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SOCIAL NETWORK BRIDGING POTENTIAL AND THE USE OF COMPLEMENTARY AND ALTERNATIVE MEDICINE IN LATER LIFE *

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Abstract

The use of complementary/alternative medicine (CAM) is typically modeled as a function of individual health beliefs, including changes in perceptions of conventional medicine, an orientation toward more holistic care, and increasing patient involvement in health care decision-making. Expanding on research that shows that health-related behavior is shaped by social networks, this paper examines the possibility that CAM usage is partly a function of individuals' social network structure. We argue that people are more likely to adopt CAM when they function as bridges between network members who are otherwise not (or poorly) connected to each other. This circumstance not only provides individuals with access to a wider range of information about treatment options, it also reduces the risk of sanctioning by network members if one deviates from conventional forms of treatment. We test this idea using data from the National Social Life, Health, and Aging Project (NSHAP), a nationally representative study of older Americans. Analyses of egocentric social network data show that older adults with bridging potential in their networks are significantly more likely to engage in a greater number of types of CAM. We close by discussing alternative explanations of these findings and their potential implications for research on CAM usage.

Keywords

social networks; complementary and alternative medicine; aging; health care

INTRODUCTION

Complementary alternative medicine (CAM) encompasses a range of medical treatment approaches generally considered distinct from those used in conventional Western medicine.

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Chiropractic care, meditation, naturopathy, use of nutritional supplements, homeopathic products and acupuncture are among CAM practices commonly and increasingly used by individuals seeking alternative means of maintaining general well-being, and/or treating specific health conditions. The prevalence of CAM usage as a supplement or substitution to conventional medicine in the United States has increased significantly over the past decade, with the relative proportion of individuals reporting use of at least one CAM practice increasing by nearly 48% between 2002 and 2012 (Clarke, Black, & Stussman, 2015; Su & Li, 2011). Recent reports indicate that over \$33 billion was spent on CAM products and practices in the U.S. in 2012 alone. And over two-thirds of the U.S. population is estimated to use at least one type of alternative medicine in their lifetime (Clarke et al., 2015; Kessler, 2001).

Dominant scholarly frameworks argue that CAM usage is largely driven by individuals' health belief systems concerning the efficacy of more holistic approaches to care, the quality of patient-provider interactions, and a general interest in seeking benefits from a wider perspective of treatment than what is typically offered by traditional allopathic medicine (Gale, 2014; Stratton & McGivern-Snofsky, 2008). Building on a growing body of work on the relationship between social relationships and healthcare utilization (Deroose & Varda, 2009; Laporte, Nauenberg, & Shen, 2008; Perry & Pescosolido, 2010; Schafer, 2013; Uchino, 2009; Umberson & Montez 2010; Wolff et al., 2012), we argue that non-conventional health care use can be understood partly as a function of individuals' social network structure. A large body of research shows that health-related behavior and health outcomes are shaped by the social influences and resources that are available to people through their social networks (Berkman, Glass, Brissette, & Seeman, 2000; Christakis & Fowler, 2007; Perry & Pescosolido, 2015; Smith & Christakis, 2008; Umberson, Crosnoe, & Reczek, 2010; Valente, 2010; York Cornwell & Waite, 2012). We expand this idea to the study of CAM by arguing that the internal structure of individuals' social networks shapes their exposure to and likelihood of adopting treatments that fall outside of conventional Western medicine. Specifically, we examine the possibility that the structural positions people occupy within a network affect their opportunities to learn about, evaluate, and utilize alternative therapies, and simultaneously shape their risk of facing sanctions for experimenting beyond the boundaries of conventional medical treatment.

We begin by reviewing existing research on the health and social contexts of CAM usage to suggest a number of reasons why occupying bridging positions within personal social networks may be associated with an increased likelihood of adopting alternative medicine. Using egocentric network data and respondent reports of CAM usage from Wave 1 of the National Social Life, Health, and Aging Project (NSHAP), we then develop a series of models that highlight the statistically significant relationship between occupying bridging positions within an egocentric network and CAM usage. We discuss the implications of these findings for understanding the role of network structure in health care utilization and decision-making in later life, particularly with regard to less traditional modes of treatment, and consider how these findings may reflect the potentially growing role of social networks in the changing environment of health care more broadly.

UNDERSTANDING COMPLEMENTARY ALTERNATIVE MEDICINE (CAM) USAGE

While the reported prevalence of CAM usage varies among surveys – using different definitions and measures – the Centers for Disease Control and Prevention (CDC) finds that 38% of U.S. adults have used at least one CAM practice sometime during the past 12 months (Clarke et al., 2015). This rate has increased steadily since the 1990s (Tindle, Davis, Phillips, & Eisenberg, 2005). Women and non-Hispanics comprise the majority of CAM users, as do those with higher levels of education and higher income earners (Zhang et al., 2015). Older adults specifically represent a key segment of CAM consumers, with estimated use ranging from 44% (Barnes, Bloom, & Nahin, 2008) to nearly 60% (Cheung, Wyman, & Halcon, 2007) of adults over age 50. Indeed, chronic conditions such as arthritis, cancer and chronic pain that often prompt CAM usage in the general population occur at higher rates among older adults.

A considerable body of work has attempted to understand the adoption of CAM by consumers. This work acknowledges a number of medically and sociologically relevant factors that shape individuals' decisions to use alternative medicine. Much empirical research cites dissatisfaction with conventional practitioners as a primary impetus behind CAM usage, attributed largely to frustrations with treatment efficacy and impersonal doctor-patient relationships (Palinkas & Kabongo, 2000; Vincent & Frunham, 1996). More recently, emphasis has shifted toward recognizing belief systems and values over general dissatisfaction with conventional medicine in motivating CAM usage. Holistic approaches to health care, individualism, autonomy, and control over health decision-making, have emerged as central ideologies that drive individuals to pursue alternative treatments (Astin, 1998; Bishop, Yardley, & Lewith, 2007; O'Callaghan & Jordan, 2003). The holistic paradigms that underlie CAM practices are recognized and valued aspects of these therapies, often contrasted with allopathic medicine's more fragmented and specialized structure of clinical practice. As individuals assume increasingly active roles in their own health care, the demand for integrative approaches increases (McCaffrey, Pugh, & O'Connor, 2007; McKinlay & Marceau, 2008). Among older adults especially, for whom autonomy and independence are important makers of successful aging (Bland, 1999; Cornwell, 2011; Secker et al., 2003), CAM usage may contribute to a sense of active involvement around health care decision-making in later life.

In addition to demographic and attitudinal predictors, contextual considerations suggest that CAM usage may be further understood as a social context phenomenon. The ambiguity associated with the effectiveness and normative acceptability of alternative medicine, for example, sets the stage for social relations to play a critical role in resolving uncertainty around utilization decisions surrounding CAM adoption. Unlike the established sequence of educational training and accreditation that regulates mainstream medicine, CAM is less professionally unified and lacks the stringent set of requirements and degrees that heuristically legitimize the conventional health care system. Likewise, the mechanisms that explain the efficacy of many CAM treatments are not well understood. Gaps in scientific evidence lead to questions around the benefits and risks of these therapies, sustained in part

by a relatively underdeveloped research infrastructure (Ernst, 2004; Kelner et al., 2003). In the absence of more traditional cues around expertise and legitimacy, CAM users rely more on personal experiences and information from knowledgeable others in their social networks to support the use of and evaluate alternative treatments (Pedersen & Baarts, 2010; van der Schee & Groenewegen, 2010). Legitimacy is user-constructed by laypersons as opposed to institutionally constructed by a well-established authorization process.

The Role of Social Networks

Following these observations, examining individuals' social networks presents a promising avenue for understanding CAM usage. In addition to providing emotional and instrumental support around health care (Thoits, 2010), having strong network ties and discussing health with network members is associated with better recovery from mental illness (Perry & Pescosolido, 2015), management of chronic conditions (Vassilev, Rogers, Kennedy, & Koetsenruijter, 2014) diagnosis and control of hypertension (York Cornwell & Waite, 2012), and a wide variety of other health outcomes (e.g., Perry & Pescosolido, 2010). This research provides strong evidence that people's health-related behaviors and decisions are shaped by the opinions and behaviors of their closest contacts. Social network members also serve to monitor health behavior, enforce social norms around health practices and decision-making, provide emotional and instrumental support around healthcare utilization, and facilitate individuals' sense of personal control over their health (Umberson, 1992; Umberson, Crosnoe, & Reczek, 2010).

Given the ambiguity surrounding the effectiveness of CAM, it is likely that the information-providing and norm-enforcing functions of social networks play a role in individuals' decisions to experiment with or adopt these forms of treatment. Indeed, prior work has found that health information seeking behavior is the strongest predictor of CAM usage among older adults (Arcury et al., 2013). Individuals actively draw on health professionals, family, friends, and other social network resources in evaluating potential benefits of CAM (Balneaves, 2008). With regard to norms, individuals' beliefs around whether or not family and friends approve of CAM are also predictive of CAM use (O'Connor & White, 2009), as is relatives' discouragement or skepticism of alternative treatments (Molassiotis et al., 2005). Among those with chronic conditions, dialogue with trusted others is a critically informative aspect in decisions to pursue CAM (Evans et al., 2007). In the case of cancer, significant others assume especially important and multi-faceted roles in shaping their partner's disposition toward CAM, both in encouraging and dissuading adoption of alternative treatments (Ohlén, Balneaves, Bottorff, & Brazier, 2006). For otherwise healthy individuals, CAM usage is largely attributed to interactions with and referrals from friends and coworkers (Palinkas & Kabongo, 2000).

Collectively, these findings suggest that social ties function in a number of important ways to influence CAM usage, from fostering general exposure to providing concrete support and recommendations. But despite the fact that research has uncovered a number of inherently social aspects underlying health care utilization decisions, little research has explicitly considered the role of social networks in alternative medicine. Work that has been done in this area focuses primarily on how the *composition* of individuals' social networks shape

CAM usage. For instance, research shows that having a network that includes non-kin ties is associated with alternative medicine use (Schafer, 2013). Relatedly, people who have varied sources of social support – including friends, neighbors, and social groups – are also more likely to try CAM than people with more kin-centered networks (Shiovitz-Ezra & Litwin, 2012). These studies suggest that people who have more diverse social networks are more likely to adopt CAM. One explanation for this is that people whose networks include different types of ties – especially those outside of the family – have access to a broader range of information and suggestions regarding possible treatment options, in part through discussing health with a wider variety of sources of social support.

In line with this argument, we propose that the *structure*, or wiring, of one's social network shapes CAM usage for similar reasons. A long line of research in social network analysis shows that the adoption of unusual or innovative ideas and practices depends on not only the composition of one's network, but also the extent to which one's network is structured such that (1) their network ties reach non-redundant (unique) sources of information, and (2) their network members are not so densely interconnected to each other that alters are able to control this information and prevent the individual in question from using it (see Burt 1992, 2004). From this perspective, the relationship between CAM usage and the diversity and range of one's social network may reflect the fact that less diverse networks (e.g., those containing only family members) are more constrained in the sense that their members tend to adopt similar general, conventional health care practices and mutually reinforce those practices (though, in social networks where alternative practices are more pervasive or normative, those less conventional practices could also be reinforced by network members).

This leads to our primary argument, which is that a key factor that links one's social network to CAM usage is the extent to which one maintains social ties to people who are not (or otherwise only poorly) connected to each other. This relational structure is referred to as network *bridging*. Bridging is marked by its capacity to elicit resources from diverse social domains (Burt, 1992; Feld, 1981), such as social support and other social benefits. Figure 1 depicts three hypothetical networks illustrating variations in ego bridging potential: one in which ego does not function as a bridge (left panel), one in which ego serves as a bridge between some but not all alters (center panel), and one in which ego functions as a bridge between every pair of alters (right panel). We argue that the structures depicted in the center and right panels (some and/or total bridging potential) are more conducive to CAM usage, all else equal, than the structure on the left (no bridging potential).

There are several reasons why bridging may be associated with CAM usage. For one, being a bridge likely increases one's opportunities to learn about different health care practices. Having network members who do not know each other increases one's likelihood of being exposed to *different* health care options. Likewise, this relational structure will increase one's likelihood of receiving referrals to different CAM providers. Bridging may also allow individuals to explore alternative treatments under circumstances of more relaxed social control and less normative reinforcement of traditional, conventional care than what denser networks might promote. When people are connected to network members who know each other well, their network members are better able to enforce widespread social norms and to informally sanction deviation from those norms (e.g., Coleman 1988). Put differently,

occupying a bridging position within a network may make it easier to experiment with unorthodox health practices, as this can occur without concern that one's network members will monitor and sanction that behavior. Finally, it is worth mentioning that people who occupy bridging positions also tend to be in better health (Cornwell, 2009a). As such, individuals who serve as bridges may be more physically able to seek out CAM providers, thus overcoming barriers commonly associated with accessing CAM therapy locations (Jain & Astin, 2001).

CAM Usage and Social Networks in Later Life

Our primary argument is that social networks with bridging potential offer individuals more opportunities to hear about, access, and adopt CAM. This less-connected social network context provides individuals with more independent social interactions, which may provide diverse opportunities to evaluate and reinforce CAM usage. In this paper, we focus specifically on CAM usage among older adults. For this group – which tends to underreport or completely avoid disclosing use of CAM practices to conventional physicians (Astin, Pelletier, Marie, & Haskell, 2000; Cheung, Geisler, & Sunneberg, 2014) – bridging positions may play an even more important role in legitimizing CAM usage than for others. For one, research shows that older adults use lay consultation networks (e.g., spouses, family and close friends) more often than physicians to talk about health matters (Stoller & Wisniewskim, 2003). Older adults' network members also tend to play a larger role in shaping health-related behavior and health care utilization. For example, older adults often rely more heavily on their network members for financial and instrumental support (e.g., transportation, advice) for accessing health care and medical decision making (Shin et al., 2013; Wolff et al., 2012). In addition, older adults' networks tend to be smaller and more connected to kin and the local community than those of younger- and middle-aged adults (Cornwell, Laumann, & Schumm, 2008). At the same time, older adults experience considerable change and turnover in their networks (e.g., due to the deaths of network members). As such, while their social networks are smaller, older adults retain (and may even prefer) considerable bridging opportunities (Cornwell, 2009b, 2011; McDonald & Mair, 2010; Suanet, van Tilburg, & Broese van Groenou, 2013; Thomas, 2011). It is therefore important that we understand how this circumstance – social network bridging – relates to health care utilization practices such as CAM within this more vulnerable population.

DATA AND ANALYSIS

Following Schafer (2013), we examine this question using data from Wave 1 of the National Social Life, Health and Aging Project (NSHAP) collected in 2005-2006 from a nationally representative sample of 3,005 older adults ages 57-85. Interviews were conducted in respondents' homes by the National Opinion Research Center (NORC). The NSHAP study used a multi-stage area probability design that oversampled by race and ethnicity, age, and gender. The final response rate is 75.5%.

CAM

As part of the in-home interview, the NSHAP asked respondents whether they used each of the following alternative medicines or therapies in the past year: Herbal supplements or remedies; high-dose or mega-vitamin; massage therapies; acupuncture; chiropractic treatments; meditation; religious or spiritual healing; any other alternative medication or treatment. We measure CAM usage as a sum of the number of alternative treatments reported, such that usage ranges from 0 (respondent used none of the treatments in the past year) to 8 (respondent used all of the treatments in the past year).

Social Network Structure

Our main goal is to examine the association between older adults' CAM usage and the structure of their personal social networks. For this, we utilize information collected about older adults' confidant networks. To develop these data, the NSHAP interviewers began by asking respondents the following:

From time to time, most people discuss things that are important to them with others. For example, these may include good or bad things that happen to you, problems you are having, or important concerns you may have. Looking back over the last 12 months, who are the people with whom you most often discussed things that were important to you?

This name generator is commonly used to elicit respondents' core confidants, who often serve as key sources of social support (Bailey & Marsden, 1999; Marin, 2004; Marsden, 1987; c.f. Bearman & Parigi, 2004). Respondents could name up to five people, who were recorded in Roster A. (The respondent is conventionally referred to as "ego," so self-reported network data such as this is often referred to as "egocentric" network data.) Respondents described the nature of their relationship to each of these confidants (e.g., friend, neighbor). If a respondent had not yet named a partner after naming these five confidants (also referred to as "alters"), s/he was asked if s/he had one. If so, the partner was recorded in Roster B. Respondents were also asked if there was any other person to whom they are especially close. If so, this person was added in Roster C. Respondents reported both how often they interact with each of their network members, and how often each network member (including the spouse/partner) interacts with each of the other network members. This information is collected from all respondents, regardless of age or other characteristics.

We measure bridging using a dichotomous indicator of whether the respondent has at least one pair of network members who are not directly (or are only poorly) connected to one another. We consider network members to be not directly or poorly connected if the respondent reports that a pair of alters have never spoken with one another, or speak with one another less frequently than once a year. While there are multiple ways to define bridging depending on the context and mechanism of interest (e.g., see Burt 1992), this measure captures respondents' potential exposure to diverse, non-redundant sources of information from confidants, as well as opportunities for spending discrete periods of time with different network members (see Cornwell 2009a, 2011). Given our hypotheses

regarding the role of these social ties in shaping respondents' awareness and legitimization of alternative medicine, as well as overall inclination to use CAM, this an appropriate operationalization of network bridging.

Because our measure of bridging relies on information about interaction among respondents' social network members, we focus our analysis of this and other network features using information on all of those network members for whom data on their frequency of interaction with ego and other alters is collected (including alters named in Rosters A, B, and Roster C, if applicable). Likewise, as the opportunity to bridge network confidants depends on having at least two network members, our analysis pertains only to those respondents that provide information on at least two network members. Note that this criterion leaves some respondents out of the valid analytic sample, which creates potential selection issues that are addressed below.

Covariates

As previous research shows, other factors account for variation in CAM usage. We control for basic socio-demographic characteristics including gender, race (African American, white and other race), age (divided by 10, to make the age coefficient more meaningful), ethnicity (Hispanic vs. non-Hispanic), marital status (married versus separated/divorced, widowed, or never married), and educational attainment (less than high school versus high school, some college, and bachelor's degree or higher). We also control for frequency of attending religious services given the inclusion of religious/spiritual healing as a component of our CAM measure (0 = never attends religious services, 6 = attends several times a week).

Given research that shows that network bridging is itself related to health (Cornwell, 2009b; Haas, Schaefer, & Kornienko, 2010; Schafer, 2013), we consider several health and network-related variables that could explain variation in older adults' use of alternative medicine and/or social network bridging opportunities. First, to capture overall health, we use respondents' self-rated health (poor, fair, good, very good, or excellent), as well as a count of the number of health conditions reported in the NSHAP interview. Respondents were asked whether they had ever been diagnosed with each of seventeen conditions, most of which are chronic and lifestyle-related in nature such as diabetes, hypertension, and cancer. We also include measures of respondents' contact with the health care system, including frequency of physician visits and regular (everyday or every week) use of non-alternative medications. Physician visits in the past year are recorded using one of eight categories (0 visits, 1 visit, 2-3 visits, 4-9 visits, 10-12 visits, 13-20 visits, 21-30 visits, 31 or more). We use the midpoint of each range to estimate the actual number of individuals' doctor visits. We also include a dichotomous indicator of whether the respondent has a regular place they visit when they are sick. Finally, we include a count of the total number of respondents' conventional prescription and over-the-counter medications (not including alternative medications or vitamins) recorded by the interviewer and later classified according to the Multum drug typology (Qato, Schumm, Johnson, Mihai, & Lindau, 2009).

Other social network-related controls include overall network size, the proportion of network members who are kin, and the proportion of network members with whom the respondent discusses health. We measure network size as the number of confidants reported

in Rosters A, B and C. Given our focus on respondents with at least two network members and only those network members for whom there is information about their interaction with other network members, this measure of network size ranges from 2 to 7. Proportion of kin is derived as the proportion of network members related to the respondent by blood or marriage. Proportion of alters with whom the respondent discusses health is derived as the proportion of network members that respondents report as someone with whom they are very or somewhat likely to discuss health. Table 1 shows descriptive statistics for the main independent and dependent variables that are examined in our analysis.

Analytic Strategy

We first assess bivariate associations between respondents' CAM usage and network bridging potential, and then move on to a multivariate analysis that controls for relevant covariates. Negative binomial regression is appropriate for the multivariate analysis given our interest in modeling the number of alternative therapies that respondents use. Negative binomial models are like Poisson models in that they predict counts, but negative binomial models also include a parameter, σ^2 , that accounts for overdispersion (high variation) in the dependent variable (McCullagh & Nelder, 1989). In the multivariate analysis, we begin by considering the relationship between bridging and CAM usage when including basic socio-demographic variables. We then include health-related covariates to better understand how the link between CAM usage and bridging may be mediated by other measures that reflect individual health overall, as well as contact with the health care system. It may be the case that healthier respondents, in addition to being more likely to bridge network confidants, also have greater capacity for or interest in trying alternative medicine. Another possibility is that more frequent contact with the conventional health care system buffers, in a way, individuals' opportunities to learn about or consider alternative practices as potentially beneficial or relevant to their own health status.

We then explore the extent to which bridging may explain CAM usage when other network measures are incorporated, apart from health-related covariates. Having a larger social network mathematically increases the likelihood of having at least one unconnected or poorly connected pair of alters, thereby affording individuals more opportunity to bridge network members, so we control for network size. A high proportion of kin ties may also signify greater network density (and fewer bridging opportunities), as kin are likely to be connected to one another. A higher proportion of kin may also limit an individual's opportunities to learn about alternative medicine from non-redundant ties. Likewise, a high proportion of kin could enhance the effects of social norms and monitoring around health behaviors and decision-making, effectively reducing the likelihood that an individual tries a less conventional, widely-recognized form of medical therapy. Other work has also suggested the distinct importance of non-kin ties in predicting CAM usage, in part as a result of the access to diverse social circles and information that non-kin ties can provide (Schafer, 2013). We may therefore expect to find a negative relationship between proportion of kin and CAM usage in our model. It is also possible that a higher proportion of alters with whom respondents discuss health affords the respondents more opportunities to learn about or support decisions to use CAM, though this relationship may depend on having some bridging potential in their network to avoid normative enforcement or social control that we

posit is a mechanism underlying bridging potential and CAM usage. A final model examines the extent to which bridging predicts CAM usage even after controlling for both health and network covariates.

Because all of our models include only the 2,467 (82.1%) respondents who provided valid data on all variables used in the final model, and who report at least two network confidants, it is possible that those respondents included in the analyses differ in some systematic way from those who are missing data on one or more key variables, or who are excluded on the basis of network size. To account for this possibility, we weight the data by first using a logit model to predict whether a respondent is included in our final sample, using age, race, gender, marital status, network size (including 0 or 1 reported alters), self-rated health, number of reported chronic conditions, and smoking status (never, former, current) as predictors. We then multiplied the inverse of this predicted probability by the person-level weights provided by NSHAP that adjust for age and urbanicity. The final weights attenuate selection bias by giving greater weight to those cases that are more likely to be excluded, allowing us to generate estimates that better approximate those that would be derived if all respondents were included in the final sample.

FINDINGS

As shown in Figure 2, CAM usage is positively skewed among the 2,467 respondents providing valid data. The majority of respondents report no form of CAM usage. Roughly 40% of respondents report using at least one of the eight types of treatments, and 18% of respondents report using multiple types.

Our main goal is to examine how such CAM usage is associated with social network structure. First, we note that bridging is more evenly distributed within the sample than is CAM usage. Among those respondents that provide information on at least two network confidants, just over half (55%) report having direct ties with at least one pair of confidants that are not directly or only poorly connected with one another.

We begin by examining bivariate associations between CAM usage and bridging status before proceeding to the multivariate models. As shown in Table 2, initial bivariate tests suggest that variation in use of almost all types of CAM is significantly associated with respondents' network bridging status. For each of the eight types, the proportion of people who both serve as a bridge and report use is greater than the proportion of those who do not bridge and report use. The association between bridging status and use remains relatively consistent irrespective of the precise nature of the treatment. The magnitude of this association is greatest for meditation ($\chi^2 = 31.25, p < .001$), massage therapies ($\chi^2 = 26.29, p < .001$), and other types of CAM ($\chi^2 = 19.86, p < .001$), and is also highly significant for acupuncture ($\chi^2 = 14.52, p < .001$). Herbal supplements or remedies and high-dose or mega-vitamins are also used more frequently by those who maintain some bridging potential within their personal networks ($\chi^2 = 18.96, p < 0.01$ and $\chi^2 = 7.32, p < 0.05$ respectively). Roughly fifteen percent of those who bridge report using chiropractic treatments, compared with slightly less than ten percent of those with denser confidant networks, the frequency of

which is also significant ($\chi^2 = 15.73, p < 0.01$). Only for reports of religious or spiritual healing do we find no bivariate association between bridging status and usage.

Given the strength of these associations by type, it is not surprising that the association remains significant when we measure CAM usage as an overall count. People who serve as a bridge between at least one pair of network members are more likely to report using at least one type of CAM than are those who report no bridging opportunities in their egocentric networks ($\chi^2 = 34.99, p < .001$). They also report using a greater number of CAM practices, on average, than do non-bridges ($t = 7.12, p < .001$).

Table 3 presents the results of negative binomial regression analyses predicting the number of CAM practices in the context of health and network measures that are likely to influence CAM usage. First, Model 1 shows how CAM is related to bridging potential net of socio-demographic controls. Consistent with prior research, this model shows that women tend to use CAM practices at a 29.6% higher rate than do men (incident rate ratio [IRR] = 1.296, standard error [SE] = .110), as do those with higher levels of educational attainment compared with less educated respondents. The rate of CAM usage decreases with age (IRR = .880, SE = .042) and increases with frequency of attending religious services (IRR = 1.070, SE = .019).

More pertinent to this paper is the finding that, net of these factors, older adults who serve as a bridge between at least one pair of network confidants have a 55.9% higher rate of CAM usage than do non-bridges (IRR = 1.559, $p < .001$). As shown in Model 2, the association between bridging status and rate of CAM usage remains significant ($p < .001$), and decreases in magnitude only slightly when elements of individual health status and health history are included. In this model, bridges have a 52.5% higher rate of CAM usage than do non-bridges (IRR = 1.525, SE = .107). This suggests that health factors such as history of chronic conditions, frequency of doctor visits, conventional medication use, and self-rated health explain little of the effect of bridging on predicting CAM usage. Also note that more frequent face-to-face contact with the health care system (as measured by physician visits) and a more extensive history of chronic conditions are associated with a significantly higher rate of CAM usage (IRR = 1.017, SE = .006 and IRR = 1.123, SE = .031, respectively), while increasing use of non-alternative medications decreases CAM usage by a factor of .973 (SE = .013, $p < .05$).

Model 3 presents the multivariate associations between network characteristics and CAM usage in the absence of health-related measures. This model allows us to see the extent to which the association between CAM usage and bridging is explained by other network-structural controls, such as network size and proportion of kin, both of which have moderate bivariate associations with bridging ($r = .47$ and $r = -.46$, respectively). Proportion of kin is significantly associated with a lower rate of CAM usage (IRR = .693, SE = .111), while a larger network is associated with a higher rate of CAM usage, though this relationship is not statistically significant. A greater proportion of alters with whom the respondent discusses health is also significantly associated with higher rates of CAM usage (IRR = 1.668, SE = .417). Still, bridges evince a significantly higher rate of CAM usage than do non-bridges (IRR = 1.423, SE = .137) after adjusting for these network controls.

The final, full model shows that even after including all network and health-related determinants, respondents who serve as a bridge between at least one pair of network members use CAM at a 39.2% higher rate than non-bridges ($IRR = 1.392, p < .001$). (These results are consistent even when including those respondents with zero or one reported confidants who were excluded from the main analyses due to lack of opportunity to occupy bridging positions based on network size [$IRR=1.413, SE=.128, p < .001$]. This supplemental analysis was conducted by recoding respondents with fewer than two network members as having no bridging potential in their networks.) To show the magnitude of this association, Figure 3 presents the predicted number of CAM practices used by bridges and non-bridges separately, holding all other covariates of the full model at their mean. Given the large proportion of respondents in the sample that report no CAM usage, it is not surprising that these predicted values are relatively low. But this figure still helps to emphasize that predicted CAM utilization among bridges is about 37% greater than that of non-bridges when controlling for other relevant health- and network-related factors. (We also considered bridging status and health discussion interactions, though these are not included in our models because they were not statistically significant.)

We further test the robustness of this model in supplementary analyses, including additional network and health-related controls. Given that the important matters prompt elicits close ties, it is possible that more socially distant network members such as co-workers, who may provide individuals with more exposure to testaments of CAM usage, would not be listed as part of the network roster and, in turn, would not be accounted for in our measure of bridging. We therefore consider the effect of whether individuals are currently working on predicted CAM usage. Additionally, although the vast majority of CAM is paid for out-of-pocket (Ernst, 2004), we consider the possibility that insurance type may also be associated with usage, perhaps through the perceived quality of conventional care that may motivate individuals to consider alternative treatments.

Bridging remains a significant predictor of CAM usage ($IRR=1.379, p < .01$) while also accounting for respondent work status and type of health insurance (Appendix Table A1). None of these additional predictors are significantly associated with CAM usage. As a supplemental exercise, we use logistic regression analyses to consider whether bridging is associated with any use of CAM, regardless of the number of reported practices (results available upon request). Consistent with the negative binomial models, bridging is a significant predictor of whether a respondent reports using at least one type of CAM. The odds of using any CAM modality are 40.7% greater for those who bridge at least one pair of network members ($OR = 1.407, p = .002$), and the predicted probability of using any CAM is approximately 23% greater for those serving as bridges relative to non-bridges, holding all other covariates at their means.

Although we use a dichotomous measure of network bridging potential in these models, it is also possible that other social network measures that capture greater variation in social closure may effectively predict CAM usage. It may be the case that the number of CAM practices one uses is a function of the relative degree to which network members are tied to one another, beyond just having at least one poorly connected pair, such that exposure to novel information and/or social monitoring could vary relative to the extent of network

closure. As such, we considered whether two continuous measures of social closure could also be associated with CAM usage. We measure respondents' network density as the number of actual ties that exist among alters relative to the total number of ties that could exist between reported network members. We measure the number of pairs of alters that a respondent bridges as the absolute number of unconnected or poorly connected pairs, truncating this count at seven or more. Comparison of these three network measures reveals that both density and number of poorly connected pairs are also significant predictors of CAM use ($p < .05$), with the rate of CAM use increasing with the number of pairs that respondents bridge and, likewise, decreasing with greater network density (Appendix Table A2), though neither of these measures are as strongly associated with CAM use as the dichotomous bridging measure.

DISCUSSION

Expanding on recent work which suggests that CAM usage is shaped by individuals' personal social networks (Arcury et al., 2013; Balneaves, 2008; Evans et al., 2007; Palinkas & Kabongo, 2000; Schafer, 2013; Shiovitz-Ezra & Litwin, 2012), this study examined the possibility that CAM usage in later life is a function of structural aspects of those networks. Specifically, we find support for the argument that individuals who function as bridges between their social network members are significantly more likely to use alternative medicine, net of a number of other predictors of CAM and network bridging. This result suggests that bridging potential may be an important structural feature of networks that shapes alternative medicine use.

This finding is further supported through our examination of alternate network structure predictors. The significant associations between density, number of poorly connected pairs, and the dichotomous bridging measure with CAM usage underscores the finding that use of alternative medicine is in part a function of connectivity among network members. The more significant dichotomous measure suggests that within egocentric networks, the relationship with CAM usage is strongly associated with a broader indicator of whether or not a respondent's social network includes *any* poorly connected confidants. This result is particularly plausible when we consider the size of respondents' networks and the potential mechanisms we have considered. Given that on average respondents report four confidants, incremental access to novel information would in theory require that each pair of poorly connected alters represents access to distinct social domains, such that the respondent spends discrete time with each member of each pair. This is typically not the case in egocentric networks, where few respondents' networks exhibit total bridging potential. It is unlikely that each tie between alters represents non-redundant sources of information or a proportional decline in the likelihood of sanctioning.

The association between bridging and CAM usage may involve several social mechanisms. For one, it may have to do with the fact that bridging reduces the capacity for social network members to sanction and control ego's behavior, including those in the realm of health behavior and decision-making. In this sense, the association between CAM usage and bridging may reflect the fact that the propensity to adopt seemingly risky or less widely used medical treatments is less challenged in network environments where there is less triadic

closure, which reduces the potential effects of external monitoring on health decisions (Umberson, 1992).

Another possibility is that bridging may afford individuals more access to diverse sources of social support and information, which increases their exposure to alternative remedies. Relatedly, it is also interesting to note that the proportion of network members with whom individuals discuss health is independently associated with greater CAM usage, net of occupying a bridging position. While we believe that bridging in part predicts CAM usage by exposing individuals to a wider range of health-related information, alternative medicine use is also likely to be broadly facilitated through diverse engagement in non-health-related discussion topics and social activities. Indeed, the congruence between CAM practices, holistic orientations to general well-being, and personal worldviews has been cited as more predictive of CAM use than specific health conditions (Astin, 1998). Likewise, alternative practices such as vitamins, herbal supplements, meditation, and prayer touch on other domains of daily lifestyle such as nutrition, religion, and general well-being (including preventative care) that are not necessarily tied directly or exclusively to health status or illness.

Additionally, many CAM therapies such as massage, meditation, and acupuncture are often used as a means to relieve anxiety, stress, and depression (Cherkin et al., 2002; Kessler et al., 2001). As close social ties are well-established sources of emotional support (Berkman et al., 2000; Umberson et al., 2010), advice or recommendations around CAM therapies may reflect these alters' more general roles as providers of social support and emotional aid, apart from health or illness-specific conversation. To this end, it is also possible that NSHAP's measure of health discussion may be capturing reports of discussing physical or functional health status with network members, which may be more salient among an older population than mental health status.

As prior work emphasizes, CAM directly challenges the longstanding patient reliance on conventional expertise, transferring much of the agency around health care utilization to the individual (Pedersen & Baarts, 2010; van der Schee & Groenewegen, 2010). With this shift in control over care, individuals' network confidants assume increasingly important roles in guiding and legitimizing choices around adopting CAM (Bishop et al., 2007; O'Callaghan & Jordan, 2003). From this perspective, it is important to recognize the association between bridging and autonomy (Cornwell, 2011), as independence and desire to control one's health are also related to alternative medicine and the growing culture of patient-empowered care. In this context, the association between bridging potential and CAM usage may reflect these individuals' general independent decision-making and sense of control over their everyday lives, net of the salience of health. As alternative medicine use continues to gain salience, trusted social relations may also drive alignment of individual belief systems with the more macro-level culture of integrative care (Gale, 2014), perhaps more proximately than health status alone.

We also find some evidence from the bivariate results (Table 2) that bridging is more closely related with some types of CAM than others. Given that social networks function in different ways with regard to health care utilization (Perry & Pescosolido, 2010), it is

possible that social network bridging serves different purposes for different CAM practices, and which may in part reflect the degree of information exposure or lack of social monitoring that could explain use. Vitamins and herbal remedies, for instance, are relatively more accessible given their availability in many retail pharmacies and grocery stores, and at relatively lower cost – especially compared to provider-based CAM practices such as acupuncture and chiropractic care. As such, the lesser significance of the association between bridging and herbal supplement and vitamin use may reflect the fact that these practices are more commonplace and less deviant than others, such that bridging opportunities play somewhat less of a role in determining use. Chiropractic care, too, has also been considered as increasingly mainstream, with more established educational and licensing systems, and growing evidence of efficacy (Meeker, 2002).

The association with bridging is more significant in the case massage therapies, acupuncture, and meditation, which may also be practices that tend to more heavily depend on individual exposure to novel sources of information or less social monitoring. In these cases, network confidants may be more critical in navigating the range of styles and philosophies that characterize these practices, as well as in locating providers (Jain & Astin, 2001). Meditation also requires a degree of consumer training, and is noted as an especially marginalized practice for most Americans (Williams, Ness, Dixon, & McCorkle, 2012), suggesting that social control may be a mechanism explaining its relationship with bridging. The potential benefits of these practices may also be less familiar, such that social network members play a bigger role as diverse sources of information, particularly in framing their relevance to individual health and in building knowledge and awareness. Bridging network members may therefore provide more opportunities for individuals to access these resources and to reinforce their legitimacy and effectiveness as medical treatments. Future work is needed to more concretely understand the processes that might explain the association between network structure and the adoption of specific alternative practices.

This study has several limitations. For one, the NSHAP does not provide data on egocentric social network members' own health practices (e.g., CAM usage). Only with this kind of information will it be possible to understand fully the mechanisms by which network members influence respondent's own health practices. This would also make it possible to examine whether and how CAM usage diffuses through networks. Second, we must rely on ego's subjective reports regarding his/her networks in order to estimate his/her bridging potential. Bridging opportunities emerge from the combination of network members' lack of connectedness to each other, not only through ego, but also through third parties. The present data do not provide direct information about the presence of third parties (outside of ego's own network) who may also serve as links between network members. Relatedly, the "important matters" name generator only provides information about linkages between relatively close social network members and strong ties. Thus, our study likely underestimates the prevalence of bridges in older adults' personal social networks.

A key analytic limitation of this study is that we have only one wave of data. While the NSHAP as a whole is a panel study, it did not collect information about CAM usage at Wave 2 (2010/2011). The lack of longitudinal data makes it impossible to establish causal order in this study, raising the specter of selection and endogeneity. It is possible that, while

networks affect CAM usage, CAM usage simultaneously shapes older adults' social networks. A given individuals' involvement with a particularly unorthodox form of treatment, or their refusal to adopt a more conventional form of treatment, for example, could alienate them from close network members who had otherwise precluded bridging opportunities. This is a possibility that deserves closer scrutiny.

It is also possible that certain individual attributes explain this relationship, which we are unable to measure using this data. For instance, older adults that use less conventional medicine may also have more diverse or eclectic social relationships, which in turn may be less likely to exhibit bonding and social closure. Additionally, individuals who use alternative medicine may have more general dispositions toward risk-taking or experimenting with novel ideas (including medical treatments). Such traits may also be more likely in personal networks with bridging potential, as social networks with less connectivity are likely less constraining on individuals' engagement in less normative or experimental behaviors more generally. Additionally, environmental factors may influence this association, such as whether one lives in an urban area. More metropolitan neighborhoods may have a greater range and availability of CAM providers. Residents in more populous, urban areas may also be more likely to have network members that do not interact with one another.

Finally, it is important to note that this study uses a sample of older adults ages 57-85 whose experience with conventional medicine may be unique to this cohort. Indeed, much of contemporary conventional medicine reflects waves of advancements in molecular medicine, epidemiology, and drug development that took place in the early second half of the twentieth century, leading in part to the widespread use of antibiotics, vaccinations, and general reliance on mainstream medical care. Given that many sample respondents grew up during this time, it is possible that they perceive CAM as more deviant than would a sample of younger or middle aged adults that may have a stronger sense of patient-empowerment and consumer-driven perspectives on medical decision-making that are more pervasive today. Future research could explore whether bridging positions are less predictive of CAM use among a younger sample.

Regardless, the findings that we report here suggest that CAM usage is, in some way, a function of social network structure. Such health care practices are closely related to structures of individual information access and/or social control. Given the fact that social networks play such a large role in older adults' health and healthcare utilization in general (Cornwell, Laumann, & Schumm, 2008; McDonald & Mair, 2010; Thomas, 2011; Thomson, 2006; Shin et al., 2013; Wolff et al., 2012), the implications of this condition for older adults' health needs to be explored in future research.

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Appendix

Appendix Table A1

Incident Rate Ratios of Negative Binomial Regression Predicting CAM Usage among Older Adults, including Controls for Insurance Type and whether R is Currently Working (N=2,101).^a

Predictor	Model 1	Model 2	Model 3
Bridge ^b	1.536*** (.108)	1.502*** (.102)	1.379** (.133)
Female	1.318** (.121)	1.319** (.117)	1.269** (.113)
Age (divided by 10)	.913 (.052)	.887 (.057)	.904 (.057)
Education (Ref=<High School)			
High school or equivalent	.965 (.128)	.962 (.134)	.974 (.134)
Some college	1.358* (.172)	1.326* (.180)	1.325* (.182)
Bachelors or more	1.864*** (.250)	1.806*** (.239)	1.814*** (.247)
Frequency of attending religious services	1.075*** (.020)	1.069*** (.020)	1.068** (.019)
Currently working	1.114 (.128)	1.098 (.121)	1.089 (.113)
Health conditions		1.107*** (.030)	1.106*** (.029)
Regular place for health care		.850 (.144)	.845 (.136)
Doctor visits		1.016* (.007)	1.014* (.007)
Non-alternative medications		.984 .014	.984 (.014)
Self-rated health (Ref=Poor)			
Fair		1.342 (.241)	1.346 (.237)
Good		1.204 (.201)	1.201 (.196)
Very Good		1.542* (.287)	1.506* (.275)
Excellent		1.440 (.305)	1.406 (.294)
Insurance (Ref=Public)			
Private		1.050 (.096)	1.070 (.098)
Other program		1.273* (.145)	1.289* (.146)
Network size			1.037 (.030)
Proportion of kin in network			.735 (.120)

Predictor	Model 1	Model 2	Model 3
Proportion of alters with whom R discusses health			1.746** (.327)
<i>F(df)</i>	16.77*** (14, 37)	12.26*** (24, 27)	9.70*** (27, 24)

Standard errors in parentheses.

* $p < .05$;

** $p < .01$;

*** $p < .001$ (Two-tailed tests).

^a Estimates are weighted using NSHAP Wave 1 respondent level weights (adjusted for age and urbanicity). All models are survey-adjusted and include controls for Wave 1 marital status, race, and ethnicity, which are not significant in these models and not shown due to space constraints.

^b Applies only to respondents with at least two network members.

Appendix

Appendix Table A2

Incident Rate Ratios of Negative Binomial Regression Predicting CAM Usage among Older Adults, Using Three Different Social Network Measures as Predictors (N=2,467)^a.

Predictor ^b	Model 1	Model 2	Model 3
Bridge (dichotomous measure)	1.392*** (.127)	--	--
Network density	--	.667* (.119)	--
Number of poorly connected pairs	--	--	1.048* (.021)
<i>F(df)</i>	11.99*** (24, 27)	11.57*** (24, 27)	12.17*** (24, 27)

Standard errors in parentheses.

* $p < .05$;

** $p < .01$;

*** $p < .001$ (Two-tailed tests).

^a Estimates are weighted using NSHAP Wave 1 respondent level weights (adjusted for age and urbanicity). All models are survey-adjusted and include controls for all variables shown in Model 4 of Table 3 (full results available upon request).

^b All predictors apply only to respondents with at least two network members.

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Highlights

- Study examines CAM usage and social network structure among American older adults.
- We model CAM usage as a function of social network bridging potential.
- Bridging potential may provide individuals with more independent social interactions.
- Social network bridging potential predicts a greater number of CAM practices used.
- Predicted CAM usage among bridges is nearly 40% greater than that of non-bridges.

Figure 1. Three Hypothetical Egocentric Networks That Have Different Implications for Ego's Bridging Potential

Note: The empty circle in the middle of each network represents the focal individual ("ego"), black circles represent network members ("alters"), and lines are drawn where a relationship exists.

Figure 2.
Number of Reported CAM Practices (N=2,467).

Figure 3. Predicted CAM usage by Respondents' Network Bridging Status

Note: All predicted values are based on the full negative binomial regression model presented in Table 3, holding all other covariates constant at their means.

Table 1Descriptions, Weighted Means and Standard Deviations of Key Variables (N=2,467).^a

	Proportion or Weighted Mean	Standard Deviation
Number of CAM practices used (0-8)	.76	1.22
Bridge	.55	.50
Female	.52	.50
Age (divided by 10)	6.80	.77
Race		
White	.80	.40
African American	.16	.37
Other race	.04	.20
Hispanic	.09	.29
Marital Status		
Married	.64	.48
Separated/divorced	.12	.32
Widowed	.21	.41
Never married	.03	.17
Education		
Less than high school	.21	.41
High school or equivalent	.27	.44
Some college	.29	.45
Bachelors or more	.23	.42
Frequency of attending religious services (0-6)	3.33	2.10
Health conditions (0-9)	2.32	1.57
Regular place for health care	.93	.26
Doctor visits	6.03	5.94
Non-alternative medications	3.84	3.19
Self-rated health		
Poor	.07	.26
Fair	.19	.39
Good	.30	.46
Very Good	.32	.47
Excellent	.12	.32
Network size (2-7)	4.28	1.47
Proportion of kin in network	.68	.29
Proportion of alters with whom R discusses health	.89	.20

^aEstimates are weighted using NSHAP Wave 1 respondent level weights (adjusted for age and urbanicity). Estimates are calculated for all respondents who have non-missing data on key variables in the final model.

Table 2Proportion of Bridges and Non-bridges Reporting Use of Each CAM Type (N=2,467)^a.

CAM Type	% Bridges Using	% Non-bridges Using	χ^2
Herbal supplements or remedies	24.47	17.28	18.96**
High-dose or mega-vitamin	15.63	11.85	7.32*
Massage therapies	12.94	6.70	26.29***
Acupuncture	4.02	1.46	14.52***
Chiropractic treatments	15.14	9.80	15.73**
Meditation	10.28	4.31	31.25***
Religious or spiritual healing	6.28	5.16	1.42
Other alternative medication/treatment	2.99	.55	19.86***

*
 $p < .05$;**
 $p < .01$;***
 $p < .001$ ^aEstimates are weighted using NSHAP Wave 1 respondent level weights (adjusted for age and urbanicity).

Table 3

Incident Rate Ratios of Negative Binomial Regression Predicting Use of Complementary Alternative Medicine (CAM) among Older Adults (N=2,467).^a

Predictor	Model 1	Model 2	Model 3	Model 4
Bridge ^b	1.559 *** (.115)	1.525 *** (.107)	1.423 *** (.137)	1.392 *** (.127)
Female	1.296 ** (.110)	1.316 *** (.105)	1.252 * (.106)	1.274 ** (.102)
Age (divided by 10)	.880 * (.042)	.847 *** (.041)	.893 * (.044)	.860 ** (.043)
Race (<i>Ref=White</i>)				
African American	.767 (.243)	.765 (.239)	.773 (.242)	.772 (.241)
Other race	1.461 (.367)	1.456 (.329)	1.454 (.349)	1.453 (.313)
Hispanic	1.524 (.348)	1.603 * (.349)	1.579 * (.354)	1.654 * (.354)
Education (<i>Ref=<High School</i>)				
High school or equivalent	.926 (.114)	.906 (.111)	.938 (.113)	.918 (.111)
Some college	1.363 * (.161)	1.310 * (.160)	1.353 * (.163)	1.305 * (.163)
Bachelors or more	1.795 *** (.215)	1.682 *** (.187)	1.780 *** (.220)	1.675 *** (.195)
Frequency of attending religious services	1.070 *** (.019)	1.064 *** (.019)	1.069 *** (.018)	1.063 *** (.019)
Health conditions		1.123 *** (.031)		1.124 *** (.031)
Regular place for health care		.825 (.148)		.814 (.141)
Doctor visits		1.017 ** (.006)		1.015 * (.006)
Non-alternative medications		.973 * (.013)		.972 * (.013)
Self-rated health (<i>Ref=Poor</i>)				
Fair		1.320 (.209)		1.329 (.204)
Good		1.206 (.181)		1.207 (.179)
Very Good		1.653 ** (.277)		1.624 ** (.265)
Excellent		1.479 (.297)		1.459 (.285)
Network size			1.027 (.025)	1.030 (.025)

Predictor	Model 1	Model 2	Model 3	Model 4
Proportion of kin in network			.693 [*] (.111)	.707 [*] (.110)
Proportion of alters with whom R discusses health			1.668 [*] (.417)	1.587 [*] (.353)
<i>F(df)</i>	18.31 ^{***} (13, 38)	15.33 ^{***} (21, 30)	15.32 ^{***} (16, 35)	11.99 ^{***} (24, 27)

Standard errors in parentheses.

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$ (two-sided tests).

^a Estimates are weighted using NSHAP Wave 1 respondent level weights (adjusted for age and urbanicity). All models are survey-adjusted and include controls for Wave 1 marital status which are not significant and not shown due to space constraints.

^b Applies only to respondents with at least two network members.