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Promoting collaboration: the role of relational multiplexity in an interorganizational health justice network

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ABSTRACT

Organizations need to collaborate to achieve complex goals. Although interorganizational relations often take the form of multiplex ties, our understanding of how multiplexity itself may facilitate interorganizational collaboration is limited. We use dynamic network analysis (SIENA) to test the role of relational multiplexity – specifically, relationships involving communication outside of coalition meetings and expertise-seeking – in promoting collaboration in a health justice coalition over three years. The results offer strong support for the role of multiplexity in the formation of interorganizational collaboration, indicating that having multiple ties between organizations facilitates collaboration, and that certain types of ties (i.e. communication relationships outside of coalition meetings) are more influential than others. We conclude that coalitions hoping to support successful interorganizational collaboration will benefit from offering opportunities for member organizations to communicate outside of group meetings, because such small acts of dyadic interaction can build into deeper levels of engagement. Additionally, our study demonstrates how network analysis can help organizational coalitions to track and suggest potential partnerships between member organizations.

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Interorganizational collaboration; relational multiplexity; communication; expertise-seeking; dynamic network analysis

Collaboration among organizations across multiple sectors is recognized as an increasingly common means to address complex, boundary-spanning problems (Bryson, Crosby, & Stone, 2006; Selsky & Parker, 2005; Shumate, Fu, & Cooper, 2018). For all of its promise and popularity, such collaboration is also fraught with risks and prone to failure (Hardy & Phillips, 1998; Koschmann, 2016; Lewis, Isbell, & Koschmann, 2010). Accordingly, a substantial body of multidisciplinary literature has investigated key antecedents, processes, and outcomes of interorganizational collaboration with the aim of increasing understanding of this organizational form among scholars and practitioners (for reviews, see Cropper, Ebers, Huxham, & Ring, 2008; Lewis, 2006).

Collaboration is often embedded in multiple interorganizational relationships. Multiplex relationships – which occur when two organizations are connected by more than

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one type of relationship – are recognized as common in interorganizational interaction. For example, mental health service agencies often return to the same partners to secure funding contracts and to exchange client referrals (Provan, Isett, & Milward, 2004), and political interest groups may be linked both by informal communication ties and by joint membership in formal lobbying coalitions (Heaney, 2014). Additionally, recent theorizing has proposed that networks of interorganizational collaboration are inherently multiplex in structure (Cooper & Shumate, 2012). Despite their ubiquity in interorganizational networks, multiplex relationships remain poorly studied (Monge & Contractor, 2003; Shipilov, Gulati, Kilduff, Li, & Tsai, 2014; Shumate et al., 2018), and little attention has been paid to how multiplex relationships may influence the formation and maintenance of interorganizational collaboration.

To address this gap, the present study uses longitudinal network modeling to examine the evolution of three types of network relationships – communication outside of coalition meetings, expertise-seeking, and collaboration – among a coalition of public and private organizations working on health justice issues in California. A tie between two organizations within the coalition exists when one organization reports communicating outside of coalition meetings, seeking expertise from, or collaborating with another organization. We not only investigate the independent effect of the first two types of interorganizational relationships on collaboration, but also explore how these ties may work in concert – in the form of multiplex relationships – to foster collaborative relationships over time.

In pursuing these objectives, our study contributes to scholarly and practical understanding of relational multiplexity and interorganizational collaboration in a number of ways. First, we present a more nuanced picture of relational multiplexity by examining the effects of the *types* of relationships (i.e. communication outside of coalition meetings versus expertise-seeking), in addition to the *number* of relationships, on collaboration. Second, we analyze the specific role of communication outside of coalition meetings in interorganizational collaboration, supplementing previous work by communication scholars investigating the relationship between communication and collaboration (Lewis, 2006). Third, we rigorously test the effects of multiplexity on collaboration by controlling for other well-established antecedents of collaboration development, including structural characteristics of the network and attributes of organizations in the network. Fourth, heeding calls for more process-oriented research on collaboration, we employ an actor-based dynamic network modeling method, SIENA (Ripley, Snijders, Boda, Vörös, & Preciado, 2018), to analyze network data collected over a three-year period. Lastly, for practitioners promoting interorganizational alliance building, our study demonstrates how a social network approach can be used to understand and evaluate relationship outcomes among a group of voluntary, multi-sector community partners. The results demonstrate how the formation of multiple, less complex relationships, such as communication outside of coalition meetings and expertise-seeking, may be used to facilitate the development of more complex, effortful forms of interaction, such as collaboration.

Research context

This study was developed from a multi-year project to evaluate the growth and effectiveness of the *California Covering Kids and Families Coalition*, a community-based network of public, non-profit, and private for-profit health advocacy and service organizations.

Formed in 1997, the coalition organizes and advocates for improved health care access among underserved, uninsured, and marginalized communities. It includes members from city-, county-, and state-level public agencies, non-profit community organizations, private insurance companies, and healthcare providers, and is administratively supported by a formally designated lead member organization, Community Health Councils, a non-profit health policy and advocacy organization in Los Angeles. In addition to the objective of engaging coalition members in collaborative activities as a group, another objective of the coalition is to foster dyadic collaborative partnerships between organizational members that develop independently of formal coalition meetings and that could persist even if the formal coalition disbands. In the current study, the organizations of interest had all demonstrated their motivation and voluntary commitment to a shared mission – advocating for children's health – through their membership in the overarching coalition. Representatives from member organizations attend monthly meetings, and membership is open to any organization interested in contributing to the coalition mission.

From 2009 to 2011, our team of academics and staff members from Community Health Councils conducted annual social network surveys to evaluate the processes and outcomes of relationship building within the coalition. Network analysis is one of a number of tools used in the field to evaluate interorganizational partnerships and collaborative efforts (Provan & Sydow, 2008; Woodland & Hutton, 2012). As part of the research-practice evaluation, social network analysis was used to assess whether and how participation in the coalition might aid members in forming relationships with one another beyond the scope of the coalition meetings – that is, does the coalition foster the development of communication outside of coalition meetings, expertise-seeking, and especially various forms of collaborative partnerships between organizations?[1] The practical objective of assessing the development of the three relationships also offered the opportunity to investigate the theoretical question of how multiplex relationships may influence collaboration.

In the following sections, we review existing literature on the longitudinal process of interorganizational collaboration and on relational multiplexity, arguing that multiplexity may, over time, foster collaboration. We then describe our network data collection and analysis methods and explain our results and implications for scholars and practitioners aiming for a better understanding of interorganizational collaboration.

The longitudinal process of interorganizational collaboration

Interorganizational collaboration takes many diverse forms (Cropper et al., 2008), and scholars from numerous disciplines, including political science, public administration, organization science, and communication have studied the topic. In the current study, we define interorganizational collaboration as a process through which multi-sector organizations voluntarily form relationships with one another in order to solve problems and generate mutual benefits. This definition highlights two characteristics of collaboration that hold particular relevance for our study: (1) collaboration is a dynamic process, and (2) it occurs within the context of the multiple, repeated interactions necessary for organizations to recognize shared problems and opportunities.

A number of scholars have emphasized the longitudinal, process-oriented nature of interorganizational collaboration. This emphasis stands in contrast to a substantial body of past research devoted to identifying antecedents or outcomes of collaboration at a

single point in time. According to process-oriented organization science scholars, for example, interorganizational relationships may begin on a small, informal scale (Ring & Van de Ven, 1994). Gradually, if the participating organizations assess the initial relationship positively, the interaction continues with the relationship expanding to one that involves a greater commitment of resources, effort, and trust. In a related stream of longitudinal, process-oriented research, communication scholars have identified various practices that constitute interorganizational collaboration over time (Heath & Frey, 2004; Heath & Sias, 1999; Keyton, Ford, & Smith, 2008; Koschmann, 2016; Koschmann, Kuhn, & Pfarrer, 2012; Lewis, 2006; Lewis et al., 2010; Milam & Heath, 2014). For example, Koschmann (2016) identifies specific communication practices that may lead to collaboration success or failure by either facilitating or discouraging joint knowledge production, shared identity, and collective agency. Aggregating or summarizing existing ideas leads to failure; whereas, the emergence of novel knowledge through contestation and negotiation leads to success.

Drawing on this literature that treats interorganizational collaboration as a longitudinal process, we formulated a research question to examine how the collaboration ties between organizations in the health justice coalition changed over time.

> RQ1: How do different domains of collaboration, i.e. (1) sharing resources; (2) joint programming; (3) working together on policy/advocacy activities; and (4) client referral evolve in a health justice coalition?

We also draw on, and attempt to contribute to, the process-oriented collaboration literature by proposing that the formation of multiplex relationships may facilitate the development of interorganizational collaboration. The next section lays out these hypotheses.

Relational multiplexity and interorganizational collaboration

The notion of multiplex relationships has long been present in network studies, where scholars have proposed that multiplex ties may indicate stronger and more resilient connections because they provide more resources and because of their redundancy (Granovetter, 1973, 1985; Kenis & Knoke, 2002; Uzzi, 1997). In conceptualizing multiplex relationships, past studies have commonly viewed the *number* of different relationships as a one-dimensional indicator of relationship strength or stability. However, to fully understand how multiplex ties may impact collaboration, one needs to take into account both the number and the *types* of relationships between two partners, as different forms of interorganizational exchange may impact collaboration outcomes at varying degrees (Provan, Fish, & Sydow, 2007).

In the present study, we focus on two types of interorganizational relationships, communication outside of coalition meetings and expertise-seeking. We posit that these two types of relationships may independently motivate collaboration. In addition, when two organizations are connected by both communication and expertise-seeking relationships, the effect on collaboration may be greater.

Communication outside of coalition meetings

While the term 'interorganizational communication' may be used to refer to a wide range of communicative exchanges in the context of collaboration (Lewis, 2006), we focus on

communication between two members of the interorganizational coalition that occurs dyadically, outside of the formal coalition meetings of the organizational community under study. In operationalizing this relationship, we surveyed participants about their 'communication' with other organizational members outside of coalition meetings, because 'communication,' although not a specific term, was best understood by, and most meaningful for, participants. Our practitioner colleagues in this study were interested in understanding if organizational members of the coalition communicated outside of formal coalition meetings, because such 'extra-meeting' communication might indicate the development of collaborative partnerships that could be sustained dyadically, independent of the formal coalition. Fostering such dyadic, independent collaborative partnerships between organizational members was one long-term objective of the coalition.

Existing literature suggests that interorganizational communication establishes a foundation for collaboration through two overlapping mechanisms. First, communication is necessary to develop a shared understanding of key issues at stake and a collective identity between organizations, which in turn facilitates coordination of collaborative activities (Heath & Sias, 1999; Koschmann, 2016; Koschmann et al., 2012). Second, communication with a partner can help a focal organization to assess the ability and trustworthiness of that partner for a possible future collaboration (Kenis & Knoke, 2002; Sydow, 1998).

Empirically, research suggests that communication is a significant antecedent of successful collaboration. For example, among participants in a nonprofit community, communication is viewed as central to facilitating collaboration via building trust over time (Lewis et al., 2010). Across sectors, communication is consistently identified as a crucial element of collaboration success among non-governmental organizations in Zambia (Cooper & Shumate, 2012), disaster relief agencies (Lai, She, & Ye, 2019), and Croatian civil society (Doerfel & Taylor, 2017). Taken together, we hypothesize:

> H1: Organizational dyads that communicate outside of coalition meetings are more likely to form a collaboration tie over time than those dyads who do not communicate outside of coalition meetings.

Expertise-seeking

We define an expertise-seeking tie as occurring when members of the coalition ask other members for advice, expertise, or knowledge. Although some scholars treat expertise-seeking as a form of collaboration itself (Dyer & Singh, 1998), we endorse the view, argued persuasively by Koschmann and others (Koschmann, 2016; Milam & Heath, 2014) that simply seeking expertise does not constitute a successful collaborative activity. Expertise is, however, a valuable organizational resource, and research suggests that resource sharing is a necessary component of the collaboration process (Lewis, 2006). Expertise-seeking is distinct from communication outside of coalition meetings, as it highlights a more one-way interaction, motivated by one organization's need for the resources of another.

Expertise-seeking constitutes a strong motivating mechanism for organizations to establish and maintain partnerships. Research by Simo and Bies (2007), for example, suggests that existing networks of expertise-seeking are vital for future collaboration in the context of a disaster response alliance. Building on this line of work, we hypothesize:

> H2: Organizational dyads that share an expertise-seeking tie are more likely to form a collaboration tie over time than those dyads without an expertise-seeking tie.

The synergistic effect of multiplex relationships

In addition to the independent effects of interorganizational communication and expertise-seeking on collaboration, we propose that organizational dyads simultaneously engaging in both communication outside of coalition meetings and expertise-seeking may be even more likely to collaborate. That is, if the presence of one type of tie between two organizations facilitates collaboration, the presence of both types of such ties will act as an even stronger facilitator for the following reasons. First, as an organization's embeddedness in multiple relationships fosters stronger dependence on its partners (Provan et al., 2004; Uzzi, 1997), such dependence motivates organizations to collaborate with those with whom they already connect through other means. Those other connections help the focal organization to scrutinize and validate potential collaboration partners' trustworthiness, and they also reduce the search and coordination costs associated with finding new partners (Bryson et al., 2006; Gulati & Gargiulo, 1999). Second, relational multiplexity may increase the likelihood of collaboration by extending what scholars call the shadow of the past and the shadow of the future. The shadow of the past refers to any prior history of interaction between two actors, and the shadow of the future refers to an actor's expectation of continued interactions with a partner (Poppo et al., 2008). By providing more opportunities for organizations to interact with and assess their partners, multiplex relationships likely enlarge the shadow of the past. Multiplex ties likewise may enlarge the shadow of the future by increasing the rewards and risks in the overall partnership, making each partner more invested in preserving the partnership in the future.

To empirically test this combined multiplexity effect, we hypothesize:

H3: Organizational dyads with both communication and expertise-seeking ties are more likely to form a collaboration tie over time than those dyads with no or a single type of tie.

Method

Study participants and data collection

The longitudinal panel data in this study were collected via organizational surveys of the *California Covering Kids & Families* coalition. From 2009 to 2011, three waves of identical survey instruments were administrated via paper and online formats to individual representatives of the coalition's active organizational members. This included all organizations that were represented in at least one coalition meeting for that year. To facilitate participant recall, the survey also included a roster of all participating organizations for respondents to refer to when completing it. Each survey respondent was the person designated by his or her organization to represent the organization to the coalition. This included attending monthly coalition meetings and other coalition activities.

The annual survey response rate was 78% (49 of 63) in 2009, 92% (46 of 50) in 2010, and 74% (42 of 57) in 2011. In order to maintain a reasonable level of retention across each wave, we first selected organizations that participated in at least two waves of the survey ($N = 35$), with participation defined as an organization reporting that it had at least one tie per wave in either the communication outside of coalition meetings, expertise-seeking, or collaboration networks. The 35 organizations that met these inclusion criteria included 15

organizations participating in all three waves, six organizations participating only in the first two waves (2009 and 2010), 10 organizations from the last two waves (2010 and 2011), and four organizations that participated only in wave one and wave three (2009 and 2011). Furthermore, the sample was supplemented by including organizations in the coalition that were nominated by the respondent organizations but did not respond themselves to the survey ($N = 56$), with the purpose of creating whole networks. The two-step process yielded a final sample of 91, including 41 non-governmental, non-profit health care organizations (45%), 40 public sector or governmental agencies (44%), and 10 private organizations such as private insurance providers (11%).

Outcome variable

The outcome variable in our analysis was the interorganizational collaboration network that consisted of four domains of collaborative activities, which were identified by community practitioners based on the diverse range of partnerships formed in the past, including (1) sharing resources; (2) joint programming; (3) working together on policy/advocacy activities; and (4) client referral. The survey first asked each organization to name up to seven[2] organizations within the coalition with which they had collaborated in the past year, and then to further indicate if such collaboration involved any of the four specific activities. The collaboration tie was defined as present if the respondent identified having at least one of the four collaborative relations. Based on each organization's nominations, a binary organization-by-organization adjacency matrix ($N = 91$) was created for each time wave, with '1' indicating a connection between two organizations and '0' indicating no tie during that time period.

Co-evolving network variables

Communication outside of coalition meetings network

Organizations were asked to name the top seven organizations from the coalition with which they communicated most frequently outside of coalition meetings in the past year. Respondents were specifically instructed to consider dyadic interorganizational communication that only occurred outside of the formal coalition meetings. All communication ties were entered in three 91 by 91 matrices to create the networks of communication outside the coalition meetings.

Expertise-seeking network

Additionally, organizations were asked to name the top seven organizations from the coalition that they contacted for expertise about health care coverage and expansion in the past year. The question focused only on expertise-seeking behaviors, regardless of if the focal organization engaged in the actual knowledge exchange process with the nominated organization. All reported expertise-seeking ties were entered in three 91 by 91 adjacency matrices.

Control variables

To more rigorously test the influence of relational multiplexity on collaboration, we included the following three sets of variables in the model: (1) network transitivity, (2)

organizational status based on network centrality, and (3) homophily based on organization-level attributes. Each of these control variables has been identified in existing literature as predicting organizational collaboration.

Network transitivity

Transitivity refers to the structural tendency of connecting to one's indirect ties (Holland & Leinhardt, 1971). The transitive network structure has been found to promote collaboration through reducing uncertainty and forging indirect trust (Monge & Contractor, 2003). Network transitivity enables the focal organization to access important information about the third party – such as its status or trustworthiness – at a lower cost than from an independent information search (Gulati & Gargiulo, 1999). Also, because the third party's trustworthiness has already been verified by its partner, the focal organization can heuristically rely on the partner's choice or extend their trust to their partner's partner (Uzzi, 1997). Empirical studies of interorganizational networks indicate that triadic closure may significantly influence the formation of collaboration ties (Atouba & Shumate, 2010; Lee & Monge, 2011; Shumate, Fulk, & Monge, 2005). In order to control for such a transitivity effect, the transitive triplet parameter was included in the model to assess the extent to which transitivity characterized change in the collaboration network.

Organizational status

Organizational status is defined as the 'prominence of an actor's relative position within a population of actors' (Wejnert, 2002, p. 304). Organizations occupying the central structural location in an organizational community are more likely to access valuable resources and achieve better performance (Chandler, Haunschild, Rhee, & Beckman, 2013; Powell, White, Koput, & Owen-Smith, 2005). Organizations with central structural locations thus make attractive collaboration partners, as network centrality confers visibility and influence (Doerfel & Taylor, 2004; Lee & Monge, 2011). Based on this concept, organizational status was operationalized as the in-degree centrality of organizations in the collaboration interorganizational network, measured as the total number of alter organizations linking to the focal organization. This effect was tested by including the in-degree centrality parameter in the network model.

Homophily

Homophily is a commonly observed attachment logic in networks where actors have a greater tendency to associate with those who are similar. In interorganizational networks, two organizations with a common attribute can more easily collaborate due to resource complementarity, a higher level of trust, or shared values and visions (Atouba & Shumate, 2010, 2015; Doerfel & Taylor, 2017; McPherson, Smith-Lovin, & Cook, 2001). To control for the possibility that organizational similarity may have influenced collaboration, we included two homophily effects, *sector type* and *jurisdiction level,* in the analysis. Public and private sector organizations are noted for the difference in governing structure (Rainey & Bozeman, 2000). Meanwhile, the jurisdiction level has been particularly noted to influence the chance of collaboration among inter-governmental organizations (McGuire & Silvia, 2010). To consider these effects, we categorized organizations as 'private' and 'public,' where private non-profit organizations and for-profit healthcare providers and insurers were coded under the category of 'private' ($N = 51$), whereas

governmental agencies and publicly funded health plans were coded as 'public' ($N = 40$). Organizational jurisdiction level was operationalized as the scope of service – those that targeted only one county or a couple of counties were coded as 'county-level' ($N = 54$), and those operating at the state level or beyond were coded as 'statewide' ($N = 37$).

Analysis

To test the three hypotheses, *Simulation Investigation for Empirical Network Analysis* (SIENA) was used to model network evolution in *R* (Ripley et al., 2018). SIENA is a stochastic actor-based modeling method for longitudinal networks (Snijders, van de Bunt, & Steglich, 2010). The modeling process involves specifying structural parameters, like reciprocity, as well as parameters derived from the actors' attributes, that are hypothesized to influence changes in the configuration of the network of interest (in our case, the collaboration network). SIENA uses simulation to produce a distribution of hypothetical networks. The structure of the simulated networks is compared to the actual network on each hypothesized parameter (e.g. reciprocity), with the goal of identifying a model that closely resembles the observed network structure. Statistically, the significance of each parameter is assessed by a *t*-value, which is the parameter estimate divided by the standard error. Any positive *t*-values greater than 1.96 suggest that the hypothesized parameter is statistically more likely to occur than what would be expected by chance alone (Ripley et al., 2018). The overall model fit is assessed by 'convergence *t*-ratios' where values less than .2 for each parameter indicate an excellent convergence (Ripley et al., 2018, p. 61).

One notable advantage of SIENA, which is critical for the current study, is its ability to model the evolution and co-evolution of multiple networks. In our analysis, we treated the three waves of communication, expertise-seeking, and collaboration networks as three co-evolving networks. Three step-wise SIENA models were used to assess the independent main effect of the evolving communication network (Model I, H1), that of the evolving expertise-seeking network (Model II, H2), and the effects of the two co-evolving networks along with the multiplex relations effect (Model III, H3) on the formation of interorganizational collaboration within the coalition. All three models included the three sets of control variables (i.e. transitivity, organizational status, and homophily) and basic structural parameters, such as network density and reciprocity (Ripley et al., 2018; Snijders et al., 2010).

Results

Research question: the forms of interorganizational collaboration over time

To answer RQ1, we calculated statistics to describe changes in the forms of collaboration in which coalition members engaged over time. Four types of collaborative relationships, resource sharing, joint programming, joint participation in policy and advocacy, and client referral, were inspected for frequency among all collaboration partners of the coalition. Figure 1 presents the change in each type of collaborative relationship over time. Overall, all types of collaborative ties experienced growth, but the magnitude of such change varied. Resource sharing relationships enjoyed the highest rate of growth. This was also the most common form of collaboration among coalition organizations (57%,

76%, and 85% of the collaborative relationships were resource sharing for each time wave[3]). The second most frequently occurring collaborative type was joint participation in policy and advocacy (43%, 65%, and 64% across the three waves), followed by joint programming (41%, 41%, and 41% across the three waves) and client referral (17%, 31%, and 42% across the three waves).

The survey data further suggested that collaboration partners often had more than one type of collaborative relationship, and the rate of having multiple versus a singular form of collaboration grew over time. Specifically, 30% of partners indicated that they only had one form of collaboration in 2009, and this rate dropped to 26% in 2010 and further to 11% in 2011. Meanwhile, the percentage of partners having two types of collaborative relationships grew from 23% in 2009 to 38% in 2011, and the rates of having three and all four types of collaborative relationships displayed similar increases (see Table 1). These descriptive results suggested that over time, organizations engaged in collaboration tended to increase their investment in that partnership.

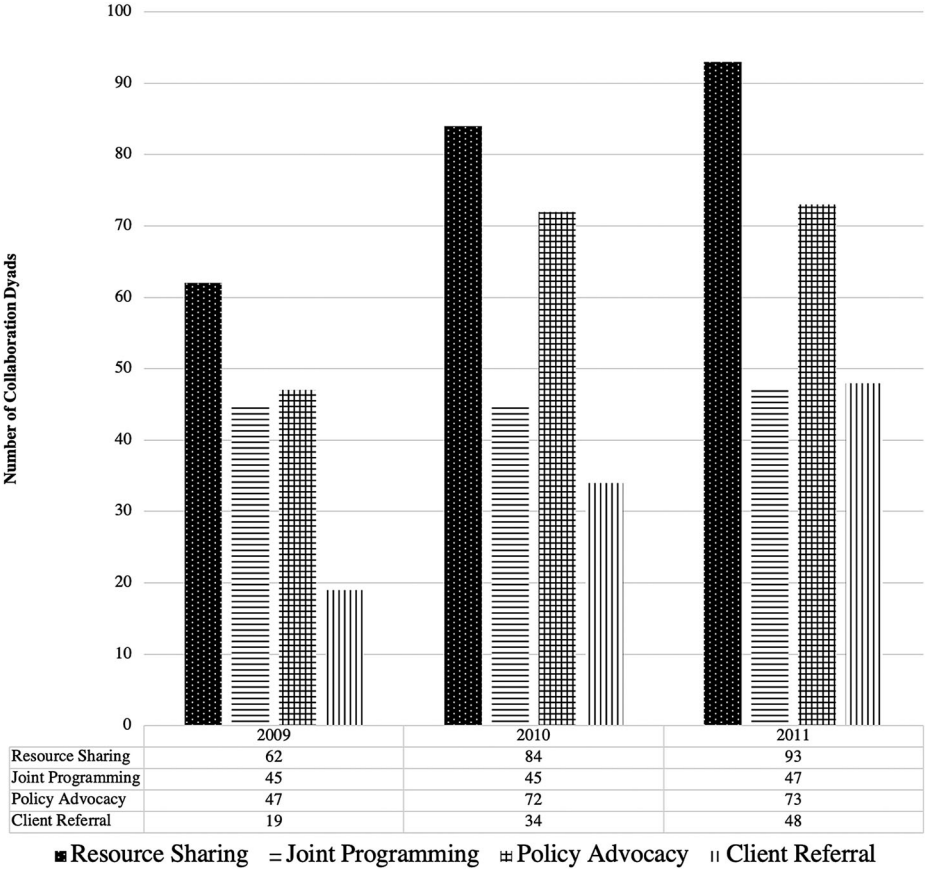

Figure 1. Changes in the four types of collaborative relationships among 91 coalition organizations between 2009 and 2011.

Note: Organizations may report more than one type of collaborative relationship.

Table 1. The percentage breakdown of organizational dyads having a single, two, three, and four types of collaborative relations over time.

	Missing	1 Type	2 Types	3 Types	4 Types
2009	24	33	25	18	9
	(22%)	(30%)	(23%)	(17%)	(8%)
2010	17	32	23	39	10
	(14%)	(26%)	(19%)	(32%)	(8%)
2011	11	12	43	29	19
	(10%)	(11%)	(38%)	(25%)	(17%)

Note: The missing column indicates the total number of partnership dyads that did not report specific types of collaborative activities.

Hypotheses testing

Table 2 presents the results of testing the three hypotheses using three SIENA models. The models showed a good level of convergence, with all of the convergence *t*-ratios lower than .1. The significant rate parameters for all three interorganizational networks suggested that each network at a prior wave significantly predicted its current network structure.

Hypothesis one posited that organizational dyads having communication outside of coalition meetings were more likely to develop collaborative relationships over time. Results from both Model I and Model III supported the independent effect of communication on collaboration (see Table 2). Specifically, having only a communication tie increased the likelihood of collaboration over time (H1) (see Model I: *Estimate* = 3.39; *SE* = .43; $p < .001$). When the multiplexity (communication *and* expertise-seeking) effect was considered, the independent effect of communication outside of coalition meetings remained significant (see Model III: *Estimate* = 5.25; *SE* = 2.44; $p < .01$).

Hypothesis two posited that organizational dyads having expertise-seeking ties were more likely to develop collaborative relationships over time, and this hypothesis was also supported. Without the presence of interorganizational communication, the independent main effect of an expertise-seeking relationship significantly predicted collaboration (see Model II: *Estimate* = 2.22; *SE* = .57; $p < .001$). Note, however, that when communication outside of coalition meetings and expertise-seeking were both considered in the multiplex model (Model III), the latter ceased to promote collaboration in a significant way.

The results of Model III supported hypothesis three, which proposed that having both communication outside of coalition meetings and expertise-seeking ties, above and beyond the independent effect of either type of tie, significantly increased the likelihood of collaboration (see Model III: *Estimate* = 2.45; *SE* = 1.10; $p < .01$).

In addition to offering support for our research hypotheses regarding the effects of multiplexity on collaboration, our modeling results indicate that multiplexity exerts these effects even when other variables known to facilitate collaboration are controlled for in the model. In the full model that included the independent effect of the communication network, expertise-seeking network, and the multiplex ties (Model III), the first control variable, transitivity, was a non-significant predictor in the interorganizational collaboration network. This meant that organizations were not significantly more likely to form partnerships with those with whom they already had a common partner (see Table 2, Model III, *Estimate* = 1.16, *SE* = .65; $p > .05$).

The second control variable suggested that organizations with higher organizational status – operationalized as those that had higher in-degree centrality in the collaboration

Table 2. Three SIENA models predicting interorganizational collaboration formation, 2009–2011.

	Model I: Communication			Model II: Expertise-seeking			Model III: Multiplex		
Variables	Estimate	*SE*	*t*-value	Estimates	*SE*	*t*-value	Estimates	*SE*	*t*-value
Multiplex network effects on collaboration									
H1: Communication Network Tie	3.39	0.43	7.88***	–	–	–	5.25	2.44	2.15**
H2: Expertise-seeking Network Tie	–	–	–	2.22	0.57	3.89***	5.05	3.06	1.65
H3: Multiplex Ties	–	–	–	–	–	–	2.45	1.1	2.23**
Control variables									
Transitivity in collaboration network	0.79	0.16	5.04***	0.71	0.12	5.69***	1.16	0.65	1.78
Organizational status in collaboration network	0.09	0.02	3.92**	0.09	0.02	4.62***	0.12	0.04	3.00**
Sector type homophily	0.27	0.18	1.53	0.34	0.13	2.61**	0.37	0.24	1.54
Jurisdiction level homophily	−−0.22	0.18	−−1.25	−0.22	0.13	−1.71	−0.29	0.31	−0.94
Structural parameters									
Outdegree (density)									
Communication network	−2.21	0.05	−44.68***	–	–	–	−2.21	0.06	−36.83**
Expertise-seeking network	–	–	–	−2.30	0.05	−45.10***	−2.3	0.08	−28.75***
Collaboration network	−4.22	0.39	−10.74***	−3.42	0.21	−15.96***	−6.38	2.47	−2.58*
Reciprocity									
Communication network	1.20	0.14	8.29***	–	–	–	1.20	0.15	8.00***
Expertise-seeking network	–	–	–	1.35	0.18	7.62***	1.34	0.20	6.70**
Collaboration network	0.44	0.33	1.35	0.99	0.28	3.60**	0.39	0.44	0.89
Rate parameters									
Period 1: 2009→2010									
Communication network	7.35	0.92		–	–		7.34	0.8	
Expertise-seeking network	–	–		5.66	0.90		5.73	0.83	
Collaboration network	9.81	3.23		8.49	1.45		8.55	1.65	
Period 2: 2010→2011									
Communication network	6.01	0.63		–	–		6.02	0.56	
Expertise-seeking network	–	–		7.91	1.06		7.92	1.24	
Collaboration network	7.04	1.42		5.64	0.94		6.08	1.01	

Note: All the convergence t-ratios (not shown in table) were below the threshold value of .1, suggesting the models converged well and the simulation fits the observed network.
*$p < .05$, ** $p < .01$, *** $p < .001$.

network – were more likely to form collaborative alliances over time (see Table 2, Model III: *Estimate* = .12; *SE* = .04; $p < .01$).

Finally, the homophily effects based on sector type and jurisdiction level were not significant in Model III, indicating that homophily did not structure collaboration in the health care coalition under study, when the effects of two co-evolving networks and the multiplex ties effect were taken into account.

Discussion

Interorganizational collaboration constitutes an ongoing subject of interest among both scholars and practitioners. This study represented a joint research-practice effort to use social network analysis as a tool to evaluate whether and how membership in an interorganizational network fostered the development of multiple relationships – communication outside of coalition meetings, expertise-seeking, and especially collaboration – between organizations over time. The results of our evaluation indicated that multiplex relationships indeed facilitated collaboration over a three-year period, and that both the type

and number of such relationships mattered: communication outside of coalition meetings was more influential than expertise-seeking, and having both types of ties was more influential than having just one.

Scholarly contributions

Our study contributes to the scholarly understanding of interorganizational collaboration and relational multiplexity in several ways. First, the results offer a more nuanced picture of network multiplexity, supporting the conventional wisdom that 'more is better,' and that the type of multiplex ties may be as important a variable as the number of ties. Few previous studies have examined how different relationship types may impact collaboration differently. The current study thus represents an effort to address this gap. We find that communication outside of coalition meetings consistently drives the formation of collaborative ties over time, whereas the role of expertise-seeking relationships is less robust, as the independent effect of these ties on collaboration becomes insignificant when communication ties are simultaneously considered.

Second, the finding that communication relationships outside of coalition meetings play a significant role in facilitating interorganizational collaboration is consistent with, and adds to, existing literature showing that communication is integral to the collaborative process (Lewis, 2006). However, our study finds that contrary to our hypothesis, the expertise-seeking network alone does not promote collaboration when controlling for communication outside of coalition meetings. This may be explained in part by the logic of status homophily (Chung, Singh, & Lee, 2000; Podolny, 1994). The logic of status homophily describes the tendency for organizations to partner with peers having a similar status, which is contrary to the status-seeking logic, where low-status organizations seek to partner with high-status organizations, as expressed in the inclusion of the centrality control variable in our analysis. Status similarity can facilitate trust and equal commitment from both parties, thus safeguarding the success of collaboration (Podolny, 1994). Since an expertise-seeking relationship in itself implies status hierarchy, this type of relationship may be less conducive to building trust, and, in turn, collaboration, than a communication relationship.

The finding that the expertise-seeking network alone does not promote collaboration may also be explained by the observation that trust is domain-specific. Mayer, Davis, and Schoorman (1995) propose that organizational trust is domain-specific such that Actor A may trust Actor B in one type of relationship (e.g. providing supplies), but this trust does not carry to another type of relationship (e.g. advising on product development). In our study, communication outside of coalition meetings may have generated more trust between partners than expertise-seeking relationships. This supports our argument that studying only the number, and not also the type, of relationships results in a less nuanced understanding of relational multiplexity.

A third contribution of our study is to demonstrate the importance of relational multiplexity while controlling for other widely-recognized antecedents of interorganizational collaboration: network transitivity, network centrality-based organizational status, and organizational homophily. Of these control variables, only organizational status has a significant effect on collaboration in our full model. In terms of the magnitude of effects on collaboration, our results show that relational multiplexity exerts a larger effect on

collaboration than status. Organizational dyads that engage in two types of network exchange are more likely to form collaborative partnerships than those dyads having only one type of connection or none, and the combined effect is independent of the main effect of communication or expertise-seeking. That is, even when one type of network tie does not directly promote collaboration (i.e. expertise-seeking), multiplex ties are still able to enhance the likelihood of collaboration. These results suggest that relational multiplexity is as important a mechanism for building collaborative relationships as other classic, widely studied antecedents of collaboration.

Fourth, addressing calls for more longitudinal studies of interorganizational collaboration and relational multiplexity (Ahuja, Soda, & Zaheer, 2012; Lizardo & Pirkey, 2014; Shipilov et al., 2014), our research encompasses three years of data on the development of three types of interorganizational relationships. Through actor-based modeling, the current research is uniquely equipped to examine the evolution of dyadic collaboration relationships as embedded within a set of overlapping interorganizational networks.

Practical implications

In addition to these important scholarly contributions, we offer recommendations for practitioners. First, organizations' dyadic collaborations deepened over time, as member organizations reported engaging in more different domains of collaboration. Community Health Councils, the lead organization of the coalition, offered member organizations a variety of ways in which they could collaborate (e.g. joint policy advocacy), and members could also choose to collaborate separately from the coalition structure (e.g. client referral). In early coalition building, any form of collaboration among pairs should be encouraged, so that even small investments can create the 'shadow of the past' that might lead to future collaborative activities and a shared mission.

Second, our study demonstrates how the formation of multiple, less complex communication and expertise-seeking relationships may facilitate more effortful and ultimately beneficial collaboration. For practitioners, this means that informal relationships should be encouraged between organizations as a means of facilitating collaboration that achieves the social change that is the goal of many interorganizational networks. In our study, responses to open-ended questions in the survey indicate that members of the interorganizational coalition strongly value these communication and expertise-seeking relationships. For example, in response to a question asking about accomplishments achieved by the coalition in the last year, respondents reported the following:

> What I value the most is the pipeline of direct communication. I really look to [the coalition] to keep me updated with very timely issues that constantly change. –Wave 1, Respondent 34

> [Accomplishments include] mobilizing in support of kids' [insurance] coverage, education on complex issues, [and] expanded networking capacities of the involved organizations. –Wave 1, Respondent 1

> The coalition has been strong in connecting partners with key players in the state government, allowing members to better understand [health] programs on both a federal and state level. –Wave 3, Respondent 25

In particular, dyadic communication emerges as an important initial relationship for evolving future collaboration. Thus, coalitions that wish to support successful

interorganizational collaboration should offer opportunities for organizations to communicate outside of group meetings. 'Speed dating' networking events that facilitate dyadic partnerships may help to initiate communication relationships. Though expertise-seeking alone is not as useful for developing collaboration as communication relationships, having multiplex relationships does lead to more collaboration. Establishing a directory of differing types of expertise (Yuan, Fulk, Monge, & Contractor, 2010) early in coalition building may allow organizations to make stronger connections with a wider variety of partners within the coalition.

Third, for practitioners engaged in interorganizational alliance building, our study offers a social network approach to evaluate collaboration outcomes and the development of different types of relationships over time among members of an organizational coalition. As Provan, Veazie, Staten, and Teufel-Shone (2005) note, network analysis offers members of interorganizational networks an objective, systematic means to evaluate network processes and performance. Following each round of surveying, organizational participants are able to see an unlabeled network map of the coalition structure. Additionally, the survey not only asks participants to report their current communication, expertise-seeking, and collaborative ties, but also to reflect on potential desired collaboration. The mere act of completing such a survey may contribute to coalition building (Provan et al., 2005), and coalition leaders can use survey results to help bridge gaps in collaboration. We recommend coalition builders ask their members to report their communication relations and expertise-seeking. Doing so may help coalition leaders to suggest missing links in communication and to create a directory of experts for different topics.

Limitations and future research

In addition to these contributions, we note several limitations of our study. First, although it included three well-established antecedents of collaboration, in addition to multiplex relationships, there were a number of other relevant variables and analyses that we were not able to consider. These include the effect on collaboration of past relationships inside or outside of the network (Gulati & Gargiulo, 1999; Lai et al., 2019; Lee & Monge, 2011; Shumate et al., 2005); the effect on collaboration of changes in the identities of individuals who represent organizations at coalition meetings (Heath & Frey, 2004; Keyton et al., 2008); and the role of multiplexity in the dissolution of collaboration (Kenis & Knoke, 2002; Lizardo & Pirkey, 2014). Additionally, we were not able to collect qualitative data on the experience of engaging in 'multiplexity' or multiple types of collaborative activities, nor were we able to gather organizations' evaluations of the quality or functionality of each type of interorganizational tie. Given that 'multiplexity' is a relatively abstract term to most practitioners and that the process of collaboration is complex, qualitative data would potentially contextualize and validate our quantitative findings.

Second, our examination of the types of multiplex ties highlights an important challenge in studying relational multiplexity, the challenge of boundary specification (Laumann, Marsden, & Prensky, 1989). That is, what are the appropriate inclusion criteria to determine which actors are included in the empirical network, and what are the appropriate types of multiplex ties to study in a particular setting? While researchers should strive to use common definitions for tie types, such as friendship, advice-seeking, etc.,

when possible, they should also use definitions that are sensitive and relevant to the practitioners and contexts they study. Definitions commonly used in the research literature will not always be applicable to a particular context. In the present project, the organizations we studied were interested in evaluating communication outside of coalition meetings, expertise-seeking, and collaboration in the coalition network, three types of relationships with fine-grained distinctions that other researchers might collapse into only one or two categories. As scholarship on relational multiplexity becomes more sophisticated, the challenge of how best to define tie types will be important for researchers to keep in mind.

In conclusion, our study results suggest that the formation of multiplex relationships plays a key role in the process of collaboration, and that both the type and number of these relationships matter.

Notes

1. Because this study was grounded in applied work to help the coalition, the social network survey questions used language appropriate to a lay audience – e.g., 'communication outside of coalition meetings' – to describe the three different types of relationships.
2. The number of informant nominations in network surveys typically ranges from five to seven (Marsden, 1987; Valente, 2010), and we chose the upper bound number, seven, with the goal of collecting more comprehensive network data.
3. In each wave of the survey, a respondent organization could report having more than one type of collaborative relationship with an alter organization, so the total percentage of the four types of collaborative relationships exceeded 100%.

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