Sustainable Network Advantages: A Game Theoretic Approach to Community-Based Health Care Coalitions

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Abstract:
Health care organizations often enter into a cooperative arrangement to create safety-net programs and coordinate care. Maintaining effective cooperation in such alliances poses special problems that can be examined using network analysis and explained in game theory terms. A mental health coalition case study is presented using network analysis and game theory interpretations. Has a positive-sum game approach been applied to the coalition's initial design, its subsequent suboptimal performance might have been averted. The application of network analysis plus game theoretic paradigm has significant implications for improving both the design and the coordination of such coalitions.
Key words: community health improvement, game theory, networks

Article:
Managed care and other cost containment measures have dramatically changed the business environment for most health care providers. Many providers have formed integrated delivery systems under common ownership to gain a sustainable competitive advantage. [1,2] Another approach has been the creation of strategic alliances or networks that combine both private firms' and public health agency's efforts without shared ownership. National surveys indicate that approximately 1500 local health agencies maintain some type of alliance with private insurers. [3] However, many such alliances fail to deliver the mutual benefits initially promised. [4]

The voluntary nature of strategic alliances and networks makes them inherently unstable because of uncertainty regarding their partners' future behavior. Lacking either institutional or contractual authority to ensure robust cooperation, health care networks rely on the partners to put the interest of the alliance to the forefront of their plans. Although desirable, mutual cooperation is not automatic, and member organizations may pursue strategies that are individually rational but collectively suboptimal. To a large degree, previous network research on voluntary coalitions of health care providers was driven by the assumptions underlying cooperative game theory and focused on successful examples of partnering.

The study illustrates why a noncooperative perspective may be more productive than cooperative assumptions for both potential health care coalition participants and funding agencies. Game theory and network analysis is applied to one community-based coalition's experience using a case study approach. Differentiating this research from the majority of other studies is that the voluntary integration effort used in the case failed—which is the far more common reality. Game theory explains interfirm relationships in terms of interdependence, vulnerability, mutual gain, transparency, and coordination issues that must be addressed if such alliances are to succeed. Network analysis provides a complementary technique for depicting the structure of interorganizational relationships.

The issue of how to structure health care networks to promote cooperation is highly relevant for both practitioners and policymakers. From a policy perspective, funders need to understand the grant and contract conditions that influence, or fail to influence, community health care coalition members' strategic decisions. [5] For network builders, understanding the strategic interdependencies of their constituents is critical to

minimizing downside risks as well as to optimizing outcomes. Coupled with a game theory paradigm, network analysis provides a framework for both policymakers and health care administrators to determine the nature of the partnership that exists and how stakeholder relationships ought to be characterized.

The contributions of this study are threefold. First, an integration of game theory's explanatory power in conjunction with network analysis techniques adds a new dimension to health services research on alliances. Second, the specific area studied, mental health partnerships, is likely to be one of the most active areas of network growth as managed care organizations "carve out" such services. In addition, effectively integrating mental health services has important implications for the quality of care people receive. Finally, clarifying the strategic implications for potential alliance members and policymakers may help to overcome some of the potential pitfalls of forming such networks.

NETWORK ANALYSIS AND GAME THEORY

Numerous theories and analytic techniques have been applied to study these strategic alliances. However, previous network research studies have tended to ignore the social structures of alliances and failed to examine how perceptions of such structures influence actors' behaviors. [6] Therefore, finding an appropriate pairing between theory and analytical technique is the first step in addressing the questions at hand. Game theory and network analyses provide such a pairing for studying strategic alliances.

Game theory was developed to study the decision-making processes of two or more individuals simultaneously. Because individuals have to make concurrent decisions, and the natures of the outcomes are dependent on others' decisions, the situation approximates a game. The rock, paper, scissors game is a very simple example of such a decision-making paradigm. In this game, each player picks her or his strategy and then reveals it to her or his opponent at the same time he/she discovers that person's choice. It is only after both choices are known that a winner can be determined. Game theory helps to explain strategic decisions of players by examining their current behaviors and probable outcomes. Thus, a more complex story can emerge than the one that assumes that managers are only hoping to get the next decision right. However, it becomes critical to understand the social structure the firms are embedded in because that is where managerial insights emerge.

Network analysis captures the embedded nature of organizational actors and helps to identify the parameters of the game. In general, a network is a system of interconnected individuals or organizations through which information is communicated and/or resources flow. Analysis can identify patterns of such flows that have strategic implications for network participants. Nevertheless, some theory is required to draw inferences from network data and to bring their story to life.

Game theory and network analysis are well matched because they share two common assumptions about social behavior that make their combination intuitively appealing. The first assumption is that participants recognize one another as being players, or actors, in the game. Second, both game theory and network analysis presume that incomplete information is the norm. This is an important trait because organizations and individuals often display less than perfectly rational behavior because they lack the information to do otherwise. Therefore, game theory and network analysis taken together can investigate coalition participants' actions and strategies in a meaningful way.

Game theory and network analysis in combination offer two major insights applicable to community-based health care coalitions. First, although the stated intention of network formations is cooperation, several game theory conditions must be met if true cooperation is to exist. Network analyses can reveal the presence of potential disequilibria that violate cooperative game conditions. Second, the cost of playing the game by the rules, or maintaining network fidelity, may be greater than the benefits that are returned to community. Therefore, understanding which individuals stand to lose or gain within a particular initiative can yield critical insights into its prospects for success vis-à-vis a cooperative model.

COOPERATIVE INTENT BUT STILL A NONCOOPERATIVE GAME

One contribution of game theory to understanding network development is its ability to differentiate between cooperative intent and strategic reality. Although the term "noncooperative game" may seem pejorative, in game theory, it describes any situation that fails to meet any one of three necessary conditions: (1) every actor's motivation is common knowledge, (2) legally binding agreements exist among members, and (3) all benefits derived from cooperation are returned to the members in a manner they consider equitable. Cartels are the prime example of such game paradigms because their members have a common goal, enter contractual agreements, and share monopoly rents. However, even the most famous cartels, Oil Producing and Exporting Countries and DeBeers, have given way to free market forces. Therefore, the vast majority of alliances and interfirm collaborations are noncooperative in game theoretic terms.

Although health care providers bring cooperative intentions to their interactions, their contexts generally include numerous noncooperative characteristics. Imperfect information about other members' intentions, lack of formal contracts, and returning the gains of collaboration to the community as either increased service provision or decreased cost (i.e., the community benefits) all violate cooperative game principles. Therefore, we apply a noncooperative game theory viewpoint, although network participants generally seek cooperation and may attain it to varying degrees.

To achieve a cooperation level that allows the coalition to survive and benefit the community, its payoff functions need to be efficient. A payoff function is the sum of all participants' gains from cooperation. Sustainable efficiency requires that each player receives at least as much from participating in the network as it would by operating unilaterally.

The common game theory metaphor for a breakdown of relationships between members in a network is illustrated with the "prisoner's dilemma," which refers to a situation in which two partners in crime have been captured and are now being interrogated separately by the police. If they vouch for each other, they will receive moderate punishment. If one vouches for the other but is betrayed, the betrayer goes free while the faithful prisoner receives a severe punishment. Alternatively, if they accuse one another, they each receive severe punishments. Under these alternatives, the prisoners collectively benefit from mutual fidelity but potentially maximize their own utility through betrayal. In the absence of trust or some other means of enforcement, each prisoner pursues her or his own narrow, short-term, "self-interest although all actors are collectively better off if they cooperate."[7(p.145)]

Among prisoners facing the dilemma, trust erodes for two reasons. The first breakdown occurs because the prisoners are isolated. Without continual reassurance from one another, the mutual commitment between prisoners can wane. Second, the police assume the roles of moderator and confidant and provide incentives for one prisoner to betray the other. The only certain way to ensure both prisoners maintain "the code of silence" is to have an external force with the capability to penalize any digression. In criminal activity, the Mafia (another cartel that eventually failed) served this function by providing certainty that anyone who broke "the code" was sure to suffer dire consequences. By this explicit threat, the Mafia maintained the trust or equilibrium between prisoners.

STRATEGIC EQUILIBRIA

The "code of silence" is a form of equilibrium among prisoners because no one can reduce their punishment, hence improve their situation by changing their strategy. Cooperative interorganizational relationships emerge based on projections about other actors' behaviors, which, when unrealized, can lead to suboptimal outcomes and unstable networks at future decision points.[8] Using the prisoner's dilemma metaphor, if the suspects could interact after their arrest, negotiate prior to interrogation, make binding agreements, and monitor one another's testimony, projections about other actor's behavior would be far more accurate. Therefore, one way to make inferences about system stability is to observe patterns of communication among members. Without the ability to communicate, actors are more likely to pursue self-interest because they lack assurances about others' motives.

Network communication analyses complement game theory by building on the information-seeking behaviors of each individual relative to every other network member. These links reflect individual calculations of net benefits after factoring in the costs of coordination. [9] Thus, traditional network analyses, which are designed to measure patterns of exchange between pairs of actors, make it possible to overcome a central challenge to game theory, which is the difficulty of directly measuring the costs and benefits of network participation to partner organizations.

The information cost approach assumes that a rational actor willingly incurs the cost of accessing another network member because the actor may thus gain access to all of the members the second party has accessed. The branching effect of such network exchanges creates synergies because an actor can gain access to the entire network's information by communicating with as few as one other member. By assigning the cost of an information link to the initiator, "this allows us to model the network formation process as a noncooperative game, where an agent's strategy is the specification of the set of agents with whom he forms links."[10(p.1182)] Therefore, the most efficient communication strategy is to access the entire network with as few links as possible.

A necessary but not sufficient condition of network equilibrium is that every actor is able to access every other network affiliate through some combination of members. Systems operating at optimal efficiency will have the minimum number of links to meet this condition and be in equilibrium. Such networks can take one of two pure forms—either stars or wheels.

A network with a star structure has a central actor who links all other actors (see Fig. 1A). Networks having multiple central actors are particularly prone to disequilibrium because peripheral actors may have multiple strategies of equal utility, which makes their behavior unpredictable. [10] Alternatively, a network lacking central coordination may have a wheel formation whereby actors use one-way links to other actors to gain information (see Fig. 1B). Graphic depiction of these relations, called sociograms, can provide a visual tool for examining the structure of the network. Measures summarizing ties between individual actors can further indicate who connects others and identify the presence of dense subgroups (cliques), which may create disequilibrium within the network. In situations of disequilibria, actors must then reevaluate the nature of their strategies. The first part of such an evaluation is whether they want to continue participating in the network (i.e., playing the game) and, in game theory terms, if that participation should be cooperative or noncooperative. These calculations are based on estimations of both individual costs and distribution of collective benefits.

BARGAINING COSTS AND SOCIAL BENEFITS AMONG NETWORK MEMBERS

Game theory has provided significant insights into the nature of bargaining costs and social benefits.[11] For community health care networks that are in equilibrium and cooperating, bargaining can occur efficiently. The necessary conditions for this situation are that all actors have common knowledge about every other actor's motivations, the costs and benefits are contractually specified, and the benefits accrue equitably to all members. However, as mentioned in the previous two sections, these conditions are frequently too stringent for any practical utility. Therefore, the conservative approach is to consider the problem as a noncooperative game.

In a noncooperative context, actors have incentives to externalize their costs and reap disproportionate benefits. Similar to the moral hazards associated with health insurance, once one coalition member understands the goals of the other members, it may seek to minimize its private costs at the expense of the collective's welfare. If the network has a central actor, as is the case in a center-sponsored star, that actor may either prevent such behavior or pursue it.

The center star's coordination activities are not without cost. In other words, the management of the network creates a cost center. Therefore, for a center-sponsored network to be viable, the net gain from network synergies needs to be greater than the cost of administration. From the perspective of other participants, the coordinating entity must both pay for itself and ensure a distribution of benefits to others that yields a net gain to each.

FIGURE 1

A, Center-Sponsored Star. B, Wheel Network
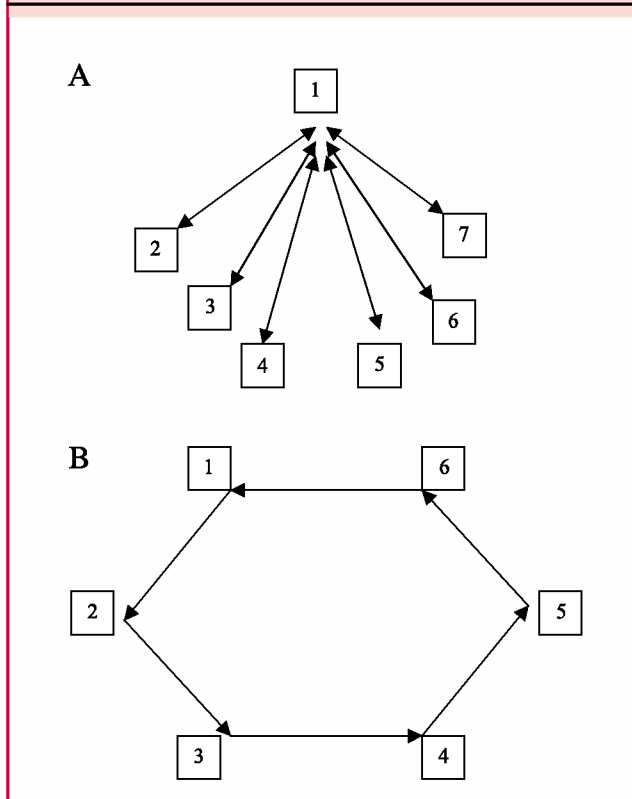
The organization coordinating the activities of network members frequently has little or no income other than grant funding and donations. In addition, the central organization has no purpose other than administering the network. Therefore, among many health care networks, one of the primary functions of the central organization is the development and pursuit of outside funding. As grant funding is exhausted, which is frequently the case, network members will be forced to pay for any coordination that does not generate increased utility (i.e., yield revenue, either earned or donated, or reduce costs).

At the point in time when outside funding runs out, is diminished, or is designated to a specific network member's control, many health care coalitions begin to experience problems or disequilibrium. The negotiating and coordinating costs of the coalition's activities may exceed the marginal utility of the network synergies for some members. In other words, some members cannot afford to belong to the alliance without some subsidy. Many networks struggle at this juncture because members cannot agree on how to allocate administrative expenses and/or synergistic gains. [12] Disequilibrium in cooperative contexts thus creates commitment problems because members perceive the nature of the initiative to have fundamentally changed with new strategies being more beneficial to them individually.

Commitment problems that create disequilibrium have a deleterious effect on networks without a central organization to maintain the fidelity of communication and ensure that all parties benefit. Alternatively, a central coordinator that either lacks the authority to enforce the conditions of mutual benefit or "games" the system to its own ends can actually be harmful to alliance members. Such nonsynergistic conditions violate the tenants of cooperative networking and create noncooperative environments where actors seek to optimize their own utility with disregard for, or even at the expense of, other members' welfare, as is illustrated in the following case.

CASE STUDY

Case studies are particularly useful when the research goal is to gain a holistic understanding of how dynamics unfold in real-life settings. In this instance, the authors' identified game theory as relevant only after careful review of all relevant documents and data about communication patterns. Thus, this study used an existing theory to explain findings emerging from the data. Because the initiative examined was not working, the case study represents a class of community-based integration efforts that are underrepresented in the empirical literature.[13]

Care Partners Network* (CPN)[1] was part of a multisite study sponsored by the Health Resources and Services Administration's Bureau of Primary Health Care (BPHC). CPN was founded as a nonprofit corporation several years earlier and has over a dozen members, including the local independent practice association (IPA) and hospital. The CPN initiative was an effort to enhance communication and referral patterns between primary and mental health care providers. The CPN was not a direct care provider; instead, it sought to facilitate coordination among its member providers by serving as the central actor in a star-configured coalition.

In the fall of 2000, an academic and a practitioner visited CPN using a semistructured protocol to inter-view the Chief Executive Officer (CEO) of CPN. Four other individuals the CEO had identified as actively involved in the initiative were also interviewed: a high-level administrator at the mental health department, the medical director of the IPA, and two "care coordinators" mandated by the state for managed care plans serving Medicaid patients. The interview protocol prompted each participant to tell the chronological story of her or his engagement in the initiative, including major events and challenges, as well as final outcomes. The academic at the CPN site visit had pilot tested the protocol with another practitioner, after which the BPHC work group guiding the study agreed on minor revisions, mostly relating to item ordering. The practitioner was an executive from another BPHC-sponsored network, who was able to relate to CPN participants as a colleague facing shared challenges. During interviews, the practitioner was therefore able to engage each participant in conversation while her academic partner attended to informed consent procedures, taping, and timely, consistent interview completion in accordance with the protocol.

For these interviews, the research team deliberately selected individuals in different hierarchical positions to include a diversity of perspectives (from policy level to front lines) on the initiative. While the people chosen were those who would know the most about this integration effort, comments by someone who was not active in this initiative (a CPN clinic medical director interviewed about a different integration effort) paralleled those of more active participants. Thus, the views analyzed for this case study were indicative of broader sentiments within CPN.

For the network data, sampling proceeded in a modified snowballing process.[14] First, each individual identified by the key informant as actively involved in the initiative was asked to checkoff a list of other participants "those whom you ask frequently for either advice or information about mental health-primary care physicians (PCPs) communication" on the instrument used for this study. Subsequently, several additional individuals were added to the sampling frame after being identified by two or more of the initial informants. Of the eleven individuals thus identified, nine responded, yielding a response rate of 82 percent.

One of the complexities of interorganizational networks is that they build on individuals who are nested within organizations. To highlight patterns at the interorganizational level, a second sampling frame was defined that has included only the highest ranking individual at each organization with active members in the coalition integration effort. This offered a uniform means of selecting respondents for these data.[15] Five of the six individuals thus identified (a subset of those described above) responded, yielding a response rate of 83 percent.

Interviews were taped and transcribed. The first two authors independently reviewed reports to the BPHC as well as minutes from meetings of the problem-solving committee discussed below and copies of e-mails between the mental health department liaison and other CPN members. The authors then compared their notes on all relevant data sources to develop the history outlined below. A timeline of the integration initiative was also developed to facilitate triangulation across informants about key events. Finally, validation included an exit

briefing with the CPN CEO, during which the site visit team reviewed their key findings. UCINET software was used to calculate network measures.

PROLOGUE—THE QUEST FOR MENTAL HEALTH-PRIMARY CARE INTEGRATION IN PLAINS COUNTY

CPN officially began in the late 1990s with support from BPHC, although several its members had a tradition of working together cooperatively. Providers in this historically underserved rural area had a shared ethos of cooperation in caring for the poor of Plains County. With the advent of Medicaid managed care, the IPA and other area providers agreed to coordinate their collective activities informally under the leadership of a community health center, whose physicians also belonged to the IPA. The county health department was also an active supporter of the coalition.

The talents and energy of CPN participants yielded many important successes. Among these were attracting substantial grant revenues, conducting community needs assessments, and recruiting providers. However, there was one area in which cooperation was not being effectively achieved.

Before CPN secured funding as a network, the IPA and a Medicaid managed care organization had sub-mitted a joint application for the state's mental health services contract. However, the contract was awarded to the county's mental health department. Based on the expedited manner in which the grant was awarded, many in CPN interpreted the decision as having been a foregone conclusion. After the award of the contract, the PCPs believed that the Medicaid mental health capitation payments went entirely to the county, although the PCPs often diagnosed and treated mental health problems in the Medicaid population. The county mental health representative disagreed, stating that the PCPs did receive compensation via their state Medicaid contract.

The belief among the PCPs that they were not being treated equitably stemmed from previous events. A few years after CPN began, a suicide occurred that many believed could have been prevented through better coordination. There was a sense that seriously depressed people had to be not only proactive but also articulate (saying "the right words") to receive treatment. In response, the state department of mental health services asked Plains County to improve communication between the county mental health department and primary care providers. A problem-solving committee formed, but when its members requested state participation, the request was denied. Over the next year, the problem-solving committee continued to meet despite a lack of substantive progress between the county mental health department and other community providers (both physicians and health maintenance organization patient representatives).

In 2000, a separate issue—escalating costs of psychotropic drugs prescribed in primary care settings— prompted the state department of human services to select Plains County for a grant to improve mental health screening in the hope that better primary care treatment would reduce costs. The CPN board formed a working group specifically for this project, which began to meet even as the broader problem-solving committee continued its efforts. This time there was optimism that the new grant would pass through CPN, both reaffirming and enhancing its role as a facilitator. These hopes were short-lived, as the state agreed to provide the funds only if CPN could meet administrative requirements that turned out to be prohibitively expensive.

At the time of this study group's site visit, the tone of participants could best be characterized as frustrated but stoic. For example:

> I'm tired of the talk. I really, really want to see action.

> ...if we don't continue to try, it will never get any better. And it has to be better than it was two years ago ...if you opt out there is no progress.

It was at this point the analysis began.

A NETWORK ANALYSIS OF MENTAL HEALTH-PRIMARY CARE INTEGRATION AT CPN

Network analysis and game theory bring into focus several of the problems associated with CPN's attempt to integrate mental health and primary care. First, "betweenness centrality" is an aggregation of "pair dependencies," indicating how many of the shortest paths between each pair of actors are mediated by each actor. Betweenness centrality thus measures the extent to which an individual actor lies between other actors in a network and can potentially broker between them. "Out-degree" centrality refers to the number of people each informant indicated she/he sought information or advice from and "in-degree" centrality indicates the number of other network members who said they sought information or advice from the focal actor. Actors with higher levels of centrality in task-related information exchanges have been found to have more power within networks than others possess. [16]

In this case, the sample of all individuals involved in the integration effort reveals a two-star structure. Two individuals were key conduits of information and advice seeking: Sue, a care coordinator at the local Medicaid managed care plan (with a betweenness score of 13.46 relative to an average of 4.04), and Diane, a care coordinator at the IPA (whose betweenness score was 13.28). For a list of all scores, see Table 1, and for a graphic depiction of individual communication ties, see Figure 2A. In interviews, both women depicted themselves as advocates for the underserved whose primary function was to overcome barriers to better coordinated patient care.

Brian, the primary liaison from the county mental health department, had a much lower betweenness centrality score of 5.41. Therefore, Brian was not one of the most active brokers although he represented the organization receiving the integration grant. The reason for this was that he sought information from relatively few people. Others did seek information from him: Brian's "in-degree centrality"—the number of people who sought information or advice from him—was 7, tying with Sue and exceeding Diane's. However, his "out-degree centrality"—the number of people he approached—was only 5, below both Sue's and Diane's values. Apparently, other initiative members were reaching out more to Brian than Brian was reciprocating. The resulting discrepancy between resource control and information exchange reflects a system in disequilibrium that was not operating efficiently.

What about the CPN leader's role? Nancy, CEO of CPN and a natural facilitator for this effort, had a betweenness centrality score of only 3.06, well below the average. Again, looking at the direct links, while she reported seeking information from five others, only three individuals sought information from her. Therefore, Nancy did not appear to play an active role in brokering network relationships and communication.

TABLE 1			
Betweenness Centrality of Individual Actors Within the Mental Health-PCP Integration Effort			
Individual	**Position**	**Organization**	**Betweenness Score***
Brian	Mental Health Specialist	County Department of Mental Health	5.41
Sue	Care Coordinator	Medicaid Managed Care Plan	13.46
Nancy	CEO	CPN	3.06
Ray	Associate Medical Director	IPA	1.80
Cynthia	Exceptional Needs Care Coordinator	Medicaid Managed Care Plan	0.22
Diane	Care Coordinator, Quality and Utilization Management	IPA	13.28
Cathy	Liaison	Department for Geriatric Services	2.32
Amy	Care Coordinator	County Department of Mental Health	2.22
Mike	Medical Director	Medicaid Managed Care Plan	†
Ann	Administrative Assistant	CPN	2.68
Kristin	Exceptional Needs Care Coordinator	IPA	†

*These are "normalized" scores, which divide actual betweenness by maximum possible betweenness and thus yield measures that are comparable across different sized networks.

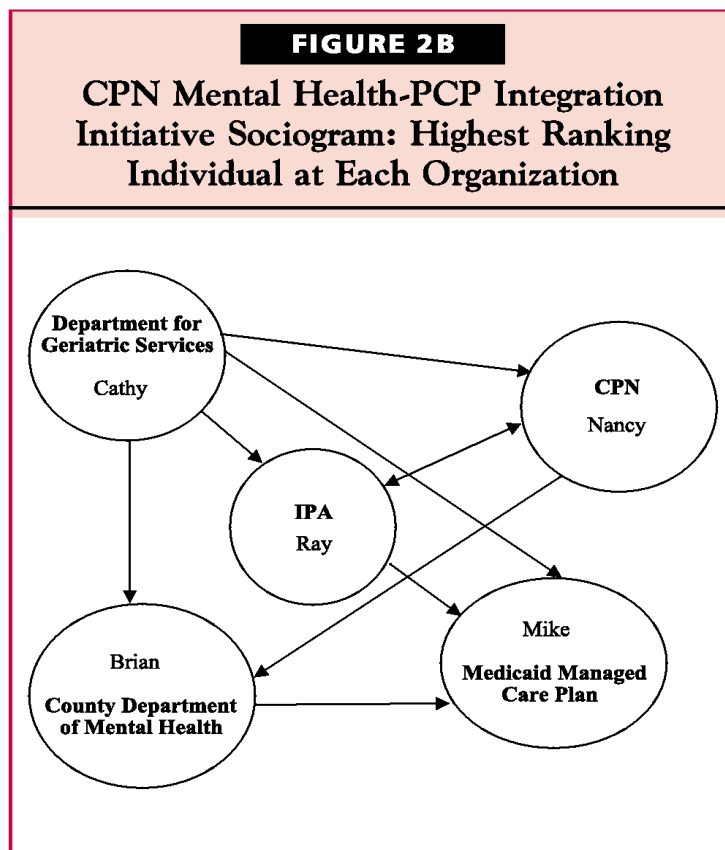†Unable to calculate because no response from that individual.

FIGURE 2A

CPN Mental Health-PCP Integration Initiative Sociogram: All Individuals
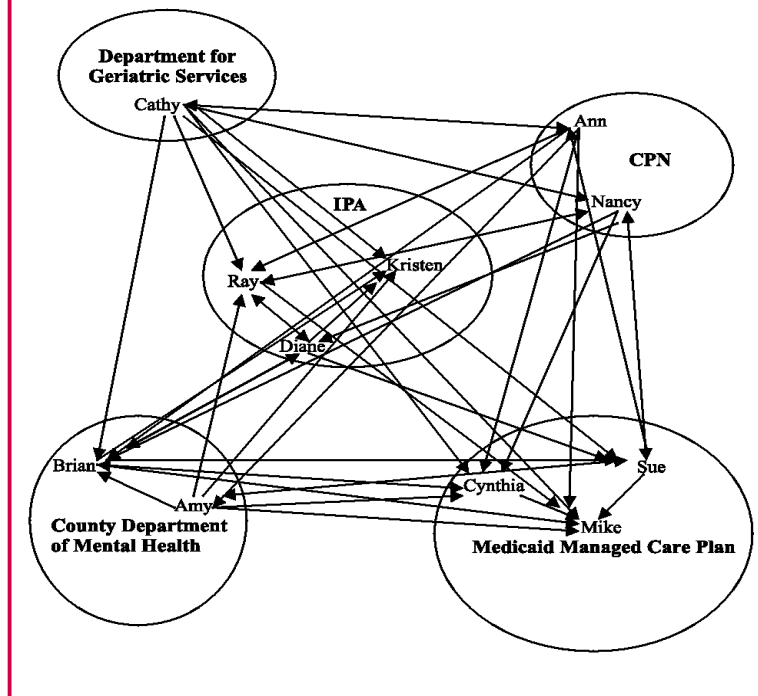
Given Brian's control of the state grant and county mental health services, further examination of his communication patterns is revealing. Brian engaged in two-way information exchanges (in which each individual sought information or advice from the other) with only three people, Sue and Cynthia, both care coordinators at the Medicaid managed care plan, and Diane, the IPA quality coordinator. Thus, he did not have direct reciprocal communication with Nancy, CPN's CEO, or Ray, the IPA's associate medical director. Brian's closest possible reciprocal communication with Nancy would have occurred through Sue. Brian's shortest path to Ray would have been through Diane. Taking direct reciprocal communication as the minimum condition for collaboration, Brian was not collaborating with the people who had authority to change how mental health care was provided. Instead, his only mutual information exchanges occurred with midlevel staff members. This indicated a major inefficiency in the integration effort.

Restricting the sample to the highest ranking individual at each respective organization, the results are more stark: Brian only indicated that he seeks in-formation or advice from one of the four other individuals with the most hierarchical authority in this network (see Fig. 2B). Notably, the two network stars, Sue and Diane, are absent from this sociogram, because neither was the highest ranking person involved in the integration at her respective organization. This also helps explain why the mental health-primary health effort was failing. Although Sue and Diane appeared to be effective advocates for individual patients, neither had sufficient authority to effect organizational-level change when it was needed.

Interviews corroborated that, although the key Plains County providers participated in CPN, the "game" of mental health services integration was noncooperative and became zero sum in nature. The committees formed to address common issues were voluntary, members did not have a clear picture of others' motivations, and, to the extent that integration was achieved, its benefits would accrue only partially to the organizations whose members incurred the costs of coordination.

From the perspective of every participant interviewed except the county mental health department representative, Brian, his department was externalizing its costs and reaping disproportionate benefits from its powerful position within the network. The PCPs believed that the county was not responsive to the needs of the patients they referred, and the state coordination grant was only serving to further enrich the county health department. One interpretation of these data could be that other members of CPN were scapegoating the county mental health department out of bitterness over having lost a bid for the state grant. However, the re-quest to the state for intervention indicates that other participants had sought to deal constructively with a situation they saw as dysfunctional (i.e., in disequilibrium). Using the prisoner's dilemma metaphor, the state was the Mafia, or external force, that had the ability to make all parties subordinate their personal agendas to that of the greater community.

FIGURE 2B

CPN Mental Health-PCP Integration Initiative Sociogram: Highest Ranking Individual at Each Organization

The state health agency, however, was unwilling to intercede on behalf of either prisoner, and the result was a predictably inequitable outcome. As one network member put it, "we begged the state to get involved, and their representative from the Mental Health Division ...pretty much said, 'Take care of it on the local level.'" Other comments by the party who benefited most by departing from the original equilibrium strategy indicated an appreciation of the fact that not revealing his desired utility function gave his organization a strategic advantage. Therefore, he purposefully minimized the communication flow. The network data collected from the primary county mental health department's liaison indicated that he was not sharing information with key network members. Therefore, his intentions were unclear to others until several key moves in the game had already ensured that the county agency controlled all of the resources and no longer had any need for the network per se.

In essence, those organizations that had optimized their own strategies at the expense of others, creating disequilibrium, were given free reign to do so by the state. This is particularly troubling in light of laissez faire approach many states' health agencies are currently adopting. Because state Medicaid agencies have begun to adopt capitated managed care models, health care and social service providers at local levels have been

intentionally given more autonomy to offer services as they see fit.[17] The state's reticence in this case about intervening in the Plains County's conflict about mental health-PCP integration seems to reflect this decision to leave local problems to local solutions. The irony is that the state had, at least in part, created the problem in the first place by funding a single entity whose incentives were not aligned with those of other providers in the area or the goals of the state itself. Thus, the state created a noncooperative game from the outset, one in which strategic options were severely constrained for all but the funding recipient, and incentives to put the alliance in disequilibrium were pronounced. This case study indicates that other state efforts to coordinate mental health and primary health care through county or city health departments may encounter similar difficulties.

In sum, this network and game theoretic analysis reveals a pattern of communication exchange that was inefficient at both collective and individual levels. The potential key players, including the recipient of the integration grant, were not actively brokering understanding or agreement, and members were expending a high level of effort for what interviewees characterized as low levels of return.

EPILOGUE OF THE CPN MENTAL HEALTH INITIATIVE
CPN was widely recognized as a competent facilitator that excelled at "bringing everyone to the table." However, as indicated above, it is notable that its CEO, although widely respected, was not a major broker within the mental health integration effort. There are two explanations for this. First, the county mental health department, which controlled the funds for the effort, did not actively value CPN's brokering role. As the mental health department representative put it: "Sorry Nancy, but if CPN were to go away tomorrow, I do not think it would affect our integration efforts whatsoever."

Second, Nancy's hours were being cut back at the time of the site visit because of insufficient funds to support her salary. Because the individual members were faced with coordination costs but were not seeing substantial individual benefits from integration, the members were not willing to pay sufficient dues to support a full-time CEO. Thus, the noncontractual commitment problems of the infrastructure within which the mental health integration effort occurred undermined its effectiveness, as posited by game theoretic analysis.

CONCLUSION
As this case study has shown, using a game theoretic framework can help both policymakers and managers structure more effective and enduring health care networks. First, game theory can help to distinguish between the cooperative intent of participants and the degree to which the structure of their context is truly cooperative. BPHC, for instance, already requires evidence of cooperation within the CHC-led networks it funds and also seeks to discern the motivations of participants. However, the good intentions of individual organizations may not suffice in situations such as this case, where there are serious structural problems. An understanding of network principles may also yield insights into the incentives faced by specific members that may cause them to undermine cooperative arrangements or not to comply with the demands of funders.[5]

Game theory also elucidates three key leverage points for enhancing the cooperative nature of interorganizational networks: (1) increasing knowledge sharing, so that all members are aware of each other's motivations; (2) ensuring the presence of legally binding contracts; and (3) structuring cooperation to benefit all members individually and collectively. In each of these, funders may play more constructive roles if they are willing to become more actively engaged than most have thus far. This implies a paradigm shift from the current belief that control should be left as much as possible to the local level.

Funders could also increase information sharing within supported networks by allocating funds to multiple agencies, each of whom is required to report on how it is coordinating with the others. Of course, these reports would still be prone to partial disclosure, but if they were available to all network participants and subject to site visit verification, they might improve transparency of member motivations to all those affected (included the funders). In other words, the funder's role would change from simply providing funds to a more active position, entailing requirements for more information from participants.

Funders could also improve cooperation within health care networks by requiring contractual agreements among participants. While BPHC-supported networks are required to have, at a minimum, a memorandum of agreement that spells out the responsibilities of each member, anecdotal evidence reveals that networks that invest in a corporate structure are more likely to demonstrate long-term success. Funding organizations could enhance the likelihood of success by (1) requiring more individual input into the initial application and (2) insisting on the establishment of a contractually specified corporate structure early in the development process.

A third leverage point for enhancing network stability could be to take steps specifically addressing individual participant interests. When members can participate at lower personal cost, they will be more likely to stay engaged, thus maximizing community health benefits in the long run. One way to enhance the return for individual members could be for funders to underwrite coordination costs and/or provide technical assistance to improve the efficiency of network-level functions. Through technical assistance and opportunities for peer-to-peer networking, funders can also provide network CEOs with tools to communicate to each member how they benefit from continued co-operation. BPHC already facilitates a peer-to-peer technical assistance function into which these leader-ship skills could be incorporated. [12,18] Because communication is essential for network success, social network data such as that employed here might be useful as part of technical assistance (with safeguards for individuals' confidentiality; it is probably not advisable to share a sociogram per se with the members of a given network, who will likely either recognize individuals within it or think they do). Patterns thus discerned could be introduced in the initial strategic planning sessions, with follow-up data showing progress as the network develops.

Another alternative is to bolster the capacity of primary care settings to provide such care directly, as the BPHC is currently doing with its $85 million "Opportunities for Health Centers to Expand/Improve Access and Services," program, thus reducing the need for interorganizational cooperation.

Individual managers can also glean valuable insights from a game theoretic perspective on interorganizational relations even in the absence of improved funding oversight. First, health care managers should carefully appraise the motivations of potential partners. "Will they all be better off in a network structure than they would be independently? Do they realize that? Can other network members collude to exclude me without repercussion?" Especially if powerful or central players do not need one's organization, one should proceed with the anticipation of being excluded to some degree, either explicitly or implicitly.

Even when incentives are aligned within cooperative networks, health care managers should seek legally binding arrangements with early departure penalties. These can both protect their own interests and ensure that others who are needed for network stability have guarantees about the benefits that they will secure. One implication of this need for clear arrangements is that managers need to understand some of the finer points of grant processes.

At the inception of the grant funding process, managers of provider organizations need to understand what they are committing to invest and receive in return. Grant budgeting can be complicated and the distribution of not only earmarked but also indirect and administrative funds may need clarification. For example, some institutions can draw as much as 40 percent of a grant's total direct cost as indirect expenses to help administer the program. If the provider organization is performing a significant amount of the administrative tasks or housing the network's coordination staff, they should receive some portion of those monies. Some agencies, particularly federal ones, have very strict policies about what can and cannot be purchased using government funds. Managers may thus find themselves responsible for purchasing computers, durable goods, and other items that they may not have anticipated.

Finally, managers need to understand how grants are renewed and terminated. Managers can look for ways to minimize coordination costs and ensure equitable distribution of benefits so that all participants will continue to see reasons for engagement over time. For instance, BPHC-supported networks are required to establish a corporate structure by the end of the second year of support. Even if BPHC does not tighten this time frame,

managers should consider earlier legal clarification of roles. Managers need clear change or exit strategies to cope with the end of external funding.

The issues described in the case study are more the rule than the exception (Kirk Strossahl, personal communication).[19] The failure of funding agencies to coordinate their activities, relying on the local level to pull it together, is neither new nor unusual, but it is unfortunate. Requiring contractually explicated agreement on expected outcomes followed by evidence from multiple parties of successful goal completion would help support the success of integration efforts. In addition, by applying game theory and network tools, funders (investors) could develop more definitive guidance for potential applicants (i.e., requiring formal corporate structures; providing enhanced technical assistance during the developmental stages, more emphasis on communication skills and patterns; and more effectively evaluate the progress of current networks, designing course corrections before problems are encountered). All of these actions could be combined to develop cooperation incentives for future success of integrated service delivery.

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