ISSUE BRIEF

MATHEMATICA Policy Research, Inc.

TIMELY INFORMATION FROM MATHEMATICA

Improving public well-being by conducting high-quality, objective research and surveys

NOVEMBER 2009
NUMBER 1

TRENDS IN RESEARCH METHODS

Making Connections: Using Social Network Analysis for Program Evaluation

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Social network analysis (SNA) is a methodological approach to measuring and mapping relationships. It can be used to study whole networks, all of the ties within a defined group, or connections that individuals have in their personal communities. The resulting graph-based structures illustrate the composition and effectiveness of networks on a variety of levels. Programs that can benefit from a social network perspective are common in evaluation research. This brief introduces the concepts behind SNA and illustrates how to use this method in process and outcome evaluations.

Uncovering Patterns in Social Networks

How do physician/nurse interactions affect patient outcomes? Are teachers who have better access to professional advice more effective instructors? To what extent do parents work together to advocate for their children and affect school policy? These examples from the fields of health and education illustrate evaluation questions that involve social networks.

Social network analysis (SNA) can help map and measure human and organizational relationships, both visually and mathematically. SNA views relationships in terms of nodes and ties—nodes are the individual actors in networks, and ties are the relationships between the actors. As part of a process evaluation, SNA can shed light into the "black box" of how and why people and groups interact. The methodology can address questions such as:

- Which organizations are working together to address disparity issues? Which are not?
- How are financial and other resources distributed among organizations promoting consumer advocacy?

SNA can also be used for outcome evaluation, linking characteristics of a network to program outcomes or determining whether relationships have changed as a program intended. It can address questions like:

- Are coalitions in which members are more connected more likely to have an impact on the long-term care system?
- How does a network evolve so that it is sustainable after initial funding ends?

SNA in Process Evaluation

SNA opens the black box of a program's processes, providing a qualitative and quantitative assessment of network relationships. These data can be used to determine the relationships among network members, identify which members are more "involved," target interventions to improve the network, and provide formative feedback to program staff.

Examine relationships. A starting point in using SNA involves defining boundaries of the network and describing the nature of relationships between individuals or organizations. Sociograms—visual displays of network structure—are useful snapshots that convey this information. Figure 1 is a sociogram showing contact among leaders for one site in Mathematica's Community Partnerships study described on page 2.

Each node in Figure 1 represents a leader, and each line represents a reciprocal relationship between two leaders. (Actor A reports having contact with Actor B at least monthly and Actor B also reports having contact at least monthly with Actor A.) The absence of a tie between individuals indicates that at least one of them did not report any contact.

Site A leaders had a distinct pattern for their relationships. Work group leaders (triangles) were largely unconnected in their contact with other leaders in the team. The core team members (squares) were connected with each other, while staff members (circles) were somewhat between the other two groups. If staff are supposed to be intermediaries between a strong decision-making body made up of core team members, this pattern suggests that the leadership team

STUDYING LEADER'S STRUCTURE AND PROCESS HELPS SHED LIGHT ON OUTCOMES

In Mathematica's evaluation of the Community Partnerships for Older Adults program, the Robert Wood Johnson Foundation awarded four-year grants to eight communities to increase awareness of elder issues, improve the long-term care system, and advocate for policy change during the second round of this program. Partnerships in these communities include a broad array of organizations, providers, and consumers focused on aging issues and typically consist of representatives of public agencies, private service providers, nonprofit organizations, local business leaders, and individual older adults.

We used SNA to study the leadership team as the network of interest, because it is responsible for identifying the partnership's goals and carrying out activities to achieve them. We defined the team as including core team members, work group leaders, and project staff. The core team guides the partnership and sets its mission. Work groups engage in specific activities, such as implementing projects. Project staff are funded by the grantee agency to coordinate activities.

Our survey questions focused on two kinds of relationships: (1) communication between members, and (2) level of regard they had for each other. We asked leaders about frequency of contact with others, which leaders had good ideas, which leaders played important roles, and which leaders were productive.

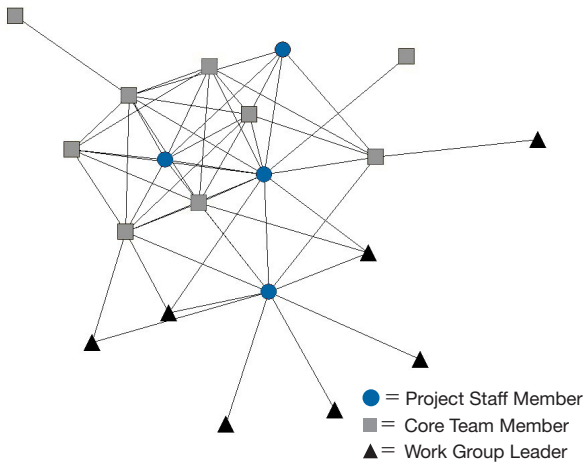
is functioning as intended. Similarly, if work group leaders are assigned specific tasks, such as setting up a hotline, and not expected to interact with other leadership team members, Figure 1 suggests they are functioning as planned.

This pattern is not the same as that found in the study site illustrated in Figure 2. The contact among leaders at Site B suggests that staff members formed a hub around which the core team and work group leaders connected. One core team member (upper left) was isolated and had no reciprocal contacts with others.

The qualitative analysis of sociograms can be augmented with descriptive statistics. The extent to which individuals interact with members of the same or different groups can be quantified and compared within and between partnerships for evaluation purposes (as we will illustrate).

Identify prominent network members. Identifying members who are most involved in a network can be a useful part of process analysis. For example, an individual's position in the network can influence how he or she sees it. Interviews among those who are more connected can provide different insights

Figure 1: Contact at Least Monthly, Site A



into program operations, compared to interviews with individuals who are less connected. We can also confirm that power resides where we would expect it (if, for example, the chair of a core team is more connected to other influential individuals).

In SNA, this concept of prominence is rooted in centrality—individuals or organizations are influential or prominent because they hold strategic positions or have many ties or groupings in a network. We can also identify the relative importance of members by their characteristics, such as the type of organization they represent, amount of experience they have, or the roles they play.

Since the leadership teams in our study have specific roles, the process analysis can explore which groups are more prominent. For example, do staff members play a brokerage role between leadership team members, or are they more central among all the members? Are core team members as prominent as staff? Not having any core team members who are prominent in a network may suggest a more centralized approach in which the grantee holds power.

Site A leaders with the most relationships in Figure 1 (represented by nodes in the sociogram with the most lines or connections) were the most prominent in the network. Two staff members and several core team members were important in this sense. In contrast, work group leaders were not prominent—only one had more than one relationship. Moreover, the core team chair (not identified in the figure) had contact with few individuals and was on the periphery of the sociogram.

Target interventions to improve the network. We can compare SNA results with a program's design (or a logic model or theory of change) to assess how well the existing network matches the program intent. This comparison to an "ideal" network can suggest ways the network could be improved.

Figure 2: Contact at least Monthly, Site B

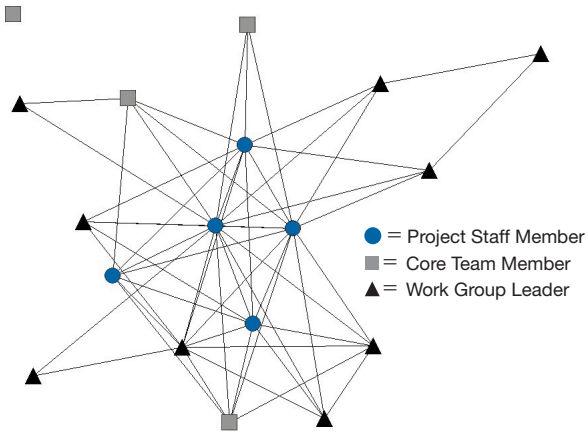


Table 1 presents a different view of the leadership teams from Figures 1 and 2. Here, we included all data about leaders (including nonrespondents to the survey) and did not restrict relationships to those that were reciprocated. The table shows density—the proportion of relationships that exist within and among different types of leaders. Density is calculated as the number of ties among members divided by all possible ties. Initiators are individuals that report a relationship; receivers are targets (and include leaders that did not respond to the survey). The information can be compared with the "ideal" relationships among leadership team members.

For Site A, 91 percent of relationships that could exist from staff members to other staff members did exist, 61 percent of relationships from staff members to core team members that could exist did, and 39 percent of relationships from staff members to work group members that could exist did. This same pattern—more relationships with staff members, fewer relationships with work group members—was found for core team and work group leaders.

The information in Table 1 confirms the visual relationships seen in Figures 1 and 2. Work group members in Site A were less connected to the leader network, as shown by the less frequent relationships reported by work group members to other leaders, and the less frequent relationships reported from other leaders to work group leaders. Compared to Site A, Site B staff had more frequent contact to and from leaders, as did work group members. Core team members had relatively less contact.

Provide formative feedback. The results produced through social network analysis can be shared with sites through a formative feedback process. This process can confirm that the network picture reflects the views of people in the network (and if not, how the views differ). Visual representations of network operations can be compelling, both for evaluators and for program administrators. However, there are important ethical considerations in presenting results, depending on how the data were collected and the questions asked.[1] For example, results may need to be shown in aggregate or without identifiers to maintain anonymity.

TABLE 1

AMOUNT OF CONTACT AT LEAST MONTHLY AMONG STAFF, CORE TEAM, AND WORK GROUP LEADERS

	Receivers		
Initiators	Staff	Core Team	Group
Site A			
Staff	91%	61%	39%
Core Team	81%	62%	19%
Work Group	36%	6%	7%
Site B			
Staff	100%	85%	72%
Core Team	50%	18%	18%
Work Group	68%	30%	40%

For each partnership in our study, we reviewed results with staff to verify whether these pictures reflected their views of the leadership. We also asked whether the visuals were accurate and what staff thought could be different. A fruitful area of discussion involved how work group leaders were integrated. Site A, in particular, had already identified lack of integration as a problem and had been involving core team members more with work group activities.

SNA in Outcomes Evaluation

In addition to understanding processes, SNA can explore outcomes, either through examining relationships between networks and outcomes or observing how a network evolves as an outcome itself.

Examine relationship between networks and outcomes. Networks observed through SNA process analysis can be compared with outcomes of interest to determine whether networks are related to outcomes. We could test, for example, whether leadership teams that are either more connected (that is, more dense) or that become more connected over time are more successful than teams that are less connected. We could also look at whether leadership teams with more integrated work group leaders are more likely to achieve their outcomes.

In our study, the outcome measure in the first year of operation is perceived effectiveness—how effec-

[1] This issue is discussed further in Penuel, W.R., W. Sussex, C. Korbak, and C. Hoadley (2006), "Investigating the Potential Uses of Social Network Analysis in Educational Evaluation," *American Journal of Evaluation*, 27(4), 437-451.

tive leaders feel they have been in working on their priorities. For the eight partnerships, members of the Site A leadership team had the lowest perceived effectiveness, while Site B had the highest. An important distinction between the two sites is how members regarded each other. Figure 3 illustrates how Site A leaders regarded each other (showing reciprocal relationships on a composite measure of who had good ideas, who was productive, and who played an important role). Figure 3 shows a similar pattern of relationships as those observed in Figure 1—core team members and work group leaders did not have high regard for each other. (This could reflect not being aware of each other or having negative views.) For Site B, the pattern is quite different, both from the level of regard in Site A and from contact relationships in Site B (Figure 2). Though staff remained in the center of the relationships, leaders were connected with many other leaders—reflecting greater density. This pattern suggests that leaders had high regard for each other and their activities.

Track network evolution. Developing visuals such as Figures 1 through 4 over time illustrates how a network evolves. The network itself could be the outcome of a program's design—for instance, to build a coalition involving advocates in state health policy decisions or to encourage better relationships among child care agencies within a community. In these examples, we would observe whether, as the program ends, advocates or agencies are more or less likely to work with each other. We would also look at whether these relationships continue after initial funding ends.

Part of Mathematica's ongoing evaluation is tracking each partnership to examine how its leadership team changes over time, and whether staff prominence declines as partnerships become more integrated into their communities and initial funding ends.

Making Connections

SNA is a useful tool for evaluating programs in which relationships are important for outcomes. It allows evaluators to identify what the network is, how it operates, and how it affects program outcomes. In addition, SNA suggests ways for funders and participants to make changes during implementation.

Using SNA also presents challenges. Evaluators must understand the network they want to observe in order to define it and determine whether it is conducive to SNA methods. Survey nonreponse can be detrimental to analysis—even a small amount of missing data can greatly limit interpretation of results. Non-survey data—such as attendance records or other observational data—can help address this problem, but the information they provide may be limited. Small network samples can limit generalizability or interpretation of results. And maintaining confidentiality may need special attention, particularly when asking individuals to assess the quality of their relationships.

Early on, proper planning and evaluation design can address these challenges. Social network methods provide compelling ways to investigate relational aspects of social structures and produce visual and mathematical analyses of complex human systems.

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Figure 3: Relationship Regard, Site A

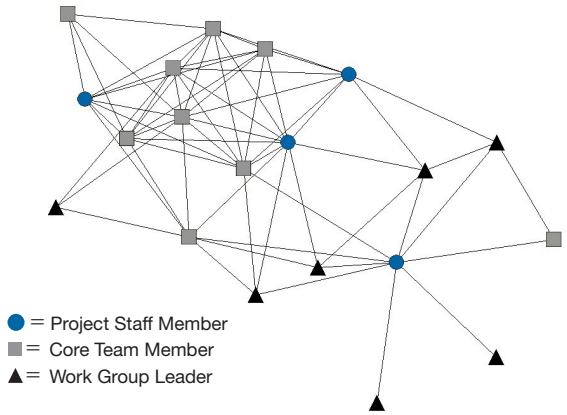

Figure 4: Relationship Regard, Site B