Structuring the Use of Social Network Analysis in Program Evaluation

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"There is Bole in the world, and then there is a swift horse that can run thousands of miles. Swift horse is common to find, but Bole is not." —Yu Han

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Abstract

Social network analysis (SNA) is increasingly viewed as a contributing methodology to program evaluation to examine the complexities of social programs and interrelationships within the program networks. Despite the growing literature on the topic, more knowledge is needed to understand how, when, and under what conditions social network analysis can add value to evaluation work.

The study's overall purpose was to explore the ways of applying SNA to support program evaluation. Using a sequential mixed method social network analysis (MMSNA) approach, this study first developed the SNA-Evaluation framework based on existing literature. Guided by the SNA-Evaluation framework, this study applied the SNA method to support the evaluation of the Community-Based Opioid Prevention and Education (C.O.P.E.) program. Data for the study were collected through a review of 30 archival documents, a C.O.P.E. Partnership Network survey to 46 partner organizations, and semi-structured interviews of 8 program stakeholders.

The results suggested that evaluators can adopt the SNA method to support their evaluation practices depending on the types of evaluation, such as needs assessment, process evaluation, and outcome evaluation. The study also observed that the use of SNA in the field of evaluation, particularly for responding to complex social programs, can sharpen program theories, strengthen evaluation methods by enabling the assessment of complex adaptive system variables, and maximize evaluation instrumental and conceptual use.

The study contributes to the body of research on evaluation methods by exploring an alternative methodology that can add value to evaluation practice. The study benefits

the knowledge base in program evaluation by providing the SNA-Evaluation framework and screening tool to help evaluators determine more appropriate steps when applying the SNA method to support their evaluation work. This study has implications for evaluators (1) who have an interest in improving their SNA use in program evaluation, (2) who hope to explore more about the theories behind the use of the SNA method in program evaluation, and (3) who support the evaluation of complex social programs.

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Chapter 1 Introduction

In program evaluation, stakeholders—defined as "one who has substantial ego, credibility, power, futures, or other capital invested in the program" (Scriven, 1991, p. 334)—are vital to programs and have an effect on program outcomes. Evaluation stakeholders might include the program's staff, participants, partners, organizations, government agencies, community members, and advisory boards. The social network they form could influence (a) program implementation by shaping access to information flow and resource distribution and (b) program outcomes by shaping access to opportunities and constraints on behavior (Popelier, 2018; Sih et al., 2009; Valente et al., 2015; Yousefi et al., 2019). Considering the importance of the social networks formed by stakeholders and the resources embedded in the networks, it is, therefore, necessary to understand the interconnectedness of program stakeholders and how their social networks can reinforce program design, program implementation, and program outcomes (Birk, 2005; Ken-Opurum et al., 2019; Laven et al., 2010; Valente et al., 2015). Additionally, evaluators increasingly acknowledge the unpredictable realities of complex programs as well as the need to identify new methods to address the complexity of the context in which programs operate (Durland & Fredericks, 2005; Funnell & Rogers, 2011; see also Larson, 2018; Walton, 2016; Williams & Imam, 2007).

In practice, evaluators can use quantitative, qualitative, or mixed methods. Quantitative methods collect data by questionnaires, pretests and posttests, observation, or review of existing databases. The strengths of quantitative evaluation methods include generalizability (if the sample represents the population), ease of analysis, and consistency and precision (if collected reliably) (Patton, 2002). Compared to quantitative

methods, qualitative methods collect data through observations, interviews, focus groups, case studies, and written documents. Patton (2002) states that qualitative methods typically "produce a wealth of detailed information about a much smaller number of people and cases" (p. 14) and "increase the depth of understanding of cases and situations studied" (p. 14) by explaining the "why" and "how" behind the "what." According to Mertens (2015), the mixed-methods approach is eclectic; it is useful when the evaluation intends to seek a common understanding through the triangulation of qualitative and quantitative data. In addition to the three evaluation methodologies mentioned above, cost analysis is another commonly used method. Cost analysis in evaluation refers to "the use of a broad set of techniques for evaluation and decision-making, including cost-effectiveness, cost-benefit, cost-utility, and cost-feasibility" (Levin & McEwan, 2000, p. 4); it can "assist evaluators in weighing the costs of programs against their outcomes, and then in choosing the best intervention" (p. 4). Despite the multiple methods to conduct evaluations, evaluators concede that conventional evaluation methods have limits in unveiling the full potential of stakeholder networks (Durland & Fredericks, 2005) and program complexities (Gates et al., 2021; Walton, 2014; Walton, 2016).

In line with these rising acknowledgments, evaluators have been exploring new methods and approaches that (1) are suitable to capture the patterns of relationship among stakeholders in a program network and (2) are compatible with dynamic and complex programs (Carman & Fredericks, 2018; Durland & Fredericks, 2005). Social network analysis (SNA)—herein described as the methodological approach to measuring and mapping relationships within a social context (Carolan, 2014; Knoke & Yang, 2008)—has been employed to help evaluators study how stakeholders connect and interact with one

another (Durland & Fredericks, 2005; Fredericks, 2005). Furthermore, evaluators can use SNA methodology to design and evaluate complex programs with the goal of understanding and examining dynamic interactions, the patterns of relationship emergent from interacting agents, unforeseen events or activities, and unpredictable outcomes induced by network complexities (Benjamin & Greene, 2009; see also Durland & Fredericks, 2005; Grack Nelson et al., 2019).

Problem Statement

In program evaluation, SNA is set apart from other evaluation methodologies due to its focus on the social context and behavior of relationships among actors (individuals or groups involved in the program) (Durland & Fredericks, 2005). As Fredericks (2005) explains, because SNA focuses on the relationships among individuals, groups, and organizations, it can help evaluators explore whole networks and all ties within a defined network. Additionally, a review of the literature finds that SNA can be used to understand, aid, and guide program evaluation work as it provides a set of techniques and tools useful for understanding a broad range of human behavior changes as people interact with others (Carman & Fredericks, 2018). For instance, Bright et al. (2019) used social network metrics to assess the potential gaps that might limit community collaboration. In their study, the application of SNA tools helped them understand the relationships among community members and their communication trends throughout the program. Furthermore, Carman and Fredericks (2018) discussed the potential use of SNA as part of process evaluation to examine the network actors involved in the process and the quality of their interactions.

However, evidence on the role of SNA in program evaluation is still developing,

and significant gaps remain. First, most of the available SNA evaluation attempts are grounded on a poor understanding of what networks are, and fundamental concepts like "network," "connectivity," "betweenness," "density," and "linkages" are often measured through rather loose and rough indicators. For instance, to identify the key individuals involved in the Community Partnerships for Older Adults program, Honeycutt (2009) used one social network metric— centrality—to examine the extent to which individuals interact with other program members. Likewise, Patterson et al. (2020) conducted a systematic assessment of programs offered at a university. To examine how content areas, such as consent, racism, gender issues, disability, and mental health, were addressed through education, training, and programming at the university, Patterson and colleagues used the SNA metric of degree to calculate "the number of other programs that covered the same content area(s) as a single, focal program" (p. 3).

In addition, most studies using SNA have taken a descriptive approach: visually mapping social networks and setting out relational data. These studies describe network structure by calculating network metrics such as size, diameter, density, degree, and centrality. One study used SNA to describe the relationships among health council members to reveal differences in communication and collaboration (Bright et al., 2019). Another study incorporated SNA to detail the change in team collaborations by tracking the structure of research networks across multiple clinical and basic science departments within one medical center (Dozier et al., 2014).

Lastly, in using SNA, evaluators often encounter challenges concerning data collection, cleaning, and coding (Carman & Fredericks, 2018). Given the nature of the network data (e.g., difficulty in guaranteeing anonymity and confidentiality), evaluators

have recognized the reluctance among some participants to "fully identify, disclose, and describe all of their relationships" (p. 180) and the reluctance among some high-level executives to "share information about their personal and professional networks" (p. 180). Carmen and Fredericks also categorize four challenges relating to data cleaning and coding: (a) transcribing interview data into text, integrating information from other data sources, and creating spreadsheets to include the names of each person in the network can be more labor-intensive than expected; (b) coding the attributes of organizations and individuals is an iterative process as evaluators use the inductive approach to coding and allowing codes to emerge from the data; (c) data cleaning process has to be accurate as evaluators need to ensure the consistency of individual names, organization affiliations, position descriptions, and data formatting; and (d) creating matrices can be challenging as evaluators need to convert the flat data file into the necessary matrix format to depict the network relationships (pp. 180-182).

Despite the growing interest by evaluators in better understanding social and organizational networks, little knowledge exists as to how and when social network analysis can add value to evaluation work. Therefore, for SNA to become a tool that can be readily applied in program evaluations, more comparative research on the application of SNA in evaluation is needed. Such research will enable evaluators to use SNA to understand relationships among stakeholders who are pivotal in supporting a program's goals and outcomes. This research is also valuable in refining social network metrics to increase the likelihood that data is appropriately analyzed and interpreted (Bender-deMoll, 2008; Penuel et al., 2006). Moreover, such research will help evaluators build a wealth of knowledge about selecting social network metrics, data collection methods, and

data analysis methods.

Study Purpose and Research Questions

The purpose of the present study was threefold: first, to enhance the use of SNA in the field of evaluation by examining the existing SNA applications in evaluation practices; second, to identify ways evaluators can use SNA in program evaluations (e.g., needs assessment, process evaluation, and outcome evaluation); and third, to understand the extent to which the use of SNA in program evaluation explains implementation processes and program outcomes. Using a variety of reasoned conventional evaluation methods and SNA methodology, this study examined the importance of SNA in supporting the evaluation of complex social programs. The overarching question was: In what ways is SNA a valuable methodology to enhance program evaluation? The study addressed three sub-questions:

1. In what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation?
2. How can the SNA methodology be applied to support the evaluation of social programs?
3. How does the use of SNA impact the evaluation of social programs?

Question 1: In what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation?

The literature suggests that SNA can provide evaluators with tools for exploring the structures that form the networks and help evaluators view evaluations through the lens of relationships. Although the application of SNA is not determined by the evaluation context, subject area, or field (Durland & Fredericks, 2005), evaluators can

appropriately apply the SNA methodology to enhance the program evaluation depending on the program stage. Hence, this question aimed to discover ways to use SNA throughout the programs to further program design, implementation, and evaluation.

Question 2: How can the SNA methodology be applied to support the evaluation of social programs?

The second question aimed to discover various ways of applying SNA methodology to evaluate social programs, especially for programs that have not mapped out any network components. In this case, evaluators should first identify whether there is an embedded network within the program. Thus, this question aimed to discover ways to apply SNA methodology to identify a network, such as network actors and relational ties.

Question 3: How does the use of SNA impact the evaluation of* social *programs?

The question aimed to understand to what extent SNA can impact program implementation and intended outcomes: short-term outcomes, such as increased collaboration among community partners; mid-term outcomes, such as increased community capacity and improved resource sharing; and long-term outcomes, such as sustainable systems. These findings can inform understanding of how and why the application of SNA in program evaluation can help achieve program outcomes by improving program design and implementation.

Significance of the Study

The field of evaluation has made significant progress in developing an awareness of the need for evaluation to explore evaluation methodologies and techniques, including multisite evaluations or multiple units of analysis, qualitative methods, mixed methods, and cost analysis (Garport & Garport, 2015). Despite the success of using traditional

methodologies to conduct evaluations to provide helpful information for decision-makers, practicing evaluators are struggling to describe the complexity and interactional nature of organizational structures (Durland & Fredericks, 2005).

The results of this study would be significant in several ways. First, this study contributes to the body of research on evaluation methods by exploring an alternative methodology that can add value to evaluation practice. Second, the SNA methodology discovered in this study provides evaluators with an alternative approach to facilitate the evaluation of complex social programs. Lastly, the study benefits the knowledge base in program evaluation by providing a conceptual SNA-Evaluation framework built on the literature review of the SNA application in program evaluation. The SNA evaluation framework incorporates four principal components: evaluation types, the use of SNA in program evaluation, research purposes, and social network metrics. This framework and its supporting screening tool will help evaluators determine more appropriate steps when applying the SNA method to support their evaluation work. This study has implications for evaluators (1) who have an interest in improving their SNA use in program evaluation, (2) who hope to explore more about the theories behind the use of the SNA method in program evaluation, and (3) who support the evaluation of complex social programs. I shall discuss the implications of the study in Chapter 5.

Definition of Key Terms

A number of key terms form the foundation of this study. They are defined here:

Program Evaluation

Scriven (1991) defined evaluation as "the process of determining the merit, worth, or value of something, or the product of that process" (p. 139, emphasis in original).

Fitzpatrick et al. (2004) go on to define evaluation as "the identification, clarification, and application of defensible criteria to determine an evaluation object's value (worth or merit) in relation to those criteria" (p. 5). In the simplest terms, Patton (2008) states the evaluation is "… said to answer three questions: What? So what? and Now what?" (p. 5). Patton formally expands the definition of program evaluation, however, beyond judgment, describing it as "the systematic collection of information about activities, characteristics, and results of programs to make judgments about the program, improve or further develop program effectiveness, inform decisions about future programming, and/or increase understanding" (Patton, 2008, p. 39).

Yarbrough et al. (2011) further define evaluation as the "systematic investigation of the value, importance, or significance of something or someone along defined dimensions (e.g., a program, project, or specific program or project component)" (p. 287). Evaluation in this paper will represent the broader definition, defined as the systematic investigation of the value, importance, or significance of something or someone in the programs to enhance program design and implementation, improve program effectiveness, or inform decisions about future programming.

Stakeholders

Stakeholders are those who have "substantial ego, credibility, power, futures, or other capital invested in the program" (Scriven, 1991, p. 334). Yarbrough et al. (2011) explain that stakeholders are those "who have a legitimate interest in or are served in some meaningful way by the program and are thus implicated in the program's evaluation" (p. 23). In other words, evaluation stakeholders refer to individuals, groups, or organizations with a direct or indirect interest in and responsibility for a program's

effectiveness.

For this study, stakeholders comprise (a) decision-makers such as sponsors, foundations, communities, governing boards, and legislators; (b) program personnel with formal or informal authority such as program leaders; (c) program implementers such as program personnel, instructional or training staff, administrators, managers, and volunteers; (d) program users such as participants who are direct beneficiaries of the program.

Stakeholder Relationships

Stakeholder relationships include cooperation, collaboration, and network influence. The development and maintenance of favorable and productive stakeholder relationships are regarded as essential in creating value for a program (Mitchell et al., 1997).

Social Networks

According to Wasserman and Faust (1994), a social network is a set of actors (individuals, small groups, organizations, or even nation-states) that are tied by at least one type of relation. Marin and Wellman (2014) describe social networks as "a set of socially relevant nodes connected by one or more relations" (p. 11). White et al. (1976) place the central value of social networks on structural relations, where they believe social structure is constitutive of "regularities in the patterns of relations among concrete entities; it is not harmony among abstract norms and values or a classification of concrete entities by their attributes" (pp. 733-734). Social network in this paper is viewed as the network formed by program stakeholders, including decision-makers, program leaders, program implementers, and program users.

Social Network Analysis

Social network analysis studies social structural relations between actors (people, groups, organizations) in a network using a set of quantitative network metrics (Knoke &Yang, 2008). Knoke and Yang (2008) claim that "the central objectives of network analysis are to measure and represent these structural relations accurately, and to explain both why they occur and what are their consequences" (p. 4).

Chapter 2 Review Of Literature

Organization of Literature Review

The literature review for this study is structured into three sections. In the first section, I set the theoretical foundations, including social capital theory, complex adaptive system (CAS) theory, network theory, and the fundamentals of SNA such as actors and relations, types of networks, and structural measures. Second, I illustrate the application of SNA in program evaluation, including SNA history and SNA practice in program evaluation. In the final section, I present a conceptual SNA-Evaluation framework and a literature review summary.

Conceptualizing the Theoretical Frameworks

Several theories that help explain and understand the use of SNA in program evaluation include social capital theory, CAS theory, and network theory. These theories demonstrate why SNA is helpful in the field of program evaluation. Exploring these theories helps elucidate the relationship between SNA and its use in program evaluation.

Social Capital Theory

Social capital represents one approach to understanding the effects of informal social networks through the patterns of interdependence and social interactions. This body examines how relevant scholarship defines and discusses social capital in relation to structural relations and collective assets embedded in social networks to produce desirable returns. Social capital, as defined by Bourdieu (1986), is characterized as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (p. 21). Bourdieu (1986) goes on to explain that social capital is not

independent because the actual volume of social capital possessed by agents depends on the number of network connections they have and the volume of social capital their connectors possess. Also, the exchanges of social capital between network agents exert an influence on the entire network.

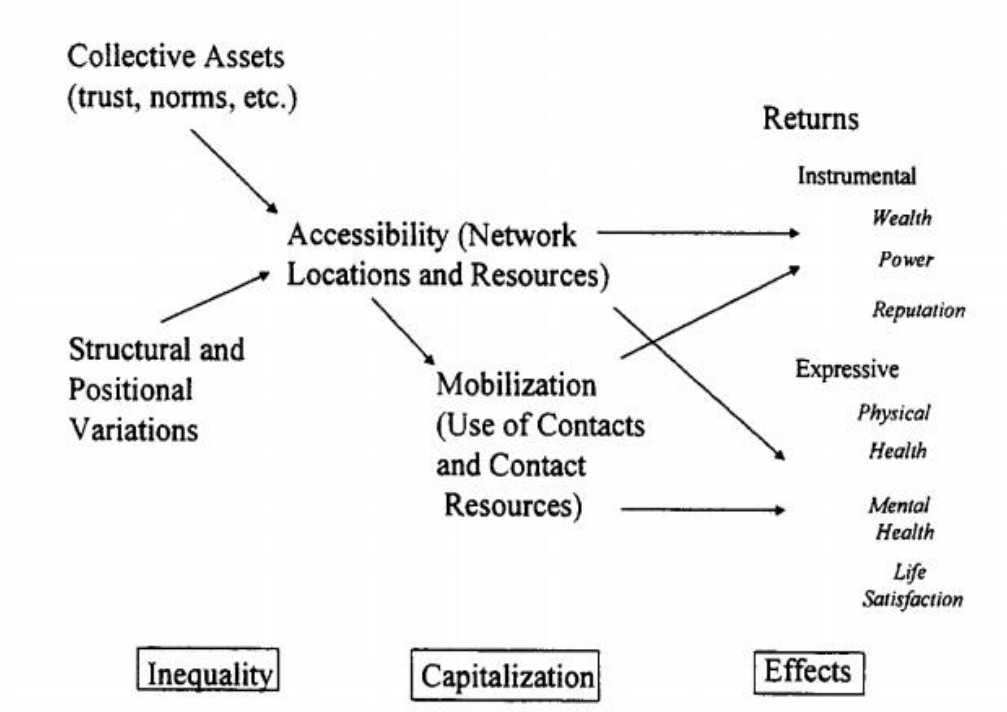
Grounded in this definition, Coleman (1988) writes that social capital "inheres in the structure of relations between actors and among actors" (p. 98) and "facilitate[s] productive activity" (p. 101), which can take the form of obligations, expectations, and trustworthiness of structures, information channels, and norms and effective sanctions. Coleman's conceptualization of social capital in creating human capital becomes one of the most salient concepts in education and social sciences. In Coleman's words, social capital refers to the norms that "social relations and social structures facilitate some forms of social capital; actors establish relations purposefully and continue them when they continue to provide benefits" (p. 105). Coleman argues that there is a relationship between the level of social capital of a dedicated and mutually rewarding group of members and their collective public goods. Using the community as an example of social structure, Coleman adds that the stronger the network relations, the greater the public goods can benefit all who are part of the social structure. Similarly, Campbell et al. (1986) describe "network as resources" (p. 98) as the network provides access to diverse and instrumental information and serves as a means of structuring the flow of information to actors.

Following Coleman and Bourdieu's pioneering work, Lin (2002) defines social capital as "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (p. 25). By its definition, Lin (2017) contends that social capital

comprises three components: resources embedded in a social structure, access to and mobilization of these resources, and return of social capital with both instrumental and expressive outcomes. These components are illustrated graphically in Figure 2.1.

Figure 2.1

Modeling a Theory of Social Capital – Lin (2017)



Note. From "Building a Network Theory of Social Capital," by Lin, 2017, Social Capital, p. 41.

In practice, it is necessary to take into account the social capital available to the program. First, social capital can facilitate information flow as the social relationships formed by individuals or groups, especially those positioned in central roles, can provide valuable information about opportunities and available resources. Second, social relationships may affect the agents (e.g., program stakeholders and community partners) who play pivotal roles in decision-making, resource distribution, and information sharing

(Lin, 2017, pp. 6-7).

Participatory evaluation—defined as "applied social research that involves trained evaluation personnel and practice-based decision-makers working in partnership" (Cousins & Earl, 1995, p. 8)—is, in fact, a practice that is capable of utilizing social capital to facilitate the information circulation and resource distribution toward intended program goals. A further attack on addressing the importance of social capital comes from Pawson and Tilley's realistic evaluation. As they suggest, a program is embedded in a social system, and the agents within the social system and the actions they take can alter program outcomes (Pawson & Tilley, 1997).

Evaluators are often engaged in program evaluations involving multiple stakeholders who directly impact a program's accomplishment of goals and outcomes. Evaluators who understand social capital theory can use it in several ways. First, it becomes a lens through which to assess the collective assets of the community that houses the program to be evaluated and the resources program stakeholders bring to the program. Identifying community assets and resources may be crucial for understanding the community's and stakeholders' strengths to make it easier to address the community's needs. The theory also helps evaluators identify key players in the community and reveal underlying community challenges.

Second, when conducting collaborative inquiries, evaluators can use social capital theory to foster constructive collaboration among stakeholders by efficiently structuring the flow of information and effectively mobilizing the use of contacts and resources within the social networks formed by program stakeholders. Understanding social network structure by defining structural relations, assessing positional variations,

identifying structural holes, and rearranging network structure can facilitate information flow and provide greater access to network resources.

Ultimately, evaluators put this theory into practice each time they designedly emphasize that the power of social capital (e.g., obligations, expectation, and trustworthiness; information channel; and norms and effective sanctions) can impact program outcomes. For example, Putnam (1993) notes that trust helps create reciprocity and collaboration; in return, reciprocity and collaboration create trust. Such a virtuous circle "results in a social equilibrium manifesting itself in a high level of cooperation, expanding trust, civic activity, and collective well-being" (p. 177). Coleman (1988) asserts that information is notable in providing a basis for action, but obtaining information entails additional costs. However, individuals in a social network can share information and knowledge with minimal or no cost to each other. The information channel can facilitate actions to enhance individual productivity and build capacity.

Complex Adaptive System Theory

Complexity theory introduces complex systems concepts (e.g., multiple interacting actors, objects, processes), interdependence, non-linearity, and emergence (Eoyang & Berkas, 1998; Zimmerman et al., 1998). It can also be understood as the study of complex adaptive systems (CAS): (1) the word 'complex' implies diversity through a significant number of interactions between various elements; (2) the word 'adaptive' refers to the system's ability to alter, change, and learn from the past; and (3) 'system' refers to a set of connected and interdependent parts (Zimmerman et al., 1998). Davis and Saumara (2006) provide another helpful definition: A CAS "is not just a form with more parts, but one that transforms itself as it experiences its world. Complex systems adapt

and learn" (p. 12).

Eoyang and Berkas (1998, Characteristics Behaviors of CAS section) suggest that the CAS is composed of five characteristics: (1) it is dynamic that the system may result in unexpected outcomes; (2) it is massively entangled due to interrelated and complicated relationships within the system and evaluation should reflect this level of interdependence and complexity; (3) it is scale-independent that evaluation should capture different levels of impact (e.g., individual, organization, community); (4) it is transformative that evaluation should involve stakeholders in the evaluation design, to create feedback loops to improve program quality, and to celebrate evaluation results with stakeholders; and (5) it is emergent that evaluators need to look at patterns over time.

In the context of evaluation, Preskill (2013) asserts that a program lives within a complex system, and its outcomes may depend on the organization's infrastructure, such as the organizational culture, the organizational systems and structures, the organization's communication systems, and the leadership's support of learning inquiry (p. 328).

Funnell and Rogers (2011) respond in the same vein as Preskill. They suggest that when thinking about program evaluation,

> it is useful to consider complication in terms of multiple components—multiple and competing objectives or causal strands, interventions that operate on multiple levels or involve multiple implementing agencies, and multiple contributors to outcomes—and complexity in terms of adaptation and emergence—evolving focus, activities, and collaborations. (p. 72)

Patton (2010) concurs with this view, stating that a program is a complex system

composed of several interacting components, and any changes from the interactive system may impact program development and intended outcomes. In applying complexity to enhance evaluation work, Patton has championed developmental evaluation, in which evaluators work closely with innovators to provide real-time information and guidance for enabling programs in a complex environment to adapt. Preskill et al. (2014) developed a set of propositions to help evaluators assess complexity. Table 2.1 displays a set of propositions of evaluation based on the CAS characteristics.

Table 2.1

Propositions for Evaluating Complexity Based on CAS Characteristics

CAS Characteristics	Propositions of Evaluation
A complex system is constantly changing, often in unpredictable ways; it is never static	Design and implement evaluation to be adaptive, flexible, and iterative
A complex system is massively entangled that relationships within the system are interrelated and complicated; events in one part of the system affect all other parts	Focus on the nature of relationships and interdependencies within the system Seek to understand and describe the whole system
Cause and effect is not a linear, predictable, or one-directional process; it is scale-independent	Explain the non-linear and multi-directional relationships between the initiatives and their outcomes Capture different levels of impact (e.g., individual, organization, community)
A complex system is emergent; patterns emerge from diverse agents within the system	Watch for patterns over time at different levels of the system
A complex system is transformative; information is the fuel that drives learning and helps the system thrive	Support the capacity of the system to learn by providing feedback loops and improving access to information

Note. Sources include Eoyang & Berkas (1998); Preskill et al. (2014).

Social Network Theory and Social Network Analysis

Social network theory is defined as "the proposed processes and mechanisms that relate network properties to outcomes of interest" (Borgatti & Lopez-Kidwell, 2011, p. 40). Mitchell (1969) defines network theory as "a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole maybe used to interpret the social behavior of the persons involved" (p. 2). According to Mitchell, there are two dimensions of social networks: structural and interactional. The structural dimension relates to how information flows within the network; it consists of an anchorage, density, reachability, and range. The interactional dimension is associated with the quality of relationships; it includes content, intensity, frequency, durability, and direction (Mitchell, 1969). In practice, evaluators who understand network theory can use a social network perspective to explore the relational aspects of networking by revealing the positioning of relationships, the extent of connectivity among members, the diversity of members in the social network, and the quality of their relationships.

Network analysis, with its focus on "the characteristic patterns of ties between actors in a social system rather than on characteristics of the individual actors themselves" (Hall & Wellman, 1985, p. 26), can help address "the structure and composition of the network and the contents or specific resources that flow through those networks" (Berkman & Glass, 2000, p. 140). In SNA, actors can be individuals, groups, organizations, or some other formation of individuals who interact with one another. For example, program stakeholders interact with one another throughout the program stages. Community members interact with one another in sharing program resources and

materials. Network analysis may take many forms depending on the nature of the evaluation work. However, a typical network analysis includes three elements: the units that comprise the network, relations among pairs of actors, and the level of data analysis (Knoke & Yang, 2008).

Units. The units to be studied comprise the actors of the network. The units or actors may represent individuals or collectives, such as informal groups and formal organizations (Carolan,2014; Knoke & Yang, 2008). Common examples of individual actors include program stakeholders, community members involved in a program, educators implementing the community intervention, and participants attending the training. Collective actors might be informal groups, for example, program teams, advisory boards, community coalitions; university departments; organizations or businesses that live within communities; or large units such as state or federal agencies.

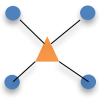
Relationship. The type of relationship among the units may vary. In a relational evaluation, the measure is the existence of or the degree of specific relationships among network actors, and the direction of the relationship can be directed (from one actor to the other) or undirected (Carolan,2014; Knoke & Yang, 2008). Moving from attribute-focused to relational-focused questions, the relationships in evaluation concern communication relations (i.e., linkages between actors to transmit messages) and instrumental relations (i.e., linkages between actors to secure resources or information), and evaluators typically include questions such as who talks to whom, who works with whom, and who is the knowledge expert for a specific topic (Durland, 2005).

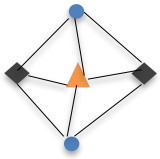
Networks. There are several levels at which the network can be analyzed (see Table 2.2 for an overview). One level analysis involves ego networks (Table 2.2-a),

where the crucial parameters are centrality and prestige. According to Knoke and Yang (2008), researchers can collect ego network data through (a) name generator—asking respondents to identify members of their network, (b) position generator—asking respondents whether they have any contacts in certain social positions, (c) resource generator—asking respondents whether their contacts have valuable resources for any specific purposes, and (d) social support scales—asking respondents to report on the types of support available from their contacts. At the subset level, a dyad (Table 2.2-b) or a triad (Table 2.2-c) refers to the relevant components such as cliques and subgroups. In these networks, relations between actors under investigation may be directed or undirected via other units in the network. Most studies involve analysis of the complete network (Table 2.2-d), which is the most well-known macro-level network analysis. There are three primary sources to complete network data: census data, archival documents, and sociometric instruments.

Table 2.2

Examples of Level of Network Analysis

Network-level	Brief Description	Illustration	Analysis
(a) Egocentric network	Consisting of one ego and direct relations with all alters		Described by the centrality, prestige, and characteristics of linkages between ego and alters
(b) Dyadic network	Consisting of pairs of actors		Analysis of 1) whether there is a specific tie exists between two actors and 2) the intensity, duration, or strength of the relation

Network-level	Brief Description	Illustration	Analysis
(c) Triadic network	Consisting of a set of actors		Described by sentiment ties (liking, friendship) with interest in triadic relations
(d) Complete network	Consisting of every relation among all network actors		Analysis of the network structure, presence of distinct positions, structural holes, and patterns of ties

Note. Sources include: Carolan (2014); Knoke & Yang (2008); Wasserman & Faust (1994).

Network Measures. There are many concepts and network measures in SNA. Table 2.3 presents a list of commonly used network measures in program evaluation to help build a basic understanding for the rest of the study.

Table 2.3

Definition of Structural Measures

Size: is the most straightforward structural measure that can be used to describe different levels of networks. It measures the number of actors in the network, which indicates the number of resources available.
Density: is another standard measure for all levels of networks. It measures the number of ties in the network and reports as a ratio of actual connections between actors compared to total possible connections. A network density score ranges from 0-1; 1 represents a fully saturated network, whereas 0 represents an isolated network.
Reciprocity: is a structural measure of complete networks, which measures the degree to which actors in a directed network select one another. This property is important as it reveals the direction of the information exchange and resource flow and further

indicates the stability and sustainability of the network.

Diameter and distance: are two properties to measure complete and ego networks. Diameter refers to the longest path (or the highest number of steps) between any two actors, and distance refers to the average of the shortest path among all connected actors in the network. These two properties are important to help understand how well resources can move from one actor to another in the network.

Clustering: is a network-level measure to assess actors' tendency to group. High clustering indicates that the network includes several groups and actors in the same group connect; low clustering implies fewer groups in the network and distributed relations across the entire network.

Centralization: is a structural property of a complete network that measures whether the network (such as relationships, information, resources, or communication) focuses on a small set of actors. Centralization relates to power and control. Centralized networks are those in which power and control are held by a very small set of actors, whereas decentralized networks are those in which power and control are diffused across the network. This property is important as it may affect how resources traverse the network.

Tie Strength: measures the relationship strength across the egocentric network. In practice, weak ties are important for transmitting information and instrumental resources between different groups, while strong ties are important for transmitting behavioral influences.

Centrality: relates to how actors (individuals, groups, or organizations) connect to other actors in a social network. The principle of centrality indicators is that the central actor is in some way close to all other actors in the network. Another viewpoint on centrality is based on the idea that central roles are those actors located between other actors; they are, for example, in a position to control the information flow. There are three centrality measures, each reflecting different concepts of connectedness.

- Degree centrality counts the number of connections an actor has to other actors in the network.
- Closeness is a measure of the average distance from any given actor to all other actors in the network and thus relates to how quickly an actor can interact with others, for example, by sharing information and resources directly or through very few paths.
- Betweenness measures how often the actor lies on the shortest path between pairs of actors in the network. Betweenness is closely related to the ideas of power and brokerage within networks, and it is an important indicator of control over information exchange or resource flows within a network.

Brokerage: Brokerage positions differ in terms of the group to which the relation's initiator, broker, and recipient belong. There are five different combinations: (1) a broker is a coordinator if it belongs to the same group; (2) a broker is a consultant if it locates on a path that connects actors that belong to the same group but do not belong to the same groups themselves; (3) a broker has the role of a gatekeeper if the broker influences the access of a member of another group to a given group; (4) a broker is a representative if it creates a relationship with an initiator that belongs to the same group and with a recipient that belongs to a different group; (5) a broker is a liaison if a broker, the relationship's initiator, and the relationship's recipient all belong to a different group.

Note. Sources include Carolan (2014); Hanneman & Riddle (2011); Knoke & Yang (2008); Wasserman & Faust (1994).

SNA for Program Evaluation

This section covers two main parts. Part one introduces the background of SNA use in the field of evaluation. Part two discusses the application of SNA to assist in different types of evaluations by exploring (a) the evaluation questions answered in the articles, (b) the operationalization of network measures, and (c) the approaches to data

collection and data analysis.

The literature sources included in the search were the *American Journal of Evaluat*ion, the *Canadian Journal of Program Evaluation (CJPE), Evaluation and Program Planning*, *Evaluation Review*, *Evaluation*, *New Directions for Evaluation*, *Journal of Multidisciplinary Evaluation*, *Educational Research and Evaluation*, and *Evaluation and the Health Professions*. The search was done from the web pages of the selected evaluation journals, and the search strategy focused on articles published in journals related to evaluation (Track 1) and SNA (Track 2). In addition, reference lists of selected papers were cross-checked for the potential discovery of other related research until reference lists and searches produced extensively replicated sources. The search strategy resulted in 40 articles published in evaluation-related journals from 1980 to 2021. The articles were categorized by their objectives, including (a) the application of SNA in evaluation (33 articles), (b) reflection on and discussion of the potential use of SNA (3 articles), and (c) a review of SNA in evaluation (4 articles).

History of SNA-Related Publications in Evaluation

Figure 2.2 presents the time distribution of the 40 articles using the search strategy. It shows a developing interest in utilizing SNA in program evaluation, especially since the turn of the century. According to Durland and Fredricks (2005), three factors have led to the increased interest in using SNA in the evaluation field. First, evaluators have begun to recognize that social networks play a vital role in program planning, development, implementation, impact, and sustainability (Abma, 2006; Carman & Fredericks, 2018; Durland & Fredericks, 2005; Fredericks, 2005). To help capture the connections between individuals and the social capital embedded in the network,

evaluators can use the SNA methodology to describe network structures (Birk, 2005; Carman & Fredericks, 2018). The second factor behind the increased interest in applying SNA, particularly in policy and social programs, is the focus on understanding complexity and systems. As Durland and Fredricks (2015) describe,

> System thinking, complexity and interactional nature of organizational structures, and the strategies for implementing, describing, and understanding complex initiatives are all current topics in evaluation discussion, problem resolution, and program theory development. In line with these evolving theoretical constructs, evaluation designs also have to reflect how we interpret and understand complexity, systems, and system change, and structure, and SNA is a methodology for doing that. (p. 6)

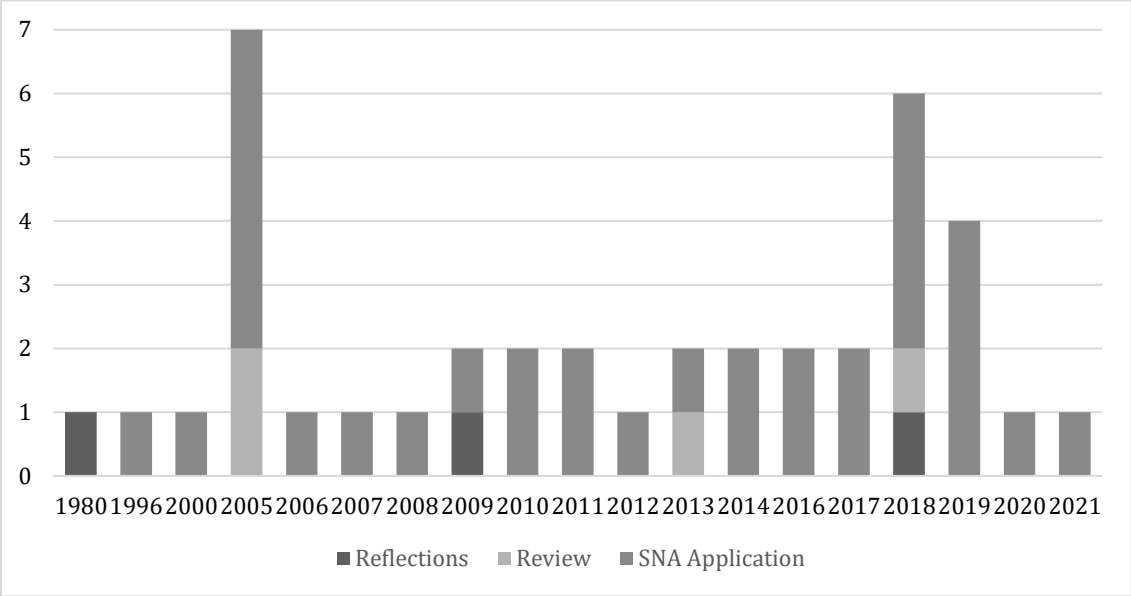
Lastly, the development and availability of SNA software programs have made it possible for evaluators to incorporate SNA into their evaluation work to "facilitate the analysis of data and the creation of sociograms" (Durland & Fredericks, 2005, p. 6). These advances coincided with greater interest and attention to understanding the value of social networks, especially for those evaluation work related to education, policy, health, and organization development and learning.

For example, in the area of health services, evaluators have been looking at the role of networks and their influence on community knowledge capacity, health council effectiveness, partnership formation and structure, and collaboration and cohesion (Bright et al., 2017; Frerichs et al., 2018; Ken-Opurum et al., 2019). In the area of education, evaluators have employed SNA to understand the value of classroom social interactions (Martinez et al., 2003), communication networks (Kochan & Teddlie, 2005), and teacher

collaboration (Penuel et al., 2006). In the area of policy, SNA has been used to map network relationships and organizational characteristics (Boumans & Ferry, 2019; Drew et al., 2011).

Figure 2.2

Distribution Over Time of SNA-Related Publications In Evaluation Journals (n = 40)



Note. The reflection category includes articles with reflection on the potential use of SNA and the lessons from the use of SNA in supporting evaluation work; the review category includes articles that provide a scoping review of the SNA in evaluation work; SNA application category includes articles with the focus on the practical application of SNA in program evaluation.

SNA Application in Evaluation

Although there is a compelling case for using network analysis in evaluation, what a network means varies depending on the evaluation context, evaluation type, and the questions being asked. Evidence from the literature review identified different ways to apply SNA in program evaluation. The following section groups the application of SNA into three categories: SNA for needs assessment, SNA for process evaluation, and SNA for outcome evaluation. Table 2.4 provides an overview of the SNA evaluation applications, highlighting the topic, context, network measures, data collection, and methods.

Table 2.4

Applications of SNA in the Evaluation and Related Evaluation Types

Authors	Topic	Context	Use of SNA	Data	Method
(a) Needs assessment					
Albrecht et al. (2014)	Analysis of regional government networks	P	Descriptive analysis	Interview Survey	SNA
Birk (2005)	Analysis of knowledge capacity	HS	Use measures of size, density, connectedness, centrality	Survey Interview	SNA
Bright et al. (2017)	Analysis of network structure	HS	Descriptive analysis	Survey	SNA
Dewachter & Holvoet (2017)	Analysis of social structure and interaction	NR	Use measures of density, (in-/ out-degree) centrality	Network data	SNA

Authors	Topic	Context	Use of SNA	Data	Method
Dozier et al. (2014)	Assessment of activity patterns among faculty members	CTS	Descriptive analysis	Survey	SNA
Drew et al. (2011)	Identification of individuals' characteristics and their relationships	P	Descriptive analysis	Interview	SNA
Durland (2005)	Analysis of team capacity	B	Descriptive analysis	Survey	SNA
Forthofer et al. (2016)	Analysis of the network structure	HS	Descriptive analysis	Focus group	SNA Thematic analysis
Kochan & Teddlie (2005)	Analysis of communication patterns among faculty members	E	Use measures of reciprocity, cliques, isolates, cutpoints, and bridges	Interview field notes Archives Survey	Clique analysis
Penuel et al. (2006)	Map the distribution of expertise and resources in a teacher network	E	Descriptive analysis	Interview	SNA
(b) Process evaluation					
Boumans & Ferry (2019)	Analysis of the relationship between network-based interventions	P	Use measures of size, degree centrality, eigenvector centrality, embeddedness	Primary database Interview	SNA Regression analysis
Cross et al. (2009)	Analysis of the development of interagency collaboration	HS	K-means clustering, modularity, centrality	Primacy data Interview	SNA
Fredericks (2005)	Analysis of the relationships	HS	Use measures of size,	Interview Archival	SNA

Authors	Topic	Context	Use of SNA	Data	Method
	within community networks		density, range, centrality, and reciprocity	evaluation sources	
Frerichs et al. (2018)	Assessment of changes in individual and groups	HS	Use measures of degree, density, centrality	Mind mapping data	SNA
Gregson et al. (2011)	Analysis of partnership form and function	HS	Use measures of density and fragmentation	Archives	SNA
(c) Outcome evaluation					
Anderson (2002)	Analysis of the impact of relationship patterns on individual attitudes and behavior	HI	Use measures of centrality, density, multiplexity, and prestige	Survey Program data	Clustering, Block model analysis Multivariate analysis
Honeycutt & Strong (2012)	Assessment of whether organizational characteristics and inter-organizational relationships influence health policy	P	Descriptive analysis	Program baseline data Survey	SNA Logistic regression model
Ken-Opurum et al. (2019)	Assessment of partnership dynamics in relation to program effectiveness	HS	Use measures of K-means, degree, density, centrality, transitivity, eigenvector centralization	Health statistics Interview Survey	SNA Longitudin-al analysis

Authors	Topic	Context	Use of SNA	Data	Method
Lahdelma & Laakso (2016)	Analysis of whether a firm's position in the program network predicts business performance	B	Use measures of size, degree centrality, ties, and eigenvector centrality	Survey Interview Performance data	SNA SAS
Laven et al. (2010)	Using SNA to understand the effectiveness of partnership network in achieving intended outcomes	NR	Use measures of size, density, betweenness centrality, and out-degree	Email	SNA
Patterson et al. (2020)	Analysis of the impact of educational programs on student learning and engagement	E	Use measures of degree	Interview	SNA
Quinn & Kim (2018)	Analysis of whether management networks influence social capital	E	Descriptive analysis of management networks	Primary data	SNA
Valente et al. (2008)	Using SNA to determine if the organizational position is associated with perceptions of organizational success	HS	Use measures of size, degree, density, and centralization	Survey	SNA Factor analysis

Note. B = Business; CTS = Clinical translational science; E = Education; P = Policy; HI = Health Informatics; HS = Health services; NR = National resources.

SNA for Needs Assessment

A literature review discovers that evaluators are using SNA to assist in needs assessment, ranging from exploring network structure to assessing knowledge experts, resource distribution, and communication patterns (Table 2.4-a). During the needs assessment, evaluators can (1) describe the network structure, (2) identify knowledge experts as perceived by the members of the program and assess expertise within the network, (3) assess the pattern of relationships within the network, and (4) identify needs and gaps (such as if additional links or network actors that might need to facilitate team collaboration).

Describe Network Structure. First, network measures can help describe network structure. Bright et al. (2017) used SNA to map the growth in the number of relationships and the level and frequencies of these relationships for the Gulf States Health Policy Center Coalition. In their study, *density* was calculated to measure the formation of relationships; values ranged from 100% to 0%, and a higher percentage indicated more relationships between network members, while a smaller percentage indicated a less connected coalition among members. *Tie strength* was selected to measure the frequency and level of relationships; an increase in either frequency of communication or level of collaboration demonstrated greater tie strength, leading to more information and resources transmitted through the collaboration network.

Dewachter and Holvoet (2017) also employed SNA to explain the underperformance of a village's water service delivery system. In their study, *density* aimed to assess social support; higher density indicated more villagers depended on each other for social support, while lower density implied villagers were disconnected and had

limited access to seeking help from other villagers. Furthermore, Dewachter and Holvoet computed *density* to assess the level of information-sharing among villagers. In this case, *density* indicated how much information exchange—the quality and availability of water services—took place within the village.

Identify Knowledge Capacity. The second function of SNA during needs assessment is to identify expertise and capture the relationships between individuals and their sources of experts. It is helpful to the program team that may need to investigate all potential areas of expertise required for their programs, which provides a systematic way to quickly understand the knowledge capacity within a group, resources sharing within a group, and communication patterns among group members. As Holtshouse (1998) suggests, SNA can make knowledge capacity visible and reveal who program experts are and where they reside in the network. By identifying the knowledge expert perceived by group members, where they are, and how they are connected, evaluators could have data to help them understand the organizational structure and make the unseen and unknown connections between individuals within a program visible and concrete.

For example, to improve schools by fostering greater collaboration between teachers, Penuel et al. (2006) employed SNA to map the distribution of expertise and resources needed to enact reform. Birk (2005) also gave an example of applying SNA to evaluate knowledge capacity for a health initiative. In the study, Birk (2005) computed the following network metrics: (a) measuring *centrality indegree* to identify experts most central to the program and (b) measuring *betweenness centrality* to identify the individuals who were better positioned in the network to control information flow.

Assess the Pattern of Relationships. The third function of using network

analysis in needs assessment is assessing the relationship pattern between network members. For example, to identify communication patterns between two departments, Durland (2005) explored two network measures: (a) computing *component* to assess the connectedness of the network and (b) computing *cliques* to explain the overall communication patterns to help identify underlying communication patterns in the network.

Similarly, Kochan and Teddlie (2005) put these ideas into practice in understanding communication patterns among high school faculty members by analyzing: (a) *components* to indicate the overall connectedness of a communication network, (b) *isolates* to locate faculty members who disconnected from the network and (c) *cutpoints* to locate faculty members who connected two components.

Identify Needs and Gaps. SNA can be applied to identify additional links that can contribute to improving the program. For example, to help develop a group walking intervention that could provide supportive relationships for behavior changes, Forthofer et al. (2016) conducted focus groups to engage community members in discussions about characteristics and features to build network-driven walking. Using SNA, they identified support from existing social networks to form walking teams and elected members who could provide central roles in encouraging other walking group members.

Another relevant aspect of network structure is the identification of communities, which are more likely to be connected than other communities in the network. Identifying communities within a network can unveil functional groups and their gaps. Bright et al. (2017) conducted a study in the community health field in which they investigated the aspects of network structure that might limit the effectiveness of the community health

council. They first mapped the relationships to visualize the prevalence of each level of partnership and then revealed opportunities to improve these relationships based on network strengths and weaknesses.

SNA for Process Evaluation

Process evaluation typically describes how the program is delivered. Fitzpatrick et al. (2004) define process evaluation as a systematic process to assess the extent to which the program operates as intended, what is working, what is not working, and what could be improved. SNA can be used as a part of process evaluation to highlight opportunities for improving information sharing (Boumans & Ferry, 2019; Freichs et al., 2018) or collaboration within the context of a program (Cross et al., 2009; Fredericks, 2005; Gregson et al., 2011) (see Table 2.4-b). Evaluators can also use SNA in a process evaluation in at least three ways: (1) studying the pattern of relationships and responsibilities in the network, (2) identifying critical network stakeholders, and (3) enhancing partnerships and collaboration.

Examine Relationships. One of the most frequently used network tactics involves defining network structure and describing the nature of relationships among network members. Anderson (2002) introduced the concept of network diagnostics, in which network data were collected and analyzed to provide diagnostic information that might be useful to the process evaluation. In the study, they calculated (a) *density* to measure the proportion of actual relations among group members compared to all possible relations, (b) *centrality* to describe information flow and resource distribution across the group, (c) *multiplexity* to describe each physician's role in the network, and (d) *prestige* to measure the extent to which a physician served as a consultant of other

physicians in the network.

Identify Critical Network Members. Identifying members most involved in a network can be instrumental in process evaluation. In SNA, the concept of critical members is rooted in *centrality*—individuals or groups are influential or critical because they hold strategic positions or have many ties in the network. For example, to assess whether the organizational position could help promote a health initiative, Valente et al. (2008) measured (a) *centrality* to determine an organization's position in the network, (b) *density* to determine whether the coalition network had sufficient communication pathways to share information and resources, and (c) *centralization* to identify organizations that played critical roles in mobilizing resources across the entire coalition network.

Another study by Boumans and Ferry (2019) explored the use of SNA in process evaluation to identify critical partners important for the successful implementation of a program. They first described the *network size*—the number of partners involved in the program—to understand whether the existing network had sufficient linkages to bring together the relevant resources. In addition, they measured *eigenvector centrality* to capture the position of critical partners in the whole network and *betweenness centrality* to explore the capacity to connect different parts of the network.

Enhance Partnerships and Collaboration. According to Valente et al. (2005), SNA is helpful in understanding, guiding, and improving relational processes. More specifically, SNA can be applied to assess collaboration networks as it helps recognize the potential pitfalls of collaboration and find possible remedies (Sih et al., 2009). A study conducted by Cross et al. (2009) explored the potential use of SNA to create an

effective interagency network to improve the delivery of services to students and families of a Safe Schools/Healthy Students Initiative (SS/HS). In the study, Cross and colleagues first tracked the growth and development of existing partnerships by measuring network *size* and *density*, and they then analyzed *tie strength* to provide insights into the types of relationships needed to improve service delivery.

Gregson et al. (2011) provided another example of using SNA as part of process evaluation to evaluate the partnership structure of a Health California network. Their study used SNA and time-series regression analysis to analyze the semi-annual progress reports. Network measure of *fragmentation* was calculated to evaluate the extent to which local partners collaborated and shared resources; *density* was measured to understand the number of relationships between local partners.

SNA for Outcome Evaluation

In contrast to process evaluation, the purpose of outcome evaluation—sometimes referred to as impact evaluation—is to assess a "mature program's success in reaching its stated goals, and as such, it frequently addresses many of the same questions as a process evaluation, but it takes place after the program has established and the timeframe posited for change has occurred" (Frechling Wstat, 2002, p.10). In addition, Frechling Wstat adds that outcome evaluation also gathers information about program outcomes and the program-related processes, strategies, and activities that have led to them. The literature review found a few studies that applied SNA to assist in outcome evaluation, either through examining relationships between network structure and outcomes or observing how partnership dynamics can influence program effectiveness (see Table 2.4-c). Moreover, considering the network itself is part of the program product, at the end of the

program, SNA can help track network evolution.

Examine Relationships between Network Structure and Outcomes.

Evaluators can compare the network observed in process evaluation with intended outcomes to determine whether network structure is associated with program outcomes. For example, Valente et al. (2008) conducted a network study to determine whether the perceptions of organizational performance were associated with its position in the network. Valente et al.'s research found that the network measures (e.g., degree, closeness, and betweenness centrality) and the organization's performance data found that central network members were more likely to perceive a higher organizational performance than those on the periphery. Similarly, Lahdelma and Laakso (2016) used SNA to determine whether a firm's position in the network could impact business performance. In their study of exploring the relationship between network position and business performance, Lahdelma and Laakso compared the enterprise's network key structural dimensions (e.g., the size of the network, the structure of network ties, the level of network cohesion, the degree of network centralization, and the betweenness centrality of each firm in the network) with business performance indicators.

The network observed in process evaluation can also be used to examine whether teams with more collaborative relationships are more likely to achieve their outcomes than those with less collaborative relationships. Honeycutt and Strong (2012) explored this idea by examining inter-organizational relationships and the overall level of shared advocacy within a coalition of organizations. They found that "a coalition with a higher level of communication and sharing values had higher averages in the number of collaborative advocacy activities among members" (Results section), which could put

member organizations in a better position to act in concert to achieve the program's goals.

Track Network Evolution. Networks are dynamic rather than static, and changes in network structure over time can impact program outcomes. SNA methodology can analyze site-specific time-series network data to help answer whether changes in network dynamics correlate to program outcomes. From their recent experience with SNA, Laven et al. (2010) point out that time-series data would allow evaluators to "ask key questions about network evolution over time and begin to correlate changes in the network dynamics" (Conclusion section) with program output and outcomes.

Conceptual Framework

Grounded in the literature, a preliminary framework for using SNA to inform various types of evaluation is presented in Figure 2.3. With social capital, CAS, and network theories serving as the foundation of the SNA application for program evaluation, the model lays out numerous ways of employing network analysis to assist in program evaluation. The conceptual framework for this dissertation served as the foundation to guide the evaluation design throughout the study.

As shown in Figure 2.3, the Y-axis presents the six broad categories related to SNA in program evaluation: (a) those related to the overall network structure, (b) those related to the patterns of relationship within a network, (c) those related to resource distribution within the system, (d) those related to prominent actors within a network, (e) those related to network position, and (f) those related to partnership and collaboration network. The X-axis presents three common evaluation types: needs assessment, process evaluation, and outcome evaluation. The double-diamond lines in the framework depicted

in Figure 2.3 indicate the use of SNA to support evaluation work situates in the same categories, and the one-directional arrow lines suggest the network indicators selected to answer evaluation questions.

Before implementation, evaluators can conduct a needs assessment, which involves determining whether a problem or need exists and making recommendations to support the program design (Fitzpatrick et al., 2004, p. 21). While evaluators may carry out needs assessment somewhat differently, some common steps include identifying resources needed for the program, identifying additional partners or leaders to support program design and implementation, and mapping out the existing barriers and opportunities. SNA can be a tool to assist in needs assessment by (1) determining if there is a network, (2) assessing relationships among network members, (3) identifying prominent individuals or groups, and (4) identifying needs and gaps (e.g., isolates, gatekeepers, brokerages). The first use of SNA in needs assessment is to determine if there is an existing network. So often, there may be no formal or informal network to support the program, especially in underserved communities. In such cases, it may be necessary to form a network. Additionally, it is essential to document network formation and structure if a network exists. This step includes assessing commonly used network-level metrics such as *size*, *density*, *diameter*, *centralization*, *clustering*, *transitivity*, and so on.

The second function of SNA in needs assessment is to help evaluators understand the relationship patterns in the network. Evaluators can select *tie strength* to address questions such

as how strong these relationships are and how frequently they communicate with one

another. Evaluators can elect *degree centrality* to measure to what extent an individual involves in various relationships, and evaluators can measure *closeness centrality* to address questions such as how close an individual is to other members within the network.

The third function of SNA in this stage is to use the network information to identify influential individuals or groups who are critical in the network: (a) those who can serve as a representative of the population or community; (b) those who can provide knowledge support and demonstrated skills; and (c) those who can facilitate the exchange of information and resources. These influential individuals or groups can be enlisted in planning and implementing programs. Besides, SNA can be a tool to assist in needs assessment to identify needs and gaps to help build an effective network. To do so, SNA can be a tool to determine if some individuals or groups are isolated or marginalized from the complete network and identify groups that need to be connected.

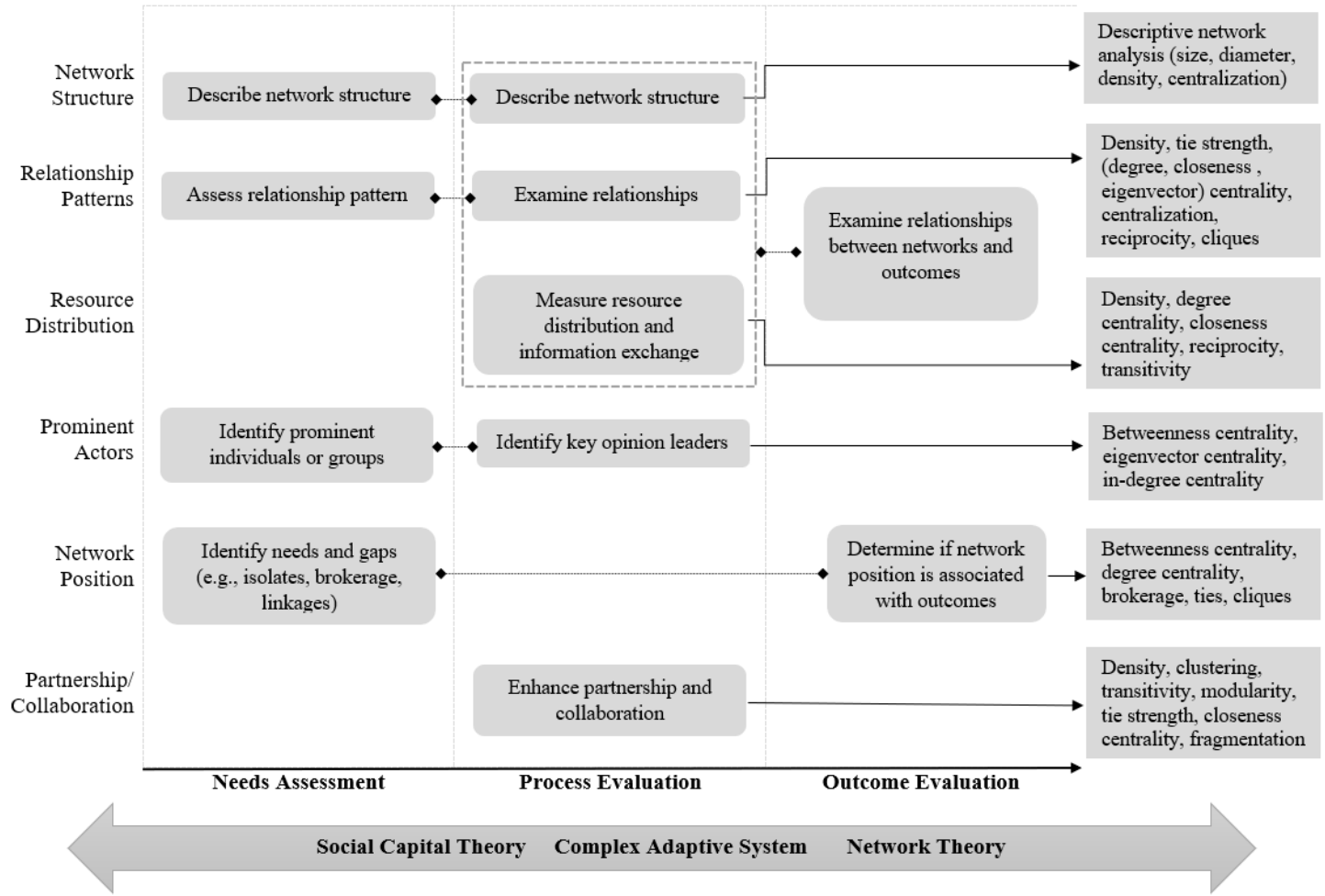
Process evaluation, occurring during the program implementation, typically involves evaluating the nature of the program delivery (e.g., delivery process, activities undertaken, involved partners or organizations, the distribution of resources), characteristics of the population served, and qualities of the program delivery (Fitzpatrick et al., 2004, p. 21). In addition to descriptive analysis to understand network structure, network data may be valuable in process evaluation in at least four ways: (1) examining the pattern of relationships of the program network, (2) identifying key opinion leaders to act as change agents, (3) measuring the pattern of resource distribution and the degree of information exchange, and (4) enhancing partnership and collaboration to improve program implementation.

After implementation, outcome evaluation is designed to describe, explore, and determine "the changes that occur in program recipients, secondary audients (families of recipients, coworkers, etc.), or communities as a result of the program" (Fitzpatrick et al., 2004, p. 21). Implementing a program is a dynamic process, and the changes in program components (e.g., network structure, relationship patterns, network positions) can impact program outcomes. For outcome evaluation, evaluators should measure the same network as the ones measured in the process evaluation. Potential areas of network analysis that can be of use in outcome evaluation are: (1) examining relationships between networks (e.g., network structure, relationship patterns, resources distribution, and information exchange) and program outcomes; (2) determining if individual actor position is associated with program outcomes; and (3) tracking network evolution such as advisory board network and community council. In combination with other statistical analyses (e.g., longitudinal analysis, Chi-Square, Pearson correlation, regression analysis, factor analysis), network analysis can address questions like:

- Does the network promote higher levels of participation and collaboration in each member?
- Does individual actor position correlate to program outcomes? Is being central in the network associated with the effects of an intervention?
- Do existing relationships improve through the program?

Figure 2.3

Conceptual SNA-Evaluation Framework



Note. Developed by Author.

Advantages and Disadvantages of SNA Application in Program Evaluation

Overall, incorporating SNA in program evaluation offers considerable benefits in several areas. First, traditional evaluation approaches cannot capture program complexities (Patton, 2010, pp. 5-10; Walton, 2006). SNA provides quantifiable measures for understanding network structure and assessing the complex dynamics of evaluation systems (Carman & Fredericks, 2018; Durland, 2005; Durland & Fredericks, 2005; Popelier, 2000). The value of combing SNA with traditional qualitative methods can (1) provide a wide range of measures to help evaluators describe, summarize, compare, and analyze network structures, patterns of relationship, and network positions; and (2) help evaluators understand the complexities and drivers of a network that facilitate improving program implementation (Durland & Fredericks, 2005; Grack Nelson et al., 2019; Walton, 2016). Moreover, SNA can also be used in longitudinal studies or predictive ways, providing opportunities to explore how the nature and intensity of relationships can evolve, identifying the factors that inhibit or promote relationships over time, and examining relationships between network structure and program effectiveness (Carolan, 2013; Durland & Fredericks, 2005; see Giuliani & Pietrobelli, 2011, for more detail).

Nevertheless, some issues still limit its use in program evaluation. First, some SNA attempts rest on a poor understanding of the fundamental concepts of SNA (Carman & Fredericks, 2018). In addition, most of the available SNA attempts in program evaluation are descriptive and rely on the mathematical approach, which is only a small part of network analysis features (Carman & Fredericks, 2018; Engelberg, 1980). Second, SNA cannot adjust for missing data, especially when looking at reciprocal relationships.

Therefore, the quality of analysis suffers if the response burden is too high for participants or if participants are reluctant to list names (Giuliani & Pietrobelli, 2011; see also Popelier, 2000; Stone & Hughes, 2002). Third, unlike most evaluations involving conventional evaluation methods, evaluation projects involving SNA require unique network analysis skills and training, and evaluators report that they do not have the technical skills or resources to apply SNA methodology to their evaluation work (Birk, 2005; Walton, 2016). Therefore, before SNA can be widely used to assist in evaluation work, evaluators will need to develop strategies for addressing these issues.

Chapter Summary

In summary, I outlined the theories supporting the use of SNA in program evaluation, described the histories of SNA application in the field of evaluation, and compared the existing SNA application in program evaluation. I also proposed and described the SNA-Evaluation conceptual framework, the foundation to guide the research questions and methodology discussed in the next chapter. In chapter three, I will describe the sequential mixed methods social network analysis used in this study to address how SNA can be applied in program evaluation to enhance program implementation and outcomes. Mainly, chapter three describes the research context, details of data collection tools and the analytic procedures used, limitations and trustworthiness of the study, and ethical considerations specific to the study.

Chapter 3 Research Design And Methodology

The overall premise of the study was to investigate the ways of applying SNA to support program evaluation and the extent to which the use of SNA in program evaluation explains implementation processes and program outcomes. To address this premise, the study specified the Community-Based Opioid Prevention and Education (C.O.P.E.) program as an example social program to conduct the research design. The study included three phases: (1) developing a conceptual framework; (2) identifying and describing social networks embedded in the program using archival documents; and (3) conducting a mixed-methods approach following the conclusion of the phase 2 evaluation to collect network data from partner organizations and solicit feedback from program stakeholders. This chapter outlines the research questions, the sequential transformative mixed methods social network analysis (MMSNA) design phases, the research context, the data collection plan, the data analysis plan, the trustworthiness of the study, and ethical considerations specific to the study. In the concluding section, I shall present the study's limitations and the summary of the chapter.

Research Context

Opioids are defined as "…a class of drugs that include legal drugs to reduce pain (such as oxycodone, hydrocodone, codeine, and morphine) and also include the illegal drug heroin and synthetic opioids such as fentanyl" (US Department of Health and Human Services, 2018), which causes the majority of all drug overdose deaths (Rudd et al., 2016). The opioid crisis is a serious national crisis that affects public health and has resulted in many preventable deaths. In 2020, nearly 92,000 people in the United States died from opioid overdoses (National Institute on Drug Abuse, 2022). Like other states,

Minnesota has experienced an alarming increase in drug overdose deaths since 2000. According to data from the Minnesota Department of Health, 427 opioid overdose deaths were reported in 2019, and 678 opioid overdose deaths were reported in 2020 (MDH, 2022).

Existing prevention and public health approaches, such as Naloxone administration, have been life-saving. However, the path to prevention, intervention, and effective treatment for people with substance use disorders (SUDs) remains problematic. Patients with substance use disorders are particularly at risk of receiving substandard care due to stigma among healthcare providers (Van Boekel et al., 2013). In addition, research has shown that the opioid crisis disproportionately impacts rural communities (Centers for Disease Control and Prevention [CDC], 2017), compounded by limited access to healthcare services and treatment facilities (Cherry et al., 2017; Hester, 2004; Pullen & Oser, 2014) and lack of involvement in services when that are available (Pullen & Oser, 2014). Pullen and Oser (2014) assert that the lack of public transportation is a substantial barrier in rural communities; the geographic spread of the population and distance from treatment services correlates with shorter stays in treatment programs and lesser completion rates. Further, there is a lack of specialty services for minority groups, leading to an underuse of treatment services (Pullen & Oser, 2014).

While crisis response and recovery services are needed as part of a comprehensive plan to address opioid overdose, what is much less addressed is the root cause of why some communities experience disproportionate addiction rates. Besides, the opioid crisis has impacted more than individuals undergoing opioid overdose but families and whole communities in complex ways (MDH, 2022). To address the complex problem of the

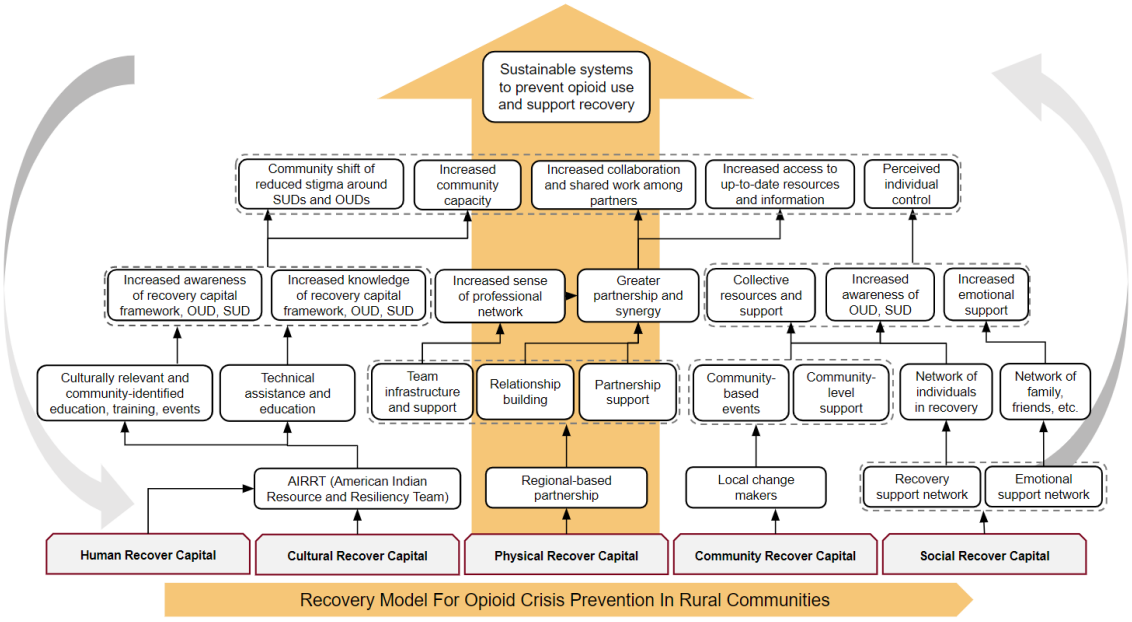
opioid crisis, such as underserved rural communities, lack of education regarding the opioid crisis, and limited access to treatment services, the University of Minnesota Extension collaborates with local, regional, state, and national agencies to enhance the opioid prevention effort in rural communities. The opioid crisis prevention aims to prevent opioid use and support sustained effort by: (1) engaging with communities, (2) enhancing opioid prevention efforts, (3) building effective and sustainable systems and supports to reduce opioid overdoes, and (4) expanding understanding and options for treatment (University of Minnesota Extension, 2022).

The opioid crisis prevention work applies a recovery capacity framework (Palombi et al., 2014; University of Minnesota Extension, 2022) to explore the ecological risks and protective factors that support or deter community members on their journey to maintain recovery from opioid use. There are five recovery capitals: (a) human recovery capital refers to an individual's unique knowledge, training or education, and lived experiences that can help them on their path to recovery; (b) cultural recovery capital refers to cultural norms, traditions, expectation, and environments that support recovery; (c) physical recovery capital is about the basic needs, such as safe housing, reliable transportation, or access to healthy food; (d) community recovery capital includes support such as access to treatment programs, laws that support recovery, non-stigmatizing language in the media, and access to support groups; (e) social recovery capital consists of positive and supportive relationships such as friends, family, coworkers, mentors, and other community members (Palombi et al., 2014; University of Minnesota Extension, 2022). The recovery capital serves as "a useful framework for understanding and exploring the unique needs and strengths of rural communities as they find themselves

facing a dire crisis of substance misuse and addiction" (Palombi et al., 2014, p. 698). Meanwhile, it gives communities direction to address the opioid crisis and helps them successfully move through the recovery phases. Figure 3.1 explains how each recovery capital is expected to lead to the opioid crisis prevention effort by drawing on a causal analysis based on available evidence.

Figure 3.1

Recovery Capitals Theory of Change



Note. The Author developed the Recovery Capitals Theory of Change based on the Opioid Crisis Prevention program documents (i.e., opioid crisis program materials, opioid crisis 2018-2021 grant reports, program website) and program-related journal articles (i.e., Palombi et al., 2014).

Community partnerships are an important way to address a wide range of social programs and the community's needs, especially in public health and human services (Agranoff, 2003; Provan et al., 2005). The logic is that, by working together, community

organizations can simultaneously pull together a broad range of resources and expertise (Provan et al., 2005), which helps improve the efficiency and effectiveness of community health prevention programs (Alter & Hage, 1993; Goodman et al., 1998; Zakocs & Edwards, 2006). Moreover, the form of community partnership can enhance the community's capacity by bringing diverse partners to solve community problems (Agranoff, 2003; Provan et al., 2005). As demonstrated in Figure 3.1, a focal point of the opioid crisis prevention efforts is to develop community partnerships that foster inter-organizational collaboration toward building a sustainable system for opioid use prevention and recovery work in MN rural communities.

While partnerships are essential in enhancing the opioid crisis prevention effort in MN rural communities, existing evaluations—such as journey mapping, qualitative Bootcamp, and meta-evaluation—are not measuring these relationships. Further, existing evaluation efforts do not assess the strength and effectiveness of community partnerships, and the structural level of recovery capital has not received enough attention. Little is known about what makes the partnerships work in the context of the opioid crisis prevention effort in MN rural communities. For example, it is unclear if it is better to have more or fewer partners working on the same activities or if diverse sectors improve coalition functioning. Moreover, little is learned about the quality of the relationships among community partners and the characteristics that support a partner's ability to effect measurable changes in achieving the program outcomes. Hence, the purpose of this study is to explore ways of using SNA to evaluate recovery capitals of the opioid crisis prevention effort, with the main focus on community partnership as it is a crucial way of addressing the opioid crisis prevention effort in rural communities.

Research Purpose and Research Questions

To address the existing measurement gaps, this study explored SNA applications to help enhance community partnerships that support the opioid crisis prevention effort in MN rural communities.

The specific research questions I addressed are the following:

1) In what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation?
2) How can the SNA methodology be applied to support the evaluation of the C.O.P.E. program?
3) How does the use of SNA methodology impact the evaluation of the C.O.P.E. program?
    a. How can the SNA methodology be applied to enhance the C.O.P.E. program's implementation and intended outcomes?
    b. How do stakeholders perceive the value of SNA methodology in supporting the evaluation of the C.O.P.E. program?

Sequential Mixed Methods Social Network Analysis (MMSNA) Design

Based on the purpose and research questions, the intent of this study was a sequential mixed method social network analysis (MMSNA) design. Chapter 2 documented that very little is understood about the SNA application in program evaluation and the impacts of SNA to further program implementation and program outcomes. To add to the existing knowledge on this topic, this study used a sequential MMSNA research design to understand a complex social program by assessing the information flow and resource exchange within the partnership network and identifying

potential opportunities to strengthen the partnership network.

Power in Mixing Methods

The complexities of social programs require an in-depth perspective to better understand the processes and outcomes. Mixed methods designs are increasingly preferred approaches in examining social programs as they counterbalance the limitations of quantitative and qualitative data (Greene, 2007; Mertens, 2009). According to Mertens (2019), mixed-methods design is the type of research in which researchers collect and analyze data, integrate the findings, and build on results from both qualitative and quantitative approaches. Johnson and his colleagues (2007) define mixed methods as:

> Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of the breadth of understanding or corroboration. (p. 123)

The research method in this chapter applied the MMSNA approach. Using mixed methods data collection in SNA offers "an almost unlimited palette of possibilities to gather in-depth data on network structures and processes" (Längler et al., 2019, p. 25) and provides a view of networks from both outsiders and insiders (Edward, 2010). Quantitative SNA approaches producing numerical descriptions of a network (e.g., nodes, connections) provide an outside view of the social network (Edward, 2010). In network research, quantitative methods are geared toward mathematical descriptions and analysis of interactions, relations, and network structures. The qualitative SNA approach adds context awareness to aid the interpretation of network maps and measures and provides

perception and descriptions of the network relations (Edward, 2010). Qualitative data generally come as text and provide insights into contexts of action and systems of meaning. With respect to network research, qualitative methods are well suited for investigating network practices and capturing the actors' system of relevance, perceptions, interpretations, and action orientations (Hollstein, 2011).

This MMSNA study was based on both qualitative textual data and quantitative, numerical network data—i.e., data describing nodes and relations. In analyzing relations and networks, qualitative strategies were used to capture practices, meanings, and the social context of relationships and networks, and quantitative strategies were tailored toward analyzing the structural dimension of relationships and networks. Using MMSNA meets the five general purposes of the mixed methods approach formulated by Greene et al. (1989): (1) triangulation to seek consistency in the results, (2) complementarity to seek elaboration and clarification of the results of both methods, (3) development to seek for the use of results from one method to help inform the other method, (4) initiation to seek new perspectives by using results from different methods, and (5) expansion of the research by applying various methods.

Using Sequential Transformative MMSNA Design

This study employed a sequential transformative MMSNA design focused on understanding the use of SNA to assist the evaluation of the C.O.P.E. program guided by the conceptual SNA-Evaluation framework. As a sequential transformative design, the SNA-Evaluation framework is foundational to the design's implementation. According to Creswell (2009):

Unlike the sequential exploratory and explanatory approaches, the sequential

transformative model has a theoretical perspective to guide the study. The aim of this theoretical perspective, whether it be a conceptual framework, a specific ideology, or advocacy, is more important in guiding the study than the use of methods alone. (p. 212)

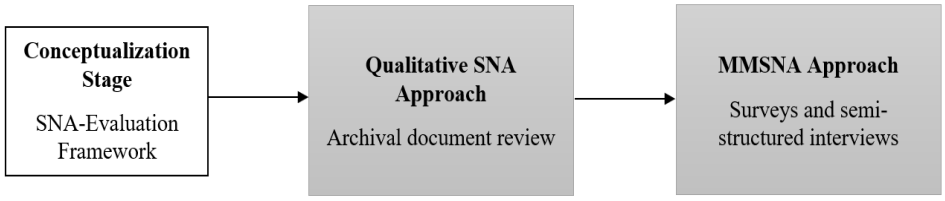
Additionally, Creswell (2009) explains:

The sequential transformative strategy is a two-phase project with a theoretical lens overlaying the sequential procedures. It too has an initial phase (either quantitative or qualitative) followed by a second phase (either qualitative or quantitative) that builds on the earlier phase. In this design, the researcher may use either method in the first phase of research, and the weight can be given to either or distributed evenly to both phases. The mixing (of data) is connected as in all sequential designs. (p. 212)

The sequential strategy, illustrated in Figure 3.2, includes the study's primary components: conceptualization stage, qualitative SNA approach, and MMSNA approach.

Figure 3.2

Sequential Transformative MMSNA Design



Note. This figure displays the sequential transformative MNSNA design procedure diagram for each study phase.

The sequential MMSNA design is a good fit as this study design relied on the SNA-Evaluation framework proposed in Chapter two. The study began with a qualitative SNA approach because the primary purpose was to explore new or yet unexplored types of networks and network practices. For instance, whether there are informal or formal networks formed with community partners that were involved in the opioid crisis prevention effort. Besides, the qualitative SNA study results can support the development of survey instruments and serve as input to guide stakeholder interviews in Phase 3 (MMSNA Approach).

The advantage of the sequential MMSNA approach is its usefulness in collecting a richer and stronger array of evidence that could not be accomplished by a single method and the availability to give voice to diverse perspectives (Creswell, 2009; Edward, 2010). In combining different perspectives on community partners involved in the opioid crisis prevention effort, mixed methods support the development of network measurement tools, the improvement of partnership networks, and the validation and confirmation of results. Moreover, the value of sequential MMSNA design can contribute to a broader and deeper understanding of how networks matter, what mechanisms and conditions figure in when producing specific network outcomes, and dynamic processes and network change (Edward, 2010; Hollstein, 2014).

Sequential MMSNA Implementation Plan

This section presents the detailed implementation of the three phases of the sequential MMSNA design presented in Figure 3.2 and summarized in Table 3.1.

Table 3.1

Overview of Implementation Plan (Sequential MMSNA Design)

Phase	Study Aims	Data Collection Procedures	Data Analysis Procedures	Products
Phase 1: Conceptualization Stage	Develop a conceptual framework	Literature review of SNA application in program evaluation	Grounded theory	SNA-Evaluation Framework
Phase 2: Qualitative SNA Approach	Identify and describe the C.O.P.E. program partnership network	Archival document review	SNA content analysis	Networks actors and ties
Phase 3: MMSNA Approach	Assess the C.O.P.E. program partnership network Solicit feedback from program partners	SNA survey Interviews	SNA Inductive analysis	Refined partnership network Evidence-based strategies

Note. C.O.P.E. = Community-based opioid prevention and education; SNA = Social network analysis.

Phase 1: Conceptualization Stage

Jabareen (2009) describes the conceptual framework as a network of "interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena" (p. 4), and it possesses ontological, epistemological, and methodological assumptions. To understand how SNA is applied in the field of evaluation, Phase 1 of this study involved the development of a conceptual framework from existing multidisciplinary literature to represent the SNA application in program evaluation.

The Data of Conceptual Framework. The literature review involved a web-based search strategy to pinpoint existing SNA applications in program evaluation. The

literature sources included in the search were the *American Journal of Evaluat*ion, the *Canadian Journal of Program Evaluation (CJPE)*, *Evaluation and Program Planning*, *Evaluation Review*, *Evaluation*, *New Directions for Evaluation*, *Journal of Multidisciplinary Evaluation*, *Educational Research and Evaluation*, and *Evaluation and the Health Professions*. The search was done from the web pages of the selected evaluation journals, and the search strategy focused on articles published in journals related to evaluation (Track 1) and SNA (Track 2). In addition, reference lists of selected papers were cross-checked for the potential discovery of other related research until reference lists and searches produced extensively replicated sources. The search strategy resulted in 40 articles published in evaluation-related journals from 1980 to 2021. The articles were categorized by their objectives, including (a) the application of SNA in evaluation (33 articles), (b) reflection on and discussion of the potential use of SNA (3 articles), and (c) the review of SNA in evaluation (4 articles).

The Use of Grounded Theory Approach. Grounded theory (Glaser & Strauss, 1999) is a systematic discovery process that facilitates theories' emergence through data collection and analysis. Instead of relying on pre-existing theories and analytical constructs, the grounded theory approach requires maximum openness and flexibility, allowing new contextualized theories to merge from the inductive analysis of the empirically observed data. Therefore, researchers gather and compare data, remain open to all possible theoretical understandings, and develop tentative interpretations of data through codes and categories. Before the theoretical saturation (i.e., no new categories and themes emerge from data), there is a need to go back to the field and gather more data to enrich and refine categories (Charmaz, 2014; Martin & Turner, 1986). The

grounded-theory approach has an epistemology base of realism, one of the kinds of post-positivism. This positionality holds the belief that the potential knowledge is out there and can be captured by observations and empirical analysis.

Grounded-theory approach is an appropriate methodology for building conceptual frameworks as it is "an inductive, theory discovery methodology" (Martin & Turner, 1986, p. 141) aimed at discovering a theory from systematically obtained data and facilitating theory generation (Glaser & Strauss, 1999; Strauss, 1987). In order to analyze the massive amount of data, I adopted Jabareen's (2009) procedure of conceptual framework analysis (see Table 3.2). This procedure served as a mind map for the analysis process and offered the flexibility to reconceptualize and modify the framework.

Table 3.2

Procedure of Conceptual Framework Analysis

Step	Analysis Process
Step 1: Mapping the selected articles	• Review the selected 40 articles • Map articles based on author, year, topic, context, research aim, data collection tools, data analysis, and evaluation type
Step 2: Extensive reading and categorizing of the selected articles	• Read the selected 40 articles • Categorize the articles by evaluation type and evaluation purposes • Remap articles based on author, year, topic, context, use of SNA, data, and method (see Table 2.4)
Step 3: Identifying and naming concepts	• Read and reread the selected 40 articles to discover concepts • Define categories of codes by SNA application
Step 4: Deconstructing and categorizing the concepts	• Deconstruct each code and identify its primary attributes, characteristics, assumptions, and role (see Table 4.3)

Step	Analysis Process
Step 5: Integrating concepts	• Integrate and group codes that have similarities • Refine and merge categories of codes to generate 6 broad categories and 10 SNA practices
Step 6: Synthesis, resynthesis, and making it all make sense	• Synthesize concepts into a theoretical framework (see Figure 2.3 and Table 4.4)
Step 7: Validating the conceptual framework	• Validate the conceptual framework by applying it to the selected journal articles (see Table 2.4) • Validate the conceptual framework by including three program professors during the written preliminary exam and four committee members during the oral preliminary exam • Validate the framework by applying it to a social program (i.e., C.O.P.E. program)

Phase 2: Qualitative SNA Approach

Phase 2 of this study involved a qualitative SNA approach to investigate ways of SNA application to evaluate the C.O.P.E. partnership network, mainly focusing on using SNA to identify and describe the existing partnership networks. Table 3.3 outlines the research questions that guide Phase 2 design, the methods used to collect data, the aligned SNA analysis, and the research purposes. Narratives of these methods are provided below.

Table 3.3

Matrix of Research Questions, Methods, SNA Analysis, and Research Purposes

	Phase 2 Overarching Research Question: How can the SNA methodology be applied to support the evaluation of the C.O.P.E. program?	**Sub Question 1**: Who are the community partners in the network?	**Sub Question 2**: What existing relational ties among the C.O.P.E. partner organizations may play a role in the opioid prevention effort?
Methods	Qualitative SNA approach		

SNA Analysis		Descriptive	Descriptive
SNA Concept		Actors	Relational ties
Purpose	Investigation of ways to use SNA to support the opioid crisis prevention evaluation	Identification of community partners	Identification of relationships among community partners

Note. C.O.P.E. = Community-Based Opioid Prevention and Education; SNA = Social network analysis.

Collecting Archival Data. Archival data refer to existing information and provide valuable information for social network analysis (Knoke & Yang, 2008). Archival data include records and documents: records typically provide quantitative information regarding the program being evaluated; documents tend to provide more descriptive and qualitative information but may also include some quantitative data (Russ-Eft & Preskill, 2009). Collecting archival documents was appropriate for Phase 2 as the purpose was to identify existing program partners involved in the opioid crisis prevention work from 2018 to 2022 and specify potential linkages that connect these partner organizations (Valente, 2010). In addition, collecting information on existing partners from archival documents does not involve issues of respondent recall and burdens on informant time and effort (Knoke & Yang, 2008; Scott, 2017).

Moreover, the archival data may contain longitudinal information if the data remain over time (Knoke & Yang, 2008). The selection of archival documents followed the guidelines developed by Russ-Eft & Preskill (2009): (1) documents could help answer Phase 2 research questions; (2) documents were permitted to be reviewed and analyzed; (3) program investigators and evaluators reviewed documents for confirmability. Based

on the selection guidelines, documents selected to answer Phase 2 research questions were related explicitly to the C.O.P.E. program in MN rural communities. These documents provided a descriptive summary of the characteristics and relational ties of the C.O.P.E. program partner organizations; the Family Development Center of the University of Minnesota Extension currently houses these documents. Selected documents included the opioid crisis prevention grant applications, evaluation reports, annual grant reports, and program event records.

In total, 30 archival documents were reviewed, and the characteristics of these selected documents are presented in Appendix B. The 30 documents were screened using the document analysis form to identify partner organizations and the relational data, and the results are presented in Table 3.4.

Table 3.4

Document Analysis Form

Data Source	Document Date	Partner Information Available (Yes/No)	Relational Data Identifiable (Yes/No)
RHSE project initiation	2018	Yes	No
ROTA work plan	2019	No	No
RHSE federal progress report	2019; 2020; 2021	No	No
ROTA federal report	2019; 2020; 2021	Yes	Yes
RHSE project initiation	2019	No	No
RHSE project logic map	2019	No	No
ROTA program narrative	2020	Yes	No
SAMHSA logic map	2020	No	No
SAMHSA project narratives	2020	Yes	Yes

Data Source	Document Date	Partner Information Available (Yes/No)	Relational Data Identifiable (Yes/No)
RHSE evaluation report	2021	No	No
RHSE annual reports	2020; 2021; 2022	Yes	No
Community forum reports (6)	2021	Yes	No
SAMHSA 6 months progress report	2021	Yes	Yes
ROTA tribal advisory committee report	2021	Yes	Yes
PEW stakeholder list	2021	Yes	No
Education and Training	2022	Yes	No
Growing the Good	2022	Yes	No
Opioid event form	2018-2022	Yes	Yes
Stakeholder interview data	2022	No	No

Note. SAMHSA = Substance Use and Mental Health Service Administration; PEW = PEW Charitable Trust; RHSE = Rural Health & Safety Education; ROTA = Rural Opioid Technical Assistance.

Qualitative SNA Data Transformation. In principle, qualitative data can be analyzed using interpretive and qualitative methods. Nevertheless, qualitative data can also be analyzed using quantitative methods such as social network analysis (Längler et al., 2019; Yousefi et al., 2020), and the quantification of relational data happens via an 'adjacency matrix' (Edward, 2010). Yousefi et al. (2020) assert that social networks are suitable subjects for qualitative data since they embody social structures and the content of social relations. The qualitative data of Phase 2 were analyzed and transformed into

SNA data following two steps: document preparation and identification of structural and content variables.

Step 1 of SNA data transformation involved preparing documents for content analysis. The primary objective of this step was to systematically identify and combine information into a single document that can be used to derive social network matrices. Given the diverse combinations of the data sources, I separated the archival data by grant, as this could assist in organizing the partnership information for each grant. For this study, the final document was imported into the Excel Spreadsheet (Microsoft Corporation, 2018) for content analysis.

In Step 2 of SNA data transformation, I identified structural or content variables through name-generating, resource-generating, and name inter-relating approaches. Name-generating refers to the collection of actors relevant to the network and helps identify the existing actors in the network (Längler et al., 2019; Marsden, 2014). The resource-generating strategy was applied to identify resource actors within the network (Knoke & Yang, 2008), which provided information about network assets. The name inter-relating strategy was applied to examine relational ties between actors, which could help draw conclusions about relational ties between network actors (Prell, 2012).

In this step, I first identified partner codes using the name-generating strategy, identified resource codes embedded in the partner organization using the resource-generating strategy, and identified relational ties using the name inter-relating approach. These codes served as a critical input for subsequent content analysis, functioning as pre-determined codes to analyze community partners. To ensure anonymity for the actors when publishing results, abbreviations were assigned to each partner organization

(Marsden, 2014; Knoke & Yang, 2008). After de-identifying partner information, each community partner was tied to organization type, county, and state.

The initial list was circulated to the program investigator and regional coordinators to solicit suggestions for the inclusion of other organizations and the exclusion of inactive organizations. Organizations were added if at least two members advocated their inclusion or removed if at least two members stated their inactive involvement in the C.O.P.E. program. The final list included 46 organizations, including community-based organizations, academic institutions, philanthropic organizations (e.g., foundations), healthcare sector, public sector (e.g., state and county department of health), and county courts. The specific types of partners involved in the C.O.P.E. program include K-12 schools, legal/criminal justice organizations (e.g., probation and county jails, sheriffs, police), healthcare systems (first responders, providers, nurses, hospitals, healthcare organizations), recovery organizations (local AA, NA, faith-based recovery, behavioral health recovery), and tribal entities (tribal government, health and human services, and organizations leading recovery efforts). Table 3.5 outlines the categories of community partners.

Table 3.5

Summary of Community Partners

Category	Description
Community-based Organizations (COBs)	Local nonprofit organizations that work to generate improvements within a community on the local level
Drug/Sobriety/Treatment Courts	Organizations that supervise treatment programs for individuals with substance disorder
Faith-based Organizations (FBOs)	Religious organizations such as churches, temples, mosques, or other houses of worship

Category	Description
Government	State, county, or local government offices that administer a region or series of communities
Healthcare	Organizations that provide medical healthcare (i.e., primary care) or behavioral health (i.e., counseling, substance use support)
K-12 Schools/School System	Organizations within a K-12 school system
Labor/Workforce Development	Organizations that provide training programs or help improve access to employment
Legal /Criminal Justice	Organizations or individuals who are engaged in law enforcement, legal services, or the courts
Media/Radio	Organizations that broadcast news or podcasts
Philanthropy	Organizations that operate for charitable, scientific, literacy, or educational purposes
Professional Organization	Professional associations that support the interest of people working in that profession
Public Health/Human Services	Organizations that operate in the public health or human services sectors
Recovery Services	Organizations that specialize in serving individuals struggling with substance use and mental health
Tribal entities	Organizations that identify as American Indian, Native American, First Nations
University/College	Universities or colleges that provide higher education

Note. The list of partner categories was developed based on the meeting log. The meeting log was developed to capture details of the community partners involved in the program.

Descriptive Analysis. Where no complete network data were generated based on the archival document review, SNA statistics describing the whole network had limited applicability at this stage. Hence, in this phase, I limited the analysis to describe the existing network, including (a) the actors involved in the C.O.P.E. program and their characteristics and (b) the total number of partner organizations. Another interest in this

phase is identifying potential relational ties within the C.O.P.E program (see Table 3.6). In this phase, the greatest interest was generating network actors and relational ties that can support the Phase 3 network survey development.

Table 3.6

Summary of Network Terms Described in Phase 2

Network Terms	Definition
Actor	Partner organizations involved in the C.O.P.E. program and the characteristics of these partner organizations
Size	The number of actors in the C.O.P.E. partnership network
Ties	The characteristics of possible ties retrieved from the archival documents

Note. C.O.P.E. = Community-Based Opioid Prevention and Education.

Phase 3: MMSNA Approach

As noted before, MMSAN is considered the best approach to examine the impacts of SNA application on the opioid crisis prevention program's outcomes and the challenges experienced in introducing the SNA methodology. Both quantitative and qualitative approaches were used during this phase, consisting of a survey instrument to collect partnership network data and semi-structured interviews with key program personnel and partners. Table 3.7 outlines the research questions that guide Phase 3 design, the methods used to collect data, the aligned SNA analysis, and the research purposes. Narratives of these methods are provided below.

Table 3.7

Matrix of Research Questions, Methods, SNA Analysis, and Research Purposes

	Phase 3 Overarching Research Question: How does the use of SNA methodology	**Sub Question 1**: How can the SNA methodology be applied to assess the partnership	**Sub Question 2**: How do stakeholders perceive the value of SNA methodology in

	impact the evaluation of the C.O.P.E. program?	network of the C.O.P.E. program to further strategic planning?	supporting the evaluation of the C.O.P.E. program?
Methods		MMSNA approach	
SNA Analysis		Network diagnostics	Inductive analysis
Purpose	Investigate ways to use SNA to support the opioid crisis prevention evaluation	Uncover network structure Identify prominent actors Identify ways to enhance the partnership network	Understand the SNA usage and value in program evaluation

Note. C.O.P.E. = Community-Based Opioid Prevention and Education; MMSNA = Mixed method social network analysis; SNA = Social network analysis.

Survey. In this study, the MMSNA approach started with surveys to collect complete network data versus ego-centric network data. In a complete-network study, researchers often "measure the relations among actors in some bounded social group by collecting data on one or more relations among the groups' actors" (Carolan, 2014, p. 68). Also, surveys are commonly used to assemble network data for many situations where such records do not exist or do not include information about relationships among social actors (Marsden, 2011). Considering the C.O.P.E. partnership network data, each partner organization involved in the C.O.P.E. program from 2018 to 2022 was considered to be within the network boundary.

An online survey was conducted with the C.O.P.E. partner organizations to collect network data. In particular, SNA can demonstrate how the partnerships in local communities are constructed, gauge whether respective community partnership networks led to increased information and resource exchange networks over time, and whether the

community-based collaboration is tied to improved community access to opioid prevention services and resources (Valente et al., 2010).

Survey Development. The survey's primary goal was to look closely at the community partners' relationships and the activities in the C.O.P.E. collaborative. To accomplish this, I developed the C.O.P.E. Partnership Network survey to determine the key players in a network, the quality of their relationships, and the context of their exchanges.

Adapted from the instrument developed by Provan and colleagues (1995; 2003; 2004) and the PARTNER tool developed by Varda et al. (2008), a survey was developed through the web-based questionnaire system (Qualtrics, Provo, UT). The questionnaire requested information on community partners' characteristics, attitudes toward partnership with other community partners, and network relationships (see Table 3.9). The questions regarding the network characteristics included:

- Organization roles. Responding organizations indicate what roles they play in supporting the C.O.P.E. program. Examples of roles include community connections, expertise in various disciplines, knowledge, research, and evaluation. Organizations also indicated the length of their involvement in the program.

To assess the relationships among partner organizations, such as the intensity, quality, and context of the relationships, the C.O.P.E. Partnership Network survey included questions related to:

- Relational ties. Each representative of the partner organizations was asked to indicate the presence or absence of specific ties with every other partner organization based on the following ties: (a) advocacy/policy, (b) client referral

systems, (c) coming to agreements pf best practices, (d) developing tools, (e) funding activities/resource development, (f) learning from each other, (g) educational programs/training, (h)technical assistance/consultation, (i) research/evaluation, and (j) service delivery. All matrices consist of scores of either “0” (no link of that type between two community partners) or “1” (a link of that type exists). The ten matrices were constructed using unconfirmed data, as the raw data collected using the network question heavily relied on community partners’ responses. The second series of matrices were constructed to capture confirmed data and increase reliability. For instance, if community partner A reports a linkage with community party B, the relationship is confirmed (i.e., a score of “1” in the confirmed matrix) only if community party B also reports the same linkage. Both unconfirmed and confirmed relationship scores were reported for this question.

- Relationship strength. Each partner organization representative rated the strength of their relationship—based on their partnership experience—with other partners regarding the relational ties they selected (from 1 = not at all to 5 = very much).
- Frequency of collaboration. Responding organizations were asked to indicate how frequently their organizations work with other partner organizations on the issues related to the C.O.P.E. program goals. Respondents were expected to choose a single answer on a scale of the lowest level of frequency (Never) to the highest (Every day).

The survey questionnaire also assessed perceptions toward partnerships with other organizations, including the partnership's perceived success, value, trust, and perceived

outcomes resulting from the partnership. The questions regarding the network characteristics included:

- Perceived partnership success was measured using a five-item Likert-type scale (from 0= Don't know to 4 = very helpful).
- The perceived value of partners to the mission was measured as an index of three questions asking about each organization's perception of the other partners as valuable to achieving the overall mission of the opioid crisis prevention work in terms of power/influence, commitment, and resource availability. Responses options are (1) not at all, (2) a small amount, (3) a fair amount, and (4) a great deal.
- Trust among community partners, measured as an index of three questions asking about the extent to which each of the other organizations in the partnership network is reliable, supports the mission of the opioid crisis prevention efforts, and is open to discussion. Responses options are (1) not at all, (2) a small amount, (3) a fair amount, and (4) a great deal.
- Perceived outcomes of the partnership were measured by an index of eight questions asking about each organization's perception of partnership outcomes regarding knowledge acquisition, funding, organizational capacity, resource exchange, service improvement, and program development. Responses options are (1) already occurred, (2) expect to occur, and (3) do not expect to occur.

The survey also asked responding organizations to reflect on the benefits and drawbacks of the partnership. Perceived benefits of partnership within the network were measured using the following range of response categories (from 1 = not successful to 5

= Completely successful). Perceived drawbacks or challenges were measured using multiple-choice questions in which respondents were asked to select all challenges that occurred throughout their collaborative work with other organizations. Table 3.8 presents the survey, including variables measured, outcomes, and the associated survey questions in Appendix C.

Table 3.8

Adopted Items for the C.O.P.E. Partnership Network Survey

Variable	Outcomes	Survey Item (Appendix C)
Roles	Multiple choices	Q4
Length of involvement	Single choice	Q5
Formation of partnership	Single choice	Q6; Q7; Q8
Relational ties	11 indices using a 5-item scale (a) not at all; (b) little; (c) somewhat; (d) considerable; (e) very much	Q9
Frequency of collaborative activities	6-item scale (a) never; (b) once a year or less; (c) about once a quarter; (d) about once a month; (e) every week; (f) every day	Q10
Number of collaborative activities	5-item scale (a) 0; (b) 1; (c) 2-5; (d) 6-10; (e) more than 10	Q11
Perceived value of partners to the mission	3 indices using a 4-item scale (a) not at all; (b) a small amount; (c) a fair amount; (d) a great deal	Q12
Trust among community partners	3 indices using a 4-item scale (a) not at all; (b) a small amount; (c) a fair amount; (d) a great deal	Q13

Variable	Outcomes	Survey Item (Appendix C)
Perceived outcomes	8 indices using a 3-item scale (a) already occurred; (b) expect to occur; (c) do not expect to occur	Q14
Perceived partnership helpfulness	5-item scale (a) not at all helpful; (b) not very helpful; (c) somewhat helpful; (d) very helpful; (e) don't know	Q15
Perceived partnership success	5 indices using 5-item scale (a) not successful; (b) somewhat successful; (c) successful; (d) very successful; (e) completely successful	Q16
Drawbacks of partnership	Multiple choices	Q17

Organization selection. Participating organizations were selected based on their involvement with the C.O.P.E. program to provide opioid prevention and recovery services related to healing and wellness, education, and training in MN rural communities since 2018. The complete partnership list was developed after Phase 2 analysis, with 46 organizations identified and a few primary contacts for each organization (see Table 4.6 and Appendix E).

Think-Aloud Testing. The use of a think-aloud approach in developing a survey instrument is critical to establish the instrument's cognitive validity, which helps ensure the survey items make sense to the potential survey respondents and participants respond to the survey items in the manner intended by the survey designer (Trenor et al., 2011). The panel of subject matter experts reviewed the survey instrument through Qualtrics, the survey implementation software hosted by the University of Minnesota. Using the think-aloud approach, experts were asked to provide qualitative feedback about confusing items, feeling about whether these survey items would make sense to the potential

respondents, and changes that could be made to the items. The survey instrument was revised based on the think-aloud feedback from experts, and an additional think-aloud session was conducted with two reviewers to confirm the survey instrument and design.

Data Collection. The survey was distributed to 72 primary contacts across 46 partner organizations through the web-based questionnaire system (Qualtrics, Provo, UT). Before administration, the partner organizations were informed by the program director about the purpose of the network survey and when the network survey would be distributed. Individualized e-mails were sent to each identified partner with a recruitment statement and the link to the survey from September to October 2022. Two reminder emails were sent to participants who did not complete the survey. To help increase the response rate and collect complete network data, the program director sent additional emails to a list of community partners who still need to complete the online survey. Participants were given 15 days to complete the online survey.

A total of 30 contacts across 20 organizations completed the survey. The rest of the organizations failed to return a completed survey despite several reminders and was excluded from the findings. Six surveys were excluded, as the respondent did not respond to the relational questions. Information on the survey response rate is presented in Table 3.9.

Table 3.9

Survey Response Rate

	Survey Sent	Response (#)	Response Rate (%)
Organizations	46	20	43.48%
Contacts	72	30	41.67%

Participating organizations included representation from university/college (n = 6), public health and human services (n = 4), drug/treatment/sobriety courts (n = 4), government (n = 3), and primary contacts from other organizations. The characteristics of network survey participants are presented in Table 3.10.

Table 3.10

Characteristics of Network Survey Participants

	# of Responses	% of Responses
Organizational Type		
Community-based Organization	3	10%
Drug/Treatment/Sobriety Courts	4	13%
Government Department/Agency	3	10%
Health Care	1	3%
K-12 Schools/School System	1	3%
Labor/Workforce Development	1	3%
Legal/Criminal Justice	1	3%
Not-for-profit organization	1	3%
Public Health/Human Services	4	13%
Recovery Services	2	7%
Tribal Organization	3	10%
University/College	6	20%
Duration of Program Involvement		
Shorter than 1 month	2	7%
2-3 months	1	3%
3-6 months	1	3%
6-12 months	3	10%
1-3 years	14	47%
3-5 years	9	30%
5 years or longer	0	0%

Note. Number of primary contacts who responded to the survey = 30.

SNA Sociogram. The Excel file was imported to software R version 4.1.0 (Rstudio Team, 2022) to map out the partner organizations involved in the C.O.P.E. program. A sociogram is a visual representation to help explore the groups, projects, and organizations involved and how they are connected (Wasserman & Faust, 1994). This visualization aimed to identify connections and subgroups within the network and help understand who connected to whom in the context of the C.O.P.E. program. While this was not a complete enumeration of all partner organizations in the network, it provided information about how organizations connected directly or through other organizations.

Data Analysis. Once data were collected, confirmed and nonconfirmed relationships (links) were counted. Confirmed links refer to those relationships in which both organizations indicate a link with the other and are typically considered more reliable indicators of network activity (Provan et al., 2005). Nonconfirmed links reflect the relationships listed by an organization, regardless of whether that organization is also named by the organization it has identified; nonconfirmed links "can be quite useful in pointing out the existence of weak ties and areas that a network might want to strength" (Provan et al., 2005, p. 606). Network analysis of Phase 3 focused on both confirmed and unconfirmed links.

Network manipulation and description were performed with R version 4.1.0 (Rstudio Team, 2022). Due to the reciprocal nature of the relationships, all network links were symmetrized by using the higher score for each dyad before applying threshold levels that define a network tie. When one partner organization in a dyad did not respond, the score for the available node was used. Regardless of the response, all partner organizations decided by the lead agency were included. The following section describes

measures used for network structure, organizational prominence, relationship activities, the intensity of relationships, and frequency occurring in relationships. A summary of social network metrics used is also presented in Table 3.11.

To examine the partnership formation, I first presented a descriptive analysis of the networks using network measures such as *size* (the number of actors the network has), *diameter* (the longest path between any two actors), *density* (the proportion of possible links in the network that exist), *modularity* (the degree to which a network's components may be separated and recombined), and *transitivity* (the network's tendency toward stability and consistency).

To examine organizational prominence, I analyzed several *centrality* metrics, as centrality is an important concept in social network analysis to identify influential actors within a group (Carolan, 2014, pp. 154-161). Centrality also reflects the number of direct connections each organization has with other organizations, which can provide valuable insights about which organizations are most and least prominent within the network (Provan et al., 2005). Organizations with higher centrality have greater access to power and control over the information flow and resource exchange and thus are considered more influential and powerful (Boje & Whetten, 1981). The following section details the various centrality scores measured in this study.

- Degree centrality assigns an importance score based on the number of ties held by each actor. In-degree measures the number of incoming connections for an actor, whereas out-degree measures the number of outgoing connections for an actor.
- Betweenness centrality measures the extent that a node sits between pairs of other actors in the network, which "captures how actors control or medicate the

relations between pairs of actors that are not directly connected" (Carolan, 2014, p. 157). A high betweenness score indicates that an actor holds authority over disparate clusters in a network.

- Closeness centrality measures how close each actor is to every other actor in the network. Closeness can indicate how quickly an actor can exchange something with others or give others early access to new information (Carolan, 2014, p. 156).

It is important to examine relationship characteristics as they may be associated with enhanced collaboration. The relationship strength among network organizations can be conceptualized and measured in multiple ways (Kilduff & Brass, 2010). In this study, community frequency and trust among community partners were analyzed and represented visually and as a score.

- The relationship strength score gives the network members an idea of the working relationship with other community partners.
- Communication frequency describes how likely organizations are to share information. Organizations that communicate more frequently with one another are more likely to share information than those with less frequent communication (Reagans & McEvily, 2003). Communication frequency may also lead to more effective inter-organizational communication through developing relationship-specific heuristics (Uzzi, 1997).
- The trust score describes the quality of connections among partner organizations. It provides a baseline to strategize and measure improvements in terms of a specific strategy for enhancing the partnership network.

In addition, attitudes toward partnerships and the perceived value of partnerships were analyzed and represented visually and as a score.

- Attitude toward partnership score is critical for building successful networks because most relationships between community partners are voluntary. Scores of perceived benefits and drawbacks can help network members decide whether to link with other partners concerning the potential benefits and drawbacks of their collaboration with other community partners.
- The value score of the community partner gives the network members an idea of which organizations they may want to target in terms of a specific strategy for strengthening the partnership network.

Table 3.11

Summary of Network Metrics Analyzed in Phase 3

Metrics	Definition	Computation and software resources
(a) Network Structure		
Size	The number of actors in the network	Computation: In a network with N members, the network size is equal to N. (Wasserman & Faust, 1994) Software: R > Size > network.size
Density	The proportion of possible relational ties that are present	Computation: In a network with N members, the number of directed ties is divided by N * (N-1). (Wasserman & Faust, 1994) Software: R > Cohesion > Density > gden
Diameter	The longest of the shortest paths across all pairs of nodes	Computation: In a network, a path is the series of steps from node A to node B. (Carolan, 2014) Software: R > Compactness > Diameter > diameter
Modularity	The degree to which a network's components may be separated and	Computation: Modularity has a range of values from -1 to 1.

Metrics	Definition	Computation and software resources
	recombined	Software: R > Complexity > Modularity > modularity
Transitivity	The network's tendency toward stability and consistency	Computation: Transitivity is the portion of a closed triangle to the total number of open and closed triangles and can range from 0 to 1. (Carolan, 2014) Software: R > Tendency > Transitivity > transitivity
(b) Organizational Prominence (Centrality)		
Degree	The number of ties sent from and to a node	Computation: In a network, degree is defined as $C_d(n_i) = d(n_i)$. Software: R > Prominence > Degree > degree
Betweenness centrality	The extent that an actor sits between pairs of other nodes	Computation: $C_B(n_i) = \sum_{j<k} g_{jk}(n_i)/g_{jk}$ Software: R > Prominence > Betweenness > betweenness
Closeness centrality	The extent to which a node is close to all other nodes in a network	Computation: $C_B(n_i) = \left[\sum_{j<k}^{g} d(n_i, n_j)\right]^{-1}$ Software: R > Prominence > closeness > closeness

Note. This table illustrates the computations and software scripts generated by program R. Adapted from Wasserman and Faust (1994).

Semi-Structured Interviews. According to Merriam (2009), conducting interviews with program key personnel can be quite helpful in understanding their perspectives and experiences related to the program and the meaning they attribute to their experiences. This qualitative phase included interviews with the C.O.P.E. program partners in university and county-based public health and human services and with the leadership of the C.O.P.E. program since they would be more familiar with the challenges of the program and the limitations of existing evaluations. For instance, the viewpoints of individuals from public health and human services were critical because

these partners play instrumental roles in forming and implementing public health programs. Similarly, the views of the leadership of the C.O.P.E. program were important because these individuals were confronted with managing and directing funds for the C.O.P.E. program and other similar opioid-related programs. Finally, including the viewpoints of individual researchers or evaluators was important because they carry out the program research and evaluation, and the findings they provide could broadly impact the program funding and program beneficiaries.

Semi-structured interviews were conducted with key personnel involved in the opioid crisis prevention work at some point over the program's timeframe of 2018-2022, guided by the interview protocol. The purpose of the interview guide was to provide "topics or subject areas within which the interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject area" (Patton, 2002, p.343). At the same time, it allowed the researcher flexibility to change the wording and sequence of the question to avoid disruption in the interview flow (Merriam, 2009).

Participant Selection. The participants for the study were recruited through purposive sampling to select information-rich individuals whose information could illuminate the questions under the study (Patton, 2002). According to Patton (2002), information-rich individuals are "those from which one can learn a great deal about the issues of central importance of the inquiry" (p. 230), and the information they provide can yield an in-depth understanding of the study. Various sampling strategies were adopted to identify participants: (a) using snowball sampling to generate several information-rich participants; and (b) using criteria sampling to review all participants identified from snowball sampling and ensure they meet the pre-determined criterion

(Patton, 2002).

A small sample of 8 information-rich individuals was selected to provide insights and an in-depth understanding of their experience with the C.O.P.E. partnership network and their perspectives on the usefulness of the SNA method and network. My target was to recruit 8 participants as "in-depth information from a small number of people can be very valuable, especially if the cases are information rich" (Patton, 2002, p. 244). Table 3.12 provides a summary of the characteristics of the people interviewed. The data collection consisted of 8 interviews with program investigators, program educators, public health and human services professionals, and evaluators. These were people involved in the program and were willing to give informed consent.

Table 3.12

Summary of the Characteristics of People Interviews

Organization	Number of Years Involved in the C.O.P.E. Program	Roles
Public Health & Human Services = 3 Recovery Center = 1 Tribes = 1 University/College = 3	Shorter than 1 month = 0 2-3 months = 0 3-6 months = 0 6-12 months = 0 1-3 years = 3 3-5 years = 5	Evaluator = 1 Public Health Official = 3 Program Leader = 2 Educator = 2

Protocol Development. I used semi-structured open-ended interview questions (see Appendix D) to clarify the constructs. The interview protocol had three parts: (1) introduction and understanding of the interviewee involved in the C.O.P.E. program, (2) information on partnership networks and impacts, and (3) information on social network tools and use of network findings. The key questions contained prompts for probing the

participant's responses in depth, and these probes were useful "to deepen the responses to a question, increase the richness and depth of responses, and give cues to the interviewee about the level of response that is desired" (Patton, 2002, p. 372). Examples of probes included detail-oriented phrases such as "what," "when," and "how" questions to obtain detailed information; elaboration-oriented probes such as "can you provide an example?" to keep the interviewee talking about the subject; and clarification-oriented probes such as "more detail" to get more information or a restatement of the answer (Patton, 2002).

The purpose of the opening questions on how stakeholders got involved in the C.O.P.E. program and their roles was to build rapport and assist respondents in feeling comfortable with the interview process. I then briefly explained key constructs to familiarize the participants with the terms and moved participants to an in-depth discussion about the topic. The final question focused on the interviewees' reflections on the future of SNA application to support the evaluation of the C.O.P.E. program.

Interview Process. The 8 interviews were conducted through a virtual platform such as Zoom. The order of the questions is provided in Table 3.13, and the duration of the interviews ranged between 50-60 minutes. Participants were encouraged to be candid with their experience, as there was no right or wrong answer. They were reminded that their participation was voluntary. Permission to video-record the interviews was obtained from each participant at the beginning of the interview. The recorded interview sessions were transcribed using the Zoom transcript feature. A numerical code was assigned to each participant on the transcript to ensure data confidentiality. The results of the interviews were transferred to a laptop at the end of the recording session.

Table 3.13

Semi-Structured Interview Protocol

Interview Questions
Q1. Please describe how you got involved in this project and your role.
Q2. Do you feel the current partnership is a good example of implementing a community-driven opioid response in rural communities? a. Please describe your understanding of partnership networks in the local community. b. Who or what is missing from the current partnership network?
Q3. Do you think this partnership network has contributed to a more sustainable opioid response in your community? a. Can you give an example of when the partnership network was useful? Can you provide an example of when the partnership network was not useful? b. At what stages of the program was the partnership network most useful?
Q4. Usefulness of the network findings a. Do you think the information generated from the network findings will be valuable for supporting the development/improvement of the partnership network in your community? b. If so, how does the information generated from the survey benefit the opioid crisis prevention work in your community? c. How will you use the network findings to strengthen the partnership network in your community?
Q5. Innovation and evaluation a. How does the SNA method support the evaluation of the opioid crisis prevention program? How might it change the quality of evaluations?
Q6. Methodological challenges a. What are some challenges in completing the C.O.P.E. partnership network survey? b. What are the possible ways to address these challenges?
Q7. In considering using SNA to continuously support the opioid prevention program evaluation, what do you see as the future of using social network analysis to support this work?

Data Preparation and Analysis. Immediately after each recorded interview, I reviewed interview notes and transcripts to "guarantee that the data obtained will be useful, reliable, and authentic" (Patton, 2002, p. 384). Next, the interview data were

analyzed using inductive analysis as this strategy can "allow important analysis dimensions to emerge from patterns found in the cases under the study without presupposing in advance what the important dimensions will be" (Patton, 2002, p. 56). In addition, inductive analysis is a method for discovering, analyzing, organizing, describing, and reporting patterns and categories found within a data set (Patton, 2002). This approach was chosen for its flexibility and ability to examine different participants' perspectives, highlight similarities and differences, and generate insights and recommendations (Patton, 2002).

I used Dedoose (Version 9.0, 2021)—a web-based platform for analyzing qualitative and mixed-method research—to organize and manage the data analysis process. I purposefully selected two information-rich interviews to get an overview of the data, as shown in Figure 3.3. These two transcripts served as the foundations for coding eight interview transcripts. First, I read each transcript vertically, line by line from beginning to end (Corbin & Strauss, 2008), and jotted on the word summaries of the phrases and paragraphs in the interview data. Some word summaries were derived directly from the data.

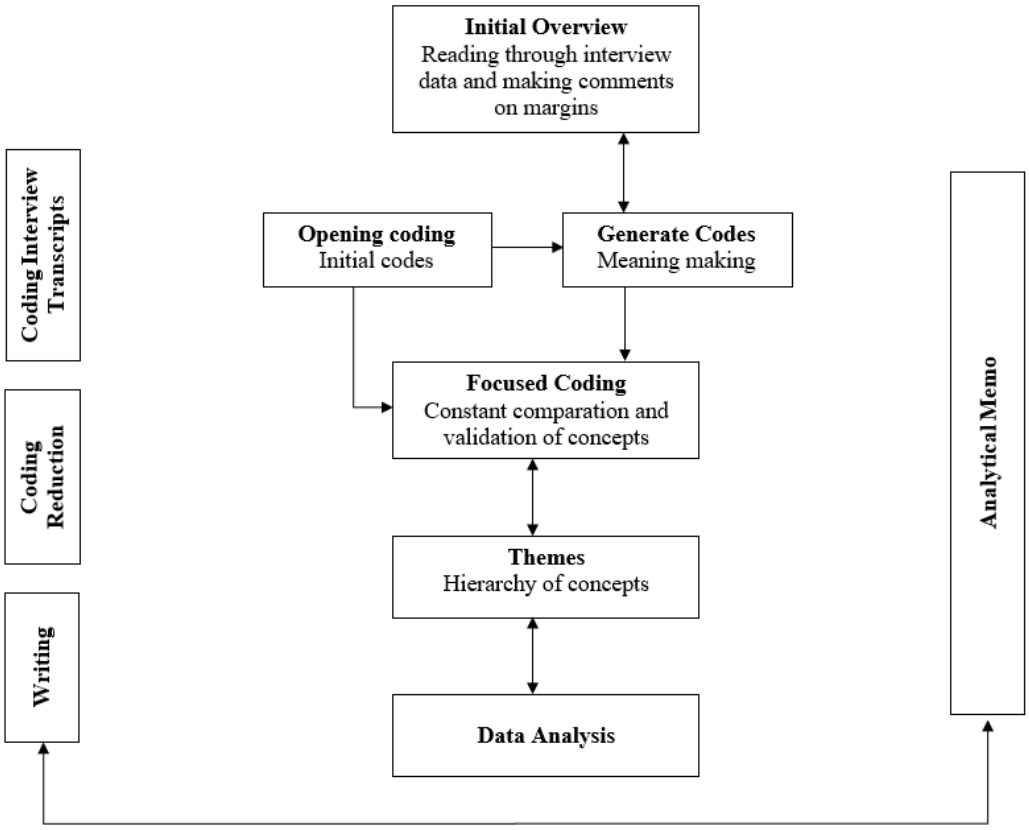
Second, I read the two transcripts horizontally and made side-by-side comparisons through open coding to make meanings of the codes. For example, the keywords participants frequently used to describe how they would use the SNA findings were "*identify missing actors*," "*help define actions,*" "*visualize network structure,*" and "*understand network structure.*" Third, I assigned numbers to each interview and used the codes from the two analyzed interviews to code the rest of the six interviews, generating a total of 11 codes (see Table 4.11). The coding process was iterative as some

codes merged and others spilt up after going through all interview transcripts. This process helped me to see patterns in the data and write descriptions for each code.

Fourth, I constantly compared and validated the concepts in the data and kept descriptions during the code reduction process. As shown in Figure 3.3, the code descriptions were an ongoing process that covered the entire coding and categorizing process.

Figure 3.3

Process for Analyzing Interview Data



Limitations

As mentioned earlier, the conceptual SNA-Evaluation framework served as the foundation to conduct the study, specifying the scope to six broad categories that constitute the SNA application in program evaluation and setting priorities for research purposes and questions. Hence, using a conceptual framework to guide the research design may limit the scope of the study.

I would like to highlight another limitation related to this study. The problem of missing data is particularly serious in social network research because of privacy issues, many relational questions, and not recalling relationships correctly (Knoke & Yang, 2008; Längler et al., 2019; Scott, 2017). Missing network data can "influence the data outcomes if important relations are not included in a network study" (Längler et al., 2019, p. 27). To address these limitations, I prevented missing data by (a) informing participants about the confidential treatment of social network data, (b) incorporating potential benefits to affiliated community partners, and (3) integrating the values of community partners and transparency of procedures throughout the process. Also, the application of mixed methods approaches can help prevent missing data by combining qualitative approaches (e.g., archival document review and interviews) with quantitative approaches (e.g., survey questionnaires) to mitigate the occurrence of missing data (Hollstein, 2014) as well as trigger a deeper reflection on the network (Längler et al., 2019, p. 27).

Other limitations of this study include concerns related to chosen methods. Table 3.13 outlines a variety of potential limitations associated with the methods employed in this study, along with the strategies used to address limitations. The limitations noted are

adapted from Johnson and Turner's (2003) tables of strengths and weaknesses of varying sources of methods.

Table 3.14

Method Limitations of Strategies to Overcome Them

Method	Limitations	Strategies to Combat Limitations
Archival document review	• Availability/ accessibility - document retrievability • Interpretation bias	• Knowledge and relationship with primary personnel in the organization provided a greater likelihood of accessing archival documents and records • Research used multiple sources of data to corroborate findings • Researcher consulted with primary personnel (i.e., PI, internal evaluation/research specialists) to determine the purpose of documents to help avoid misinterpretation
Survey questionnaire	• Missing data • Nonresponse to selective items	• Use of well-respected and connected key personnel to collect survey data and follow up with missing data • Distribution of survey questionnaires over two consecutive months during the bi-weekly community connection meeting
Interviews	• Willingness and availability of interviews • Response bias • Articulation and recall inaccuracies • Reflexivity – responding with what is believed to be desired	• Researcher's position in the organization provided more ready access and flexibility in meeting interviewee' schedules and needs • Application of multiple sampling strategies to identify potential informants • Development of precise, well-written measures allowed interviews to provide novel responses to the questions • Included a group of diverse stakeholders (i.e., community partners, program educators, and program leaders)

Method	Limitations	Strategies to Combat Limitations
		• Comparison of information across interviewees

Note. Adopted from Johnson & Turner's (2003).

Trustworthiness of the Study

The study's trustworthiness followed Lincoln and Guba's (1985) evaluative criteria: credibility, transferability, dependability, and confirmability. To enhance the "confidence in the 'truth' of the findings" (Lincoln & Guba,1985, p. 290), this study was established through the triangulation of data sources whereby the researcher compares and validates data collected from multiple resources, including archival documents, network survey, and interviews (Denzin & Lincoln, 2011; Miles et al., 2014; Merriam, 2009). Triangulation of data sources is based on the idea that the strengths of different sources would provide the researcher with a better explanation of a phenomenon than findings based on a single source.

Lincoln and Guba (1985) suggest assessing the transferability of the study to understand the extent the findings of one study apply to other contexts. To show transferability, Miles et al. (2014) claim that a "thick description" is essential for readers to assess the potential transferability and appropriateness of their settings. This study provided a thick description—a "highly descriptive, detailed presentation of the setting and in particular, the findings of a study" (Merriam, 2009, p. 227)—including the program context, participants' background, research background, methodology, and study results for readers to assess its transferability to other settings.

Aside from fulfilling the credibility and transferability, this study used an audit trail strategy (Lincoln & Guba, 1985) to ensure the dependability of findings. As Lincoln

and Guba (1985) suggested, an audit trial strategy can be a valuable tool to help researchers build dependability by describing in detail how the data are collected, how they are analyzed, how different themes are derived, and how the results are obtained.

Furthermore, as Lincoln and Guba suggest (1985), the study should meet confirmability to assess "the degree of neutrality or the extent to "which the findings of an inquiry are determined by the subjects (respondents) and conditions of the inquiry and not by the biases, motivations, interests, or perspectives of the inquirer" (p. 290). This study adopted audit trail and triangulation strategies to address these issues. The researcher in this study was also explicit and aware of personal assumptions, values, and biases that may affect the study.

Ethical Considerations

This study was submitted to the Institutional Review Board (IRB) at the University of Minnesota to determine whether the study qualified as human research and was required to go through the IRB review process. The IRB determined that the study did not involve human subjects, and IRB review and approval was not required.

Every effort was made to ensure that the study posed no physical or psychological risk to participants. A clear explanation of the study and its procedures was furnished to all participants. Once individuals confirmed their participation, they received an information sheet (Appendix A) detailing the study's purpose, expectations, and right to withdraw at any study stage. Participants were informed that the interviews would be audio-recorded and notes would be taken during the interview process. Participants were assured of their responses' confidentiality, how the data would be used, and who had access to it. Interview data were stored on a password-protected computer. Pseudonyms

were used to protect the identity of participants.

Chapter Summary

The purpose of this chapter was to provide a structure of methodology for this study. I overviewed the study, research context, and questions in the first section. In the second section, I described the sequential mixed methods social network analysis approach, the development and validation process of the SNA-Evaluation framework, and the C.O.P.E. partnership survey instrument. Finally, in the last section, I discussed this study's limitations, trustworthiness, and ethical considerations. This study generated a practical conceptual framework that not only guides evaluators with the application of SNA to support their evaluations but also validates the usefulness of the SNA method to enhance program evaluation by tackling complex systems. Moreover, screening tools were developed to support evaluators' SNA applications. I will now discuss the findings of this study in the next chapter.

Chapter 4 Research Findings

The purpose of this study was to enhance the use of SNA in the field of evaluation by examining the existing SNA applications in evaluation practices and identifying ways evaluators can use SNA in program evaluations. The phenomenon was explored by addressing the following guiding questions: (1) In what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation of the social program? (2) How can the SNA methodology be applied to support the evaluation of social programs? and (3) How does the use of SNA methodology impact the evaluation of social programs?

The study results are presented in three sections to address each major research question. Section One focuses on current SNA applications in program evaluation by examining the selected SNA evaluation journal articles. A conceptual framework was developed after exploring ways of SNA application in the field of evaluation. Section Two presents the results of the qualitative network analysis of the archival documents collected from the C.O.P.E. program. Section Three presents the results of the mixed-method social network analysis of the survey and interviews.

Phase 1: Conceptualization Stage Results

Representing a framework that entails all the steps I mentioned in Table 3.2 seemed helpful. By reviewing almost all the literature on SNA application in program evaluation, this section developed a pervasive framework to help evaluators use the SNA method to support their work. The section has two parts:

1. First, I present the concepts that make up the conceptual framework. These concepts were derived from the comprehensive review of a purposive sample of

40 SNA-related evaluation studies.

2. Second, I present the integration phase of the development of the SNA-Evaluation framework.

Findings: Concepts of SNA Application in Evaluation

Through the conceptual analysis guided by the initial question, in what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation of the social program? I identified nine distinct concepts that make up the SNA-Evaluation framework. The three evaluation concepts represent various evaluation types, including needs assessment, process evaluation, and outcome evaluation. The six broad SNA concepts are (a) those related to the network structure, (b) those related to the relationship patterns within a network, (c) those related to resource distribution within the system, (d) those related to prominent actors within a network, (e) those related to network position, and (f) those related to partnership and collaboration network. The above concepts were developed to help illustrate how SNA is applied to support the evaluation of programs. For clarity, each concept is discussed separately.

Concept 1: Needs Assessment. This concept represents one type of evaluation implemented during the development of a new program or the modification of an existing program. Needs assessment is a "systematic approach to identifying social problems, determining their extent, and accurately defining the target population to be served and the nature of their service needs" (Rossi et al., 2010, p. 119). From a program evaluation perspective, needs assessment can help determine if there is a need for a program and prioritize needs within and across program areas (Chen, 2014; Rossi et al., 2010). Such an assessment is critical as it identifies gaps and needs for a new or existing program,

allows for modification to be made to the plan before full implementation begins, facilitates the selection of goals and target groups, and maximizes the likelihood that the program will succeed.

When conducting needs assessment, evaluators can apply SNA to (1) describe the network structure, (2) identify knowledge experts as perceived by the members of the program and assess expertise distribution within the network, (3) assess the pattern of relationships within the network, and (4) identify needs and gaps.

Concept 2: Process Evaluation. This concept represents the type of evaluation that can be conducted periodically during the operation of an existing program to determine (a) how well the program is working, (b) whether program activities have been implemented and resulted in specific outputs, or (c) whether the program is accessible to its target population (Scheirer, 1994; Rossi et al., 2010). Fitzpatrick et al. (2004) define process evaluation as a systematic process to assess the extent to which the program operates as intended, what is working, what is not working, and what could be improved. In Chen's (2014) words, process evaluation can provide information to help stakeholders develop a remedial strategy, verifies how a program is being implemented and provides information on the quality of program implementation and areas that need improvement (pp. 176-177).

Literature suggests that evaluators can use SNA in a process evaluation in at least three ways: (1) studying the pattern of relationships and responsibilities in the network, (2) identifying critical network stakeholders, and (3) enhancing partnerships and collaboration.

Concept 3: Outcome Evaluation. This concept represents the type of evaluation

conducted after the program has been implemented and made contact with the target population (Frechling Wstat, 2002; Rossi et al., 2010). Outcome evaluation aims to (a) assess whether a program has a desirable effect on its stated goals or outcomes (Chen, 2014); (b) and gather information about program outcomes and the program-related processes, strategies, and activities that have led to them (Frechling Wstat, 2002).

The literature review found that SNA can be applied to assist in outcome evaluation to examine relationships between network structure and program outcomes and observe how network dynamics influence program effectiveness.

Concept 4: Network Position. This concept relates to the role an actor plays in the network and how it is linked directly and indirectly to other actors in the network. In SNA, the number of direct ties an actor has with others in the network—degree centrality—is one of the most basic ways to measure centrality (Table 4.1-a). However, depending on the nature of the ties and on the type of impact the actors seek, other centralities may be more relevant (Borgatti & Lopez-Kidwell, 2011; see Table 4.1 for an overview). For instance, in the types of networks (e.g., the flow of resources), it may be advantageous to be tied to actors with many connections as it guarantees access to more resources (Table 4.1-b).

In other circumstances, the advantages of being central may stand in an actor's control over the flow of assets and resources. In this case, a central and powerful actor bridges the connection between other actors that would be otherwise disconnected (Giuliani & Pietrobelli, 2011; Wasserman & Faust, 1994; see Table 4.1-c). A further classical distinction is made between the case in which an actor is positioned in a network where its alters densely connected (high closeness, see Table 4.1-d) and the case in which

an actor sits on a structural hole, with all or most of its alters being unconnected to each other (Table 4.1-e). These two types of network positions convey different advantages. For example, high closeness predicts the emergence of trustful relations (Coleman, 1988). Also, close ties allow knowledge to be exchanged in open networks and entail effective joint problem-solving arrangements (Giuliani & Pietrobelli, 2011; Uzzi, 1997).

Table 4.1

Examples of Network Positions, Beneficial Effects and Limits

SNA Concept	Brief Description	Advantages/ Benefits	Limits
(a) Degree centrality	Number of direct ties an actor has with others in the network	Easy access to information, knowledge, and any resource	Too many connections can be time-consuming and not always rewarding
(b) Bonacich centrality	Centrality of an actor is dependent on the centrality of its direct contacts (alters)	Power (if alters have low centrality); access to resources (if alters have high centrality)	Too many connections may overload the actor
(c) Betweenness centrality (also called structural holes)	Degree to which an actor can connect others that will be otherwise disconnected	Gatekeeping, influence, dependence, control	If there are only a few actors with high betweenness centrality, they may easily disrupt the network
(d) Closed ties	High local connectivity between an actor's alters	High trust, high-quality knowledge, joint problem-solving	Too much closure is detrimental and leads to lock-in
(e) Structural holes (see also betweenness centrality)	When an actor's alters are poorly connected	High level of knowledge diversity, high opportunities for creativity and innovations, efficiency and	Does not have the advantages of network closure

SNA Concept	Brief Description	Advantages/ Benefits	Limits
		control in ties	
(f) Brokerage	Itinerant Gatekeeper Representative Liaison	Identifying the degree to which an actor plays any of these roles is necessary. Actors connecting different communities have access to different resources and can exert control over the actors they are connecting with. The advantages and limits of their roles depend very much on the nature of linkages and context.	

Note. Sources include: Carolan (2014); Knoke & Yang (2008); Giuliani & Pietrobelli (2011); Wasserman & Faust (1994).

Concept 5: Network Structure. The snapshot of the network's structure—the linkages and the pattern of relations among the network actors—can provide unique information about the structure of connections between network actors. In Newman's (2003) words, "real networks are nonrandom in some revealing ways that suggest both possible mechanisms that could be guiding network formation, and possible ways in which we could exploit network structure to achieve certain aims" (p. 180). The non-random distribution of networks means that their structure is due to their actors' connectivity choices, which reflect the actors' strategies, purposeful and selective choices, and bounded rationality.

Given the nonrandom structure of networks, one of the major concerns of network analysis is to uncover the network structure through structural measures (see Table 4.2 for an overview) and sociograms. Another primary concern of social network analysis is identifying subgroups of actors—referred to as cohesive subgroups with relatively strong, direct, frequent ties—that display higher connectivity than the rest of the actors in the network (Giuliani & Pietrobelli, 2011; Wasserman & Faust, 1994). Further, the

characteristics of different subgroups are associated with different benefits and disadvantages for network members.

Table 4.2

Examples of Network Structure, Advantages and Limits

SNA Concept	Brief Description	Advantages/ Benefits	Limits
(a) A single cohesive set (clique)	A dense network where (almost) all actors are connected	High level of trust, cooperation, and support	Redundant linkages, risk of "getting trapped in their own net"
(b) Small worlds	Non-overlapping cliques (high local closeness), connected by a few ties with distant actors	Efficient structure, local dense ties (trust and cooperation), and distant ties (competitive advantage)	Success is dependent on actors with local and distant ties
(c) Core-periphery	A core of densely connected actors and a periphery with a few connections to the core	Core actors, as well as actors connecting the core to the periphery, may have advantages	Peripheral actors may suffer exclusion, uneven network structure

Note. Sources include: Carolan (2014); Knoke & Yang (2008); Giuliani & Pietrobelli (2011); Wasserman & Faust (1994).

Concept 6: Relationship Patterns. This concept relates to the relationships between actors within the network. In SNA, the relational identity and the relational information in the form of data create the network structure, which are the lines connecting the shapes that represent the people, organizations, and so on (Cross et al., 2009). Although various types of relationships are discussed in SNA, the relationships for this study concern community and knowledge relationships and include collaborative efforts over a specific time in a specified manner.

Further, in SNA, this concept is rooted in tie strength, which can be measured in multiple ways, including closeness, frequency of interaction, duration of the relationship, and overlapping social support (Cross et al., 2009). In relational evaluation, Durland (2005) suggests that the measure is "the existence of or the degree of a specific relationship between two members of the network, and generally the direction of the relationship can be in either or both directions, from each member to the other" (p. 28).

Network analysis can discover if there are relationships between network members and the strength (or the value) of those relationships by providing qualitative and quantitative assessments of the network relationships. The qualitative findings of network relationships can be used to describe the types of relationships in the network. In contrast, the extent to which individuals interact with other network members can be quantified and compared for evaluation purposes (Carolan, 2014).

Concept 7: Resource Distribution. This concept relates to allocating and distributing available resources within the network to ensure an effective response to building a more effortless and broader information and resource-sharing system between different organizations. In SNA, this concept is rooted in (a) network positions such as centrality, brokerage, and structural holes; and (b) network structure measures such as transitivity. To effectively achieve such a level of resource sharing, leaders must foster an interchangeable predisposition that allows their team members to be open to and become an actual "shareable resource." Such collaborative resource sharing will optimize the use of the resource pool, making it more straightforward to respond to changes in resource allocation across the entire organization (Lan et al., 2010).

Concept 8: Partnership. This concept relates to the partnership between two or

more partners who "work toward common goals by sharing responsibilities, authority, and accountability for achieving results" (Chrislip & Larson, 1994). In program evaluation, partnerships can take on numerous roles and are often integral to addressing social issues. The complexity of partnerships can range from simply sharing resources, to fostering community mobilization among partner organizations in an area, to becoming an organizational infrastructure (Gregson et al., 2011).

In SNA, this concept is rooted in tie strength, identified as a predictor of network functioning and information exchange. Social network analysis can provide information about the structure of relationships between partner organizations and thus be used to examine complex connections within and across partner organizations (Cross et al., 2009; Gregson et al., 2011; Provan et al., 2005). It also has the unique capacity to demonstrate how the structure of interagency and intra-agency relationships relate to program effectiveness by computing statistical inference (Honeycut & Strong, 2012; Ken-Opurum et al., 2019; Laven et al., 2010).

Concept 9: Prominent Actors. This concept relates to the identification of members most involved in a network. In SNA, the concept of prominence is rooted in centrality—individuals or organizations are prominent because they hold strategic positions or have many ties or groups in the network (Carolan, 2014). Centrality describes the status, power, or control of an individual actor within the network, which can affect "the process through which resources traverse the network" (Carolan, 2014, p. 108). In general, higher centralization provides fewer actors with more power and control, and the location can either accelerate or prevent the spread of information or resources to other actors within the same network.

The Conceptual Framework

Each of the nine concepts collectively constitutes the SNA-Evaluation framework and represents distinctive aspects of the SNA application in program evaluation. Further, the framework includes specific attributes associated with each SNA concept and their applications in program evaluation (see Table 4.3).

Table 4.3

Overarching Characteristics of SNA Application in Evaluation Informed by the Literature

Concepts	Specific Attributes
Attributes related to network position	• Identifying needs and gaps (i.e., isolates, brokerage, linkages) (NA) • Determining if network position is associated with program outcomes (OE)
Attributes related to network structure	• Determining network presence (NA) • Describing network structure (NA, PE)
Attributes related to relationship patterns	• Assessing relationship pattern (NA) • Examining relationships within the network (PE) • Examining the relationship between networks and outcomes (OE)
Attributes related to resource distribution	• Measuring distribution and information exchange (PE)
Attributes related to partnership/collaboration	• Enhancing partnership and collaboration (PE)
Attributes related to prominent actors	• Identifying prominent individuals or groups (NA) • Identifying key opinion leaders (PE)

Note. SNA = Social network analysis; NA = Needs assessment; PE = process evaluation; OE = outcome evaluation.

I suggest that SNA-Evaluation Framework represents the evaluation types, network analysis purposes, and related attributes that an evaluator needs to know and consider while using SNA methodology. As shown in Figure 2.3, SNA can be a tool to assist in needs assessment to describe the network structure, assess relationship patterns among network members, identify prominent individuals or groups, and identify needs to facilitate strategic planning conversations. When conducting process evaluation, SNA may be valuable in at least five ways: (1) assessing the existing network structure, (2) examining the relationships among network members, (3) identifying key opinion leaders who act as change agents, (4) measuring the pattern of resource distribution and the degree of information exchange, and (5) enhancing partnership and collaboration to improve program implementation. Further, network analysis can be applied in outcome evaluation to examine relationships between networks and program outcomes and determine if network position is associated with program outcomes.

When applying the framework, I suggest the starting point is defining the type of evaluation, which can be theoretical or practical. Then, setting a specific purpose in the next step is beneficial. For example, is the evaluation intended to uncover the network structure of an existing partnership network? After that, the evaluator needs to specify the network boundary and then choose the method of gathering data (see Table 4.4). In the next step, the evaluator can define suitable network measures depending on the purpose. Finally, the evaluator can decide which method can help analyze the gathered data. Several methods mentioned in the literature are presented in Table 4.4. I believe evaluators can use this framework as a checklist in their evaluation with SNA methodology.

Table 4.4

SNA Application in Evaluation Framework

Evaluation Type	SNA Evaluation Purpose	Network Data Collection	Network Data Analysis
-Needs assessment -Process evaluation -Outcome evaluation	-Describe the network structure -Measure the relationships -Measure resource distribution or information exchange -Identify prominent actors -Assess network position -Enhance partnership and collaboration -Examine relationships between networks and program outcomes -Determine if network position is associated with outcomes	-Archives -Census -Observations -Interviews -Focus groups -Surveys	- Network analysis (i.e., descriptive analysis, clique analysis) -Thematic analysis - Statistical inference (i.e., t-test, regression analysis, longitudinal analysis)

Note. Sources include: Carolan (2014); Durland (2005); Knoke & Yang (2008); Scott (2017); Valente (2010).

In order to see whether the framework is pervasive enough, I decided to review some of the articles listed in Table 2.4. Following the steps listed in table 4.4, a summary result of the sample articles is represented in Table 4.5. The results of analyzing six articles (randomly selected from Table 2.4) that were accepted and published since 2005. I set the year 2005 as the benchmark due to the increased use of SNA program evaluation starting that year.

As mentioned before, the application of SNA to program evaluation has steadily

increased over the past ten to fifteen years. By carefully analyzing the sample articles, I have found that the framework presented in Table 4.4 and Figure 2.3 is pervasive as these evaluation articles passed the steps I considered necessary to use the SNA as the research methodology.

Table 4.5

SNA Application in Evaluation Framework

Articles	Evaluation Type	SNA Evaluation Purpose	Network Data Collection	Network Data Analysis
Using Social Network Analysis to Predict Early Collaboration Within Health Advocacy Coalitions (Honeycutt & Strong, 2012)	Outcome evaluation	Examine relationships between networks and program outcomes	Surveys	Network analysis Statistical inference
Using Mixed-Method Design and Network Analysis to Measure Development of Interagency Collaboration (Cross et al., 2009)	Process evaluation	Measure relationships	Focus groups	Network analysis
Network analysis as a method of evaluating enterprise networks in regional development projects (Lahdelma & Laakso, 2016)	Outcome evaluation	Determine if network position is associated with outcomes	Surveys	Network analysis Statistical inference
A mixed-methods evaluation using effectiveness perception surveys, social network analysis, and county-level health statistics (Ken-Opurum et al., 2019)	Outcome evaluation	Examine relationships between network structure and program outcomes	Survey	Network analysis Statistical inference
Identifying Emerging Research Collaborations and Networks: Method Development (Dozier et al., 2013)	Needs assessment	Describe network structure Measure the relationships	Survey	Network analysis
Application of Network Analysis in Evaluating Knowledge Capacity (Birk, 2005)	Needs assessment	Identify prominent actors	Emails Interviews Surveys	Network analysis

Phase 2 Qualitative Network Analysis and Findings

This section presents the qualitative results of the network data retrieved from the C.O.P.E. archival documents. As shown in Table 3.3, the overarching research question (RQ) in Phase 2 is, How can the SNA methodology be applied to support the evaluation of the C.O.P.E. program? Applying the overarching question to the C.O.P.E. program context, two sub-questions were explicitly designed to identify potential network actors and ties embedded in the program.

- Who are the community partners in the network?
- What existing relational ties among the C.O.P.E. partner organizations may play a role in the opioid prevention effort?

Phase 2 Results

Network actors refer to partner organizations. In total, 51 unique partner organizations were retrieved from archival documents.

Network ties refer to the relations that connect these partner organizations. 11 relational ties were identified based on archival documents and grouped into five levels of community linkage.

C.O.P.E. Network Actors

After analyzing archival documents, 51 network actors (or partner organizations) were identified. The main actors consisted of the coalition or task force, community-based organization, drug/treatment/sobriety court, government department/agency, health care sector, legal/criminal justice, media/radio, philanthropy, public health and human service, recovery services, tribal organization, and university or college. These actors' identification labels were signified by using their abbreviation IDs. A summary of the

various types of organizations and sectors is presented in Table 4.6, and the complete list is attached to Appendix E.

Table 4.6

Summary of Organizations and Sectors Involved In the C.O.P.E. Program

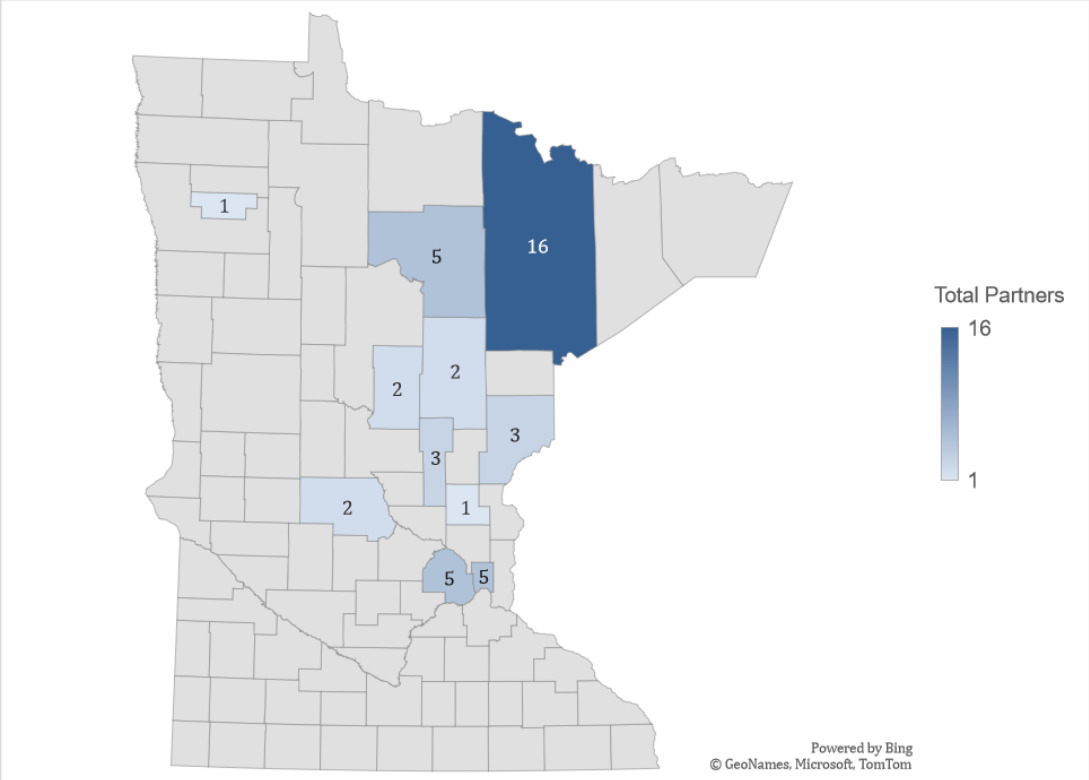
Network Actors	Organization Type	Count	Percentage
CAPE, RAAN	Coalition or Task Force	2	4%
FW, HRS, LCVL, MEND, MR, NESC, NLY, YY	Community-based Organization	8	16%
JDTC, CADT	Drug/Treatment/Sobriety Courts	2	4%
MDE, MDH, VA	Government Department/Agency	3	6%
4WS, EH, LBH, MEDS, NACC, RMHC, SH	Health Care	7	14%
ACC, ICP	Legal/Criminal Justice	2	4%
BFRS	Media/Radio	1	2%
SMN	Philanthropy	1	2%
ACPH, BFHHS, ICPB, PCHHS, SLPHHS	Public Health/Human Services	5	10%
ARC, ERS, MATC, PIR, RAD, TFRR, WRC	Recovery Services	7	14%
BFBC, MLBHHS, MLBO, MLBUO	Tribal Organization	4	8%
CLC, ECMECC, KSUCEP, MBTCL, PRCE, RLNC, UCP, UFD, UNRE	University/College	9	18%

Note. See Appendix G for a complete list of the network actors.

Additionally, the network actors (partner organizations) were distributed across four U.S. States, including KY, MN, NV, and WI. Most network actors (n=48) are located in MN across 12 counties, and the geographical distribution of these network actors is presented in Figure 4.1. Using the geographical boundary defined by the C.O.P.E. program, the number of partner organizations varies across different counties. This information is helpful in assessing local needs and assets toward achieving the program goals.

Figure 4.1

Geographical Distribution of MN Partner Organizations



Note. The geographical distribution of C.O.P.E. partner organizations in MN and the number indicates the number of partner organizations in that county. For example, St. Louis county has the most partner organizations (n=16).

C.O.P.E. Network Ties

Network ties connect partner organizations, and the range of ties connecting any two partner organizations can be distinct. The analysis of archival documents retrieved some common ties that could be used to denote connections among partner organizations involved in the C.O.P.E. program. Each of the ties is identified and defined:

- Advocacy/policy: the collaboration aims to advocate and/or change policy, laws, and or regulations that may impact the C.O.P.E. program and its opioid prevention effort in MN rural communities;
- Communication: the collaboration establishes a process for communication between meetings to build a shared understanding of the organizations, program, and community;
- Client referral systems: the collaboration aims to provide a functional referral system for clients on their recovery journey;
- Coming to agreements of best practices: the collaboration aims to develop agreements of best practices that can help improve the program implementation and benefit other similar prevention programs;
- Developing tools: the collaboration aims to develop practical tools that partner organizations can commonly adopt;
- Funding activities/resources development: the collaboration aims to secure funding resources through various activities;
- Learning from each other: the collaborative aims to provide a learning platform that allows partner organizations to share knowledge, information, and resources;
- Educational programs/training: the collaboration aims to develop and deliver

educational programs or training that can benefit professionals and communities;

- Technical assistance/consultation: the collaboration aims to provide technical assistance or consultation as requested by professionals or communities;
- Research/evaluation: the collaboration aims to conduct research or evaluation to measure goal achievement and provide evidence-based results that can inform policy-making;
- Service delivery: the collaboration aims to provide direct services to individuals on a recovery journey. Services refer to treatment, recovery, health care, housing, transportation, finance, wellness, and healing.

These common ties were grouped into four levels based on the Collaboration Framework published by the National Network for Collaboration (Hogue et al., 1995). The results are presented in Table 4.7, which supported the development of survey items 8 and 9 (see Table 4.7 and Appendix C).

Table 4.7

Summary of Network Ties and Affiliated Levels

Network Ties	Collaborative level	Purpose	Structure
-Communication	Awareness: Involves awareness of an organization's services, mission, etc.	-Communicate for a common understanding -Create a base for support	-Nonhierarchical -Loose/flexible link -Roles loosely defined
-Learning from each other -Technical assistance/ consultation -Educational programs/training	Cooperative: Involves exchanging information, attending meetings, and sharing resources	-Match needs and provide information -Limit duplication of services -Ensure tasks are done	-Central actor as communication of hub -Semiformal links -Roles somewhat defined -Links are advisory

Network Ties	Collaborative level	Purpose	Structure
-Client referral systems -Developing tools -Service delivery -Funding activities/ resource development	Coordinated: Involves synchronization of activities for mutual benefit	-Coordinate and share resources to address common issues -Merge resource base to create something new	-Central body of partners consists of decision-makers -Formalized links -Defined roles -Group develops new resources and joint budget
-Research/ evaluation -Coming to agreements on best practices -Advocacy/policy	Integrated: Involves a formal or binding relationship involving contracts, grants, etc.	-Accomplish shared vision and impact benchmarks -Build an interdependent system to address issues and opportunities	-Consensus used in shared decision making -Roles, times, and evaluation formalized -Links are formal and written in work agreements

Notes. Adopted from "Evaluating your collaborative effort'' by Lynne Borden and Daniel Perkins, 1998, Program Evaluation Newsletter, 1:5. Center for the Study and Prevention of Violence.

Phase 3 Network Analysis and Findings

This section addresses Research Question 3 (RQ3): "How does the use of SNA methodology impact the evaluation of the C.O.P.E. program?" by asking the following sub-questions.

1. How can the SNA methodology be applied to assess the partnership network of the C.O.P.E. program to further strategic planning?
2. How do stakeholders perceive the value of SNA methodology in supporting the evaluation of the C.O.P.E. program?

The results of this section are presented in two sections. Section one includes the network findings from the survey: program-level network findings and attitude toward

partnership success. Section two describes the findings from stakeholder interviews.

Program Level Network Findings

The reliability of the network data is problematic due to the relatively low response rate of the network survey. Though I had simulated the network positions of non-respondents according to the answers of those who participated in the survey, complicated measurements of network indicators can be misleading under the conditions of incomplete network data. Intuitively, centralization measures would be particularly sensitive to missing data because they reflect not only actors' direct relations but also the broader structure of the network and are thus potentially affected by any error in the network data. Hence, these graphical representations of the network were not drawn to scale but were adjusted for the program network's readability and comprehensibility. Also, this network sociogram is a sketch of the leading partners involved in the project and offers a sense of the size, range, and importance of the actors involved in the project.

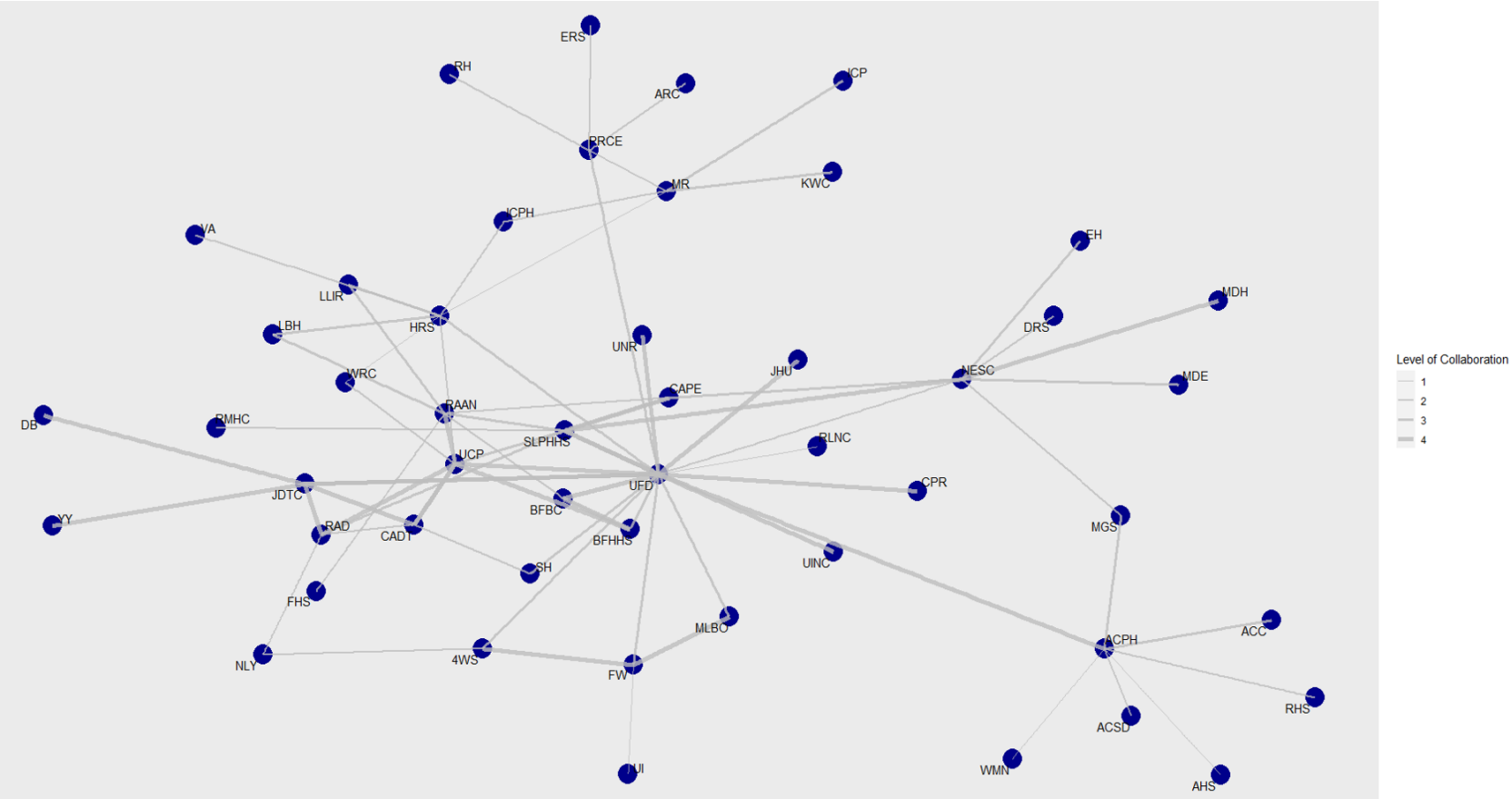
In the figure depicting the overall structure of the project network (see Figure 4.2), these actors' identification labels were signed with organization names, which were deidentified to ensure anonymity. The thickness of the lines reflects the strength of the connections, which was determined by the level of collaboration. Overall, the network displays a core-periphery structure, with a core group of organizations with many connections at the center of the network and other groups of organizations with fewer connections on the network's periphery. Both groups play important roles in networks: those at the core are strategically positioned to share information, resources, and best practices, while those at the periphery often serve as bridges to other organizations operating outside the network.

For example, the network diagram makes it clear that the program involved a closely knit network with a core group of four actors (UFD, UCP, SLPHHS, RAAN) located in the center of the network. These actors occupy a central role in the network as they are involved in most relationships with other actors and are in liaison positions between other pairs of actors. Location in the network is also explained by organization type. Organizations in universities, public health and human services, and local coalition or task force are more likely to be at the center of the network than other organizations.

As displayed in Figure 4.2, a few actors—such as ACPH, NESC, and PRCE—at the periphery serve as bridges to other organizations. These actors are gatekeepers or liaisons in the network to connect to different subgroups and have access to different resources. However, they can also exert control over the actors they are connecting with. For example, suppose ACPH has no connections to other organizations in the network. In that case, the organizations that only collaborate with ACPH may lose the opportunity to receive new resources and technical assistance from other organizations. The advantages and limits of any of these roles depend very much on the nature of linkages and context.

Figure 4.2

Location of Partner Organizations in the Program Network



Note. Nodes are identified by organization name (see Appendix G for an overview). Edges are identified by collaborative activities; width is assigned to each edge based on the level of collaboration: 1 = Awareness; 2 = Cooperative; 3 = Coordinated; 4 = Integrated.

Network Structure. Five number summaries are provided in Table 4.8 to describe how large the network is, how densely connected it is, whether the network is made up of one or more distinct groups, how compact it is, and how clustered are the network members. Overall, the network is composed of 50 organizations across 10 MN counties; these organizations reported having 77 ties with one another (using the four collaboration levels).

To answer the question of whether there were collaborative relationships within the network, I examined the number of collaborative relationships. A network's *density* is the number of existing relationships or ties between pairs of partner organizations in the network as a proportion of all possible ties (i.e., if every partner organization had a direct collaborative relationship with every other partner organization) (Hanneman & Riddle, 2014). It refers to network cohesiveness, and the examination of *density* scores across different types of collaboration can demonstrate how organizations collaborate most and least.

On average, the partnership network had 0.063 connections, which is a significantly low figure compared to the number of possible connections within the network. Consistent with the information presented in Figure 4.2 and Table 4.9, the number of inter-organization connections showed significant variation. The majority of organizations only had one connection to another organization involved in the project, while few organizations had many connections in the network. The program network *density* scores indicate a relatively lower degree of cohesiveness, which may limit social capital and the potential for success in partnership networks in community networks (Lee et al., 2012).

Considering the network's *diameter*, the longest path between two actors is 5, suggesting that it can be difficult for some organizations to receive timely resources. Also, the network *transitivity* is relatively small, with a score of 0.12 (see Table 4.8), which is consistent with the network diagram. When the network is relatively sparse and has numerous null ties, resources can have difficulty flowing from one part of the network to another part of the network. These two scores indicate that the partnership has not necessarily resulted in an effective resource exchange among the partner organizations (see Table 4.10).

Table 4.8

Program Level Network Structural Measures

SNA Metrics	Size	Diameter*	Density*	Modularity*	Transitivity*
Score	50	5	0.063	0.455	0.12

Note. *Diameter is the longest path between two actors and measures network efficiency or compactness. A larger diameter indicates that the network is not very compact.

*Density measures the number of ties in the network and ranges from 1 to 0. 0 indicates no collaboration across organizations and 1 represents full collaboration across organizations. The density of the C.O.P.E. partnership network is 0.063.

*Modularity measures the network actors' tendency to group together and ranges from -1 to 1. The modularity value near 1 indicates the good quality of partitions, while a value near -1 indicates the bad quality. The modularity of the C.O.P.E. partnership network is 0.455.

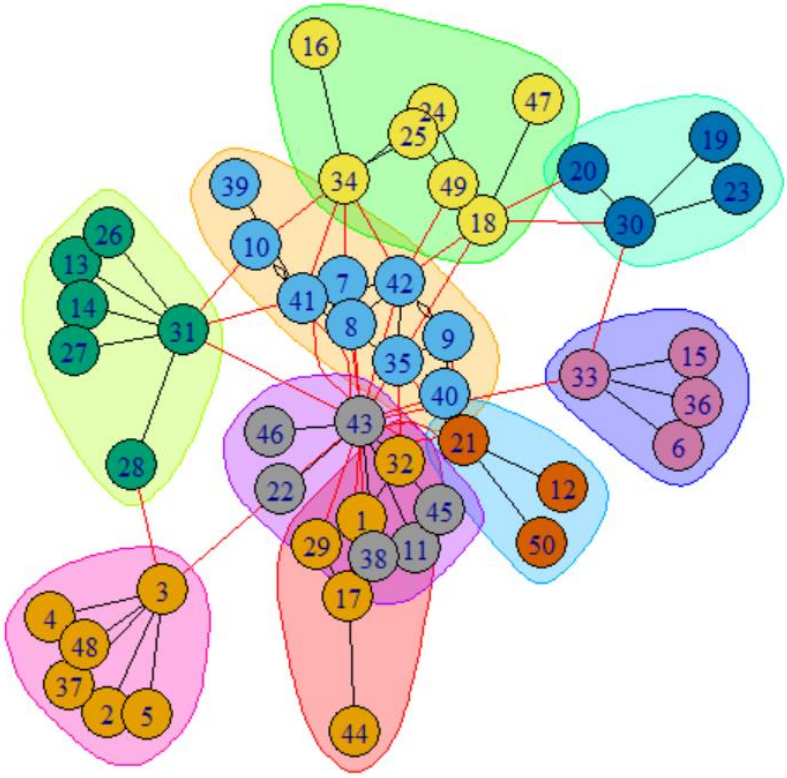
*Transitivity is the portion of closed triangles to the total number of open and closed triangles, ranging from 0 to 1. The closer to 1 the transitivity, the more stable is the network. The transitivity of the C.O.P.E. partnership network is 0.12.

To further understand the network structure, community detection was conducted. In social networks, community refers to "a sub-graph for which the nodes are cohesive, densely connected internally than the rest of the network and sparsely connected with others" (Mohamed et al., 2019, p. 297). *Modularity* is a quality metric for measuring the strength of the division of a network into communities (Fortunato et al., 2016), which is often used in optimization methods for detecting community structure in networks (Newman, 2006). Networks with high modularity have a dense connection between nodes within communities but sparse connections between nodes in different communities. Overall, the network has a *modularity* score of 0.455, suggesting the program network has relatively dense connections between the partner organizations within the same communities but sparse connections between partner organizations in different communities.

The nine different groups were also identified and represented in Figure 4.3. This information can help identify potential leaders in the network and explore the similarities around leaders to build sustainable systems. For example, actors 3 and 34 are structural holes in the network and serve as prominent actors for their subgroups. Without their connections, other actors from their subgroups could have no access to new resources or information. Another set of noticeable actors, such as 1, 11, 29, 32, 38, and 45, are insiders of multiple subgroups. In network analysis, these actors are structural folds that participate in dense, cohesive relationships and have familiar access to diverse resources (Vedres & Stark, 2010).

Figure 4.3

Community Detection on Program Network



Note. The program network includes nine subgroups. Sets of actors (shaded in different colors) in each subgroup are connected to others, with only a smaller number of connections between actors of different subgroups.

Organizational Prominence. To identify which organizations collaborate with others the most across organizations, *centrality* scores for all 50 organizations were computed to capture "the extent to which a focal factor occupies an important position of prestige and visibility" (Carolan, 2014, p. 155). Typically, centrality is used to quantify an actor's prominence or importance by computing *in-degree*, *out-degree*, *closeness*, and *betweenness centrality*.

The four centrality measures were computed and presented in Table 4.9. A subset of organizations was highly connected and consistently played a more central role in the network, as they have both relatively higher *in-degree* and *out-degree* scores. These organizations can control the most information or quickly connect with the broader network (Carolan, 2014, pp. 155-156; Hanneman & Riddle, 2014, p. 365).

As shown in Table 4.9 and Figure 4.4, it is apparent that UFD is the most prominent actor as it has the highest *centrality* scores, suggesting that UFD can provide a source of expertise, observe the information exchange or resource flow, and quickly interact with others in the network. However, it is noteworthy that UFD has the highest *out-degree* score, indicating that it helps spark the flow of information across a network. In addition, UCP is another critical actor in the network as it has higher *degree centrality* with a score of 9, indicating that this organization mainly provides a source of expertise and develops new tools or resources toward achieving the program goals.

Aside from UFD and UCP, a few other organizations, such as HRS, NESC, SLPHHS, ACPH, RAAN, JDTC, CADT, RAD, MR, and PRCE are well-connected within the network. However, these organizations are different influencers due to the variation in *in-degree* and *out-degree* scores. For example, organizations RAD and HRS

have relatively higher *in-degree* scores than other organizations, indicating that these organizations are their local influencers who can provide a source of advice, expertise, or information (Carolan, 2014; Knoke & Yang, 2008). Organizations such as NESC and ACPH have relatively higher *out-degree* scores, and they can reach many network actors and spark the information flow across the network (Carolan, 2014; Knoke & Yang, 2008). For instance, if the program stakeholders have challenges spreading opioid training information or resources, particularly in hard-to-reach areas, the *out-degree* is a helpful indicator to identify local influencers who can spread the information within the network.

In this network, a few organizations have higher *betweenness* scores (see Table 4.9 and Figure 4.4-c). *Betweenness* measures the number of times an actor lies on the shortest path between other actors. This measure shows which actors are bridges in the network and can be important to locate the organizations influencing the flow within the system. Organization UFD has the highest *betweenness* score and can be in the position to observe or control the information exchange or resource flow in the network (Carolan, 2014; Knoke & Yang, 2008). Additionally, organizations such as UPC, ACPH, PRCE, HRS, JDTC, and SLPHHS are also in the position to control the information exchange and resource flow as they have relatively higher *betweenness* scores across the network.

Another pattern should be noted here. For example, both HRS and NESC have higher *degree* scores. However, it is interesting that NESC mainly supports the information flow system by sending information to other organizations in the network, which might be correlated with its closeness ($C_c = 0.427$) with other organizations. Other organizations such as SLPHHS, JDTC, PRCE, and MR have relatively higher *closeness*

scores. These organizations are best placed to quickly influence the entire network by directly interacting with others to share information or allocate resources(Carolan, 2014; see Table 4.9 and Figure 4.4-d).

Table 4.9

Centrality of the 50 Partner Organizations of the C.O.P.E. Program

Organization	Centrality			
	In-degree*	Out-degree*	Betweenness*	Closeness*
UFD	***6***	***14***	***0.098***	***0.483***
UCP	***2***	***7***	***0.026***	***0.388***
HRS	***4***	***4***	***0.014***	***0.082***
NESC	***0***	***8***	***0.000***	***0.427***
SLPHHS	***3***	***5***	***0.013***	***0.352***
ACPH	***1***	***6***	***0.025***	***0.122***
RAAN	***2***	***5***	***0.008***	***0.112***
JDTC	***1***	***5***	***0.014***	***0.345***
CADT	***2***	***2***	***0.004***	***0.274***
RAD	5	0	0.000	0
MR	***0***	***5***	***0.000***	***0.341***
PRCE	***1***	***4***	***0.014***	***0.357***
BFBC	3	1	0.000	0.020
FW	1	3	0.004	0.061
BFHHS	3	1	0.000	0.020
4WS	3	0	0.000	0.000
CAPE	3	0	0.000	0.000
MGS	2	0	0.000	0.000
SH	2	0	0.000	0.000
MLBO	2	0	0.000	0.000
ICPH	2	0	0.000	0.000
LBH	2	0	0.000	0.000

Organization	Centrality			
	In-degree*	Out-degree*	Betweenness*	Closeness*
LLIR	2	0	0.000	0.000
NLY	0	2	0.000	0.041
WRC	***0***	***2***	***0.000***	***0.284***
ACC	1	0	0.000	0.000
ACSD	1	0	0.000	0.000
AHS	1	0	0.000	0.000
RHS	1	0	0.000	0.000
WMN	1	0	0.000	0.000
UI	1	0	0.000	0.000
VA	1	0	0.000	0.000
DB	1	0	0.000	0.000
YY	1	0	0.000	0.000
ICP	1	0	0.000	0.000
KWC	1	0	0.000	0.000
DRS	1	0	0.000	0.000
EH	1	0	0.000	0.000
MDE	1	0	0.000	0.000
MDH	1	0	0.000	0.000
ARC	1	0	0.000	0.000
ERS	1	0	0.000	0.000
RH	1	0	0.000	0.000
FHS	1	0	0.000	0.000
RLNC	***0***	***1***	***0.000***	***0.296***
RMHC	1	0	0.000	0.000
CPR	1	0	0.000	0.000
JHU	1	0	0.000	0.000
UINC	1	0	0.000	0.000
UNR	1	0	0.000	0.000

Note. The results in the table were filtered by organizations' overall degree scores, ranging from highest to lowest. Organizations with relatively higher centrality scores are boldfaced and italicized.

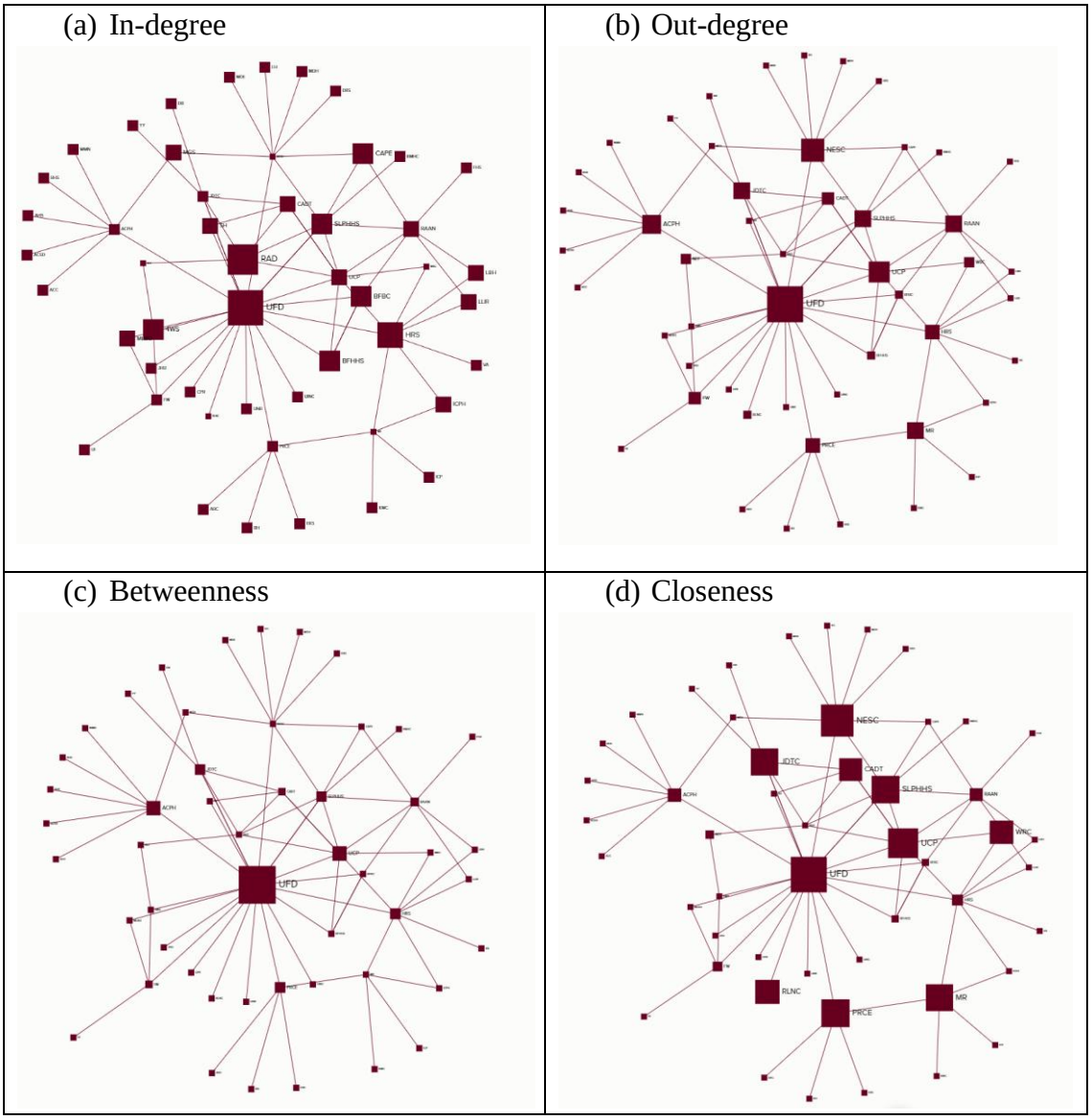
*Degree centrality assigns an importance score based on the number of ties held by each actor. In-degree measures the number of incoming connections for an element; out-degree measures the number of outgoing connections for an element.

*Betweenness centrality measures the extent that a node sits between pairs of other actors in the network. A high betweenness score indicates that an actor holds authority over disparate clusters in a network.

*Closeness centrality measures how close each actor is to every other actor in the network. A high closeness score indicates that an actor can quickly exchange something with others.

Figure 4.4

Centrality of the 50 Partner Organizations of the C.O.P.E. Program

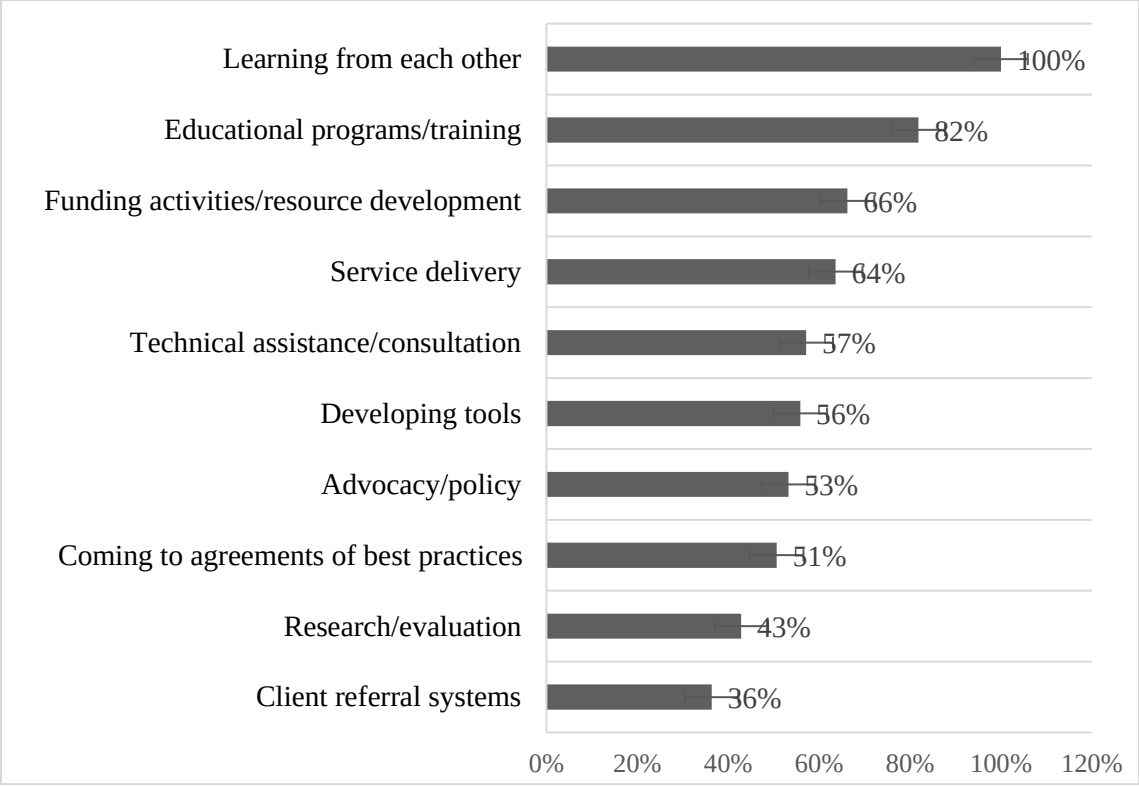


Note. Network graph for the C.O.P.E. program. Graph (a) is node size by in-degree scores, with larger size reflecting higher in-degree scores; Graph (b) is node size by out-degree scores, with larger size reflecting higher out-degree scores; Graph (c) is node size by betweenness scores, with larger size reflecting higher betweenness scores; Graph (d) is node size by closeness scores, with larger size reflecting higher closeness scores.

Relationship Activities. The relational questions are important to create network visualizations and populate the dyad data. In this study, two questions were asked to assess the relational activities that participating organizations had with their partner organizations. The most common inter-organizational activities are learning from each other and providing educational programs or training. The least common activities are referring clients and providing research or evaluation support (see Figure 4.5).

Figure 4.5

Relationship Activities



Note. Survey question is, what activities does your relationship with this organization include? (Select all that apply; n = 468 relational activities reported for this question).

Intensity of Relationships. Quality of relationships helps describe the network, and this information can help build network strategies as partners may vary in their willingness to engage and get involved in the network. Network relationships were assessed according to their level of intensity and diversity of relationships. It is important because only greater intensity of connections does not necessarily result in a thriving and sustainable network. For example, the network needs to leverage its collaborative advantage if most relationships are at the awareness level. The network requires more resources to maintain its functionality if most relationships are at the integrated level.

Figure 4.6 indicates a positive result that connections are somewhat distributed across the levels. 34% of the network relationships are at the integrated level, and the shares of relationships at the coordinated and cooperative levels are equally distributed. It is consistent with the length of program involvement, as most participating organizations (n = 87%) have supported the C.O.P.E. program for more than six months (see Table 3.11).

Understanding the quality and strength of network relationships is critical so that the information flow is not vulnerable to interruption within the network. With the network's goals and the data presented in Figure 4.5 and Figure 4.6, partner organizations can define evidence-based actions and manage the network relationships by asking the following questions.

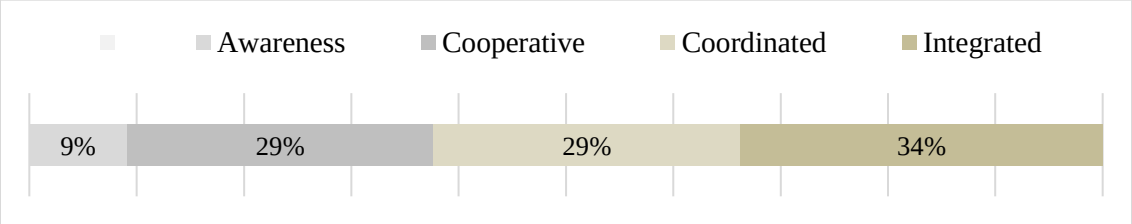
- Are these the appropriate relationships for supporting the C.O.P.E. prevention work in local communities?
- Are there any indications that a particular type of working relationship (awareness, cooperation, coordination, integration) is most advantageous to

meeting network goals?

- Should loosely connected partner organizations be brought into the network? What can the network do to increase specific connections around this work?
- How can these relationships be leveraged to achieve more considerable network outcomes? Or what level of engagement is needed from partner organizations for the network to reach its goals moving forward?

Figure 4.6

Relationship Strength



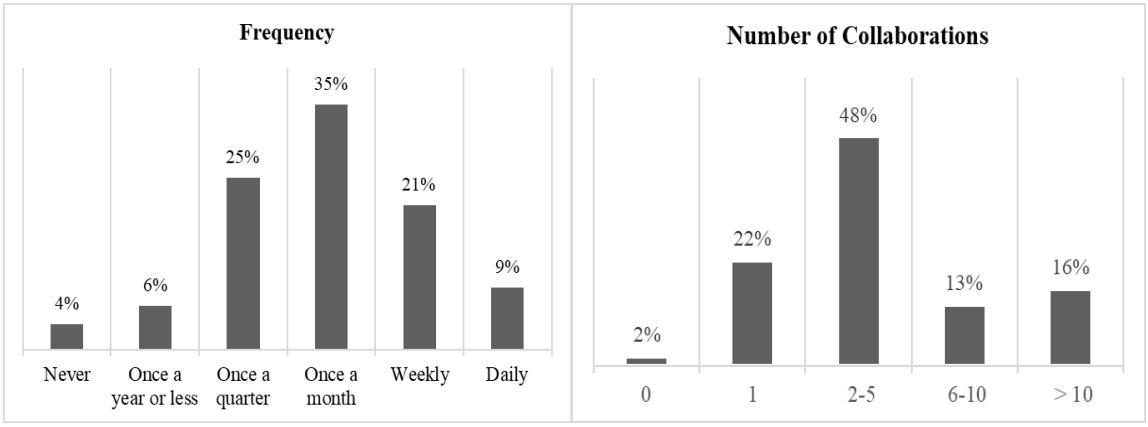
Note. Awareness involves understanding an organization's services and mission; cooperative partnership involves exchanging information, attending meetings, and sharing resources; coordinated partnership involves synchronizing activities for mutual benefits; integrated partnership involves a formal or binding relationship that may involve contracts and grants.

Frequency Occurring in Relationships. Participating organizations reported various frequency scores of collaborations in the partnership network. Depending on the type of collaboration, the variation in the frequency and number of collaborations may have the potential to impact the partnership's success and program outcomes. As shown in Figure 4.7, about 65% of participating organizations have a higher frequency with their partner organizations, which may result in more collaborations to help achieve the program goals. This information can help define the strength of links in the network

maps.

Figure 4.7

Frequency Occurring in Partnership



Note. Frequency of collaborations is measured by asking, "Approximately how frequently do you work with the partner organization?" Responses range from the lowest frequency (Never) to the highest (Daily).

Collaboration is assessed by asking, "Approximately how many collaborations do you have with the partner organizations?" Responses range from the lowest collaborations (0) to the highest (More than 10).

Attitude Toward Partnership

Although community partnerships have been touted as a promising strategy for the C.O.P.E. program, there is limited evidence of their effectiveness in achieving stated goals and bountiful evidence of the challenges of developing and maintaining them. To help improve the partnership's effectiveness, four indicators—including value, trust, partnership success, and challenges—were measured to understand the perceptions that partner organizations hold of one another and the perceptions of the network itself.

Partner organizations' power or ability can influence partnership functionality.

Their potential to influence may be derived from their positional or resource power in the network, or their actual influence may be derived from their credibility as critical leaders (Gallivan & Depledge, 2003). Their attitude to the program was measured by how much they would back (support) or block (resist) the program goals.

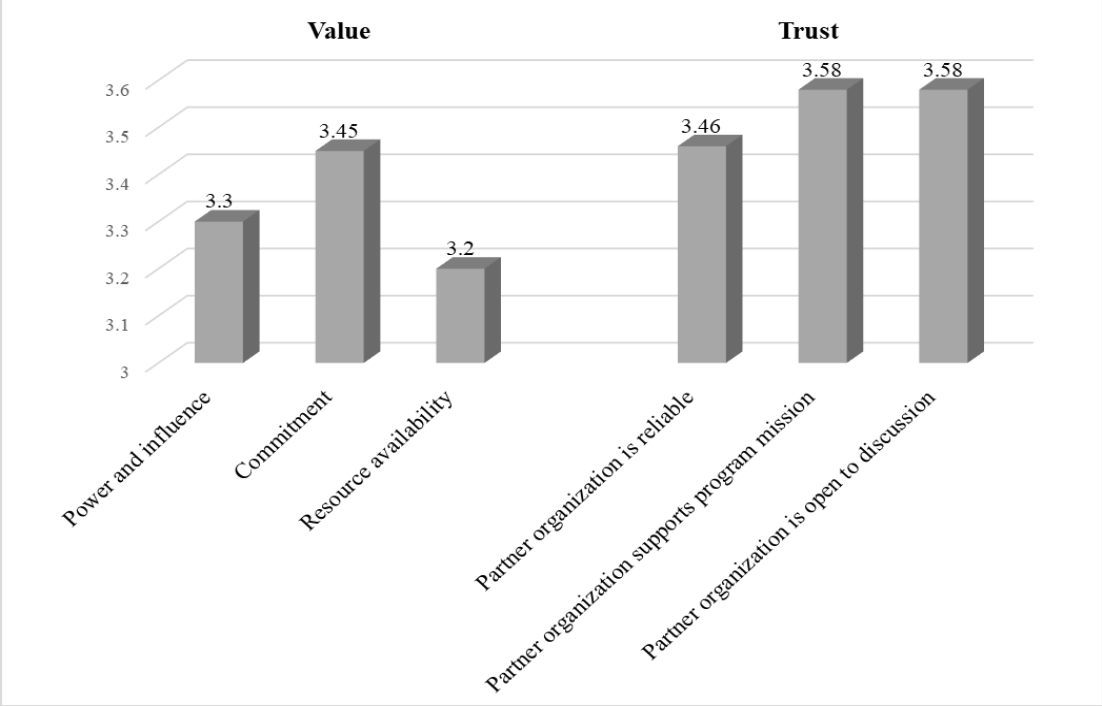
Value and Trust. The level of value and trust that partners perceive to exist in network relationships is important in building and maintaining collaborative capacity. As network members do not supply value in the same way, perceptions of value are critical for building a network or creating new ways to leverage existing partnerships. Measuring trust is fundamental for partnership building, including establishing mutual respect and trust, developing clear and open communication, and working toward a shared mission and goals (Varda & Sprong, 2020). Moreover, trust in inter-organizational network relationships facilitates effective information exchange and decision-making and reduces duplication of effort among partner organizations that may have previously competed.

The following figure (Figure 4.8) shows all members' averaged perceptions of relational partners along six dimensions of value and trust. Participating organizations reported strong levels of value and trust for their relational partners. In particular, respondents perceived their partners to be open to discussion and supportive of a joint mission of addressing opioid issues in MN rural areas. These are strengths of the network to recognize and build upon. Across all six dimensions of value and trust, resource availability received the lowest average score, although it was not much lower than other dimensions. Given the results presented in Figure 4.8, network members can (a) leverage ways members bring value to the network, (b) focus on building trust among members, and (c) focus on increasing the perception of value among members, especially in the

areas of resource availability. More specifically, network members may wish to consider if other influential organizations in the community should be included in the network to support resource sharing and distribution.

Figure 4.8

Average Perceptions of Value and Trust



Note. Value is measured by power and influence, commitment, and resource availability. Trust is measured by organizational reliability, mission support, and open to discussion, with scores ranging from 1 = not at all to 4 = a great deal. Scores above 3 are considered good.

Partnership Success. Evaluating partnership success perceived by the network members is critical as it can help develop strategies to structure the network to meet the needs of communities. Participating partner organizations rated the degree of success with respect to three levels: overall partnership success, system changes, and community success. Overall partnership success was reported with an average score of 4, indicating

that most partner organizations believed participation in the partnership has been beneficial to their work.

Network relationships that have resulted in some system changes are presented in Table 4.10. Participating organizations were asked to rate seven elements to assess the system changes. Overall, participating organizations reported that they expected the system changes to occur (with an average score of 1.78). Relationships leading to increased acquisition of additional funding were most common, while relationships leading to the development of new, valuable relationships were least common.

Participating organizations also rated the degree of success with which area community is currently addressing opioid issues across five specific objectives. On average, participating organizations reported that the C.O.P.E. partnership has successfully supported their community's ability to achieve program goals, with a score of 3.29. Participating organizations reported that the objectives of "increasing community awareness of opioid use disorders" and "improving the linkage of community partners to support services" were most successfully addressed. They rated "increasing identification of community members experiencing opioid use disorders" as the least successful effort.

Using the data presented in Table 4.10, partner organizations can work collaboratively to assess the degree to which the network meets its intended goals. Partner organizations can define strategies by asking: (a) which goals are the network most likely to achieve successfully? (b) Has the network successfully met the needs of communities? and (c) Do these reported outcomes align with current network strategies? If not, what strategies can the network implement to contribute to more successful outcomes, particularly for the unmet system goals?

Table 4.10

Descriptive Statistics of Partnership Success

Score	N	M	SD	Min	Max	Skew	Kurtosis
Partnership Success[a]	26	4	0.078	3	5	0	4.55
Partnership Resulting in System Change [b] (M =1.78)							
Increased acquisition of new knowledge or skills	76	1.40	0.075	1	3	1.42	0.75
Increased acquisition of additional funding	***76***	***2.17***	***0.100***	***1***	***3***	***-0.34***	***-1.63***
Improved my organization's capacity	***76***	***1.82***	***0.100***	***1***	***3***	***0.37***	***-1.63***
Led to an exchange of resources	76	1.34	0.071	1	3	1.70	1.74
Led to improved services for my clients	76	1.67	0.087	1	3	0.64	-0.99
Led to enhanced ability to serve the community	76	1.29	0.061	1	3	1.68	2.04
Led to development of new, valuable relationships	76	1.19	0.055	1	3	2.63	6.35
Led to new program development	76	1.61	0.084	1	3	0.78	-0.75
Community Success[c] (M = 3.29)							
Increasing community awareness of opioid use disorders	***25***	***3.48***	***0.164***	***2***	***5***	***-0.17***	***-0.33***
Increasing identification of community members experiencing opioid use disorders	25	3.12	0.176	1	5	-0.25	0.42
Improving the linkage of community partners to support services	***25***	***3.46***	***0.162***	***2***	***5***	***-0.24***	***-0.15***

Score	N	M	SD	Min	Max	Skew	Kurtosis
Increasing evidence-based intervention in opioid crisis prevention	25	3.2	0.238	1	5	-0.42	-0.45
Identifying barriers and discrepancies between systems-level and personal networks of care and recovery	25	3.2	0.216	1	5	-0.22	0.01

Note. [a]Assess the overall partnership success by asking, "To what extent has your participation in the partnership been helpful in your or your organization's work related to Opioid Use Disorder (OUD) or Substance Use Disorder (SUD)?." The scale range from 1 = don't know to 5 = very helpful.

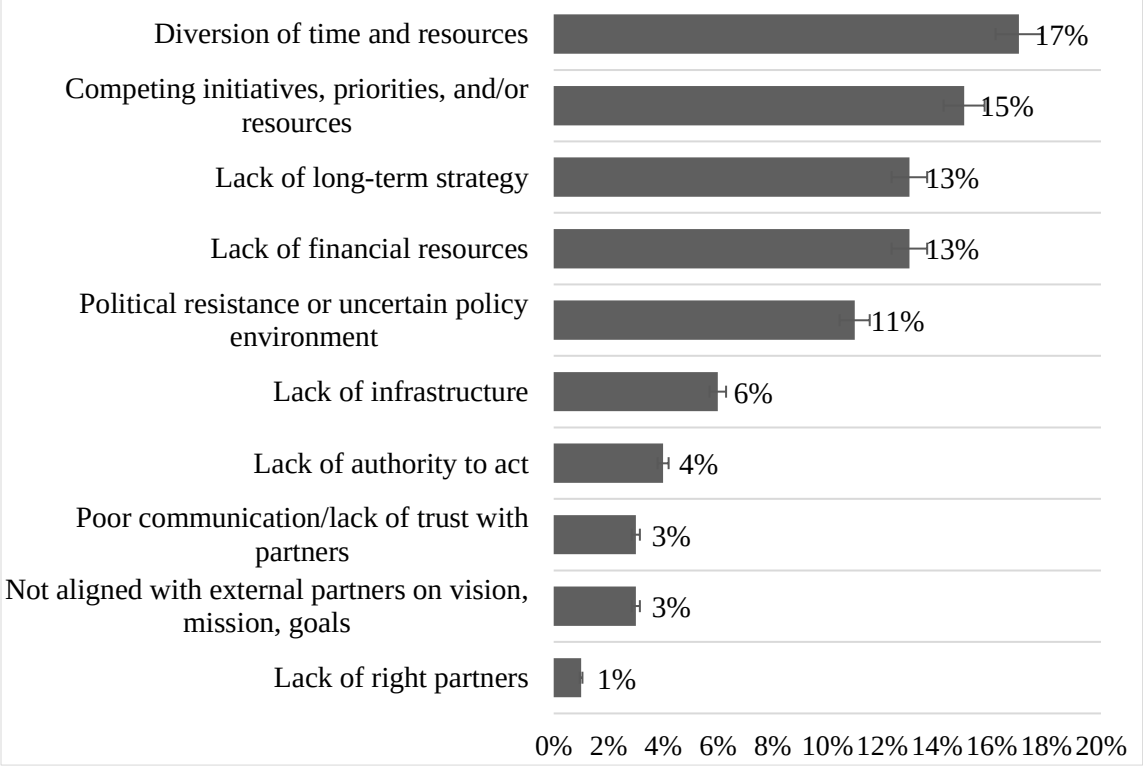
[b]Assess the system changes as a result of the partnership with a scale ranging from 1 = do not expect to occur to 3 = already occurred. The average score of system change score is 1.78. Items above the average score are boldfaced and italicized.

[C]Assess the community success as a result of the partnership with a scale ranging from 1 = not successful at all to 5 = completely successful. The average score for community success is 3.29. Items above the average score are boldfaced and italicized.

Challenges. Identifying the collaboration's challenges assists the collaboration in developing strategies to address these issues, thus allowing the group to move forward and accomplish its goals. As shown in Figure 4.9, participating organizations identified "diversion of time and resources" and "competing initiatives, priorities and/or resources" as top challenges to partnering with other organizations to support the program. Few respondents perceived the "lack of the right partners," "not aligned with external partners on vision, mission, goals," and "poor communication/lack of trust with partners" as challenges to fulfilling this mission.

Figure 4.9

Partnership Challenges



Note. The survey question is, what are the challenges of partnering with other organizations within the C.O.P.E. project? (Select all that apply; n = 30 partner responses).

Interview Results

To explore the sub-question: "How do stakeholders perceive the value of SNA methodology in supporting the evaluation of the C.O.P.E. program?" During Phase 3 of this study, data were collected through one-on-one interviews with 8 critical C.O.P.E. program personnel, including program leaders, public health and human services representatives, program educators, and program evaluators. Members were asked questions about their perceptions of network results' usefulness and the SNA method's value in supporting the program's future evaluations. The main themes and subthemes that emerged from the interviews are presented in Table 4.11. The sub-themes, descriptions, and sample excerpts within the theme of the use of SNA results and the value SNA method are presented in Table 4.12 and Table 4.13, respectively.

Table 4.11

Stakeholder's Attitudes Toward SNA Use in Program Evaluation

Domain	Theme	Sub-themes
SNA result use	Uncovering partnership network	Visualizing partnership network Identifying partner organizations and their roles Revealing relationships among partner organizations
	Prioritizing planning actions	Identifying prominent actors Identifying missing actors Design and facilitate strategic networking
	Building a sustainable prevention system	Improving partnership capacity Maximizing partnership synergies

Domain	Theme	Sub-themes
SNA method value	Improving program evaluation	Responding to programs in complex environments Supporting the evaluation of partnerships Advocating funding policy

SNA Result Use: Uncovering Partnership Network. Stakeholders shared that the partner network is the infrastructure of the C.O.P.E. program to support opioid prevention work in MN rural communities. However, current evaluations have not assessed this piece to help stakeholders understand what the infrastructure is, who is part of it, what is working, and what is not working. With the network results presented, they could reflect on the infrastructure of the partnership network. Stakeholders indicated that the sociogram could visualize the network partners. The network results are valuable for them to identify partner organizations and their roles in the network and characterize the relationships between partner organizations. As one stakeholder noted,

> The network results allow us to reflect on whether we are working under the guidance of the recovery framework, and it will give us some energy to think about the relationships between community partners and to look at who is at the table and how we can bring others into the conversation. Maybe the folks who do not want to be part of the conversation would like to do their own thing.

Visualizing Partnership Network. Nearly all respondents shared that the sociogram generated through social network analysis provides a clear visualization of "*circles of influence*" within the program network. The results provided through social network analysis could be shared with other organizations through a formative feedback

process. This process could help confirm that the network picture reflects the views of people in the network. Additionally, stakeholders from public health sectors indicated that visual representation of network members could be compelling and serve as a valuable tool to communicate information with board members.

Identifying partner organizations and their roles. SNA can help to describe the overall network structure. The structure of a network can influence its potential to facilitate diverse social processes such as collective action, consensus, or problem resolution (Bodin & Crona, 2009; Ernstson et al., 2010). Interviews with stakeholders suggest that getting people from various sectors to the table has been challenging due to the invisible network structure or inability to understand the partnership network. Stakeholders also shared that network results could help conceptualize their involvement and identify what resources partner organizations have brought to the collaborative work. As one stakeholder expressed, the network results help them reflect on, "Who are the new players? Who are the missing players? Where do that intersections happen among these players?"

Characterizing relationships between partner organizations. 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 strategies to improve the network, and provide formative feedback to partner organizations. With that insights, stakeholders noted, the network results could be "beneficial for people to see who is working with whom and how the connecting like."

SNA Result Use: Prioritizing Planning Actions. Nearly all stakeholders

expressed the urgency to use the network results to help them clarify evidence-based actions to strengthen the partnership network. As they mentioned, the geographic view of a social network provides perspective on the opportunities and constraints for defining actions. In addition, linking relationship patterns to geographic locations can highlight existing relationships and help operationalize planning actions. The ways in which stakeholders described how SNA results could be helpful for their work make up the sub-themes, including locating prominent actors that contribute to achieving the collective goals, identifying any missing actors that could bring valuable assets to the prevention work, and designing and facilitating strategic networking.

Identifying Prominent Actors. SNA can illustrate which partner organizations are particularly important for influencing policy, on-group action, or facilitating information and resource transfer (Weiss et al., 2012). In the C.O.P.E. program, prominent actors include (a) organizations that hold strategic positions to bring issues upfront and advocate changes in their communities, (b) organizations that can serve as an expert to create new resources and provide education for communities, (c) organizations that control information exchange or resource flows within the network, and (d) organizations that are best placed to quickly influence the entire network by interacting with others to share information. As one stakeholder explained,

> It is our mission to meet the needs of our community partners, no matter what they are and where they are. Thus, we always listen and learn what is happening in our communities; we rely on community partners to help us identify those things. Moreover, we also rely on other critical partners to bring those issues to the forefront.

Stakeholders participating in the interviews expressed their interest in using the network results to identify what organizations hold a strategic position to influence the information flow and resource exchange. One stakeholder noted that the network results can help "identify those local community leaders and those change leaders and then give them the tools and resources to respond to issues in their local community."

Another particular interest was to use the network results to identify partner organizations that acted as brokers by creating pathways to present local knowledge, interests, and actions at regional and state levels while retaining their relationships with communities and their abilities for localized actions. In network analysis, brokers are organizations that spend time engaging with local and regional organizations and create social arenas to deliberate the priorities of different groups (Ernstson et al., 2010). As shown in Figure 4.3, stakeholders can quickly locate their organization positions and the organizations that serve as brokers.

Identifying Missing Actors. Nearly every stakeholder realized that the existing partnership network needs to include some crucial actors, such as community-based faith organizations and local recovery centers. One stakeholder from the public health sector explained:

> I think it would be beneficial for us as a team to look at the information to see where there are gaps, and at this point, we can guess some of the apparent gaps; but until we have the information and we can kind of look at it from of a bird's eye view more.

Stakeholders participating in the interviews expressed an interest in using the network results to identify potential organizations that can help expand the prevention

work to the community as they felt "not connecting to the right people." As one stakeholder noted,

> It would allow us to identify potential connections and people we should reach out to, so it is beneficial to get a sense of who we should be working with and talking to, specifically in the [rural] community. So we were able to find out new ways that we could partner with different things that are happening in the community.

Designing and Facilitating Strategic Networking. Based on the belief that a dense network is more likely to deliver a full range of services to all clients, stakeholders stated their intention to use the network findings to strengthen weak linkages. Public health stakeholders believed network results could help them facilitate strategic network planning.

Program educators in the interview highlighted their interest in using network results to facilitate strategic conversations with their partner organizations to build common goals. As one stakeholder observed, "as this work continues…it is imperative to relay and communicate the purpose and our intentions to keep working and moving ahead."

Aside from facilitating strategic planning, stakeholders who had challenges reaching out to potential key players indicated that the network results could serve as an invitation. As one stakeholder explained:

> I wonder if some of those departments we had a hard time reaching and if they saw some of the work we were doing with other community partners, they might want to work with us.

Another stakeholder expressed the same interest,

> It is a key part of our role to make that connection and invite other stakeholders into these spaces. Moreover, I think this could be an entree point. This data could be an invitation to those partners, and maybe we have more loosely affiliated partners, and this data is an invitation to plug in more deeply and richly.

In summary, stakeholders expect to use to results to (a) communicate messages to the board, (b) communicate the purpose and goals with community organizations, (c) invite partners missing from the network or loosely affiliated with the work, and (d) invite local organizations that hold strategic position to advocate changes in their communities or organizations that control information flow or resource exchange within the network.

SNA Result Use: Building Sustainable Prevention System. Perhaps the most significant use of the network results generated from this study is to help build a sustainable prevention system in rural communities. The network results have the potential to help stakeholders: 1) maximize partnership synergies and minimize duplicates, and 2) improve partnership capacity by addressing resource gaps. These two points are discussed as subthemes in this section.

Maximizing Partnership Synergies. Partnership synergy is a product of group collaboration that combines the partners' perspectives, resources, and skills (Lasker et al., 2001). As several stakeholders mentioned, the partnership has been instrumental in "building the bridges over those silos that exist in this type of prevention work" and "creating a pathway to ensure resource sharing goes both ways for large-scale national programs." However, stakeholders participating in the interview believed that the current

work has been divergent and the partnership lacks coherence across the state, resulting in "a ton of duplications." As one stakeholder explained:

> One of our partnership network's weaknesses is that so many people are doing this work across the state...So I think as we move forward, is to figure out how we can continue to work together and maybe even weave a more robust network.

At the same time, stakeholders realized the importance of different actors in shaping and influencing connections. As one stakeholder noted,

> There are many silos within this work. Sometimes it is chasing to ensure that we connect with all the people we need. There are gatekeepers, which can be helpful to us because if they are in sync with our work, they can open up and introduce us to new opportunities and connect with new people, but that can also work against us if they are overwhelmed or do not understand our work, or are not interested, we may not have access to others that we would otherwise need to.

The emphasis on using network results for maximizing partnership synergies is also driven more by program stakeholders involved in developing new tools or resources. As one shared, "there is an incredible amount of knowledge available across the state, but somehow we do not seem to create coherent policies to bring this knowledge together…the network results can help us to break out of our silos to work together and engage with new actors we may not necessarily be familiar with."

Improving Partnership Capacity. Most primary and community organizations consist of a mix of single discipline practices to provide a discrete range of either generalist or more specialized services. Few organizations, therefore, have the resources to provide a complete range of services for people on the recovery journey. It is

consistent with stakeholders' reflections on current barriers, such as limited resources. Stakeholders, particularly those in remote regions, shared awareness of limited resources to provide a complete range of services for people on the recovery journey. As one shared,

> I would say the one group that has been difficult to get to is the professional group, whether mental health or addiction providers. And we do not have many providers in [our area], and our resources are limited. Sometimes, we have no public transportation, so some of those issues are real barriers for our people.

Examining the network structure could help them understand types of interaction, such as sharing resources or participating in collaborative prevention efforts. It would be helpful for them to gain access to resources to serve their clients. Speaking of long-term goals, stakeholders expressed that the network data can help them identify pathways to build community capacity to sustain the prevention effort in rural communities. As one stakeholder mentioned,

> I think that our job will be to think about the long term. What does this body of work look like? Can we create something sustainable with all partners, even as grants end and flow? I think that is where this data could help us start thinking through. What is a map for sustainability? Who are those key players, and what resources do they bring to this? Are other entities besides extensions to place some of these roles?

With that insights, stakeholders agreed that when partnerships are capable of implementing comprehensive multi-component prevention programs, they are more likely to achieve substantial changes in a community-driven program and thus have a

meaningful impact on the delivery of community-based prevention services.

Table 4.12

Stakeholders' Descriptions of Practical Use of SNA Findings

Sub-themes	Description	Excerpts from Interview Data
(a) Uncovering partnership network		
Visualizing partnership network	Stakeholders indicated that the visual representation of the partnership network could be a valuable tool to visualize their work and communicate messages to the board or funders	"it could be beneficial for people to see who is working with whom and how connecting like." "it will be useful to communicate messages to our board to show the growth and the valuable outcomes we had from the original money, to talk about networks…"
Identifying partner organizations and their roles	Stakeholders indicated that the network results could help understand the network structure by seeing the partner organizations, their roles, and contributions	"…Who are the new players? Who are the missing players? Where do that intersections happen among these players?" "… it would even allow the organizations I work with to better tap into local resources or organizations that are doing work."
Revealing relationship patterns	Stakeholders indicated that the network results could identify linkages and interactions among the partner organizations	"see that snapshot of all those benefits and the relationships and who local partners are and who else has been partnering on the work."
(b) Clarifying action plan		
Identifying prominent actors	Stakeholders expressed that the network findings can help them identify prominent actors that contribute to achieving the collaborative goals	"… being able to identify partners already working with to sustain that work." "…being able to see challenges associated with the partnerships…and work with them to address the challenges."
Identifying missing actors	Stakeholders stated that the network findings could help them identify missing organizations that may bring	"…to identify the missing network pieces, why they are important, how we can work

Sub-themes	Description	Excerpts from Interview Data
	additional assets to the prevention work	together, and what collaboration looks like."
Designing and facilitating strategic networking	Stakeholders shared how to use the network results to facilitate strategic networking to strengthen linkages between local and regional partners	"… is important to relay and communicate the purpose and our intentions as you meet goals to keep working and moving ahead."
(c) Building a sustainable prevention system		
Maximizing partnership synergies	Stakeholders stated that the use of the network results could help maximize partnership synergies and minimize duplicates	"have some partners doing something, other partners doing another thing, and having people working at odds, and you will be able to create some synergy around resources."
Improving partnership capacity	Stakeholders noted that the network results could help strengthen partnership capacity after restructuring the network	"… build capacity because our grants would change, and maybe the nature of the composition of our team and what we would offer would change because it is formative and dynamic."

SNA Method Value: Improving Program Evaluation. Stakeholders described the value of the SNA in program evaluation, including addressing complex programs by strengthening the program theory, supporting the evaluation of partnership networks, and translating findings into policy to inform grant funders. The sub-themes, descriptions, and sample excerpts within the theme of the value SNA method are presented in Table 4.13.

Responding to Programs in Complex Environments. Stakeholders shared that the awareness of program complexities has increased considerably in the last few years. However, despite the growing awareness and interest, current program theory has limitations in explaining the "complicated system change work." A few stakeholders mentioned that applying SNA in program evaluation can "help story that the theory of

change" and "connect people around a coherent theory of change around this wicked problem that's happened." Stakeholders expressed the importance of SNA and how this method can help address system change and complex issues. As one noted,

> I think we are at the edge of systems change; this work is complicated and nuanced, and we are still figuring out how to describe it in a tangible, pragmatic, and valuable way. It is no surprise that we are also struggling on the evaluation side, so I think that social network analysis absolutely has the potential to be a highly useful evaluation method for complex systems change.

Aside from strengthening program evaluation theory, stakeholders suggested "comparing SNA results with a program's design to assess how well the existing network matches the program intent. This comparison can be ideal for suggesting ways the program could be improved." Furthermore, this method provides a deeper analysis of the complex and entangled needs of people and partners through a systemic approach by mapping out the drivers of a system and clarifying the dynamic interdependencies among different partners.

Supporting the Evaluation of Partnerships. As discussed in Chapter 3, Opioid grants (i.e., SMASHA, ROTA, RHSE, PEW) are made to local agencies to establish relationships among community organizations. Stakeholders noted that, for this grant-funded initiative, interagency collaboration is seen not only as "a prerequisite of effective, comprehensive programs but also as the primacy methods of sustainability." Hence, not only are program sites required to demonstrate the presence of existing partnerships, but grant funders also require them to establish measures that evaluate collaboration. However, evaluating interagency collaboration is notoriously challenging

because of the “complexity of collaborative efforts” and “the inadequacy of existing methods.” Stakeholders also shared that they struggled to have adequate “know-how” and “appropriate method”; using SNA in program evaluation could effectively evaluate interactions and interlinkages within a complex system.

Aside from program complexities, stakeholders added, current evaluations tend to focus on “individual components of collaborative efforts” or “hard numbers.” The application of SNA to support program evaluation makes it possible to assess the effects of the interactions among partners that denote the true value of collaboration. Furthermore, it helps determine the extent to which partnership synergy is achieved by assessing the critical determinants of partnership synergy, such as relationships among partners, resources embedded in the partnership network, and the characteristics of the partnership network (Lasker et al., 2001).

Advocating Funding Policy. Stakeholders expressed that addressing opioid issue is a regional effort to achieve the program goals; however, “there is a mismatch between what the funder thinks it will be taken to address this program and the work people on the ground think the work needs to be done.” This misalignment between funders and program implementers has resulted in so many barriers, such as “confusion of funding stream,” “duplicated work,” and “siloed work.”

Stakeholders mentioned that by using SNA in program evaluation, they can “rebuild and strengthen those relationships” and inform funders that “there is another metric that we can use to look at the success of this program that [they] did not know.” Moreover, program leaders believed that the capacity to measure their work’s impact and the ability to use network data to help funders and partner organizations realize the full

benefits of this work, which could have the potential to shift the funding policy as "current funding stream has largely restricted the state-wide collaboration."

Table 4.13

Stakeholders' Descriptions of Value of the SNA Method in Program Evaluation

Sub-theme	Description	Excerpts from Interview Data
Responding to programs in complex environments	Stakeholders stated that the use of the SNA method in program evaluation could enhance program theory by addressing program complexities	"we as a system, all the informal entities within a system, do we have that same sort of theory of change? "what is happening at a meta-level…is getting people to connect around a coherent theory of change around this wicked problem that's happened."
Supporting the evaluation of partnerships	Stakeholders stated that the use of the SNA method in program evaluation could provide appropriate methods to evaluate relationships within an existing network	"I think one thing that's hard to measure is how the work is going." "…we believe this work based around networks and partnerships is impactful."
Advocating funding policy	Stakeholders stated that the use of the SNA method in program evaluation could translate findings into policy by helping funders and stakeholders maximize the return on investment and realizing the full advantage of collaboration	"It would help us look for funding that will meet the needs that are not being met right now. Alternatively, if we have the opportunity to shift and change, maybe some of our programs will better meet the needs."

Challenges of Incorporating SNA into Program Evaluation. While there are potential contributions of SNA, some challenges remain in applying SNA as a routine part of program evaluation. For example, networks of actors can be extensive and highly dispersed geographically, so undertaking a comprehensive SNA can require large amounts of time and effort to reach out to the network actors (Wasserman & Faust, 1994).

Additionally, while the social network analytical methods aim to capture relations that are longer-term and stable (Borgatti et al., 2011; Schneider et al., 2003), there are increasing efforts to understand how network structure and function change over time in response to endogenous and exogenous drivers (Borgatti et al., 2011). Accordingly, social networks might require reassessing their structures periodically. It requires additional investment to identify, maintain or promote desirable linkages among actors, particularly when structural changes within networks can compromise the implementation of conservation actions.

Chapter 4 Summary

This chapter presented the results from sequential mixed methods social network analysis; findings are presented in three sections that correspond with each research question. Section one addresses Research Question 1 (RQ1): "In what ways is SNA a useful methodology in conducting a needs assessment, process and outcome evaluation?" The results are presented in a conceptual framework to structure the use of SNA in program evaluation, and relevant key concepts are described. Section two focused on Research Question 2 (RQ2): "How can the SNA methodology be applied to support the evaluation of the C.O.P.E. program?" This section intends to identify network actors contributing to the program and the ties connecting these actors. The purpose of this section was not to provide complex network analysis but to focus on identifying actors and potential ties existing in the network.

Section three addresses the Research Question (RQ3): "How does the use of SNA methodology impact the evaluation of the C.O.P.E. program?" C.O.P.E. partnership network surveys and interviews with key personnel were used to address this question.

The findings of this section suggested that the network results can be widely used to help stakeholders uncover the program partnership network, plan evidence-based actions and build a sustainable prevention system. Also, the SNA method in program evaluation has the potential to improve program evaluation by responding to the complex program, providing an additional quantitative methodology to assess proxy indicators (i.e., actors, interlinkages, relationships, network dynamic), and translating findings into funding policy by helping funders realize the full benefits of collaboration. In the next chapter, I discuss the implications, recommendations, limitations, and directions for future research.

Chapter 5 Discussion and Conclusion

Introduction

As the use of social network analysis to support program evaluation continues to increase, it is essential to understand how and under what conditions social network analysis can add value to the field of evaluation (Carmen & Fredericks, 2018). In an effort to build on small but growing literature about social network analysis in program evaluation, this study explored the application of social network analysis through a sequential MMSNA method.

In the previous chapter, I presented the results of data analysis, which explained the development of the SNA-Evaluation framework, explored the application of SNA to support the evaluation of the C.O.P.E. program under the guidance of the framework, and discussed the usefulness of the SNA method in program evaluation through the interviews with stakeholders across various sectors. In this chapter, I present the substantive outcomes of the study, their implications for evaluation practice, the limitations of the study, and recommendations for future research.

Background

In recent years, attention has been paid to the complexities of social programs as effective solutions to social programs depending on coherently and purposefully collaborative efforts across organizational, sectoral, and geographical boundaries to solve complex problems (Benjamin & Greene, 2009; Fredericks et al., 2002). The collaboration of many actors—nonprofit, for-profit, and public organizations—often forms a complex system consisting of "a network of components with no central control and simple rules of operation that give rise to complex collective behavior, sophisticated information

processing, and adaptation via learning or evolution" (Michell, 2009, p.13). To address the challenges of complex networks, evaluators have expressed increased interest in applying social network analysis to explore the structures that form the networks and examine the nature of relationships of the networks relative to the program (Durland & Fredericks, 2005).

While this call to action raised interest in adopting the SNA method to assess complex networks and the interrelationships within the networks, evaluators may fail to effectively use the SNA method if (a) there is no evidence of the role of SNA in the program evaluation; (b) there is little knowledge exists as to how and when to apply SNA; and (c) evaluation practitioners focus on the simple descriptions of a complex network rather than maximizing the use of SNA method to improve programs. Furthermore, existing literature does not speak to the needs and practice of program evaluation due to the divergent and inconsistent practices in the evaluation field, and evaluators need advice in understanding the implications of using SNA to support their evaluation work.

The primary purpose of this study was to investigate the applications of the SNA method in program evaluation and to examine the importance of SNA in the field of evaluation. This study was guided by three research questions: (a) in what ways is SNA a useful methodology in conducting a needs assessment, process, and outcome evaluation? (b) how can the SNA methodology be applied as a useful methodology in supporting the evaluation of social programs? and (c) how does the use of SNA impact the evaluation of social programs?

The outcomes of this study are summarized in three broad areas: (a) the

development and usage of the SNA-Evaluation framework for program evaluators, (b) the connections between SNA results and their use to support program stakeholders, and (3) reflections on the value of SNA method in program evaluation.

Summary of Key Findings

Setting the Stage for SNA-Evaluation Framework

A unique contribution of this study to the field was the development of the SNA-Evaluation framework for evaluators to guide their SNA applications in evaluation work. The development of the conceptual framework has undergone a thorough process, including (1) building theory blocks that support the SNA method in program evaluation, (2) connecting SNA concepts to evaluation practice, and (3) developing a screening tool to support the conceptual framework.

As Shadish et al. (1991) note, the kind of knowledge evaluators should construct and how to construct the knowledge often vary to a great extent; evaluators should construct evaluation knowledge through systematic observations by addressing three assumptions: (1) the nature of the reality, (2) the justifications of knowledge, and (3) the methods used for this knowledge (p. 42). Followed with these assumptions, the development of the SNA-Evaluation conceptual framework started with building theory blocks that explain the meaning of the SNA method for program evaluation.

As discussed in Chapter 2, evaluators have addressed the importance of considering social capital available to the program because the collective assets stakeholders bring to the program and their interrelationships may directly impact program outcomes (Cousins & Earl, 1995; Pawson & Tilley, 1997). Aside from the increased attention to social capital, evaluators have discussed the dynamic and

complicated nature of social programs. They assert that any changes in the complex system may impact program implementation and intended outcomes (Patton, 2010; Preskill, 2013). To further support their understanding of the complex system, evaluators have considered various descriptions. In this study, I adopted the description of a complex adaptive system (CAS) proposed by Eoyang and Berkas (1998): a CAS consists of a large number of interdependent agents, and the behavior of these agents (i.e., entangled relationships, emergent patterns) can impact the program outcomes to a great extent. As the value of social capital and the program complexities that evaluations aim to address cannot be treated separately by evaluation practices, I suggest that network theory and network analysis play a critical role in describing the characteristics of program agents within a CAS and explaining the interrelationships and patterns of changes occurred among the large group of agents.

With that insight, I investigated the existing literature to understand the application of SNA in program evaluation and its limitations. Evidence from the literature review suggests that evaluators need to have a conceptual framework to understand what realistic options they have, what considerations might result from their decisions, and how to measure the complexities within the system. The development of the conceptual framework began with identifying key concepts and their affiliated attributes based on the systematic review of SNA-related evaluation articles. These concepts formed the framework's foundation along with the three theories discussed above (see Figure 2.3). Using this SNA-Evaluation framework, evaluators can apply the SNA method to support their evaluation work depending on the evaluation types and purposes. Evaluators can address complexities by:

- Describing the roles and responsibilities of different actors as well as the diverse resources for achieving program outcomes;
- Identifying interlinkages and different types of interactions between network actors;
- Identifying enabling and disabling actors: the drivers that contribute to and disablers that hamper program outcomes at the local, regional and national levels.

Furthermore, a screening tool was developed to assist the evaluators who may be interested in applying the SNA method to support their evaluation work under the guidance of the SNA-Evaluation framework. As presented in Table 5.1, the SNA-Evaluation screening tool includes an integrated checklist of key elements evaluators can consider when applying the SNA method. The components and elements of the screening tool are summarized in Table 5.1.

Table 5.1

SNA-Evaluation Screening Tool: An Integrated Checklist of Key Elements

Main Elements	Aspects Addressed	SNA Indicators
(1) *SNA Needs Assessment*		
1.1 Describe network structure • Is there an existing formal or informal network? • What actors (organizations or stakeholders) have to be involved and influenced? • Who connects to whom through what relations?	• Characteristics of different actors • Type of relationship	Types of actors Characteristics of ties
1.2 Assess relationships • What are the existing relationships present in the network? And to what extent?	• Content of interaction • Strength of relationship • Frequency of interaction	Characteristics of ties Tie strength
1.3 Identify prominent individuals or groups • Who are the key opinion leaders that can represent the community's interests and needs? • Who are the knowledge experts that can provide conducive information to advance program design?	• Prominent actors	Centrality
1.4 Identify needs and gaps • What links need to be added to the program	• Brokerage (i.e., coordinator, consultant, gatekeeper,	Betweenness centrality Structural holes

Main Elements	Aspects Addressed	SNA Indicators
network to facilitate the program design and implementation? • Where do relationships need to be built?	representative, liaison)	Structural folds
(2) SNA Process Evaluation		
2.1 Assess network structure • Which actors are working together to address community issues? • To what extent are partners connected to other partners within the network?	• Network connection	Size Density Transitivity Multiplicity Reciprocity Centralization
2.2 Examine relationships • To what extent does a program partner lie between network sections? • What are the power relationships within the network?	• Relationship strength • Relationship patterns	Tie strength Centrality
2.3 Measure resource distribution and information exchange • How are resources distributed during the program implementation stage?	• Network distribution	Betweenness centrality Degree centrality Shortest path

Main Elements	Aspects Addressed	SNA Indicators
• Does the network effectively bridge partners to share resources and information to promote program delivery?		
2.4 Identify key opinion leaders • Who are the key opinion leaders that contribute to achieving the program outcomes?	• Prominent actors	Degree centrality Betweenness centrality Closeness centrality Eigenvector centrality
2.5 Enhance partnership and collaboration • Where do relationships need to be (re)built to promote partnership success? • What actors are missing from the existing partnership network? What actors could be removed from the existing partnership network?	• Partnership development/ improvement	Density Clustering Transitivity Modularity Tie strength Centrality
(3) SNA Outcome Evaluation		
3.1 Examine relationships between networks and outcomes • Does the network promote higher levels of participation and collaboration in each member?	• Correlation between network structure and intended outcomes	Size Density Centralization

Main Elements	Aspects Addressed	SNA Indicators
3.2 Determine if network position is associated with outcomes • Does individual actor position correlate to intended outcomes? • Is being central in the network associated with the effects of an intervention?	• Correlation between network position and intended outcomes	Density Centrality Centralization

Connecting SNA Findings to Stakeholders' Perspectives

Although community partnerships have been touted as a promising strategy for the C.O.P.E. program, there is limited evidence of their effectiveness in achieving stated goals and bountiful evidence of the challenges of developing and maintaining them. There are many reasons for this lack of evidence. Some documented ineffectiveness may be due to the inadequacy of existing evaluation methods to provide data back to stakeholders that could be used to improve the partnership's development, functioning, and effectiveness.

In my study with this program, I found that the presence of social network data to stakeholders provided a powerful tool to further their understanding of the relationships among community organizations and how these relationships can impact the program outcomes. With the network findings, stakeholders expressed higher interest in using the network results to define their next steps to improve the partnership's effectiveness. Table 5.2 summarizes the network findings, interview findings, and how these findings connect to the network concepts presented in the SNA-Evaluation framework.

For instance, if stakeholders believe that connecting as many organizations as possible is an ideal approach to increasing community capacity, then the network density can represent how well they achieve that goal. The network structure data can also help them determine whether there are vulnerabilities in the network. Similarly, the network data can inform stakeholders about organizations that appear to be less engaged in the network, allowing for incorporating the information into strategic planning. Stakeholders may undertake efforts to discover more about barriers to these organizations' involvement and then define actions to address these barriers.

In comparison with the network results and interview findings, it is apparent that resource duplication and competition have been the most significant issue within the network due to the grant stream. As stakeholders reflected, the funding policy has limited the partnership's capacity and only allowed it to solve problems by focusing on one side or one dimension alone. They expressed the urgency to use the network results to advocate the funding policy to maximize partnership synergies and improve community capacity for a more sustainable opioid prevention system.

Furthermore, stakeholders can use the value and trust score to facilitate strategic planning. For example, partner organizations need to carefully manage organizations' degree of commitment and their power or influence to accomplish program goals because the level of involvement and degree of power and influence can affect resource exchange. With that insight, there is a clear pattern across the network results, perceptions of the partnership's impacts on system change, and interview findings. The network results indicate that the partnership has not resulted in effective resource exchange within the network. Stakeholders should focus on leveraging different ways partner organizations bring value to the network.

Table 5.2

Summary of Use of Network Findings to Support Stakeholders

SNA Concepts	SNA Findings	Interview Findings
Network structure	• The network consists of 50 organizations across 12 types of organizations, and these organizations reported having 77 relationships. • In general, there is a lower level of connectivity reported among organizations. • The network displays a co-periphery structure with a core of critical plays in the center of the network. • The network includes nine subgroups.	• Stakeholders reported using network findings to identify partner organizations and their roles. • Stakeholders expected to use the network findings to identify linkages and interactions among the partner organizations. • Stakeholders reported using the network results to facilitate strategic conversations and action planning with their board members.
Prominent actors	• Seven organizations emerged as key network actors, as indicated by their high degree centrality score. • The network has a few actors serving as brokerage, indicated by their unique network positions.	• Stakeholders indicated using network findings to identify key organizations that contribute to the partnership's success. • Stakeholders indicated using network findings to identify missing organizations that can bring additional assets to the program.
Relationship pattern	• The most common inter-organizational activities are learning from each other and collaborating on educational programs. • The network relationships range on a spectrum from awareness to cooperative, coordinated, and fully integrated partnerships. Most relationships	• Stakeholders reported using network findings to strengthen the weak linkages by facilitating strategic conversations. • Stakeholders reported removing some loosely connected actors if they worked against the program goals or expressed

SNA Concepts	SNA Findings	Interview Findings
	can be attributed to the relationship-building effort of the partnership. • Most organizations collaborate for one month or less, which might result in loose relationships	less interest in continuing this prevention effort.
Partnership and collaboration	• Agreements among the network's members differ regarding the network's success in supporting the program. Organizations identified different areas responsible for their observed success. • The network has a relatively higher trust score than the value score. Both scores are above the healthy score. • The network has a few significant challenges that need to address, such as the diversion of time and resources, competing initiatives/priorities/resources, and lack of long-term strategy.	• Stakeholders reported using network findings to maximize partnership synergies and minimize duplicates by strengthening existing or building new relationships. • Stakeholders reported identifying solutions to address the major challenges, particularly advocating funding policy.

Reflecting on the SNA Methodology in Program Evaluation

Sharpening Program Theories. As Schwandt (2015) states, social programs are based on "some set of often implicit assumptions about how it is supposed to achieve its intended outcomes" (p. 37). Evaluators often use these assumptions as a conceptual framework to guide their evaluation design to assess program effectiveness.

However, many programs that are evaluated are quite complex in that they involve a system of interacting agents (i.e., organizations, agencies, groups, individuals), and their complicated interrelationships and emergent behaviors can result in structural changes to impact program outcomes (Patton, 2011; Schwandt, 2015; Wolf-Branihin, 2013). With that recognition, evaluators become worried that traditional evaluation approaches may lack the capacity to portray the characteristic behaviors of CAS (Eoyang & Berkas, 1998; Schwandt, 2015). As we discussed in Chapter 2, a CAS consists of characteristics such as:

- Constant change driven by the number of agents, their associations with their own rules of behavior, and the interdependence between the agents and their environments;
- Massive entanglement due to a large number of agents and their complicated interrelationships;
- Scale independent due to relatively independent actions, various groupings of agents emerging in the dynamic course of events, and system-level behaviors;
- Transformation across the open system;
- New patterns and structural changes generated by the interactions of the agents within the system.

Although network theory cannot address all CAS characteristics, a network perspective can be helpful by focusing on the domains of individual agents and their complicated interrelationships, as "complexity is concerned with relationships and the interconnected of people" (Wolf-Branihin, 2013, p. 7). With that insight, a network perspective can help formulate statements in several ways. First, organizations making decisions about the program comprise an emerging list of partners and complicated relationships. For example, the C.O.P.E. program involves a cross-disciplinary and multisectoral collaborative partnership network toward improving opioid crisis response in MN rural communities.

Second, the network agents' interrelationships and the strength level can enable or disable the network condition. Applying network perspectives can reveal interconnections between agents and support more effective conversations by enabling network agents to see more clearly where their interests coincide, where they diverge, and how they might reconcile their differences (Weitz et al., 2014). Such understanding provides the necessary tactical information in opening dialogues, rallying stakeholders around shared goals, and building stakeholder coalitions around diverse and shared interests.

In addition, the structural changes featured by dense and complicated interactions between network agents can either negatively or positively affect the program outcomes. For example, programs that promote system changes often allow multi-disciplinary and multi-sectoral organizations to collaborate to synthesize knowledge and resources that need to be addressed for an integrated approach to program implementation (Griggs et al., 2017). In this context, network perspectives can help formulate assumptions about the

structural changes within the system and understand whether the system structure is producing intended system-wide outcomes.

Furthermore, network concepts and measures can strengthen program theory by contributing to the iterative process of a complex adaptive system and facilitating the testing of statistical models of how interactions and interrelationships among network actors affect programs. It can help formulate more precise statements about how this combination of factors (i.e., individual agents, complex interrelationships, and structural changes) can drive a complex dynamic such as the opioid prevention system and offer paths to building a sustainable prevention system.

Strengthening Evaluation Method. With increased attention paid to complex systems, evaluators are concerned with describing what works and identifying program factors that can be deliberately varied to bring about change in a valued outcome (Cook, 2004). As Eoyang and Berkas (1998) suggest, "the behavior in a CAS does not conform to the assumptions that are the foundation of those traditional evaluation processes because many traditional evaluation methods were not designed to capture data about the complex and unpredictable performance of a CAS" (p. 9).

Social network analysis would be an effective evaluation tool to respond to the characteristics of a CAS described above, particularly changes driven by agents, massive entanglements, emergent patterns, and structural changes. The social network analysis method provides "a strong methodological approach that is consistent with complexity" (Wolf-Branihin, 2013, p. 63) as this relational approach studies the connections within the system by focusing on the interdependent agents, the relational properties, and structural changes. Most broadly, SNA can study relationships within systems as it

assumes that “social units are interdependent and have multiple levels of relational properties” (Wolf-Branihin, 2013, p. 63). Table 5.3 represents the CAS variables that can be assessed by the SNA method.

For example, using SNA in program evaluation can examine inter-organizational collaboration by describing the network structure and analyzing the linkages between pairs of organizations rather than the attributes of the organizations themselves (Scott, 2017). Integrating social network analysis into program evaluation, the evaluator can describe the linkages between different organizations involved in a program and what these linkages tell them about collaboration. In particular, it can help organizations understand if and how the patterns of linkages differ depending on the type of organization, the level of collaboration, and the resources being exchanged. Further, to the degree that network analysis can reveal existing structures and compare them with effective structures, it may fill the gap in existing methodologies, which primarily examine the functioning but not the structure of collaborative relationships.

As details of the SNA method have been discussed in previous chapters, I now shift to answer one question: “What conditions should evaluators consider before applying SNA?” As suggested by Wolf-Branihin (2013), social network analysis operates under several assumptions: (1) there are actors with interdependent actions; (2) there are ties between actors that serve as channels for information flow or resource exchange; and (3) there is network structure (or relational pattern) emerging from the network.

Table 5.3

CAS Variables Assessed by SNA Method

CAS Variables	Assessed by SNA Method (Yes)	Aspect Addressed
(a) Dynamic		
System actors	Yes	System size Characteristics of actors
Constant interactions	Yes	Nature of interactions
(b) Massively entangled		
Interrelationships among system actors	Yes	Nature of relationships
(c) Scale independent		
Behavior of individual actor		
Behavior of emergent groupings		
Behavior of system		
(d) Transformative		
Feedback loops		
(e) Emergent		
Relationship patterns	Yes	Relationship pattern Relationship strength
Structural changes	Yes	System structure

Note. Variables unable to be assessed by the SNA method are shaded in grey.

Maximizing Evaluation Use. Cronbach (1982) states that an evaluation that simply assesses the merit of a program without providing stakeholders with insights to help them define evidence-based actions is of limited use. Similarly, Chen (2015) agrees that stakeholders often "find evaluation useful if they both offer conclusions about how well programs have worked and provide information that assists the stakeholders in figuring out what must be done next to maintain—or even surpass—program goals" (p.

23). Moreover, he continues that the evaluation's ultimate task is to produce useful information that can enhance stakeholders to improve the program for better solving social problems (Chen, 2015).

This applies to my case. This study suggests that using SNA in program evaluation helps increase instrumental use, meaning that stakeholders apply "direct application of an evaluation or piece of research to a specific decision or in defining a solution to a particular problem" (Schwandt, 2015, p. 109). As discussed earlier, using SNA results to define strategic changes in network structure was considered beneficial to the program. For example, stakeholders can use the network findings to identify actors that contribute to achieving the collaborative work, strengthen the network by adding new actors or removing loosely connected actors, and design solutions to maximize partnership synergies and minimize duplicates of resources.

Similarly, the dissemination of network findings increases conceptual use, indicating that the evaluation knowledge can gradually influence "the perspectives, understanding, and actions of decision-makers" (Schwandt, 2015, p. 109). Schwandt (2015) explains that evaluation use "is not the direct application to solving problems, but rather a matter of setting the terms of a discussion around significant concepts, propositions, empirical generalizations and the like" (pp. 109-110). It is consistent with stakeholders' reflections that the SNA findings can serve as a tool to enlighten policymakers. For example, in the C.O.P.E. program, the structure of the comprehensive service is based on the evidence that an integrated community-driven approach is an effective strategy for promoting healthy community development and reducing opioid, drug, and other substance abuse. However, as stakeholders indicated, the current funding

policy limits the interagency collaboration for the implementation of comprehensive and coordinated programs, resulting in silos across the opioid crisis response. Results of the SNA evaluation demonstrated how network data could be used to help funders maximize the return on investment by realizing the full advantages of collaboration.

Implications for Evaluation Practice

This study draws together the literature on the use of SNA in evaluation practices and research, the demonstration of SNA to evaluate a complex community-driven prevention program, and the solicitation of stakeholders' feedback related to the use and value of the SNA method. Following previous discussions, this study has important implications for three levels of practitioners: (1) evaluation practitioners who want to increase their SNA use, (2) evaluation practitioners who want to explore the theoretical foundations underlying SNA use in program evaluation, and (3) evaluation practitioners in their efforts to evaluate complex community-driven social programs.

Evaluation Practitioners Wanting to Increase the SNA Use

While the potential use of SNA has been discussed in the field of evaluation, such as scoping reviews or demonstrations of SNA applications in program evaluation, little evidence is provided to help evaluators determine how to apply the SNA method to enhance their evaluation. For example, Durland and Fredericks (2005) introduce the SNA method in program evaluation by describing the SNA concepts and applications. Regardless, evaluators may still feel uncertain as it lacks clear guidance to help them determine if SNA is suitable for their evaluation practices and when to choose the SNA method. As Shadish et al. (1991) suggest, "[p]ractitioners are action oriented. If they rely on theories of evaluation at all in their work, it is to find pragmatic concepts to orient

them to their task and to suggest general strategies and some practical methods to implement those strategies" (p. 54). More broadly, evaluators often need practical methods for evaluation practice.

This study changes the notion. First, the SNA-Evaluation framework offers a frame of reference for applying SNA in the field of evaluation by connecting the SNA concepts to general evaluation practices. Guided by the framework (see Figure 2.3), evaluators can first decide what type of evaluation needs to be done and set the specific evaluation purposes aligned with the program theory and context. The screening tool (see Table 5.1) outlines key elements to help evaluators define "what types of questions should be asked" (Shadish et al., 1991, p. 58); the supporting information presented in Table 4.4 summarizes common network methods by addressing "what design will be used" (Shadish et al., 1991, p. 58) to collect and analyze network data.

When evaluating programs, evaluators often serve as methodological experts providing competent consultation to stakeholders. However, evaluators may take on different roles and responsibilities in practice (Shadish et al., 1991). For example, evaluators—particularly in policy or program settings—often need to carry out some activities to facilitate the evaluation use. This study also highlighted how to increase the use of SNA findings by providing considerations for action planning and soliciting feedback from stakeholders regarding the SNA use and value for the program.

Evaluation Practitioners Wanting to Explore Theoretical Foundations

The second implication that derives from the development of the SNA-Evaluation framework is the opportunity for building theory blocks that explain why SNA matters for program evaluation. As discussed previously, the use of SNA in evaluation continues

to increase as evaluators need a tool that has the capacity to measure and understand the complexities present in the programs (Durland & Fredericks, 2005). However, existing literature has not explained the theories underlying the selection of SNA as a tool to assess complexity.

Followed with the suggestion given by Shadish et al. (1991), a good theory of knowledge should "comprehensively address their ontological, epistemological, and methodological assumptions" (p. 43). This study offers a new lens to explain why the SAN method can effectively capture data about complex and unpredictable performances by connecting the CAS, social capital, and network theories.

Evaluation Practitioners Working with Community-Driven Social Programs

The present study serves as an initial step toward acquiring a more objective and comprehensive view of inter-organizational relationships in a community-driven prevention network. These descriptive findings may provide helpful capacity-building insights for partner organizations by revealing collaborative strengths and improvement opportunities. For instance, centrality scores may help to identify organizations that may be underutilized resources in the community, and strategies can be developed to increase the participation of these organizations. On the other hand, more highly connected organizations can be supported to continue establishing and sustaining collaborative bonds with other organizations.

This study attempted to provide new insights and knowledge on networks based on the experiences of the large community-based opioid prevention program with multiple grants. The findings from this study suggested that using SNA can help improve evaluation use by assessing the proximal factors of partnership and disseminating

network findings for strategic planning and policy advocacy. Evaluators may apply a similar approach to use SNA to support the evaluation of complex social programs.

Limitations

The following section discusses the limitations of this study that should be considered: (a) limitations related to the study of the C.O.P.E. program and (b) limitations related to the conceptual framework. First, the case demonstrated in this study was initiated to help stakeholders engaged in the C.O.P.E. program discover whether the program established partnership networks to support the achievement of program outcomes and how well the partner organizations collaborated with one another. As a first step, the use of SNA to evaluate the program was limited to descriptive analysis, including identification of network actors and ties, description of network structure, examination of relationship strength, and assessment of perceived partnership value, trust, and success. Another limitation was the network data; not all of the partner organizations identified as part of the C.O.P.E. partnership network completed a survey. Ideally, the data would be collected again after a year or two for further assessment.

Second, the conceptual framework provides insights to inform the SNA use in program evaluation. However, it is not without limitations. The exploratory review of SNA application in program evaluation sought to characterize relevant categories of SNA application within a sample of published SNA-related articles, particularly in the field of evaluation. SNA-focused articles were drawn from a database of articles published between 1980 to 2022 from nine evaluation-related journals. This sampling frame restricts the findings to articles published in evaluation-track journals. It does not include any publications from domain-specific journals (e.g., social network analysis track,

education track, development track, health).

While this data frame established an initial understanding of the use of SNA in program evaluation, a broader review of the state of SNA application in the evaluation should draw a sample of studies across an additional set of journals. Future research should expand the data frame and explore how SNA application might vary across disciplines by assessing SNA-related evaluation studies published in domain-specific journals.

Recommendations for Future Research

The results of this study suggest several notable recommendations to (a) enhance the use of SNA to support the C.O.P.E. program evaluation and (b) increase the understanding of SNA use in the evaluation field.

Future Research of the C.O.P.E. Program

As noted earlier, missing network data has always been challenging. Future studies should address the network data issue by ensuring all partner organizations are invited and included to participate in the network survey to strengthen the trustworthiness of the data. When the incomplete network data issues are addressed, future studies can conduct correlation analyses to examine the associations between all variables to determine which variables to include in the regression models. For example, future studies should investigate whether there are correlations between all variables, such as network density, centrality, relationship strength (i.e., communication frequency, collaboration level), partnership value, partnership trust, and perceived partnership success.

Future studies should also include control variables because an organization's

level of involvement and resources for opioid prevention activities could influence how much they collaborate with other organizations. These control variables may include: (1) the total number of staff from each partner organization, (2) the total number of funding sources for opioid prevention, and (3) the total number of services provided related to opioid prevention. Furthermore, when variables are identified through correlation analysis, the future study can run regression analysis to examine how the control and predictor variables lead to changes in outcome variables such as partnership success.

In responding to complex social programs (i.e., substance use prevention), it is increasingly important for community organizations to develop strong collaborative relationships to build capacity and provide an integrated system to serve individuals in recovery. In addition to providing new insights regarding the structural and relational aspects of a network of organizations involved in opioid prevention, future research should also explore the directionality of the relationships between collaboration and tie strength using longitudinal data collection methods. Finally, it is also vital to assess the relationship between inter-organizational collaboration and the impact on both individual outcomes (i.e., the actual impact on opioid overdoes) and system-level (i.e., system sustainability).

Future Research of the Conceptual Framework

One of the motivations for developing this new framework was to answer calls for a practical tool to support the use of SNA in program evaluation. As discussed earlier, the current framework has a limited number of concepts retrieved from evidence. What is important for the future is that the scope of the literature search extends to a set of SNA applications from other fields. The comprehensive database would open avenues for

refining the conceptual framework by combining SNA applications from other fields, particularly social programs, public health, education, and development.

It is important to monitor the use of the framework and evaluate its acceptability and impact. Future research should continually monitor the use of the SNA-Evaluation framework and screening tool by collecting SNA studies guided by the framework. With wider scope and the range of detailed SNA concepts added to the existing framework, future research should consider conducting meta-evaluation to evaluate the quality of the SNA-related evaluation activities and aggregate findings from these evaluations (Stufflebeam, 2011).

Chapter Summary

The purpose of this study was to inquire about how SNA is a useful methodology to enhance program evaluation. This study found that evaluators can adopt the SNA method to support their evaluation practices depending on the types of evaluation, such as needs assessment, process evaluation, and outcome evaluation. Guided by the SNA-Evaluation framework, this study used an innovative method to provide a system-level description of the partner organizations using whole networks as the units of analysis. The findings suggested that network results can help partner organizations facilitate action planning, reduce service redundancies, and provide more accessible and consistent services to individuals under recovery. Also, the study found that the use of SNA in the field of evaluation, particularly for responding to complex social programs, can (a) sharpen program theories by incorporating CAS, social capital, and network theories; (b) strengthen evaluation method by enabling the assessment of CAS variables such as a large number of network actors, dynamic interactions, complicated interrelationships, and

emergent patterns; and (c) maximize evaluation use to support decision making about a program, enhance the accountability of agencies that operate the program, and inform policymakers by helping them realize the full benefits of a collaborative effort to address social programs.

REFERENCES

Abma, T. A. (2006). The social relations of evaluation. *The Sage Handbook of Evaluation*, 184-199.

Agranoff, R., & McGuire, M. (2010*). Collaborative Public Management: New strategies for Local Governments.* Georgetown University Press.

Albrecht, M., Elbe, J., Elbe, S., & Meyer, W. (2014). Analyzing and evaluating regional governance networks: Three challenges for applications. *Evaluation, 20*(1), 58–74. https://doi.org/10.1177/1356389013518457

Alter, Hage, & Hage, Jerald. (1993). Organizations working together (Sage library of social research v. 191). Sage.

Anderson, J. G. (2002). Evaluation in health informatics: SNA. *Computers in Biology and Medicine*, *32*(3), 179-193.

Balkundi, P., & Harrison, D. A. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *The Academy of Management Journal*, *49*(1), 49–68. http://www.jstor.org/stable/20159745

Benjamin, L. M., & Greene, J. C. (2009). From program to network: The evaluator's role in today's public problem-solving environment. *American Journal of Evaluation, 30*(3), 296–309. https://doi.org/10.1177/1098214009338621

Berkman, L. F., & Glass, T. (2000). Social integration, social networks, social support, and health. *Social Epidemiology*, *1*(6), 137-173.

Birk, Sandra M. (2005). Application of network analysis in evaluating knowledge capacity. *New Directions for Evaluation, 2005*(107), 69-79.

Boje, D. M., & Whetten, D. A. (1981). Effects of organizational strategies and contextual constraints on centrality and attributions of influence in interorganizational networks. *Administrative Science Quarterly, 26*(3), 378–395. https://doi.org/10.2307/2392513

Borden, L. M., & Perkins, D. F. (1998). *Evaluating Your Collaborative Effort*. Center for the Study and Prevention of Violence, University of Colorado.

Borgatti, S. P., & Lopez-Kidwell, V. (2011). Network Theory. *The SAGE Handbook of Social Network Analysis*. Sage. https://dx.doi.org/10.4135/9781446294413

Boumans, D., & Ferry, M. (2019). Networks and efficient policy implementation: Insights from cohesion policy. *Evaluation*, *25*(4), 411–429. https://doi-org/10.1177/1356389019855096

Bourdieu, P. (1986). The forms of capital. *Cultural Theory: An anthology*, *1*, 81-93.

Bright, C. F., Haynes, E. E., Patterson, D., & Pisu, M. (2017). The value of social network analysis for evaluating academic-community partnerships and collaborations for social determinants of health research. *Ethnicity & Disease*, *27*, 337–346. https://www.jstor.org/stable/48668361

Campbell, K. E., Marsden, P. V., & Hurlbert, J. S. (1986). Social resources and socioeconomic status. *Social Networks*, *8*(1), 97-117. https://doi-org/10.1016/S0378-8733(86)80017

Carman, J. G., & Fredericks, K. A. (2018). Applications of social network analysis in evaluation: Challenges, suggestions, and opportunities for the future. *Canadian Journal of Program Evaluation*, *33*(2), 175–187. https://doi-org/10.3138/cjpe.31156

Carolan, B. (2014). *SNA and Education: Theory, Methods & Applications*. Sage.

Centers for Disease Control and Prevention. (2017). CDC reports rising rates of drug overdose deaths in rural areas. https://www.cdc.gov/media/releases/2017/p1019-rural-overdose-deaths.html

Charmaz, K. (2014). *Constructing Grounded Theory*. Sage Publications.

Chen, H. T. (2014). Practical program evaluation: Theory-driven evaluation and the integrated evaluation perspective. Sage Publications.

Cherry, S., Robinson, A., Jashinsky, J., Bagwell-Adams, G., Elliott, M., & Davis, M. (2017). Rural community health needs assessment findings: Access to care and mental health. *Journal of Social, Behavioral, and Health Sciences*, *11*(1), 18.

Chrislip, D. D., & Larson, C. E. (1994). Collaborative leadership: How citizens and civic leaders can make a difference (Vol. 24). Jossey-Bass.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*, S95-S120.

Cook, T. D. (2004). Causal generalization: How Campbell and Cronbach influenced my theoretical thinking on this topic, including in Shadish, Cook, and Campbell. *Evaluation Roots: Tracing Theorists' Views and Influences*, 88-113.

Corbin, J., & Strauss, A. (2008). Qualitative research. *Techniques and Procedures for Developing Grounded Theory*, *3*.

Cousins, J. B., & Earl, L. M. (1995). *Participatory Evaluation in Education: Studies in Evaluation Use and Organizational Learning*. Falmer.

Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of Mixed Methods in Social and*

Behavioral Research, 209(240), 209-240.

Creswell, J. (2009). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (3rd ed.). Sage Publications.

Cross, J. E., Dickmann, E., Newman-Gonchar, R., & Fagan, J. M. (2009). Using mixed-method design and network analysis to measure development of interagency collaboration. *American Journal of Evaluation, 30*(3), 310–329. https://doi-org/10.1177/1098214009340044

Davis, B., & Sumara, D. J. (2006). *Complexity and Education: Inquiries into Learning, Teaching, and Research.* Lawrence Erlbaum Associates.

Dewachter, S., & Holvoet, N. (2017). Intersecting social-capital and perceived-efficacy perspectives to explain underperformance in community-based monitoring. *Evaluation, 23*(3), 339–357. https://doi-org/10.1177/1356389017716740

Dedoose Version *9.0.17*, web application for managing, analyzing, and presenting qualitative and mixed method research data *(2021)*. Sociocultural Research Consultants, LLC. https://www.dedoose.com/

Dozier, A. M., Martina, C. A., O'Dell, N. L., Fogg, T. T., Lurie, S. J., Rubinstein, E. P., & Pearson, T. A. (2014). Identifying emerging research collaborations and networks: method development. *Evaluation & the Health Professions*, *37*(1), 19-32. https://doi-org/10.1177/0163278713501693

Drew, R., Aggleton, P., Chalmers, H., & Wood, K. (2011). Using SNA to evaluate a complex policy network. *Evaluation*, *17*(4), 383-394. https://doi-org/10.1177/1356389011421699

Durland, M. M. (2005). A formative evaluation of the integration of two departments.

New Directions for Evaluation, 2005(107), 81-94. https://doi-org /10.1002/ev.163

Durland, M. M., & Fredericks, K. A. (2005). An introduction to SNA. *New Directions for Evaluation, 2005*(107), 5-13. https://doi-org/10.1002/ev.157

Edwards, G. (2010). Mixed-method approaches to social network analysis.

Engelberg, S. (1980). Network analysis in evaluation: Some words of caution. *Evaluation and Program Planning, 3*(1), 15-23. https://doi-org/10.1016/0149-7189(80)90003-8

Eoyang, G. H., & Berkas, T. (1998). Evaluation in a complex adaptive system. *Managing Complexity in Organizations.* Quorum Books.

Fitzpatrick, J., Worthen, B., & Sanders, J. (2004). *Program Evaluation: Alternative Approaches and Practical Guidelines* (3rd ed.). Pearson/Allyn and Bacon.

Forthofer, M., Burroughs-Girardi, E., Stoisor-Olsson, L., Wilcox, S., Sharpe, P. A., & Pekuri, L. M. (2016). Use of formative research and social network theory to develop a group walking intervention: Sumter County on the Move! *Evaluation and Program Planning, 58*, 28-34. https://doi-org/10.1016/j.evalprogplan.2016.05.004

Fortunato, S., & Hric, D. (2016). Community detection in networks: A user guide. *Physics Reports, 659*, 1-44. https://doi-org/10.1016/j.physrep.2016.09.002

Fraenkel, J., & Wallen, N. (2009). How to design and evaluate research in education (7th ed.). McGraw-Hill Higher Education.

Frechling Wstat, J. (2002). The 2002 user-friendly handbook for program evaluation. *Division of Research, Evaluation and Communication National Science Foundation*.

Fredericks, K. A. (2005). Network analysis of a demonstration program for the developmentally disabled. *New Directions for Evaluation*, *2005*(107), 55-68. https://doi-org/10.1002/ev.161

Frerichs, L., Young, T. L., Dave, G., Stith, D., Corbie-Smith, G., & Lich, K. H. (2018). Mind maps and network analysis to evaluate conceptualization of complex issues: A case example evaluating systems science workshops for childhood obesity prevention. *Evaluation and Program Planning*, *68*, 135-147. https://doi-org/10.1016/j.evalprogplan.2018.03.003

Funnell, Sue C., and Patricia J. Rogers. *Purposeful Program Theory: Effective Use of Theories of Change and Logic Models*, John Wiley & Sons, Incorporated, 2011. *ProQuest Ebook Central*. https://ebookcentral.proquest.com/lib/umn/detail.action?docID=706626

Gallivan, M. J., & Depledge, G. (2003). Trust, control and the role of interorganizational systems in electronic partnerships. *Information Systems Journal*, *13*(2), 159-190. https://doi-org/10.1046/j.1365-2575.2003.00146

Galport, M., & Galport, N. (2015). Methodological trends in research on evaluation. *New Directions for Evaluation*, *2015*(148), 17-29. https://doi-org/10.1002/ev.20154

Gates, E. F., Walton, M., Vidueira, P., & McNall, M. (2021). Introducing systems- and complexity-informed evaluation. *New Directions for Evaluation*, *2021*(170), 13-25. https://doi-org/10.1002/ev.20466

Giuliani, E., & Pietrobelli, C. (2011). Social network analysis for the evaluation of cluster development programs.

Glaser, B., & Strauss, A. (1999). *Discovery of Grounded Theory: Strategies for*

Qualitative Research (1st ed.). Routledge. https://doi-org/10.4324/9780203793206

Goodman, R. M., Speers, M. A., McLeroy, K., Fawcett, S., Kegler, M., Parker, E., Smith, S. R., Sterling, T. D., & Wallerstein, N. (1998). Identifying and Defining the Dimensions of Community Capacity to Provide a Basis for Measurement. *Health Education & Behavior*, *25*(3), 258–278. http://www.jstor.org/stable/45055010

Grack Nelson, A., King, J. A., Lawrenz, F., Reich, C., Bequette, M., Pattison, S., Kunz Kollmann, E., Illes, M., Cohn, S., Iacovelli, S., Cardiel, C. L. B., Ostgaard, G., Goss, J., Beyer, M., Causey, L., Sinkey, A., & Francisco, M. (2019). Using a complex adaptive systems perspective to illuminate the concept of evaluation capacity building in a network. *American Journal of Evaluation*, *40*(2), 214–230. https://doi-org/10.1177/1098214018773877

Greene, J. C. (2007). *Mixed Methods in Social Inquiry* (Vol. 9). John Wiley & Sons.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis*, *11*(3), 255–274. https://doi-org/10.3102/01623737011003255

Gregson, J., Sowa, M., & Flynn, H. K. (2011). Evaluating form and function of regional partnerships: Applying SNA to the network for a healthy California, 2001- 2007. *Journal of Nutrition Education and Behavior*, *43*(4), S67-S74. https://doi-org/10.1016/j.jneb.2011.02.018

Griggs, D. J., Nilsson, M., Stevance, A., & McCollum, D. (2017). *A Guide to SDG Interactions: From Science to Implementation*. International Council for Science.

Hall, A., & Wellman, B. (1985). Social networks and social support. *Social Support and*

Health. Academic Press, pp. 23- 41.

Hanneman, R., & Riddle, M. (2014). Concepts and measures for basic network analysis. *Concepts and Measures for Basic Network Analysis*. (pp. 340-369). Sage.

Hester, R. D. (2004). Integrating behavioral health services in rural primary care settings.

Hollstein, B. (2011). Qualitative approaches. *The Sage Handbook of Social Network Analysis*, 404-416.

Hollstein, B. (2014). Mixed methods social networks research: An introduction. In S. Domínguez & B. Hollstein (Eds.), *Mixed Methods Social Networks Research: Design and Applications* (Structural Analysis in the Social Sciences, pp. 3-34). Cambridge University Press. https://doi:10.1017/CBO9781139227193.003

Holtshouse, D. (1998). Knowledge research issues. *California Management Review, 40*(3), 277–280.

Honeycutt, T. C., & Strong, D. A. (2012). Using social network analysis to predict early collaboration within health advocacy coalitions. *American Journal of Evaluation, 33*(2), 221–239. https://doi-org/10.1177/1098214011424201

Hogue, T., Perkins, D. F., Clark, R., Bergstrum, A., Slinski, M., & Associates. (1995). Collaboration framework: Addressing community capacity. *National Network for Collaboration*.

Kadushin, C., Lindholm, M., Ryan, D., Brodsky, A., & Saxe, L. (2005). Why it is so difficult to form effective community coalitions. *City & Community, 4*(3), 255-275. https://doi-org /10.1111/j.1540-6040.2005.00116

Jabareen, Y. (2009). Building a conceptual framework: Philosophy, definitions, and procedure. *International Journal of Qualitative Methods, 8*(4), 49–62.

https://doi.org/10.1177/160940690900800406

Johnson, B., & Turner, L. A. (2003). Data collection strategies in mixed methods research. *Handbook of Mixed Methods in Social and Behavioral Research*, 297-319.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112–133. https://doi-org/10.1177/1558689806298224

Ken-Opurum, J., Lynch, K., Vandergraff, D., Miller, D. K., & Savaiano, D. A. (2019). A mixed-methods evaluation using effectiveness perception surveys, SNA, and county-level health statistics: A pilot study of eight rural Indiana community health coalitions. *Evaluation and Program Planning*, *77*. https://doi-org/10.1016/j.evalprogplan.2019.101709

Kilduff, M., & Brass, D. J. (2010). Organizational social network research: Core ideas and key debates. *Academy of Management Annals*, *4*(1), 317-357.

Knoke D, Yang S. *SNA* (2nd ed.) Thousand Oaks, CA; SAGE: 2008.

Kochan, S., & Teddlie, C. (2005). An evaluation of communication among high school faculty using network analysis. *New Directions for Evaluation*, *107*, 41-53. https://doi-org/10.1002/ev.160

Lahdelma, T., & Laakso, S. (2016). Network analysis as a method of evaluating enterprise networks in regional development projects. *Evaluation*, *22*(4), 435–450. https://doi-org/10.1177/1356389016667888

Lan, T., Kao, D., Chiang, M., & Sabharwal, A. (2010). *An axiomatic theory of fairness in network resource allocation* (pp. 1-9). IEEE.

Längler, M., Brouwer, J., & Gruber, H. (2019). Data collection for mixed method approaches in social network analysis. In *Mixed Methods Social Network Analysis* (pp. 25-37). Routledge.

Larson, A. (2018). Evaluation amidst complexity: Eight evaluation questions to explain how complex adaptive systems affect program impact. *Evaluation*, *24*(3), 353–362. https://doi-org/10.1177/1356389018781357

Lasker, R. D., Weiss, E. S., & Miller, R. (2001). Partnership synergy: A practical framework for studying and strengthening the collaborative advantage. *The Milbank Quarterly*, *79*(2), 179-205. https://doi.org/10.1111/1468-0009.00203

Laven, D. N., Krymkowski, D. H., Ventriss, C. L., Manning, R. E., & Mitchell, N. J. (2010). From partnerships to networks: New approaches for measuring U.S. national heritage area effectiveness. *Evaluation Review*, *34*(4), 271–298. https://doi-org/10.1177/0193841X10370668

Lee, S. H., Yang, J., Goddard, M. E., Visscher, P. M., & Wray, N. R. (2012). Estimation of pleiotropy between complex diseases using single-nucleotide polymorphism-derived genomic relationships and restricted maximum likelihood. *Bioinformatics*, *28*(19), 2540-2542. https://doi.org/10.1093/bioinformatics/bts474

Leutz, W. N. (1999). Five laws for integrating medical and social services: Lessons from the United States and the United Kingdom. *The Milbank Quarterly*, *77*(1), 77-110.

Levin, H. M., & McEwan, P. J. (2000). *Cost-effectiveness Analysis: Methods and Applications* (2nd ed.). Sage.

Lin, N. (2002). *Social Capital: A Theory of Social Structure and Action* (Vol. 19).

Cambridge University Press.

Lin, N. (2017). Building a network theory of social capital. *Social Capital*, 28-51.

Marin, A., & Wellman, B. (2014). Social network analysis: An introduction. *The SAGE Handbook of Social Network Analysis*, *11*, 25.

Marsden, P. V. (2005). Recent developments in network measurement. *Models and Methods in Social Network Analysis*, *8*, 30.

Marsden, P. (2014). Survey methods for network data. *The SAGE Handbook of Social Network Analysis, 25*, 370-388.

Martin, P. Y., & Turner, B. A. (1986). Grounded Theory and Organizational Research. *The Journal of Applied Behavioral Science*, *22*(2), 141–157. https://doi-org/10.1177/002188638602200207

Martınez, A., Dimitriadis, Y., Rubia, B., Gómez, E., & De la Fuente, P. (2003). Combining qualitative evaluation and SNA for the study of classroom social interactions. *Computers & Education*, *41*(4), 353-368. https://doi-org/10.1016/j.compedu.2003.06.001

Mertens, D. M. (2007). Transformative paradigm: Mixed methods and social justice. *Journal of Mixed Methods Research, 1*(3), 212–225. https://doi-org/10.1177/1558689807302811

Mertens, D. M. (2019). *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed Methods*. Sage.

Merriam, S.B. (2009). *Qualitative Research: A Guide to Design and Implementation*. Jossey-Bass.

Microsoft Corporation. (2018). *Microsoft Excel*. https://office.microsoft.com/excel

Minnesota Department of Health. (n.d.). Drug Overdose Dashboard. Indicator Dashboards Opioid Dashboard. Retrieved January 5, 2022, from https://www.health.state.mn.us/communities/opioids/opioid-dashboard/index.html

Mitchell, J. C. (1969). The concept and use of social networks. *Social Networks in Urban Situations.*

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, *22*(4), 853-886.

Mohamed, E. M., Agouti, T., Tikniouine, A., & El Adnani, M. (2019). A comprehensive literature review on community detection: Approaches and applications. *Procedia Computer Science*, *151*, 295-302. https://doi-org/10.1016/j.procs.2019.04.042

National Institute on Drug Abuse. (2022, January 20). *Overdose Death Rates*. https://nida.nih.gov/drug-topics/trends-statistics/overdose-death-rates

Newman, M. E. J. (2003). The Structure and function of complex networks. *SIAM Review*, *45*(2), 167–256. http://www.jstor.org/stable/25054401

Newman, M. E. J. (2006). Modularity and community structure in networks. *Proceedings of the National Academy of Sciences of the United States of America*, *103*(23), 8577–8582. http://www.jstor.org/stable/30050231

Palombi, L., Hawthorne, A. N., Irish, A., Becher, E., & Bowen, E. (2019). "One out of ten ain't going to make it": An analysis of recovery capital in the rural upper midwest. *Journal of Drug Issues*, *49*(4), 680–702. https://doi-org/10.1177/0022042619859309

Patterson, M. S., Prochnow, T., Richardson, R. G., & Jackson, K. P. (2020). Using

network analysis to conduct a system-wide program evaluation within a university. *Evaluation and Program Planning*, *79*, 101783. https://doi.org/10.1016/j.evalprogplan.2020.101783

Patton, M. (2002). *Qualitative Research & Evaluation Methods* (3rd ed.). Thousand Oaks, Calif.: Sage Publications.

Patton, M. Q. (2008). *Utilization-focused Evaluation* (4th ed.). Thousand Oaks, CA: Sage.

Patton, M. Q. (2010). *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use*. Guilford press.

Pawson, R., & Tilley, N. (1997). *Realistic Evaluation*. Sage.

Penuel, W. R., Sussex, W., Korbak, C., & Hoadley, C. (2006). Investigating the potential of using social network analysis in educational evaluation. *American Journal of Evaluation, 27*(4), 437–451. https://doi-org/10.1177/1098214006294307

Popelier, L. (2018). A scoping review on the current and potential use of social network analysis for evaluation purposes. *Evaluation, 24*(3), 325–352. https://doi-org/10.1177/1356389018782219

Prell, C. (2012). *Social Network Analysis: History, Theory and Methodology*. Sage.

Preskill, H. (Ed.) (2004). The transformational power of evaluation: Passion, purpose, and practice. SAGE Publications, Inc. https://dx.doi.org/10.4135/9781412984157

Preskill, H., Gopal, S., Mack, K., & Cook, J. (2014). Evaluating complexity: Propositions for improving practice.

Provan, K. G., & Milward, H. B. (1995). A preliminary theory of interorganizational network effectiveness: A comparative study of four community mental health systems. *Administrative Science Quarterly*, 1-33.

Provan, K. G., Nakama, L., Veazie, M. A., Teufel-Shone, N. I., & Huddleston, C. (2003). Building community capacity around chronic disease services through a collaborative interorganizational network. *Health Education & Behavior*, *30*(6), 646-662. https://doi-org/10.1177/1090198103255366

Provan, K. G., Veazie, M. A., Teufel-Shone, N. I., & Huddleston, C. (2004). Network analysis as a tool for assessing and building community capacity for provision of chronic disease services. *Health Promotion Practice*, *5*(2), 174-181. https://doi-org/10.1177/1524839903259303

Provan, K. G., Veazie, M. A., Staten, L. K., & Teufel-Shone, N. I. (2005). The use of network analysis to strengthen community partnerships. *Public Administration Review*, *65*(5), 603–613. http://www.jstor.org/stable/3542526

Pullen, E., & Oser, C. (2014). Barriers to substance abuse treatment in rural and urban communities: Counselor perspectives. *Substance Use & Misuse*, *49*(7), 891–901. https://doi-org/10.3109/10826084.2014.891615

Putnam, R. (1993). The prosperous community: Social capital and public life. *The American Prospect*, *13*(4).

Quinn, D., & Kim, J. (2018). Experimental effects of program management approach on teachers' professional ties and social capital. *Educational Evaluation and Policy Analysis*, *40*(2), 196-218. https://www.jstor.org/stable/44983427

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly*, *48*(2), 240–267. https://doi-org/10.2307/3556658

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2010). *Evaluation: A Systematic*

Approach. SAGE Publications.

Rstudio Team (2022). Rstudio: Integrated Development for R. Rstudio, PBC, Boston, MA. http://www.rstudio.com/

Rudd, R. A., Seth, P., David, F., & Scholl, L. (2016). Increases in drug and opioid-involved overdose deaths—United States, 2010–2015. *Morbidity and Mortality Weekly Report*, *65*(50 & 51), 1445-1452. https://doi.org/10.15585/mmwr.mm655051e1

Russ-Eft, D., & Preskill, H. (2009). *Evaluation in Organizations: A Systematic Approach to Enhancing Learning, Performance, and Change*. Basic Books.

Schneider, C. (2003). The influence of spatial scale on quantifying insect dispersal: an analysis of butterfly data. *Ecological Entomology*, *28*(2), 252-256. https://doi-org/10.1046/j.1365-2311.2003.00495

Schwandt, T. (2015). *Evaluation Foundations Revisited: Cultivating a Life of the Mind for Practice*. Stanford University Press.

Scott, J. (2017). *Social Network Analysis* (4th ed.). Sage.

Scott, W. R., & Davis, G. F. (2015). Organizations and organizing: Rational, natural and open systems perspectives. Routledge.

Scriven, M. (1991). *Evaluation Thesaurus*. Sage.

Shadish, W. R., Cook, T. D., & Leviton, L. C. (1991). *Foundations of Program Evaluation: Theories of Practice*. Sage.

Sih, A., Hanser, S. F., & McHugh, K. A. (2009). Social network theory: new insights and issues for behavioral ecologists. *Behavioral Ecology and Sociobiology*, *63*(7), 975-988. https://doi-org/10.1007/s00265-009-0725-6

Stone, W., & Hughes, J. (2002). Measuring social capital: Towards a standardized approach.

Strauss, A. L. (1987). *Qualitative Analysis for Social Scientists*. Cambridge University Press.

Stufflebeam, D. L. (2011). Meta-evaluation. *Journal of Multidisciplinary Evaluation, 7*(15), 99-158.

Trenor, J. M., Miller, M. K., & Gipson, K. G. (2011, June). Utilization of a think-aloud protocol to cognitively validate a survey instrument identifying social capital resources of engineering undergraduates. ASEE Annual Conference & Exposition (pp. 22-1656).

University of Minnesota Extension. (n.d.). Recovery Capitals. Community-based Solutions to the Opioid Crisis in Rural Minnesota. Retrieved March 4, 2022, from https://opioid.umn.edu/recovery-capitals

U.S. Department of Health and Human Services, Office of the Surgeon General. (2018). *Facing addiction in America: The Surgeon General's spotlight on opioids.* https://addiction.surgeongeneral.gov/sites/default/files/Spotlight-on-Opioids_09192018.pdf

Uzzi, B. (1997). Social structure and competition in interfirm networks. *Administrative Science Quarterly*, *42*(1), 37-69.

Valente, T. W., Coronges, K. A., Stevens, G. D., & Cousineau, M. R. (2008). Collaboration and competition in a children's health initiative coalition: A network analysis. *Evaluation and Program Planning*, *31*(4), 392-402. https://doi-org/10.1016/j.evalprogplan.2008.06.002

Valente, T. W. (2010). *Social Networks and Health: Models, Methods, and Applications*. Oxford University Press.

Valente, Thomas W, Palinkas, Lawrence A, Czaja, Sara, Chu, Kar-Hai, & Brown, C Hendricks. (2015). SNA for program implementation. *PloS One, 10*(6), E0131712.

Van Boekel, L. C., Brouwers, E. P., Van Weeghel, J., & Garretsen, H. F. (2013). Stigma among health professionals towards patients with substance use disorders and its consequences for healthcare delivery: systematic review. *Drug and Alcohol Dependence, 131*(1-2), 23-35. https://doi-org/10.1016/j.drugalcdep.2013.02.018

Van de Ven, A. H., & Ferry, D. L. (1980). Measuring and assessing organizations. Varda, D.; Chandra, A.; Stern, S.; Usanov, A. Partner (Program to Analyze, Record, and Track Networks to Enhance Relationships); RAND Corporation: Santa Monica, CA, USA, 2008.

Varda, D. M., & Sprong, S. (2020). Evaluating networks using PARTNER: A social network data tracking and learning tool. *New Directions for Evaluation, 2020*(165), 67-89. https://doi-org/10.1002/ev.20397

Vedres, B., & Stark, D. (2010). Structural folds: Generative disruption in overlapping groups. *American Journal of Sociology*, *115*(4), 1150–1190. https://doi.org/10.1086/649497

Walker, D. T., Bourne, L. M., & Shelley, A. (2008). Influence, stakeholder mapping and visualization. *Construction Management & Economics*, *26*(6), 645–658. https://doi-org /10.1080/01446190701882390

Walton, M. (2014). Applying complexity theory: A review to inform evaluation design.

Evaluation and Program Planning, *45*, 119-126. https://doi-org/10.1016/j.evalprogplan.2014.04.002

Walton, M. (2016). Expert views on applying complexity theory in evaluation: Opportunities and barriers. *Evaluation*, *22*(4), 410–423. https://doi-org/10.1177/1356389016667890

Wasserman, S., & Faust, K. (1994). Social network analysis: Methods and applications.

Weitz, N., Nilsson, M., & Davis, M. (2014). A nexus approach to the post-2015 agenda. *The SAIS Review of International Affairs*, *34*(2), 37-50.

White, H. C., Boorman, S. A., & Breiger, R. L. (1976). Social structure from multiple networks. i. Blockmodels of roles and positions. *American Journal of Sociology*, *81*(4), 730–780. http://www.jstor.org/stable/2777596

Williams, B., & Imam, I. (2007). *Systems Concepts in Evaluation: An Expert Anthology*. Edge Press of Inverness.

Williams, T. A., & Shepherd, D. A. (2017). Mixed method social network analysis: Combining inductive concept development, content analysis, and secondary data for quantitative analysis. *Organizational Research Methods*, *20*(2), 268–298. https://doi-org/10.1177/1094428115610807

Wolf-Branigin, M. (2013). *Using Complexity Theory for Research and Program Evaluation*. Oxford University Press.

Yarbrough, D. B., Shulha, L. M., Hopson, R. K., & Caruthers, F. A. (2010). *The Program Evaluation Standards: A Guide for Evaluators and Evaluation Users*. Sage Publications.

Yousefi Nooraie, R., Khan, S., Gutberg, J., & Baker, G. R. (2019). A network analysis

perspective to implementation: the example of health links to promote coordinated care. *Evaluation & the Health Professions*, *42*(4), 395-421. https://doi-org/10.1177/0163278718772887

Yousefi Nooraie, R., Sale, J. E. M., Marin, A., & Ross, L. E. (2020). Social network analysis: An example of fusion between quantitative and qualitative methods. *Journal of Mixed Methods Research*, *14*(1), 110–124. https://doi-org/10.1177/1558689818804060

Zimmerman, B., Lindberg, C., & Plsek, P. (1998). A complexity science primer: What is complexity science and why should I learn about it. *Edgeware: Lessons from Complexity Science for Health Care Leaders, Dallas, TX: VHA Inc.*

Zakocs, R. C., & Edwards, E. M. (2006). What explains community coalition effectiveness?: A review of the literature. *American Journal of Preventive Medicine*, *30*(4), 351-361. https://doi-org/10.1016/j.amepre.2005.12.004

APPENDICES

Appendix A: Consent Form
for
Dissertation Research
University of Minnesota, College of Education
Organizational Leadership and Policy Development
Doctoral Candidate: Lixin Zhang

Study: Structuring the Use of Social Network Analysis in Program Evaluation

What is the research?
You have been asked to participate in a research study conducted by Lixin Zhang, a Doctoral Candidate at the University of Minnesota. This study will be used to complete the doctoral requirements for the research component of the Evaluation Studies curriculum. This information will also be beneficial to the field of evaluation practice. The IRB has determined that STUDY00015959 is not human research.

Why have I been asked to take part?
You have been invited to participate because you are a key personnel or partner in the opioid crisis prevention work at some point over the program's timeframe (2018-2022).

Voluntary participation
This discussion is voluntary, and you do not have to participate if you do not want to. This project is not related to or sponsored by any national, state, or professional organization. If you do not participate, it will not affect your relationships with your professional organization. You may stop responding to the interview questions at any time and are not obligated to answer any questions.

Risks and Benefits
There are no known risks involved in taking part in this study. There are no personal risks or benefits. Your insights are helpful to this topic, and your participation in the study will provide an opportunity to reflect on your perspectives on using SNA methods in supporting the evaluation of social programs (i.e., opioid crisis prevention in rural communities).

Audio Recording
The interview will be audio recorded with your permission to ensure that your comments are accurately captured. Your privacy will be protected, and your name will not be used in any report. This discussion will be kept strictly confidential, and this recording will only be available to the interviewer. The recordings will be stored securely and erased when the analysis is completed.

If you agree to this consent form, please check yes and sign

_____ Yes, I agree to take part in this interview.

Name

_____

Signature

_____

Date

_____

Appendix B: Summary of Archival Documents

Data Source	Document Date	Document Name	Document Use	Description of how the document will help answer evaluation questions	Grant
Evaluation/Program work plan	2019	ROTA work plan	Provide a means of tracking change and development	Understand the project's goals, objectives, activities, targeted outcomes, timeline, collaborators, and outcome measures	ROTA
Program initiation	2018	RHSE project Initiation	Provide background and context	Provide the project's initial goals/objectives, assessment plan, target audience, products, intended outcomes	RHSE
Evaluation/ Research reports	2021	Rural health and safety grant final report	Provide a means of tracking change and development	Summarize the project impacts, outputs, outcomes	RHSE
Annual reports	2021	Federal report	Provide a means of tracking change and development	Summarize the project's accomplishments, dissemination of data, target audience, products	RHSE
Websites	2022	Education and Training	Provide supplementary data	Provide education and training information related to opioid and substance use disorder	RHSE
Evaluation/ Research reports	2021	Six community forums	Provide supplementary data	Provide community forum's speaker's name, organization, and key takeaway	RHSE

Data Source	Document Date	Document Name	Document Use	Description of how the document will help answer evaluation questions	Grant
Websites	2022	Website name	Provide supplementary data	Provide health education and resources created by the Extension team and community partners	SAMHSA
Annual reports	2019	RHSE federal progress report (year 1)	Provide a means of tracking change and development	Summarize the project's progress	RHSE
Annual reports	2020	RHSE federal progress report (year 2)	Provide a means of tracking change and development	Summarize the project's progress	RHSE
Program narrative	2020	Program name	Provide background and context	Provide the project's narrative	ROTA
Annual reports	2019	ROTA federal report (Year1)	Provide a means of tracking change and development	Provide project outputs, outcomes, products, and community partner data	ROTA
Annual reports	2020	ROTA federal report (Year2)	Provide a means of tracking change and development	Provide project outputs, outcomes, products, and community partner data	ROTA
Annual reports	2021	ROTA final report	Verify findings from other data sources	Provide project outputs, outcomes, products, and community partner data	ROTA

Data Source	Document Date	Document Name	Document Use	Description of how the document will help answer evaluation questions	Grant
Program initiation	2019	RHSE project Initiation	Provide background and context	Provide the project's initial goals/objectives, assessment plan, target audience, products, intended outcomes	RHSE
Annual reports	2021	RHSE progress report	Provide a means of tracking change and development	Summarize the project's progress	RHSE
Logic maps	2019	RHSE project logic map	Provide a means of tracking change and development	Outline the project's situation, inputs, activities, outputs, and outcomes	RHSE
Annual reports	2022	RHSE final report	Provide a means of tracking change and development	Provide project outputs, outcomes, products, and community partner data	RHSE
Logic maps	2020	SAMSHA logic map	Provide a means of tracking change and development	Outline the project's situation, inputs, activities, outputs, and outcomes	SAMHSA
Program narrative	2020	SAMSHA project narrative	Provide background and context	Provide project statement, approach, timeline, project management, etc.	SAMHSA
Annual reports	2021	ROTA 6 months progress report	Provide a means of tracking change and development	Summarize the project's progress	ROTA

Data Source	Document Date	Document Name	Document Use	Description of how the document will help answer evaluation questions	Grant
Secondary data	2021	Advisory Committee Report	Provide supplementary data	Outline ROTA organizations and their profiles	ROTA
Secondary data	2021	Stakeholder list	Provide supplementary data	List grant stakeholders and their organizations	PEW
Secondary data	2022	Program event form	Provide supplementary data	List organization information, including participant's email, the title of the event, date of the event, profession, event type, event location, educator, community partners	SAMHSA
Secondary data	2022	Stakeholder interview data	Provide supplementary data	Include stakeholder interview data from the third party	PEW

Note. SAMHSA = Substance Use and Mental Health Service Administration; PEW = PEW Charitable Trust; RHSE = Rural Health & Safety Education; ROTA = Rural Opioid Technical Assistance.

Appendix C: Community-Based Opioid Prevention and Education (C.O.P.E.)

Partnership Network Survey

Q1As a Community-Based Opioid Prevention and Education (C.O.P.E.) project partner, you are invited to participate in the *C.O.P.E. Partnership Network Survey*. This survey is designed to get your opinion about the partnerships within the C.O.P.E. Project. As we know, partnerships are essential to addressing the complex issue of the opioid crisis. Your responses will help us identify what is working and what are areas of growth related to the project's partnerships.

There are no right or wrong answers. Your opinion is important, even if it is different from others. The survey takes approximately 15 minutes to complete. Your participation is completely voluntary and confidential. Our report will include only aggregated information, and no individual respondents will be associated with specific responses.

The aggregate, anonymous survey results will be shared with project partners, and we will work with you to use the results for continuous improvement.

If you have any questions, please email Lixin Zhang at zhan4995@umn.edu.

Thank you!

Q2 Which organization are you working with to support the C.O.P.E. project led by the UMN Extension? *Check one best answer*

Note: The complete list of partner organizations was removed from the dissertation to maintain anonymity.

Q3 What type of organization do you represent? *Check one best answer*

- ○ Community-based Organization
- ○ Drug Courts/Treatment Courts/Sobriety Courts
- ○ Faith-based Organization
- ○ Government Department/Agency
- ○ Health Care
- ○ K-12 Schools/School System
- ○ Labor/Workforce Development
- ○ Legal/Criminal Justice
- ○ Media/Radio
- ○ Not-for-profit organization
- ○ Philanthropy
- ○ Professional Organization
- ○ Public Health/Human Services
- ○ Recovery Services
- ○ Tribal Organization
- ○ University/College
- ○ Other (Please specify) _____

Q4 What roles does your organization play in supporting the C.O.P.E. project? *Select all that apply*

- ☐ Advocacy and policy change
- ☐ Community connections
- ☐ Expertise/service in family support and community education
- ☐ Expertise/services in physical health
- ☐ Expertise/service in social, emotional and mental health
- ☐ Expertise/service in other wrap-around supports
- ☐ Funding
- ☐ Knowledge- and resource-sharing with other organizations
- ☐ Research/evaluation
- ☐ System building
- ☐ Workforce training and professional development
- ☐ Other (please specify) _____

Q5 How long have you been involved in the C.O.P.E. project?

- ○ Shorter than 1 month
- ○ 2-3 months
- ○ 3-6 months
- ○ 6-12 months
- ○ 1-3 years
- ○ 3-5 years
- ○ 5 years or longer

Q6 Which organization(s) do you **most frequently** work with on the C.O.P.E. project? ***Select up to seven organizations***

Note: The complete list of partner organizations was removed from the dissertation to maintain anonymity.

Q7 When did you form this partnership with **${lm://Field/1}**?

- ○ Shorter than 1 month
- ○ 2-3 months
- ○ 3-6 months
- ○ 6-12 months
- ○ 1-3 years
- ○ 3-5 years
- ○ 5 years or longer

Q8 What is your organization's most common way of interacting with **${lm://Field/1}**? *Check one best answer*

- ○ Awareness: Involves awareness of an organization's services, mission, etc.
- ○ Cooperative: Involves exchanging information, attending meetings, and sharing resources.
- ○ Coordinated: Involves synchronization of activities for mutual benefit
- ○ Integrated: Involves a formal or binding relationship involving contracts, grants, etc.

Q9 What activities does your relationship with **${lm://Field/1}** include?

	Yes	No
Advocacy/policy	○	○
Client referral systems	○	○
Coming to agreements on best practices	○	○
Developing tools	○	○
Funding activities/resource development	○	○
Learning from each other	○	○
Educational programs/training	○	○
Technical assistance/consultation	○	○
Research/evaluation	○	○
Service delivery	○	○
Other (please specify)	○	○

Q10 Approximately how frequently do you work with **${lm://Field/1}**?

- ○ Never/We only interact on issues unrelated to the collaborative
- ○ Once a year or less
- ○ About once a quarter
- ○ About once a month
- ○ Every week
- ○ Every day

Q11 Approximately how many collaborations do you have with **${lm://Field/1}**?

- ○ 0
- ○ 1
- ○ 2-5
- ○ 6-10
- ○ More than 10

Q12 How would you rate the value of the **${lm://Field/1}** in terms of the following items?

	Not at all	A small amount	A fair amount	A great deal
Power and influence	○	○	○	○
Commitment	○	○	○	○
Resource availability	○	○	○	○

Q13 To what extent do you trust the **${lm://Field/1}** in terms of the following items?

	Not at all	A small amount	A fair amount	A great deal
The partner organization is reliable.	○	○	○	○
The partner organization supports the mission of the program.	○	○	○	○
The partner organization is open to discussion.	○	○	○	○

Q14 The partnership with **${lm://Field/1}** has:

	already occurred	expect to occur	do not expect to occur
Increased acquisition of new knowledge or skills	○	○	○
Increased acquisition of additional funding	○	○	○
Improved my organization's capacity	○	○	○
Led to an exchange of resources	○	○	○
Led to improved services for my clients	○	○	○
Led to enhanced ability to serve the community	○	○	○
Led to development of new, valuable relationships	○	○	○
Led to new program development	○	○	○

Q15 To what extent has your participation in the partnership been helpful to you or your organization's work related to Opioid Use Disorder (OUD) or Substance Use Disorder (SUD)?

- ○ Not at all helpful
- ○ Not very helpful
- ○ Somewhat helpful
- ○ Very helpful
- ○ Don't know

Q16 How successfully has the C.O.P.E. project supported your community's ability to achieve the following goals?

	Not successful	Somewhat successful	Successful	Very successful	Completely successful
Increasing community awareness of opioid use disorders	○	○	○	○	○
Increasing identification of community members experiencing opioid use disorders	○	○	○	○	○
Improving the linkage of community partners to support services	○	○	○	○	○
Increasing evidence-based intervention in opioid crisis prevention	○	○	○	○	○
Identifying barriers and discrepancies between systems-level and personal networks of care and recovery	○	○	○	○	○

Q17 What are the challenges of partnering with other organizations within the C.O.P.E. project? *Select all that apply*

- ☐ Competing initiatives, priorities, and/or resources
- ☐ Diversion of time and resources
- ☐ Lack of financial resources
- ☐ Lack of long-term strategy
- ☐ Lack of infrastructure (e.g., physical space, data systems, collaborative supports)
- ☐ Lack of authority to act
- ☐ Lack of right partners
- ☐ Not aligned with external partners on vision, mission, goals
- ☐ Political resistance or uncertain policy environment
- ☐ Poor communication/lack of trust with partners
- ☐ I don't know
- ☐ Other (please specify) _____

Q18 Are any key organizations/partners missing from the C.O.P.E. project?

- ○ Name of organization _____
- ○ Name of organization
- ○ Name of organization
- ○ Name of organization
- ○ Name of organization

_____

Appendix D: Semi-Structured Interview Protocol

Name of the Study: Structuring the Use of Social Network Analysis in Program Evaluation

Date:
Time:
Location:
Type of Participant:
Interview Name:

Agenda

Overview of the topic: *The purpose of this interview is to better understand your experience with the opioid crisis prevention partnership network you have been involved in and your perspectives and insights on using social network analysis to better support the evaluation of this project.*

Introduction: *Before we start the interview, I would like to reiterate that this interview is voluntary. You can skip any question you do not want to answer (or end the interview at any time). Also, I would like to audio record the interview to accurately capture your perspectives. The interview recording will be transcribed for analysis, and all identifiable information will be removed. Is it ok to record our conversation?*

Yes___ No_____

Any additional questions you may have before the interview?

Interview Questions

First, let us quickly recall a few terms in the interview handout.

- By "**partnerships**," I refer to new or existing community partners developed as part of this work.
- **Partnership network** refers to the network formed by the community partners involved in the C.O.P.E. project.
- **Partnership relationships** in this context include cooperation, collaboration, and network influence. Developing and maintaining favorable and productive partnership relationships are essential in creating a program's value.
- **Social network analysis** studies structural relations among interacting actors (i.e., organizations) and the effect on the network (how those relationships produce varying effects). In this context, the networks refer to the partnership between community partners to achieve mutually desired C.O.P.E. project objectives.

Information on the interviewee

Q1. Please describe how you got involved in this project and your role.

Information on the partnership, relationship and use

We know how important partnerships are to the opioid crisis prevention work. In the next section, we will focus on the Information on networks, partnerships, and use.

Q2. Do you feel the current partnership is a good example of implementing a community-driven opioid response in rural communities?

- Please describe your understanding of partnership networks in your community.
- Who or what is missing from the current partnership network?

Now we would like to learn about your perceptions of the effectiveness of these developed partnership networks:

Q3. Do you think this partnership network has contributed to a more sustainable opioid response in your community?

- Can you give an example of when the partnership network was useful? Can you provide an example of when the partnership network was not useful?
- At what stages of the program was the partnership network most useful?

Social network tools and use

Now we would like to learn about the value of the network analysis method developed to support the evaluation of the opioid crisis prevention program.

Q4. ***Usefulness of the network findings***

- Do you think the information generated from the network findings (i.e., network results from archival documents and network surveys) will be valuable for supporting the development/improvement of the partnership network in your community?
- If so, how does the information generated from the survey benefit the opioid crisis prevention work in your community?
- How will you use the network findings to strengthen the partnership network in your community?

Q5. ***Innovation and evaluation***

- How does the SNA method support the evaluation of the opioid crisis prevention program? How might it change the quality of evaluations?
- To what extent do you feel using SNA to evaluate opioid crisis prevention can help improve the program outcomes?

Q6. ***Methodological challenges***

- What are some challenges in completing the C.O.P.E. partnership network survey?

Q7. In considering using SNA to continuously support the opioid prevention program evaluation, what do you see as the future of using social network analysis to support this work?

Thank you very much for your time today!

Appendix E: Complete List of Network Actors

ID	Organization Type	State
ACC	Legal/Criminal Justice	MN
ACPH	Public Health/Human Services	MN
ARC	Recovery Services	MN
BFBC	Tribal Organization	MN
BFHHS	Public Health/Human Services	MN
BFRS	Media/Radio	MN
CAPE	Coalition or Task Force	MN
CADT	Drug/Treatment/Sobriety Courts	MN
CLC	University/College	MN
ECMECC	University/College	MN
ERS	Recovery Services	MN
EH	Health Care	MN
FW	Community-based Organization	MN
HRS	Community-based Organization	MN
ICP	Legal/Criminal Justice	MN
ICPB	Public Health/Human Services	MN
LBH	Health Care	MN
LCVL	Community-based Organization	MN
MEDS	Health Care	MN
MEND	Community-based Organization	MN
MLBHHS	Tribal Organization	MN
MLBO	Tribal Organization	MN
MLBUO	Tribal Organization	MN

ID	Organization Type	State
MBTCL	University/College	MN
MATC	Recovery Services	MN
MDE	Government Department/Agency	MN
MDH	Government Department/Agency	MN
MR	Community-based Organization	MN
NACC	Health Care	MN
NESC	Community-based Organization	MN
NLY	Community-based Organization	MN
PIR	Recovery Services	MN
PRCE	Recovery Services	WI
WIPCHHS	Public Health/Human Services	MN
RMHC	Health Care	MN
RAD	Recovery Services	MN
RLNC	University/College	MN
RAAN	Coalition or Task Force	MN
SMN	Philanthropy	MN
JDTC	Drug/Treatment/Sobriety Courts	MN
SLPHHS	Public Health/Human Services	MN
SH	Health Care	MN
TFRR	Recovery Services	MN
UCP	University/College	MN
UFD	University/College	MN
KSUCEP		KY
UNRE		NV

ID	Organization Type	State
VA	Government Department/Agency	MN
WRC	Recovery Services	MN
YY	Community-based Organization	MN
4WS	Health Care	MN

Note. County information is removed from the list to maintain anonymity.