

Types of network-based interventions: a conceptual clarification

Original Study

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Abstract: The term “networks” is frequently used in the field of community intervention in a generic or metaphorical way, without necessarily referring to indicators based on graph theory. With the aim of contributing to greater conceptual clarification, in the first part of this article, we review five operational uses of network analysis in community intervention to evaluate social support resources, identify key players, monitor community coalitions, generate participatory dynamics, and improve program implementation. In the second part, we distinguish four uses of networks in the intervention, namely: preparatory, substantive, performative, and translation. I conclude by examining possible lines of research that could arise from the distinction between the use of networks or the modification of networks in the intervention.

Keywords: *Community coalitions • Key players • Social support • Participatory uses • Program implementation*

1. The structure of relationships in social intervention

The structural properties of social networks are related to risk behaviors, access to social support resources, and health outcomes. However, applications of network analysis in the development and implementation of interventions have been comparatively rare. Some areas where intervention experiences with promising results have been accumulating include HIV/AIDS prevention and smoking cessation (Shelton et al., 2019). With some frequency, these are interventions that are based on innovation diffusion models and that focus on localized and clearly delimited networks (Kennedy et al., 2022).

In this article, we will review and systematize experiences that incorporate social relations as a central component in community interventions. Following Thomas Valente, we understand network-based interventions as those “intentional efforts in which social networks or social network data are used to generate social influence, accelerate behavior change, improve performance, and/or achieve desired outcomes” (Valente, 2012, p. 49). The adoption of a structural approach has, among other

antecedents, Kurt Lewin’s approach in which he examined the impact of situational factors and other people’s behavior in determining individual behavior (Freeman, 2004).

1.1 From metaphor to the analytical use of networks

In the field of community intervention, “networks” have very often been referred to in a metaphorical sense. The term is used generically, or vaguely, to refer to the mobilization of individuals’ informal social support resources. Among social work professionals, “networking” refers to the collaboration between the different players and agencies involved in the follow-up of a case, to ensure the relevance, functionality, and continuity of services. It can also be used in the qualitative description of community interaction structures, although it does not necessarily translate operationally into the formulation of graph theory-based indicators.

In this text, we adopt a more restrictive use of the term. With the term “network-based interventions,” we will refer to psychosocial interventions that use social network analysis techniques in program design, implementation, or evaluation. This can occur at multiple ecological

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levels. At an individual level, network analysis is used to identify opinion leaders and key players. At a group level, it is applied in the evaluation of self-help and social support groups, or in training with groups sharing risk behavior. At a meso-social level, it can be used to describe the structure of communities or inter-organizational collaboration networks. However, as we will have the opportunity to show, the network approach is characterized by its flexibility in combining the micro and macro-social levels.

2. Uses of networks in intervention

Below, we review five network-based intervention modalities. First, we describe social support strategies, the targeting of key individuals and groups, and the development of community coalitions. Second, we examine the use of networks as a tool for participatory action and in monitoring program implementation. In the first three modalities, networks are part of the content of the intervention. In the last two, networks are integrated into the intervention process.

2.1 Social support structures and resources

Programs based on “social support networks” have a long tradition in community intervention (Gracia, 1997). Support groups bring together people who share the same problem to generate coping dynamics based on the exchange of mutual help. In this context, reciprocity, empathy, and the adoption of an active role by all participants are associated with positive results in the treatment of chronic diseases, family problems, and mental health needs. This is an area in which analysis of the functional aspects of social support has predominated over the structural properties of social networks (Maya-Jariego, 2009; Maya Jariego et al., 1999; Maya-Jariego & Holgado, 2015). Nevertheless, the types of exchanges that take place in support and self-help groups can be assessed with network analysis techniques, both in terms of small group interaction patterns (Zhang & Yang, 2015) and the development of strong relationships between members (Esmaeeli et al., 2022).

A recent example involved an intervention using network analysis and visualization techniques to improve the social support resources accessed by homeless individuals (Kennedy et al., 2022). The visual representation of the personal network served to reduce risk behaviors and to increase positive supportive exchanges. In the context of a motivational interview, visualization allowed for the

identification of the people with whom the individual interacted to use drugs. It also served to identify support resources available in the interpersonal environment, contributing to the achievement of program objectives related to greater housing stability. As this experience illustrates, presenting the personal network structure promotes awareness and facilitates behavioral change.

2.2 A tool for identifying opinion leaders, key players, and cohesive subgroups

The canonical use of the analysis of the structural properties of networks in the design and implementation of psychosocial interventions possibly begins with strategies for detecting opinion leaders and other key players. The aim is to identify those individuals who stand out for their levels of popularity or connectivity in a given social network and who, as a result, can contribute efficiently to the dissemination of preventive messages or the behavioral change of the group’s members. This is usually done using indicators of individual centrality, such as degree or betweenness (Valente, 2012). Well-connected individuals can act as opinion leaders and often have a prescriptive capacity over the behavior of others. Drawing on individuals with higher levels of social activity accelerates dissemination processes, while intermediation indicators allow diverse subgroups to be reached (Maya-Jariego & Holgado, 2017). An especially effective alternative is to identify which individuals optimally span the largest portion of the network (Borgatti, 2006). The identification of key players is useful for both the efficient diffusion of information and for fragmenting a network by hindering its normal functioning (Borgatti, 2003).

The use of network-based methods has been shown to be particularly effective in smoking prevention among high school students (Starkey et al., 2009; Valente et al., 2003). Natural leaders are characterized by being well-connected and influential among their peers. They also tend to use the same communication style as the target population, thus improving community relevance and adequacy in the dissemination of health messages. This has been reflected in the expansion of peer education strategies in public health campaigns. In COVID-19 community prevention, the World Health Organization (WHO) collaborated with influencers on Instagram and YouTube to promote behaviors such as face mask use, hand washing, and physical distance (Young et al., 2021). These people with high social prominence, popularly known as “influencers,” can be identified through indicators such as the number of followers, the number of mentions, or the number of times

their posts are shared, which indirectly informs people about their position in online interaction structures.

A second strategy based on the calculation of structural indicators consists of administering interventions to pre-existing groups. In this case, network analysis is used to segment a collective into subgroups of friends or to identify sets of individuals who share a risk behavior.¹ This is done by calculating cliques, factions, clusters, and communities, among other strategies for detecting cohesive subgroups (Valente, 2012). Small group intervention is particularly effective in changing social norms. It also makes it possible to take advantage of the impact of social influence processes in changing individual behavior. In practice, it is a type of action that improves the coverage of hard-to-reach groups and contributes to the sustainability of interventions in the medium and long term (Maya-Jariego, 2016).

One of the areas where it has been successfully applied is in the prevention of AIDS, HIV, and, in general, sexually transmitted infections. Condom promotion programs have been effectively implemented with natural groups. That is, with sets of individuals who define themselves as part of a group even before the intervention is designed. This differentiates it from peer education, where the individuals selected to lead the intervention may not know or have not previously interacted with the peer group (Wang et al., 2011). Acting on groups that have a previous relationship has shown substantial improvement in condom use and a lower occurrence of HIV and sexually transmitted diseases when compared to a control group (Wang et al., 2011). Segmentation strategies also allow different messages to be directed to different groups, improving the relevance and appropriateness of preventive messages (Coates et al., 2008).

2.3 Analysis and development of inter-organizational networks in the community

Community coalitions are alliances between organizations in a specific community context that collaborate with each

other to achieve a common goal (Butterfoss, 2007). They have been frequently used in the field of public health. As they are usually channeled through groups of individuals representing the different entities involved, their effectiveness is often highly dependent on the leadership and cohesion of the group (Zacocs & Edwards, 2006). The network approach makes it possible to examine this form of community action as an inter-organizational network among the participating entities (Laumann et al., 1978). It has been found that effective coalitions usually adopt a core-periphery structure, in which some units exercise a relevant role of leadership, coordination, and involvement of the other players (Faust et al., 2015). These types of alliances generate a shared vision among key individuals and institutions in the community and improve the coordination of services (Butterfoss & Kegler, 2002; Maya-Jariego & Holgado, 2021b).

The longitudinal tracking of networks serves to monitor collaboration between organizations, recording, where appropriate, the formation of relationships over time. For example, in a coalition advocating for greater racial equity in the criminal justice system in Chicago, the network of entities was found to enable the functional integration of heterogeneous organizations (Haapanen et al., 2024). Specifically, it served to connect entities developing restorative justice programs with community-based grassroots organizations. As a result, specialized justice entities improved their capacities to achieve changes in public policy (Christens & Cooper, 2021). In this case, analysis of the interaction between organizations in multiple relational domains highlighted the value of collaboration between entities that are considerably diverse from one another.

2.4 Participatory uses of social networks

Another way of linking networks to intervention is to make use of relationship visualization as an intervention tool in its own right. The graphic representation of personal networks reveals emergent properties that are not intuitive in the first instance for the individual (Maya-Jariego & Holgado, 2005), and that can serve as a catalyst for behavioral change (Kennedy et al., 2022). It also allows for the identification of the groups and communities into which each subject is integrated (Maya-Jariego & Cachia, 2019). In small groups, the visual representation of the interactions occurring among members generates social comparison processes and has an impact on individual performance levels (Borgatti & Molina, 2002; Holgado, 2018). At a community level, the participation of

¹ It is a matter of detecting natural groups that are linked by a relationship prior to the intervention. In preventive programs, it is common to target interventions at groups that share a risk behavior, such as syringe exchange in drug use by injection. In this area, some longitudinal studies have shown, for example, that the level of popularity is significantly associated with substance use (Moody et al., 2011).

representatives of the different interest groups in the participatory diagnosis of the relationships between local key players produces a shared vision that, in turn, facilitates strategic planning (Schiffer, 2007). In all these cases, visual representation contributes to awareness of the network structure in which individuals are immersed and motivates behavioral change. In any case, it is not so much the visualization itself as its ability to explore, describe, and communicate the structural properties of the network (Brandes et al., 2005).

Following this logic, in a community-based HIV prevention intervention in Kenya, visual representations of sexual contact networks were used as a strategy to promote behavioral change (Knopf et al., 2014). The visualizations empirically illustrated how the existence of concurrent sexual partners (at an interpersonal level) produced very important changes in the connectivity of the network as a whole. In each village, anonymous data on sexual relationships among all village residents were used. Public assemblies then discussed how changes in individual behavior could have a population-level effect. This strategy proved effective in transforming social norms. The experience also showed that, along with purely descriptive uses, network visualization can have a performative value. In this case, it proved functional in the implementation of community AIDS prevention programs.

2.5 Integration of networks into the intervention process

The most common way to incorporate the network approach into intervention is to use it as a guide in program design, or at any rate to interpret the content of interventions from a relational perspective (Sheldon, 2019). However, network analysis can also be used in the implementation, transfer, or sustainability of interventions.

As part of the needs assessment, networks can provide a description of the community context in which the intervention takes place. They are particularly useful for mapping resources, identifying local leaders, or examining relationships between different stakeholders (Latkin & Knowlton, 2015). In program evaluation they also have significant potential (Durland & Fredericks, 2005), as demonstrated by the application of network techniques to monitor collaboration between teachers within the school (Penuel et al., 2006), local development processes (Giuliani & Pietrobelli, 2011), community coalitions (Drew et al., 2011), the implementation of sex education activities (Broccatelli et al., 2021), and prevention programs in

primary and secondary education (Gest et al., 2011). On the other hand, once the intervention ends, they serve to assess the existence of power structures and prominent players that affect the sustainability of the intervention (Valente et al., 2015). In all these cases, both personal network indicators and full network indicators can be used.

However, the area where possibly the incorporation of network analysis has been most novel and innovative lies in the monitoring and improvement of program implementation. The central idea consists of assuming that the interaction occurring between the different agents involved in the development of programs determines both their performance and their impact (Valente et al., 2015). On the one hand, during the development of interventions, participants establish relationships among themselves. On the other hand, the program facilitators also actively collaborate in the implementation of the activities. In Appendix 1, we have compiled other possible significant relationships that normally take place in the design, transfer, and implementation phases of programs. This opens up enormous potential for translating implementation into relational terms. One of the great benefits of taking these relationships into consideration is the opportunity to incorporate changes, improvements, and adjustments throughout program development.

Although this is an emerging area of research, some evidence has accumulated on the importance of relationships in the implementation process. We can illustrate this with a few examples. With regard to the target population, an intervention to prevent childhood obesity showed that the network of relationships between participating parents increased in density over the course of implementation (Gesell et al., 2013). At the same time, that increase in network connectivity was significantly associated with a greater impact of the intervention. In terms of facilitators, it has been found that the adoption of evidence-based practices might depend on peer pressure, whereas implementation fidelity would be more related to access to novel scientific information through intermediaries (Neal & Neal, 2019). Similarly, in a community-based drug prevention initiative, it was observed that facilitators who had greater centrality in their relationships with peers exercised a key coordinating role in the program, whereas a series of peripheral intermediaries facilitated the adaptation of the intervention to the specific community contexts in which it was carried out (Maya Jariego & Holgado, 2021a). In psychoeducational interventions, in addition to facilitators, both school principals (Neal et al., 2020) and other staff (Maya-Jariego et al., 2024) may have a relevant role in implementation fidelity.

3. Toward a typology of network-based interventions

Valente's (2012) original proposal distinguishes four basic network-based intervention strategies: (1) the identification of prominent players in the social network, (2) the segmentation of the network into groups, (3) the induction or activation of new relationships, and (4) the modification or alteration of the network. The first two are the most commonly used; they are usually based on innovation dissemination models to promote behavioral change and often consist of the calculation of structural indicators of networks with which to define preventive strategies. Consequently, relational data are in this case a decision-making tool for the intervention that follows. In the last two cases, on the other hand, the relational content is part of the very definition of the intervention: first, by eliciting social interaction between some of the players that are part of the network (*induction*); second, by modifying the network structure itself, either by adding or by deleting nodes or links, or even by re-establishing pre-existing links (*alteration*).

It is this differentiation that leads Robins et al. (2023) to distinguish between interventions that *use* the social network and those that *modify* it. The former promote behavioral and attitudinal change through relationships, while the latter focus on modifying the structure of social systems.² In turn, each of them can be developed locally, in a defined social environment (*setting*), or address the system as a whole. This approach is perfectly in line with the use of multiple ecological levels of analysis in psychology (Bronfenbrenner, 1979). In this context, the modification of social networks has a greater potential to produce systemic changes, which go beyond the mere aggregation of individual changes.

In our case, we have started with a previous analysis (Maya-Jariego, 2016; Maya-Jariego & Holgado, 2017) from which to develop an inductive classification of the most common uses of the term "network-based interventions." Table 1 summarizes the basic types we have reviewed, taking the field of community intervention as a reference. In the table, we have separated the selection and segmentation strategies into different categories, as these are widely used strategies for which wide evidence has accumulated. However, both involve an instrumental use of networks to identify individuals and groups to intervene

in. For each type analyzed, the theoretical basis, the advantages it provides, and the way in which they are normally made operational with structural indicators based on network analysis are described. Two uses are clearly connected to Thomas Valente's typology and coincide with the strategies that Garry Robins and his collaborators' group under the category of "identification"; these are the selection of key players and segmentation into natural groups to develop community prevention strategies.

However, we have also documented the use of the term "social support networks" to refer to the resources provided by relationship structures, as well as the longitudinal examination of inter-organizational networks to track the evolution of community coalitions. Both can be considered "modification" strategies, by introducing changes in the contexts of interaction at group and community levels, respectively. Finally, we have shown the instrumental use of networks to promote participatory action or to monitor program implementation. In these last two cases, networks *are part* of the intervention process, or its follow-up and continuous improvement.

Our inductive classification of network-based interventions reveals the existence of two different dimensions, which overlap with each other and that should be differentiated in order to formulate a systematic classification thereof:

- How networks are used in the intervention?
- The relational content of the intervention.

First, network analysis and visualization are used in practice to gain insight into the properties of the social system being intervened upon, as a means of diffusing innovation or behavioral change; to modify the structure of community contexts and social systems; as a catalyst for collective self-efficacy and participation; and as a tool for monitoring interventions, among other potential uses. This opens up a wide range of possibilities for integrating relational data into program design and implementation.

Second, social relationships, at their multiple ecological levels, often constitute the central elements of the intervention. This makes it necessary to understand the different mechanisms through which we are influenced by relationships with others and, consequently, to be more explicit about the types of relationships that inform intervention programs (Veenstra & Laninga-Wijnen, 2022). Without being exhaustive, relationships are at the core of community interventions that draw on the mobilization, training, or involvement of support providers; mentors, tutors, and chaperones; behavioral prescribers and social influencers; mediators and intermediaries; and educators, coaches, and trainers, among many others

² More specifically, Robins et al. (2023) differentiate three types: identification, diffusion, and structural change.

Type of intervention	Psychosocial foundation	Network analysis strategies	Advantages
Social support and self-help	• Use of own resources • Empowerment • Empathy	Support and multiplicity modalities	• Subjective value
Selection of key players	• Behavioral models • Natural communication	Indicators of individual centrality (e.g., degree and betweenness)	• Efficient dissemination • Community setting • Sustainability
Segmentation into natural groups	• Social norms • Social influence	Detection of cohesive subgroups (e.g., cliques, communities)	• Modification of norms in natural groups • Coverage • Sustainability
Monitor inter-organizational networks	• Social norms • Collaboration among key players	Evaluation of core-periphery structures	• Coordination of services • Shared goals
Participatory uses of networks	• Awareness • Social comparison • Self-efficacy	Visualization of personal and key player networks in community contexts	• Generates a shared vision • Induces behavioral change
Monitor program implementation	• Relational basis for fidelity, fit, and effectiveness	Density of relationships among participants and science-practice chains	• Make adjustments and improvements during implementation

Table 1. Types of network-based interventions.

Source: Author's contribution.

(Maya Jariego, 2021). Moreover, the immediate family context often plays a central role in determining the risk and protective factors common to different social problems.

In any case, interventions can have a behavioral basis independent of the structural and relational aspects on

which we have focused in this article. In this regard, it would be interesting to explore the interaction between the content of the interventions and the relational context in which they are developed.

4. Conclusion

Networks can play a relevant role in the design, implementation, and monitoring of interventions to promote behavioral change (Valente, 2017). In this article, we have reviewed the various modalities with which to connect networks to intervention. It is common for networks to be used for preparatory purposes, to design educational interventions, or to disseminate health messages taking into consideration the structure of the community before implementing a program. Substantive use can also be made of networks, giving content to interventions, as occurs in programs that aim to modify the relationships of participants, either through support groups or collaboration between organizations. In some cases, the performative power of visualizing personal networks or whole networks is used to elicit behavioral change. Finally, we have shown that networks can also be integrated with the implementation process itself, in the relational translation

Uses	Description
• Preparatory	Calculate properties of the pre-existing social structure in order to design relevant, appropriate, and potentially effective interventions
• Substantive	Modify participants' relationships through self-help groups, inter-organizational networks, and other interventions
• Performative	Use network visualization to promote behavioral change, through awareness or social comparison
• Translation	Reveal the interactions that take place among participants in a program, or between facilitators and other stakeholders

Table 2. Four uses of networks in intervention.

Source: Author's contribution.

of a needs assessment, activity implementation, or program evaluation. Table 2 summarizes these four modalities. This conceptual clarification exercise could contribute to further research in this area in the future.

The peculiarity of this classification consists in examining networks from the point of view of action. What differentiates each of these four types is not the network indicators or the structural properties analyzed, but the role that network analysis plays in the intervention process. There is a canonical or substantive use that consists of developing programs whose *content* is based on relationships or on the modification of relationships. Alternatively, there is a preparatory or *instrumental* use in which relational data are collected for the design of programs. Nevertheless, network analysis can also be used in *participatory* strategies to promote behavioral change, as well as in *monitoring* and improving the implementation of programs. That is, it can be integrated with the intervention process itself.

4.1 An ongoing research agenda

The use of structural properties of social networks in the design of community prevention strategies already has some historical background. However, it is in the last decade, especially since the review by Thomas Valente (2012), that this topic has become an emerging area of network analysis research. Broadly speaking, there is a consolidated line of research, consisting of the use of centrality, intermediation, and clustering indicators to identify key players and social groups on which to influence intervention. These are preparatory strategies, as we have indicated. Additionally, we can mention other lines under development that may possibly offer novelties in the coming years:

- First, the longitudinal monitoring of the exchanges that take place in support groups, or of the inter-organizational relationships that are established within a community coalition, corresponds to a substantive use of networks, with interventions that aim to modify relationships in the target population. This line would benefit from the use of quasi-experimental designs and randomized controlled trials. Moreover, it is promising to explore how the pre-existing configuration of the network determines the type of outcome obtained with the intervention (Matous et al., 2021).
- Second, it is practical to explore which properties of visual representations of networks promote awareness or social comparison and, consequently, facilitate behavioral change. Preliminary developments in this regard already exist in clinical, group, and community settings.

- Third, the relational translation of program implementation is one of the areas with the greatest potential for research and can be particularly useful in improving interventions. In this case, it is the relationships between different stakeholders in program design and implementation that can determine intervention outcomes. Some of the potentially relevant exchanges are systematized in Appendix 1. Two central relationships in program implementation are the interaction among facilitators and the interaction among participants. Facilitators collaborate with each other during program implementation. Participants develop relationships that can determine the impact of the intervention. However, there are other relationships that may be relevant during the intervention process. The table highlights some of the most common. Thus, academics transfer evidence-based practices to intervention professionals. Facilitators also connect with other professionals who are functional in the implementation of the program.

Ultimately, over the last decade, the first steps have been taken to understand the different mechanisms and the different types of relationships that make network-based interventions work (Veenstra & Laninga-Wijnen, 2022). This occurs in a context in which we are still in the process of typifying the modalities of network intervention. We have also tried to contribute to this effort with these pages.

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Author contributions

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Conflict of interest statement

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Appendix 1 Types of relationships involved in the program implementation process.

	Academics and experts who design EBPs	Program facilitators	Participants	Organizations, services, and institutions	Other professionals
Academics and experts who design EBPs	• Building models and “theories of change”	• Adoption of EBP • Transfer chains	• Program evaluation	• Training and capacity building	• Preparing the community context
Program facilitators		• Coordination of activities • Exchange of best practices • Consistency of implementation	• Catalytic link to behavioral changes	• Accessibility to services and continuity of care	• Organizational integration of the program • Local setting
Participants			• Cohesion of the receiving social system and behavioral regulation • Effectiveness of the intervention	• Comprehensive need satisfaction	• Access to complementary resources
Organizations, services, and institutions				• Service networks • Continuity of services	• Synergies and resource leveraging
Other professionals					• Networking

Source: Author's contribution.