Social Network Health Interventions

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J. A. Barnes defined the concept of the social network in 1954 as a set of points (nodes) and lines (links). Its structure and its relationships are analyzed through a range of methods and tools, called social network analysis (SNA), whose ancestor is the methodology of sociometry introduced by the psychiatrist Jacob L. Moreno. SNA explores the social interactions between individuals or organizations. Even though this network analysis emerged primarily from the domain of social psychology, it has been widely used, since the 1960s, by a plethora of disciplines, including sociology, anthropology, history, mathematics and graph theory, as well as computer science, contributing to the expansion of SNA. Network analysis was further developed at Harvard University, where physician Harrison White established the perennial theory of SNA. Many distinguished authors, considered as a reference in social sciences, have been influenced by this theory: sociologist Everett Rogers utilized the SNA concept to explain the process of diffusion of innovation within a network; psychologist Stanley Milgram indicated that any person could be connected to another through roughly six social links ("small-world" theory); finally, one of White's students, Mark Granovetter, pointed out the strength of interpersonal ties within a social network (SN).

From a communication perspective, a social network is composed of unique identifiable profiles connected to each other, interacting, creating, consulting, or sharing information or content. From the same standpoint, an SN is perceived as a digital social network (DSN); however, it also maintains an offline presence.

Even if most health interventions continue to focus on an individual level, their underlying strategies struggle to measure the importance of an individual's social environment. However, more and more studies are examining the network's influence, both societal and digital, on our health behaviors. It is noteworthy that significant developments have been made in comprehending the features of social networks since the more we understand networks' functions, the more we can improve health interventions.

Social networks and health behaviors

The impact of social networks – examined through the prism of their functional traits and structure – on the individuals' physical health and health behaviors is widely discussed in the literature (Shelton et al., 2019). First of all, at a functional level, an individual's social network features, such as social support, social norms, social cohesion,

or even social capital, play a crucial role in shaping the individual's health behavior and physical health. Moreover, the structural aspect of a social network (i.e., its size, density, and interconnectivity of its members) can affect an individual's health behaviors and attitudes through their access to resources, information, and support networks. In other words, the more an individual occupies a pivotal place within their network, the more they will benefit from its resources (Shelton et al., 2019). It has also been shown that certain noncommunicable diseases, such as depression or obesity, have been to a large extent dependent on social networks (Coeira, 2013). Hence, the importance of the influence of a network on an individual's health makes interventions on social networks particularly relevant.

Types of social network interventions

Valente (2012) introduced the term "network interventions" to describe the process of using social networks, or their data, to influence or accelerate behavioral change among individuals, communities, organizations, or an entire population. He distinguished four types of network interventions. The first type occurs at an *individual* level. The vast majority of these interventions involve identifying a key actor within an SN to operate as an activist aiming to change or adopt a health behavior. Campbell and colleagues (2008), in their study involving young high school students, recruited and trained a few influential students in an attempt to encourage their peers during social interactions outside of class not to smoke – a particularly effective approach. This kind of intervention relies on the utilization of opinion leaders to relay information, a theory that Katz and Lazarsfeld dubbed a two-step flow of communication.

The second type of intervention, *segmentation*, operates directly within a network of peers. Contrary to the individual intervention, it focuses on shifting simultaneously the behavior of a peer group. Indeed, certain individual behaviors are induced by peer group norms; consequently, the only way to shift their behaviors is to act at a peer-group level. To give an example on a health-related theme, the prevention of nosocomial infections in hospitals requires all hospital staff to adopt hand hygiene practices.

The third level of intervention, the network *induction*, as defined by Valente, involves stimulating interactions between individuals within the same social network to disseminate information on health behaviors. At this point, the interventions do not depend strictly on the network's data; nonetheless, they resort to the presence of a network with preexisting social ties to acquire the desired outcome. This type of intervention, similar to word-of-mouth, is particularly suitable when trying to reach a network of individuals with common behaviors, often considered as marginal. For instance, it is used for prevention programs for drug users.

Finally, the fourth type of intervention, which Valente conceptualized as network *alteration*, involves changing a network's structure by adding or removing some members or reconsidering certain social ties between its different members. For example, in the case of an epidemic, quarantining individuals infected with the virus functions as an intervention strategy, suggesting the removal of one or more members of the network to limit the spread of the virus. Additionally, it is also possible to integrate a

new member to the network, subsequently creating new ties. Alcoholics Anonymous relies on this intervention method to create links between individuals with the same addiction through a third party.

Structure of social networks and dissemination of information

The structure of social networks influences the diffusion of information and therefore information on health issues. The networks comprise social ties that we qualify in reference to Granovetter's (1973) theories of strong and/or weak ties (strong ties are established with our close friends and relatives, while weak ties signify relationships with individuals that we rarely see). Network analysis allows the visualization of the strong ties regrouped by multiple triangles of close friends. Information disseminated through this network is thus repeated from one individual to another, consequently becoming redundant as it circulates within the network. Due to this redundancy, transmission eventually stops. Conversely, a social network composed primarily of weak ties is broader. Its structure is represented in the form of a pyramid: an individual is in contact with two individuals who do not know each other. In their turn, these two individuals will contact two other individuals belonging to a new network, and so on. Under this configuration, information is transmitted further and more rapidly. The diffusion of information via (social) contagion facilitates the quick transmission of prevention messages to a large population while limiting the issue of redundancy. Nonetheless, when an intervention aims to change health behaviors which require a high individual commitment, the model of diffusion via contagion becomes less efficient since it urges individuals to be exposed to the same message repeatedly. This process of repetition is conceptualized in the literature as social reinforcement. Therefore, to succeed in shifting health behaviors, the message should be diffused via weak and strong ties, in other words, a complex contagion dissemination model (Centola, 2013).

Digital social network health interventions

The digital contribution of health interventions to networks

The scale of application enabled by information and communication technologies (ICTs), particularly by DSNs, increases the possibilities and scope of health interventions considerably, overcoming geographic and time limits. This phenomenon is notably evident in the field of epidemiology regarding communities of patients or even public health promotion. Epidemiology, whose goal is to comprehend the diffusion patterns of a disease within a population, has considerably benefited from the digital contribution. As a result, the term digital epidemiology is now used to qualify epidemiology that uses digital data generated outside the public health system, produced without the primary intention of doing epidemiology per se (Salathé, 2018). Among the benefits is faster detection of diseases, unlike the usual tracing reports,

which often lag the actual progression of the disease by one to two weeks – a fact that generates a positive impact on the forecast and, consequently, on the effectiveness of health intervention strategies. The use of digital data also allows the anticipation of pandemic phenomena. Algorithmic processing techniques and the creation of advanced alerts from data generated on networks will carry an increasingly decisive weight in public health interventions (consider, for example, the importance of mobile tracking applications during the COVID-19 pandemic). Despite the potential of some digital tools, current research tends to view these technologies as complementary to rather than a replacement for traditional public health surveillance tools.

Among health interventions on digital social networks, it is crucial to mention patient communities. Many online platforms pave the way for the development of peer interactions. Within these community spaces, interactions range from the consumption to the creation of health content (user-generated content), produced at different levels of communication: private, semi-private, one-to-one messages or public discussion forums (Mi et al., 2020). Patient communities contribute to the management of disease and health to a considerable extent. Several studies have indicated that online engagement enhances the well-being of people who are ill while reducing their stress level and the risks of depression (Mi et al., 2020; Coeira, 2013). Indeed, the act of sharing one's condition and concerns, obtaining feedback, while also cultivating a sense of belonging, allows patients to better understand their pathology. In general health management, social networks often provide an opportunity to exchange medical "tips." Social media is capable of creating coalitions – so-called communities of interests – around common objectives. ICTs enable interactions to occur anywhere, at any time. Such exchanges can take place without a preexisting relationship, providing at the same time the option to maintain anonymity, a fact that reflects their online success. Finally, the constitution of digital patient records, as well as the sharing of important clinical databases, provide significant perspectives in the field of personalized medicine, and more globally in personalized health.

Furthermore, digital social networks have laid the foundation for a new impetus in public health promotional campaigns. They constitute an additional channel of information diffusion via a unidirectional model of one-to-many (a feature of traditional media communication), while also functioning as the ideal environment for the diffusion of information via contagion (as discussed above), a process which is qualified as viral. Such a strategy is particularly relevant when a campaign's primary objective focuses not on shifting behaviors but on informing the population in a rapid and highly cost-effective way. Additionally, the interactivity features of digital social networks stimulate audience engagement. Indeed, by taking advantage of functionalities such as likes, shares, and comments, public health organisms can engage Internet users in their campaigns in an attempt to increase their virality and impact. The latter will play a more prominent role if a campaign appeals to opinion leaders to relay information. The use of DSNs to promote public health can also improve evaluation of prevention campaigns via analysis of the users' digital traces. Finally, the data of DSNs allow targeting of specific profiles, particularly high-risk populations for certain diseases.

Risks of health interventions on digital social networks

The use of DSNs in public health interventions also carries certain risks. Inequalities in access and the use of ICTs in general, and DSNs in particular, can lead to representativeness bias. The latter can cause significant repercussions on interventions carried out via DSNs, and it becomes more difficult to reach more vulnerable populations as well as those at highest risk.

In regard to eHealth, the availability and cross-referencing of digital health data raises several medical, ethical, and even legal questions. The principal risk concerns the reidentification of supposedly anonymous individuals when different databases are regrouped. Hence, anonymous and personal health information can be used outside of the framework in which it was collected.

Other crucial challenges emerge when DSNs are implemented in order to encourage risky behaviors or disseminate false information. Consider, for instance, the "pro-ana community," which promotes anorexia as a lifestyle (Coiera, 2013). Misinformation (false information spread irrespective of the intention to mislead) and disinformation (the spread of deliberately misleading or biased information) are a recurring problem for online health information. Infectious diseases have been affected the most by this phenomenon, resulting in serious consequences for public health. This can be verified by the sharp rise in vaccine skepticism. Benchmark institutions thus have to strengthen their efforts to tackle the dissemination of false information. As for DSNs, the task becomes increasingly difficult since Internet users are overwhelmed by the amount of information available. Hence, it is necessary to apply communication strategies in order to stand out, producing health interventions with strong reach and beneficial effects. On social networks, online or offline, it must be kept in mind that even weak social ties have the power to influence (Granovetter, 1973).

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SEE ALSO: Global Health Interventions; Social Networks; Social Networks and Support Health Outcomes; Intervention Research; Informal and Formal Networks; Systematic Reviews and Meta-analyses; Social Media: General; Health Information Seeking; Health Information Seeking Theories; Opinion Leaders; Social Norms; Public Health; Online Support Groups; Electronic Health Records; Health Campaigns: Evaluation; Health Disparities: Access; Health Communication Ethics; Personalized Medicine.

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ABSTRACT

This entry provides an overview of the different health interventions that rely on social networks by analyzing their structure, functionalities, and data. It first presents a brief history of the origins of social network analysis (SNA) and its applications to understand and manage human health. Different types of health interventions on social networks are also explored. The entry deals with the structure of social networks and their impact on disseminating health information, the effectiveness of prevention or awareness campaigns, and the interventions on health behaviors. Finally, considering that digital social networks have brought new possibilities to health interventions on social networks, particular attention is paid to the benefits and risks that emerge from health interventions taking place on these platforms.

KEYWORDS

digital social networks; health behaviors; health communication; health information; health interventions; social media; social networks