

Executive Summary

The Social Component of Diabetes Health Disparities: New Directions in Analyses and Interventions through Social Networks and Structures

May 19–20, 2022

A workshop by

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Background

Extensive diabetes health disparities (DHD) exist in the prevalence, control, and rates of complications of type 1 and type 2 diabetes (T2D). One important and promising direction for tackling this challenge is to engage people living with diabetes, their families and communities, and other components in their social networks (SNs) in and beyond clinical settings. Such approaches may recruit SNs and structures to be both forces for and recipients of change (e.g., recruiting community opinion leaders as peer mentors to support behavior change, educating a family about how to address its own shared risk factors). These approaches will also benefit from methods new to diabetes, such as social network analysis (SNA), which focuses on the role of the structure and characteristics of social relationships in behavioral outcomes and the impact of behavioral intervention on the network. The SNA field has studied a number of mechanisms through which SNs affect health, such as social contagion, social influence, social support, social capital, and social undermining or aggression. Most relevant, SNA has led to an improved understanding of how information, behaviors, and technologies spread through social relationships. Interventions focusing on SNs and structures, guided by such methods as SNA, may improve the development, evaluation, dissemination, implementation, and sustainment of health behavior interventions, including interventions to prevent or treat obesity and diabetes. These approaches have great potential in addressing diabetes-related health disparities.

Presently, the application of SNA in diabetes is extremely limited, and interventions focused on recruiting and leveraging SNs and structures as forces for change have not been explored widely. To advance this field of knowledge, the overarching questions of this workshop include the following: How can SNA improve understanding of the roles social relationships have in the prevention and treatment of DHD? How can interventions focused on SNs and structures accelerate efforts to reduce or eliminate DHD? To answer these questions, the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) hosted a workshop on May 19–20, 2022, to bring together multidisciplinary scientists with diverse expertise relevant to SNA, interventions focused on social structures and networks, and DHD. The workshop was held in Bethesda, MD, using a hybrid format open to registered virtual attendees. During the two days, the attendees together critically explored the state of the science and key research gaps and delivered promising and actionable directions in reducing DHD and promoting health equity by leveraging SNA and the networks and structures it analyzes.

Brief Summary

The workshop opened with two keynote talks. First, Dr. Leonard E. Egede provided an overview of health disparities; the intersection of structural racism, social determinants of health (SDOH), and health disparities; and structural racism as a driver of health disparities. Dr. Egede also proposed directions to tackle health disparities more effectively, enabled by an increasing number of investigators working on SDOH and by increasingly sophisticated analyses that are made available and that can be incorporated at multiple levels. Second, Dr. Elbert Huang briefly reviewed studies of SNA and social network interventions (SNIs) in human behavior and health, as well as those in diabetes. Dr. Huang argued that results from existing efforts and examples suggested that SNI can be a promising tool to manage diabetes and reduce DHD. He further provided several examples showing how SNI may be an effective tool not only for improving health behavior of individuals, but also for enabling sociometric studies that can potentially inform policy toward addressing structural inequalities.

The workshop organized three sessions of presentations from leading scientists in the fields of SNA and DHD. This provided the opportunity for speakers to introduce their work to scientists from the other field, intentionally crossing domains of scientific interest. To ensure all voices were heard and maximally facilitate interaction and discussion, the workshop was designed with ample time and opportunities for all attendees to pose questions, express their views, and socially engage with one another. These included two sessions of panel-led discussions, a session of end-of-day-1 open discussions, and a session of breakout group discussions.

One highlight of the workshop was a panel session centered on lived experiences, which was hosted in an effort to glean firsthand insights from people living with diabetes and how the social aspect of their lives intersects with their diabetes, as well as how this may be harnessed. The Lived Experience Panel was led by four stakeholders living with diabetes: Ms. Elena Ennis from California, Rev. Dr. Patrick Gee Sr. from Virginia, Ms. LaQuita Smith from Alabama, and Dr. Nicole Wiesen from Georgia. The panel was moderated by Dr. Marissa Lightbourne from the NIDDK, who also has personal experience living with diabetes. The experiences they shared were eye-opening and insightful. Shame is often the biggest challenge people experience upon being diagnosed. At diagnosis, counseling, though much needed, was rarely part of the prescription; in the stakeholders' experience, no SN questionnaire or related information for social support was provided. Patients' SNs can bring both benefit (such as support) and harm (such as stigma and chronic stress); empathy, sympathy, understanding, and patience are needed from care providers. Legislation must understand social and psychological needs to combat diabetes. Integrated care from a multidisciplinary team, including mental and behavioral health support, is essential, and a cultural change in formal care by promoting the relational aspects of clinical practice is needed. As summarized by Dr. Gee, the key to building relationships (as in SN) is to "relate" to each other, yet many hurdles stand in the way: the professional relationship, race, gender, and sexual orientation, among others. The stakeholders' perspectives underscored the importance of hearing from patients and community members—and the importance of collaborating with them—when thinking about and designing programs to ensure the strategies and solutions are culturally and contextually relevant. The interventions and solutions developed cannot be "one size fits all."

To provide opportunities for the next generation of scientists to participate in this important discussion, a travel scholarship call was released for scientists ranging from senior graduate students to investigators less than 2 years in to their first faculty appointment. In total, approximately 50 applications were received, 35 complete applications were reviewed, and 6 scholarships were offered. The travel scholars were paired with senior leaders in the field to co-moderate sessions pertaining to their field of interest.

Overall, the workshop discussions acknowledged that social connections are fundamental to primates and their health; the general interest in this field has dramatically increased in the past several decades because of a variety of factors, including increases in available data, computational power, and statistical applications. SNs are a major determinant of health, as positive SN resources can improve health, and adverse SN experience increase mortality more than many other factors to which more attention has been devoted, such as smoking, alcohol consumption, obesity, and physical activity [1]. Throughout the two days of activities, a number of themes emerged regarding the critical gaps and feasible actions.

Critical Gaps

Gap 1: The potential of SN and SNA are underutilized in diabetes prevention, in diabetes care, and in reducing diabetes health disparities

SNs are social structures that are made of social actors and the relationships among these actors. SNs measure multiplicity of relationships (e.g., kinship, friendship, collaboration) that can occur at multiple levels (e.g., between individuals, organizations, countries) and can be made up of diverse types of relationships and social actors. Numerous studies have shown that SNs “matter”—they affect health behaviors and outcomes [2–5] and the way health practice and policy happen and are implemented [6–8]. They also shape how information and innovation are diffused through the population, as demonstrated during the COVID-19 pandemic. More specifically, in diabetes, it is known that people with fewer friends have a higher risk for developing diabetes, and SNs play a role in risk for diabetes and complications, as well as in diabetes management [9]. It is fair to say that SN is a major determinant of health [1] and plays a large role in structuring and affecting health disparities across many domains, although how SNs interact with other SDOH still is not fully understood.

SNIs are interventions that purposefully use SNs or SN data to promote uptake of positive health behaviors (or curtailment of negative health behaviors) among individuals, communities, organizations, or populations. These interventions typically (a) use SN data to identify the best person (often termed “opinion leaders”) or group of people to target with an intervention to make behavior change likely to spread to others in the network or (b) manipulate or change the network structure or composition to modify psychosocial processes associated with health behavior change in the individuals within the network. In SNI, the unit of analysis would be the entire network—for example, the spread of information and behavioral intervention or the benefit of the spread. It utilizes not only the individuals in the SN, but the SN structure as a driving force.

Overall, while a variety of ways exist to design network interventions [10], using opinion leaders is the most straightforward and has been the most frequently used in different settings since 1999, when Dr. Tom Valente first studied their role in regulating, slowing, or accelerating the process of information and innovation diffusion through SNs [11]. Meta-analyses consistently show that interventions utilizing opinions leaders enjoy 10–15 percent greater uptake when compared to those that do not [12].

The general interest in SN studies and SNI has dramatically increased in the past several decades. Factors that have led to this growth include increases in available data, computational power, and sophisticated statistical applications. Presently, such research concentrates more heavily in such clinical areas as infectious diseases and substance abuse, with a smaller body of research in chronic diseases like diabetes.

Despite the promising potential of SNI and the increasing interest in the field, SNIs in DHD currently remain largely underdeveloped and undertested. Network is not the only factor that matters in intervention, but it is an ingredient that is often missing. For example, traditional behavioral interventions, which are well represented in DHD research, have focused on the individual and may also have SN components (such as in peer support programs), but these SN components are not well characterized nor are they the primary focus. Furthermore, while a proportion of DHD interventions have leveraged social relationships to promote health behavior change, very few have leveraged the broader SN in which relationships exist to promote health behavior change *at scale* (i.e., SNIs) or intervene in the social and environmental spaces so that they help to support and sustain the changes in the long term.

In diabetes, many trials, including those of social support interventions, have been designed to influence the behavior of an individual by engaging with the person's SN (e.g., family, friends, colleagues, peers, community organizations). The success of these programs often relies on how social support and the social capital of people are leveraged. While most trials are not labeled as SNI, some are, and a 2017 systematic review found 19 randomized clinical trials [13]. However, when conducting interventions, most often researchers have not been intentional or explicit about including design considerations regarding how individuals' SNs can be incorporated and engaged. SN factors are not being measured as rigorously as possible, nor are the SNs being explicitly assessed, and little explicit research on SNIs in diabetes prevention and management exists. Opportunities are missed from not asking the questions that could have been asked, not collecting SN data, and not including network-level assessment and interventions. Last, opportunities exist both in leveraging individual and interpersonal networks, as well as organizational networks, to promote the sustainability of diabetes intervention programs. For example, while a great deal is understood about how to provide effective initial diabetes self-management and education (DSME), less is known about who, where, when, and how to provide effective, sustained DSME. A critical need exists to develop and evaluate DSME models that are patient driven and embedded in existing community infrastructures.

Overall, the potential of formal SNA and SNI are underutilized in diabetes, and this represents a significant gap. Moving forward, opportunities exist for bridging diabetes behavioral intervention researchers and the SNA field.

Gap 2: The need for more basic research in SNs and health, behavior, and DHD

Presently, a critical gap in how to best leverage the opportunities offered by SNA and SNI is the lack of basic and mechanistic research on SNIs that can improve understanding of how and why SNs are important for diabetes prevention and reducing DHD. Examples include how to characterize SNs, the pathways by which SNs affect behavior, the role of SN in health disparities and DHD, and the interactions with other SDOH.

An SN has three dimensions: structure (types of social relationships and roles, the interconnections among them), function (e.g., information transferred, social influence perceived support or stigma), and qualitative character (positive or negative). Often, the dimension that directly affects health and SDOH is the function, but the function of the SN depends on its structure and qualitative characters. Functions also depend on emergent properties that may not be intuitive, an exemplar being the strong tie versus weak tie effect reported in a landmark paper by Granovetter [14]. While close-knit, dense, small, reciprocal networks are good for general health and providing support, they can be homogenous and enforce strong norms. In contrast, large, more diffuse, heterogeneous networks with many weak ties may offer more diverse information and resources, increase bridges to innovative information and technologies, and be helpful during a transition or crisis.

Presently, limited research exists on understanding the role of SN structure and even less on understanding the intersection between social influences/function and SN structure within diabetes and DHD. Many peer interventions and the like provide social support to individuals, but more efforts are needed to investigate the potential of SNs to influence cultural norms and beliefs to reduce social isolation and loneliness, reduce chronic stress, and help sustain positive health behavior for individuals.

The SNA field has studied a range of mechanisms through which SNs affect health, such as social bridging, social bonding, social capital, social contagion, social influence, social support, social stress, and social undermining or aggression. Personal SNs operate through behavioral, psychological,

neurological, and physiological pathways that affect health. SN activities result in epigenetic changes. All of these are extremely understudied in diabetes and DHD.

It is known that SNs play a large role in structuring and affecting health disparities across many domains. Another important area of basic research is how SNs, as a major determinant of health, interact with other SDOH. It is long known that SNs can bring both benefit (if harnessed well) or harm. However, the research field has been paying more attention to the beneficial side and less to the detrimental side (which is generally termed the social cost). Examples include social stress, social undermining, harmful social support, and relational strain. The problems of stigma, judgment, and shame not only cause chronic stress and affect people's mental health, but they also prevent people from building and leveraging SNs to improve mental health. More studies of social costs and an integrated model to put the diverse range of factors together are needed. The network chain, the relationship between structural forms, the composition and network content, and antecedental factors of social relationships need to be considered. For intervention, not only do people who lack network resources or who face more social costs need to be considered, but also people who suffer from both, as they are likely the most vulnerable and disadvantaged.

Gap 3: A deeper understanding of cultural and other contextual dependence of SNs

Better characterization and appreciation of culture, community, place, and other contextual dependence of both individual and community SNs, as well as an appreciation that SNs may work very differently, are critically needed. Additionally, a better understanding of how structure and other network features can be different in different populations is needed, understanding that benefit and harm can vary between differing populations. Interventions need to be culturally tailored; they cannot rely on intuition or conventional thinking, which are derived from data collected in the past and often from undersampled minority communities. Many of the assumptions behind existing models, including how information and behavior spread, often do not hold true for minority communities or for all environments and are not applicable across cultural and ethnic groups.

In a rural environment, the SN is very important and distinct from an urban environment (which is more commonly the source of clinical research). Rural people have less social bridging than urban dwellers, which negatively affects their access to novel information and technologies. For example, residents of rural Appalachia often live in grandparent-headed households. Features of their SNs and the nature of social support are very different than other places, and reported social support is not always positive. SN for immigrants from south and central America are more kinship centered and more homogeneous. Immigrants from Asia often live in multigenerational extended families (that include cousins), live in multiunit housing, and show transnationalism with time split between the United States and their country of birth, hence transiting between different SNs. These population-dependent unique features can affect information dissemination and behavioral changes differently than conventional thinking and offer opportunities for innovation of diffusion of messages and interventions with unique contexts.

Overall, these aspects of culture, race, time, and generational complexity of SNs are underappreciated and understudied. Little is known regarding differences in rural and minority community SNs' size, composition, multiplicity, transitivity, and complexity; how socioeconomic status and race/ethnicity shape their SNs and the network properties; and the differences in access to social capital and social resources. Little is known of their SN-related core value, either generally or relative to T2D prevention or treatment. For example, the Asian American community faces a disproportionate burden of diabetes; nationwide, they face higher prevalence of age-adjusted high body mass index and diagnosed and undiagnosed diabetes [15]. While the workshop covered much on differences in the SNs of minority

populations and communities, it was pointed out that the workshop and the field at large has missed the opportunity to use SNI and SNA to learn from the experiences of Asian Americans and immigrant populations. In social sciences literature and textbooks, a routine lack of attention exists regarding racial ethnic differences and disparities issues in Asian Americans. This was underscored during the recent COVID-19 pandemic, during which Asian American communities were effectively left out of federal and local COVID-19-related programs and mostly relied on mobilization and bonding at the community level between organizations to address the crisis.

More work is needed to understand and characterize the cultural differences in SNs, identify the modifiable SN characteristics that enhance T2D prevention behaviors, enhance management and control of all types of diabetes, and culturally tailor elements of effective interventions that are sustainable. It is important to listen to and collaborate with affected individuals and community members when thinking about and designing programs to ensure the strategies and solutions are culturally and contextually relevant and to determine priorities and appropriate outcome measures according to the specific community.

A related critical gap is the underappreciated network instability: SNs change over time and show generational differences. For instance, the personal SNs of the Baby Boomer generation show significantly different characteristics than that of the other generations—they are less kin oriented and have more friends of choice. Such changes have been accelerated by the COVID-19 pandemic and will be rapidly shaped by new technologies, such as robotics, digital health, telemedicine, and artificial intelligence. Technologies and the COVID-19 pandemic are even changing SNs that have traditionally been stable, such as patient-sharing physician networks. Such changes affect and may exacerbate existing health disparities. For example, telemedicine is not as effective in rural areas or in minority populations, which may lead to this technological advancement's having inequitable reach. These changes should drive new considerations for addressing chronic disease disparities. Therefore, many conventions from the past that contributed to shaping conventional knowledge are no longer relevant, and they must not be relied on when designing interventions.

Gap 4: The need for multilevel approaches to reduce DHD

An integrated care model is needed for people living with a chronic condition like diabetes that not only cares for their physical health, but also their behavioral, psychological, and mental health. Such care is a collective effort that requires a multidisciplinary care team (e.g., primary care provider, endocrinologist, nurse, pharmacist, psychologist, behavioral health clinician, counselor, other specialist) and support from one's family, friends, and community. While many intervention programs include a social component, they often tend to focus on the interpersonal level; the social relationships within the team and personal SNs are rarely targeted. When it comes to the application of SNI to reduce DHD, researchers need to move beyond linear or single-level analysis, as all the contextual factors are connected and could reinforce one another. Multilevel (individual, family, community, care team, etc.—all the way to policy) approaches are needed. The upstream factors of SDOH and multiple factors from different levels that act simultaneously also need to be considered, and multisector collaborations and infrastructure building in order to address them are needed. Outcomes from such efforts can inform and influence policy and—in turn—the upstream factors to SDOH, such as structural inequalities.

Using the care team and DHD as examples, care coordination, diffusion of medication innovations, and community detection are among the important tasks. Studies have shown that disparities in technology utilization and dissemination may also exist among health care professionals serving disadvantaged communities [16]. Physician networks serving rural communities are more vulnerable than those serving

urban ones to turnovers of specialists, including endocrinologists [17]. The role of physicians in DHD is extremely understudied in such areas as care team stability, culture and messaging of the team, information dissemination to patients, reciprocal connection to community services, and how to best align the health care teams to increase the participation of individual in health behaviors that prevent T2D and improve individual self-care management.

Structural inequality (racism)—which is based in policies, governance, culture, and social values—is antecedent (upstream) to social determinants and social risk. Existing studies of SDOH have paid little attention to structural, upstream causes of DHD, and approaches that tackle individual factors at “downstream” levels often result in conflicting processes. A better understanding of the relationships in networks and systems of power is needed and, more specifically, when it comes to interventions, how networks to enhance power and change the power structure are leveraged. Infrastructure to study upstream factors to social relationships to make people aware of the connections, foster transdisciplinary work, and do more to inform (and hence influence) policy is needed.

SN may be a mechanism through which structural racism affects disparities. More consideration should be given to how to harness this and work with SNA to reduce DHD. For example, it would be interesting to investigate the potential of SNs to influence cultural norms and beliefs to reduce the social isolation, stigma, and chronic distress that disadvantaged populations face. Using the “change the fish versus change the water” analogy, it is possible that the first step is changing individual “fish” to change other fish and that, over time, the water (culture and norms) will follow suit.

Gap 5: The need for data—much more data—and better methods and measures

To address all the gaps mentioned thus far, data—much more data—and more types of data relevant to SN need to be collected. Collecting SN data is time and resource consuming, and possible starting points include supplementing existing studies to add additional data collection, such as egocentric network questionnaires; collecting administrative and physician data; and adding or increasing efforts to collect information about race, socioeconomic status, and socioeconomic position.

Also needing improvement are measures and methods, such as metrics to assess SNs; how to capture not only the quantity of one’s social links but also the quality and the nature of the links; how to translate results from complex studies to simplicity in delivery to patient care; and how to meet the challenge of balancing between efficacy and scalability, given that social interventions are expensive.

Standardization, including the standardization of documentation of tools used in SN studies, also is needed. One specific example is the survey tools, which are as important as the physical tools but currently do not receive adequate support for development. Other needs include psychometric validation of the tools, as well as improvement in their findability and sharing with the community. Procedural standardization in SN studies is needed, including standardization in designs, forms, and documentation to survey for social interactions, such the nature, number, frequency, and quality of interactions, and extraction of the SN from raw observational data. The community of SN studies needs to establish best-practice principles (such as transparency in data use) and ethics standards, which are critical in view of the technology changes and the ability to collect a wide range of personal digital data. Last, standardization of reporting should be improved so that others can replicate analyses and reproduce findings.

Gap 6: The need for better funding mechanisms

More appropriate funding mechanisms (than currently offered by federal agencies) that provide more sustainable support for the following are needed:

- Infrastructure building that fosters transdisciplinary work and trans-sectoral collaborations
- Planning, engagement, and partnership development, as well as pragmatic, optimized trials and mixed-method approaches to identify the most effective interventions
- Community groups and organizations—funded on an ongoing basis, not one-time—so that they can be an ongoing resource for the community and readily be part of the interventions
- Organizational-level networks toward promoting long-term sustainability of interventions post-delivery

Actionable Items Recommended

A1. Improve the reach of existing (large cohort) studies and utilize them to readily increase SNA data collection and analyses

Improve the reach and uptake of existing studies. In the Diabetes Prevention Program (DPP), while the intervention is highly effective for certain individuals, expanding the reach of DPP had been a major challenge for the past 15 years. DPP’s current model of “If we build it, people will come” is able to touch only a small percent of the population who need it. The program until now has not explicitly targeted key members in the SNs to spread the reach of the interventions. On the other hand, SNI studies demonstrated the potential of SN approaches in reaching, retaining, and changing the behavior of so-called hidden, hard-to-reach, and at-risk populations [18]. Approaches to include SNI should be tested to examine if they will improve the reach of programs like DPP; broaden diabetes care; improve individual ego’s uptake, compliance, and adherence; and improve rigor and reproducibility of clinical intervention programs.

Collecting SN data for deep phenotyping and analysis of systems and contextual dependence. Creating a new clinical cohort for the purpose of SNA is time and resource consuming. On the other hand, in an existing large cohort study, network data can be more readily collected, such as through adding a battery of questionnaires that can include egocentric network questionnaires, collection of administrative and physician data, and information on socioeconomic status and socioeconomic position. From such data, latent networks can be inferred; this is already an emerging topic of interest. Currently, SN studies often sample only particular populations, whereas larger networks that include SNs in different minority populations need to be studied and followed over time. Large existing population cohort studies—such as The National Social Life, Health and Aging Project and the DPP—can be leveraged. They will allow characterization and comparison of SNs across different populations and communities and improved understanding of the cultural and other contextual dependence of SNs.

A2. Execute new observational studies to understand the role of physician networks in DHD

The roles of care provider networks in dissemination of information and medical innovations, in improvement of patient uptake of health behaviors and patient outcomes, and in DHD are understudied. Data relevant to physician networks are much easier to collect than those of patients. Example sources of data collection include administrative data, Medicaid claims, referrals, surveys, and

electronic health records (EHRs). Existing works have demonstrated the potential of physician network analysis in answering a wide range of questions and in offering new places and opportunities for intervention.

Diabetes care requires a team of multidisciplinary care providers. Studies of how provider networks function, how clinicians and providers function within these networks, and how to best align the coordination and messaging among providers—as well as between providers and patients—can help identify places to optimize in order to improve patient outcomes in diabetes care and management. Investigation of how policy and payment systems may impede access to health care networks, and of provider behavior with new alternative payment model experiments, also is relevant.

The culture, messaging, and trust around diabetes prevention and intervention are critical for patient participation and uptake of health behaviors and thus are critical for the success of these programs. The role of clinicians and providers in these and the value from reciprocal connections between community services and health care teams in promoting awareness of risks, improving access to information, and building trust can be studied leveraging SNA.

Another interesting and important area is the role of clinician and provider networks in diffusion of medical guidelines and information, as well as in the delivery of medical innovations, such as molecular technologies [19]. This is a place where existing inequities in access and use of quality care can be further exacerbated [19]. Agent-based modeling, a sociometric network approach, has been used in studies of messaging and guidelines dissemination in physician networks and in integrating networks of patients, providers, and organizations [20] and has been shown to be a useful tool in generating results that can inform policy relevant to reducing structural inequalities.

Disparities in physician network robustness (against physician turnover, for example) exist for networks serving different communities; how they contribute to DHD needs to be studied. Last, greater development of methodologies and measures is needed in physician network analysis using different types of data (e.g., EHR, administrative, survey).

A3. Improve peer and community support programs leveraging SN and SNA

The two recent decades have seen growing interest in peer support and related general social support topics, as reflected in the growing number of publications. This includes the many peer support studies in diabetes. The doctrine of peer matching has been based on the type and stage of disease and the type of treatment. Lessons learned indicated that it is important to not make preconceptions about what parameters will be important for the participants and suggested a need for paradigm change. Needed are a deeper understanding of how to better engage support from peer networks and other community resources for people living with diabetes; the role of social aspects, such as being in the same community, having shared interest, and being able to relate; and how to identify the best resource for support, especially for individuals and communities that are socially or geographically isolated.

SNA and SNI can be leveraged to address these needs. Their concepts and theories can provide insights in guiding new designs of peer selection and open a new dimension of people's social status in peer selection, thus offering opportunities to improve existing practice. Using the concept of segmentation from SNA as an example, while advantages exist to selecting peers from within one's segments (e.g., proximity), selecting peers from outside has the advantage of social bridging and access to heterogeneous information, knowledge, and resources; SNA may allow the "sweet spot" to be found. A national database of peers can be established, which allows stakeholders to decide the desirable

features of their peers, identify their supporting peers, and engage support from peers. This will also allow the broadening of peer networks to create new networks.

SNA and SNI can also be leveraged to inform community-based organizations (CBOs), community health care workers, and peer mentors during social support. Examples of areas include how to balance “being pushy” with modeling behavior that varies by culture; how lived experiences can shed light on how to address SDOH in diabetes care and management; and how to leverage community resources to build trust with stakeholders who are developing or are at risk for diabetes diseases and to reduce DHD. Harnessing community resources, such as CBOs, will be important to include when conceptualizing where SN data come from—and where SN centers arise—and thus may be important for data collection and interventions.

The COVID-19 pandemic and the increasing adoption of social media technologies and telemedicine are changing the landscape of people’s SNs. Such changes may complicate social intervention programs and increase the disparities that already exist in clinical care. SNA offers opportunities to investigate the balance between telemedicine and other high-tech virtual social connections, in contrast to low-tech in-person interactions with peers, and offers new models to address the unique needs, challenges, and resources available in particular communities.

One major challenge in fully leveraging peer support in diabetes and other chronic disease care and management is that the current health care system’s payment model does not allow such activities as the dissemination messages of health behavior (exercise, diet, no smoking) to be compensated, and peer support notes cannot be included in EHR. SNA may provide critical data that support the effectiveness and importance of such support and over time could influence the payment model. SNA may also help a stratified approach to be designed, in which SN could be leveraged to efficiently identify high-risk patient groups where peer support will be highly needed and can make a noticeable difference in the short term, and thus it could inform the health care system to pay for the peer support for these groups versus patients within low-risk strata.

A4. Learn from the COVID-19 pandemic

The pandemic offers unique opportunities to study a number of important questions. Prior to the pandemic, the increasing adoption of new technologies—such as robotics, digital health, telemedicine, social medial apps, and artificial intelligence/machine learning algorithms—was changing how patient and care providers interact and how physician networks, such as the patient-sharing networks, interact and coordinate care. New technologies are also changing how people socialize, the meaning of the workplace, how community organizations function, and thus the whole landscape of SNs. They pose new challenges and opportunities for social intervention and prevention programs and run the risk of exacerbating existing disparities in clinical care. The pandemic accelerated these changes. For example, the rate of telemedicine in Cigna rose from 2 percent pre-pandemic to 50 percent in 2020; it fell later in the pandemic but still is at approximately 25 percent in 2022. While the changes are still fresh, data can be readily collected from this accelerated time window and can greatly inform such questions as how to leverage new technologies in intervention programs and how to balance between telemedicine and other high-tech virtual social connections versus low-tech in-person interactions with peers.

During the pandemic, the critical role of CBOs, including social service agencies and faith-based organizations, were amplified in all communities, particularly minoritized communities and communities that were underserved in federal and local COVID-19-related programs (such as Asian American communities). Extensive mobilization in binding together at the community level occurred between

organizations to address the crisis. Such experiences can be collected and will offer an opportunity to understand how connections of CBOs can foster support for community members materially and emotionally, as well as enhance a sense of community and social capital, and to design new models to address the unique needs, challenges, and resources available in particular communities.

The COVID-19 pandemic also exposed how technologies are shaping the ways in which information and innovation are diffused through the population, as well as the importance of reducing SN segregation and building trust for researchers and public health, as demonstrated in efforts accelerating the uptake of testing and vaccination through SNs and trusted community members. Such experiences should also be collected. They will be informative to policy and can be used to help improve messaging, rebuild trust, and improve social health.

A5. Other actionable items

Improve methods, measures, and standards. Examples include the following:

- Develop metrics and measures to assess SNs, including their structure, function, and qualitative measures.
- Develop more software tools for friendly and convenient data collection, analysis, and integration with statistical models.
- Develop standardization of documentation of tools used in SN studies, especially the survey tools.
- Improve psychometric validation, findability, and sharing for tools.
- Develop procedural standardization in SN studies, including standardization in designs, forms, and documentation to survey for social interactions, such as the nature, number, frequency, and quality of interactions and extraction of the SN from raw observational data.
- Develop best-practice principles (such as transparency in data use) and ethics standards.
- Improve the standardization of reporting.
- Develop strategies to recruit community uptake and adoption of standards and best practice principles.

Basic mechanistic studies of SN and health, SDOH, and DHD. Using both observational and mechanistic studies and simulated modeling, investigate the following:

- Pathways by which SNs affect physiology, neural and immune systems, the epigenome, and behavior
- The role of SNs in health disparities and DHD
- The interactions between SNs and other SDOH
- Both the beneficial and harmful aspects of SNs

New interventions to recruit SNs and SN structures as a force for change. Many opportunities exist to intentionally apply SNIs in diabetes prevention, care, and management. Some examples include the following:

- Compare the effectiveness of SNI trials and examine which SNs and what SNI approaches are optimal under what circumstances.
- Design new trials that focus on changing both the ego and the network.
- Study network effects in SNI trials.
- Investigate the optimal balance between efficacy and scalability given that social interventions are expensive and resource intensive.

- Characterize information diffusion and dissemination and uptake during SNI.

Conclusion

Observed disparities are not necessarily caused by factors intrinsic to the populations; rather, they most often are the process of the systems around the populations, such as victimization and lack of resources and support. However, interventions and measurements in disparity studies are typically targeted at individuals. SNA is a tool that can be used to see beyond individuals to understand the complexity of disparities at the system level, such as the distribution of resources. At the same time, SNA is only one approach to tackle the social component of health disparities; other models and approaches exist. It was anticipated that this workshop would represent the start of additional efforts to bring multidisciplinary, innovative approaches to study the social component of health disparities. Attendees generally considered discussions during the workshop to be fundamentally revolutionary against a highly entrenched hierarchy and an expert-based health care delivery system.

The application of SNA and SNI is crosscutting for many different health conditions, and multiple funding agencies have expressed interest. Recently, the National Institute on Aging hosted [a similar workshop](#). Currently, the NIH sponsors several active funding opportunity announcements on social connectedness (PAR-21-[349](#), [-350](#), [-352](#)). The basic research of methods and measures is perhaps of trans-sectoral interest.

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