

Social Network Diffusion of Individual Behavior Change Interventions Workshop

National Institute on Aging

Division of Behavioral and Social Research

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Executive Summary

On March 2-4, 2022, the National Institute on Aging Division of Behavioral and Social Research convened the Social Network Diffusion of Individual Behavior Change Interventions Virtual Workshop to foster discussion among researchers with expertise in social networks of older adults, life course changes in social networks, network interventions in a variety of settings and populations, social relationships and influence, and behavior change. This interdisciplinary group of experts, brought together for the first time, discussed approaches to leveraging social networks to extend the reach of individual behavior change interventions with the goals of promoting healthy aging, slowing cognitive decline, preventing Alzheimer's disease and related dementias (AD/ADRD), and improving outcomes for people living with AD/ADRD and their care partners.

Over the first two days of the workshop, discussions focused on (1) characterizing social networks and social network processes in aging, (2) mapping social network diffusion processes, (3) adapting existing social network interventions to aging populations, and (4) leveraging social network dynamics to enhance the reach of individual behavior change interventions. Individual presentations provided the interdisciplinary group with overviews of the state of the science in the various fields represented, which served as a foundation for more speculative conversation about how social network intervention approaches could be best developed, adapted, and implemented for aging populations.

During the first session, presenters discussed the dynamics of older adults' social networks and their function across the life course. The second session focused on the ways that behavior changes spread throughout networks, including the dynamics and structures that shape intervention uptake. The third session highlighted essential components of successful network interventions that have been used to modify behavior in other populations. The fourth session explored ways to maximize the impact of behavior change interventions by leveraging social networks and ensuring the use of rigorous methods in intervention development.

The third day of the workshop was a closed session for workshop speakers and NIH staff and featured breakout discussions of key topics that emerged during the first two days of the workshop:

- Matching interpersonal and network mechanisms and outcomes
- Network dynamics and modification
- Optimizing environments and setting effects
- Challenges and opportunities in methods and measurements
- Implementation and evaluation
- Unintended consequences of network interventions

Several key themes emerged across the workshop, including:

- The importance of using multidisciplinary, multimodal measures that are tailored to populations in order to characterize the complexities of social ties and evaluate network interventions
- The need for more evidence to identify potential target mechanisms that drive associations between social network features and specific behaviors and health outcomes, as well as to effectively match interventions to specific outcomes, settings, and populations
- The importance of using diverse intervention seeding and dissemination approaches to avoid exacerbating disparities (e.g., attending to which networks or members of a network have access to an intervention)
- The need to include diverse racial, ethnic, and socioeconomic populations in research on social network interventions
- The opportunity to leverage environmental factors (e.g., community infrastructure) to disseminate interventions and promote elastic social ties in support of healthy aging
- The importance of attending to weak, peripheral, and negative ties when studying older adults' social networks
- The need for further discussion of ethical considerations in social network interventions, particularly with reference to potential unintended consequences of interventions that alter network dynamics

Meeting Summary

Welcome Session and Meeting Charge

Introduction to the National Institute on Aging Division of Behavioral and Social Research

Lis Nielsen, PhD, NIA BSR

The National Institute on Aging (NIA) Division of Behavioral and Social Research (BSR) supports social, psychological, economic, and behavioral research on the processes of aging at both the individual and population levels with an emphasis on transdisciplinary integration of behavioral, social, and biological perspectives. Across a large, varied research portfolio, NIA BSR seeks to understand and ameliorate the sources of health disparities at older ages and approach aging processes from a life course perspective, including exploration of midlife opportunities to prevent chronic diseases of aging (including dementia) exploring where there might be the potential to intervene early to promote resilience and improve aging trajectories before disease onset. NIA BSR supports the study of health, function, and well-being as well as of disease and promotes rigorous approaches to understanding and advancing behavior change at the individual and organizational levels including interventions targeting processes in families, workplaces, communities, and health systems. In doing so, we promote both use-informed basic research and mechanisms-informed intervention science in alignment with the NIH Stage Model and Science of Behavior Change (SOBC) Common Fund program.

Supported by the Common Fund from 2009 to 2019, SOBC sought to accelerate research on common mechanisms of behavior change that could be applied to a broad range of health behaviors by bidirectionally integrating basic and applied science; uncovering the drivers and mediators of behavior change; and increasing the rigor, transparency, and dissemination of methods and measures. SOBC identified interpersonal and social processes as one domain with promising behavior change targets and, in 2015, published a request for applications to identify, measure, and target interpersonal and social processes implicated in health behavior. Although identifying and measuring interpersonal processes beyond the individual organism can pose challenges in biomedical research, recent advances in fields such as social neuroscience, sociology, and anthropology, as well as the availability of rich social network data, present the opportunity to build on the work of SOBC by conducting mechanistic research on those processes. NIA BSR seeks to leverage this opportunity to enhance the reach of individual behavior change interventions by convening the Social Network Diffusion of Individual Behavior Change Interventions Workshop.

Introduction to the Workshop

Laura Major, DrPh, NIA BSR; Liz Necka, PhD, NIA BSR

The dissemination of behavioral interventions typically emphasizes the direct delivery of interventions to individuals, often relying on health care systems, community organizations, and other partners to perform this delivery at scale. These efforts may be compromised by

heterogeneity in individuals' response to the intervention, in part because of variations in delivery across settings. The mechanism-focused experimental medicine approach supported by SOBC offers a means to address dissemination challenges. This approach encourages identification of a putative target of an intervention (i.e., what the intervention proposes to affect), which (when engaged) is associated with behavioral change. Though many interventions target processes that are *intrapersonal* in nature, *interpersonal* targets also exist. Interventions that target interpersonal processes may extend the reach of behavioral interventions by enabling individuals who receive interventions to promote the spread of behavior change throughout the social networks in which they are embedded. In some cases, the composition or function of individuals' networks may require modification to effectively diffuse interventions. Through this workshop, NIA BSR seeks to identify (1) methods of adapting or developing interventions that leverage social networks to enhance the diffusion of behavior change; (2) critical interpersonal targets for intervention diffusion; (3) important considerations for using social network interventions in aging populations; and (4) the gaps, challenges, and opportunities that attend this research.

Meeting Charge

Brea Perry, PhD, Indiana University; Thomas Valente, PhD, University of Southern California

Much research has been conducted on the distinct topics of network interventions, interventions for aging populations, and social networks in aging populations. This workshop seeks to bring together these bodies of knowledge to accelerate the development of novel approaches that leverage networks to enhance intervention diffusion.

Key topics to consider at the intersection of research on network interventions and older adults' social networks include the following:

- Promotion of intervention dissemination through personal networks
- Network structures and ties that may be most suited to disseminate interventions
- Measurement of diffusion in personal networks
- Strengths and challenges associated with older adults' networks
- Diseases of aging that are amenable to network interventions
- Risk of creating or exacerbating health disparities in homophilous networks

Session 1: Characterizing Social Networks and Social Network Processes in Aging

Network Bridging and Bonding in Older Adults: Lessons From Cognitive Aging

Brea Perry, PhD, Indiana University

Social network dynamics vary across the life course, and lower social engagement in older adults is strongly linked with increased AD/ADRD risk. Yet the social and biological mechanisms that drive this association are not well understood. Development of network interventions for older adults requires clear and consistent definitions and tailored measures of distinct social

mechanisms such as bridging, bonding, stress, and influence that are not commonly present in existing AD/ADRD literature. Notably, research has more consistently linked social bridging measures (e.g., network size, density, minimum tie strength, proportion non-kin) to protection against cognitive decline than social bonding measures (e.g., number of close ties, mean frequency contact, relationship quality), suggesting that social bridging may moderate neurodegeneration by increasing cognitive reserve. However, unequal access to social bridging based on race, sex, class, occupation, education, and urbanicity complicates intervention dissemination. Because networks are homophilous, interventions seeded only in networks of individuals with high social capital are less likely to reach other groups, and thus may exacerbate social inequities.

Core Personal Networks in Later Life: Emerging Evidence About Composition, Distance, and Adaptive Change

Markus Schafer, PhD, University of Toronto

Comparisons of longitudinal cohorts of older adults indicate that a previously observed later-life decline in non-kin ties has slowed in recent cohorts, with no such decline observed for older adults born after 1923. In fact, recent cohorts' network size spikes post-retirement. Research further suggests that changes to older adults' networks occur not through unidirectional decline but rather through adaptive rebalancing, with the same number of confidants gained as lost and sequential, inverse periods of decline and growth maintaining stable network size. Dr. Schafer and colleagues found that geographical proximity is associated with contact frequency within a network, with important regional differences (e.g., people in more familistic southern and eastern European countries are more likely than others to have household-based and proximate-family networks). While the likelihood of adult children being included in the core network is associated with proximity, older adults with better cognitive health and higher education tend to have more geographically elastic ties with adult children. Average emotional closeness to network members is not necessarily associated with proximity.

Social Networks in a Season of Loss and Change

Stacy Torres, PhD, University of California San Francisco

Dr. Torres's ethnographic research on older adults who are aging in place in New York City indicates that their social networks adapt to serve shifting needs over the life course. These adaptations include reducing network size to focus on ties that promote positive emotions as well as growing engagement with elastic non-kin social ties that offer a balance of closeness and distance. Informal neighborhood settings facilitate these non-strong, non-weak relations, allowing older adults to reap the benefits of intimacy at a distance without assuming the personal burden of strong ties or overstressing ties with family members. Older adults often prefer these informal "third spaces" where they can socialize and benefit from intergenerational contact over health care settings where they may experience ageism, condescension, and stigma. The interaction and resources that older adults access in neighborhood gathering spaces underscore the opportunity to promote healthy aging and

health equity by developing community infrastructure that facilitates elastic networks and provides venues for informal interactions as well health-related discussions and support.

Social Networks, Age, and Potential for Intervention: What We Know and What We Need to Know

Toni Antonucci, PhD, University of Michigan

Social networks and the support they provide are increasingly recognized as meaningfully linked to health, well-being, and cognitive function. Previous research has demonstrated that social support may be linked to self-efficacy and attribution, that gender differences exist in how social support is provided and received, and that positive and negative social attributes often co-occur within any single relationship. Notably, social support operates at multiple micro and macro levels of influence, including genetic, biological, individual, family, community, environmental, cultural, and societal levels. Personal (e.g., education, age) and situational (e.g., housing, role within a social group) factors impact the structure, support, and quality of individuals' "social convoys" – that is, the core sets of relationships that shape well-being and move with the individual throughout the life span. More research is needed to understand how mechanisms of social support may inform social network-based interventions. When using social networks to deliver interventions, researchers must consider individuals' histories and needs, the capacity of social contagion to spread both positive and negative health behaviors, and the potential for social ties of varying formality and recency to function as intervention agents.

Moderated Discussion of Session 1

Moderator: Liz Necka, PhD, NIA BSR

Impact of Measures

Participants noted that measures impact the personal network information that researchers collect and thus emphasized the importance of using varied, multidisciplinary measures to assess social bridging and bonding as well as the strength and significance of specific ties.. Dr. Claude Fischer's [UC Berkeley Social Networks Study](#) offers useful measures to identify social ties and interactions that surveys often overlook. Wearable technology is also a promising method to measure older adults' participation in interactions, activities, and social spaces. Variations in older adults' networks can complicate their measurement and characterization, especially compared to networks that form in more homogenized settings (e.g., schools, workplaces): traditional definitions of close friends may not align with older adults' experiences of support.

Determining Mechanisms and Motivating Change

Researchers have observed direct relationships between individuals' brain volume and function and their social bridging potential, but more multilevel data (e.g., biomarkers, social network data) are needed to establish mechanisms of protection. Possible protective mechanisms that merit further study include (1) the potential amelioration of AD/ADRD risk factors (e.g., chronic stress, kin-focused networks) through robust social networks, as well as (2) development of

cognitive skills and resilience grounded in a lifetime of establishing community relationships in urban settings.

Mechanistic questions also arise in efforts to support behavior change in older adults and how to effectively engage them in interventions. Participants noted that interventions may be more appealing when presented as proactive opportunities to plan for the future rather than as correctives to maladaptive behavior. Creating partnerships and convoys of care that include multiple individuals can also reinforce behavior change. Finally, online tools may entice isolated individuals to expand their networks or enable them to revive dormant ties. Indeed, loneliness itself may serve as a signal that incentivizes individuals to form new connections; tools that facilitate this process may be useful for encouraging change. National surveys have indicated that technology use is increasing among older adults, and the COVID-19 pandemic may be further accelerating this trend.

Considering Equity in Network Interventions

Researchers developing social network interventions must attend to disparities that impact access to resources and uptake of interventions, such as differences in health, energy, and socioeconomic status (SES). For example, community spaces that support elastic ties may be particularly important for individuals experiencing serious mental illness and housing insecurity. Interventions should include diverse sets of individuals, should ‘seed’ (i.e., start) interventions in areas and groups with low bridging potential (who may not otherwise gain access to an intervention), and should be tailored for specific populations.

Implications for Future Research

- Variation in older adults’ networks complicates their characterization, especially compared to adolescent networks, which are often shaped by homogenizing structures such as public schools. Use of varied, multidisciplinary measures and wearable technology can help researchers capture older adults’ social ties with greater nuance.
- Multilevel data (e.g., biomarkers, social network data) are needed to determine mechanisms that drive associations between specific social network features and favorable health outcomes in older adults.
- To avoid replicating or exacerbating disparities, researchers who use social networks as a dissemination tool must employ intervention seeding practices that are diverse, accessible, and appropriate for the population.
- Studies that leverage community infrastructure to facilitate elastic networks represent a promising way to promote healthy aging and health equity.
- Ongoing shifts in technology use among older adults may create an opportunity to study the use of online tools to help entice isolated individuals to expand their networks.

Session 2: Mapping Social Network Diffusion Processes

Network Interventions: Past, Present, and Future

Thomas Valente, PhD, University of Southern California

Network interventions use four distinct primary strategies: identification of fertile opportunities to seed interventions (e.g., opinion leaders, bridges, peripherals), segmentation to target certain groups and positions within a network, induction to spread an intervention through network excitation, and alteration to spur change by manipulating connections within the network. Systematic review of network intervention studies has shown that identifying and targeting opinion leaders within networks is the most commonly used strategy and accelerates diffusion and increases overall compliance. However, further research is needed to uncover the generative mechanisms by which opinion leaders influence behavior and how factors such as tie strength, centrality, and alter attributes may moderate that influence. Although network interventions have primarily been assessed in closed networks, in community settings without clearly defined boundaries ideal network intervention strategies may depend on varying intersections of desired outcome, setting, life stage, and cultural context.

Network Features Affecting Behavior Diffusion

James Moody, PhD, Duke University

Use of simulation tools to examine how network structures mechanistically promote or restrict diffusion indicates that network topology and timing of contact impact overall diffusion potential as well as probability of transmission. Factors that impact likelihood of diffusion potential include interconnection, simultaneous contact, exposure frequency, and the traits of the target behavior (e.g., costliness, social rarity). Although diffusion may overcome social norms more easily on the network periphery, peripheral nodes are unlikely to accelerate diffusion throughout the network. Conversely, highly connected star spreaders could reach more nodes, but relying on these star spreaders for diffusion creates a single point of failure that could halt diffusion throughout the network. Simulations using a complex contagion model that assumes adoption requires multiple exposures resulted in bifurcated diffusion cascades, with transmission either halted by a structural bottleneck after just a few nodes or overcoming that bottleneck to diffuse throughout the network. Studies that combine existing knowledge of diffusion, adoption threshold, and avenues of transmission are needed to refine network intervention strategies with reference to networks' structural features.

Network Interventions to Disseminate and Diffuse: Ingredients and Measuring Effectiveness

Reza Yousefi-Nooraie, PhD, University of Rochester

Passive diffusion, which can be studied but not controlled, is distinct from active dissemination and implementation tactics to promote the reach and adoption of interventions. Diffusion, dissemination, and implementation interact with one another in a recursive, iterative manner, in which efforts in one realm may also activate mechanisms that drive progress in the others.

Among network approaches to dissemination and implementation, the formation, activation, and rewiring of ties through network alteration remain understudied. A systematic scoping review conducted by Dr. Yousefi-Nooraie and colleagues identified and analyzed five primary categories of strategies to address loneliness by building or changing networks: (1) creating opportunities for people to participate in activities, (2) providing social skills training, (3) engaging other network members in the intervention, (4) monitoring networks through diagnostics such as mapping, and (5) engaging individuals in goal-setting, feedback, and reflection, which can reinforce other intervention strategies. Further classification and mixed methods analysis of network intervention strategies are needed to support targeted, theoretically informed approaches to dissemination and implementation.

Facilitating Engagement in Risk-Reducing Behaviors Among Relatives of Persons Living with Alzheimer’s Disease and Related Dementias

Laura Koehly, PhD, National Human Genome Research Institute

Family caregivers may be at increased risk of AD/ADRDL because of both stress and genetic factors. Previous research has shown that caregiving discussions within family networks—including discussions about care recipient health and familial risk of AD/ADRDL—can help alter risk perceptions and enhance risk-reducing behaviors. In a study of AD/ADRDL familial caregiving, Dr. Koehly and colleagues found that while Black and White families discussed care recipient health at similar rates, Black families discussed AD/ADRDL risk at significantly lower rates than White families. In a study of Mexican immigrant multigenerational households at increased risk of diabetes and heart disease, Dr. Koehly and colleagues found that family health history feedback activated both risk communication and behavioral engagement ties within familial systems, resulting in adjusted perceptions of disease risk, sharing of information with health providers, increased physical activity, and familial co-engagement in physical activity. Family history based interventions in the context of AD/ADRDL may have similar success in activating health promotion and disease prevention strategies.

Moderated Discussion of Session 2

Moderator: Laura Major, DrPh, NIA BSR

Tailoring Interventions to Specific Network Structures

Network structures reflect the traits of individuals within them, and varied structural factors (e.g., size, number of ties, bridging potential) impact the function of behavior change mechanisms. Further, different individuals may influence specific behaviors within each network. Maximizing intervention potential requires determining which network attributes to target, examining varied roles of individuals within networks (including all individuals present in an older adult’s setting), leveraging both global and local opinion leaders, and using adaptive designs and mixed methods to evaluate distinct intervention strategies. Participants noted that the feasibility of certain intervention types varies in different settings—for example, a snowball intervention may be effective in a bounded senior community, but not for older adults in neighborhood settings. Community stakeholders can guide intervention selection and provide insights about feasibility. Useful knowledge about network structures and dynamics may also

be gained through study of animal networks, such as those of primates and elephants.

Intervention Sustainability and Network Change Over Time

Participants emphasized the need to separately measure initial adoption of an intervention and its sustainability. Although behaviors that become embedded in networks are often sustainably reinforced by individuals within the network, interventions may not perform as expected over time. Understanding longer-term dynamics requires examining how network processes that occur early in an intervention shape later processes that in turn impact behavior.

Network Differences Across Cultural Groups

Differences in social network structures may contribute to or protect against disparities across cultural groups and impact the spread of interventions. For example, taboos against discussing health and disease risk or emphasis on protecting certain family members from worry may contribute to the differences in discussion of AD/ABD risk that Dr. Koehly and colleagues observed. Researchers must study such differences further to avoid introducing network alterations that disrupt existing mechanisms of support or cause interpersonal strain.

Implications for Future Research

- Translational studies should connect network analysis and implementation research frameworks to match intervention strategies with specific outcomes, network structures, settings, life stages, and cultural contexts.
- Responsible implementation of network interventions requires developing greater understanding of the variation of networks across cultural groups to ensure that interventions do not disrupt protective factors or exacerbate disparities.
- Study of older adults' networks should attend to not only named connections, but also all individuals present in a setting.
- Nonhuman animal networks, such as those of primates and elephants, may offer useful models from which to learn.
- Further research is needed to uncover the generative mechanisms by which opinion leaders influence behavior and how factors such as tie strength, centrality, and alter attributes may moderate that influence.
- Including community stakeholders in intervention selection may offer researchers access to a new set of insights about feasibility.
- To understand longer-term dynamics of interventions, researchers should examine how network processes that occur early in an intervention shape later processes that in turn impact behavior.

Session 3: Adapting Existing Social Network Interventions to Aging Populations

Personal Network Study and Behavior Change: What Can We Learn From Observational Studies and Interventions Among Disadvantaged Populations

Carl Latkin, PhD, Johns Hopkins University

Social network data collected through both observational studies and randomized controlled trials (RCTs) illustrate that developing effective social network interventions for disadvantaged populations (e.g., people who inject drugs) requires using tailored tools to identify sources of influence for health behaviors, considering varied approaches to promote behavior change within networks, and strategically developing elastic social roles to reinforce change sustainably, even when members leave the network. These lessons can be applied to the development of network interventions for older adults, which should also consider the need to preserve autonomy and offer a sense of reciprocity within relationships and the potential adverse consequences of network interventions. Negative consequences may arise when a network rejects changes to social norms, messengers experience role conflict, researchers lack control over messages delivered throughout the network, and interventions change network dynamics in ways that may have adverse impacts following the intervention program.

Network-Based Interventions: Lessons Learned

Kar-Hai Chu, PhD, University of Pittsburgh

Dr. Chu and colleagues found that identifying peer leaders through social network analysis resulted in a successful, flexible intervention to provide middle school students with vaping prevention education. The researchers asked students to identify peers who fit several categories (e.g., closest friends, leaders, advice givers) and used those nominations to assign peer leaders who received an educational curriculum that they could share within naturally occurring friend groups. The flexibility of this approach allowed peer leaders to intuitively emphasize specific aspects of the curriculum based on groups' internal priorities, thus leveraging existing social relationships to produce changes in social norms, behavior, knowledge, and attitude. Dr. Chu and colleagues also developed a catalogue of corrective actions to implement in response to unplanned events that could interfere with the intervention (e.g., if a student selected for peer leadership already vapes). Identifying peer leaders who can influence group opinion may also help insert new messages in contexts in which one strongly held opinion is frequently repeated (e.g., on social media).

Network Approaches for Promoting Healthy Lifestyles in At-Risk Families and Communities

Kayla de la Haye, PhD, University of Southern California

Achieving sustainable behavior modifications to diet and physical activity is particularly difficult because eating and physical activity behaviors are largely habitual, often unconscious, and driven by both external and internal cues embedded in social and environmental structures, which can exacerbate disparities through behavior feedback loops. To target these multiple, intersecting factors and promote long-term behavior change, Dr. de la Haye and colleagues developed an intervention in which trained home visitors meet with high-risk mothers to deliver an evidence-based curriculum on healthy eating and physical activity habit formation. Pilot testing of this intervention indicated that more favorable mother and child outcomes were associated with a higher proportion of network members who were female and who encouraged the mothers participating in the study to practice healthy habits. An ongoing RCT

augments this intervention by including network intervention components that seek to alter mothers' social networks so that they include more ties and cues that encourage healthy behavior. This is achieved by engaging with mothers' family members in the home as part of the intervention delivery, and group activities for participating mothers to form new social connections. This augmented intervention is compared to a 'standard' home visiting program curricula that does not address diet, physical activity, or social networks.

Practical Magic: Use of Social Network Analysis-Based Strategies for Scaling Up Improvements in Long-Term Care

James Dearing, PhD, Michigan State University

Social network analysis—including sociograms that visualize networks—can help decision-makers gain knowledge and make more informed decisions. For example, Dr. Dearing and colleagues augmented a questionnaire that assessed nursing home owners' readiness to adopt a new care model to also measure their social position and influence, thus gauging their potential as opinion leaders who could promote intervention dissemination to other nursing homes. In another instance, health authorities were trained to use social network data, including sociograms, to identify isolated nursing homes and establish relationships among the homes' directors, which could aid the process of sharing evidence-based interventions. Without proper guidance, however, sociograms can lead decision-makers to make unwarranted assumptions; thus, analysts must be prepared to moderate potential incorrect interpretations.

Moderated Discussion of Session 3

Moderator: Emerald Nguyen, PhD, NIA BSR

Designing Interventions for Buy-In and Sustainability

To effect change, interventions require buy-in from messengers and functional ties through which messages can be shared. Pairing multiple name generators with more detailed analysis to identify relevant relationships; equipping messengers with skills, resources, or props to initiate conversations; and leveraging existing relationships and natural interactions can all support effective intervention spread. Determining which relationships best support intervention spread may require piloting interventions with different network members, analyzing which group configurations promote cohesion, or selecting intervention approaches based on contextual factors that may be present or absent (e.g., shared spaces). When established social ties do not already exist, intervention strategies that build emotional connections and create ongoing opportunities for support and social exchange may result in greater long-term effects, particularly for individuals with low SES who face additional impediments to maintaining relationships. Establishing long-lasting ties can be especially challenging within the time constraints of existing funding structures.

Participants noted that relevance, flexibility, and choice can enhance intervention diffusion. Interventions should provide messengers with skills and information that are relevant to their needs, as well as flexible options for sharing messages with other network members. Co-designing interventions with communities and offering the opportunity to choose from a set of

interventions can also increase alignment between interventions and participants' needs. Researchers should also consider ideal intervention timing; in some cases, intervening earlier in the life course (e.g., at midlife) may more effectively support a healthy aging trajectory than attempting to change established behaviors later in the life course.

Measuring Success in Network Interventions

Effective measurement of the success of network interventions requires developing methods to monitor network change over time while attending to multiple mechanisms of action, potential contamination effects, and structural features of networks that impact intervention diffusion. Assessment practices should account for the possibility that behavior adoption may initially appear similar across active and control arms, with differences in maintenance emerging later. Definitions of success also vary depending on intervention aims—in the use of social network analysis to support informed decision-making, successful outcomes can include a potential adopter using the information provided to reject an intervention that is not suited to their organization.

Ethical Use of Network Data

Important ethical concerns attend the collection and use of network data to identify prospective messengers and motivate behavior change. Merely providing individuals with sociograms or other network data may influence individual behavior, network dynamics, and the network information provided in subsequent assessments. In some cases, using existing data to map relationships (e.g., among organizations) prior to conducting sociometric interviews may limit these potential unintended effects. Participants emphasized the need to preserve anonymity, state upfront what data will be shared, and allow individuals to make self-determined choices about their own sharing, participation, and leadership. Using an asymmetric paternalistic approach can support healthy choices through environmental structures, but it is important to still allow individuals to determine their own behaviors and ties. Additional data are needed to assess unanticipated consequences of network interventions. An NIA workshop on ethical principles in community and network interventions could facilitate helpful further discussion of these issues.

Implications for Future Research

- Researchers should leverage mixed methods approaches and implementation science to improve measurement of the success of network interventions over time and to better understand potential unintended consequences.
- Further discussion is needed on ethics in community and network interventions, perhaps through a subsequent workshop on that topic.
- Longer-term funding structures are needed to allow interventions to progress from initially realigning ties to establishing lasting ties.
- Important opportunities may exist to intervene earlier in the life course (e.g., at midlife) in order to support a healthy aging trajectory.
- Researchers can use social network analysis (e.g., sharing social network data with individuals) to improve decision-making and support intervention dissemination.

- Future research can improve network interventions for older adults by developing tailored tools to identify sources of influence, varied approaches to promote behavior change, and elastic social roles that reinforce change sustainably even when members leave the network.

Session 4: Leveraging Social Network Dynamics to Enhance the Reach of Individual Behavior Change Interventions

Understanding Which Intervention Components Work and How They Work: The Multiphase Optimization Strategy

Linda M. Collins, PhD, New York University

The Multiphase Optimization Strategy (MOST), a method developed and refined by Dr. Collins and colleagues, can enhance the development of social network-based behavior change interventions by assessing distinct intervention components and their interactions with one another prior to an RCT in order to achieve a strategic balance of effectiveness with affordability, scalability, and efficiency. MOST includes three phases: (1) preparation, which involves developing a conceptual model, identifying and pilot testing candidate intervention components, and selecting an optimization criterion; (2) optimization, in which an intervention that meets the optimization criterion is built by conducting one or more optimization trials (that can include cluster randomization) and using the results, in concert with the optimization criterion, to select components for inclusion in the optimized intervention; and (3) evaluation, which confirms the optimized intervention's effectiveness through an RCT. MOST can support the creation of practical, implementable, and affordable social network interventions, help build a knowledge base about which interventions are well suited to social network approaches and which diffusion techniques are effective, and facilitate steady, incremental improvements to interventions over time.

Promoting Behavior Change and Restructuring Personal Networks with the Motivational Network Intervention

David Kennedy, PhD, RAND Corporation

In a network alteration intervention focusing on substance use, Dr. Kennedy and colleagues paired motivational interviewing with personal network visualizations to promote self-directed changes to behavior and social networks in adults and young adults transitioning from homelessness to supportive housing. Network enumeration following the intervention showed participants' networks changed to include fewer recent drinking partners, and participants reported decreased alcohol and marijuana use, increased readiness to change, and higher abstinence self-efficacy. Adaptations of this intervention for other populations and outcomes include a pilot study mapping the social networks of caregivers of older adults and assessing their impact on caregiver burden over time, which could reduce caregiver burden and improve care recipient well-being.

Interventions for Social Connection in Later Life: State of the Science

Kimberly Van Orden, PhD, University of Rochester

Reducing loneliness provides meaningful benefits for health and well-being at all ages but remains challenging, particularly among older adults and caregivers who may be impacted by multiple, intersecting pathways to loneliness (e.g., social resources, mental health, cognitive and physical function). Evidence suggests that behavioral intervention approaches including mindfulness, behavioral activation, peer companionship, and group exercise and health promotion can reduce loneliness; however, more evidence is needed to identify mechanisms and determine which interventions are effective for specific groups. Promising approaches to fill these gaps include assessing individuals' pathways to loneliness, determining which interventions may be most effective and least burdensome for them, and providing training and practice in behavioral skills. Future research should develop improved methods to engage isolated older people and increase their social self-efficacy; incorporate tailoring, stepped care, and peer delivery; and identify ideal settings for network approaches to addressing loneliness.

Building Patient-Centered Network Interventions in Neurology

Amar Dhand, MD, Brigham and Women's Hospital

Observing that patients' networks tend to become smaller, more close-knit, and healthier following stroke, Dr. Dhand and colleagues developed TEAMS-BP, an intervention to manage blood pressure in patients following stroke by engaging members of their social networks who are selected based on factors including support provided, distance to patient, and frequency of contact. Using a primary outcome of systolic blood pressure change, a pilot RCT will compare the effectiveness of individual counseling with that of TEAMS-BP, which emphasizes a team approach to setting goals, identifying challenges, developing solutions, and engaging in activities to promote success. The development and initial testing of TEAMS-BP has indicated that systolic blood pressure number setting a concrete and objective goal for the group (e.g., reduction of systolic blood pressure number) is critically important for intervention success. It has further illustrated challenges that can affect network interventions, including complex regulatory and consent requirements and a tension between encouraging network participation and respecting the autonomy of patients who may resist asking certain network members to join the intervention for reasons such as perception of burden.

Moderated Discussion of Session 4

Moderator: Lisa Onken, PhD, NIA BSR

Need for Tailored Objective and Subjective Measures

Participants emphasized the importance of using both objective and subjective measures to assess social ties, burden, and network resilience, and of tailoring existing measures for different populations. Objective measures can capture information (e.g., actual time spent with network members) that may contrast with self-reported perceptions of tie strength and burden; however, subjective measures remain important because individuals' perceptions may drive their behavior even if those perceptions do not correspond to objective fact. Network

visualizations can also modify subjective perceptions by illustrating networks using information provided by participants or through objective measures. Improved measures of network burden and resilience could help address individuals' reluctance to participate in interventions because they perceive themselves as burdening their networks and could inform approaches to facilitating network-based support without exhausting vulnerable network members.

Impacts of Weak and Negative Ties

Network interventions should attend to peripheral and weak ties, which can be critically important to promoting healthy behavior and may be even more impactful than strong ties in certain behavior domains. In addition, negative ties may include complex interactions that create opportunities for growth. Capturing these ties necessitates the use of multiple intervention-specific name generators that prompt discussion of both positive and negative support as well as peripheral (e.g., virtual) interactions whose importance individuals may underestimate. In some cases, personal network interventions may result in individuals spending less time with certain negative ties (e.g., those network members associated with substance use); future research should consider how these interventions may negatively impact network members who are not directly involved in the intervention.

Priming Networks for Change

Individuals are more open to changing their personal networks during life transitions, including unexpected transitions such as life-threatening health events (e.g., stroke). Future research should explore methods to prompt network malleability outside of emergency events to promote healthy behaviors prior to the onset of medical crises.

Comparing and Adapting Interventions

Using MOST to compare prospective interventions can help determine which is best suited to specific circumstances based on criteria such as affordability as well as effectiveness. In addition, MOST can inform adaptations of network interventions first designed for other populations for application in older adults and adaptations of behavioral interventions to leverage social networks.

Implications for Future Research

- Additional objective and subjective measures are needed to assess network burden and resilience and should be tailored to both specific populations and interventions.
- Further research should examine peripheral, weak, and negative ties, as well as consider how personal network interventions may negatively impact network members who are not part of the intervention.
- Future research should explore methods of prompting network malleability outside of life-threatening crises (e.g., stroke).
- MOST offers a promising avenue to determine which interventions are optimal in the context of specific circumstances and available resources, to adapt network interventions designed for other populations for application in older adults, and to adapt behavioral interventions to leverage social networks.

- Future research on interventions for loneliness should develop improved methods to engage isolated older people and increase their social self-efficacy; incorporate tailoring, stepped care, and peer delivery; identify ideal settings for network approaches to addressing loneliness; and gather more evidence to identify mechanisms and determine which interventions are effective for specific groups.
- Motivational interviewing paired with personal network visualizations can be adapted for use with varied populations, including older adults and caregivers.

Reports From Breakout Session Groups

Breakout Room A: Matching Interpersonal and Network Mechanisms and Outcomes

Rapporteur: Alexander Rothman, PhD, University of Minnesota

Advancing knowledge of interpersonal and network mechanisms and outcomes requires not only identifying specific mechanisms to target when designing network interventions, but also recognizing that those mechanisms are linked to context and setting and can operate at individual, relational, and structural levels. Further research in this area should address how network changes over time may impact intervention function and which network members an intervention should engage. Funding opportunities are needed to support this research, and early- or mid-career training programs may enable researchers whose experience is primarily in network analysis to learn about advances in intervention science.

Breakout Room B: Network Dynamics and Modification

Rapporteur: Brea Perry, PhD, Indiana University

To advance approaches to modifying networks, researchers need to gather more data on the conditions under which relationships and networks are malleable, such as by identifying key transitions during which interventions may be particularly impactful. More longitudinal data and observational studies in natural settings are also needed to understand network dynamics, measure and model change, and develop intervention approaches that leverage common network structures and traits (e.g., homophily, transitivity) to alter networks more effectively and sustainably. An improved understanding of network dynamics can also enable researchers to contribute to the many existing group interventions that do not use a network-based approach, such as by measuring network change and identifying mechanisms of change within those interventions.

Breakout Room C: Optimizing Environments and Setting Effects

Rapporteur: Kayla de la Haye, PhD, University of Southern California

Optimizing environments and setting effects requires identifying the contexts and spaces that are critical venues for network interventions, considering the interdependency of networks and contexts as well as how individual settings are embedded in multiple contexts and spaces, and investigating the dynamics and resilience of contextualized networks to understand how changes within multilevel systems can impact individuals throughout networks over time.

Further research is needed to tailor interventions to life phases and contexts (e.g., prevention, transition planning, and crisis management) and to determine how settings and contexts can further intervention sustainability. This work must attend to challenges such as the risks and barriers that underserved populations often experience cumulatively across multiple settings, the impact that timing within the life course may have on individuals' receptivity to engagement in network interventions, and the disruption of networks and spaces that attends transitions. Support is needed for multi-setting studies that capture longitudinal and dynamic behavior, which may not be possible within the bounds of 5-year research grants. Methodological resources are also needed to integrate network data across individuals, settings, and levels, as well as to navigate privacy concerns.

Breakout Room D: Challenges and Opportunities in Methods and Measurements

Rapporteur: Thomas Valente, PhD, University of Southern California

Refinements of methods and measurements should balance respondent burden with increasingly specific network elicitation tools (e.g., name generators), assess the accuracy of network measures, and prioritize developing implementable interventions that are both effective and feasible. Challenges to achieving these goals include the need to adapt research designs to specific populations and the unsuitability of classical measurement theory to assess outcomes in social network analysis settings, particularly when measuring affective experiences (e.g., loneliness) that can vary from day to day. Key research questions to consider include which name generators are most effective for specific outcomes; how to avoid and assess contamination in network interventions; which network interventions may be scalable; how to feasibly collect longitudinal network data; how to effectively measure networks across the life span; and how archetypical roles of older adults vary from those of adolescents.

Breakout Room E: Implementation and Evaluation

Rapporteur: Reza Yousefi-Nooraie, PhD, University of Rochester

Approaches to implementation and evaluation should distinguish between implementing network interventions and using network interventions to enhance the implementation of *other* interventions, as well as between network interventions for individuals and sociocentric interventions that engage networks to promote behavior change. Key topics for future research include the extent to which network interventions are context- and system-dependent, how to sustain interventions through changes in dynamic networks, how to develop sustainable assessment metrics for large networks, and how to assess implementation mechanisms of complex, multi-component network interventions. Additional challenges to consider include privacy and ethical concerns; the difficulty of identifying and engaging stakeholders, particularly in community interventions; the differing needs for implementing interventions initially and implementing them sustainably and at scale; the need to ensure that interventions are reimbursable; the risk that network interventions may unintentionally reinforce disparities within existing power structures; and the potential for disciplinary silos to hinder the sharing of existing implementation strategies.

Breakout Room F: Unintended Consequences of Network Interventions

Rapporteur: Robert Faris, PhD, University of California Davis

Network interventions may result in varied unintended negative consequences, including exacerbating health and resource disparities both within and across groups through unequal distribution and exclusion; altering behavior in ways that have surprising and potentially negative effects on health; causing unintended changes in relationships by altering social norms and introducing new topics of conversations; and changing network hierarchies by boosting the status of some individuals at the potential detriment of others, which could trigger antagonism and abuse. To anticipate and ameliorate these potential negative consequences, researchers can draw transferable lessons from other fields and comparable environments (e.g., applying lessons from schools to senior communities). A compendium of mistakes and lessons learned could be a useful knowledge-sharing resource for network intervention researchers.

Large Group Discussion

Moderator: Thomas Valente, PhD, University of Southern California

Network Mechanisms and Behavior Change

Development of effective network interventions requires additional research into how network mechanisms at the individual, group, and community levels interact and impact diffusion. Although existing literature does theorize network mechanisms and structures, participants emphasized the need to match specific mechanisms and social ties to behavioral outcomes, noting that the mechanisms most directly associated with behaviors are not necessarily the most effective targets for changing those behaviors. While acknowledging that older adults are not necessarily more vulnerable to deception than other populations, participants suggested that researchers could study motivational targets that are abused in efforts to exploit older adults (e.g., desire to help family, contribute to society, or feel connected to others) and redirect them to promote beneficial behaviors. Intergenerational network interventions related to large-scale societal issues (e.g., climate change) can also promote feelings of relevance and connectedness. Future research on network mechanisms should include study of different racial and ethnic groups across varied geographic sites.

Documenting Network Dynamics

Understanding the characteristics, needs, and longitudinal changes that shape older adults' networks requires more complete and granular data. Participants noted that behavior change interventions for individuals may result in unintended network modifications that researchers do not document. Collecting data on these changes could inform network intervention strategies to promote behavior change. In addition, studies that do track network modifications often focus on traits such as size, density, and structure rather than nuanced changes in the quality of individual relationships, extent of support, and frequency of contact. Studies that combine monitoring of larger network structures with analysis of personal network changes can enhance understanding of how interventions impact network dynamics. Future research should also attend to the negative aspects of social ties (e.g., interpersonal strain) and how factors

such as cost and burden may shape individuals' preferences for networks that offer support without frequent interaction or intimacy.

Refining Measures and Methods

Participants discussed the need for qualitative measures that are both flexible and culturally adapted to accurately capture the characteristics of interpersonal relationships. Further research should also examine the correlation between network properties measured over time and target intervention outcomes to support the development of enhanced causal inferences and promote public confidence in social network interventions. Optimization trials can enable analysis of underlying mechanisms, but applying certain study designs (e.g., factorial) to network interventions can pose randomization challenges when network boundaries are not clearly defined. Participants emphasized the need to distinguish between spillover and contamination, suggesting that the former should be measured and viewed as an indicator of successful diffusion while the latter constitutes a methodological problem that can be avoided through cluster randomization.

Network Interventions and Personal Transitions

The plasticity and risks associated with significant life course transitions (e.g., retirement, moving into a senior living community) present important opportunities for intervention and data collection. Researchers should consider conducting research in the settings in which transitions occur, mapping networks before and after transitions, and analyzing longitudinal changes throughout networks following unexpected transitions (e.g., health crises). The transitions experienced by military service members and veterans (e.g., from mobilization to demobilization, from active duty to civilian life) may be particularly suitable for studying the effectiveness of existing intervention strategies. Research on networks in transition could inform proactive, capacity-building interventions that increase network resilience and social skills prior to anticipated transitions or in preparation for potential crises. Participants suggested that such interventions may represent an opportunity to improve the quality of networks that individuals will build in the future rather than merely improving the function of existing networks.

Need for Training and Guidelines

Participants identified a number of additional resources that can advance the development and implementation of effective network interventions: (1) an NIH Toolbox or similar resource on network interventions and measures; (2) guidance on ethical considerations in network interventions; (3) implementation science training for social network analysis that considers complexities including context, network dynamics, and interconnected factors and mechanisms; and (4) guidelines to support efficient and consistent institutional review board (IRB) evaluation of network interventions.

Implications for Future Research

- Matching target behavioral outcomes to mechanisms of action and specific changes in network properties requires additional research, including optimization trials and studies across racial and ethnic groups and geographic locations.

- Researchers should use flexible, culturally adapted measures to collect additional data on potential unintended network modifications caused by interventions for individuals, qualitative changes to relationships in network interventions, and negative aspects of social ties.
- Studying transitions in the settings in which they occur may offer opportunities to learn about network plasticity and the potential benefits of capacity-building interventions implemented prior to moments of transition or crisis.
- Resources that offer guidance on network intervention measures, ethical considerations, implementation, and IRB evaluation could help advance the field.
- To better understand how interventions impact network dynamics, researchers should study how network mechanisms at the individual, group, and community levels interact with and impact diffusion, as well as combine monitoring of larger network structures with analysis of personal network changes.
- Researchers should distinguish between spillover and contamination in network interventions and apply appropriate methods to measure the former and avoid the latter.
- Future research should examine motivational targets that are abused in efforts to exploit older adults, which could be leveraged to promote beneficial behaviors.

Social Network Diffusion of Individual Behavior Change Interventions Workshop

National Institute on Aging Division of Behavioral and Social Research (NIA BSR)



*March 2, 2022
10:30 AM – 3:30 PM EST*

*March 3, 2022
11:00 AM – 3:30 PM EST*

*March 4, 2022
11:00 AM – 2:30 PM EST
(Closed Session)*

Meeting Chairs:

[Brea Louise Perry](#), PhD; *Indiana University*
[Thomas Valente](#), PhD; *University of Southern California*

NIA Planning Committee

[Liz Necka](#), PhD, Chair
[Laura Major](#), Chair
[Allie Walker](#), Coordinator

Large-scale behavior change is often conceptualized as resulting from widespread dissemination and implementation of behavioral interventions that have been developed for individuals or other small social units, such as the dyad or family. Efforts prioritize direct administration of an intervention to all individuals within a target population. An alluring but underexamined alternative model for producing large-scale behavior change involves leveraging social network dynamics across the lifespan. By strategically administering interventions that draw upon our understanding of social networks and social influence within them, we may effectively change behavior in people who themselves never directly received the intervention. This workshop will focus on gaps, opportunities, and strategies for leveraging or strengthening social networks to enhance the reach of individual behavior change interventions to promote healthy aging, slow cognitive decline and prevent Alzheimer’s Disease and Related Dementias (AD/ADRD), and improve outcomes for persons living with AD/ADRD and their care partners.

Schedule at a Glance

Day 1 (March 2)

10:30 AM – 11:00 AM	Welcome Session & Meeting Charge
11:00 AM – 1:00 PM	Session 1: Characterizing Social Networks and Social Network Processes in Aging
1:00 PM – 1:30 PM	Break
1:30 PM – 3:30 PM	Session 2: Mapping Social Network Diffusion Processes

Day 2 (March 3)

11:00 AM – 1:00 PM	Session 3: Characterizing Social Networks and Social Network Processes in Aging
1:00 PM – 1:30 PM	Break
1:00 PM – 3:30 PM	Session 4: Mapping Social Network Diffusion Processes

Day 3 (March 4) Closed Session

11:00 AM – 11:45 AM	Day 1 & 2 Recap
11:45 AM – 12:30 PM	Breakout group discussions
12:30 PM – 1:00 PM	Break
1:00 PM – 2:20 PM	Large Group Discussion
2:20 PM – 2:30 PM	Closing Remarks

Schedule in Detail

Day 1 (March 2)

Welcome Session
10:30 AM – 11:00 AM

- 10:30 AM – 10:35 AM **Welcome and Introductory Remarks**
[Lis Nielsen](#), PhD; Director, Division of Behavioral and Social Research, NIA
- 10:35 AM – 10:45 AM **Goal Setting**
NIA Planning Committee Chairs
[Laura Major](#); National Institute on Aging
[Liz Necka](#), PhD; National Institute on Aging
- 10:45 AM – 11:00 AM **Meeting Charge**
Meeting Chairs
[Brea Perry](#), PhD; Indiana University
[Thomas Valente](#), PhD; University of Southern California

Characterizing Social Networks and Social Network Processes in Aging

Session 1
11:00 AM – 1:00 PM

- | | | |
|---------------------|---|---|
| 11:00 AM – 11:20 AM | Network bridging and bonding in older adults: Lessons from cognitive aging
Brea Perry , PhD; Indiana University | Questions speakers will address:
<i>How do social networks and the ways that people leverage them change over the life course? How do older adults use their social networks? What are major issues in older adult social networks?</i> |
| 11:20 AM – 11:40 AM | Older Adults' Core Networks: Composition, Geographical Distance, and Turnover
Markus Schafer , PhD; University of Toronto | |
| 11:40 AM – 12:00 PM | Social Networks in a Season of Loss and Change
Stacy Torres , PhD; University of California, San Francisco | |
| 12:00 PM – 12:20 PM | Social Networks, Age and Potential for Intervention: What we know and what need to know more about
Toni Antonucci , PhD; University of Michigan | |
| 12:20 PM – 1:00 PM | Discussion
Moderator: Liz Necka , PhD; NIA BSR | |

1:00 PM – 1:30 PM Break

Mapping Social Network Diffusion Processes

Session 2
1:30 PM – 3:30 PM

- | | | |
|-------------------|--|---|
| 1:30 PM – 1:50 PM | Network Interventions: Past, Present, and Future
Thomas Valente , PhD; University of Southern California | Questions speakers will address:
<i>How does behavior change spread across a network (and what are the methods and means by which we can study it)? What are the network dynamics that influence uptake of behaviors?</i> |
| 1:50 PM – 2:10 PM | Network Features affecting Behavior Diffusion
James Moody , PhD; Duke University | |
| 2:10 PM – 2:30 PM | Network interventions to disseminate and diffuse; ingredients and measuring effectiveness
Reza Yousefi Nooraie , PhD; University of Rochester | |
| 2:30 PM – 2:50 PM | Facilitating engagement in risk-reducing behaviors among relatives of persons living with Alzheimer's Disease and related dementias
Laura Koehly , PhD; National Human Genome Research Institute | |
| 2:50 PM – 3:30 PM | Discussion
Moderator: Laura Major ; NIA BSR | |

Day 2 (March 3)

Adapting Existing Social Network Interventions to Aging Populations

Session 3 11:00 AM – 1:00 PM	11:00 AM – 11:05 AM	Welcome Back Meeting Chairs and NIA Planning Committee	Questions speakers will address: <i>How have existing social network interventions been used to modify behavior? What are the essential ingredients that make social network interventions successful?</i>
	11:05 AM – 11:25 AM	Personal network study and behavior change: What can we learn from observational studies and interventions among disadvantaged populations Carl Latkin , PhD; Johns Hopkins University	
	11:25 AM – 11:45 PM	Network-based interventions: lessons learned Kar-Hai Chu , PhD; University of Pittsburgh	
	11:45 PM – 12:05 PM	Network and systems approaches for promoting healthy eating and physical activity among at-risk families and communities Kayla de la Haye , PhD; University of Southern California	
	12:05 PM – 12:25 PM	Practical Magic: Use of Social Network Analysis-Based Strategies for Scaling Up Improvements in Long-Term Care James Dearing , PhD; Michigan State University	
	12:25 PM – 1:00 PM	Discussion Moderator: Emerald Nguyen , PhD; NIA BSR	
1:00 PM – 1:30 PM Break			

Leveraging Social Network Dynamics to Enhance the Reach of Individual Behavior Change Interventions

Session 4 1:30 PM – 3:30 PM	1:30 PM – 1:50 PM	Understanding which intervention components work and how they work: The multiphase optimization strategy (MOST) Linda Collins , PhD; New York University	Questions speakers will address: <i>How do we identify essential ingredients of a behavior change intervention within an experimental medicine approach? How do social relationships influence health behaviors and outcomes?</i>
	1:50 PM – 2:10 PM	Promoting behavior change and restructuring personal networks with the Motivational Network Intervention David Kennedy , PhD; RAND Corporation	
	2:10 PM – 2:30 PM	Interventions for Social Connection in Later Life: State of the Science Kimberly Van Orden , PhD; University of Rochester	
	2:30 PM – 2:50 PM	Building patient-centered network interventions in neurology Amar Dhand , MD; Brigham & Women’s Hospital	
	2:50 PM – 3:25 PM	Discussion Moderator: Lisa Onken , PhD; NIA BSR	
	3:25 PM – 3:30 PM	Interim Closing Remarks NIA Planning Committee	

Day 3 (March 4)
Closed Session

Discussion
11:00 AM –
12:30 PM

11:00 AM – 11:45 AM **Day 1 & 2 Recap**
Meeting Chairs
11:45 AM – 12:30 PM **Breakout group discussions**
All participants

12:30 PM – 1:00 PM Break

Discussion
1:00 PM –
2:30 PM

1:00 PM – 2:20 PM **Large Group Discussion**
Moderators: Meeting Chairs
2:20 PM – 2:30 PM **Closing Remarks**
Meeting Chairs and NIA Planning Committee

Breakout Session Panelists

[Jimi Adams](#), PhD *University of Colorado Denver*
[Steven Albert](#), PhD *University of Pittsburgh*
[Sato Ashida](#), PhD *University of Iowa*
[Elizabeth Bouchard](#), PhD *Roswell Park*
[Thomas Cudjoe](#), MD *Johns Hopkins University*
[Robert Faris](#), PhD *University of California, Davis*
[Esther Friedman](#), PhD *University of Michigan*
[Lauren Gaydos](#), PhD *University of Texas at Austin*
[Ruth Hunter](#), PhD *Queen's University Belfast*
[Mariano Kanamori](#), PhD *University of Miami*
[Ashwin Kotwal](#), MD *University of California, San Francisco*
[Anne Krendl](#), PhD *Indiana University Bloomington*
[Elizabeth McGee Hassrick](#), PhD *Drexel University*
[Tara McKay](#), PhD *Vanderbilt University*
[Alexander Rothman](#), PhD *University of Minnesota*
[George Vega Yon](#), PhD *University of Utah*
[Peter Wyman](#), PhD *University of Rochester*

Appendix B: Presenter Talking Points

Session 1: Characterizing Social Networks and Social Network Processes in Aging

Network Bridging and Bonding in Older Adults: Lessons From Cognitive Aging

Brea Perry, PhD, Indiana University

- Networks change over the life course, partly as a function of preferences and values, but also because of life events and exits from social roles.
- Social connectedness is associated with cognitive function and decline, and with mental health and quality of life.
- Attention to measurement and network mechanisms is critical, such as differentiating social bridging and bonding.

Core Personal Networks in Later Life: Emerging Evidence About Composition, Distance, and Adaptive Change

Markus Schafer, PhD, University of Toronto

- Older adults' core networks are getting larger and more non-kin focused, a pattern which seems to be driven by cohort change.
- Geographical distance still matters in the formation and function of older adults' core networks, though with patterned heterogeneity.
- As people age, their core networks appear to be marked by stability and rebalancing.

Social Networks in a Season of Loss and Change

Stacy Torres, PhD, University of California San Francisco

- People have shifting needs over the life course, and their social network adaptations reflect these changes and losses, including: neighborhood change; the loss of neighbors, friends, and family; health setbacks; depression; financial struggles; and other challenges.
- In my research, I have observed elasticity in elders' non-strong, non-weak relations that allowed a balance of closeness and distance and helped avoid overstressing family ties.
- For older adults living independently and aging in place, neighborhood places serve as crucial settings where people not heavily involved in institutions of work and family can connect with others, form supportive relationships, and avoid social isolation.

Social Networks, Age, and Potential for Intervention: What We Know and What We Need to Know

Toni Antonucci, PhD, University of Michigan

- What we know about continuity and change in social networks across the life span and in old age.
- Which is more important: the quality or quantity of social networks?
- How to use social networks as a vehicle for change/intervention.

Session 2: Mapping Social Network Diffusion Processes

Network Interventions: Past, Present, and Future

Thomas Valente, PhD, University of Southern California

- Network interventions have a long and varied history and have morphed from metaphor to meta-analyses.
- Existing network intervention approaches have mainly been executed in whole closed networks such as schools, organizations, and hospitals.
- As we move toward open systems and attempt to generate community spread, we face challenges such as assessing how interventions can be diffused, how to measure spread, and how to evaluate their effectiveness.

Network Features Affecting Behavior Diffusion

James Moody, PhD, Duke University

- Network diffusion depends on connectivity patterns; features that create multiple independent routes between adopters and non-adopters should promote diffusion.
- Network patterns are not just who-connects-to-who, but also when-to-when: timing and repeat contact considerations limit diffusion.
- Individual threshold effects for adoption models imply complex limits on adoption that, in many cases, will lead to bifurcated spread with either very small adoptions or nearly complete cascades.

Network Interventions to Disseminate and Diffuse: Ingredients and Measuring Effectiveness

Reza Yousefi-Nooraie, PhD, University of Rochester

- Network approaches to study diffusion (passive) and dissemination (active) of health innovations.
- The ingredients and themes of interventions to build and restructure social networks.
- The mixed methods and fused approaches to study patients' social networks.

Facilitating Engagement in Risk-Reducing Behaviors Among Relatives of Persons Living with Alzheimer's Disease and Related Dementias

Laura Koehly, PhD, National Human Genome Research Institute

- Family health history can activate conversations about shared risk in families affected by both inherited and common, complex disease, which in turn facilitates diffusion of information and behaviors in familial network systems.
- Families affected by Alzheimer's disease and related dementias are often navigating both their caregiving roles and potential increased risk through their family health history, one important risk factor of Alzheimer's disease, affecting how they function as a network to care for and support each other.
- Data indicate that family caregivers discuss family risk with caregiving network members at rates much lower than discussions about the care recipient's health, with notable

disparities in these discussion rates by race, pointing to opportunities for family history-based interventions within these families.

Session 3: Adapting Existing Social Network Interventions to Aging Populations

Personal Network Study and Behavior Change: What Can We Learn From Observational Studies and Interventions Among Disadvantaged Populations

Carl Latkin, PhD, Johns Hopkins University

- Key factors to consider when developing network interventions include reciprocity, network stability, and turnover. With older adults, agency and trust may also be important factors.
- In developing peer-based network interventions, attention should be paid to sustainable roles and the relationships that are reinforced by the network.
- Within networks, the discussion of certain health behaviors is not normative. However, changing these norms may have a positive effect on health outcomes.

Network-Based Interventions: Lessons Learned

Kar-Hai Chu, PhD, University of Pittsburgh

- Peer-leaders identified through social network analysis works!
- But don't ignore pragmatic, implementation concerns.
- Pros and cons of echo chambers.

Network Approaches for Promoting Healthy Lifestyles in At-Risk Families and Communities

Kayla de la Haya, PhD, University of Southern California

- Eating and activity habits are a major cause of non-communicable diseases and are strongly influenced by social networks and socio-ecological contexts; factors that are insufficiently addressed in many interventions.
- Multi-level interventions can integrate components that effectively leverage or alter social networks of family, friends, peers, and community stakeholders to change eating and activity habits and improve health outcomes.
- Innovations in network and data science methods, big data, and transdisciplinary team science is important to advancing this work.

Practical Magic: Use of Social Network Analysis-Based Strategies for Scaling Up Improvements in Long-Term Care

James Dearing, PhD, Michigan State University

- Long-term care administrators, organizational leaders, and key intermediaries who advocate for improved long-term care and improved patient outcomes can find practical uses for social network analysis-based information that serves as a novel input for decision-making.

- Social network analysis-based strategies complement the operationalization of other diffusion of innovation concepts that help to explain reactions to new practices, programs, technologies, and policies.
- This presentation will illustrate the above points through three examples of practical applications.

Session 4: Leveraging Social Network Dynamics to Enhance the Reach of Individual Behavior Change Interventions

Understanding Which Intervention Components Work and How They Work: The Multiphase Optimization Strategy (MOST)

Linda Collins, PhD, New York University

- Sole reliance on the randomized controlled trial, to the exclusion of other approaches to experimentation, is hindering progress in intervention science.
- A more iterative, discovery-driven approach would move intervention science forward faster.
- The multiphase optimization strategy (MOST) enables the intervention scientist to achieve a strategic balance of effectiveness against affordability, scalability, and efficiency (we call this balance Intervention *EASE*).

Promoting Behavior Change and Restructuring Personal Networks with the Motivational Network Intervention

David Kennedy, PhD, RAND Corporation

- Each person is the center of a personal network that influences and constrains their behavior in a variety of ways and making changes to behavior often requires making changes to this personal network.
- Providing visual feedback to individuals about their personal network characteristics can assist the behavior change process and personal network restructuring when coupled with techniques for enhancing motivation such as motivational interviewing.
- Behavior change interventions that use personal network visualizations have been successful in substance use interventions with formerly homeless people transitioning to permanent supportive housing and this approach could be adapted for other outcomes and populations, such as reducing caregiver burden.

Interventions for Social Connection in Later Life: State of the Science

Kimberly Van Orden, PhD, University of Rochester

- Social connections that create a sense of *caring*, *contributing*, and *community* have a range of benefits for health and well-being at all ages, while social isolation and loneliness are associated with *reduced quality of life* (including well-being, depressive symptoms), *unhealthy behaviors* (smoking, unhealthy diet, lack of exercise), and *adverse health outcomes* (including cardiovascular disease, metabolic syndrome, hypertension, pain, fatigue, insomnia, depression, dementia, suicide, and all-cause mortality).

- The state of the science in social connection interventions in older adults indicates several promising behavioral interventions, but overall a limited evidence base to support one intervention over another, low utilization outside research settings, low acceptability of programs framed as targeting loneliness, and inability to tailor programs to person-specific causes of disconnection.
- A variety of behavioral interventions to reduce caregiver stress have demonstrated positive effects on burden, depression, subjective well-being, ability/knowledge, and improved symptoms of the care recipient, but most have little evidence to support improvements in any dimension of social connection—social isolation, social support, or loneliness—either because dimensions of social connection were not examined as outcomes or because interventions did not reliably improve social connection.

Building Patient-Centered Network Interventions in Neurology

Amar Dhand, MD, Brigham and Women's Hospital

- After stroke, social networks become small and close-knit, but also healthier.
- This natural pattern suggests that a patient-centered network intervention, defined as involving multiple key network members in a lifestyle-improvement program, has promise.
- I will discuss an NIA-supported randomized controlled trial aimed to improve hypertension in older adults after stroke using a patient-centered network intervention.

Appendix C: Participants

Jimi Adams, University of Colorado Denver
Steven Albert, University of Pittsburgh
Toni Antonucci, University of Michigan
Sato Ashida, University of Iowa
Jessica Boten, NIA BSR
Elizabeth Bouchard, Roswell Park
Kar-Hai Chu, University of Pittsburgh
Linda Collins, New York University
Thomas Cudjoe, Johns Hopkins University
James Dearing, Michigan State University
Kayla de la Haye, University of Southern California
Amar Dhand, Brigham and Women's Hospital
Robert Faris, University of California Davis
Elena Fazio, NIA BSR
Esther Friedman, University of Michigan
Lauren Gaydosh, University of Texas at Austin
Melissa Gerald, NIA BSR
Ruth Hunter, Queen's University Belfast
Mariano Kanamori, University of Miami
Amelia Karraker, NIA BSR
David Kennedy, RAND Corporation
Laura Koehly, National Human Genome Research Institute
Ashwin Kotwal, University of California San Francisco
Anne Krendl, Indiana University Bloomington
Carl Latkin, Johns Hopkins University
Laura Major, NIA BSR
Elizabeth McGhee Hassrick, Drexel University
Tara McKay, Vanderbilt University
James Moody, Duke University
Liz Necka, NIA BSR
Emerald Nguyen, NIA BSR
Lis Nielsen, NIA BSR
Priscilla Novak, NIA BSR
Lisa Onken, NIA BSR
Brea Perry, Indiana University
Alexander Rothman, University of Minnesota
Markus Schafer, University of Toronto
Janine Simmons, NIA BSR
Lijun Song, Vanderbilt University
Albert Stevens, EBSCO
Luke Stoeckel, NIA BSR

Stacy Torres, University of California San Francisco

Thomas Valente, University of Southern California

Kimberly Van Orden, University of Rochester

George Vega Yon, University of Utah

Allie Walker, NIA BSR

Xujing Wang, National Institute of Diabetes and Digestive and Kidney Diseases

Peter Wyman, University of Rochester

Reza Yousefi-Nooraie, University of Rochester

Appendix D: Breakout Session Participants

Breakout Room A: Matching Interpersonal and Network Mechanisms and Outcomes

Jimi Adams, University of Colorado Denver
Elizabeth Bouchard, Roswell Park
Amar Dhand, Brigham and Women's Hospital
Ashwin Kotwal, University of California San Francisco
Tara McKay, Vanderbilt University
Liz Necka, NIA BSR
Lis Nielsen, NIA BSR
Alexander Rothman, University of Minnesota
Allie Walker, NIA BSR

Breakout Room B: Network Dynamics and Modification

David Kennedy, RAND Corporation
Anne Krendl, Indiana University Bloomington
Carl Latkin, Johns Hopkins University
Brea Perry, Indiana University
Janine Simmons, NIA BSR
Albert Stevens, EBSCO
Luke Stoeckel, NIA BSR
Peter Wyman, University of Rochester

Breakout Room C: Optimizing Environments and Setting Effects

Toni Antonucci, University of Michigan
Jessica Boten, NIA BSR
Thomas Cudjoe, Johns Hopkins University
Kayla de la Haye, University of Southern California
Elena Fazio, NIA BSR
Esther Friedman, University of Michigan
Laura Koehly, National Human Genome Research Institute
Laura Major, NIA BSR

Breakout Room D: Challenges and Opportunities in Methods and Measurements

Kar-Hai Chu, University of Pittsburgh
Linda Collins, New York University
Elizabeth McGhee Hassrick, Drexel University
James Moody, Duke University
Emerald Nguyen, NIA BSR
Lijun Song, Vanderbilt University
Thomas Valente, University of Southern California
George Vega Yon, University of Utah

Xujing Wang, National Institute of Diabetes and Digestive and Kidney Diseases

Breakout Room E: Implementation and Evaluation

Sato Ashida, University of Iowa

Lauren Gaydos, University of Texas at Austin

Lisa Onken, NIA BSR

Kimberly Van Orden, University of Rochester

Reza Yousefi-Nooraie, University of Rochester

Breakout Room F: Unintended Consequences of Network Interventions

Robert Faris, University of California Davis

Melissa Gerald, NIA BSR

Mariano Kanamori, University of Miami

Amelia Karraker, NIA BSR

Priscilla Novak, NIA BSR