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Advancing Collaborative Research with 2-1-1 to Reduce Health Disparities:

Challenges, Opportunities, and Recommendations

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Introduction

The 2-1-1 system is a Federal Communications Commission nationally designated 3-digit telephone information and referral (I&R) system that connects callers with basic needs to health and social services in their community. Although the 2-1-1 system has a number of limitations—uneven geographic coverage within states, diverse data collection and storage systems, and scarce resources—it also offers an unprecedented opportunity to reduce health disparities by providing an infrastructure with near national reach that can enable partnerships between researchers and 2-1-1 systems to monitor health inequalities; track utilization of health services; and provide evidence-based information, referral, and behavioral interventions to vulnerable segments of the population.

The papers in this supplement to the *American Journal of Preventive Medicine*^{1–17} bring together an emerging body of research conducted in the context of the 2-1-1 system and

highlight the exciting opportunities for collaborations between researchers and these systems. This foundation is drawn on to outline a path for moving forward to systematically and strategically realize this potential. In particular, there is a need to (1) utilize theoretical and conceptual frameworks to better place 2-1-1 in the larger public health context and show linkages between/among other public health organizations. Next, tackling differences among data systems across 2-1-1 systems arguably offers the most significant gains for 2-1-1 research and practice; therefore, we propose to (2) establish common measures and methods to enable data integration. In turn, integrated data can help to better (3) identify unmet needs of individuals and communities served by 2-1-1 systems.

The development and delivery of 2-1-1 services can be enhanced through a better understanding of callers' risk factors and barriers to accessing needed services. Therefore, we propose to leverage 2-1-1 systems to (4) study basic individual and social factors that influence both health behaviors and the effectiveness of interventions to address health disparities among 2-1-1 callers. This basic knowledge makes it easier to (5) develop and evaluate targeted, tailored, and multilevel interventions to meet the needs of the 2-1-1 callers. Then, issues of (6) reach, sustainability, and implementation of these interventions are addressed to ensure that they continue to produce health benefits for 2-1-1 callers and can be scaled up and integrated into the larger 2-1-1 system. This commentary expands on these proposed areas for enhancing the utility of 2-1-1 systems and realizing research opportunities. The conclusion offers recommendations for how to facilitate these exciting possibilities.

1. Utilize Theoretical and Conceptual Frameworks to Address How the 2-1-1 System Fits Into the Larger Public Health Context

Research collaborations with the 2-1-1 system need to develop and apply frameworks that draw on existing evidence to illustrate and advance the conceptual and organizational relationships key to the success of the 2-1-1 system and its efforts to reduce health disparities and improve public health. The use of theoretical and conceptual frameworks can serve as a tool to better understand the needs of the 2-1-1 population and increase the reach and effectiveness of interventions designed to address them. For instance, a conceptual framework could help illuminate how collaborations with 2-1-1 can complement other channels of communication, intervention, and research. Theoretical models could help explain how perceptions of 2-1-1 as a trusted institution and of its information specialists as knowledgeable and empathic enhance the credibility of the service as a source for health information and referrals. There are a number of existing models from which researchers and practitioners can draw to articulate a conceptual framework to address the various aspects of the 2-1-1 mission and its related research, service, and policy opportunities. A recent inventory of models used to enhance dissemination and implementation research provides a compendium of relevant frameworks that could be adapted specifically to inform the design and assessment of 2-1-1 research.¹⁸ For example, the RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, Maintenance)^{19,20} is an over-arching model that could be used for planning and evaluating a comprehensive 2-1-1 research agenda for addressing disparities.

To enhance progress on moving the needle on population health, networks of partnerships with 2-1-1 systems, including local and national organizations, government agencies, and academic researchers, should be systematically expanded and strengthened, to address important questions around understanding the needs of the 2-1-1 population, identifying barriers to accessing social and public health services, and informing broader, integrative strategies that have the potential to mitigate disparities. Although the 2-1-1 systems have an established infrastructure and wide-reaching network designed to address the public's needs for information and referrals, gaps inevitably exist, and there are many potential opportunities to establish new critical connections between 2-1-1 systems and other research and service organizations. For instance, participatory systems dynamics modeling²¹ could be used to engage multiple stakeholders in an effort to conceptually map the perceived needs of 2-1-1 callers and their communities and link those needs with relevant local and national organizations (e.g., CDC, Federal Emergency Management Agency [FEMA], state smoking quitlines) as well as enriching this information with data from other sources (e.g., Census and geospatial data). Identifying potential gaps in needs and service links and facilitating collaboration can provide avenues for new research directions, novel intervention approaches, and innovative strategies to integrate data across the 2-1-1 and other data sources.

2. Establish Common Measures and Methods to Enable Data Integration Across 2-1-1 Systems and with Other Data Sources

The 2-1-1 system operates as a federated collection of organizations that attempt to work together despite limited resources and varying organizational structures. As a result, there is no unified approach to collecting, storing, and classifying data, which introduces immense challenges to researchers who wish to use this rich source of information by combining data across 2-1-1 systems. Different 2-1-1 systems use different data-collection and management software programs, which vary significantly in structure and function. The data routinely collected by 2-1-1 systems include caller characteristics (e.g., age, gender, and income) and caller needs or service requests; each call is linked to geographic data by ZIP code. However, in this supplement, no two papers measured or reported caller data in the same way. For instance, the analysis by Bame and colleagues,⁵ which merged 25 different 2-1-1 caller data sets within the Texas 2-1-1 network, found that demographic data were collected and coded consistently for only 15% of the callers over the 5-month study period.

Given this lack of a unified system, achieving consensus on key measures and associated methods would result in more extensive, consistent, and reliable capacity to merge data across 2-1-1 systems. Thus, establishing uniform formats for collecting and storing data, standardized procedures, and reporting, and developing integrated data systems would not only help advance the potential for research but also give 2-1-1 systems more powerful data to enhance service to their callers and enable national-level advocacy and assessment. The ability of organizations like the North American Quitline Consortium to successfully standardize questions on tobacco use across quitline systems in all 50 states²² provides encouragement that such goals can be accomplished across 2-1-1 systems.

These data systems also would provide a remarkable resource that could be used by governmental, nonprofit, and corporate entities to identify types, volume, and location of risk and vulnerabilities within and between communities and regions. For example, communities could identify gap areas—by topic or geography—where health and social service needs greatly outpace available resources. Using this information, budget allocation, service priorities, and/or philanthropic activities might be shifted to better serve community needs.

There is tremendous potential to connect data collected by 2-1-1 systems with other data sources. For instance, linking 2-1-1 call data with census-level data generated maps to highlight vulnerable areas (e.g., OneStar Foundation's Texas Connector for Texas 2-1-1 data, HealthyCity.org for California's 2-1-1 data). Given the complex needs of the populations accessing 2-1-1 systems, the communities 2-1-1 serves are likely to face challenges with health care, including health promotion, disease prevention, screening, treatment, and end of life. Linking 2-1-1 data to other sources such as cancer registries; Medicaid; the U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); and the CDC's National Breast and Cervical Cancer Early Detection Program would enable researchers to answer questions such as the impact of different levels of Medicaid coverage/eligibility across geo-political regions on a caller's health needs or unmet needs.

Other potential areas for linkage include connecting natural history events with area-level healthcare delivery characteristics (e.g., number of primary care physicians or hospital beds per 100,000 population); registry data (e.g., Surveillance, Epidemiology, and End Results); policy; or other public health information and trends in 2-1-1 calls. This could enable researchers to consider questions such as the impact of media events/stories, changes to or introduction of screening guidelines, public health campaigns, and policies on the frequency of referral calls to 2-1-1 systems.

Data integration and the development of dashboards also could serve to raise awareness of 2-1-1 systems and the needs of its callers, facilitate outreach in areas of great need, and identify underutilized services. For researchers, a 2-1-1 data dashboard could inform new hypotheses and provide information, such as estimates of special populations of interest to demonstrate feasibility in applications for grant proposals. For public health systems, surveillance of caller data and need requests—such as an increase in calls requesting information on symptoms of influenza—could provide an early indication of potential epidemics. Similarly, disaster management systems could use caller needs to allocate resources in times of crisis.⁵ Policymakers could use a 2-1-1 dashboard to obtain real-time and longitudinal health and social services data at district levels to help guide policy and the allocation of resources. Similarly, community service providers could use this tool to examine how and where to focus the distribution of resources. Finally, the public could use a data dashboard to assess where to allocate their own individual resources—such as charitable contributions and volunteerism—as well as to guide voting behavior on policies related to health and social service needs.

Ultimately, a more systematic and standardized approach to collecting, merging, and accessing 2-1-1 data can increase the quality of research and the speed of innovation. Likewise, these changes would allow 2-1-1 to better use their data as a tool for policy, resources, funding, and service provision.

3. Identify Needs of Individuals and Communities to Enhance the Health and Well-Being of Populations Reached/Targeted by 2-1-1 Systems Using Methods That Go Beyond Existing 2-1-1 Practices

Although 2-1-1 systems currently collect some information to explore basic trends and needs of their callers, more systematic, sophisticated, and in-depth efforts are required to fully understand these trends locally and nationally. Caller data also can show how community needs may vary by population subgroups, location, and/or over time. Even further, geographic regions can be explored at micro and macro levels. For example, calls can be mapped to local areas (e.g., neighborhoods) or much larger geographic areas (e.g., states). Geo-spatial methods can be used to study needs, gaps, and opportunities for intervention, such as exploring differences in service requests, referrals, and availability of referral agencies across regions.

Although 2-1-1 callers tend to connect with the system to obtain referrals for basic needs, these individuals often have additional unmet social and health needs that go undeclared during routine 2-1-1 calls. Recent work has suggested that proactive assessments administered during 2-1-1 calls have identified additional caller health needs including cancer screening, prevention behaviors, vaccinations, and child development services.^{8,9,11,23} For example, Purnell and colleagues²³ pooled data from four 2-1-1 centers and found that more than 69% of callers surveyed had at least one cancer control or prevention need, and nearly 40% reported two or more needs. Similarly, Roux et al.⁹ identified 56% of children screened for developmental delays through the Los Angeles County 2-1-1 as having a moderate to high risk of developmental delay, including more than 28% who were classified as high-risk. These examples illustrate the need for further evaluation of unmet, undeclared, and potentially unrealized needs of the callers.

Developing an evidence-based triage system to effectively identify the undeclared needs of the callers and proactively direct them to relevant services could enhance 2-1-1 services dramatically and lead to a demonstrable public health impact. Predictive analysis offers a promising approach to provide more tailored services to callers. For example, Alcaraz and colleagues¹³ explored a strategy that used routine 2-1-1 service request data and an evidence-based algorithm to develop decision support or “smart” systems to identify and target particular subgroups that may have specific cancer control needs. This same type of strategy could be used to identify those at high risk for a broad range of diseases and medical conditions, such as cardiovascular disease, diabetes, and HIV. Moreover, the positive referral acceptance seen in previous studies^{11,23} points to the feasibility of assessing multiple needs and referring callers to relevant services.

The articles in this supplement include examples of using 2-1-1 data to monitor disaster management, mortgage relief, disease prevention, and epidemic needs. Although search engines and social media recently have been used to track similar trends, an exciting opportunity exists for maximizing the value of the 2-1-1 system by tracking community and 2-1-1 caller needs in real time, in particular, for this distinctly low-income population. Real-time surveillance through 2-1-1 systems would enable 2-1-1 systems and other public health organizations to anticipate community needs and interface more efficiently with one another to address them.

4. Study Basic Individual and Social Factors That Influence Health Behaviors and the Effectiveness of Interventions to Address Health Disparities Among 2-1-1 Callers

Opportunities exist to leverage 2-1-1 as an innovative tool to collect data to answer basic behavioral and social science and health-related research questions while enhancing services, identifying those at risk, and intervening on risk factors. Basic behavioral and social factors can be examined using approaches such as integrating survey questions into call center protocols, observation/analysis of call transcripts, or secondary analysis of existing data. For instance, Savas and colleagues⁸ provide a model for collecting data about social-cognitive-affective determinants of the human papillomavirus vaccination, which can be applied to other health behaviors. Additionally, using a similar approach, objective data (e.g., use of a brief phone-administered cognitive battery to assess cognitive functioning) also could be collected and then linked to caller data (e.g., service barriers, follow-up on referrals) to further understand factors that influence health disparities in the 2-1-1 population.

Studies can connect 2-1-1 data with data sources outside the 2-1-1 system to examine basic psychological hypotheses using creative and innovative methodologies. For example, data at varying levels of stratification (e.g., county, ZIP code, state) are available to estimate population-level exposure to stimuli such as ultraviolet rays, health-related policies, and even emotional stimuli (e.g., news coverage of tragedies such as natural disasters, terrorist attacks, or mass shootings). These can be connected to data collected during a 2-1-1 call in order to better understand broad psychological or health-related phenomena, including questions about whether new smoking policies are associated with greater call volume for smoking-cessation resources, or whether changes in the emotional valence of a community is associated with any pattern of caller needs. Additionally, 2-1-1 callers could be asked questions drawn from nationally representative (e.g., National Health Interview Survey, Health Information National Trends Survey, or National Health and Nutrition Examination Survey) and state-based surveys (e.g., Behavioral Risk Factor Surveillance System), enabling comparisons between 2-1-1 callers and nationally representative samples.

Discussions between I&R specialists and the callers they serve often include rich and moving stories that provide concrete, sensory, and experiential details about the challenges of living in poverty. Qualitative approaches and text-mining strategies could be used to analyze call transcripts or recordings to provide detailed information about individual callers

or their interactions with I&R specialists. With proper consent from callers and careful consideration of research ethics, call transcripts could be used as a secondary data source, where investigators listen to the calls and code them to illuminate potential hypotheses about determinants of risk, service-seeking behaviors, or intervention dynamics.

These 2-1-1 callers represent a segment of the U.S. population that is typically underserved. Although there have been a number of research studies that focus on the health needs of this population, the majority of these studies have utilized cross-sectional research designs. The creation of cohorts and an infrastructure to follow callers longitudinally would provide an opportunity for 2-1-1 leaders and researchers to learn critical information about a caller's risk and protective factors and mechanisms of change. However, despite the significant opportunity that creating and tracking 2-1-1 cohorts would present, there are several methodologic issues that must be considered. For instance, Kreuter et al.¹¹ and Cortino et al.⁷ attempted to track 2-1-1 callers over time and reported fairly low retention rates. Oftentimes, callers with the greatest needs are also the least likely to have stable housing and consistent phone access, which can effect retention and follow-up. For instance, many callers have prepaid cellular phone plans, and phone numbers routinely change or become disconnected. Research is needed to explore the factors that hinder or facilitate connectivity and influence retention rates with callers and to, in turn, increase the success of longitudinal studies and the potential for service follow-up.²⁴

5. Develop and Evaluate Targeted, Tailored, and Multilevel Interventions to Meet the Needs of the 2-1-1 Callers

Perhaps the biggest and most exciting motivation for partnering with the 2-1-1 is the possibility of reaching the hard-to-reach and doing so on a large, national scale. Collectively, 2-1-1 systems handled nearly 17 million calls this past year, most from the very population that often is not reached with traditional health promotion and interventions. To overcome this, one of the greatest and most immediate opportunities is to test the application and delivery of 2-1-1 services using emerging media like mobile technology (phones and tablets), Internet interfaces, and social media.¹⁵ Further, the use of mHealth approaches not only can serve as reach and delivery mechanisms but also can change fundamentally the way 2-1-1 interventions and referrals are developed. For instance, one can envision the development of apps or mobile web tools to link 2-1-1 callers to resources in real time, and real location. A recent study found that 74% of a sample of callers to United Way 2-1-1 Missouri have mobile phones, and 78% of those use text messaging, which demonstrates that the use of text messaging is a viable method to deliver information and referral across 2-1-1 systems (JQP et al, unpublished observations, 2012). Moreover, research exploring the comparative effectiveness of I&R services delivered by phone version versus text can help optimize 2-1-1 activities.

Research collaborations with 2-1-1 systems can help enhance the rigor of the development and assessment of 2-1-1 interventions and aid in understanding how successful strategies can be implemented on a large scale. Several examples of intervention modalities described in this supplement highlight the fact that a range of exciting strategies can be integrated successfully into 2-1-1 systems, including patient navigation services,^{10,11} tailored print,²

and combining media outreach with referrals to 2-1-1.⁴ Future 2-1-1 research collaborations can build and expand on these approaches.

Existing 2-1-1 information can be leveraged to develop targeted interventions. For instance, because basic demographic and location information can be linked to callers, callers who fall into specific groups easily can be targeted according to health guideline criteria (e.g., women aged >40) to intervene on multiple relevant behaviors simultaneously (e.g., breast, cervical, and colorectal cancer screening as well as tobacco-cessation activities, diet, and physical activity/energy balance). Moreover, collecting additional data from callers using a brief health assessment could provide an opportunity to link health-related data to standard information collected for specific service requests (e.g., eligibility for income assistance programs). Using this example, such linked information could be used to determine the extent to which financial strain may be contributing to health problems (e.g., mental health, self-medicating with tobacco, alcohol, and other substances) and the extent to which health problems may be exacerbating financial strain (e.g., medical crises, bills, caregiving for a loved one). Interventions could then be designed that address financial and health status in ways that are mutually reinforcing and more efficient.

Tailored interventions can be developed using data regularly collected from each caller as well as an additional brief assessment related to the intervention focus. Integrating automated tailoring algorithms into a 2-1-1 system can supplement and enhance health interventions delivered to 2-1-1 callers, and these algorithms can be programmed to deliver information about a variety of health promotion and disease prevention needs. Establishing an automated tailoring intervention requires an initial investment of resources but the ultimate cost per person for delivery is likely to be hugely cost effective at the population level. Further, it is possible that different types or intensities of interventions will likely be more or less effective with subgroups of the population. Therefore, there is a need to understand when and for whom minimal-contact interventions like tailoring are most likely to be effective, and when and for whom more-intensive approaches might be indicated.

The 2-1-1 system offers opportunities to serve a central role in the development and testing of multilevel interventions where researchers and 2-1-1 systems collaborate with other community partners working collectively to address priority problems. For instance, a multilevel intervention to increase cancer screening behavior among low-income populations could include targeted dissemination of a community-based message, training for service providers in local clinics, and training for I&R specialists to deliver screening promotion messages.

There is also an opportunity to flexibly integrate specific modules into an already well-developed service with near-national reach. For instance, the exemplars in San Diego (proactive Medicaid and Supplemental Nutrition Assistance enrollment); Los Angeles (screening and referral for developmental disabilities); and Missouri (proactive screening and referral for cancer control and prevention needs) presented in this supplement⁹⁻¹¹ demonstrate how interventions can be packaged into modules for proactively screening callers for unidentified needs, and integrating additional service delivery systems into the 2-1-1 platform. As more modules are created, a centralized portal could be developed to

offer a menu of evidence-based interventions (EBIs). Local 2-1-1 systems could then choose from the menu based on community needs or grant funding opportunities.

Finally, there is a need to better understand the impact of 2-1-1 services on health outcomes and costs of care. For example, research that examines the effects of 2-1-1 messaging and referrals on relevant health outcomes such as hypertension control among immigrants or mammogram screening for high-risk women can provide important information to 2-1-1 leaders and community partners about how to maximize their resources to achieve the greatest impact. Health outcomes can be assessed at the individual or community levels through longitudinal cohorts or by linking to healthcare utilization data. Being able to assess the proportion of improvement in the health of a community that may be attributable to the actions of a 2-1-1 can help demonstrate the role of 2-1-1 in the context of a broader system to reduce population health disparities in the community and to identify potential leverage points where action may be most beneficial.

6. Assess Reach, Sustainability, and Implementation Factors and Strategies Within and Across 2-1-1 Systems for Addressing Health Disparities

The success of 2-1-1 as a referral/intervention service and research tool to address health disparities is dependent on the system reaching its intended audience. Although the 2-1-1 systems operates in all 50 states and logged nearly 17 million calls last year, there is evidence to suggest that certain vulnerable populations—such as recent immigrants—may be less likely to use it.⁷ As such, there is a critical need to expand outreach efforts, reduce barriers to access, and encourage utilization of 2-1-1.

There are a number of different strategies to connect individuals in need with 2-1-1 services. For instance, Shah and colleagues⁴ demonstrated the potential of mass media, or more specifically, public broadcasting, as a means for disseminating information about 2-1-1 services to the public. Additionally, 2-1-1 systems could leverage other forms of mass media and develop targeted marketing strategies based on the different types of services that 2-1-1 offers. This type of approach also can be employed to target other particular subgroups of interest, such as the elderly, individuals with disabilities, or those at high risk for cancer or chronic diseases. As strategies to expand outreach are implemented, there is a need to rigorously evaluate these strategies and develop an evidence base to improve 2-1-1 outreach. Further, associations between short- and long-term costs of care and increased reach and expanded services by 2-1-1 systems should be explored. For example, given the findings on the effects of outreach campaigns through public broadcasting and media outlets like television and radio on call volume,⁴ assessments of what happens with respect to an increase in clinical load generated by rapid increases in system use, intervention delivery, and associated referrals to clinical care should be considered.

As more research collaborations are developed with 2-1-1 systems, additional EBIs will be developed, refined, or adapted for delivery through 2-1-1. Implementation science can help us better understand how established, empirically based interventions can be integrated

effectively and efficiently into and delivered through 2-1-1 systems.^{25,26} Further, consideration of reach, implementation, and sustainability issues early in the intervention development process can increase the likelihood that newly developed interventions are suited to the 2-1-1 context and are designed to be sustainable. To achieve this, research is needed to understand the 2-1-1 context more fully, and gain insight into the conditions under which 2-1-1 works best. For instance, what factors influence whether or not a 2-1-1 call center decides to adopt a program; what organizational, leadership, communications, incentives, and other factors influence implementation? A synthesis of existing literature on implementation and sustainability of similar types of interventions (e.g., smoking quitlines) should be conducted and used to help develop research questions that are specific to the unique aspects of 2-1-1.

Finally, if 2-1-1 interventions are found to be effective and cost effective, how can they be sustained? Even if researchers are able to demonstrate, for instance, that they can get at-risk callers to contact healthcare providers or access needed health services, it is critical to also demonstrate that the intervention can be readily adopted, consistently implemented, and sustained by 2-1-1 systems over the long term. Additionally, researchers need to consider if the community has the capacity to handle additional or new types of referrals or sustain new programs. Therefore, an evidence base must be built around issues of sustainability and the cost effectiveness of different 2-1-1 deployments, strategies, and purposes. Such analyses can drive new innovations and provide compelling evidence for more broad-based support for 2-1-1.

Recommendations

In an effort to move forward to address the critical gaps and opportunities highlighted in this paper, we propose the formation of a 2-1-1 Health, Service, Research, and Policy Consortium. This consortium would consist of 2-1-1 leaders, academic researchers, policymakers, and funders who would work collaboratively toward the goal of better understanding and addressing the health needs of low-income Americans. We recommend that this consortium create special workgroups of relevant stakeholders to address the recommendations outlined below; we have organized these recommendations around which groups might best be positioned lead these opportunities.

Recommendations for Researchers—Researchers have a unique role to play not only in advancing our knowledge of health and health disparities but also in enhancing the quality and types of services that 2-1-1 systems can provide by establishing an evidence base for the development and implementation of interventions to meet the needs of the 2-1-1 callers. To advance these goals, we recommend the following:

Understand and respect the primary mission of 2-1-1: Collaborations with 2-1-1 systems provide researchers with an exciting opportunity to collect data and disseminate behavioral health interventions to an underserved low-income population by leveraging a well-established and highly utilized 2-1-1 infrastructure. However, it is important for researchers to recognize and respect the primary mission of the 2-1-1 as a social service information and referral source. As such, researchers looking to partner with 2-1-1 centers must be mindful

of the fact that 2-1-1 I&R specialists need to be able to carry out their mission and that this service must take precedence over research obligations. In addition, 2-1-1 systems are funded primarily through United Way and other local organizations and tend to operate under tight budgets and limited resources. Given these issues, it is important for researchers to be creative in their study designs, make a concerted effort to be unobtrusive, and minimize the financial and personnel costs to the 2-1-1 system by providing funding for additional personnel and support staff in their grant applications. Finally, potential research collaborators should take into account that any additional revenue or resources to 2-1-1 should enhance the delivery of service, and issues of sustainability must be considered carefully.

Develop guidelines/lessons learned for researchers looking to collaborate with 2-1-1:

This supplement highlights a core set of collaborations that have existed between 2-1-1 systems and academic researchers. These partnerships offer important insights on how to successfully engage with 2-1-1 systems and carry out a research agenda that both advances science and the mission of the 2-1-1 systems and the community it serves. To leverage the knowledge gleaned from these past experiences, we recommend that researchers who have collaborated with 2-1-1 systems develop a set of guidelines that build on these lessons learned and offer practical advice to help facilitate these collaborations.

Specifically, we propose that these guidelines cover topics such as ensuring alignment between the goals of the researcher and the participating 2-1-1, including factors that help facilitate or hinder effective collaborations, barriers to success, and factors that led to the successful adoption and implementation of interventions. Broad dissemination of these guidelines can help raise awareness within the academic community of the potential opportunities available to partner with 2-1-1 systems and help ensure that future collaborations are successful.

Develop new and improved infrastructure, tools, and measures to share data:

Researchers within the 2-1-1 consortium should create a workgroup to develop the infrastructure, tools, and measures necessary to standardize data collection and storage across 2-1-1 systems. For instance, researchers in this workgroup should work to identify a set of common measures or questions that can be implemented across research studies. Having a set of standardized measures will enable researchers to harmonize and share data, which promotes collaboration and results in larger data sets that could more easily detect associations among variables. One possibility would be to develop a workspace specific to 2-1-1-related measures and constructs on a website such as the Grid-Enabled Measures database (www.gem-beta.org/Public/Home.aspx). GEM is an interactive website that enables users to collaborate with peers to build consensus on the use of common behavioral and social science measures.

Disseminate research findings to scientific community: Researchers should actively share research results from 2-1-1 collaborations with the research community. In addition to publishing data in their respective scientific journals, we encourage researchers to present their findings at relevant scientific and service meetings (e.g., Alliance of Information and Referral Systems); develop symposia; and create press releases and lay-language summaries

that could highlight these 2-1-1 partnerships. These dissemination efforts can serve the dual role of sharing results with fellow 2-1-1 collaborators and marketing the research potential of the 2-1-1 system to the broader research community.

Demonstrate added value of collaborating with the 2-1-1 system: Partnerships between 2-1-1 systems and academic researchers have the potential to make significant progress in better understanding and addressing the health and social needs of low-income Americans. However, research is not the primary mission of 2-1-1 system, and participation in these collaborations takes valuable resources such as personnel time and money away from fielding calls and providing referrals. Therefore, it is important for researchers to be able to demonstrate the added value of these collaborations for both the 2-1-1 systems and the populations they serve. In particular, researchers should make efforts to highlight the contributions made through the collaborations, including evidence regarding issues of cost effectiveness, sustainability, and effectiveness of interventions delivered through the 2-1-1 system in making an impact in reducing health and cancer disparities among the 2-1-1 callers. Such evidence can be used by the 2-1-1 system to garner additional support to continue to fulfill and enhance its mission.

Recommendations for 2-1-1 Systems—The 2-1-1 system leaders can leverage the expertise of the diverse stakeholders involved in the consortium to enhance the capacity of 2-1-1 systems to address the health needs of callers and their ability to collaborate with researchers. With the support and partnership of the consortium, we recommend the following:

Educate 2-1-1 staff to understand the unique role that 2-1-1 systems can play in research, evaluation, and implementation of evidence-based interventions: The 2-1-1 system has the potential to serve as a platform for monitoring health inequalities and the utilization of health services, and for providing referrals and behavioral interventions to a low-income, disproportionately minority and female population. As such, the 2-1-1 system has the potential to expand beyond its primary mission and provide linkages to critical public health services in populations that are often underserved and at particularly high risk for cancer and other chronic diseases. However, to achieve this vision, it is important to secure buy-in and create an environment where it is clear to 2-1-1 staff from their participation and roles that they are important partners in the research collaboration. Therefore, we recommend that 2-1-1 staff meet and interact with researchers to gain a better understanding of the value of research collaborations and the unique and important role that 2-1-1 can play in reducing health disparities within their communities.

Develop guidelines, infrastructure, and procedures for researchers to work with 2-1-1 systems: To facilitate effective collaboration between 2-1-1 centers and the research community, we advocate for the formation of a workgroup consisting of 2-1-1 administrators actively involved in research and academic researchers. Members of this workgroup would be charged with creating a set of expectations and policies to help manage research collaborations and promote a more systematic and standardized approach to collecting and storing 2-1-1 data. The 2-1-1 systems operate independently and may have a

particular strength or focus depending on the specific population or region they serve. As such, we recommend that this workgroup balance the need for the 2-1-1 system to maintain local autonomy over their data use and applications with the benefits of creating a centralized repository of data-use practices that would result in more efficient and effective responses of the local 2-1-1 systems to outsiders wanting to use their data.

Form a committee to develop and monitor a unified set of policies and procedures to oversee research collaborations with 2-1-1 systems: As an increasing number of researchers and outside collaborators engage with the 2-1-1 system and its rich set of databases, it will be important for 2-1-1 systems to have policies and procedures in place to protect the confidentiality and/or anonymity of staff and callers, and to maintain ethics and integrity when working with the 2-1-1 databases. Although researchers collaborating with a 2-1-1 system must obtain formal approval from their home IRB, an oversight committee could provide an additional layer of protection and ensure that research proposals are in line with the mission of the 2-1-1 system and do not result in unreasonable harm or burden to the callers and staff.

Create standards for data entry, recording, and storage so that databases across 2-1-1 systems are consistent: To allow for the merging of data across 2-1-1 centers, we recommend that the workgroup create standards for data entry and storage so that databases across the centers are consistent and adhere to a common taxonomy. Specifically, 2-1-1 systems should work with vendors to designate a set of variables and database fields and formats that can be applied across 2-1-1. Moreover, in order to adequately capture the richness of the data collected from 2-1-1 and recognize the differences in caller's needs across 2-1-1 centers, programmers should focus on creating a taxonomy that allows for the coding of multiple and diverse sets of needs using variable names and definitions that are consistent with those applied to other large tertiary data sources (e.g., Census, CDC, FEMA, DHHS, Department of Defense, Environmental Protection Agency, National Oceanic and Atmospheric Administration). We also advocate for the use of consistency in data collection and coding and promote the importance of thorough and high-quality data recording by the I&R specialists to ensure that the data collected are complete and reliable across centers.

Create templates to facilitate data analyses: Relatedly, workgroups should identify priority data needs for 2-1-1 systems and researchers and create templates for data analysis that can be used to simplify the application of their data findings. For example, one strategy proposed by the Bame et al.⁵ 2-1-1 disaster data study sites was a centralized team for data analysis and reporting. Using this type of approach, the team could operate like a cooperative, with member 2-1-1 systems supporting and having access to these services and, in turn, being able to share their data and/or findings and reports to outside agencies. With centralized expertise, 2-1-1 data analysis and reporting could be more efficient and timely and have more rigorous quality control. However, at the same time, the local 2-1-1 would have input so that the analyses and reporting would meet their individualized community needs. This centralized expertise also may help the 2-1-1 systems keep up with the ongoing rapid changes in data and reporting technology.

Create a repository for 2-1-1 research and reports: Finally, this workgroup could be tasked with developing and maintaining a repository of existing and future 2-1-1 research collaborations, and proactively disseminating this information to 2-1-1 systems and research stakeholders. Although there are ongoing efforts to create this record, inevitable gaps exist. For example, a web page that is part of the 2-1-1 general website could be created to post reports, articles, and proposals. A designated webmaster could monitor and facilitate submissions, and protect copyright and intellectual property. Access to this site could be made public to encourage wide dissemination. A variation of this idea was carried out by the Bame et al.⁵ disaster study group and included a “data co-op” of 2-1-1 members that could allow access to specific and/or more confidential reports to their supporters (e.g., disaster management committees, Voluntary Organizations Active in Disaster, Council of Governments, funding agencies). In addition to keeping a record of 2-1-1 research collaborations, the reports and publications housed on this website also could serve as a means of marketing 2-1-1 services and data to communities, agencies, and corporations along with encouraging consultants and researchers to develop funding to explore the remarkable potential of the 2-1-1 data system.

Partner with researchers to conduct training and provide technical support to enable 2-1-1 staff to effectively engage in research: To engage in effective collaborations with the research community, it is essential that 2-1-1 center staff receive basic training in social science research methods. Therefore, we recommend that 2-1-1 systems partner with researchers who can educate staff on areas such as survey administration, data entry, data management, and research ethics. For instance, it may be possible for a postdoctoral fellow or advanced graduate student affiliated with a participating research partner to offer short workshops to the 2-1-1 staff on these issues. Moreover, these individuals also could be available as a resource and provide ongoing technical support over the course of the research collaboration. In addition to education in basic research methods, it also will be important to train staff on the specific research protocols to ensure standardization and treatment fidelity across the study. Likewise, as 2-1-1 systems continue to partner with researchers and the catalogue of potential interventions grows, 2-1-1 staff will require guidance on how to appropriately triage callers.

Encourage and support 2-1-1 centers to participate in research: Finally, we recommend the development of strategies to encourage and promote the participation of 2-1-1 centers in research and the creation of procedures to allow researchers to utilize 2-1-1 systems for research in a way that minimizes the time and expense burden to the call center. For example, 2-1-1 centers could advertise a call for proposals for studies to be fielded through 2-1-1. Those proposals that most directly align with the goals and priorities of the 2-1-1 center could be selected to be fielded. Thus, 2-1-1 I&R specialists could then randomly select callers to be invited for participation following their call, and the principal investigator for the specific study could provide the labor (e.g., research assistants trained to ask the questions who can be on-call during peak 2-1-1 hours). However, we also encourage 2-1-1 centers to develop research proposals and seek out research partners and sources of extramural funding on their own.

Recommendations for Policymakers and/or Funding Agencies—Ongoing support across the legislative, research, and service arms of the government will be needed to leverage the incredible potential the 2-1-1 systems have to offer. In collaboration with the consortium, we place a call to action to policymakers and funders to achieve the following:

Develop a comprehensive research agenda (establish priorities) to advance research with 2-1-1: Policymakers and funders are in a unique position to convene key partners and establish priorities for the research community to (1) promote the 2-1-1 system as an important source of information; (2) advance our knowledge of the needs of large communities of vulnerable populations; and (3) expand the effectiveness and reach of interventions and services to these populations. Establishing, with the support of the consortium, a set of priorities and collaborative guidelines to comprehensively achieve those priorities can increase the efficiency and effectiveness of the public's resources (i.e., investments in 2-1-1 and research dollars). Moreover, facilitating a coherent research agenda will enable programs of research to move forward and strategically build an evidence base to increase the health and well-being of a large segment of the U.S. population.

Offer funding opportunities to support collaborative research with 2-1-1 systems, including innovative funding mechanisms to enhance research opportunities: Following the establishment of a research agenda, funding agencies can identify priorities related to their particular agency and institutional missions and develop funding opportunities to help advance those research objectives. For example, the CDC may focus their efforts on developing funding opportunities related to the surveillance capabilities of 2-1-1, whereas other federal agencies such as the Agency for Healthcare Research and Quality and the NIH may be better suited to focus issues related to interventions and health outcomes. Further, there are many research areas that can be addressed using the 2-1-1 system that are relevant to the mission of other nongovernmental research foundations such as the Patient-Centered Outcomes Research Institute and the Robert Wood Johnson Foundation.

In addition to traditional methods of funding, agencies may want to consider more creative approaches such as creating a contest or research challenge. For example, the Research Triangle Institute (RTI) recently held a contest where individuals submitted short surveys on a wide range of social, economic, and policy topics.²⁷ Those surveys that were judged to be most cutting-edge and creative were then fielded by the RTI. Similarly, the General Social Survey solicited outside proposals for questions and topic modules to be included in their 2014 survey.²⁸ These types of proposals tend to yield highly creative and innovative research and should be considered as a possible approach moving forward.

Support research infrastructure for 2-1-1: Over the past few decades, large investments have been made to develop databases of cohorts and registries designed to support research. The 2-1-1 system represents an unprecedented opportunity to leverage an existing resource that could be developed into a cross-national database to facilitate research on populations in need. Expanding the utility of the 2-1-1 offers the opportunity, over the long term, to make important strides in increasing the well-being and reducing health disparities of a large segment of the U.S. population. As such, investments in improving and integrating the data systems and research capacity of 2-1-1 will enable researchers to more rapidly move a

research agenda forward. Funders can start by convening stakeholders to outline priorities and gain support for this effort.

Raise awareness of untapped potential of 2-1-1: In collaboration with the consortium, participating policymakers and funders can help develop a strategy for raising awareness of the untapped potential of 2-1-1 systems for research purposes. Garnering the support to expand the utility of this existing resource requires thoughtful documentation of the impact and value addition that 2-1-1 systems can offer. Although this supplement serves as an important initial step, much more work needs to be done. The development and dissemination of targeted messages will be critical to ensuring that relevant organizations are aware of the benefits that research collaborations with the 2-1-1 systems can offer. Further, documenting the existing reach and effectiveness of 2-1-1 as well as its potential to help monitor and address the health and social needs of a large underserved population can help provide policymakers and funders with the necessary information for decision making related to investments in supporting these important research partnerships.

Conclusion

The papers in this supplement^{1–17} represent an effort to highlight some of the existing evidence of the value and potential of 2-1-1 systems and showcase the opportunities the 2-1-1 system offers as a research resource to advance science along the research continuum from discovery to development to delivery. By advancing science in this context, researchers working side by side with 2-1-1 colleagues can further enhance these services. In this article, we outline research opportunities for 2-1-1 research collaborations to realize this potential and provide recommendations for moving forward. We believe the cumulative effect of joint efforts between researchers and 2-1-1 colleagues offer the potential for a significant and measureable reduction in health disparities and increases in the well-being of our nation.

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