

ARTICLES

Exploratory Sequential Mixed-methods Design of the Niakhar Social Networks and Health Project Surveys

John Sandberg, MA, PhD¹, Valerie Delaunay, MA, PhD²

¹ Global Health, The George Washington University School of Public Health, ² Laboratoire Population Environnement Développement, Institute de Recherche et la Développement

Keywords: social networks, mixed-methods, survey design, cultural models

<https://doi.org/10.29115/SP-2026-0011>

Survey Practice

Vol. 21 Special Issue, 2026

This article describes the exploratory sequential mixed-methods design of the Niakhar Social Networks and Health Project Surveys (NSNHP), which investigated the association between social networks and health in rural Senegal. The project used a multi-stage approach, beginning with formative qualitative research (study one) to understand local social ties and sociability, which informed the development of the network survey instrument. This was followed by pilot and validation surveys (study two) to test the efficiency of the network instrument and methods for linking named individuals and their network alters to existing demographic data. Next, disease narrative interviews (study three) were conducted to conceptualize and measure contextually relevant cultural models of health beliefs and behaviors, which were then integrated into the main panel surveys (study four). The paper highlights that this extensive, iterative mixed-methods process successfully addressed significant limitations in traditional social network survey designs and led to higher confidence in the construct validity of instruments used.

Introduction

Social networks have been seen as fundamental to understanding health beliefs and behaviors, and network surveys are a key design used to assess their potential influence. Most social network surveys use questions called name generators asking respondents to list their network members (or 'alters'). Such designs generally need to ask additional questions, called name interpreters, about the characteristics of each alter named. This increases survey length and complexity, so most often the types of social ties studied are limited, and the number of alters respondents can name is restricted. Such restrictions likely bias estimates of networks' effects, and name interpreters may yield inaccurate or missing data (Sandberg 2018).

This paper outlines the sequential mixed-methods approach used to develop network survey instruments to address these problems and assess the association of network characteristics with health beliefs and behaviors in a rural Senegalese population as part of the Niakhar Social Networks and Health Project (NSNHP).

Background and Setting

The NSNHP was conducted in collaboration with the Niakhar Health and Demographic Surveillance System (NHDSS), which has collected prospective longitudinal demographic and health data from a large population in rural Senegal for over 50 years under the *Institut de Recherche pour le Développement* (IRD), the French national research institute for sustainable development (Delaunay et al. 2013). The population of the NHDSS study zone is 96.7% ethnically *Sereer* and residence in the zone is organized in kin-based compounds. Economic production is largely agro-pastoral, characterized by rainfed agriculture and livestock production (Lericollais 1999). Social organization in the zone may be seen as a type of solidarity system in which individuals and families rely predominantly or exclusively on social networks, both institutional (e.g. kinship) and informal, for mutual insurance and survival (Ba Gning and Sandberg 2018; Fafchamps 1992; Sandberg et al. 2014).

The dominant western religion is Islam, followed by Christianity. A significant syncretism or blending of beliefs exists for both, however, with an indigenous monotheism practiced by most of the population. As in many West African contexts, an analogous syncretism also exists in the behaviors, beliefs, and ideals about health and illness held by the population. The biomedical classification of etiology of disease, its causes and treatment competes with (and at times complements) an established ethnomedical tradition associated with traditional religious practice (Sandberg, Park, et al. 2019).

The innovation of the NSNHP was to address the design issues discussed above by linking respondents and their alters to sociodemographic and health information in the NHDSS, limiting the number of name interpreters needed. This made it possible to collect extensive, high-quality network data in conjunction with indicators of health beliefs and behaviors in a population-based survey. The NHDSS have been working in the area for 50 years, they are well known and have a good working relationship with members of the population, which, despite a prohibition on incentivizing respondents, no doubt was partly responsible for the excellent response rates achieved, described below.

Despite the advantages of working in the NHDSS surveillance zone, the project faced significant challenges. These included how to measure types of social ties important to respondents' personal networks, how to identify alters named by respondents for linking to the surveillance system, and how to identify, then measure, relevant, contextually specific cultural models of health and illness.

Study One: Formative Research on Sociability

Overview

The project began with in-depth interviews and focus groups to gain a better understanding of the dimensionality of contemporary sociability in the NHDSS study zone and identify salient types of social interaction over which to assess network ties.

Data and Methods

We conducted 24 semi-structured in-depth interviews and five focus groups. Both the interview participants and focus groups were stratified by region, marital status, and sex. The interviews were conducted with a simple random sample conditional on these strata of 24 adults age 16 and over to account for heterogeneity in network composition across these characteristics.¹ The focus groups were composed of 8-14 individuals each who had not been previously interviewed sampled in the same way. The interview and focus group guides were based on 30 common name generator questions from the network literature, ethnographic reports, and advice from project scientists and staff. These were used as prompts for discussion about different types of social relationships and their valences. Participants described who they interacted with, under what circumstances, and the nature of those relationships. Interviews were transcribed, translated into French, coded (by hand) and analyzed to identify major types and modalities of social ties.

Results

The analysis revealed four key domains of interaction: affective, exchange and support, frequency, and role-relational.² A byproduct of this analysis, supplemented by key informant discussions, was a better understanding of the informal algorithms by which residents identify each other in their community, where both given and surnames are commonly shared and no public institutional address system exists, critical for linking alters to the NHDSS data.

Study Two: Pilot & Validation Network Surveys

Overview

Building on the work from study one and extensive informal focus group discussions with the NHDSS staff and fieldworkers concerning semantics and idioms in the Sereer language aimed at increasing construct validity,

1 Three main regions exist within the surveillance zone, defined by dialectic variation, cultural practices, and level of urbanization.

2 Affective ties are relationships characterized by emotional closeness, exchange or support ties are relationships involving material or instrumental assistance, frequency-based ties are relationships defined primarily by time spent together, and role-relational ties are those based on structural or institutional positions. These domains aligned with theoretical frameworks in the social networks literature while reflecting the specific social context of rural Senegal.

we developed pilot survey and auxiliary validation survey instruments to assess the degree to which a reduced set of name generators aligned with the four domains of interaction was effective in capturing a wide breadth of respondents' personal networks, and to test the questions to be used in an algorithm for identifying network alters in the surveillance records.

Data and Methods

The pilot instrument contained 15 name generators based on qualitative analysis of interaction types in the interviews and focus groups from study one, thematically coded by the principal investigator. Individuals could name as many others as they wished in each name generator. For each person named, we collected information through 'name identifier' questions to match alters to their surveillance records along with a select set of name interpreters.³ The pilot was administered on paper with a specialized grid format where all alters' names were elicited first, followed by name identifiers and interpreters to minimize fatigue and motivate consistency in completion of the survey. The same sampling strata were used for respondent selection as in study one, and 141 respondents were interviewed with a response rate of 96.5%, with interview times ranging from approximately 40 minutes to over 2 hours, largely dependent on how many alters the respondent named.

The validation survey contained the same 15 name generators as the pilot plus an additional twenty-five adapted from study one and conventionally used in the network literature adapted to the local context, but no name interpreters. This instrument was designed specifically to assess the extensiveness of networks captured by the pilot name generators (or the degree of network closure) and to provide evidence for their revision. Twenty-four respondents were administered this instrument, with 19 of the originally selected 24 respondents supplemented with five additional respondents from a supplemental random sample.

Results

On average, respondents in the pilot named 36 individuals, 21 of whom were unique after accounting for multiplexity, or duplication across multiple name generators. Significant challenges in matching named individuals to surveillance records were detected, however, indicating the need for additional name identifiers.⁴ The additional 25 name generators in the validation survey yielded on average 11 new, unique alters over and above those in the pilot. Analysis of the joint frequencies of unique alters and multiplexity in each

³ The name identifiers included alters' names and whether they were alive, currently (or previously) lived in the same compound, village, another village in the zone, the capital Dakar, elsewhere in Senegal, or overseas. The name interpreters addressed relationship type, kinship status (if any), frequency of interaction, and a psychophysical measure of tie strength.

⁴ Analysis indicated the addition of questions concerning alters' parents' names, the names of the compound and household head, their sex, age relative to the respondent, clan affiliation and marital status would yield higher levels of discrimination in the main panel survey.

name generator in the validation survey, in conjunction with informal focus group discussions with project staff led to the revision of the name generators to be used in the main panel. Only three of those used in the pilot remained unchanged. Seven were modified to include reference to homologous types of ties in the same domain of interaction as revealed in supplemental questions from the validation survey that had yielded new, unique alters. Four poorly performing questions were replaced by ones from the validation instrument.

Study Three: Disease Narrative Interviews

Overview

The theoretical framework motivating this research posits that interaction in networks informs and structures health beliefs and behaviors through its influence on cultural models, or hierarchically nested cognitive schemas of health and illness that reciprocally shape one another (D'Andrade 1992; Smith and Queller 2004; Strauss and Quinn 1998). In this case, higher level schemas concern the ultimate cause(s) of illness and the relative efficacy of biomedical and ethnomedical treatment, mid-level schemas the proximal, or specific causes of illness, lower-level schemas behaviors such as therapeutic or preventative measures taken, and treatment choices. The goal of this study was to probe these schemas, relationships between them, and the role of networks in shaping them through semi-structured in-depth interviews.

Data and Methods

Ninety-eight respondents aged 16 and above drawn with a simple random sample from the NHDSS surveillance zone were interviewed. Among these were equal numbers of men and women, with a median age of 40. Sixty percent were Muslim, 31% Catholic, and 3% Protestant. Seventy-three percent had no formal education, 19% had attended at most primary school, and two thirds were engaged primarily in agricultural production. Each was asked to recount the specific circumstances of at least one recent episode of illness affecting themselves or close family members. For each, respondents discussed initial recognition of illness, symptoms, perceived etiology, sequential therapeutic steps taken, reasons for the sequencing pursued, logistical arrangements, financial costs, perceived outcomes of therapy, and the role of others (e.g., family, friends, neighbors, medical practitioners) in each of these areas. All interviews were translated from Sereer into French, transcribed, and coded for analysis. The coding tree contained detailed codes for illnesses and symptoms discussed, their causes and moral judgements attached to them, types and sequences, and places of treatments sought, their efficacy, as well as the individuals who provided health aid and the type they provided.

Results

Our analysis revealed that, as in other parts of West Africa, schemas concerning the cause of illness in this population may be categorized as either naturalistic, having a natural, mechanistic explanation, or personalistic, caused by some entity, usually a supernatural being or a human with supernatural powers (Foster 2016). In addition to those recognized under the biomedical model, naturalistic ethnomedical illnesses were prominent. Individuals were rarely attached solely to either the biomedical or ethnomedical model, however, and there was substantial heterogeneity in individual beliefs and behaviors within this broad framework. The result was a dynamic and pluralistic approach to therapeutic itineraries. Individuals frequently navigated between biomedical and ethnomedical systems—serially or simultaneously—based on the perceived efficacy of treatments and the influence of their social networks (Ba Gning and Sandberg 2018).

Study Four: Main Panel Surveys

Overview

The main NSNHP survey integrated insights gained from both the network pilot/validation and disease narrative analyses into a survey which measured both respondents' social networks and indicators of their attachment to elements of biomedical and ethnomedical cultural models. The first panel was piloted and fielded in 2014, the second in 2016 using a computer-assisted personal interview instrument (CAPI).

Data and Methods

Using the results of the disease narrative analysis we developed a battery of 16 survey questions to be used as indicators of health schemas in the population. These included measures of higher order schemas such as the perceived relative importance of ethnomedical and biomedical causes of illness, religious beliefs, efficacy of biomedicine vs. traditional medicine, belief in ancestral intervention, the ability of biomedicine to cure personalistic disease, and whether respondents were observed wearing a magical protective talisman. Mid-level schemas were measured with vignettes concerning diagnosis as personalistic or naturalistic of symptoms respondents in the disease narratives had differentially attributed to each, and moral responsibility for a child's death. Lower-level schemas were measured with vignettes assessing treatment sequencing, preference for the location of childbirth, and preventative measures taken against illness and adverse pregnancy outcomes.

These were integrated with the network instrument, along with a series of questions concerning health and other substantive issues hypothesized to be associated with network characteristics in a CAPI.⁵

In the first panel of the main survey, we interviewed 882 randomly selected residents from across the surveillance zone and a census of 1,310 residents aged 16 and above from one purposively selected village. This village was chosen for characteristics that constrained interaction primarily within village boundaries. Collection of data from all adult residents allowed us to measure the responses (including the indicators of health-related schemas) of both respondents and their identified alters, yielding better data on the characteristics of respondents' alters than is generally possible, and the ability to model these simultaneously with characteristics of network structure. We achieved response rates of 96% for the selected village and 99% for the population sample. In the second panel we achieved retention rates of 94% and 88% in these, respectively. Response rates for surveys in sub-Saharan Africa tend to be much higher than in high-income countries, and those reported here are similar to those reported for the Senegal Demographic and Health Surveys conducted in the same years (Agence Nationale de la Statistique et de la Démographie - ANSD/Sénégal and ICF International 2015; Agence Nationale de la Statistique et de la Démographie - ANSD/Sénégal and ICF 2017; Delaunay et al. 2019).

Results

Respondents in the population sample named an average of 47 alters in both panels, representing approximately 28 unique alters after accounting for multiplexity. This was a substantial increase relative to the pilot. The indicators of health-related schemas were used to estimate and test latent class models of individual attachment of respondents, and in the case of the single village where all adults were interviewed, their network alters, to biomedical, ethnomedical and liminal (taking elements from both) cultural models of health and illness (Sandberg, Park, et al. 2019). Our team has used these data in many peer-reviewed papers and conference presentations. These include analyses of the associations between social networks and attachment to biomedical and ethnomedical cultural models as referenced above, fertility preferences and behaviors (Boujija et al. 2019; Sandberg 2015), health aid given and received (Douillot and Sandberg 2017), intimate partner violence (Sandberg et al. 2018; Sandberg, Fennell, et al. 2019), network survey design and methodology (Delaunay et al. 2019; Sandberg 2018; Sandberg et al. 2008), social isolation and mental health (Deslauriers et al. 2022; 2023; 2024) and migration (Boujija et al. 2022; 2024).

⁵ These included questions concerning reproductive health, family planning, women's status, intimate partner violence, and mental health.

Discussion and Lessons Learned

Strengths of the Mixed-Methods Approach

The NSNHP demonstrates the importance of extensive formative research, and iterative collaborative revision of survey instruments to increase construct validity, particularly in contexts that are culturally dissimilar relative to the investigators' own. The qualitative research described in study one improved the validity of the name generators in capturing culturally salient relationship types rather than relying solely on investigators' assumptions or existing ethnographic evidence. The pilot survey and validation instruments identified practical and conceptual challenges that would have severely compromised data quality in the main survey.

The disease narratives informed meaningful indicators of cultural models of health ideation and behavior that have been used extensively as explanatory variables in many of the analyses of substantive associations with network characteristics referenced above. Each study built upon previous findings, creating a robust final instrument.

Challenges and Limitations

Many of the challenges associated with this project have been described above, others elsewhere (Delaunay et al. 2019). Studies one and two were funded under a small innovation grant, and available funds precluded larger samples which would have been desirable. This was particularly true of the validation survey which was developed while in the field (as some of the best ideas are) with a limited time frame for respondent contact. The larger challenge, however, is that careful, iterative mixed-methods research requires significant financial investment and multidisciplinary commitment over an extended period, engaging a large number of stakeholders including collaborators, supporting institutions and funding sources. A mixed-methods undertaking as extensive as has been described here- spanning over a decade- would not have been possible without the continued collaboration, patience, and commitment of project scientists and staff of the IRD, the *Laboratoire Population Environnement Développement* (LPED), *l'Institut national d'études démographiques* (INED), France, and the Niakhar research station. Unfortunately, substantive areas of funders' interest change, and emphasis in many health related fields tends to be placed on short-duration projects and quick turnaround of results, which precludes this type of work except in the case of large-scale, institutionally supported research.

Conclusion

The NSNHP demonstrates that careful, iterative survey development can overcome fundamental limitations in social network data collection. By combining formative research, pilot testing, methodological validation, and

linkage to prospective surveillance data, the project created a resource enabling more rigorous analysis of how social networks shape health behaviors than was previously possible.

For survey methodologists and substantive researchers alike, the NSNHP offers important lessons about the value of investing in survey development. While time-intensive, the mixed-methods approach produced high-quality data capable of answering questions that conventional survey designs cannot address. As researchers increasingly recognize social networks' importance for understanding health and other outcomes, the methods developed and refined through the NSNHP provide a model for future work in this critical area. Interested parties wishing to learn more about this project, its methodology and research findings associated with it, or to access publicly available data can visit the project website at www.nsnhp.org⁶

.....

Corresponding author contact information

John Sandberg (corresponding author)
 Professor of Global Health
 Milken Institute School of Public Health
 Department of Global Health
 The George Washington University
 950 New Hampshire Ave., NW
 Washington, DC 20052
 240 413-4571
jsandber@gwu.edu

Submitted: November 12, 2025 EDT. Accepted: March 13, 2026 EDT. Published: August 23, 2026 EDT.



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-NC-ND-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-nc-nd/4.0> and legal code at <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode> for more information.

⁶ Blinded for review.

REFERENCES

- Agence Nationale de la Statistique et de la Démographie - ANSD/Sénégal and ICF. 2017. *Sénégal: Enquête Démographique et de Santé Continue (EDS-Continue) 2016*. ANSD and ICF. <https://dhsprogram.com/publications/publication-FR331-DHS-Final-Reports.cfm>.
- Agence Nationale de la Statistique et de la Démographie - ANSD/Sénégal and ICF International. 2015. *Sénégal: Enquête Démographique et de Santé Continue (EDS-Continue 2012-14), Rapport Régional. Septembre 1, Résultats Régionaux*. ANSD/Sénégal and ICF International. <https://dhsprogram.com/publications/publication-FR315-DHS-Final-Reports.cfm>.
- Ba Gning, Sadio, and John Sandberg. 2018. "Tomber Malade et En Guérir sans Aller Au Dispensaire. La Place Des Réseaux Sociaux Dans Les Représentations de La Maladie et de La Guérison En Milieu Rural Sereer." In *Niakhar, Mémoires et Perspectives. Recherches Pluridisciplinaires Sur Le Changement En Afrique*. IRD Editions. <https://doi.org/10.4000/books.irdeditions.31672>.
- Boujija, Yacine, Simona Bignami, Valérie Delaunay, and John Sandberg. 2022. "Who Matters Most? Migrant Networks, Tie Strength, and First Rural–Urban Migration to Dakar." *Demography* 59 (5): 1683–711. <https://doi.org/10.1215/00703370-10191592>.
- Boujija, Yacine, Simona Bignami, and John Sandberg. 2024. "Rural–Urban Migration and Fertility Ideation in Senegal: Comparing Returned, Current, and Future Migrants to Dakar to Rural Nonmigrants." *Population and Development Review* 50 (1): 177–210. <https://doi.org/10.1111/padr.12609>.
- Boujija, Yacine, Laetitia Douillot, Valérie Delaunay, Simona Bignami, and John Sandberg. 2019. "Préférences de Fécondité et Perception de La Planification Familiale Des Migrants Temporaires à Dakar." *African Population Studies* 34 (1). <https://doi.org/10.11564/34-1-1165>.
- D'Andrade, Roy G. 1992. "Schemas and Motivation." In *Human Motives and Cultural Models*, edited by Roy G. D'Andrade and Claudia Strauss. Cambridge University Press.
- Delaunay, Valérie, Laetitia Douillot, Aldiouma Diallo, et al. 2013. "Profile: The Niakhar Health and Demographic Surveillance System." *International Journal of Epidemiology* 42 (4): 1002–11. <https://doi.org/10.1093/ije/dyt100>.
- Delaunay, Valerie, Laetitia Douillot, Steven Rytina, et al. 2019. "The Niakhar Social Networks and Health Project." *MethodsX* 6: 1360–69. <https://doi.org/10.1016/j.mex.2019.05.037>.
- Deslauriers, Veronique, Simona Bignami, Valerie Delaunay, and John Sandberg. 2022. "L'isolement Social Dans Une Société de Solidarité. Le Cas Des Sereer Siin Au Sénégal." *Population* 77 (3): 673–96.
- Deslauriers, Véronique, Simona Bignami, Valérie Delaunay, and John Sandberg. 2023. "L'intégration sociale protège-t-elle vraiment contre la solitude? Déterminants genrés dans une population rurale du Sénégal." *Santé Publique (Laxou)* 35 (4): 423–34. <https://doi.org/10.3917/spub.234.0423>.
- Deslauriers, Véronique, Simona Bignami, and John Sandberg. 2024. "A Typology of Social Network Interactions in Sub-Saharan Africa: Evidence from a Rural Population in Senegal." *Population Studies* 78 (2): 251–68. <https://doi.org/10.1080/00324728.2024.2345070>.
- Douillot, Laetitia, and John F. Sandberg. 2017. "Social Networks and Direct Caregiving in Rural Senegal." Paper. XXXVII Sunbelt Conference of the International Network for Social Network Analysis, Beijing, China, March 31.

- Fafchamps, Marcel. 1992. "Solidarity Networks in Preindustrial Societies: Rational Peasants with a Moral Economy." *Economic Development and Cultural Change* 41 (1): 147–74. <https://doi.org/10.1086/452001>.
- Foster, George M. 2016. "Disease Etiologies in Non-Western Medical Systems." In *Understanding and Applying Medical Anthropology*, 3rd ed. Routledge.
- Lericollais, André. 1999. *Paysans sereer: dynamiques agraires et mobilités au Sénégal*. IRD Editions. <https://doi.org/10.4000/books.irdeditions.15828>.
- Sandberg, John. 2015. "Ideal Family Size, Acceptability of Contraceptive Use and Social Network Processes." With Laetitia Douillot, Steven Rytina, Valérie Delaunay, Cheikh Sokhna, and Yacine Boujija. Population Association of America Annual Meetings.
- Sandberg, John. 2018. "Le Rôle Des Observatoires Dans La Recherche Sur Les Réseaux Sociaux." In *Niakhar: 50 Années de Recherche En Population et Santé*. Edition IRD.
- Sandberg, John, Sadio Ba Gning, and Loubna Belaid. 2014. "Morbidity, Mortality, and Health-Seeking Behaviour in Rural Senegal: Local Understanding and Representation of Disease across Method of Treatment." *The Lancet Global Health, Consortium of Universities for Global Health, 5th Annual Conference* 2 (Supplement 1): S15. [https://doi.org/10.1016/S2214-109X\(15\)70037-9](https://doi.org/10.1016/S2214-109X(15)70037-9).
- Sandberg, John, Valérie Delaunay, Yacine Boujija, et al. 2018. "Individual, Community, and Social Network Influences on Beliefs Concerning the Acceptability of Intimate Partner Violence in Rural Senegal." *Journal of Interpersonal Violence*, October 22, 0886260518805778. <https://doi.org/10.1177/0886260518805778>.
- Sandberg, John, Rosalind Fennell, Laetitia Douillot, et al. 2019. "A Latent Class Analysis of Attitudes Concerning the Acceptability of Intimate Partner Violence in Rural Senegal." *Population Health Metrics* 18 (1): 27. <https://doi.org/10.1186/s12963-020-00233-0>.
- Sandberg, John, Chulwoo Park, Steven Rytina, et al. 2019. "Social Learning, Influence, and Ethnomedicine: Individual, Neighborhood and Social Network Influences on Attachment to an Ethnomedical Cultural Model in Rural Senegal." *Social Science & Medicine* 226 (April): 87–95. <https://doi.org/10.1016/j.socscimed.2019.02.028>.
- Sandberg, John, Steven Rytina, Richard Lalou, and Valérie Delaunay. 2008. "Social Networks across the Lifecourse and the Development of the Niakhar Networks Pilot Survey Instrument." Paper. International Sunbelt Social Network Conference XXVIII, St. Pete Beach, US.
- Smith, Eliot R., and Sarah Queller. 2004. "Mental Representations." In *Social Cognition*, edited by Marilyn B. Brewer and Miles Hewstone. Wiley-Blackwell.
- Strauss, Claudia, and Naomi Quinn. 1998. *A Cognitive Theory of Cultural Meaning*. Cambridge University Press. <https://doi.org/10.1017/CBO9781139167000>.