RESEARCH ARTICLE

Best of ARM: Evaluating engagement in multisector community health networks: The case of tribal organizations

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Abstract

Objective: To quantify variation in public health system engagement with tribal organizations across a national sample of communities and to identify predictors of engagement.

Data Sources: We used 2018 National Longitudinal Survey of Public Health Systems data, a nationally representative cohort of the US public health systems.

Study Design: Social network analysis measures were computed to indicate the extent of tribal organization participation in public health networks and to understand the sectors and social services that engage with tribal organizations in public health activities. Two-part regression models estimated predictors of tribal engagement.

Data Collection: A stratified random sample of local public health agencies was surveyed, yielding 574 respondents. An additional cohort of oversampled respondents was also surveyed to include jurisdictions from the entire state upon the request of their respective state health departments ($n = 154$). Analyses were restricted to jurisdictions with a nearby American Indian and Alaska Native (AI/AN) serving health facility, yielding a final sample size of 258 local public health systems.

Principal Findings: When an AI/AN serving health facility was present in the region, tribal organizations participated in 28% of public health networks and 9% of implemented public health activities. Networks with tribal engagement were more comprehensive in terms of the breadth of sectors and social services participating in the network and the scope of public health activities implemented relative to networks without tribal engagement. The likelihood of tribal engagement increased significantly with the size of the AI/AN population, the presence of a tribal facility with Indian Health Service funding in the region, and geographic proximity to reservation land ($p < 0.10$).

Conclusions: The vast majority of public health networks do not report engagement with tribal organizations. Even when AI/AN serving health facilities are present, reported engagement of tribal organizations remains low.

KEYWORDS
public health systems, social network analysis, tribal health

What is known on this topic

- There is growing evidence that strong multisector networks of community organizations can reduce health risks and improve outcomes for historically marginalized and underserved populations.
- American Indian and Alaska Native (AI/AN) populations suffer from high rates of preventable diseases.
- Public health networks have the potential to engage with tribal organizations in order to better serve AI/AN residents; however, the prevalence of tribal organization engagement in these networks is unknown.

What this study adds

- The vast majority of public health networks near AI/AN serving health facilities (72%) do not engage with tribal organizations.
- Public health networks that engage with tribal organizations are more diverse in sectors and social services compared to networks that do not engage with tribal organizations.
- The likelihood of tribal engagement increases significantly with the size of the AI/AN population, the presence of a tribal facility with Indian Health Service funding, and geographic proximity to reservation land.

1 | INTRODUCTION

American Indian and Alaska Native (AI/AN) communities are disproportionately affected by preventable diseases, injuries, and deaths. Higher rates of chronic disease, as well as suicide, alcohol, and drug-related deaths, contribute to a 5.5-year lower life expectancy relative to other population groups.[1] Disparities in poverty rates, education attainment, preventive cancer screenings, and behavioral risk factors exacerbate poor health in AI/AN populations.[2–4] The COVID-19 epidemic has also disproportionately impacted AI/AN communities, where AI/AN have one of the highest COVID-19 mortality rates and are over three times more likely to die of COVID-19 compared to their White peers.[5] A robust public health system is needed to address persistent health disparities in AI/AN communities.

Around 5.2 million Americans who identify as AI/AN reside throughout the United States, with only 22% living primarily on reservations or other tribal lands.[6] For these reasons, public health systems across the United States require the ability to identify and address the health needs of AI/AN communities. In the United States, public health systems comprise decentralized networks of local, state, federal, tribal, and territorial government agencies and their community-based partners that work together to identify and address health needs in their respective jurisdictions. Much of the responsibility for delivering and financing public health services exist at the local level, where public health agencies and their partners serve jurisdictions delineated as counties, cities, townships, or special regional districts. On tribal lands, tribal government agencies have primary responsibility for carrying out public health activities, working in tandem with the federal Indian Health Service (IHS) and other governmental and nongovernmental organizations authorized by federally recognized tribes.[7] Beyond the boundaries of tribal lands, a variety of organizations specialize in serving AI/AN populations, including IHS facilities, organizations chartered by or affiliated with tribal governments, and organizations affiliated with enrolled members of tribes and others who

identify as AI/AN.[8] Collectively, these types of organizations are known as AI/AN serving health facilities.

One way that local public health systems can address the health needs of AI/AN communities is by engaging with AI/AN serving health facilities. There is growing evidence that multisector networks of community organizations can reduce health risks and improve outcomes for historically marginalized and underserved populations.[9,10] Voluntary forms of engagement are essential in working with AI/AN serving institutions because federally recognized tribes are sovereign entities having legal rights to self-governance guaranteed by the US Constitution and federal treaties.[7] A variety of factors may impede successful collaboration between these institutions and other partners within local public health systems, including differences across local communities in the array of available AI/AN serving health facilities, lack of geographic proximity between organizations, differences in the legal agreements and eligibility requirements that govern who can receive assistance from tribal governments and other AI/AN serving institutions, differences in cultural norms and values, and constraints on the financial and human resources that support the work of AI/AN serving institutions and other public health partners.

Public health networks that engage tribal organizations have the potential to better serve AI/AN residents living in and outside of tribal lands; however, the prevalence of tribal organization engagement in local public health networks is unknown. In this study, we aim to understand the variation of public health network engagement with tribal organizations and the predictors of engagement.

1.1 | Conceptual framework

The engagement of tribal organizations in a public health network is likely to be dependent on the overall capacity of the public health system and the array of available AI/AN serving institutions.

Public health systems with greater resources, funding, and staffing are more likely to have better-performing public health systems and more sustainable partnerships.[11,12] The social, economic, and political environment in which the system also operates directly influences public health capacity.[13] In this study, we use community characteristics to represent the resources, needs, and policy environments that are known to influence the demand and availability of public health services.[14]

We expect that comprehensive public health systems with a wider range of community partners (or ties) will be more likely to engage tribal organizations. Although strong connections between two sectors tend to demonstrate levels of trust and collaboration, the strength of weak ties theory argues that weak but diverse connections may be more likely to bridge hard-to-reach sectors.[15] This is due to the concept of "*triadic closure*" in which a newly developed partnership between two organizations will connect the new partners to all other existing relationships.[16] Networks with many multisector partners are likely to reduce barriers to entry in the network because more opportunities are available to connect to the network.

Engagement also depends on the ability and incentive of an organization to participate in the network. Tribal organizations have an economic motivation to collaborate with nontribal public health agencies to share resources, skills, and information. They also have a mission to improve the health of AI/AN communities that likely aligns with many public health partners in their pursuit to reduce health disparities. However, tribal organizations represent a diverse group of sovereign nations throughout the United States with historically strained relationships with governmental agencies and mistrust in nontribal health care settings.[17,18] Nonetheless, tribal health authorities indicate forming partnerships as one of their top priorities to improve public health.[7] There are many recent examples of tribes collaborating with local governments and organizations in order to improve health in AI/AN communities.[19–21] Moreover, there is evidence that partners can still be valued even if mistrust exists between partners.[22] Therefore, we start with the assumption that most tribal organizations want to participate in local public health networks.

We expect partnerships to be pursued where large AI/AN communities reside. Communities in closer proximity to reservation lands and those with greater AI/AN population size will be more likely to engage tribal organizations in public health networks. In addition, IHS facilities have been built to provide medical services for AI/AN communities and can serve as an indicator that a federally recognized tribal community resides in that region. Although some IHS facilities are not operated by tribal organizations, these entities may be able to facilitate a relationship between tribal organizations and public health networks.

2 | METHODS

2.1 | Study design

We conducted a retrospective, cross-sectional comparative study using data from a nationally representative survey of local public health jurisdictions within the 50 US states and the District of Columbia. The units of observation for this study included local governmental jurisdictions organized as counties, cities, townships, or special multicounty districts. The study did not include tribal public health jurisdictions operated by federally recognized tribes and located on tribal lands.

2.2 | Data

We used data from the 2018 wave of the National Longitudinal Survey of Public Health Systems (NALSYS), which focuses on a nationally representative cohort of local public health jurisdictions. NALSYS asks the local public health official in each jurisdiction to report on the availability of 20 public health activities every 2 years (see Appendix S1 for a list of NALSYS survey questions). The activities included in the survey are those that have been recommended by the National Academy of Medicine, the US Centers for Disease Control and Prevention (CDC), and other national scientific and professional advisory bodies for universal implementation.[23,24] For each activity that is implemented within a jurisdiction, the local health official indicates the types of organizations (sectors) that participate in implementing the activity. We used responses to the NALSYS questions "What other types of organizations are involved in performing this activity in your jurisdiction?" and "Do any of the organizations involved in this activity deliver the following services?" to characterize the types of organizations engaged in local public health systems across the United States. The 14 sectors listed on the survey included local health departments, other local government agencies, state health departments, other state government agencies, federal agencies, community health centers, hospitals, physician groups, K-12 schools, universities, faith-based nonprofits, other nonprofits, health insurance, and employers. Beginning in 2018, "tribal organization" was added to the survey instrument; thus, we conducted a cross-sectional study design using the 2018 survey wave to examine tribal organization engagement.

2.3 | Study population

A national, stratified random sample of local public health jurisdictions was surveyed, yielding 574 respondents. We oversampled jurisdictions located in four purposefully selected states (KY, OH, OR, and WA) at the request of their state health departments ($n = 154$). Together, these public health jurisdictions contain approximately 70% of the US population. The overall survey response rate was 58%. Respondents were excluded if over half of the survey questions were missing ($n = 3$) or if respondents reported zero activities were implemented ($n = 2$). Analyses were further restricted to jurisdictions with an AI/AN serving health facility located in the county or adjacent county, yielding a final sample size of 258 local public health systems. These jurisdictions have the potential for collaboration with tribal organizations and have sizable AI/AN communities. Appendix S1 display the characteristics of the full sample (Table S1) and characteristics by whether an AI/AN serving health facility was in the region (Table S2).

2.4 | Measures

2.4.1 | Tribal Organization Engagement in Public Health Networks

We constructed two primary measures of tribal organization engagement in the local public health system using the NALSYS survey data. First, we constructed a binary indicator for each public health jurisdiction indicating whether tribal organizations were reported to be engaged or not in any of the public health activities listed on the survey. This measure was used to determine the proportion of jurisdictions in which tribal organizations were engaged in the public health system, indicating the *extensive margin* of tribal engagement. Second, we calculated the proportion of public health activities in which tribal organizations were engaged for each jurisdiction, indicating the *intensive margin* of tribal engagement. As supplementary measures, we examined individual indicators of tribal engagement for each of the public health activities listed on the survey.

2.4.2 | Public health network structure

We used standard network analysis methods to construct four types of measures indicating structure and composition of each jurisdiction's local public health system.[25] First, for each pair of sectors listed on the NALSYS survey (dyad), we calculated the proportion of public health activities that were jointly contributed by both sectors in the dyad and used this proportion as our measure of *connectivity between sectors* (or tie strength). Second, we calculated a measure of *network density* as the sum of connectivity across all dyads in the network, divided by the highest possible sum of connectivity (i.e., the sum of all dyads contributed to all activities). Third, we calculated a measure of *network degree centrality* for each sector listed in the survey, indicating that sector's overall influence within the jurisdiction's public health network. Degree centrality was calculated for each sector as the sum of connectivity for each dyad involving that sector, divided by the sum of connectivity for all dyads in the network. Fourth, we measured the *scope of activity* for each sector by calculating the proportion of public health activities implemented by each jurisdiction. Social Network Analysis visualizations were created using nwcommands in Stata.[26] To improve the interpretability of the plots, any average tie strength less than 0.05, which meant that two sectors completed less than one public health activity in common on average, was recoded to zero (excluded 705 ties).

2.4.3 | Proximity to AI/AN serving health facilities

Boundary file information obtained from the National Association of County and City Health Officials (NACCHO) was used to identify counties included in each local public health jurisdiction.[27] We then used data from the IHS Facility Directory to identify AI/AN-serving health facilities and their proximity to local public health

jurisdictions.[28] We constructed measures for five types of health facilities included in the directory: facilities operated by IHS; facilities operated by tribes or tribal organizations with IHS funding; facilities operated by nonprofit AI/AN serving organizations and funded by IHS through the Urban Indian Health Program; tribal health clinics operated by tribes or tribal organizations but without IHS funding; and Tribal Epidemiology Centers funded by IHS to provide nonclinical public health services. For each jurisdiction, we constructed variables indicating whether or not each type of facility was located in the county or an adjacent county. As an additional measure, the US Census Bureau's American Indian Reservation Statistical Area data was used to calculate the distance from the geographic center of each jurisdiction to the center of the nearest reservation land.[29]

2.4.4 | AI/AN populations and other community characteristics

We measured the size of the AI/AN population in each county using the 2018 American Community Survey (ACS) 5-year estimates.[30] We included all self-identifying AI/AN, who either identified as a single race or multiracial, as a percentage of the total county population.

TABLE 1 Characteristics of Public Health Systems, National Longitudinal Survey of Public Health Systems, 2018

	Mean	SD
Any tribal engagement (extensive margin, %)	27.9	44.9
Public health activities with tribal engagement (intensive margin, %)	8.7	19.2
Facility type (%)		
IHS facility	33.7	47.4
Tribal facility with IHS funding	58.1	49.4
Tribal facility without IHS funding	18.6	39.0
Urban Indian Health Program	40.3	49.1
Tribal Epidemiology Center	9.3	29.1
Reservation land distance (miles)	43.4	35.7
AI/AN population (%)	3.1	6.0
Rural (%)	31.8	46.7
Multicounty jurisdiction (%)	12.0	32.6
Primary care providers (per 10,000)	12.0	6.1
Population over 65 (%)	18.5	5.5
Income per capita ($10,000)	5.3	1.9
Below poverty (%)	12.2	4.3
Uninsured (%)	7.5	3.9
4-year college degree (%)	19.8	7.7
Unemployment (%)	2.0	0.6
N	258	

Abbreviations: AI/AN, American Indian/Alaskan Native; IHS, Indian Health Service; SD, standard deviation.

Additional county-level demographic and socioeconomic characteristics were obtained from the Area Health Resources Files, including the number of primary care providers, income per capita, and the percentage of the population over 65, below federal poverty levels, uninsured, with a four-year college degree, and unemployed.[31] Rural counties were defined as nonmetropolitan counties with a rural–urban commuting area code (RUCA) of 4–9 per the US Health and Human Services Office of Rural Health Policy's definition of rurality.[32]

FIGURE 1 Tribal Organization Engagement in Public Health Activities by Activity Type, National Longitudinal Survey of Public Health Systems, 2018. Figure presents the percent of public health activities with tribal organization engagement. The figure is restricted to only networks with at least one activity with tribal organization involvement ($n = 72$). The complete list of survey questions is presented in the Appendix S1. [Color figure can be viewed at wileyonlinelibrary.com]
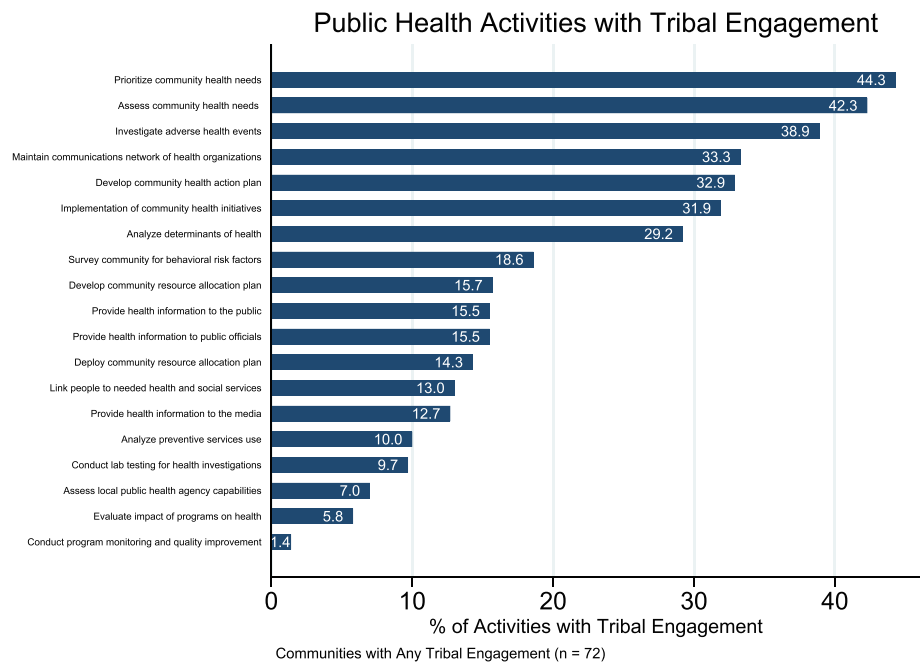
TABLE 2 Characteristics of public health systems with and without tribal engagement, National Longitudinal Survey of Public Health Systems, 2018

	Communities with tribal engagement ($n = 72$)		Communities without tribal engagement ($n = 186$)	
	Mean	SD	Mean	SD
Facility type (%)				
IHS facility	47.2**	50.3	28.5	45.3
Tribal facility with IHS funding	83.3***	37.5	48.4	50.1
Tribal facility without IHS funding	8.3**	27.8	22.6	41.9
Urban Indian Health Program	29.2**	45.8	44.6	49.8
Tribal Epidemiology Center	9.7	29.8	9.1	28.9
Reservation land distance (miles)	29.8***	20.9	48.7	38.8
AI/AN population (%)	6.2***	10.4	1.9	2.0
Rural (%)	37.5	48.8	29.6	45.8
Multicounty jurisdiction (%)	13.9	34.8	11.3	31.7
Primary care providers (per 10,000)	12.0	6.1	12.0	6.1
Population over 65 (%)	19.6*	6.3	18.2	5.2
Income per capita ($10,000)	4.7***	1.2	5.6	2.1
Below poverty (%)	14.5***	4.7	11.2	3.9
Uninsured (%)	9.1***	4.3	6.8	3.4
4-year college degree (%)	16.6***	5.9	21.2	8.1
Unemployment (%)	2.1*	0.5	2.0	0.6

Note: Statistical significance determined by *t* tests and chi-squared tests between jurisdictions with and without tribal engagement reported at ***$p < 0.01$, **$p < 0.05$, * < 0.10.

Abbreviations: AI/AN, American Indian/Alaskan Native; IHS, Indian Health Service; SD, standard deviation.

For jurisdictions spanning more than one county, we used the weighted population average for the demographic and socioeconomic variables and used the lowest RUCA code (i.e., most urban). Last, we included an indicator for multicounty jurisdictions.

2.5 | Statistical analysis

Two-part regression models were used to identify the community characteristics associated with tribal engagement in public health systems. The first part of the model estimated the probability of any tribal engagement (i.e., extensive margin) using logistic regression. The second part of the model estimated the proportion of public health activities in which tribal organizations engaged (i.e., the intensive margin) using generalized linear regression (GLM). We used a log link and Gamma distribution for the GLM model to account for right-skewness in the intensive margin. To aid in interpretation, we calculated the marginal effect of each community characteristic.[33] All models used robust standard errors.

We used the characteristics listed in Table 1 as covariates in the two-part model. Splines were constructed to estimate the relationship of tribal engagement at different levels of the AI/AN population. We began by creating splines at quartiles and used common model fit criteria (i.e., AIC, BIC) to determine if AI/AN population had a nonlinear relationship with tribal engagement. A knot was created at 1% (about the bottom 25th percentile) using Stata's mkspline command. The AI/AN population variables and a rural indicator were interacted to estimate if there were differential effects between rural and urban counties, but we found no differential effects between rural and urban communities. All analyses were conducted using Stata v.16.1.

This study was determined not to be human participants research by the Colorado Multiple Institutional Review Board.

3 | RESULTS

Local health officials in 28% of surveyed public health systems reported tribal organization engagement in at least one public health activity (Table 1). Tribal organizations participated in only 8.7% of the nationally recommended public health activities on average, which was the lowest rate of participation among all 14 sectors.
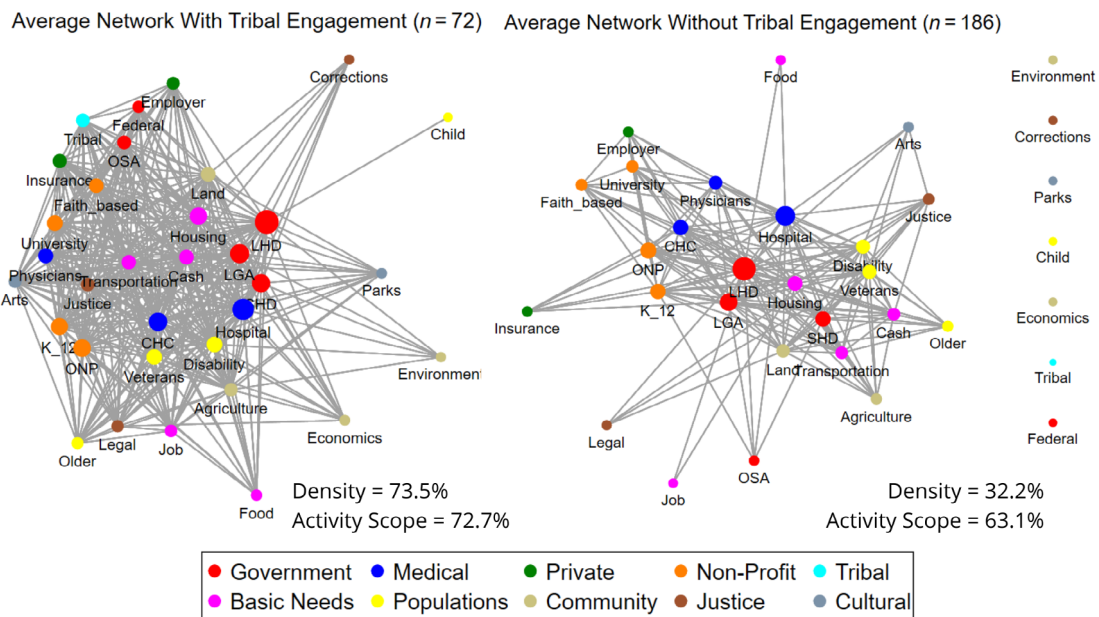

FIGURE 2 Public health network map of sectors and social services by jurisdictions with and without tribal engagement, National Longitudinal Survey of Public Health Systems, 2018. The figure displays the social network analysis of public health jurisdictions with a nearby American Indian/Alaskan Native serving health facility. Each line (dyad) represents the proportion of public health activities that were jointly contributed. Degree centrality is indicated by node size and represents the sector's overall influence within the jurisdiction's public health network. Network density is the sum of connectivity across all dyads in the network. Scope of Activity measures the proportion of public health activities implemented in the jurisdiction. Government Sector: LHD (Local Health Department), SHD (State Health Department), LGA (Other Local Government Agency), OSA (Other State Government Agency), Federal (Federal Agency); Medical Sector: Hospital, CHC (Community Health Center), Physicians; Private Sector: Employer, Insurance; Nonprofit Sector: University, K-12 (Primary to High School), Faith-Based, ONP (Other Nonprofit); Basic Needs: Housing (assistance with housing shelter or utilities), Job (employment assistance or job training), Cash (cash assistance for low-income households), Transportation (transportation services), Food (food and nutrition assistance); Populations: Disability (support services for disabled populations), Veterans (support services for veterans), Older (support services for older adults), Child (child and family support services); Community: Economics (economic development services), Environment (environment protection programs), Agriculture (agriculture or cooperative extension services), Land (land use, zoning, or community development services); Justice: Legal (legal assistance), Justice (law enforcement), Corrections (corrections, criminal justice or juvenile justice services); Cultural: Arts (library, arts, or cultural programs), Parks (parks, recreation, or physical activity program). [Color figure can be viewed at wileyonlinelibrary.com]

Around 34% of communities had an IHS facility, 58% with a tribal facility with IHS funding, 19% with a tribal facility without IHS funding, 40% with an Urban Indian Health Program, and only 9% with a Tribal Epidemiology Center. Public health jurisdictions were located 43 miles from the reservation land and 3.1% of the population identified as AI/AN on average.

Tribal engagement by public health activity type is presented in Figure 1. Among public health systems with tribal engagement in at least one activity, tribal organizations participated in 31% of the implemented public health activities. Top activities in which tribal organizations participated included prioritizing community health needs (44.3%), assessing community health needs (42.3%), investigating adverse health events (38.9%), and maintaining a communications network (33.3%). Analyzing preventive health service utilization (10.0%), conducting lab testing for health investigations (9.7%), assessing local public health agency capabilities (7.0%), evaluating the impact of programs on health (5.8%), and program monitoring and quality improvement (1.4%) were the lowest activities with tribal engagement.

Table 2 displays descriptive characteristics of public health systems with and without tribal engagement. Communities with tribal engagement were more likely to have a nearby IHS-directed facility (47.2% vs. 28.5%, $p < 0.05$) and tribal facility with IHS funding (83.3% vs. 48.4%, $p < 0.01$). Communities with tribal engagement were less likely to be near a tribal facility without IHS funding (8.3% vs. 22.6%, $p < 0.05$) and an Urban Indian Health Program (29.2% vs. 44.6%, $p < 0.05$). Communities with tribal engagement were also more likely to be closer in proximity to tribal land and have a greater percentage of the AI/AN population ($p < 0.01$). Communities with tribal engagement had a lower per capita income, higher proportion of the population living in poverty and uninsured, and a lower percentage with a college degree ($p < 0.01$).

Figure 2 plots the average network of sectors and social services that were involved in recommended public health activities. The plots are stratified by networks with and without tribal organization engagement. *Organizational centrality* is indicated by the size of nodes. In public health networks that engage with tribal organizations, their *network density* is about 74% relative to only 32% in networks without tribal organization engagement. This indicates that most sectors and social services are connected to each other in at least one public health activity in networks with tribal engagement. These networks also had a higher *activity scope* (72.7% compared to 63.1%), indicating

TABLE 3 Predictors of Tribal Organization Engagement in Public Health Networks, National Longitudinal Survey of Public Health Systems, 2018

	First stage extensive margin (1)	Second stage intensive margin (2)	Two-part model overall (3)
AI/AN percent – below 1%	0.177 (0.143)	−0.006 (0.280)	0.049 (0.088)
AI/AN percent – above 1%	0.030** (0.012)	0.005** (0.002)	0.010*** (0.004)
AI/AN Serving Health Facility			
IHS facility	0.067 (0.052)	−0.049 (0.067)	0.005 (0.024)
Tribal facility with IHS funding	0.096 (0.061)	0.059 (0.060)	0.041* (0.022)
Tribal facility without IHS funding	−0.092 (0.077)	−0.030 (0.097)	−0.033 (0.030)
Urban Indian Health Program	0.017 (0.062)	0.031 (0.074)	0.014 (0.028)
Tribal Epidemiology Center	−0.103 (0.077)	0.072 (0.126)	−0.015 (0.037)
Reservation land distance (10 miles)	−0.028*** (0.010)	−0.014 (0.009)	−0.012*** (0.004)
Rural	−0.132*** (0.048)	0.072 (0.076)	−0.020 (0.024)
Multicounty jurisdiction	−0.015 (0.071)	−0.024 (0.077)	−0.011 (0.029)
Primary care providers per 10,000	0.019*** (0.004)	−0.003 (0.005)	0.005*** (0.002)
Population over 65 (%)	0.008* (0.005)	0.007 (0.006)	0.004** (0.002)
Income per capita ($10,000)	0.016 (0.025)	−0.086** (0.034)	−0.019 (0.012)
Poverty (%)	0.008 (0.009)	−0.016* (0.009)	−0.002 (0.003)
Uninsured (%)	0.015** (0.007)	0.003 (0.008)	0.005* (0.003)
College degree (%)	−0.018*** (0.006)	−0.004 (0.009)	−0.007** (0.003)
Unemployment (%)	−0.068 (0.061)	−0.050 (0.048)	−0.034 (0.023)
Observations	258	72	258

Note: Statistical significance is reported at *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Table presents marginal effects from the two-part regression models with robust standard errors in parentheses. The first stage estimated the probability of any tribal inclusion (i.e., extensive margin) with a logistic regression model. The second stage estimated the proportion of public health activities with tribal participation (i.e., intensive margin) with a Generalized Linear Model with a Gamma distribution and log link. All measures are reported by the local public health official in each jurisdiction. AI/AN above and below 1% are continuous splines variables created using a knot at 1% AI/AN population as a percent of the total population. AI/AN serving health facility indicates whether a facility is present in the county or adjacent county.

Abbreviations: AI/AN, American Indian/Alaskan Native; IHS, Indian Health Service.

that more recommended public health activities were implemented in their community. Tribal organizations had the strongest network ties (i.e., activities that were jointly contributed) with local health departments, hospitals, local government agencies, community health centers, other nonprofits, and K-12 schools (see Table S3 for the complete results).

Models estimating predictors of tribal engagement are displayed in Table 3. AI/AN population below 1% indicates the association between AI/AN population size and tribal engagement when the AI/AN population is below 1% of the county population. AI/AN below 1% was not associated with tribal engagement; however, AI/AN population increased the likelihood of tribal organization engagement in both the extensive and intensive margins in jurisdictions with an AI/AN population size above 1% of the county population ($p < 0.05$). Thus, AI/AN population size above 1% increased the likelihood of any participation, as well as the number of public health activities that tribal organizations participate in when an engagement occurs. Tribal facilities with IHS funding increased the probability of overall tribal engagement by 4.1 percentage points ($p < 0.10$). There was no statistically significant association with IHS facilities, Urban Indian Health Programs, or tribal facilities without IHS funding. Closer proximity to tribal reservation land increased the likelihood of any tribal engagement ($p < 0.01$). Jurisdictions in a rural location were 13.2 percentage points less likely to have any tribal engagement ($p < 0.01$). The number of primary care physicians was also positively associated with an increase in tribal engagement ($p < 0.01$). The income per capita and poverty were both negatively associated with the number of public health activities with tribal participation ($p < 0.10$). The percentage of the population with a 4-year college degree was negatively associated with any tribal engagement ($p < 0.01$).

4 | DISCUSSION

We find that the vast majority of public health systems across the United States do not engage with tribal organizations. Even when AI/AN serving health facilities are located proximate to the public health jurisdiction, only around a quarter of public health systems report tribal organization engagement. The public health activities most likely to include tribal organization engagement included assessing and prioritizing community health needs, maintaining a communications network, and investigating adverse health events. Public health networks that engaged tribal partners were more likely to have diverse networks in terms of the breadth of sectors and social services and implement more recommended public health activities. When tribal organizations were engaged in a network, they were connected to sectors that participate in the most public health activities, such as local health departments and hospitals, as well as less dominant sectors, such as other nonprofits and K-12 schools. Closer proximity to tribal lands, AI/AN population size, and the presence of tribal facilities with IHS funding increased the likelihood of tribal engagement. IHS facilities, tribal facilities without IHS funding, and Urban Indian Health Programs had no impact.

The social network analyses provide a further understanding of why we observed low tribal engagement in public health networks. Public health networks that did not engage with tribal organizations were narrower in the scope of their partners and were more centralized around the local public health department. Prior research has found that local public health departments have centralized roles in public health collaborations early on in the network formation, but over time, the distribution becomes more shared and decentralized.[22,34] It is possible that these collaboratives are at an early stage in their partnership development considering the majority of public health collaboratives are recent endeavors.[11] Moreover, public health networks are dependent on their own capacity and resources to develop and maintain partnerships.[11,12] We also found that networks without tribal engagement were more limited in their provisions of public health services. Thus, these networks may be low resourced, impeding their ability to form multisector partnerships.

The complexity and fragmentation of the US health care system may also prohibit partnership development. Tribes have a history of successfully collaborating with state and local agencies to address AI/AN health disparities, but it often requires navigating tribal sovereignty and the complexity of tribal jurisdictions. It is unclear whether local, nontribal public health departments and their community partners consider tribal organizations to be feasible partners, especially when they are not in close proximity to tribal lands. Nevertheless, about 70% of tribal public health organizations reside less than 50 miles away from a nontribal public health department, and 40% are located within 25 miles.[7]

In addition, the vast majority of US counties have AI/AN populations of less than 1%.[30] We found that communities with AI/AN populations above 1% were more likely to have tribal engagement in their public health network. This suggests that a large AI/AN presence likely increases the awareness of the need to collaborate with tribal organizations. A recent study found that AI/AN experienced the highest chronic mental distress in the United States compared to other races over a nearly 30-year period, but the gap was markedly less in states that had large AI/AN populations.[35] It is plausible that tribal engagement in public health networks was partly responsible for this improvement. However, future studies should examine whether tribal engagement in public health collaboratives will be effective at improving health outcomes and reducing disparities.

5 | LIMITATIONS

NALSYS survey data are dependent on the knowledge and perspectives of local, nontribal public health officials. Nontribal health officials may have differing perspectives of tribal organization engagement than the tribal organizations themselves. Future studies should assess engagement in public health networks from the perspectives of tribal organizations. In addition, the survey does not specify the "tribal organizations" that are involved in activity implementation. Therefore, the responses are dependent on the health official's interpretation of the question. The list of organization sectors and social services may not be comprehensive and may exclude some partners in public health

networks. The survey is also limited in that it cannot assess the strength of collaboration between tribal organizations and other sectors. Although our overall survey response was high (58%), nonresponse bias may still be present. Nonresponders were more likely to have a higher percentage of the AI/AN population (4.4% compared to 3.1%, see Table S4). Therefore, it is possible that these communities may be more likely to engage tribal partners. However, nonresponders were similar to responders in other key predictors of engagement, such as distance to the reservation land and the percentage of communities with a nearby AI/AN serving health facility. Moreover, communities with a lower propensity for multisector partnerships may be less likely to complete the survey. In addition, the IHS Facility Directory only includes tribal facilities without IHS funding that voluntarily submit contact information to the IHS and may not include all tribal facilities that do not receive IHS funding. Last, these results are purely descriptive, and we are unable to determine why public health systems may engage tribal partners in this study.

6 | PUBLIC HEALTH IMPLICATIONS

Although there is increasing recognition of the importance of multisector partnerships in the delivery of public health services, we find that only 28% of public health systems engaged with tribal organizations. These findings demonstrate the vast opportunity to develop partnerships with AI/AN communities, especially in areas where AI/AN serving health facilities are already present.

Efforts designed to address AI/AN health may need to include designated funding for cross-sector collaboration. For example, the National Institute of Health's program "Intervention Research to Improve Native American Health" requires that grant funding be partially used for the allocation of resources and time to collaborate with tribal leaders.[36] The IHS, in particular, could benefit from dedicated funding for partnership development with local organizations. The IHS has partnership programs to improve multisector collaborations, but partnerships are almost exclusively with other federal agencies.[37] A pivot toward local partnerships may be more effective. Moreover, current funding for the IHS is primarily limited to providing medical services. Around 3% of IHS spending is allocated to preventive health, and approximately 6% of funding is devoted to mental health, alcohol, and substance use treatment.[38] Public health networks might prioritize the engagement of tribal organizations in public health activities where IHS is insufficiently funded, and current participation in networks is low, such as preventive health and behavioral services. In addition, only 1% of IHS funding is allocated to Urban Indian Health Programs,[38] leaving approximately 60% of AI/AN people who live in urban areas with limited resources.[39] Future research should explore whether dedicated funding for cross-collaboration is effective at improving AI/AN inclusion in community health networks.

The delivery of public health services to AI/AN communities should be responsive and adaptive to the individual community. AI/AN populations are not homogeneous and may have differing needs, perspectives, and cultures that require differing public health approaches. Including tribal organizations in public health networks has the potential to promote public health services that are tailored to the culture and perspectives of individual communities, build trust with historically marginalized populations, and break down barriers to public health initiatives.[40] In order to achieve this, public health systems must develop relationships based on mutual respect and understanding, cooperation, transparency, and accountability.[41] By developing tribal public health partnerships, we can better address persistent AI/AN health disparities and emerging health threats.

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