

Developing Cross-Sector Referral Networks to Address Social Determinants of Health:
Results from a Multi-Year Evaluation Before and During COVID-19

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Acknowledgements: The authors wish to thank the community partners and providers in Southeast Kansas for their participation in this study. The following individuals provided data preparation or evaluation support during the study period: Thomas Ball, Brittany Chaplin, Jason Miller, Pegah Naemi-Jimenez, Debbie Richardson, Katherine Soon, & Greta Stuhlsatz. We also wish to thank the feedback from three anonymous reviewers on a previous version of this paper.

Funding: This evaluation was supported by funding from the U.S. Department of Health and Human Services; Health Resources and Services Administration Maternal Infant and Early Childhood Home Visiting Innovation Award to the Kansas Department of Health and Environment (17UH4MC30466). The University of Kansas Center for Public Partnerships and Research was contracted by the Kansas Department of Health and Environment to conduct this evaluation.

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Abstract

Collaboration between public health, healthcare, and social services is critical to address social determinants of health and crises like COVID-19. Over forty-seven months (2017 to 2020), five rural counties in southeast Kansas implemented an adaptive collaboration approach to service and referral coordination with a shared protocol and tool, IRIS. Over time, the active partner network increased in size (Time 1 $N=5$; Time 4 $N=45$), included seven sectors (e.g., social services, public health), and coordinated services for 2,314 individuals with 3,088 referrals. Social network analysis showed an efficient and interconnected network by Time 4. The percentage of referrals that converted into service enrollments (i.e., ‘quality referrals’) increased (Time 1= 33.1%; Time 4 = 41.4%, $\chi^2(1, 1045) = 2.87, p = .09$). Referrals made interim-COVID-19 decreased, but they were more likely to be quality referrals. Results support the importance of an adaptive collaboration framework, a shared referral tool, and transparent protocols to build effective cross-sector networks.

Key Words: Cross-sector Networks; Social Determinants of Health; Referral and Service Coordination; Adaptive Collaboration

Introduction

The link between social determinants of health and equity in access to care and social services has long been a focus of public health research and practice (Heiman & Artiga, 2018; Marmot & Allen, 2014; Marmot, Friel, Bell, Houweling, & Taylor, 2008). Disruptions in housing, transportation, food security, healthcare access, and social isolation can adversely affect the health trajectories and outcomes of individuals and families. These experiences are further exacerbated by siloed or misaligned public health and social service systems at the state and community level. Common reasons for this include criteria-based funding and access barriers, disorganized referral processes, and functional administrative dissimilarities between public health, healthcare, and community-based sectors (Whiteside, 2004). These disconnects make it difficult for individuals to choose experiences, behaviors, and services that can optimize their health and well-being. Navigating disparate systems without a clear ‘entry point’ is particularly challenging for vulnerable and underserved populations (Lewis, Larson, McClurg, Boswell, & Fisher, 2012; Martino, et al., 2018; Shi, Stevens, & Politizer, 2007). The impact of a confusing network of services, bureaucracies, and information can be laid bare by crises such as the COVID-19 pandemic.

It is difficult to effectively align services and tackle system disconnects, even in a community of well-intentioned partners. Cross-sector divides in practice, technology, and nomenclature must be bridged. However, building a community-wide network of providers who share a common language, practices, tools, and commitment to collaboration can help drive better outcomes. Bell and colleagues found that effective cross-sector network coordination can impact the rate individuals and families engage in the right services to avert further compounding needs (Bell, Corfield, Davies, & Richardson, 2009). Robust networks of providers who actively

and authentically collaborate on behalf of individuals and families “reinforces the notion that advancing health equity requires intentionally creating a bridge between clinical and community settings” (Corbie-Smith, Hoover, & Dave, 2019). Service coordination, regardless of the determinant, population, or community, improves outcomes for all (Ervin, 2004; Malone & Crowston, 1994). Several studies have found that individuals who had positive experiences with effective coordination were more likely to participate in services, and to perceive that their outcomes had improved over time (Ervin, 2004; Seldon, Sowa, & Sandfort, 2006).

When addressing social determinants of health, the need for strong collaboration between health, public health systems, and community-based organizations is clear (Gundacker, Stadter, Burghardt, & Willis, 2020; Henize, Beck, Klein, Adams, & Kahn, 2015). Community-based providers are often stabilizers for individuals and families. They can help individuals navigate and better access economic, education, social, and neighborhood services and supports for prevention and intervention during crises. For example, during COVID-19, food banks, safe transportation, shelter for those without homes, and emergency childcare for essential workers became lifelines for health, well-being, and employment (Bedrick & Daily, 2020; Dickinson, 2020; Tirachini & Oats, 2020). Communities that have a clear framework for adaptive collaboration across sectors can coordinate referrals and services in mutually-reinforcing ways (Harms & Severin, 2021). It is critical for an adaptive collaboration approach to acknowledge and navigate the practical differences across sectors. Those factors include diverse service perspectives, missions, and culture, fiscal administration and reimbursements, workflow and referral practices, service provision and eligibility, and contractual and personal relationships. A community can leverage a shared vision, compromise, transparency, common language, and a shared tool to bridge the divides across sector partners when competing priorities, funding, and

business models can derail network cooperation (Severin & Chrans, 2021). With the increasing proliferation of resource and referral platforms, tools, and interoperability demands, it is even more critical for sectors to cooperate on decision-making and collaborate throughout the adaptive implementation process (Cartier, Fichtenberg, & Gottlieb, 2019).

Development and Growth a Cross-Sector Referral Network

Resource navigation or care coordination models in public health and other sectors have shown promise in helping individuals and families access care and services (Chen, Hisako, DuGoff, Novak, & Wang, 2020; Moore, 2019). Family resource centers and coordinated intake systems also focus on engaging with and connecting individuals and families to prevention, crisis, and intervention services among an array of partners in a community (Waddell, Shannon, & Durr, 2016). These models are successful when navigators understand the needs of individuals and families in their community, build relationships with partners providing services, walk individuals through their options, and provide a ‘warm’ handoff of that individual to the waiting service provider.

It is with this foundation that a multi-county region in Southeast Kansas began building a more robust and purposeful cross-sector referral network. Using an adaptive collaboration framework and a shared referral tool (Harms & Severin, 2021), five community-based organizations engaged in an eleven-month pilot period in 2017 to redesign how they coordinated services. These partners assessed their readiness for change, created a shared vision with local community champions, and developed standardized protocols for communication and coordination. Those protocols included how the network would align their referral processes collectively and modify their own organizational workflows to support the referral standards of

the community. Once in place, the community launched their shared referral tool, Integrated Referral and Intake System (IRIS), to streamline and standardize referral practice (IRIS, 2021).

IRIS is a web-based application that contains features such as a customizable shared referral form, in-application chat function, email notifications, individual referral status tracking, capacity bar to indicate ability to accept clients, and the ability to select a referral partner based on community-created service tags associated with each participating organization. Referrals are bi-directional in real time: The system provides feedback to and from the sending organization the moment it occurs via email notifications. The first point of bi-directional feedback occurs when the referral is ‘rejected’ or ‘accepted’. Rejected referrals get sent back with reasons for rejection and inspire a different course of action by the sender. Accepted referrals are contacted by the receiver and the ultimate outcome is communicated. That information is the second point of bi-directional feedback: Completed referrals indicate whether the individual ‘enrolled in services’, ‘declined’, or were ‘unable to contact’. This fully closes the feedback loop among partners. After the pilot period, the community established goals of engaging more referral partners in the network over a three-year period. Through active outreach, facilitated meetings, workflow and decision-making sessions, governance and consent protocols, and staffing alignment, the initial network sought to expand the breadth of collaboration partners across other sectors. Administrative data in IRIS serves to monitor and evaluate network development, cooperation, and effectiveness.

Methods

We evaluated cross-sector network development and service coordination with a longitudinal outcome evaluation over the course of forty-seven months (2/2017 – 12/2020). The design utilized four timepoints (*Time 1* = 2/2017 to 12/2017; *Time 2* = 1/2018 to 12/2018; *Time 3*

= 1/2019 to 12/2019; *Time 4* = 1/2020 to 12/2020) to measure network development, cooperation, and effectiveness over time. We employed a quasi-experimental design to compare network effectiveness to a sample of three other referral networks in the state implementing the same adaptive framework for at least three years during the study period (*Time 2, Time 3, Time 4*). The primary research question was whether a cross-sector network coalesced to use a shared tool and cooperative practices to coordinate referrals and services community-wide. A secondary research question was whether this network was effective and efficient in their referral and service coordination practices. A tertiary research question emerged on whether COVID-19 may have had on referrals and client engagement into services.

COVID-19 Effects on Services. Using the longitudinal design, we were able to examine if changes occurred in network cooperation or effectiveness during the pandemic. With three years of pre-COVID-19 data, the interim-COVID-19 period (1/2020 – 12/2020) offers a robust comparison of the disruption in the network service array during this time.

Community Characteristics

Five rural designated counties in southeast Kansas became a multi-county referral ‘community’ because many service catchment areas overlapped and families travel between them with relative ease. This community is home to 96,715 residents (3.3% of the state population) spread between miles of farms, schools, meat packing, and light industry. Individuals and families living in these counties (Montgomery, Labette, Cherokee, Wilson, and Neosho) have median household incomes below the state average (\$55,477) and experience more negative health outcomes (i.e. mortality 904.16 per 100,000) compared to the state (762.5 per 100,000) (Kansas Health Matters, 2019; Robert Wood Johnson Foundation, 2019). Data in Table 1 on social health factors (i.e., healthy behaviors, access to care, suboptimal environmental

factors) show these counties falling behind the state. The comparison group sample included three other network communities: one urban (population = 165,429); two rural designated county communities (population = 31,670; population =122,998).

Network Characteristics

The unit of analysis for network development was individual providers or programs using IRIS, the shared referral tool. Providers were categorized by sector: *Behavioral Health* (mental health and substance use treatment providers); *Concrete Support* (financial assistance, job training, housing, law enforcement, food assistance); *Developmental Disabilities* (intervention and programs for adults and children with disabilities); *Early Childhood Birth to Five* (home visitation, pre-school, early intervention, maternal/child health services, Women and Infants and Children/WIC); *Family & Education Supports* (prenatal/parent education, fatherhood programs, case management; K-12 public school/afterschool); *Healthcare* (hospitals, physician practices, federally qualified health centers); *Public Health* (family planning, immunizations, health behavior education); and *Resource Navigation* (care coordinators, family engagement).

Measures and Analyses

Network Development. We examined the network over time from a developmental standpoint and used multiple measures for each stage: *incubation*, *growth*, and *maturity*. From administrative IRIS profile data, we used descriptive data on the number and type of providers actively sending and receiving referrals as a measure of *network incubation*. We examined change over time from initial size and makeup of the provider network after a shared referral tool was first launched to its ever-evolving state. To measure *network growth*, we used administrative IRIS referral data associated with every partner in the network to map the relationships among them over time. Using KUMU relationship mapping software (KUMU Inc., 2021), we examined

changes in mutually reinforcing activities (i.e., referrals) between partners or “nodes” in the network. This allowed us to see if there was reciprocity in referrals between sectors, if there were clusters providers referring exclusively among themselves, or if there were stranded nodes outside of the larger network. *Network maturity* was measured by using social network analysis (SNA) metrics derived from the KUMU-generated Social Network Analysis of the connections between the nodes. We used the following metrics: 1) *betweenness centrality* to measure of how often an individual partner lies on the shortest path between two other organizations, 2) *eigenvector centrality* to measure how well individual partners in the network are connected to other well-connected providers, and 3) *reach efficiency* to measure a normalized portion of the network within two-steps of an individual partner (Hanneman & Riddle, 2005; Prell, 2012). Taken together, these measures serve to assess network functioning and efficiency among a diverse set of partners (Bright, Haynes, Patterson, & Pisu, 2017). We analyzed change over time in these metrics at the partner and network level at Times 3 and 4 based on unit of analysis sample size.

Network Cooperation. We used administrative IRIS referral data combined with profile data to measure cooperation as the adoption and utilization of a community-wide referral process among network providers. We examined patterns of referrals over time to see if all sectors were involved in sending and receiving referrals, if there were differences in sector involvement, and if volume of referrals increased or decreased by sector.

Network Effectiveness. We created two community-level measures of network effectiveness. Using administrative IRIS referral data, we calculated a *quality referral percentage* comprised of the number of referrals sent that resulted in an individual actively enrolling in services divided by the total number of referrals sent during each time point. We also created a

population reach percentage for the network derived from the number of unique individuals referred within the network as a percentage of the community population. We analyzed group differences on these measures between the study network and a comparison sample of three other networks during an equivalent 36-month period within a quasi-experimental design.

Results

Network Development Over Time

Network incubation. During the 47-month study period, the number of cross-sector partners actively sending and receiving referrals in IRIS increased over time except for a small drop during Time 4 (Time 1: $N=11$; Time 2: $N=25$; Time 3 $N=51$; Time 4 $N=45$). An additional rural county (Crawford) joined the community referral network and increased the population served in the entire catchment area by 29% to 135,533. The breadth of network sectors grew from an early focus on resource navigation and early childhood partners in Time 1 to include a larger cross-sector network of providers in public health, family support, healthcare, concrete supports, developmental disabilities, and behavioral health by Time 4.

Network growth. Results from the SNA using KUMU network mapping software are displayed in Figure 1. Each node in the network map represents a discrete partner or program in IRIS providing a distinct service. Larger nodes indicate quantitatively more referrals received and made by that partner. Arrows represent the directionality of referrals between partners. Over time, each partner was connected to at least one other through uni-or bi-directional referrals and many had multiple connections to other providers. A cluster of partners operated separately from the larger network at Time 2. By Time 3, the network was fully integrated with each node connected to at least one other. Most partners were both sending and receiving referrals within the larger network of coordinated referrals and services. The number of distinct connections in

the network increased from 18 (Time 1) to 155 (T3) but there was decrease in activity among all network partners at Time 4.

Network maturity. The mean *betweenness centrality* of all partners in the network decreased from Time 3 ($M = 2.2\%$, Range = 0% to 16.5%), to Time 4 ($M = 1.0\%$; Range = 0% to 11.1%). This means that, on average, all partners within the network have found the shortest path to each other and established more direct 1-to-1 connections over time. The mean *eigenvector centrality* metrics remained nearly the same from Time 3 ($M = 0.02$; Range = 0.0 to 0.09) to Time 4 ($M = 0.02$; Range = 0.0 to 0.12) suggesting that the network is not relying heavily on nodes being closest to the most well-connected partners to collaborate. The mean *reach efficiency* metrics increased from Time 3 ($M = 2.8\%$; Range = 0.2% to 10.5%) to Time 4 ($M = 3.3\%$; Range = 0.2% to 11.1%), showing that the portion of partners in the network within two-steps of any other partner improved slightly from Time 3 to Time 4.

Network Cooperation

The number of network referrals made increased over time (Time 1: $N=538$; Time 2: $N=558$; Time 3: $N=1,139$) but decreased in Time 4 ($N=836$). Overall, the network made a total of 3,088 referrals on behalf of 2,134 individuals by the end of Time 4. Table 2 presents data on the number of referrals sent and received by time period. It also presents the sector representation of providers sending and receiving those referrals. The pattern of referral sources and recipients shifted over time as new sector providers actively engaged in the referral process, particularly at Time 3 when network expansion efforts intensified. By Times 3 and 4, the healthcare and public health sectors represented half of all referrals sent or received. Early childhood, family support, behavioral health, and developmental disability providers received more referrals than they sent

at all time periods. Health care, public health, and resource navigation providers sent more referrals than they received.

Network Effectiveness

Quality referral percentage. The percentage of quality referrals that resulted in service enrollment increased over time (Time 1= 33.1% (178/538); Time 2 = 37.5% (209/558); Time 3 = 37.5% (427/1139); Time 4 = 41.3% (345/836). We calculated a chi-square test for differences over time. The omnibus test comparing all time periods together was not significant $\chi^2(3, 2319) = 2.93, p = .4$. We also calculated a chi-square test to test the difference between Time 1 and Time 4 and found there was a marginally significant increase in referrals converting into service enrollment ($\chi^2(1, 1045) = 2.87, p = .09$). During a 36-month period (Time 2 to Time 4), the study network had an average *quality referral percentage* of 38.8% (981/2533) while the comparison sample had an average of 47.1% (2732/5792; range = 23.2% to 61.3%) and this was significantly different ($z = -7.13, p < .0002$).

Population reach indicator. At the end of Time 4, the network had a 1.5% *population reach indicator* of individuals referred by the network relative to the expanded six-county catchment population ($N= 2134$ individuals referred / community population =135,533). During a 36-month period (Time 2 to Time 4), the study network reached 1.4% (1923/135,533) of the catchment population compared to an average 1.3% (3863/295,714) reached by the comparison sample networks. This difference was not significant. The comparison network sample reach ranged between .8% and 3.5% by the end of the 36-month period.

COVID-19 Effects on Services

Data from Time 3 (pre-COVID-19) and Time 4 (interim-COVID-19) offer a glimpse of the quantitative and qualitative effects on the network as the pandemic occurred. Slightly fewer

network providers were actively engaged in sending and receiving referrals in IRIS to other providers (Time 3 $N=51$; Time 4 $N= 45$). As a result, the SNA map and statistics at Time 4 shows a disruption in the size, shape, and density of network connections compared to Time 3. Referral patterns shown in Table 2 also changed from Time 3 to Time 4: Referrals received by healthcare providers increased by 207%; referrals to public health providers increased 57% while referrals to early childhood services decreased by 48% during the interim-COVID-19 time period. Total number of referrals decreased by 17% from Time 3 ($N=1139$) to Time 4 ($N=836$). However, the *quality referral percentage* was at its highest during Time 4 (41.3%).

Discussion

To address our first research question, results showed that this cross-sector network evolved and changed over time in network development, cooperation, and effectiveness. Initial community-based providers pilot tested an adaptive collaboration framework, shared referral protocols, and a common referral tool to establish and then expand their network of service providers. This expansion resulted in over eight different service sectors represented in the network across six counties. These partners were all actively participating in coordinating referrals and services among each other. Over time, as the cross-sector network grew, so too did the interconnection (e.g., uni/bi-directionality of referrals) between providers as they strengthened the holistic social support, social services, public health, and healthcare systems of care. This growth occurred despite the wider scope of services and diverse populations served by the network sectors (Graddy & Chen, 2006). The network was finding the most efficient and shortest path for connecting individuals to the right service provider. Referrals steadily increased over time until 2020, when disruptions in the network and referral patterns changed. Trend data

over time in the pattern of cross-sector referrals demonstrated which sectors were more likely to ‘send’ vs ‘receive’ and can serve as a tool to monitor emerging needs or capacity strains.

To address our second research question, results showed increases in the effectiveness and efficiency in the network over time. Quality referrals increased (though non-significantly) as providers used IRIS to communicate and coordinate throughout the referral process and individuals enrolled in services. Even as there was a decline in the number of referrals and individuals being referred in Time 4, the conversion rate of those referrals into service enrollment increased. More than a third of sent referrals resulted in service enrollment. Findings from the social network analysis suggest that the influence of individual partners acting as bridges or intermediators was less important over time. Individual providers began directly partnering with each other in a 1-to-1 network. These findings suggest the cross-sector network became more integrated, collaborative, and efficient overall and less reliant on the influence of individual providers to broker relationships and connections to services.

Results did not occur overnight; cross-sector coordination takes time and intentional expansion across sectors requires active and persistent relationship building (Cartier, Fichtenberg, & Gottlieb, 2019; Severin & Charns, 2021). Providers in Southeast Kansas were committed to following an adaptive collaboration framework developed to support the success of a shared referral tool, IRIS (Harms & Severin, 2021). This phased approach included core components and activities designed to build, nurture, investigate, and refine coordination practices, communication protocols, and referral tool utilization. Cross-sector providers had to compromise on shared protocols and practices and this, in turn, helped individuals ‘co-navigate’ the larger ecosystem of services. The result was that more referred individuals successfully enrolled in services over time. We were able to longitudinally measure how this network

developed, cooperated across sectors and differences in workflows, and became an efficient and integrated network of providers. This evaluation establishes additional evidence and effectiveness measures for the kind of community-level collaborative approaches required to address social determinants of health (Henize, Beck, Klein, Adams, & Kahn, 2015; Gundacker, Stadter, Burghardt, & Willis, 2020).

Effects of COVID-19 on Service Coordination

There was a clear pattern of disruption to referrals and services during the interim-COVID-19 time period. COVID-19 effectively halted many in-person social services in March 2020 in Kansas, across the country, and the world. Schools, businesses, child care, public and social services were closed for weeks, months or indefinitely during this time. Health care and public health providers received exponentially more referrals in this network than before which was unsurprising given the public health crisis unfolding. At a time when economic and social pressures were at their height, however, the story was different for critical supports and services for children and families. Referrals for early childhood services, developmental disabilities, concrete support, and family supports decreased between 20% and 48%, often reflecting closures, reduced workforce, funding reductions or revenue declines, and safety net practices such as routine screenings, assessments, and interventions. Despite this, the cross-sector network that had been built and nurtured before COVID-19 continued to operate efficiently and effectively in how they coordinated referrals and services. More referrals resulted in individuals enrolling in services interim- COVID-19. This may be due in part to reduced availability of options and/or a more mature referral network with improved warm handoff and engagement practices. Regardless, a committed cross-sector network during a time of crisis can

mobilize quickly when there are well-practiced, standardized process to connect individuals and families to needed services.

Community-Based Monitoring and Social Determinants of Health

There is no doubt that effective collaboration and coordination of services across sectors is a key strategy in addressing social determinants of health. Once an individual's needs are assessed, whether that occurs at a medical clinic or a food pantry, there must be a robust community-wide mechanism to guide that individual to the pathways that can support their health and well-being. In many communities, the most complex barrier to this is the difficulty of sharing information between sectors. Even more difficult is the ability of a community to assess whether or not they are making progress in effectively and equitably addressing needs across a range of services and supports. This is why transparent cross-sector data and accountability structures are critical to creating collaborative systems of care and services. Partners who have actionable data about their coordination workflows and network effectiveness can better to identify gaps, pressure points, and sector disconnects.

This study identified two effectiveness indicators for cross-sector collaborations. The *quality referral percentage* acts as a community-level metric of network effectiveness, it quantifies at a macro-level whether more individuals who were referred to services actually engaged in those services rather than declining or being unable to be contacted. It is difficult to move to needle on this indicator over time without intentional cooperation and reliable data. The right data allows network partners to monitor different points of intervention where failures occur in the referral process or successes can be scaled. When this indicator improves over time, it may mean that the network as a whole is getting better at making the right referrals to the right partner to match an individual's need and choice. This could be a factor in increasing the

probability that an individual will engage in services. For some sectors, such as healthcare, a ‘quality referral’ as measured here is a criterion for fiscal reimbursement. This active network used administrative data from IRIS regularly to investigate and actively change practices or procedures within or between providers. This is a reflection of a healthy cross-sector ecosystem that is needed to drive community-level health and well-being outcomes.

Additionally, the *population reach percentage* can be used as a way of assessing whether a community and their network partners are reaching more individuals relative to population need (e.g., rates of birth, poverty, unemployment, food insecurity, diabetes). With referral and service data shared across sectors, partners are able to identify community-level needs based on referral patterns and mapping of cross-sector coordination. A larger coordinated network of providers is also able to increase the number of individuals assessed for needs, refer more individuals to more services, and ultimately increase the reach by populations served. Communities choosing to collect and monitor demographic data of their shared referral process (in IRIS or elsewhere) can then embed data-driven decision making into the service coordination and collaboration process. This helps identify inequitable access by marginalized communities or underfunded services and supports. It will be important for cross-sector networks to standardize measures of effectiveness and track them longitudinally to improve systems-level functioning and ultimately, desired health and well-being outcomes.

Limitations and Future Considerations

This study contributed to our understanding of how cross-sector networks develop over time and how they function. However, we were unable to obtain any pre-study data on referrals and service engagements across partners given the organic nature of how the network developed and the lack of reliable, historical data from every partner involved. Therefore, an outcome

evaluation design with longitudinal time series analyses of reliable IRIS administrative data from every provider in the network was the best available methodology. Caution is warranted in extrapolating the results of this study to other network samples or drawing causal conclusions regarding the mechanisms driving the outcomes. An additional limitation is the time-dependency of some of the measure, though the developmental process of network incubation, growth, and maturity is itself time-dependent. For example, the *population reach indicator* can vary in interpretation based on time. It could reflect more individuals receiving referrals, a longer window to refer more people, greater outreach by existing partners, or changes in population and provider catchment geography. However, the *quality referral percentage* is not impacted by time and serves as a robust measure of the success of a collaboratively agreed upon referral process and service engagement. The inclusion of a quasi-experimental design to test the difference between the study network and three other referral networks provided a relative comparison on these measures. The variability in development, implementation, and collaboration across every cross-sector network makes it difficult to ensure equivalencies in groups. Therefore, differences in these measures should be viewed within that context.

In Kansas and in other states, there have been concerted efforts to align systems in public health, early childhood, family supports, behavioral health, and social services. Models of care coordination and resource navigation are designed to improve access to needed services and in turn, health and well-being. Data from other communities using IRIS provides opportunities to further investigate network development, refine and validate measurements, establish benchmarks, and draw broader conclusions about cross-sector collaboration networks. Each network is unique and the successes and challenges faced vary. However, the ultimate goal of successfully connecting and engaging individuals and families in the services they need and

desire remains the same. The adaptive collaboration process that each community engaged in holds clues into which aspects of implementation are most critical for driving an effective network.^{17,22} Addressing social determinants of health is more than simply adopting technology to solve the problem. Partners and providers in a community must share a coherent vision and compromise more on functional, fiscal, and cultural differences in how the ‘business’ of well-being is done. When that happens, communities have the foundation upon which to respond efficiently and effectively to the needs of its members, especially during crises.

Submitted Version

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Table 1. Description of Health Outcomes and Characteristics of Southeast Kansas IRIS Community.

Domain	Social Determinants of Health	Indicator	Cherokee County	Labette County	Montgomery County	Neosho County	Wilson County	State
Population	Economic Stability	Total population ¹	20015	19964	32120	15951	8665	2.912 (million)
Socioeconomic Status	Economic Stability	Poverty (%) ¹	15.8	15.3	16.8	15.5	15.3	11.9
		Unemployment (%) ²	3.9	4.5	5.2	5.2	4.7	3.6
	Education	High School Dropout (%) ¹	4.7	2.1	6.4	1.3	9.0	4.2
Adverse Perinatal Outcomes	Health and Health Care	Low Birth Weight (%) ³	8.1	8.2	6.9	7.1	6.7	7.0
		Teen birth of unmarried women (rate per 1000) ⁴	17.3	20.3	17.4	12.6	19.6	11.9
		Inadequate prenatal care (%) ⁴	15.6	20.0	16.6	14.9	15.8	11.1
Insurance	Health and Health Care	Adults with health insurance (%) ⁵	89.4	89.5	87.4	90.8	90.1	89.9
Diabetes	Health and Health Care	Adults with Diabetes (%) ⁵	14.4	12.5	11.5	16.1	n/a	10.5
Child Maltreatment	Neighborhood and Built Environment	Child Maltreatment (rate per 1,000) ³	6.0	5.5	11.8	10.2	13.1	3.3
Substance Use Disorder	Social and Community Context	Alcohol Use (prevalence rate) ⁶	5.9	5.9	5.9	5.9	5.9	5.6
		Smoking Use (%) ⁵	30.6	23.7	28.0	35.9	n/a	17.4

Note. County level data obtained from the following sources as designated by superscripts.

¹United States Census Bureau. *Community Facts. American Fact Finder*. Retrieved from <https://factfinder.census.gov>.

² United States Department of Labor Bureau of Labor Statistics. *Local Area Unemployment Statistics*. Retrieved from <https://www.bls.gov/lau/#cntyaa>.

³ Health Resources and Service Administration. *OMB No: 0906-0038*; 2019.

⁴ Kansas Department of Health and Environment. *Kansas Annual Summary of Vital Statistics*. Retrieved from http://www.kdheks.gov/phi/as/2018/2018_Annual_Summary.pdf.

⁵ Kansas Health Matters. *Community Health Dashboard. Kansas Health Matters*. Retrieved from <http://www.kansashealthmatters.org/>

⁶ Substance Abuse and Mental Health Services Administration. *National Survey on Drug Use and Health*. Retrieved from <http://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health>.

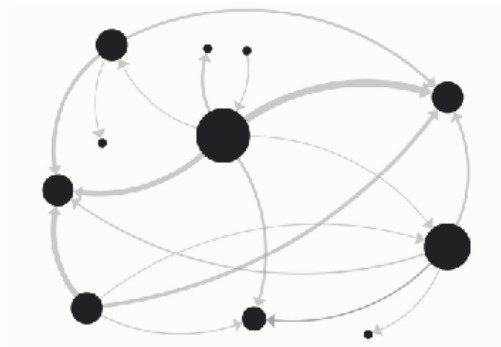
Submitted Version

Table 2. Coordinated Referrals by Sector Over Time.

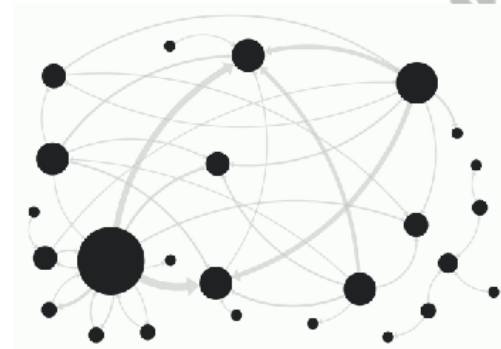
Sector Representation	Time 1 (2/1/17 - 12/31/17)			Time 2 (1/1/18 - 12/31/18)			Time 3 (1/1/19 - 12/31/19)			Time 4 (1/1/20 – 12/31/20)		
	% of Total Orgs	Sent	Received	% of Total Orgs	Sent	Received	% of Total Orgs	Sent	Received	% of Total Orgs	Sent	Received
Behavioral Health	0%	-	-	7%	1	1	6%	1	12	7%	1	12
Concrete Supports	0%	-	-	7%	1	2	10%	52	41	7%	3	32
Developmental Disabilities	9%	-	2	4%	0	26	4%	3	60	7%	9	31
Early Childhood	36%	-	529	19%	4	484	14%	17	701	15%	13	363
Family Support	0%	-	-	7%	5	10	6%	10	36	9%	8	21
Healthcare	0%	-	-	0%	-	-	12%	58	13	9%	70	40
Public Health	18%	3	1	41%	23	13	41%	274	159	38%	354	250
Resource Navigation	36%	535	6	15%	524	22	8%	724	117	9%	378	87
Total	100%	538		100%	558		100%	1139		100%	836	

Note. Orgs = Organizations. Sent = Referrals sent to other organizations during each time period. Received = Referrals received from other organizations during each time period.

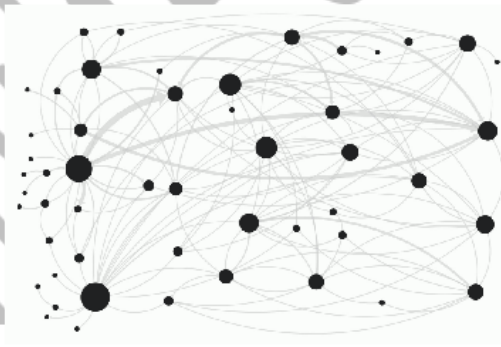
Figure 1. Social Network Maps of Referral Connections By Time Period



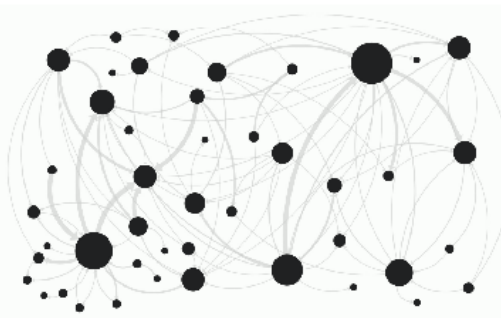
Time Period 1 | 11 Organizations | 18 Connections



Time Period 2 | 25 Organizations | 42 Connections



Time Period 3 | 51 Organizations | 155 Connections



Time Period 4 | 45 Organizations | 110 Connections