Using Social Network Analysis to Explore Issues of Latency, Connectivity, Interoperability & Sustainability in Community Disaster Response

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ABSTRACT

Community-based disaster response is gaining attention in the United States because of major problems with domestic disaster recovery over the last decade. A social network analysis approach is used to illustrate how community-academic partnerships offer one way to leverage information about existing, mediated relationships with the community through trusted actors. These partnerships offer a platform that can be used to provide entré into communities that are often closed to outsiders, while also allowing greater access to community embedded physical assets and human resources, thus facilitated more culturally appropriate crisis response. Using existing, publically available information about funded community-academic partnerships in Wisconsin, USA, we show how social network analysis of these meta-organizations may provide critical information about both community vulnerabilities in disaster and assist in rapidly identifying these community resources in the aftermath of a crisis event that may provide utility for boundary spanning crisis information systems.

Keywords

Community Engagement, Social Network Analysis, Boundary Spanning, Data Fusion

INTRODUCTION

Increasing attention to community disaster planning and response strategies have emerged in the wake of several less than effectual domestic recovery efforts in the US over the last decade (Ahmed, et al, 2012). Community level response has long been part of the equation, with community agencies that were tasked with and specifically trained to respond (e.g. the Red Cross). However, events like Hurricane Katrina and more recently Hurricane Sandy illuminated a number of critical weaknesses with this approach (Geytanchi, et al, 2005). As a result the Department of Homeland Security, FEMA and other domestic US response groups placed greater focus on a "Whole of Community" approach, hoping to more effectively identify, coordinate and integrate existing community based organizations (CBOs) that provide direct services at the grass roots level and involving local businesses and governments to a much greater degree (Ahmed, et al, 2012; FEMA, 2011).

While this level of community engagement is typically not leveraged nor utilized by local emergency management agencies and is indeed relatively novel in the disaster response community, a number of models for "deep engagement" exist in other domains that may be useful, including Community Engagement in Research (CEnR) which has a rich literature that has evolved over several decades (Ahmed & Palermo, 2010). CEnR encourages community-academic partnerships to tackle complex societal problems, and these partnerships themselves and interrelationships between partnering organizations represent some specific types of response capabilities. Articulating the relationships among universities and CBOs for specific health outcomes (e.g.

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community primary care, homelessness/food access, special populations research, etc.) may provide unique insights in to regional response capabilities that capitalize on these networks which can field specific local resources as part of a recovery effort. These type of partnerships also encourage diverse input that informs creative and innovative pre-event planning to develop solutions to challenges in improving community resiliency as an outcome of more effective response and recovery activities (PPD-8).

The Healthier Wisconsin Partnership Program (HWPP) has funded approximately 140 such community-academic partnerships over the last decade that represents an investment in research as well as evidenced-based practices that improve community health. This program serves as an ideal platform for us to examine the inter-relationships between these partnerships using Social Network Analysis (SNA) and exploring ways in which latent networks of CBOs might be activated prior to as well as in the aftermath of a major disaster in our state. However, a number of rate limiting factors to this approach exist, including, 1) issues of latency: i.e. how to manage shifting priorities, interests, and personnel within these partnerships given the fact that disasters requiring major resource deployment and advanced capabilities are infrequent, 2) issues of connectivity: i.e. how to rapidly and effectively formalize these loosely coupled relationships to community during a crisis, and 3) issues of interoperability: i.e. how to improve both technical and soft interoperability between local CBOs and regional, state or federal response agencies 4) issues of sustainability; how to identify and evaluate life cycle of CBO during recovery operations (when and how to support or stand-down).

LATENCY

Because catastrophic disasters requiring a significant surge in capacity and capabilities over an extended duration are infrequent and CBOs are often caught up in managing day-to-day operational concerns, the ability of such organizations to plan for disasters is often relatively low. However, CBOs also offer key infrastructure such as member networks and informal leadership at the community level, as well as services and service providers that are culturally nuanced. One of the key problems facing federal, state and regional response organizations is how to interface with communities more effectively as well as rapidly in the event of a disaster in ways that leverage these resources in a respectful way. While periodic meetings, exercises and table-tops with community representation make some in-roads into creating this deeper response network, a number of structural issues exist which have created perpetual latency problems in engaging these groups in response. These issues include insufficient participation by a diverse group of CBOs in core emergency operations planning by local government, the turnover of trained personnel with contacts to the emergency management community, lack of centralized planning to prepare the CBO for such an event, and issues with business continuity of the CBO's services in the event of a major disaster – to name just a few.

Our goal is to search for potential practical solutions to these problems, which are designed to improve *latency* considerations in two ways. In the first instance, we are attempting to address latency in the sense of *reduced time to integration and merger* of emergency response agencies and CBOs for tasks that could improve disaster overall management performance (Franco, et al. 2008) for a variety of impacted communities (e.g. minorities groups, special populations, and others who may be at particular risk in these events; Geytanchi, et al. 2007). In the second sense, we are also trying to create frameworks for better identification and inventory of *latent community assets* which may have survived the acute disaster and could be used either directly by the community at large or integrated into wider-scale disaster response and recovery efforts if response agencies had awareness of these resources as well as ability for CBO mobilization and sustainment.

BOUNDARY SPANNING CONNECTIONS TO COMMUNITY

Weick's (1976) views on tight and loosely coupled systems have provided much of the theoretical framework for understanding organizational behavior in the context of crisis. Both tightly and loosely coupled systems offer specific advantages and drawbacks in terms of creating the conditions necessary for natural accidents to occur, as well in responding to catastrophic events. Historically, community-academic partnerships have been viewed as loosely coupled systems, with faculty and community partners functioning in largely autonomous roles, responding to very different organizational rules and constraints and collaborating to form meta-organizations that are typified by their virtual, transient, and boundary spanning characteristics. In this sense, the faculty and community partners function as information and cultural brokers across this loosely coupled organizational architecture and arbitrate the types transactions that occur within this liminal space (Sandy, 2005). The issue, however, remains how to move from this loosely coupled system to a tightly coupled one (i.e. the goal of seamless integration into an existing Incident Command System structure for the disaster event), without creating additional problems that often result when differently coupled systems interact (Snook, 2011).

Our efforts the transdisciplinary space occupied by Community Engagement and crisis response studies center

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around the notion that leveraging existing community/academic partnerships that do not necessarily have any prior focus on disaster preparedness provides one avenue of addressing the needs of at risk communities more immediately and in culturally appropriate ways, while also providing a specific point of entry that emergency responders can use to identify critical community level assets. Because of their boundary spanning nature, and the specific meta-organizational competencies embodied in the individual members comprising these organizations, these partnerships are particularly well positioned to broker access to what would normally be private communication channels within the community, allowing for emergency access to these networks, and can provide community level assets (e.g. large industrial kitchens, emergency housing facilities, the ability to send trusted representatives door-to-door, and so on).

Further, it seems that the automation of identification of these networks, and information systems that assist communities and professional responders to leverage this information should be achievable. Tools to support disaster management such as information systems often focus on information management types of tasks. Given that disaster management spans multiple facets of a community play there is a need to better understand how to design ISs to support coordinative activities (Janssen M, Lee J, Bharosa N, & Cresswell, 2010). In that sense ISs to support disaster management need be able to identify and negotiate boundary spanning objects in the problem space – integrating informational, social and governance aspects of diverse communities. Designing boundary objects is challenging as they must be flexible enough to adapt to diverse community needs yet rigid enough to provide common structure across settings (Star & Griesemer, 1989). However understanding the integration and interoperability needs of communities to develop boundary tools is challenging.

METHOD

Using an organizational SNA approach, publically available administrative data from 128 community academic partnership projects funded by HWPP were normalized to describe the inter-relationships between community organizations involved in specific, public health related projects. For example, a CBO serving a minority community, the Public Health Department at the City of Milwaukee, and a faculty member at the Medical College of Wisconsin might all be involved in addressing chronic illness within the African American community. In this preliminary analysis, the relationships between non-academic portions of these community partnerships were entered into UCINet, an SNA analytical tool. This whole network approach is depicted in Figure 1, with the nodes (colored circles) representing *specific projects*, while the lines (edges) can be thought of as the community partners, creating connections between each of these different projects. Notably, the city of Milwaukee is one of the most segregated cities by race and poverty status in the US – making the issues associated with competent community response and resilience particularly salient.
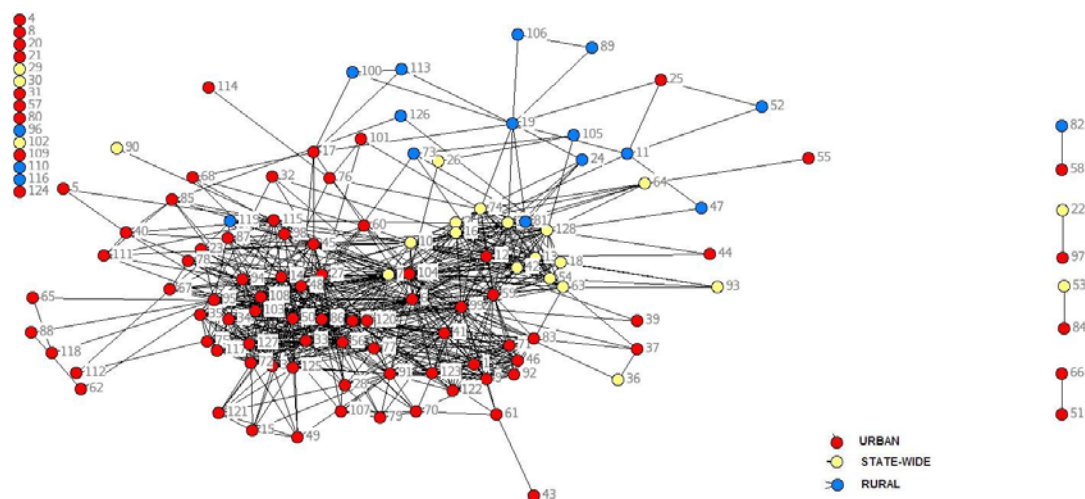

Figure 1. Social Network Analysis of HWPP Funded Community-Academic Partnerships in Wisconsin, USA

We also explored these data by health risk area addressed by each community partnership project. While a number of risk areas were visualized, we present only one here as an exemplar of the types of interconnections that can identified through this process. Figure 2 shows seven community partnerships projects focused on

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chronic illness issues. While imperfect, this information suggests that we may be able to identify projects and communities particularly vulnerable to further isolation in the aftermath of a disaster and to connect them to other community resources with broader connections. For example, many of the projects conducted around specific health risk areas in these communities may not have direct connections to each other, but are secondarily connected through a small cadre of community engagement faculty at a handful of universities. Thus the *community-academic partnerships themselves* represent a potentially robust, resilient connection. Further work in this area may be able to identify critical nodes within social network analysis that have implications for the integrity of the network within the context of specific disaster scenarios (e.g. healthcare provider surveillance, notification and surge capacity during early phase of novel communicable disease spread) that can be potentially reinforced or back-up / fail-over partnerships.
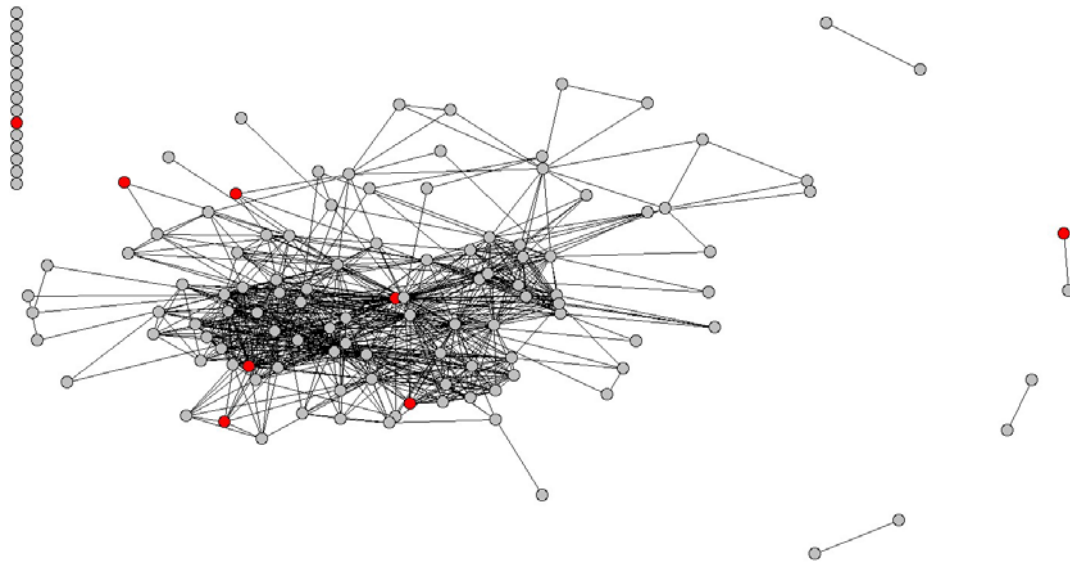

Figure 2. Community academic partnerships focused on chronic illness (e.g. diabetes, etc.)

TOWARD COMMUNITY INTEROPERABILITY

While part of our focus is on how these structures can assist federal, state and regional crisis response agencies to gain mediated entré into these communities, findings from a number of studies in community engaged disaster response point to the striking ability of communities to help themselves and potentially to offer a broader set of solutions for society as a whole (O'Sullivan, et al., 2012). CBOs in particular have a wide range of physical assets, structures, and human resources (often highly-trained, multi-lingual, culturally competent, and who posses existing interpersonal relationships with hard-to-reach populations) with unique response capabilities. One of the challenges to improving disaster response is to combine the types of network level awareness of mediated, boundary spanning access points offered through community-academic partnerships *with* detailed descriptions of types of response capabilities the CBOs have in place individually and in combination. Assuming those two types of information can be meaningfully merged (e.g. in Intelligence Fusion Centers), this data may be then integrated into existing situational awareness software platforms.

COnclusion

U.S. federal emergency management agencies and presidential directives have adopted outcomes for community preparedness that increasingly focus on rapid recovery and resilience (FEMA National Recovery Framework September, 2011). CBOs can be an essential partner in assisting community recovery after catastrophic events including meeting longer-term shelter, food and spiritual needs of a population. The community membership, informal networks and cultural attenuation inherent to CBOs represents a valuable asset to government agencies and one that can be potentially leveraged to improve overall resiliency. However, creating systems that both identify and meaningfully describe these resources continues to limit leveraging CBO capacity and capabilities for crisis response. In addition, more thoroughly understanding CBO sustainability during large disasters including the expansion and contraction mechanisms needs to occur. Rapid recovery and resilience from mega-disasters remains a very complex task and will require strategic attention to CBOs and other non-traditional first responders in close partnerships as previously described and yet to be fully realized.

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REFERENCES

1. Ahmed, S., Nelson, D. A., Biedrzycki, P. A., Sandy, M. G., Opel, S., & Franco, Z. Community Engagement for Translational Disaster Research: Fostering Public, Private & Responder Group Partnerships. *Proceedings of the 9th International ISCRAM Conference* – Vancouver, Canada, April 2012. L. Rothkrantz, J. Ristvej and Z. Franco, eds.

2. Ahmed, S. M., and Palermo, A. G. (2010). Community engagement in research: frameworks for education and peer review. *Am J Public Health* 100(8)**,** 1380-7.

3. Franco, Z. E., Zumel, N., Holman, J., Blau, K., & Beutler, L.E. (2009). Evaluating the impact of improvisation on the Incident Command System: A modified single case study using the DDD simulator. In J. Landgren & S. Jul (Eds.) *Proceedings of the 6th International ISCRAM Conference* – Gothenburg, Sweden. [Best paper award]

4. Gheytanchi, A., Joseph, L., Kimpara, S., Gierlach, E., Housley, J., Franco, Z. E. & Beutler, L. E. (2007). The dirty dozen: Twelve key failures of the Hurricane Katrina response & how psychology can help. *American Psychologist, 62*, 118-130.

5. Janssen M, Lee J, Bharosa N, & Cresswell A. (2010). Advances in multi-agency disaster management: Key elements in disaster research. Inf Syst Front (2010) 12:1–7

6. O'Sullivan, T. L., Kuziemsky, C., Toal-Sullivan, D., & Corneil, W. (2012). Unraveling the complexities of disaster management: A framework for critical social infrastructure to promote population health and resilience. *Social Science & Medicine*.

7. Sharp—Theoretical and Practical Application of Loose Coupling: A Study of Criminal Justice Agencies in the State of Florida (2009) *Southwest Journal of Criminal Justice, Vol. 6(1). pp. 45–58.*

8. Snook, S. A. (2011). Friendly fire: The accidental shootdown of US Black Hawks over northern Iraq. Princeton university press.

9. Star, S.L., Griesemer, J.R., 1989. Institutional ecology, &translations' and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907}39. Social Studies of Science, 19 (3), 387}420.

10. A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action (2011). FEMA.

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