Leadership and Cross-Boundary Information Sharing
Insights from the U.S. West Nile Virus Outbreak

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Abstract
Information is one of the most valuable resources of government. Government managers, however, are finding the information needed to plan, make decisions, and act is often held outside their own organizations, collected for widely different purposes and maintained in disparate formats. As a consequence, governments around the world are increasingly turning to information sharing as a strategy for maximizing the value of information in providing services and responding to problems. New practices are emerging at all levels; from town governments creating performance-based management capability by sharing information between departments such as police and highway, to state- and provincial level efforts to coordinate public safety, to national and cross-national efforts to respond to public health crises. Information sharing allows government managers to work at the same time, with the same information integrated from multiple disparate sources. It has the potential to support the transformation of organizational structures and communication channels among multiple agencies working in different locations. These integration processes often involve new work processes and significant organizational change. They are also embedded in larger political and institutional environments that shape their goals and circumscribe their choices. This paper draws on the research program underway at the Center for Technology in Government at the University at Albany in New York State (www.ctg.albany.edu) to present guidance on information sharing as a strategy for building the capability of government to adapt to the new knowledge intensive economy. One study in particular from this program1 is highlighted2. This study explored mechanisms through which executive involvement, formal authority, and informal leadership affect multi-sector collaborative information sharing, thereby extending what is known about leadership in complex, multi-sectoral network environments such as a public health crisis.

1. Introduction
Information is one of the most valuable resources of government. Government managers, however, are finding that the information needed to plan, make decisions, and act is often held outside their own organizations, collected for widely different purposes and maintained in disparate formats. As a consequence, governments around the world are increasingly turning to information sharing as a strategy for maximizing the value of information in providing services and responding to problems. New practices are emerging at all levels; from town governments creating performance-based management capability by sharing information between departments such as police and highway, to state- and provincial-level efforts to coordinate public safety, to national and cross-national efforts to respond to public health crises. Information sharing allows government managers to work at the same time, with the same information integrated from multiple disparate sources. It has the potential to support the transformation of organizational structures and communication channels among multiple agencies working in different locations. These integration processes often involve new work processes and significant organizational change. They are also embedded in larger political and institutional environments that shape their goals and circumscribe their choices.

Understanding the factors influencing information sharing and collaboration in solving pressing public problems is a focus of attention for digital government practitioners and researchers alike. Researchers at the Center for Technology in Government at the University at Albany, State University of New York (www.ctg.albany.edu) are exploring many of these factors and providing both new guidance for practitioners and new models of understanding for academics. For example, trust building has been identified as an important social process for developing cross-boundary information sharing among organizations and individuals. Given the critical role trust plays in fostering collaboration and allowing the development of enterprise-wide integrated information resources, practitioners planning new cross-boundary information sharing initiatives must explicitly include resources for trust building.

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among information sharing partners. Leadership characteristics and authority strategies are also significant in sustaining collaborative efforts across organizational boundaries. New guidance built on this research provides practical advice to leaders on how to create information sharing capability in government.

In late summer and early fall of 1999 the United States experienced the first outbreak of West Nile virus (WNV) in the Western hemisphere. The first cases appeared in the New York City area. In 2002, as the outbreaks continued to move westward, the State of Colorado experienced its first case. As New York and Colorado worked to build response capacity, they turned to information sharing and inter-organizational collaboration as lead strategies. In both states the response required many new relationships to facilitate the sharing of required information; animal and human public health professionals unaccustomed to collaborating across traditional government boundaries came together with a mix of other public and private sector organizations representing both human and animal healthcare facilities and providers.

Recent research highlights the level of changes required to create the kind of high-functioning, cross-boundary capability necessary in these response efforts as among the most complex, deep functional and institutional changes (Fountain, 2001; Cook, 2004). Previous studies have identified the challenges to efforts to create this capability as ranging from data and technical incompatibility to the lack of institutional incentives to collaborate and the power struggles around multi-organizational settings (Gil-Garcia & Pardo, 2005). Some of the challenges faced by response agencies were new. In particular, government leaders faced new challenges resulting from the nature of the threat and the complex requirements of an interorganizational response. They needed to find ways to facilitate and foster interorganizational collaboration and information sharing across organizations from multiple sectors and all three levels of government.

Although there were important differences, the responses in New York and Colorado shared several characteristics such as their dependence on information technology and multi-sector organizational networks. The organizations involved included federal and state agencies, local governments, and a mix of public and private human and animal healthcare facilities and providers to include hospitals, university labs, and veterinarian practices. The comparative analysis of these two cases focuses on the role of government executives, formal authority, and informal leadership in the networked response to the West Nile virus outbreak. The study attempts to disentangle how these leadership factors affected the collaboration efforts and the necessary information sharing during the responses. Therefore, it provides not only evidence of the importance of each of these variables, but also uncovers some of the mechanisms through which they have an impact on interorganizational information sharing. Further, it contributes to current knowledge by describing some of the mechanisms through which executive involvement, formal authority, and informal leadership influence cross-boundary collaboration and information sharing. The study also provides practical guidance on leveraging executive involvement, formal authority, and informal leadership in highly complex networks enabled by information and communication technologies.

2. Leadership, Information Technologies, and Cross-Boundary Collaboration

Governments around the world are increasingly turning to information sharing as a lead strategy for developing response capacity for problems in a wide range of programs and policy areas. As information sharing is pursued the complexity of this strategy is becoming clear. Developing cross-boundary information sharing to support government response capacities requires change, in some cases, significant changes in organizational and...
technological processes. The delivery and management of public services increasingly relies on complex networks of interdependent organizations (O’Toole, 1997). Crosby and Bryson (2005, p.8) describe this setting as “no-one-in-charge, shared-power world”, where a great number of organizations and groups have only partial responsibility to act on a public problem and share the power that is required to solve it. As a result, the need has been raised for a new type of leadership that crosses boundaries of departments, levels of government, and sectors. As Huxham and Vangen (2000) point out, two fundamental assumptions of traditional leadership literature do not apply to collaborative settings. First, a leader cannot exert formal authority based on hierarchical rank because the individuals involved are from different organizations. Second, it is very difficult to agree upon a common goal because participating organizations have different and often conflicting goals.

Interorganizational, cross-boundary leadership has started to become an essential element of information systems management. In today’s organizations the wall between traditional information technology (IT) departments and functional business units have been dismantled, and interorganizational networks and external alliances have become more common (Tapscott & Carston, 1993). Since IT permeates all business functions of an organization, IS leadership requires a holistic cross-functional view of the organization, which poses unique challenges for many chief information officers (CIOs) (Karahanna & Watson, 2006). Recent literature highlights the importance of leadership as an influence of IT initiatives in general and information sharing in particular. These studies also acknowledge the differentiated impact of executive involvement, exercise of formal authority, and informal leadership as manifestations of a more general leadership concept. However, this literature does not closely and systematically analyze the mechanisms through which these variables affect information sharing and multi-sectoral collaboration. The present study shows the effects of these important variables and explains some of the causal mechanisms involved in this complex phenomenon by disentangling some of these relationships through careful qualitative analysis. In doing so, this study extends this basic framework to incorporate other variables and their corresponding effects and clarifies why these factors are important for cross-boundary collaboration and information sharing.

3. Research Methods and Description of the Cases
The research included eight in-depth case studies of state-level efforts to create the ground work for sharing information across agencies and across government levels in two policy domains: public health and criminal justice. Within the criminal justice arena, we used an action research framework with facilitation, observations, interviews, and document analysis. The public health domain was studied through a retrospective analysis of the state and county public-health response to West Nile virus, using interviews and document analysis. This section presents the main results of our analysis. The results clearly support a core set of mechanisms or intermediate variables that affect the relationships between cross-boundary information sharing and each of the three leadership variables identified: executive involvement, formal authority, and informal leadership. Below we present the different mechanisms found in the cases and the corresponding propositions and causal relationships.

3.1. New York State’s Response to the West Nile Virus Outbreak
In late summer and early fall of 1999, New York was the site for the first outbreak of West Nile Virus (WNV) in the Western hemisphere. In preparation for a possible re-emergence of the disease in 2000, the New York State Department of Health led an effort to improve the state wide capacity to respond to another outbreak. A critical component of this response capacity was the development of a Web-based integrated information network. This network, the Health Information Network (HIN), was originally created to provide secure Web-based electronic

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4 See Gil-Garcia, et. al. 2007 for the related literature review.
5 See Gil-Garcia, et. al. 2007 for details on the research method employed in this study.
health information exchange for a multi-sector group of organizations including state and local health departments, healthcare facilities, and healthcare providers (Eidson et al., 2001). Based on the existing infrastructure, the state health department worked with other state agencies and local health departments to develop and implement an integrated electronic system used to collect and provide access to West Nile virus related case data. The collecting and sharing of this information was critical to the state’s ability to effectively respond to the initial virus outbreak and subsequent re-emergences over the years. The HIN became the platform for sharing data on mosquitoes, birds, mammals, and humans throughout a network of county health departments, state animal and human public health agencies, and healthcare facilities. The creation of this network brought together animal and human public health professionals unaccustomed to collaborating across traditional government boundaries. These professionals were more accustomed to dealing with disease outbreaks restricted to either animal or human health domains, the West Nile virus outbreak shattered these professional and organizational boundaries because it was a disease affecting both humans and animals. Sharing information across these government boundaries was further complicated by the traditional ways in which state and local governments interact in the state. In New York, state and local governments share responsibility for public health; two cities and 33 of the 57 counties maintain full-time health agencies. While the state-level public and animal health agencies provide a number of regulatory and direct service functions to local governments in support of citizens, responding to a public health crisis, such as West Nile virus, ultimately is the responsibility of county health agencies. At the state-level, new relationships needed to be formed among multiple agencies with diverse expertise in human health, birds, mammals, and mosquitoes. Similar relationships needed to be formed at the local and federal levels and then across these levels of government and among organizations such as healthcare providers.

3.2. The Response to West Nile Virus in Colorado

The first case of WNV in the state of Colorado occurred in Larimer County in 2002. In 2002, the virus was reported in only birds and horses. The first human cases were reported the following year in 2003. The county health department was responsible for coordinating the response to the initial outbreak and the subsequent annual re-emergence of the virus since then. This response capacity included a cross-boundary information sharing initiative that involved a wide range of Larimer County organizations as well as surrounding counties, the state, and federal government. Similar to New York, in Colorado, local government ultimately is responsible for providing public health services to its citizens. With over 2,800 local governments of various types, each having different kinds of statutorily defined authority and responsibility, coordinating West Nile virus response efforts between the state and local governments and even regional efforts among neighboring local governments was a complex task. The cross-boundary information sharing initiative among Larimer County, the state, and neighboring local governments reflecting this complexity and was characterized by an interorganizational process of collecting, disseminating, and analyzing information from a disparate group of information providers and users. An effective response capacity for West Nile virus depends on an accurate assessment of how the virus is spreading among the animal population to include birds, mosquitoes, and particularly in Colorado, horses. Tracking the number of West Nile virus cases within this network of animals provides a critical early warning for the possible spread of the virus to the human population. Therefore, the key information providers and users for a West Nile virus response included both animal and human public health agencies at the state, local, and federal levels as well as a mix of public and private sector human and animal healthcare facilities and providers such as hospitals and veterinarian practices. Colorado had a similar state-level system for collecting and disseminating WNV case information to relevant government organizations throughout the state and to the appropriate federal authorities such as the Centers for Disease Control and Prevention (CDC). However, at the local level, the coordination of response efforts relied heavily on a less formal or single system. This ‘system of systems’ was comprised of e-mail, phone, and fax communications as well as ad hoc databases and even geographic information system (GIS) applications. For interaction with the public, the county health department posted case data on the Web in addition to other public communications efforts such as press releases.

3.3. Executive Involvement and Cross-Boundary Information Sharing

Executive support has been identified as important for IT projects in general and cross-boundary information sharing in particular. One of the ways executives were found to have a positive impact in the response to the West Nile virus outbreak cases studied was by supporting the actions of influential informal leaders. Informal leaders were found to be powerful actors in the interorganizational efforts. This power was, in part, influenced by the involvement and support of top executives such as agency commissioners. A state-level public health representative with IT responsibilities explains this relationship,
“…I really look at the people and see--if you got really good, strong people that work together, that'll make any project successful. And I look at Ivan getting us working on it and Deb, involved in negotiating with the counties and [the informal leader] taking the lead. I mean, these are some really good, strong people that made sure that this was successful. And all of it under the support of our commissioner, you know, which I think is--and she was definitely involved early on in establishing the way we were going to proceed and I think that just worked out well.”

P1: Executive involvement has an influence on cross-boundary information sharing initiatives through executive efforts to support the actions of informal leaders.

Another important way executives influenced the cross-boundary information sharing initiatives in the cases was to demonstrate the respect for the autonomy of participating organizations. In the case of New York, this was demonstrated through willingness to consider the concerns of peer county commissioners about disclosure of information about infected birds. With the help of an influential informal leader, the group was able to establish a rule that allowed county commissioners to be notified about WMV cases in their respective counties 24 hours before this information was released to the rest of the state and potentially to the press. A state public health representative remembers some details about this situation,

“The counties were really concerned because I guess they didn't want--we want, when we develop applications, we want to make the data available to everyone, O.K.? And the counties were concerned that if a West Nile bird showed up in their county, the other counties would see it and that maybe they could release to the press this information immediately. And so the press would be notified of a problem before the county commissioner was notified--which happens all the time. I mean, sometimes it's in the newspaper and the commissioners are reading about it before they're notified about it. They were really concerned about a system that we had set up so that the lab results would immediately go in and become available to everyone. And that was like a deal-breaker to them in some ways. I don't really--I think that we should always make the data available. But they were really concerned about that. That's a valid point. They needed time to react and marshal their resources.”

In contrast, there were other situations in which the lack of respect for the autonomy of participating organizations negatively affected the willingness to participate and consequently the effectiveness of the cross-boundary information sharing effort. The involvement of top executives can mitigate or exacerbate these tensions and promote or detract rules and mechanisms that ensure a certain degree of autonomy for participating organizations. In Colorado, tensions were created when the state took an authoritative position in its relationship with the counties. State executives did not demonstrate respect for the autonomy of county governments and this resulted in a conflict between these two entities.

“The state decided you are going to now use our system. We said "no" because we've already got something we're using. How about we just share data? And there was a big fight--no, you work for us. And we're saying, no, you get our data and it's our data, not yours and there was a big fight. Well, after the fight had ended, we all sat down and got together and said… You know what? What we're getting right now is, here's my system, here's what you will use if you want to do collaboration. Well, that's not collaboration; that's you dictating a system to me and that's different.”

P2: Executive involvement has an influence on cross-boundary information sharing initiatives through executive demonstration of respect for the autonomy of participating organizations.

The cases provided evidence that executives have the ability to affect willingness to participate either from members of their own organizations through traditional organizational incentives or from members of other organizations through negotiation. In New York, the commissioner of department of health played a critical role in promoting collaboration across divisions (human, mosquito, bird, mammal) and with other agencies to respond to the WNV outbreak. A senior public health manager identifies the commissioner as a very important actor,

“I think you really want to trace it all the way back; you can almost start with our state health department commissioner, you know. She pretty much said we're going do this; we gotta get it done; we don't have
much time and we're going to all work; we're going to all cooperate, you know. And I think it was understood by everyone that we were going to work together."

The degree of involvement of and support from executives was affected by the severity of the problem and the potential loss of human life. The nature of the event directly influenced the willingness of many individuals to participate, but also had an impact on how executives promoted participation. A senior public health manager in New York explains the role of executives in increasing the participation,

"I think because the top administrators, particularly in Health, saw that there was a real health threat—people were dying in New York City and elsewhere from West Nile. And it was a new disease to the hemisphere, lack of experience and skills with dealing with this disease. We had to come up to speed, define controls and education right off the bat and study it and see just where it was going to go. They made a high priority of doing just that. And therefore, epidemiologists and virologists and all these people came online to work on it. And the information services had to be part of that and it was a statewide program..."

**P3:** Executive involvement has an influence on cross-boundary information sharing initiatives through executive ability to affect the willingness of key actors to participate.

The actions of executives served to highlight the role executives can play in enhancing the capability of informal leaders to affect change in the many organizations involved in a response efforts. These actions also served often to positively influence willingness to participate; while other actions, in particular, those communicating a lack of respect for the autonomous nature of some organizations, negatively influenced this willingness. The ability of executives to apply or in some cases, withhold, influenced the cross-boundary information sharing efforts in the responses.

### 3.4. Exercise of Formal Authority and Cross-Boundary Information Sharing

The exercise of formal authority was found to facilitate cross-boundary information sharing by affecting the existence and nature of problems and the necessity of localized and episodic solutions for those problems. In some instances the exercise of formal authority was found to solve some of the existing problems; in others it produced new problems. The case analysis sheds light on how tensions created by the exercise of authority by states can influence the willingness of autonomous local governments to participate in collaborative information sharing. In Colorado this lead to problems between the state and some of the counties (See quotes for P2). In a different context, formal authority can help build agreement among multiple organizations. As discussed in the previous section on executive involvement, in New York, counties were concerned about information disclosure. With the help of an informal leader accepted by the counties, the state health department came up with a rule about delaying the public release of laboratory results for 24 hours.

**P5:** The exercise of formal authority has an influence on cross-boundary information sharing initiatives by affecting the existence and nature of localized episodic problems.

The exercise of formal authority was found to be important to the crisis response efforts; in particular due to the compressed timeframe and the importance of coordination. The exercise of formal authority influenced the development of appropriate and effective strategies for cross-boundary information sharing. In the cases organizations from multiple levels of government and multiple sectors needed to participate. The lack of fit between the strengths of traditional coordination mechanisms such as hierarchies and formal communication channels and the complexity of the interorganizational settings increased the complexity the response efforts. In New York the legal framework establishes autonomy of local governments promoting a decentralized response. Authority for making decisions about a public health crisis such as the WNV outbreak rests with the counties.
“They [state department of health] could suggest things but they couldn't say you had to do something. And from the county's perspective, it would have been a lot easier if the state could have just said, "You need to do this; you have to do this; you're mandated to do this" but that's not the way things happen. It's county rule in New York State and so leaving the decision up to the counties, each county could do different things. And with a disease like West Nile, it wasn't something that was going to stop at a county border. So that often made it very difficult if counties decided to do different things. And so I think that did make it difficult a lot of times because there were differences and opinions about what should be happening and what was in the best interest and what was in the best political interest.”

P6: The exercise of formal authority has an influence on cross-boundary information sharing initiatives through the development of appropriate and effective strategies.

The exercise of formal authority was also found to have a direct influence on the willingness of key actors to participate. As mentioned before, the relationship between the state and the county governments was necessary for an effective response. This relationship was affected by decisions taken at the state level that had implications for counties and their capacity to respond. In some cases, the exercise of authority by the state reduced the willingness of the counties to participate. One example of this was the creation of bioterrorism regions in Colorado. A county-level public health manager in Colorado remembers,

“Well, just recently, with the state getting all the bioterrorism money, the state has basically forced people into regions, whether they make sense to be regions or not. I mean, we're in this region that goes from our county all the way to the Kansas-Nebraska border and to some counties that are along the Kansas-Nebraska border, as far south as Colorado Springs. Now if this makes any sense to you as being a region but, you know, that met their, they had some other thing divided up that way and so they said, these will be your bioterrorism regions. So, yes, we do have those. They're sort of state-imposed; they're not natural, people who naturally would necessarily be working together.”

The analysis highlights the need for collaboration and information sharing among state and local governments as well as other organizations in the response efforts. The data also showed the need for each actor, states in particular, to be sensitive to the differentiated needs of local governments as well as their own needs in creating aggregate data. In New York, there was a tension between the state and New York City (NYC) regarding the development of the Health Information Network (HIN) for disease surveillance. The state was trying to use its authority to develop a single solution for all local governments, but initially did not take into consideration that NYC is much different from other local governments in the state. Early in the initiative, this affected NYC’s willingness to participate. However, the state named a public health manager from NYC the co-chair of the data committee and that helped give NYC more influence and increased their willingness to participate.

P7: The exercise of formal authority has an influence on cross-boundary information sharing initiatives by affecting the willingness of key actors to participate.

The cases highlight the mechanisms through which the formal authority influence cross-boundary information sharing. Formal authority served to both exacerbate and mitigate localized episodic problems in the cross-boundary information sharing efforts. The creation of appropriate and effective strategies for cross-boundary information sharing was positively influenced in the cases through both direct authority being exercised within agencies and through support of informal leaders from across other organizations. The cases also provide insight into how formal authority influences information sharing by highlighting willingness to participate as a influence mechanism.
3.5. Informal Leadership and Cross-Boundary Information Sharing

In both New York and Colorado informal leadership was instrumental to building trust and willingness to participate among individuals from different levels of government and sectors. Informal leaders built connections among groups, looked for solutions, and created an open environment.

“…and so she was very responsive and, as I said, I don't know if it affected [the results of the response] but I thought it was a good working relationship where she seemed very interested in input, to what the needs were and what would be helpful to people. And I think she really tried to get it done on the other side, what she thought would be helpful.”

Informal leaders did not wait to receive directions; instead they took initiative and started sharing information across organizational boundaries. A state-level public manager from Colorado explained how they started this process, “…and so it's not something, for instance, that high up in my agency [the state health department] or high up at CSU [Colorado State University] said, well, you guys need to get together and share this information. It was something that I knew about and I called the director of their diagnostic lab, who I know from other issues over the years…” Informal leaders were able to talk to individuals participating in the response in their own words. In fact, some of them built trust among participants by playing the role of “brokers” between public health professionals and information technology (IT) staff. A state-level public health manager explained how an informal leader talked to a senior public health manager in another agency highlighting aspects of the effort that were important for him in his own terms and, in that way, got his buy-in. “She persuaded him also on the importance of health… importance to the research to understand the transmission of the disease and they talked on that level…”

P8: Informal leaders have an influence on cross-boundary information sharing through their ability to build trust among key participants and leverage existing trust embedded in their professional networks.

Each response required a strategic vision to guide the cross-boundary information sharing efforts. However, to be successful, they also needed to find creative localized solutions to important problems. Informal leaders were found to play a very important role in this regard. They were negotiators of localized and episodic solutions that allowed the cross-boundary initiatives to happen and be more effective. An informal leader in Colorado was able to provide a flexible information system that allowed information to be updated at any time. Initially this was not possible and it took the county one or two days to have their emergency page available in their Web site. An informal leader was essential in solving this problem and moving the initiative ahead by empowering the IT staff to develop and implement a technical solution that would enable the timely reporting to the public of important information related to the virus.

For New York, deciding which identifiers to use for tracking information about animals and humans was an issue, especially due to the large number of organizations involved and how different they were. Again, an informal leader was able to negotiate the use of certain standards, even with powerful actors. A public health representative from New York clearly explains this,

“You gotta go back to [the informal leader]. She really, you know, made it work. I don't know if you're familiar with [senior public health manager for different state agency]. But he's a very intelligent, interesting guy. He's always making his point. But he's got a very strong personality and he wants to make sure when he's dealing with the [state department of health] that it's going to be a benefit to him.”

P9: Informal leaders have an influence on cross-boundary information sharing initiatives through their ability to apply localized and episodic solutions to complex problems.

Informal leaders’ use of boundary objects to facilitate a conversation between individuals from different organizations and/or different professional backgrounds was found to play an important role in the development of the information systems used in the responses. In New York, an informal leader helped design the forms in the system and promoted a faster use of prototypes to negotiate with the counties. This was very important in the response due to the time pressure.

P10: Informal leaders have an influence on cross-boundary information sharing initiatives through the use of boundary objects such as prototypes, documents, plans, etc.
The cases illustrate the role of informal leaders in creating appropriate and effective strategies for developing cross-boundary information sharing. Creating these strategies required government agencies to work with other organizations in new ways. In the two cases, informal leaders helped develop these strategies by first envisioning the different organizations needing to be involved and the associated interorganizational business processes. Next, the informal leader negotiated new relationships among the network of key players turning vision into reality. In New York one of the key informal leaders at the state level demonstrated this capacity. According to a state manager, “She took the lead in the whole thing and really, she was the one that did all the negotiating. She was at all the meetings. She really led the group in a way that was very, very efficient. She's a very capable person. She made the--the system was really broken down into three major systems--birds, mosquitoes and humans. So she took the lead on that and kind of the mosquito group kind of followed along so, you know, and even the human stuff came in later. But she took the lead on that and really set the standards for everyone else.”

Informal leaders sometimes have formal authority that allows them to be at the same time supporting and leading initiatives. One public health manager with IT responsibilities had this to say when asked about the foundation of his department’s cross-boundary information sharing strategies, “[the public health director] primarily, I think; she really has a great vision on where she thinks public health should be and how to improve that and is willing to fund it... She wants to find better ways of using information technology.” This individual played a dual role as a formal leader within her own agency and informal leader for the broader interorganizational initiative. The cases illustrate how informal leaders contributed to appropriate and effective strategies by encouraging individuals within their own organizations to become more involved and knowledgeable of the interorganizational setting.

**P11:** Informal leaders have an influence on cross-boundary information sharing initiatives through their contribution to the development of appropriate and effective strategies.

Informal leaders were instrumental in the cases in drawing together people and organizations with little prior knowledge and little past experience working together. They used a variety of techniques to clarify the roles and responsibilities of key individuals and the organizations in the response efforts. According to a state manager, a lack of clarity of roles and responsibility was one of the biggest challenges,

“One of the big [challenges] for our program was the interagency issue because of the birds and mammals, because that does cross the multiple agencies. ....There had not been a disease that spread so quickly and affected so many different species where you had to have so many different agencies at all different levels involved. And how would you keep everybody involved and allow them to have input and knowledge all at the same time, as we said, protecting confidentiality and allowing local jurisdictions to handle things before it became public. .....And so all of the groups--there was one on bird and mammal, one mosquito, one on public information--these groups had people from all the different agencies so universities, local health, other agencies. And so those were issues that crossed all of the applications. And so these interagency working groups were able to develop components for the 2000 West Nile plan.”

In Colorado, clarity of roles and responsibilities was critical to the efforts of one informal leader to integrate a large and sprawling network of local governments into their response. The informal leader, a senior public health manager for the state, identified single points of contact at each of the local governments to be responsible for receiving and sharing information related to the spread of the virus with their locality. The public health manager made it very clear this information would be disseminated only to these identified individuals and they would be responsible to share it with others in their government. This process, it turned out, was not easy to implement with many individuals attempting to redefine the initially established roles and responsibilities. Once accepted, the new arrangements were generally adopted for the long term as important channels of communications.

“…each county had a single point of contact and that point of contact was the inlet into that county. And so when I had to send something out, I sent it to that point of contact. And it was their job then to distribute that to all of the people within their agency but also all the other agencies within their county who may want to know about that information. And so it would come out and it'd branch out and then there'd be more branches and more branches. But what that enabled is that this point up here didn't have to
communicate with three hundred branches at the bottom of the tree; you had this kind of gradual. … at least initially; that was a little bit of a paradigm shift for some groups. Because I got I don't know how many calls about, you didn't send me this press release. Well, yeah, it was sent to your county point of contact. Well, I didn't get it and I want to get one. Well, then you need to call your county point of contact and make sure that you're on the loop for their distribution. Well, no, I want you to send it to me. Well, no, you need to get your county point of contact—which often was somebody in their own agency. Well, that's not, you know, that [is not] my responsibility. I can't be responsible for communication problems within your agency—that's your problem; that's your issue to resolve. And so we got a lot of that early on. Once I think those were set, we didn't hear that complaint and I think most people thought it worked pretty well.”

P12: Informal leaders have an influence on cross-boundary information sharing initiatives through their ability to clarify roles and responsibilities.

The cases provide new insight into the mechanisms through which informal leaders influence cross-boundary information sharing. Informal leaders in the cases used their ability to build trust among participants and to engage in localized problem solving through the use of boundary objects to influence the cross-boundary information sharing efforts in the responses. Their ability to engage participants in effective strategy development can also be connected to the success of these leaders to create clarity around roles and responsibilities in these collaborative efforts.

4. Discussion
Overall, this study provides further evidence of the importance of leadership and authority in cross-boundary information sharing among multiple organizations. In doing so, extends this basic framework to incorporate other variables and their corresponding effects and clarifies why these factors are important for cross-boundary collaboration and information sharing. Therefore, the study contributes both to our current understanding of interorganizational collaboration and cross-boundary information sharing by systematically analyzing the mechanisms through which executive involvement, formal authority, and informal leadership affect these initiatives. The study also provides the foundation for future testing of an extended theoretical framework as a way to fill the gap in what is known generally about the mechanisms through which executive involvement, formal authority and informal leadership influence cross-boundary information sharing.

The cases served to unpack our understanding of executive involvement in cross-boundary information sharing initiatives. Executives in the cases exerted influence through their involvement; they could support or disapprove the actions of informal leaders, demonstrate and ensure respect for the autonomy of participating organizations or lack of respect, encourage or discourage individuals within their own organizations to participate, and increase or reduce the financial resources available for the response efforts. The exercise of formal authority also affected interorganizational collaboration and cross-boundary information sharing by producing or mitigating problems, enabling or hindering the development of appropriate and effective strategies, and encouraging or discouraging
individuals to participate in the initiative. Finally, informal leadership was also critical for these complex initiatives. Informal leaders built and held trust among participants, found creative localized solutions to problems, effectively used boundary objects to communicate ideas among individuals from different organizations and backgrounds, contributed to the development of appropriate and effective strategies, and helped to clarify roles and responsibilities. Although the evidence comes from two public health crisis response efforts the findings may apply to other situations in which interorganizational collaboration and information sharing is required. Future research should explore if the propositions suggested in this study per are applicable to other realities and social phenomena.

5. Conclusion
As governments around the world turn to information sharing as a lead strategy for developing response capacity for problems in a wide range of programs and policy areas efforts to extend what is known about the factors that influence these our capability for success become increasingly important. Events such as the 2002 emergence of the WNV in the US and its spread across the country since then, have shown that gathering, handling, and sharing information in response to a public health crisis, requires not only adequate technical capabilities for sharing information across organizational boundaries and among multiple levels of government, but reliance on strong interorganizational collaboration skills. The WNV response required collaboration and information sharing among animal and human public health professionals, as well as healthcare facilities that spanned state, local, and federal jurisdictions, all of whom were unaccustomed to working together across traditional organizational and jurisdictional boundaries. This event and events like it, when systematically studied, provide great opportunities for new insights into the capabilities of governments world-wide to succeed in the new knowledge economy.

References