ICTs, CITIZENS AND GOVERNANCE: AFTER THE HYPE!

Innovation and the Public Sector

The functioning of the public sector gives rise to considerable debate. Not only the efficiency and efficacy of the sector are at stake, but also its legitimacy. At the same time we see that in the public sector all kinds of innovations are taking place. These innovations are not only technological, which enable the redesign of all kinds of processes, like service delivery. The emphasis can also be put on more organizational and conceptual innovations. In this series we will try to understand the nature of a wide variety of innovations taking place in the public sector of the 21st century and try to evaluate their outcomes. How do they take place? What are relevant triggers? And, how are their outcomes being shaped by all kinds of actors and influences? And, do public innovations differ from innovations in the private sector? Moreover we try to assess the actual effects of these innovations, not only from an instrumental point of view, but also from a more institutional point of view. Do these innovations not only contribute to a better functioning of the public sector, but do they also challenge grown practices and vested interests? And what does this imply for the management of public sector innovations?

Volume 14

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ICTs, Citizens and Governance: After the Hype!

Edited by

Albert Meijer

Utrecht School of Governance, the Netherlands

Kees Boersma

VU University Amsterdam, the Netherlands

and

Pieter Wagenaar

VU University Amsterdam, the Netherlands

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Information Sharing and Public Health: A Case-based Look at the ICT Expectations-Reality Gap

Theresa A. Pardo
Center for Technology in Government, University at Albany, SUNY, USA

J. Ramón Gil-García
Centro de Investigación y Docencia Económicas (CIDE), Mexico

G. Brian Burke
Center for Technology in Government, University at Albany, SUNY, USA

Abstract. Sharing information across organizational boundaries is central to efforts to improve government operations and services. However, creating the capability necessary to enable information sharing across the boundaries of organizations is among the most difficult types of information technology projects. New knowledge about information sharing is required; in particular, new understanding about how government, non-governmental and private sector organizations come together to share information is necessary. This chapter draws on the experiences of key actors in three states in the United States as they organized to create new capability to share information as part of their responses to the West Nile virus outbreaks. The cases highlight the gap between expectations and reality, providing opportunity to more fully understand the gaps between expectations (the hype) about ICTs and the reality facing government practitioners who seek to use ICTs to share information. Examining the cases in terms of four contexts of information integration and sharing provides a more specific understanding about the gaps between these expectations and the reality (after the hype). The lessons learned in the context of public health include the central role of information sharing and the implications of resource constraints on data capture and use capability in the context of an outbreak management and surveillance effort. Insight into the interdependence of system design and process support and improvement in the context of public health surveillance was also found to be critical to future planning of public health surveillance systems. This chapter serves to reemphasize to both researchers and practitioners the need to close the gap between expectations and reality; the point is made again through the cases that closing the gap depends on strategies that draw on technology, process, interorganizational, and political perspectives and resources.

Keywords. information sharing, electronic government, information technologies, information integration, cross-boundary collaboration, social aspects, technical aspects.

1. Introduction

Sharing information across organizational boundaries is central to efforts to improve government operations and services. The enabling role of information integration and sharing in government programs and services is broadly recognized by researchers and practitioners alike, in particular in the public health and safety policy areas [1]. The central role of information and information sharing is becoming more and more evident over time, particularly as the world faces new and complex issues such as public health, where borders are generally irrelevant. However, creating the capability necessary to enable information sharing across the boundaries of organizations is among the most difficult types of information technology projects. As a consequence new knowledge about information sharing is required; in particular, new understanding about how government, non-governmental, and private sector organizations come together to share information is necessary. Information and communication technologies are expected to play a major role in creating this new information sharing capability. And in many cases, it has been found to do so. However, recent experiences such as Hurricane Katrina in the United States and the Tsunami in Southeast Asia tell us we do not know enough about the gap between what we expect ICTs to do for government and citizens and what they are actually doing. In a sense, we need a reality check: Are the expectations about the role of ICTs in information sharing being met through the solutions provided? If not, what is the gap and what can we do to close it?

This chapter contributes to these questions by drawing on the experiences of three states in the United States as they responded to the outbreaks of the West Nile virus (WNV) beginning in 1999. The cases highlight in specific detail the nature of the gap between expectations about ICTs in terms of sharing information as part of three WNV response efforts and the actual impact of the systems put in place. In doing so, the study demonstrates the recursive causality and interactions between important social and technical processes in cross-boundary collaboration and information sharing. It also provides some lessons and implications for public managers facing similar situations.

The chapter opens with a brief review of the literature on information integration and sharing, followed by the introduction to the four contexts of information integration used to frame the case discussions. Following an overview of the research method and the cases, the three cases are discussed within the four contexts of information integration and in terms of expectations, real experiences, and lessons learned. Practical lessons and insights from the cases are presented in the conclusion as guidance for both practice and future research.

2. Information Sharing and Integration as a Social Process

Digital government, e-government, e-governance: all are terms that have become synonymous with the use of Information and Communications Technologies (ICTs) in government agencies. Regardless of the label, ICTs have become a central component of government administrative reform, as well as non-routine response strategies [2, 3, 4]. E-government projects can potentially increase the quality of government services, generate financial savings, and improve the effectiveness of government policies and programs [5, 6, 7, 8]. In an effort to understand this generalization more fully, many scholars focus on specific aspects of digital government. Along the way, they are

realizing some of the most promising benefits from the use of ICTs in government rely upon the integration of information across organizational boundaries [9, 10, 11, 12, 13, 14].

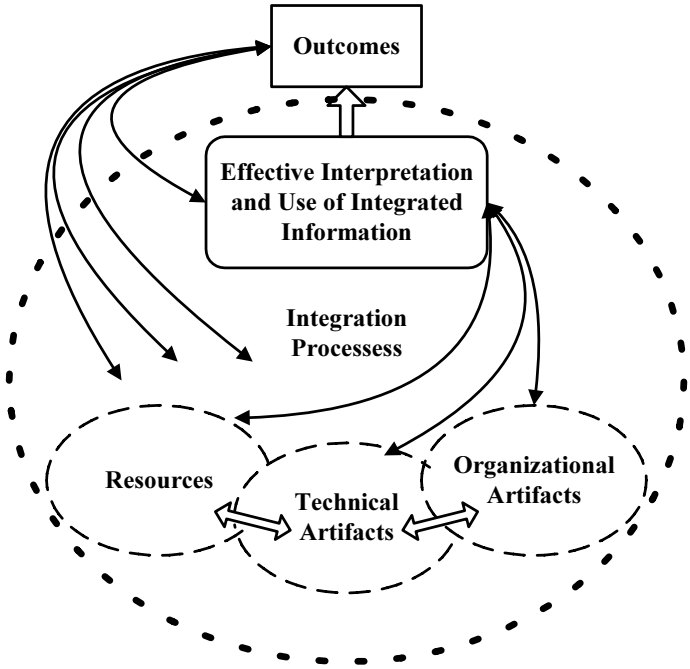

Figure 1: Relationships of integration components

Cross-boundary information integration can be conceptualized as a complex social process in which technological and organizational artifacts are developed and assembled for the purpose of information use (see Figure 1). These social and technical processes are embedded in four contexts: technology, business process, interorganizational, and political (see Figure 2). Advancing understanding of information integration in terms of these four contexts requires a multi-disciplinary perspective. Such a multi-disciplinary perspective can enhance the ability of government leaders and IT professionals to look beyond traditional organizational and information systems technology boundaries.

2.1. The Technology Context

Issues of meaning and semantic translation are central to integrating and sharing information from diverse, distributed sources such as data bases, text files, images, or Web sites. Solving the technical problems of access and use of information from these diverse sources typically involves development of standards, platform and application interoperability, metadata, and use of algorithms and other software devices. These tools address the problems resulting from unstructured textual information and natural language names for objects and data by developing automated matching methods (for example [15, 16]). Other techniques involve constructing systems of ontologies that provide the underlying structure for alignment of meaning across heterogeneous data

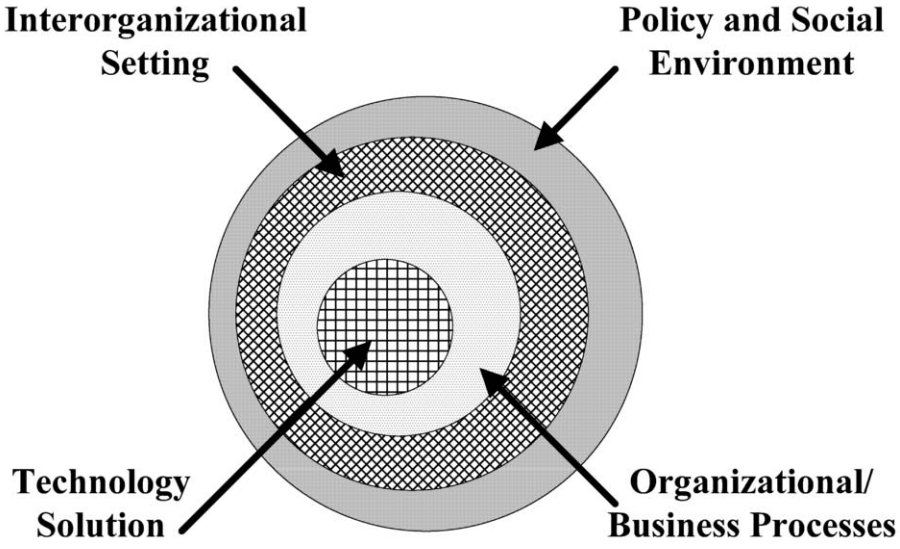

Figure 2: Contexts of information integration

bases [17-19]. These methods have the potential to greatly reduce the cost of manual search and translation processes, making automated searching and matching of heterogeneous data feasible in large database environments. However, these methods will not in themselves resolve issues of agreement about the significance or use of integrated data or problems of policy in the public sector [20].

The changing and expanding use of data in governmental and private organizations demands increased attention to all of the components of data quality—accuracy, timeliness, consistency, and completeness [21]. Until recently, this attention was confined to improving the quality of data generated and used within single organizations. Today, the effectiveness of both public and private organizations often depends on data exchanges with others. As more organizations deploy and use communication networks in their day-to-day processes, sharing and integrating data across institutions becomes more attractive and more feasible [22]. However, integrating large amounts of data that often differ in form, as well as in organizational and geographical origin, poses myriad challenges in ensuring the quality of the integrated data. These problems arise because the integrated data reveals broad inconsistencies in definition, content, and overall quality, even when the individual data sources appear to be valid [23]. Moreover, data quality cannot be evaluated, and hence improved, independently of the context in which data are produced, stored, and used. Whether data are of high quality depends on the characteristics of the resulting integrated information infrastructure and on the demands of the tasks that use these data [24].

2.2. The Business Process Context

The tasks and production processes of complex organizations have been the subject of research since the early 20th century when Taylor [25] offered his principles of scientific management that strongly influenced the structure and functional

specialization of business and government organizations. Work processes, including decision processes, have interested contemporary scholars, especially as they relate to productivity and information technology. Hammer and Champy [26] contend that, over time, processes lose their connection to productive purposes and become rigid and self-perpetuating. Productivity breakthroughs demand radical re-engineering of entire organizations. Taking a less dramatic view, Davenport [27] recognizes the intractability of complex organizations and advocates more selective process innovation, coupled with applications of advanced IT to achieve performance improvements. Zuboff [28] studied the infusion of information technology into work processes and the effects that the technology has on the discretion of workers, the means of process control, and the meaning of work. Information systems are commonly understood to embed processes and information flows in complex software, which becomes difficult to change and has strong influences on the work of the organization and its employees, managers, and leaders. Information integration demands that the work processes of multiple organizations be both understood and mutually adjusted. However, the development of separate operating procedures, control mechanisms, information flows, and work flows makes such integration exceedingly difficult, leading to serious problems, quick disintegration, or outright failures of information system initiatives that depend on not only information integration, but process integration [2, 29].

2.3. The Interorganizational Context

Sharing and integrating information among organizations depends on the creation and maintenance of interorganizational relationships. The formation of these relationships, involving differing goals and interests, requires negotiations and the development of commitment among participants [30-33]. The strength and richness of resource commitments and their distribution can be influential [34, 35]. The development and maintenance of the relationships may also be critically dependent on trust [36-42]. Knowledge and information sharing among organizations is also characterized by substantial risk, resource constraints, and conflict [43, 44]. Some risk and conflict comes from the differences in expectations and goals the various parties bring to the sharing process [12, 45, 46]. These differing expectations may reflect each party's individual and organizational history [47, 48], or simply variations in the characteristics of the individuals or organizations [49]. Interorganizational relationships are also influenced by the characteristics of the problem or goal motivating the activity. Interorganizational relationships may result from mandates, common interests [31], interdependence [50, 51], or from the need to resolve a variety of different problematic situations [52]. In addition, there may be substantial disagreement among potential participants about the level or exact nature of the problem to be addressed [49]. Interorganizational networks in the public sector have traditionally been studied as political structures [53-57] and more recently as dynamic operational partnerships (for example, [58, 59]). The bureaucratic and institutional issues surrounding interorganizational networks in the public sector have also gained interest from the research community [2, 60].

2.4. The Political Context

The political environment of government agencies exerts strong institutional and situational influences on information integration. A focus on government organizations

requires attention to bureaucratic and political theories. Most government activity is defined and funded through legislation that creates specific programs and assigns responsibility for those programs to specific agencies. This web of vertical relationships leads agencies to focus on their own programs rather than on cross-boundary issues or linkages with outside organizations. These program boundaries are powerful barriers to collaboration [60, 61]. Agency staff develop deep knowledge and expertise in their respective programs and protect their ability to act with discretion and autonomy [62]. Since information integration may subject agencies to external evaluation and criticism, agencies seldom regard program information as an asset of the whole agency, the entire government, or the public [52]. Since cooperation across organizations implies joint responsibility and shared control, it often involves coordination, monitoring, and feedback that can potentially damage legitimacy and integrity if cooperation fails [63]. Dawes [52] contends some of these barriers can be lessened by policies that encourage information use and stewardship (rather than ownership) and by the creation of practical tools, such as metadata inventories and standardized data sharing agreements. Landsbergen & Wolken [64] propose similar tools, including an economic model, to help agencies identify costs and benefits of information integration. Citing the experiences of information technology initiatives sponsored by the National Partnership for Reinventing Government, Fountain [2] maintains that strong institutional pressures and existing incentives and resource allocation patterns mitigate against even the most highly visible and politically popular integration efforts.

3. Research Methods and Description of the Cases

This research is based on a study conducted by the Center for Technology in Government at the University at Albany and supported by a grant from the United States National Science Foundation. The research included eight in-depth case studies of state-level efforts to share information across agencies and across government levels in two policy domains: public health and criminal justice. The public health domain, the focus of this paper, was studied through a retrospective analysis of state and county public-health responses to WNV. The cases discussed in this paper focus on the response to or preparation for WNV outbreaks in Colorado, Connecticut, and New York. Facilitations and interviews were transcribed and analyzed following an inductive logic approach and using grounded theory techniques [65, 66].

3.1. The Response to West Nile Virus in New York

In late summer and early fall of 1999, New York was the site for the first outbreak of 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's capacity to respond to another outbreak. A critical component of this response capability 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 health information exchange for a multi-sector group of organizations, including state and local health departments, healthcare facilities, and healthcare providers [67]. 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 to collect and provide access to WNV related case data. The collecting and sharing of this information was critical to the ability of the state to effectively respond to the initial outbreak and subsequent re-emergence over the following 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.

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. At that time the virus was reported in only birds and horses. The first human cases were reported the following year in 2003. At the local government level, the county health department was responsible for coordinating the response to the initial outbreak and the subsequent annual re-emergence of the virus. In Colorado, similar to New York, local government is responsible for providing public health services to its citizens. With over 2,800 local governments, each having different statutorily defined authority and responsibility, coordinating WNV 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 reflected this complexity and was characterized by an interorganizational process of collecting, disseminating, and analyzing information from a disparate group of information providers and users.

3.3. The Response to West Nile Virus in Connecticut

The State of Connecticut identified its first WNV case in the fall of 1999. It was identified in birds only and confirmed in eighteen towns; the first human case occurred in 2000. The Connecticut Department of Environmental Conservation was the lead for WNV but the Connecticut Department of Public Health was responsible for coordinating the daily surveillance of the virus with local health departments and other state agencies. Key partner agencies for WNV outbreaks also include Connecticut Agriculture Experiment Station, responsible for the trapping of mosquitoes; the Department of Agriculture, responsible for the testing of horses for the virus; and the University of Connecticut, responsible for the identification of birds for testing and coordinating samples with the state lab. In contrast to New York and Colorado, Connecticut has no county government. It is the responsibility of each town, by statute, to provide public health services. The 169 towns work with 100 local health departments to provide these services.

4. Expectations and Reality: The Hype

Experience tells us that the impact of ICTs on organizational programs and processes, in general, does not meet our expectations. To understand the gap between our expectations and reality this study examines three cases where information sharing and integration was a core activity. The four contexts of information integration provide a framework for the case analyses. The technology context focuses attention on issues such as the technical problems of access, the use of information from diverse sources, and data quality problems, as well as organizational and geographical origins. The

business process context draws attention to questions about the *infusion of information technology into work processes* and *the ability of organizations to mutually adjust their work processes*. Through this lens we can examine the extent to which information systems *commonly understood to embed processes and information flows in complex software* are in fact doing so in these cases. The interorganizational context supports a focus on the creation and maintenance of interorganizational relationships, in particular the ability of organizations to work through differing goals and interests to forge the necessary agreements and to establish commitment among participants. Examining the cases through this lens will provide understanding of the effect of differing expectations and organizational history. Focusing on the cases from the political context allows an examination of the Web of vertical relationships that lead agencies to focus on their own programs rather than on cross-boundary issues or linkages with outside organizations. Further, this lens supports an analysis of the institutional pressures and incentives and resource allocation patterns that mitigate collaboration even in highly visible events such as disease outbreaks.

The four contexts frame of reference allows examination of the social and technical interactions taking place in such initiatives and provides new insight into how social processes influence and are influenced by interorganizational information integration. The discussion of the cases is presented in three sections: 1) expectations about how ICTs will enable information sharing in the response efforts, 2) experiences with ICTs and information sharing in the response effort, and 3) lessons learned during actual use in the response and reform efforts. A brief discussion of the 'vision' practitioners communicated is presented first to set the stage for the analysis.

4.1. A Common Vision

The vision of a highly integrated information system to support response efforts was common to many, if not most, of the participants, regardless of their home state or profession. This ideal system would contain data about all aspects of the outbreak and provide users with the capability to access and use that data to understand the virus and to support decision making and planning about the response. According to a state level public health manager in Connecticut,

> Because West Nile is an arthropod-borne virus with a wild vertebrate host, this complex lifestyle meant we needed complex surveillance systems. And so we tried to establish surveillance systems that would capture information from each of those different stages of its life cycle.

Participants talked about how such a system might make is possible to provide citizens with accurate and timely information about the disease; telling citizens what they want to know, when they want to know it. One local public health manger in Colorado characterized his vision of the value the right system could deliver to citizens.

> …we knew we had a death from West Nile, confirmed at the hospital, but it took several days or longer to have it confirmed with the state. So we were showing a death in Larimer County from West Nile before the state actually confirmed it. And it was kind of verbal confirmation at the state but not in their statistical pool. And so we again have to deal with some of that lag. The public wants to know right now what's going on...

This vision of an ideal system and the value it should deliver sets the stage for a discussion of expectations held by participants in the response, the reality they faced, and the lessons they learned along the way.

4.2. Expectations about ICTs, Information Sharing, and the WNV Response

Participants in all three states were guardedly optimistic about the role of ICTs in supporting the response to the WNV outbreak. The cases consistently illustrate a set of expectations centered around data and the use of technology to capture and share it. These expectations were presented primarily in terms of the technology and business process contexts and the interactions between the two. Some observations were also made about the political and interorganizational contexts and their respective interactions.

Many local governments could not handle all the testing themselves and needed to work with laboratories run by the state and other local governments, as well as universities and the private sector. As a consequence, getting efficient and timely access to the results of tests was difficult. In New York, public health professionals expected the new technology to provide users with access to a data repository containing testing information from the laboratories engaged in the testing process. One local government public health manager in New York stated his expectations for the new health information network and how it would alleviate the difficulty of drawing together data from all the testing facilities.

> What happened in 2000 was that even though we acquired the ability to do the testing locally, we still were going to rely on the state for some of our laboratory testing. So we had hopes that somehow the system would make it easier to reconcile testing that was being done in other laboratories with our own testing...

Expectations about the role technology could play in addressing problems of access and bringing together data from diverse sources were expressed. Specifically, participants spoke of the central role an integrated data repository could play in creating improved business processes in laboratory testing. The HIN in New York can be considered an example of where the *infusion of information technology into work processes* was considered central to improving the process of reconciling test results and following up on questionable results.

> It wasn't even the positives that we were so concerned about. It was really just making sure that everybody got tested that needed to get tested and that we actually had negative results on those… So we had hopes that the HIN would help us do that and that was the reason that (name) spent more time working with ... their data folks than the actual, you know, administrators.

Participants also shared expectations that the technology would allow them to bring data from different programs together into one place. These expectations were stated most consistently in terms of a system that would support new ways to look at data, both in terms of data completeness and analysis tools, and generate new understanding of the virus and its behavior. A local government public health professional characterized his expectations about the potential value of an integrated data repository, both in terms of efficiency and knowledge generation, in this way: 'Also to just have

more of a pool of data for them to use, to hopefully figure something out. And that'll come back to help us hopefully in the future'.

Expectations about the role of ICTs were stated consistently in terms of how technology could be used to change the way data was captured, made available, and used in the processes of responding to and tracking the virus. In particular, participants hoped for more rapid and fact-based responses to the public and a more holistic understanding of the disease in context.

5. Mapping the Gaps: The Backlash

Participants identified gaps between their expectations for technology as a core component of the response and planning efforts and the reality they were experiencing. They reported gaps in terms of data access and manipulation capability, impact on work processes, and coordination across programs. As noted above, one expectation commonly held in two of the states was that a centralized data repository would reduce the overhead of working with a number of decentralized and disparate data sources. Participants from these states also expected an increase in the quality of data available for use in decision making and planning. Localities expected to benefit from the new repositories; i.e., they expected they would have access to the data and be able to use it in a variety of ways for local purposes. They expected a streamlining of data entry and problem resolution. These expectations, according to two local public health managers, one in New York and one in Colorado, were found to be misaligned with reality.

> I think mostly it was going to be … a sort of a centralized database so that we wouldn't have to keep things separately here. And that we would all be able to access, meaning both ourselves here locally as well as (capital city) and all be working off of the same database to be looking for any types of information.

> And one of the things, as I said, that I guess is a bit frustrating about it right now is that even though the HINs there, it seems to me that even at the state they're still using a separate database a lot of times to do certain things. And so things are having to be data-entered twice. And so it's not unique to the HIN but it seems to me if we could get it all in one place, all of us would rather just data-enter it once because then it's only once as opposed to having to do this repeated times… So I'd like to see it just one place, one time, everybody working off of that same database.

In addition to the technology context, the interorganizational context provides additional perspective on the challenges a centralized data repository raised in terms of delivering on expectations about data access. Expectations were also misaligned in terms of ease with which systems could be developed to capture and use data more effectively to generate new understanding of the virus and its behavior. 'Putting it all together' was not as easy as it sounded.

The time involved in establishing new relationships across the boundaries of programs, even in a visible situation like a public health crisis, was also an issue. Participants noted gaps between what they expected in terms of new understanding about the virus and what the systems in place were designed and used for. Regardless they continued to be hopeful and committed resources to doing things that did not provide value immediately, but which they believed would provide value in the long run. According to one public health manager,

> We're entering a lot of it because the state is asking us to. We don't feel that it's a requirement but we're hoping that some good will come out of giving them all this data. I haven't seen a lot of benefits of that at this point. I was hoping to have some more answers by now about what's happening with the virus and the mosquitoes and thought that maybe by now they'd figure out from all that data they're collecting, be able to predict some things and just know more about what's going on … But I'm hoping it's not all just a bunch of busy work and hoping to get some, hoping that somebody's doing research with all this and statistical analysis or something and is going to be able to tell us something pretty soon from entering all of this stuff.

As this indicates, participants were hopeful, but they were also frustrated. Frustrations were created by gaps between expectations and reality in capturing surveillance data, data integration, and supporting local processes and practices. These frustrations are best understood in the context of technology and process.

5.1. Capturing Surveillance Data

When asked about the experience of using the computer to capture data, one local government public health worker in Connecticut responded in this way,

> It was slow… You'd have to wait until it would accept that record... And you didn't always have the choices of, you know, if it was a strange kind of bird, you'd just have to check off 'miscellaneous' if you didn't know what kind of bird it was. You were to report it anyway.

Another respondent from New York noted a gap in the capability of the system as designed to accommodate the situation; the result being that things had to be 'juggled' to get them into the system.

> The most frustrating part about using it is the error messages. And it doesn't seem to accept every possibility that can possibly happen for an individual entering data. And when you put in your circumstances, it doesn't like them a lot of times and it won't take it. So you've got to juggle things around until it's happy with it.

And another spoke to the choices that localities are making about what they enter and why, because entering all the data they capture isn't realistic.

> We actually got a call last year from the state saying that they see that we're not, they noticed that we're not doing any larval surveillance or something to that effect. But we are doing larval surveillance; we're responding to complaints that homeowners have about mosquito breeding grounds and we're taking samples and we're identifying mosquitoes and we're keeping track of it. But every time we find larvae we're not entering it and it's not that easy to enter that part of it anyway. It takes a lot of time to enter; it's not just forms to fill out.

5.2. Data, Sharing, and Integration

A local government public health IT manager in Colorado expressed frustration about how data quality issues prevented the integration necessary to make certain kinds of

data usable. Geocoding laboratory results, in particular, were affected by data quality issues.

> For human cases, CEDRS was utilized--that's the Colorado Electronic Disease Reporting System. And the human case would be reported in there with the type. That information was then manually plotted into the same system with a different layer so that we could view them separate from horses and birds and all that stuff. Frequently the information or sometimes--I won't say frequently--about, say, ten to fifteen percent of the data in CEDRS was not able to be plotted with just as it is. Either the address wasn't really right or it didn't have the correct locations...

In New York there was hope the centralized repository would provide operational support for case management.

> So there was a level of granularity that we needed just for operational purposes that wasn't necessarily, that didn't need to be--I don't know how, whether or not it was an issue for the other counties. But for us it was an issue to have a database that we could use for operational and not just, you know, data counting purposes.

5.3. Balancing Priorities

Gaps between expectations and reality were also found in areas related to the interorganizational and political contexts of the response efforts. Balancing local government priorities with the state's desire to have the fullest data available on the virus, for example, was a challenge in all three states. The states wanted as much data as possible, but the localities were not fully motivated to do so. This was due to the lack of access localities were then given to the data; both theirs and others, as well as the lack of resources available to support the new workload.

> We're still hopeful that it's a good system to use and we want to continue to enter data on there. But as we get busy, we didn't have any of our work taken away from us--we got West Nile added onto our work load. So we're at the point where we're going to do enough, we don't want to be criticized by the state for not doing enough. And we actually feel like we're doing more than some other counties as far as sending birds year round ... So we're trying to do our part to give them the data that they need. But we're certainly not motivated to enter every bit of data.

5.4. Communication and Coordination

An inability to communicate and share data with even contiguous counties was a frustration for one local public health IT manager in Colorado.

> Our closest health department, as far as the physical locality, Weld County has a health department location thirty miles away from us... I can't directly communicate with them [using the state surveillance system] and we share a population.

The lack of ability to see each other's cases, as this participant points out, also limits the ability of the counties to work together on process improvements; to deal with response efforts, for example, on a regional versus a jurisdictional level.

> Their West Nile system and our West Nile system, as far as reporting, don't talk to each other 'cause it's specifically excluded in the CEDRS piece [the state's disease reporting system]--we only get our cases; we don't get Weld County's cases. How can we work on rules or enhancements to those kinds of processes to allow these local agencies that are physically close to each other, declared as a region of communicable disease reporting and control potentially and allow us to purge that data for basically a region-wide response?

A local public health professional from New York captured the sense of frustration created by the lack of coordination across programs and agencies, in particular the cost to the response effort in terms of dollars and time.

> And I think one of the things we got a sense of is, for whatever reasons, is that even though it was all the HIN, it was very fragmented in New York--I shouldn't say and I don't know that I necessarily mean that in a bad way. But for example, there was one set of either data or IT people who were working specifically on the bird database. There was a second group of people who would work on the mosquito database. There was yet a third group of people who might have been working on the human database. So it was just not one central place to have this discussion even though at a local health department level, it was the same group of people; we were working on everything. And so it seemed that it was a lot of communication issues trying to get that coordinated. ... it was an issue of having to have similar conversations with at least three separate groups of people, even though it was the same disease, the same outbreak.

The response to WNV required a new kind of coordination across programs not used to working together. The delay associated with building new capability, in terms of interorganizational relationships and alignment, was real. Efforts to improve response processes and to leverage technologies in support of that response effort were impacted by these coordination challenges. The technical, process, interorganizational, and political contexts of information integration all shed light on the challenges to the response efforts. Overall, the gaps which emerged between expectations for ICT and the reality were tangible and the impact of those gaps on the ability of the states and localities to work together effectively to respond to WNV as a public health crisis are clearly expressed by those directly involved.

6. Lessons Learned: After the Hype

The challenges faced in responding to the WNV were significant, but in facing them participants noted the lessons learned for use in future efforts. Insights about leadership; the critical role of an integrated database for public health surveillance and the difficulty of creating such a resource; the need to fully appreciate the size of the job of getting data, all the data, into that database; and about the need to be incremental in creating capability for data capture, access, and use in support of a public health crisis were consistently noted by the participants.

6.1. Health Information Sharing is Critical to Public Health Response Efforts

Many participants considered an integrated database a necessary resource to support the complex and broad-based job of communicable disease surveillance. The Health

Information Network in New York, for example, became a core resource in the response effort. According to one NY public health professional,

> …I know for our particular function in terms of communicable disease surveillance and again, just being used to track … disease, trying to identify populations that are at highest risk or geographically locating where something might be clustered. It's really the only way to collect or look at this data. So we absolutely--I think it's fair to say, if we didn't have such a database, we couldn't do our jobs.

6.2. Understanding Resource Implications

One local government public health professional spoke to new understanding about the resource implications of getting data collected and entered.

> That was a major, major challenge. And one of the things that I've learned, whether it be West Nile, whether it be SARS, whether it be whatever it is, is that just supporting that kind of data collection and data entry in itself is a not insignificant thing. And something that we did not and still do not quite honestly have the resources for.

He spoke about the need to pull people from the hallways, or worse from other important public health areas to do the data entry.

> The first year that we were doing this, which really was in 2000 when we had any kind of systematic place to do this, we were pulling in just about everybody that you can imagine to help do the data entry. We had our nurses, who normally have to do, out doing bird data entry, helping to do with mosquito entry. Actually, the director of my HIV programs here... had a strong data background and was overseeing all the data entry ... We had a couple of summer students that we hired that year that we were having help do this. We were having clerical staff and I believe that we, even with the help--and this was again the Planning and Evaluation Division upstairs also just hired some temporary clerical help to help with the data. So that was a major, major challenge, was to do that.

Creative strategies were used to 'press' people into service for dealing with the resource constraints on data entry, but the same strategy was recognized as not feasible for data analysis.

> We're able to do the investigations, interview the people and collect the information and even fill out maybe a hand-written questionnaire. But where we don't have the capability is then to get all that into a database so you can do something with it. And that is like the big bottleneck, so to speak, I have found over and over again. We can't manage all the information that we're collecting and we can't analyze it to figure out how to use it in a constructive way in terms of what to do next.

The challenge of public health surveillance, according to a number of the participants, and aptly characterized by one, is the 'huge, huge' job, of getting the data available so the right people, in the midst of resource constraints, 'can look at it in any way.'

6.3. Incrementalism and Flexibility

Participants had high hopes for the integrated repositories. Through the response efforts they learned that an incremental approach might have, in the long run, provided more

functionality. One Colorado public health professional spoke to the value of an incremental approach.

> I've certainly and we've taken this approach with CEDRS [the state disease reporting system], is you start out with a base model. And then you add on the bells and whistles as you go on, once you make sure that the base model, once you make sure the car starts and backs out of driveway, then you start adding the horns and the lights and the other features that might be useful down the road. Because I've seen when programs have gone the other way to let's build a Cadillac 'cause it does everything for everybody that everybody could possibly want--they don't work too well; they can bomb badly. And so that's been part of the way we've approached this is, you know, let's get the base thing, which is moving information on case reports from hospital to the local health to the state, getting that piece in place. And then adding on, let's have--how about a mapping feature ... statistical calculation or statistical feature or search feature that might be useful.

The base capability in this case is the capture and sharing of information, not analytical tools. Another participant spoke to the strategy used in New York to leverage the base capability of the integrated repository and the local analytical capability.

> I think what we were able to work out with them and I believe what we do now is that whenever we want anything from the HIN, we basically do a download. And then once it's into sort of an Excel or Access type of format, you can then basically do with it whatever it is that you want or look for whichever field that you want.

In this case, local government practitioners convinced the state to focus on a quality interface for data collection and sophisticated downloading capability rather than canned queries, generally considered inflexible and restrictive.

6.4. A New Style of State-level Leadership

Participants overall seemed to recognize the unique leadership role state government has in intergovernmental coordination. Beyond a certain level of complexity, they noted, the state needs to take the leadership role. In these cases, the state agencies often were taking the lead, but the traditional approach was not effective. Participants spoke to need for a collaborative strategy rather than the traditional command and control strategy. A local public health professional in Colorado characterized the lesson learned in this way,

> The locals can only initiate that to a point. It needs to flip a little bit, this thing, we need an initiative statewide to do data collaboration and sharing. What we're getting right now is, here's my system, here's [the state system] tracking 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.

7. Conclusion

The premise of this chapter is that information sharing across organizational boundaries is a powerful strategy to improve government operations and services. The cases presented support this premise in the context of public health response. Additionally, they provide opportunity to more fully understand the gaps between expectations (the

hype) about ICTs and the reality faced by government practitioners who seek to use ICTs to share information as part of performance and service improvement strategies. Examining the cases in terms of the four contexts of information integration and sharing provided a more specific understanding about the gaps between these expectations and the reality (after the hype). The cases map these gaps and in doing so highlight the need for new answers to the question, 'What are the challenges?' Policy makers and practitioners alike can benefit from a consideration of these well known challenges in the context of information sharing in public health. The specific lessons learned after the hype in the context of public health include the central role of information sharing and the implications of resource constraints on data capture and use capability in the context of an outbreak management and surveillance effort. Insight into the interdependence of system design and process support and improvement in the context of public health surveillance was also found to be critical to future planning of public health surveillance systems. This chapter serves to reemphasize the need to close the gap between expectations and reality, and once again the point can be made that closing the gap depends on integration strategies that draw on technology, process, interorganizational, and political perspectives and resources.

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