FACILITATING AND IMPROVING HEALTH INFORMATION SHARING IN THE U.S.: ASSESSMENT OF THE IMPACTS OF POLICY, TECHNOLOGICAL, AND ORGANIZATIONAL FACTORS ON INFORMATION SHARING

By

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(Under the Direction of Andrew B. Whitford)

ABSTRACT

Since the enactment of the American Recovery and Reinvestment Act, health information technology networks have had the potential to connect public health agencies, private clinics, practitioners, and laboratories to share health-related data. Information sharing benefits participating organizations by reducing transaction costs, maintaining collaborative relationships, increasing efficiency in policymaking, being competitive, and finally, leading to desired policy changes and innovation such as policy integration and collaborative governance.

In spite of its significance and mutual benefits, little is known about how external and internal features of organizations influence information sharing in public agencies. Hence, this study not only addressed these issues but also aimed to provide further understanding of influential factors on the information-sharing activities of public organizations from three

perspectives – the policy, technological, and organizational lenses. Also, this research suggested new measurement for organizational information sharing by specifying the target audience and the activities to share information.

The findings reveal that the impacts of the organizational characteristics of local health departments on information sharing are greater than the impacts of the legislation and the use of information technology. Specifically, a certain degree of centralization and formalization – if they do not overly restrict flexibility – can help organizations share information with other agencies by setting organizational goals or providing guidance to achieve the goals. This research also highlights critical roles of human resource management, a strategic plan, and contracting out of public service delivery for better outcomes – in determining the activities and the levels of government with which to share information. In addition, the results imply that information sharing can be an initial step for organizations to seek further collaboration.

Taken together, this research found that these policy, technological, and organizational characteristics jointly determine local government agencies' information sharing. As the United States government has strived to promote information sharing among agencies across sectors to improve policymaking, this study can contribute to identifying the determinants of information sharing and understanding how the federal government can help local and state governments prepare guidelines and secure needed resources to actively share information.

INDEX WORDS: Information sharing, Health Information Technology, Local health departments, Health Information Technology for Clinical and Economic Health (HITECH) provision, Information Technology, Organizational Characteristics

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DEDICATION

This dissertation is dedicated to my parents and my aunt, Haeyoung Kim. I could never have achieved this without your support, constant encouragement, and love. Thank you for teaching me to believe in myself and in my dreams. Thank you very much for being there whenever I need you. You mean the world to me. I am sincerely grateful to have you in my life as my parents and my aunt.

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CHAPTER 1

INTRODUCTION

Research Background

After the 9/11 attacks, the U.S. federal government realized the need for fostering information sharing among government agencies to promote intelligence products created by different units. More specifically, the government aimed to build a network of federal, state, local, and foreign governments, and the private sector; and to transform agency cultures into those that willingly and regularly share information (White House, 2007). More recently, Hurricane Katrina helped us recognize that developing a network of local governments, schools, and agencies across sectors is critical for responding to the immediate needs of the public. Similarly, to accelerate building a nationwide network among public organizations, the U.S. government is now moving toward "meaningful use" of health information and data with the Health Information Technology for Clinical and Economic Health (HITECH) provision of the American Recovery and Reinvestment Act of 2009 (ARRA). For example, with the increasing need to monitor the spread of communicable diseases, such as Ebola in 2014, a health network that utilizes the advancing information technology would greatly facilitate vital information sharing.

Health information technology (HIT)[1], a rapidly growing area in health care, has great potential for information sharing. This potential has been elevated by major reformative

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[1] Examples of HIT include electronic health records (EHRs), health information exchange (HIE), mobile health technologies, social media, electronic surveillance systems, and geographic information systems (GIS).

legislative efforts to enable the government to construct and support the development of HIT. The first step was the establishment of the Office of the National Coordinator for Health Information Technology (ONC) authorized through an Executive Order[2] in 2004 and later legislatively mandated in the Health Information Technology for Clinical and Economic Health (HITECH) provision that supported policy coordination, strategic planning for the adoption of HIT and health information sharing, establishing governance for the Nationwide Health Information Network (NwHIN) and, above all, promoting a national HIT infrastructure. Under the HITECH provision of the American Recovery and Reinvestment Act (ARRA) and the Affordable Care Act (ACA), the Department of Health and Human Services (HHS) and the ONC have initiated further steps to facilitate the health information sharing among health care stakeholders, including physicians, hospitals, laboratories, and pharmacies. This exchange is necessary to lower costs, to integrate the current health care systems, and ultimately to provide better health services to Americans.

Impact of Legislative, Technological, and Organizational Factors on Information Sharing

Legislation influences innovation in organizations. Legislative and policy changes promote interorganizational information sharing by providing legal standards for security and confidentiality of shared information (Gil-Garcia & Pardo, 2005; Yang & Maxwell, 2011). In terms of expanding health information technology (HIT) networks, which refers to an automated and networked system to share health-related data such as patient health history, payment information, and changes in policies among healthcare providers, the HITECH provision mandates the development of a nationwide infrastructure for health information exchange that

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[2] Executive Order 13335 of April 27, 2004, Incentives for the Use of Health Information Technology and Establishing the Position of the National Health Information Technology Coordinator.

"ensures that each patient's health information is secure and protected, in accordance with applicable law" (Title XXX, Subtitle A, §3001). The regulations require organizations to develop a culture of openness, accountability, and trust inside agencies as well as with participants across organizations while protecting the privacy of the patient's information. Furthermore, the legislation provides funding to develop infrastructure for information sharing. For example, the HITECH provision authorizes the U.S. Department of Health and Human Services to spend $25.9 billion to promote the adoption and the utilization of HIT networks. Public organizations funded by government are subject to governmental controls such as the HITECH provision, which can encourage interorganizational information sharing (Rainey, 2014).

In addition, organizations can increase their capabilities to process and disseminate acquired information through the rapid development of information technology. The advances in such technology greatly facilitate collecting and analyzing massive data ("big data") and contribute to increased information-sharing activities. Technological advancement even changes the role of individuals and organizations as information producers, processors, and consumers, and emphasizes the importance of appropriate management to ensure security and interoperability in dealing with a huge amount of data. As the use of mobile technology equipment helps enhance organizations' capabilities to handle a massive amount of health data, the use of social network services (SNS) facilitates a culture in which information senders and receivers communicate more easily and faster with user-friendly access to needed information. Heintze and Bretschneider (2000) found that organizations can improve the ease of communication and technical decision making by utilizing more information technology tools.

Organizations strive to make well-designed policy. Policymaking is a process of finding an optimal solution, which requires precise interpretation of information from many different

sources. In public health, local health departments (LHDs) play a critical role in implementing policies and programs which could be carried out differently depending on the public health agencies' strategies on information utilization (Brewer, 2005; Feldman, 1989; Keiser, 2010; May & Winter, 2009; Wood & Vedlitz, 2007). For that reason, organizations make serious efforts, such as searching behavior, creating, disseminating, sharing information, and investing in information, to enhance decision making (Feldman & March, 1981). In this manner, it makes sense why a wide range of policies inform actions for local public health agencies that practice strategic management for obtaining and sharing health-related information, and improving health care service through coordinating with nonprofit organizations and research centers, building governance with the state government, and advocating health policies.

Information plays a key role in each stage of the policymaking process. Decision makers strive to find quality information to choose the most appropriate solution among possible alternatives that "maximize the likelihood of achieving the goals and preferences" (Allison, 1971; Lindblom, 1959; Feldman, 1989, p.16). However, as the bounded rationality theory supposes, the limits in human cognition and complexity in the environment cause high information costs in searching for quality information, which is precise, timely, and suitable. Unfortunately, the degree of uncertainty and ambiguity is more likely to be intensified when a new policy is just introduced due to a high level of uncertainty and insufficient information about a new circumstance.

In such tentative and ambiguous conditions, the "windowing process" (Lazer & Binz-Scharf, 2007) of seeing others' practice and acquiring knowledge from implementation success and failure help reduce redundant potential alternatives to a few refined options. An individual public manager obtains information through interactions and contact with colleagues to ask or

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give knowledge, advice, and referrals on new policies. Individuals and small groups at large integrate, codify, and routinize such information they collect for their organization. Organizations, as human social constructs, also exist and interact within social environments, and are rationally intended; they evaluate values and beliefs, and seek, process, and use information to solve problems as they strive to achieve missions, goals, and outcomes (Rainey, 2014). At the organizational level, therefore, information sharing provides learning opportunities for new insights into the problems and access to information. Furthermore, organizations can reduce transaction costs and uncertainties in the policy process by sharing information about other agencies' success and failure in policymaking and implementation. For example, the Social Security Administration was able to increase consistency in disability decision making by even simple information sharing among units, thereby enhancing the delivery of public service (U.S. General Accounting Office, 2004).

Organizations, however, often experience political and cultural resistance against new technology or policy such as the HIT adoption since policy is not always made with well-defined goals, clear guidelines, and preferences (Cyert & March, 1963; Feldman, 1989; Jones, 1999). Sometimes even conflicting and multi-valued goals are set (Rittel & Webber, 1973; Weber & Khademian, 2008), or external and internal factors such as politics, budgeting, and complexity are intertwined (Kettl, 1993b). In such situations, it is helpful for organizations to have informational networks, which are considered "the architecture for systemic search" for the best options, to obtain information, advice, and opportunities to observe others' practices (Lazer & Binz-Scharf, 2007, p. 264). Such networks help decision-makers as well as organizations narrow down redundant alternatives to a few refined options to benchmark. Information sharing allows organizations to obtain needed information, to redesign information flow, and to diffuse quality

information. By doing so, organizations can reduce transaction costs and uncertainties in decision making, which is one of the great benefits of information sharing.

Local health agencies consider multijurisdictional and multidisciplinary networking for the exchange of health-related and situational awareness data, such as information on emergencies, disease outbreaks, or policy changes, among the different levels of government so that they can provide more effective and cost-efficient healthcare services to the public (CDC, 2011; Provan, Huang, & Milward, 2009). When implementing HIT networks, LHDs can take advantage of lowering costs of forming and maintaining networks to obtain and share health-related information to improve the delivery of care (Chow & Chan, 2008; Dawes, 1996; Gil-Garcia & Pardo, 2005; Kim & Lee, 2006; Landsbergen & Wolken, 2001; Pardo, Gil-Garcia, & Burke, 2008). Walker and his colleagues (2005) projected that a net value of HIT information sharing among healthcare providers, LHDs, laboratories, pharmacies, and payers could be $77.8 billion per year once nationwide standardized HIT networks are implemented (Walker et al., 2005). Therefore, building and facilitating such information sharing networks would benefit public organizations in connecting with others across sectors, geographic boundaries, and levels of governments for precise policymaking.

Brief Review of Information Sharing in Public Administration

In spite of its importance in policymaking, information sharing has been less highlighted in the field of public administration. Research on information sharing has been widely conducted in business administration and management information systems (MIS), for example, to improve efficiency of chain supply (Sahin & Robinson, 2002), knowledge management (Abrahamson & Goodman-Delahunty, 2014; Bock, Zmud, Kim, & Lee, 2005; Davenport & Prusak, 1998), and

communication (Chow & Chan, 2008). In public administration, information sharing has been discussed as an initial step of networking or a precondition of successful collaboration (i.e. Dawes, 1996; Thompson & Perry, 2006). Also, scholars seem to agree on the need for encouraging information sharing across sectors to enhance the performance of government programs (Bock, Zmud, Kim, & Lee, 2005; Hale, 2011; Landsbergen & Wolken, 2001; Tsai, 2001). Thus, it is worthwhile not only to explore the impacts of information sharing on organizational performance but also to assess the determinants of interorganizational information sharing, theoretically and empirically.

According to Constant, Kiesler, and Sproull (1994), information-sharing behavior is an action demonstrating the willingness to share the product (tangible information), expertise, and/or values (intangible information) with others[3]. It also reflects a desire to improve decision making through the management of information and technologies regarding the use and processing of information. In this light, therefore, information sharing differs from knowledge sharing, which is an activity of sharing acquired understanding from one's own perception, discovering, or learning.

Nonetheless, it seems that a consensus on the terminology of information sharing has not yet been reached, as even scholars have different interpretations. Scholars arbitrarily refer to information sharing as knowledge sharing (i.e., Abrahamson & Goodman-Delahunty, 2014; Chow & Chan, 2008; Dawes, Cresswell, & Pardo, 2009; Kim & Lee, 2006; Park, Dulambazar, & Rho, 2015; Soule & Applegate, 2005), information exchange (i.e., Leifeld & Schneider, 2012),

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[3] Information is not simply knowledge. While knowledge is defined as facts, understanding, awareness, and skills acquired through experience or education, information is characterized as facts that are codified, interpreted, and combined with value and usefulness. Two types of information exist: tangible information is identified as general information obtainable from a documented "product" including computer programs, records, and written manuscripts; intangible information is referred to as "expertise" information embodied as competence, skills, experience, and knowledge such as a specialty in computer programming (Constant, Kiesler, & Sproull, 1994).

information sharing (i.e., Dawes, 1996; Hatala & Lutta, 2009; Gil-Garcia, Chun, & Janssen, 2009; Landsbergen & Wolken, 2001; Pardo, Gil-Garcia, & Burke, 2008), and knowledge transfer (i.e., Szulanski, 2000; Tsai, 2001). Carefully defined terminology of information sharing helps scholars and practitioners understand and communicate clearly.

Although most information sharing research has found benefits or barriers of information sharing, public administration scholars have, in fact, been focusing on individuals' information-sharing activities. Prior research measured information sharing at the individual level by asking participants about their willingness to share information with others, their attitude toward sharing information, and their intention to exchange information (i.e., Abrahamson & Goodman-Delahunty, 2014; Bock et al., 2005; Chow & Chan, 2008; Kim & Lee, 2006; Park, Dulambazar, & Rho, 2015). However, as organizations are a major body of decision-making, it is important to examine information sharing at the organizational level. Given that governments are charged with addressing social problems, making policies, and providing quality services to the public, a range of information sharing at government agencies, in this research, includes activities to collate, process, and disseminate information from various perspectives with different levels of government. Thus, this study proposes measures of information sharing at the organizational level, which consist of a variety of information-sharing activities and the levels of government to share information.

The U.S. government has continuously modernized technical infrastructure with the most advanced information and communication technology devices to share information among the levels of governments and across sectors. However, as the House of Representatives pointed out, even though "the federal government is the largest purchaser of information technology in the world," the U.S. is "woefully incapable of storing, moving, and accessing information" (U.S.

House of Representatives, 2006, p.1). This implies that securing IT tools is not enough to incentivize government agencies to share information effectively. The study assumes that not only acquiring technological infrastructure but other factors such as legislative and internal organizational dimensions influence organizations' information-sharing activities. By examining multiple factors, the research aims to help organizations understand the determinants and prepare for effective information sharing.

Although the information sharing research conducted in public administration is valuable, several questions remain when it comes to exploring the impact of interorganizational information sharing on public policymaking and linking information sharing to various outcomes at the organizational level. For example, it has not been evidently explained what factors influence interorganizational information sharing, how information sharing encourages organizations to develop their relationships with other entities to collaborate, and how organizations strategically foster a culture of sharing information. With this in mind, this study examines the relationship among the policy, the advanced technology, and the organizational features and strategy for information utilization in the policymaking process.

Research Questions

The research has begun to explore what external and internal aspects of local public health departments have determined whether they reach the goals of managing and sharing health-related information. In other words, this study contributes to the research by addressing the question of what features affect some public health departments to actively share information with other agencies and stakeholders when they make policies and/ or implement programs, while others do not. Thus, this dissertation is guided by the following research questions: How

do the legislation of ARRA, the advancement of technology, and organizational characteristics

promote information sharing among local health departments and other agencies? More

specifically, the research assumes that the local health department that is more likely to share

information with other agencies is one that uses more HIT tools to comply with the ARRA and

that practically utilizes mobile technology equipment and social network services. In terms of

organizational characteristics, the study proposes that centralization and formalization are

negatively related to increasing information-sharing activities, while having information officers,

a strategic plan, and the ratio of contracted-out healthcare services are positively associated. By

addressing these research questions, the study aims to identify the determinants of networking

and information sharing in public organizations. Figure 1.1 below illustrates the conceptual

framework of the research.

Dissertation Structure and Outline

This study explores the determinants of information sharing at local public health

departments in the U.S. The dissertation takes three different perspectives of policy,

technological, and organizational approaches to examine how each factor influences health

information exchanges. The next chapter explains what information sharing is and why it is

important in the process of policymaking. Also, it provides an explanation of what health

information technology (HIT) systems are and in which context the HITECH policy was made.

The third chapter aims to create a baseline understanding of three major factors influencing

information sharing – policy, technology, and organizational perspectives. This chapter explores

how information-sharing behaviors of public health departments have changed with the passage

of the ARRA in 2009 and with the advancing technology. The study also describes how

organizational characteristics shape information sharing in terms of organizational structure, human resources, strategic planning, and service delivery options (contracted out and provided directly). The fourth chapter concerns measures of main variables, data, and methods of multivariate probit model. The unit of analysis in the study is local health departments, and all variables are examined at the organizational level. In chapters five and six, taking the three perspectives together, based on the analysis results, the dissertation discusses how information sharing in local health departments would be explained by the advancement of technology, the legislation, and internal organizational characteristics, as the frames of the research. This paper concludes with chapter seven, which discusses the main research findings, limitations of the study, and implications for future research. This study would contribute to refining theories of bounded rationality, organizations, and innovation in information sharing with empirical analyses and results. Ultimately, this research aims to help public managers and policymakers understand interorganizational information sharing as a key resource for innovation in HIT so that they can apply this knowledge in practice.
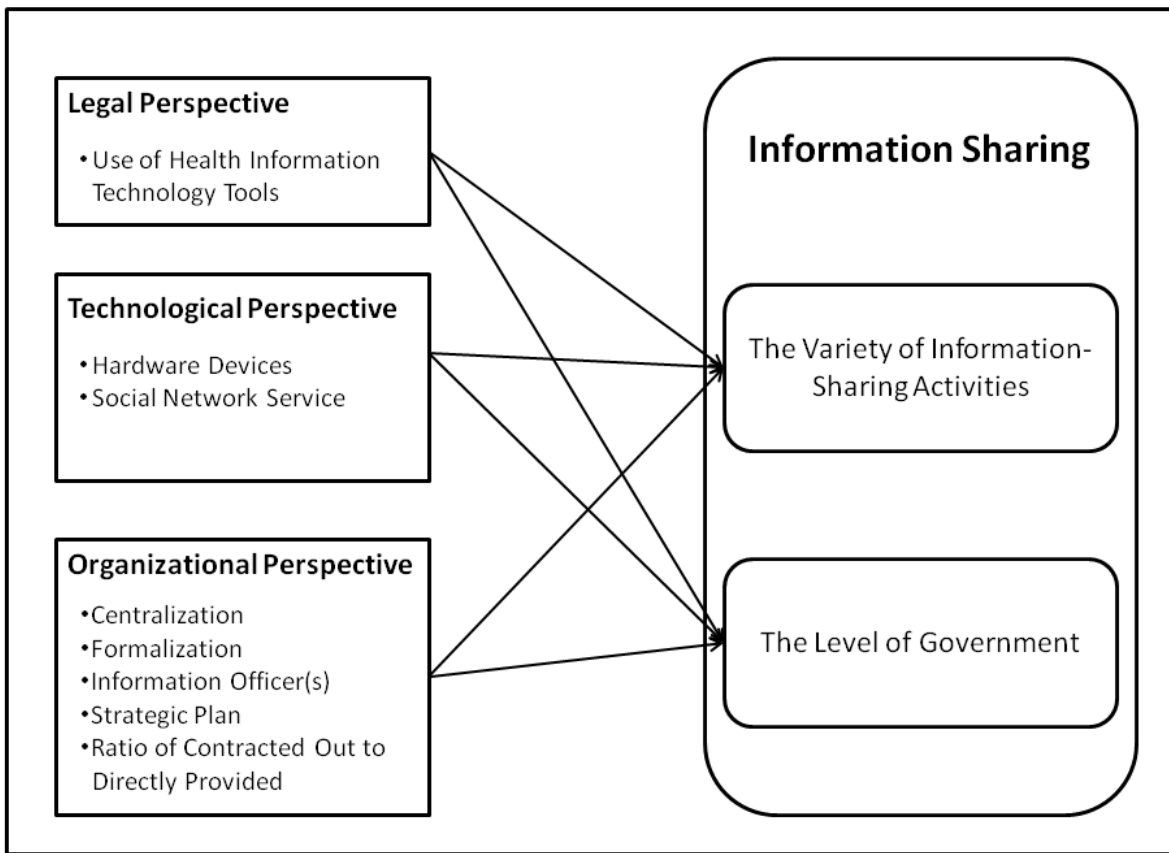
Figure 1.1

Conceptual Framework

Table 1.1

Summary of Previous Studies on Information Sharing

Study	Dependent Variable(s)	Independent Variables	Unit of Analysis	Data and Sample Size
Abrahamson & Goodman-Delahunty (2014)	Information sharing in policing	Process and technology, workload, leadership, individual/organizational unwillingness, physical location, and risk management	Agency	134 officers in three Canadian police organizations
Bock et al. (2005)	Intention to share knowledge	Attitude toward knowledge sharing, subjective norm, and organizational climate	Individual	154 employees from 27 organizations
Chow & Chan (2008)	Intention to share knowledge	Social network, social trust, shared goals, attitude toward knowledge sharing, and subjective norm about knowledge sharing	Individual	190 managers from 136 companies
Dawes (1996)	Exchanging or otherwise giving other executive agencies access to program information	Usefulness of information sharing for problem solving, benefits and problems sharing creates for the involved agencies	Agency	254 New York State government managers in 53 agencies
Dawes, Cresswell, & Pardo (2009)	Public sector knowledge networks as information systems	Challenges in information sharing – the nature of knowledge and the complexities of the boundaries	Individual	Public managers in the State of New York
Hatala & Lutta (2009)	Information sharing frequency	Interventions to increase information sharing	Individual	70 employees from a midsized engineering consulting firm in Canada

Kim & Lee (2006)	Knowledge sharing capabilities	Organizational Culture, organizational structure, and information technology	Individual	322 employees from five public-sector and five private-sector organizations in South Korea
Leifeld & Schneider (2012)	Political and technical Information exchange	policy committees, communication channels, third parties, perceived influence, governmental access, and interest group homophily	Individual	30 actors from 39 organizations in German
Pardo, Gil-Garcia, & Burke (2008)	Cross-boundary information sharing	Establishing clarity of role and responsibility, trust building, respecting for the autonomy of participating organization, exercise of authority	Agency	Public managers and other actors in the State of New York
Park, Dulambazar, & Rho (2015)	Knowledge sharing and performance	Strategy, leadership, reward, trust, and personal network	Individual	220 Mongolian public officers
Soule & Applegate (2005)	Types of Knowledge Sharing Practices – contribution, coaching, and collaboration	Dimensions of Knowledge, dimensions of interaction, and learning outcomes	Individual	Employees in a multinational manufacturing company
Tsai (2001)	Innovation and performance	Absorptive capacity and network position	(Work) Unit	120 employees in 60 units from two large business firms
Williams et al. (2009)	Inter-agency collaborations	Governor's power, state expenditure, state police FTE, the number of violent crime, and population	Agency	Public Safety Networks across 50 states in the U.S.
Williem & Buelens (2007)	Knowledge-sharing intensity, Effectiveness of knowledge sharing	Organizational structure, incentives, trust, power games, and coordination	Individual	358 Belgian public sector officers

CHAPTER 2

THEORY OF BOUNDED RATIONALITY AND INFORMATION SHARING

A major premise underlying this study is that acquiring accurate and quality information is key in decision making and, therefore, information sharing can help policymakers obtain such information and enhance policymaking. As the bounded rationality theory supposes, due to limited human cognition abilities it is difficult to find the best possible alternatives to consider before making a decision. Also, because of the complexity embedded in the environment, it is impossible to calculate and foresee ambiguity and uncertainty. For that reason, information sharing, which enables decision-makers and organizations to be competitive with acquired quality information, is necessary to improve policymaking.

In this chapter, applying the bounded rationality theory, this study explores why information sharing is needed and how sharing information from others' past experiences is beneficial to organizations as well as decision-makers to reduce transaction costs and to lower uncertainty.

Theory of Bounded Rationality and Information Sharing

Even though numerous theories compete to explain the policymaking process and to identify some critical factors affecting decision making, this study is rooted in the bounded rationality assumptions. In 1947 Herbert A. Simon originally argued that decision making, in reality, cannot reach "optimal choices," as traditional rational choice theories such as Down's *An Economic Theory of Democracy* suppose, mainly because of two constraints: the limited human

cognition ability and the complex nature of the environment. Limitations in human cognitive ability in searching, storing, integrating, retrieving, and transmitting information impede people in calculating costs for collecting and processing information about optimal alternatives as well as the utility functions, especially when having multi-valued utility function with varying weights (Odell, 2002). According to the notion of bounded rationality, therefore, agents with limited information settle for "satisficing" choices and cease searching to increase utility.

Another constraint in decision making is the complex environment in which policy makers and organizations interact. The theory supposes the uncertainty of likely outcomes and ambiguity that comes from multiple meanings (March, 1994) and relatively unclear importance (Jones, 1999). While the rational choice models assert that a desired consequence could be reached by maximizing the probability of reaching the optimal solution, bounded rationality presumes that preferences for the best possible solutions could be ambiguous or that sometimes it is almost impossible to identify and to calculate the desired preferences. In addition, information costs in analyzing trade-offs between the uncertainty of the risks and maximized utility obstruct policy makers from accomplishing the rational choices. For these reasons, in most cases, the search for alternatives is incomplete (Simon, 1947) since the rationality is "intended but not always achieved" (Jones, 1999, p.302). Therefore, the search for optimal alternatives is usually ceased at the satisficing point.

When a new policy or program is made and first introduced to the public, that circumstance is filled with a high level of uncertainty and ambiguity in the probable consequences of that policy. Such uncertainty inherent in a newly made program includes unknown or unpredictable policy outcomes, increases in costs, and potential impacts on organizational systems, structures, and processes. For example, with regard to the policy of EHR

systems, which was newly introduced to health care providers as well as all the public health departments, it is impossible for public health government agencies to calculate exact costs in developing the nationwide system and its benefits in monetary value. On the other hand, policy making is not always done with well-defined goals, clear guidelines, and preferences (Cyert & March, 1963; Feldman, 1989; Jones, 1999); sometimes even conflicting and multi-valued goals are set (Rittel & Webber, 1973) and, consequently, ambiguity is indeed embedded in a policy. To reduce such uncertainty and ambiguity in decision making, public managers seek information for a better understanding of the policy goals in order to successfully implement the policy. However, scholars assert that information helps reduce the uncertainty of unpredictable policy consequences, but not the ambiguity originating from complexity (Feldman, 1989; Wilson, 1989; Zahariadis, 2007). In such situations, organizations can develop strategies such as gathering more information and expanding their information base for decision making (Feldman & March, 1981; Kasperson, 2008).

Indeed, organizations are rational decision-making systems in that they process information to cope with uncertainty (Cyert & March, 1963). In other words, the way an organization searches, collects, and processes information demonstrates how it makes decisions. Nonetheless, the implications of the individual members' bounded rationality for organizations are that organizations need to tactically vary information-processing activities to elaborate feasible alternatives to adjust to environmental changes. Galbraith (1973, 1977) claims that organizations can reduce or avoid uncertainty in two ways – the first strategy is to reduce the amount of information to process and the other approach is to increase information-processing capacity. By creating slack resources such as increasing budget and delaying task schedule, organizations can cut down on the amount of and needs for information (Galbraith, 1973).

However, while an individual's information processing in making decisions tends to be simplified and experiential, information processing in organizations is likely to be systematized, complex, and incremental as the amount of information to handle increases (Keen, 1981). Therefore, in these modern times, organizations tend to increase information-processing capacity in the forms of purchasing information technology equipment, expanding communication channels, integrating work units and departments, and redesigning organizational structure (Galbraith, 1973).

An organization consists of cooperative coalitions among groups of members to promote their common interests (Cyert & March, 1963). Considering that organizations exist to achieve organizational goals, coalitions in organizations are sometimes systemically coordinated and altered for the organization's own interests. Galbraith (1973) proposes investment in vertical information systems and creation of lateral relations in organizations to handle unexpected or unplanned exceptions in routine: for example, creating a new role for coordinating internal units and departments, or even external stakeholders, helps an organization have an integrated information process and a smooth flow of information among participants. Taking the example of chief information officer (CIO), the position is designated to oversee information technology system quality assessment and improvement as well as to make decisions in regards to information technology investment. By creating a CIO position, organizations can have more coordination modes in processing information and decisions in hierarchy of authority and lateral linkages. In a similar way, organizations reorganize structural designs by centralizing or decentralizing authority relations for decision making, depending on information processing (Mintberg, 1979). Therefore, organizations can reduce uncertainty and respond to information-processing demands through changing organization design – better planning and coordination,

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often by rules, hierarchy, goals, cooperation and contracting with other organizations (Galbraith, 1973; Kates & Galbraith, 2007; Mintberg, 1979; Rainey, 2014).

Another implication of the individual's bounded rationality for organizations is that organizations can reduce uncertainty from surroundings by expanding investment in information technology systems and fostering information networks. Adoption of a new technology system requires simultaneous shifts of interrelationships among tasks, people, and organizational structure, and even changes in decision process (Leavitt, 1965; Lucas & Baroudi, 1994; Simon, 1997). The use of health information technology tools such as EHR systems at local health departments, at first, call for extensive training for healthcare practitioners to understand the operation and acquire certified programs. Patterns of decision making are also influenced by the adoption of new technology because it changes communication channels into more transparent and accessible ones. For example, local health departments can make health policies for a community based on health data collected by the EHR systems, which patients, clinics, and practitioners enable to exchange health-related information. By accumulating and analyzing data with the use of information technology, organizations can reduce a certain part of task uncertainty and improve decision making.

As a way of information-processing activities, the "windowing process" of seeing others' practice and acquiring knowledge through implementation success or failure reduces redundant potential alternatives to a few refined options (Lazer & Binz-Scharf, 2007). Information sharing allows organizations to obtain needed information, to redesign information flow, and to diffuse quality information. Organizations often experience political and cultural resistance against new technology or policy such as the EHR systems. However, information from others who have already gone through trial and error with a new procedure can relieve such barriers to help

manage the new challenge. By doing so, organizations can reduce transaction costs and uncertainties in decision making, which is one of the great benefits of information sharing. For example, a study by the U.S. General Accounting Office (2004) found that even simple information sharing increases consistency in disability decision making among units in the Social Security Administration. Accordingly, information sharing contributes to enhancing the delivery of public services.

Increasing efficiency in providing public services requires a strong commitment by all levels of governments. Even though Weber (1997) argued that efficiency can be achieved by controls through hierarchical organizational structures, challenges in modern health care systems call for governments to deal with multijurisdictional and multiprogrammatic approaches emphasizing horizontal links among organizations. The advancing information technology shapes the information flow as well as the channel of public services, considerably differing from the traditional public administration approach of transferring information in the top-down chain of command. For example, the EHR systems may increase efficiency in health information exchanges among the public and the private health-related agencies with the support of information technology and network management. Meeting the goal of collaborative governance in EHR implementation, however, presents challenges for local health departments due to their limited resources and inability to make long-term plans. Considering networks as "the architecture for systemic search" for the finest options, building and facilitating networks would greatly benefit public organizations in obtaining information, advice, and opportunities to observe others' practices (Lazer & Binz-Scharf, 2007, p. 264). In fact, information sharing is one of the practical ways to network with others across sectors, geographic boundaries, and levels of governments.

Furthermore, Lomas (1997) described how information sharing can contribute to resolving difficulties in communication among healthcare providers, researchers, and policymakers and, to this end, how such increased interaction can improve public policy outcomes. Decision-makers, health service providers, and researchers often experience conflict in communication or difficulties in reaching consensus because their priorities are different. For example, policymakers prefer real solutions that respond to policy priorities to research findings while researchers and healthcare practitioners expect to discover practical applications, rather than research results that are fabricated for politics. However, consistent information sharing among policymakers, researchers, and healthcare providers increases understanding different roles and expectations of decision making, and finds consent for evidence-based practice and policymaking.

Definitions of Information Sharing

In the view of bounded rationality, information is a critical factor that affects searching for and choosing solutions. Information provides an indication not only for preferences of the most favored alternatives for a collective decision, but also for the most maximized utility from the potential alternatives. Information plays different roles in policymaking models such as "feedback" depending on the stage in which an organization is involved in the incremental models (Feldman, 1989) or as "issue interpretation" of what issues catch the decision maker's attention in the garbage can model (Feldman, 1989; Zahariadis, 2007).

Information, Knowledge, and Data

Information is not simply data or knowledge. While data is "structured records of transactions" without relevance or purpose of delivery, knowledge is defined as facts, know-how, understanding, awareness, and skills acquired through experience or education, which reflects one's value, judgment, and beliefs (Davenport & Prusak, 1998; Wang & Noe, 2010). Logically, knowledge contains an individual's arbitrary interpretation mixed from one's own unique experiences and value. Information is characterized as facts that are codified, interpreted, and combined with value and usefulness (Davenport & Prusak, 1998). Two types of information exist: Tangible information is identified as general information obtainable from a documented "product" including computer programs, records, and written manuscripts; intangible information is referred to as "expertise" information embodied as competence, skills, experience, and knowledge such as a specialty in computer programming (Constant, Kiesler, & Sproull, 1994). Therefore, an action of sharing information means not only simply transferring data, but also deliberately conveying expertise in a certain area and tactics to solve problems. Information, as defined for this research, includes health-related data, protocols for health care service such as prevention, and evidence-based research results (i.e., identifying health hazards).

Scholars have explained that the reason why people share information with others in terms of interdependence and reciprocity is that helping each other with shared information or knowledge would contribute to reaching desired goals (Bock, Zmud, Kim, & Lee, 2005; Constant, Kiesler, & Sproull, 1994; Tsai, 2002). The purposes of sharing information vary depending on the relationships between information givers and receivers; however, generally, these include 1) for educating or enlightening, 2) for communicating mutual contents or understanding, 3) for collaborating, and 4) for discovering (Davenport & Prusak, 1998; Marshall

& Bly, 2004). Information sharing occurs at interpersonal, intra-organizational, and inter-organizational levels.

Elements of Information Sharing

The elements of information sharing are participants (senders and receivers), contents (information), and activities to deliver information (channels). The information-sharing process begins with senders and ends with receivers. The participants, both senders and receivers, in interorganizational information sharing are groups and organizations. The receivers are target audiences who the senders aim to transport information. The contents of information sharing include the senders' experience, perception, knowledge, facts, and skills that senders encode to process such information. Information sharing encompasses a broad scope of activities presented as writing (e.g., research publications, technical reports, newsletters, emails, advisories, and policy briefs) and speaking (e.g., lectures conferences, meetings, conversation, presentations, workshops, and testimony). These activities mainly occur electronically, in print, or face-to-face (Burnett & Dollar, 1989; Gaál, Szabó, & Csepregi, 2015).

Taken together, this research defines information sharing as an interactive behavior, which can be processed voluntarily or by the formal agreement, to exchange information with other organizations to reach desired goals. It should be noted that this study uses *interorganizational information sharing* and *organizational information sharing* interchangeably to refer to information sharing which occurs between different organizations. Also, in this study, the terms *information sharing* and *information-sharing activities* are used interchangeably.

Figure 2.1 displays the element of information sharing as well the flow of how information is delivered through channel.
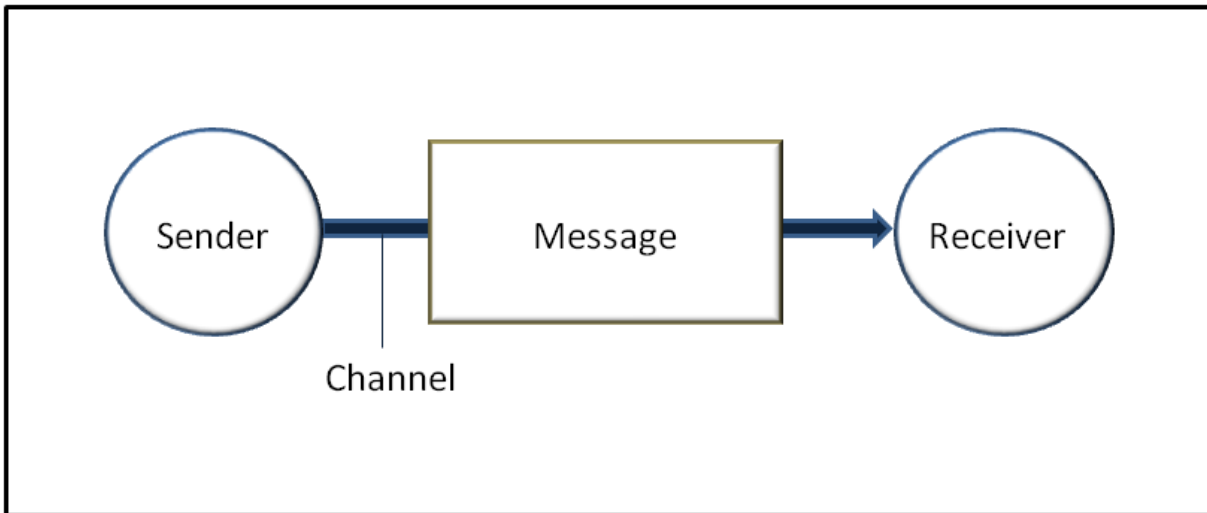
Figure 2.1

Element of Information Sharing

Knowledge Sharing, Knowledge Transfer, and Knowledge Exchange

Scholars tend to use the term *information sharing* synonymously with *knowledge sharing*, *knowledge transfer*, and *knowledge exchange* (i.e. Bock, Zmud, Kim, & Lee, 2005; Kim & Lee, 2006; Lee & Rao, 2007; Pardo, Cresswell, Thompson, & Zhang, 2006; Park, Dulambazar, & Rho, 2015; Tsai, 2001). Nonetheless, as obvious differences exist between information and knowledge, information sharing and knowledge sharing need to be distinguished. Pauline and Suneson (2012) claimed that knowledge cannot be sharable or transferable because knowledge should be understood in a context, combining the receiver's own unique interpretation which is based on his or her experiences, values, and beliefs. In knowledge sharing, therefore, the focus is not on knowledge, but rather the interaction between the sender and the receiver. Knowledge transfer is a rather limited activity, which usually occurs across work units or within the organization to deliver knowledge about implementation policies or procedures (Pauline &

Suneson, 2012). In other words, knowledge transfer focuses on the transmission of knowledge

between different units, divisions, or departments in an organization rather than individuals

(Wang & Noe, 2010). Lastly, knowledge exchange is a broader concept, which includes both

knowledge sharing and knowledge seeking to organize, create, and distribute knowledge

(Davenport & Prusak, 1998; Wang & Noe, 2010).

Benefits and Barriers of Information Sharing

Information sharing is a major source to obtain different types of information including

others' experiences, best practices, and politics, which can help organizations define and solve

problems to act in response to uncertainty and complexity in the environment. By sharing

information with external agencies, organizations can develop collaborative relationships,

increase productivity, improve policymaking, and integrate public services (Dawes, 1996).

Although it is obvious that information sharing contributes to enhancing organizational

performance and policymaking, sometimes organizations confront difficulties and barriers to

initiate or keep interorganizational information sharing. Therefore, it is necessary to identify the

benefits and barriers of information sharing to promote further information sharing and to

resolve impediments.

Benefits

Dawes (1996) suggested a framework for evaluating benefits and barriers of information

sharing, by categorizing technological, organizational, and political aspects. Technical

advantages that information sharing provides include efficient data management and

development of information structure. From the organizational viewpoint, sharing information

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not only provides comprehensive and accurate information for problem solutions but also reduces the information burden of searching and reprocessing duplicate information. In other words, information sharing allows saving time and costs for searching for the needed information, a shorter path in trade-off, thereby improving the public service delivery.

In the process of policymaking, information sharing helps organizations take joint action to address specific needs or solve a policy problem by consolidating information about certain topics (Dawes, Cresswell, & Pardo, 2009). Sharing more complete and comprehensible information, organizations can build trusted relationships with partner agencies (Leifeld & Schneider, 2012). Also, when public organizations share information about programs and services with other agencies and the public, they strive to be more accountable for their policymaking.

In conclusion, sharing information helps agencies build comprehensive capacity to manage information contents and IT infrastructure (Dawes, 1996). As organizations acquire more experience in information sharing, managerial skills to share information and to facilitate integrated functions for improving public service delivery can be honed and advanced (Dawes, Cresswell, & Pardo, 2009). Accordingly, public organizations that share information through streamlined IT infrastructure can reduce costs, save resources, and increase efficiency, which in turn will enhance the accountability of organizations that participate in public service delivery. In the long term, sharing information promotes organizational innovation (Landsbergen & Wolken, 2001; Powell, Koput, & Smith-Doerr, 1996).

Barriers

Technological barriers, which impede a free flow of information, fundamentally come from lack of budget for up-to-date IT purchase (Dawes, 1996; Dawes, Cresswell, & Pardo, 2009; Heintze & Bretschneider, 2000; Lee & Rao, 2007; Pandey, & Bretschneider, 1997). Since each organization has different standards in managing IT equipment, it is essential to ensure interoperability of IT systems, software, and networks for successful interorganizational information sharing. Furthermore, with regard to data management, differences in data definition and forms, information security, privacy, and confidentiality hinder the flow of information. To resolve the issues of technical barriers, public organizations need political and legislative support to expand the budget for compatible IT systems as well as communication among participants in information sharing to ensure consistency in data management and to integrate information systems.

Organizational barriers are rooted in differences in organizational structures and culture. Organizational cooperation or coordination such as information sharing can be complicated since each organization has its own value, culture, leadership, and systems. Moreover, organizations have their own self-interest, which means they pursue benefits. Organizations may hesitate to participate in information sharing because the benefits of cooperation are often indirect and hard to calculate in accurate value (Dawes, 1996). Reasonably, organizations may not engage in sharing information with other agencies without expectation that they will obtain mutual benefits such as improving good reputation from the public or expanding their influence over other organization. Therefore, successful information sharing can be fostered by developing trust

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among partners and a culture of flexibility and openness (Gil-Garcia, Pardo, & Burke, 2010; Landsbergen & Wolken, 2001; Li & Lin, 2006; Yang & Maxwell, 2011).

Political barriers are a central challenge in fostering information sharing, especially for organizations in the public sector. Public agencies tend to resist interorganizational information sharing because they perceive information as a source of power and expertise as well as a symbol of authority to make decisions (Dawes, 1996). In addition, because policy and legislation determine budget and resource allocation for organizations, without such political support, public organizations may have difficulties in facilitating interorganizational information sharing.

On the other hand, political authority and legislative support can foster information sharing by setting program and service coordination, establishing relationship building among agencies, and promoting trust development. Therefore, for interorganizational information sharing to continue, policy and legislation must provide funding and legal support so that public organizations set information sharing as a priority to improve policymaking with shared information.

Scholars have pointed out that technology is necessary for convenience in sharing but it cannot be a sufficient condition for successful information sharing (Dawes, Cresswell, & Pardo, 2009; Landsbergen & Wolken, 2001). However, organizational and political barriers negatively influence interorganizational information sharing because those aspects obstruct instilling a culture of openness among partners, overcoming risk-averse practices of public organizations, and securing funding and resources.

Table 2.1

Benefits and Barriers of Interorganizational Information Sharing

Category	Benefits	Barriers
Technological	• Increasing efficiency in data management • Development of information infrastructure	• Lack of budget for IT purchase • Interoperability of IT systems • Differences in rules for data management • Incompatible IT infrastructure
Organizational	• Reducing information burden • Improving the public service delivery • Promote organizational innovation	• Risk-averse practice • Conflicting organizational self-interests • Not fostered a culture of flexibility and openness
Political	• Increasing accountability • Establish relationships for program cooperation and coordination • Provide political/legislative support	• Less willingness to share information because it is as a power of expertise and a symbol of authority • Power game in budget and resource allocation

CHAPTER 3

IMPACT OF LEGISLATION, TECHNOLOGY, AND ORGANIZATIONAL FACTORS ON INFORMATION SHARING

The Legislative Perspective

Innovation is driven by internal forces in organizations such as leadership and by external influences outside of organizations such as state-of-the-art technology, environmental changes, and political events. Among the various influences, legislation has one of the strongest impacts on information sharing since it changes the way organizations utilize data, process information, and assure the privacy and confidentiality of the shared information (Gil-Garcia & Pardo, 2005; Yang & Maxwell, 2011). Innovation in health care has become an intense issue, with the support of recent legislation such as the American Recovery and Reinvestment Act (ARRA) and the Affordable Care Act (ACA). Under these enactments, the Health Information Technology for Clinical and Economic Health (HITECH) provision promotes health information technology (HIT), focusing on building HIT infrastructure and exchanging health-related information among health care providers across sectors. The primary legislation of the ARRA makes information sharing easier through electronic health record (EHR) systems, which is at the heart of such innovative forces in health care to improve efficiency in service delivery, to increase customer satisfaction, and to lower costs of public health services.

The legislative and policy changes promote interorganizational information sharing by providing the legal foundation and standards. First, the legislation allows establishing a new

office, department, and a new position. For example, the Information Technology Management

Reform Act (ITMRA) of 1996, also known as the Clinger-Cohen Act, established the position of

Chief Information Officer (CIO), who is in charge of managing information technology (IT),

making policies, setting and enforcing standards for technology and security, and promoting

information sharing among agencies in the state and federal government agencies. In addition,

the HITECH established the Office of the National Coordinator for Health Information

Technology (ONC) to launch a nationwide infrastructure for health information exchange that

"ensures that each patient's health information is secure and protected, in accordance with

applicable law" (Title XXX, Subtitle A, §3001).

Another function of the legislation is to provide regulations and guidance for the use of

shared information in security and privacy. For instance, the Health Insurance Portability and

Accountability Act of 1996 (HIPAA) contributes to establishing national standards for new

breach notification requirements on patients' health-related information and electronic health

care transactions (Transaction and Code Sets, TCS). Under the influence of the HIPAA, a series

of changes were made in Subtitle D of the HITECH Act, which regulates the accounting of

disclosures of a patient's health information on treatment, payment, and health care operations

when organizations use the EHR systems. Based on the guidance and regulations set forth by the

legislation, organizations can build up a culture of openness, accountability, and trust in sharing

information with internal members as well as partners across organizations.

Furthermore, the legislation allows funding and resources to modernize IT systems and

develop infrastructure for interorganizational information sharing. For example, the HITECH

provision of the ARRA of 2009 allocated $25.9 billion for the United States Department of

Health and Human Services to promote the adoption of certified HIT tools[4] for private clinics

and practitioners. In addition, the HITECH allows the ONC to spend $9.1 million in FY 2016 in

developing health IT policy and governance with states, health information organizations, health

information service providers, and other government agencies[5]. Public organizations funded by

government budget allocations from the legislation that makes public institutions subject to some

degree of governmental control have obligations to achieve the goals (Rainey, 2014).

The influences of legislation and policy on information sharing are strong and

fundamental to the ways that organizations exchange information, especially public agencies

(Gil-Garcia, Chengalur-Smith, & Duchessi, 2007; Gil-Garcia & Pardo, 2005). Compulsory

regulations and policies support interorganizational information sharing by facilitating

interorganizational relationships such as networking through face-to-face or online

communication; reducing risk regarding privacy and confidentiality; encouraging a culture of

trust, openness, and transparency among participants in networks; subsidizing funding; and

developing infrastructure (Zhang & Dawes, 2006). The HITECH Act of the ARRA enactment

requires government agencies to set up social welfare provisions for health care including

infrastructures for health information technology such as the adoption of the EHR, HIE, and IR

systems. Public health departments should comply with the ARRA, which encourages adopting

HIT tools and sharing information among health care providers in both public and private sectors

toward meaningful use of health-related data. Therefore, this study assumes that a certain degree

of information-sharing activities at LHDs would increase after the ARRA was enacted. More

specifically, local health agencies that adopt more HIT tools to comply with the ARRA

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[4] ONC, https://www.healthit.gov/policy-researchers-implementers/health-it-legislation
[5] ONC, https://www.hhs.gov/sites/default/files/budget/fy2016/fy2016-onc-health-information-technology.pdf

legislation would participate in more information-sharing activities than would other organizations that adopt fewer HIT tools.

> H_1: LHDs' information-sharing activities have a positive association with the passage of the ARRA.

> H_{1a}: Local public health departments that adopt more health information technology (HIT) tools are more likely to share information with other organizations.

The Technological Perspective

The advancing information technology is directly related to organizations' capabilities to collect needed information, and process and disseminate acquired information. It greatly facilitates collecting and analyzing massive data ("big data") and contributes to increasing information-sharing activities. For example, the creation of the Internet has allowed us to search information and data regardless of physical distance and time limitation. Also, technical equipment for processing massive data, ranging from hardware to cloud storage, has been developed and innovated over the decades to record, retrieve, and retain information. Such technological advancement even changes the role of individuals and organizations as information producers, processors, and consumers, and emphasizes the importance of appropriate management in dealing with a huge amount of data. Similarly, in the health care area, the pattern of facilitating big data has kept up with the advancement of technology. A patient's medical records can easily accumulate and become a pile of x-rays, orders for drugs or therapies, prescriptions, laboratory test results, and reports. The increasing amount of information, problems in dealing with health information such as storing data, security, and privacy of individuals' records, and the compatibility and interoperability of different systems have

presented challenges for health care (Zhang & Dawes, 2006). Dealing with a massive amount of patient-specific medical histories, the EHR systems allow practitioners to make decisions about a patient's treatment through nationally certified interoperability systems across more than one health care organization. In this way, IT adoption helps organizations have a direct positive impact on improving technical decision making (Heintze & Bretschneider, 2000).

Compared with private organizations, public organizations are known to be more information-intense agencies, implying they need to acquire technical capabilities to deal with information (Heintze & Bretschneider, 2000; Willem & Buelens, 2007). Considering that information and communications technology (ICT) helps people easily access needed information regardless of physical distance and time, it is pertinent that public organizations also have more available channels to obtain information concerning their work and others' practices. Furthermore, as organizations improve accessibility and usability of information through ICT equipment and networks, public agencies can be more transparent, accountable, and responsive to the public by providing quality information. For example, a nationwide health information network such as an electronic syndromic surveillance system and immunization registry helps LHDs detect preventable diseases, identify populations affected by the illness, determine appropriate treatment, and evaluate interventions through interorganizational information sharing. Even though public organizations are confronted with certain challenges of adopting new information technology to attain quality information because of limited and inflexible budget (Lee & Rao, 2007; Pandey, & Bretschneider, 1997), utilizing information technology benefits organizations by enhancing effectiveness and efficiency in interorganizational collaborative work (Kim & Lee, 2006; Zhang & Dawes, 2006).

Technological barriers stemming from restricted budget for IT investment hinder interorganizational information sharing. For a constant flow of information, organizations need to maintain hardware and software compatibility to process and transfer acquired information. Outdated IT devices make organizations exposed to a protracted information process. In addition, interoperability based on standards set by leading standard organizations is another technical issue to solve. Improving interoperability allows public organizations consistency in shared decision-making rules, data quality, and usability of information, and therefore results in increasing government accountability (Landsbergen & Wolken, 2001). Considering that shared information with other agencies is to improve policy or management, compatible and interoperable IT resources are in place to support effective interorganizational information sharing.

In sum, the development of technology enables organizations to increase capabilities in creating and disseminating shared knowledgeable resources with ease. Especially, information and communications technology such as computer networks and the huge capability of a database helps individuals and agencies engage in cross-boundary information sharing. Information technology is essential for successful information sharing, allowing the coding and sharing of acknowledged information, to combine new sources of knowledge, to increase access to the database, to create networks, and to communicate with other participants in the networks (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Dawes, Cresswell, & Pardo, 2009; Gil-Garcia, Chun, & Janssen, 2009; Kim & Lee, 2006; Lee & Rao, 2007; Zhang & Dawes, 2006). Therefore, this study hypothesizes that the development of technology influences information sharing in a positive way or, more specifically, that the advanced technology promotes more information sharing among public health agencies to enhance the public health programs.

H$_2$: Local public health departments that use the advancing information technology are more likely to share information with other organizations.

The advancing information technology helps individuals and organizations communicate and more easily access needed information through compatible hardware and software. To increase organizations' capabilities to handle a massive amount of health data, social network services (SNS) also help both information senders and receivers communicate more easily and faster with user-friendly access to needed information. For example, the Georgia Department of Public Health provides the Online Analytical Statistical Information System (OASIS), web-based tools for public health and public policy data analysis, which can also be accessed through social network services such as Facebook and Twitter for the clients' convenience. Therefore, this research supposes positive impacts of mobile technology tools and social network platforms on increasing information sharing at LHDs.

H$_{2a}$: Local public health departments that use more mobile technology tools are more likely to share information with other organizations.

H$_{2b}$: Local public health departments that use more channels of social network service (SNS) are more likely to share information with other organizations.

The Organizational Perspective

Organizations are active in processing and producing information to achieve their goals. Organizations tend to gather as much information as they can (Feldman & March, 1981) for improved performance, but they do not accept all information. For example, they value information sources differently and prefer obtaining evidence-based information to eliminate uncertainty in policy decisions (Jennings & Hall, 2012). Also, organizations tend to seek more

information to prepare for new programs and to adapt to an environment that results in the new arrangement and procedures. In such information process, interorganizational information sharing lets organizations reduce transaction costs in searching and acquiring quality information and, thus, they can be more productive with more effective information exchange channels.

Interorganizational information sharing requires taking a step to first identify and to analyze the characteristics of partner agencies because each organization is in a different setting; thus, interoperability is the key for successful information sharing (Landsbergen & Wolken, 2001). Rainey (2014) suggested a comprehensive framework for organizational analysis, describing that an organization is founded based on constant interactions between both the external environment including the political climate and the internal elements including goals and values, leadership, culture, structures, organizational performance and effectiveness, tasks and technology, and processes. Thus, considering organizations as active organisms in an open system, sharing information is a kind of action by which organizations make an effort to be more competitive and efficient by manipulating contingencies.

Local public health departments are the core of delivering public health care. Public health departments pursue multijurisdictional and multidisciplinary information sharing for the exchange of health-related information and situational awareness data among the different levels of government and sectors so that they provide more effective and cost-efficient health care services for the public (CDC, 2011; Provan, Huang, & Milward, 2009). Researchers have examined various factors that influence organizations' information-sharing activities including value and culture (e.g., Kim & Lee, 2006; Pardo, Cresswell, Dawes, & Burke, 2004), trust (Gil-Garcia, Pardo, & Burke, 2010; Landsbergen & Wolken, 2001), leadership (Gil-Garcia, Pardo, & Burke, 2007), incentives and reward for sharing knowledge (Kim & Lee, 2006), organizational

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structure (Hall, 2002; Kim & Lee, 2006; Tsai, 2002), and issues of roles, responsibility, and authority in networks (Pardo, Gil-Garcia, & Burke, 2008). However, as public organizations have multidimensional concepts (Bozeman, 1987; Perry & Rainey, 1988; Rainey, 2014), a gap still exists in the literature concerning what organizational factors of local public health departments have influenced reaching the goals of managing and sharing health-related information. In other words, it is questionable why some public health departments actively share information with other government agencies and stakeholders when they make policies or implement programs, while others do not.

This study aims to assess the effects of organizational structure, human resources, a strategic plan, and the type of service delivery. Centralization and formalization are the main axes in organizational structure revealing how bureaucratic an organization is. Centralization refers to the hierarchical locus of power and authority affecting a variety of decision making in an organization (Blau & Schoenherr, 1971; Mansfield, 1973). As a local government agency, each public health department is in a different setting in which decisions influencing the whole organization are made – for instance, an independent body to provide health care services directly to the public, or a dependent branch under the health and human services agency of the state government. Therefore, independent departments can have a more centralized structure than the dependent ones. Also, although the executive board of the local organization is often considered to have the power and authority of decision making, the board can play different roles ranging from advising to authorizing local ordinances and budget. Thus, whether or not the locus of power and authority is centralized in the board depends on the extent to which the board is involved in the decision making of the local health department.

Several studies have reported that the hierarchical structure has negative impacts on information sharing because of lack of flexibility. For example, Creed, Douglas, and Miles (1996) noted that the formal hierarchy impedes building trust, which is necessary for communicating and sharing knowledge among employees. Kim and Lee (2006) explained that centralization restricts an informal group's autonomy in information-sharing activities because it requires approval from the top management level for exchanging information. As a result, adoption of innovations such as information sharing through the advancing information technology takes place more in functionally differentiated and decentralized organizations (Moch & Morse, 1977). In a slightly different way, Willem and Buelens (2007) asserted that even though the formal structures in public organizations are not the main barrier to knowledge sharing, they negatively influence information sharing when the coordination function in cooperative work is weak. However, Yang and Maxwell (2011) suggested that top authority can even initiate the development of supportive environment for interorganizational information sharing by providing appropriate strategies to recruit participating organizations. Therefore, this study supposes a negative association between the degree of centralization and information-sharing activities.

H$_3$: Local public health departments with a higher degree of centralization are less likely to share information with other organizations.

Another dimension of an organization's structure is formalization, which is revealed through written regulations, ordinances, formal instructions, and organization charts (Rainey, 2014). Pardo, Gil-Garcia, and Burke (2008) asserted that clearly stated roles and responsibilities in documents and the appropriate exercise of authority contribute to developing trust among organizations, and such growing trust leads to increasing information sharing. On the other hand, a written agreement or formal records for the resource exchanges would impede an

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organization's interorganizational information sharing because such formalization obstructs

flexibility and openness in communication (Jarvenpaa & Staples, 2000; Kim & Lee, 2006;

Willem & Buelens, 2007). Local government agencies exchange a range of resources including

equipment, funding, staff, and information about programs and evaluations. Unlike exchanging

tangible articles, a culture of sharing information would be fostered more under a flexible

environment such as informal networks, rather than written agreement (Willem & Buelens,

2007). Also, restrictions on acquiring and disseminating information often lead to bureaucratic

red tape (Hatala & Lutta, 2009; Johanson, 2000). Taken together, this research proposes a

negative association of formalization and information sharing of public local health departments.

> H_4: Local public health departments with a higher degree of formalization are less likely
> to share information with other organizations.

The Information Technology Management Reform Act (ITMRA) of 1996 established the

position of Chief Information Officer (CIO) in the executive branch agencies. The Act states the

importance of information resources, which include personnel, equipment, funds, and

information technology, as well as IT management in organizations. Information officers

including chief information officer, information systems specialist, and public information

specialist are responsible for IT management to reduce the cost of data operation, to be involved

in IT decision-making, and to improve public administration of the agency (Grover, Jeong,

Kettinger, & Lee, 1993; McClure & Bertot, 2000). In addition to being responsible for IT

management, information officers endeavor to meet the needs of internal and external

stakeholders for networking and collaborative governance (GAO, 2015). Therefore, this study

supposes a positive association between having an information officer in an LHD and

information sharing.

H$_5$: Local public health departments that employ more information officers are more likely to share information with other organizations.

A strategic plan helps organizations maintain their principles and missions to achieve organizational goals, enhance ongoing practices, and adopt innovation (Berry, 1994; Bryson 1995; Poister & Streib, 2005). Similarly, the findings reported by Moon (2002) imply that municipalities implementing a long-term strategic plan over five years are likely to initiate e-government earlier and to practice a more specific e-government strategic plan than the ones executing a one- or two-year strategic plan. Successful implementation of a strategic plan requires sharing resources, collaborating across sectors and multiple disciplines (Hale & Williams, 1989), and using data, information, and technology (Holzer & Callahan, 1998; Walker & Andrews, 2015) so that organizations can prepare for changes and be more effective (Rainey, 2014). For example, the Centers for Disease Control and Prevention (CDC) encourages LHDs to develop a strategic plan by offering a Community Health Improvement Plan (CHIP) and Community Health Assessment (CHA), both of which include information sharing as a core requirement for a strategic plan.

In this study, a strategic plan refers to a comprehensive and agency-wide plan to make a long-term and systematic effort to solve community health problems. It should be noted that this study does not attempt to assess the quality or results of the strategic plan. Therefore, this study proposes a positive association between a strategic plan that organizations have developed and information sharing with other agencies.

H$_6$: Local public health departments that have developed a strategic plan for their health care services and programs are more likely to share information with other organizations.

In general, public services are usually underprovided by the market because they are labor intensive, which possibly allows public organizations to save from reduced transaction and production costs by contracting out (Bickers, 2007). Public agencies, which are unlikely to produce public services at minimal cost because of the absence of competition and profit incentive, contract out public services with other public organizations, private providers, and nonprofits (Kettl, 1993a). LHDs also contract out to achieve cost-efficient delivery of public health services, to increase customers' satisfaction, to supplement infrastructure and workforce, and to expand public health services to the most marginalized and underserved populations (OECD, 2011). Public health services include activities in immunization, treatment for communicable disease, and environmental health activities such as hazardous waste disposal and animal control, which LHDs are required to provide universally available to the public.

While implementing the services that are contracted out with other state and local government agencies and other healthcare providers, LHDs can attain quality information from the providers who compete for funding in the interorganizational networks and apply the acquired information to similar projects or problems through windowing and benchmarking (Hale, 2011; Lazer & Binz-Scharf, 2007; Provan, Fish, & Sydow, 2007). The windowing process of seeing others' best practices and acquiring knowledge from implementation success or failure helps organizations lower costs by reducing redundant potential alternatives to a few refined options (Lazer & Binz-Scharf, 2007).

Each organization has its own values, workflow, culture, and procedures that make information sharing more complex and difficult (Pardo, Cresswell, Thompson, & Zhang, 2006). However, information sharing in the process of contracting out helps organizations reengineer

those differences to reach agreement, thereby reducing transaction costs in providing public

services (Dawes, Cresswell, & Pardo, 2009; Thomson & Perry, 2006). Consequently, contracting

out public health services allows LHDs and providers to engage in innovative management with

market-based and collaborative frameworks for coordinating service delivery (Martin, 2000;

Soeters & Griffiths, 2003). The type of service delivery is important for public health

departments to determine whether to engage in an interagency network with other organizations

to solve policy problems together and to reduce transaction costs in service delivery. Hence, this

research supposes a positive association between a type of public health service delivery and

information-sharing activities.

> H_7: Local public health departments that have contracted out more public healthcare
> programs than they have directly provided are more likely to share information with
> other organizations.

Table 3.1

Summary of Hypotheses

The Policy Perspective

H_1: Local public health departments that adopt more health information technology (HIT) tools are more likely to share information with other organizations.

The Technological Perspective

H_{2a}: Local public health departments that use more mobile technology tools are more likely to share information with other organizations.

H_{2b}: Local public health departments that use more channels of social network service (SNS) are more likely to share information with other organizations.

The Organizational Perspective

H_3: Local public health departments with a higher degree of centralization are less likely to share information with other organizations.

H_4: Local public health departments with a higher degree of formalization are less likely to share information with other organizations.

H_5: Local public health departments that employ more information officers are more likely to share information with other organizations.

H_6: Local public health departments that have developed a strategic plan for their health care services and programs are more likely to share information with other organizations.

H_7: Local public health departments that have contracted out more public healthcare programs than they have directly provided are more likely to share information with other organizations.

CHAPTER 4

METHODOLOGY

Data

This research employs the 2013 National Profile of Local Health Departments datasets, administered by the National Association of County and City Health Officials (NACCHO), to examine the impacts of the legal, technological, and organizational factors on local health departments' information-sharing activities. Seven surveys have been conducted since 1989, funded by the Robert Wood Johnson Foundation, the United States Department of Health and Human Services, and the Centers for Disease Control and Prevention (CDC). The survey is composed of three parts: The Core is distributed to every local health department to acquire basic information about jurisdiction, budget, programs, and services. Stratified random sampling (without replacement) is used to select some agencies to receive Modules 1 and 2, which are designed to further explore their activities related to health disparities, assessment, planning, and improvement in the delivery of public health services. Therefore, all agencies received either 'Core only' or 'Core and one of the two modules.' The survey is designed for public health managers at a local health agency who were defined by the NACCHO as "health service managers, administrators, health directors overseeing the operations of the agency or of a department or division [including] the top agency executive in this category regardless of education or licensing" to respond electronically.

The National Profile surveys have been distributed to all local health departments[6] across the nation except Hawaii and Rhode Island, whose state health departments operate in support of local public health and without sub-state units, to investigate the workforce, finance, leadership, governance, partnerships, programs, evaluations, policy advocacy, and the utilization of information technology.[7] The survey was emailed to 2,532 local health departments during January-March 2013 and 2,000 responses were collected, which is a response rate of 79%.

Table 4.1 displays the total number of local health departments, the number of respondents, and the response rate, by state, in 2013. With some exceptions, such as Indiana and Massachusetts, all states had a response rate of more than 60% in 2013.

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[6] The NACCHO estimates approximately 2,500 local health departments or units in the United States as of 2013.
[7] The NACCHO categorizes four types of governance - decentralized/local (29 states), centralized/state (6 states), hybrid (13 states), and no LHDs such as Hawaii and Rhode Island. The 13 states that have hybrid structures of both regional and local offices of the state health agency were given the option of choosing to respond to the survey at either the regional or local level, but not at both levels.

Table 4.1

Total Number of LHDs in Study Population, Number of LHDs Completing Questionnaire, and

Response Rates, for All LHDs, by State, in 2013

State	Total No. of LHDs	No. of Respondents	Response Rate (%)	State	Total No. of LHDs	No. of Respondents	Response Rate (%)
All States	2,532	2,000	79	Missouri	115	95	83
Alabama	67	65	97	Montana	49	36	72
Alaska	7	6	86	Nebraska	21	19	90
Arizona	15	12	80	Nevada	4	4	100
Arkansas	75	74	99	New Hampshire	4	3	75
California	61	44	72	New Jersey	97	82	85
Colorado	54	48	89	New Mexico	6	6	100
Connecticut	74	52	70	New York	58	47	81
Delaware	2	2	100	North Carolina	85	78	92
District of Columbia	1	1	100	North Dakota	28	27	96
Florida	67	67	100	Ohio	124	93	75
Georgia	18	12	67	Oklahoma	70	70	100
Idaho	7	7	100	Oregon	34	30	88
Illinois	95	86	91	Pennsylvania	16	16	100
Indiana	93	55	59	South Carolina	8	5	63
Iowa	101	69	68	South Dakota	8	8	100
Kansas	100	79	79	Tennessee	95	92	97
Kentucky	57	54	95	Texas	65	44	68
Louisiana	10	9	90	Utah	12	12	100
Maine	10	10	100	Vermont	12	12	100
Maryland	24	24	100	Virginia	35	32	91
Massachusetts	329	132	40	Washington	35	32	91
Michigan	45	40	89	West Virginia	49	37	76
Minnesota	70	61	87	Wisconsin	88	79	90
Mississippi	9	9	100	Wyoming	23	23	100

The unit of analysis in this study is the local public health department, at the

organizational level. Table 4.2 shows the response rates by the size of population served. Nearly

half of the local health departments serve jurisdictions with small populations under 50,000

people. However, it should be noted that the 137 local health departments (as of 2013) that serve

large jurisdictions of 500,000 or more people cover the public health services of nearly half of

the U.S. population. Therefore, the National Profile of Local Health Departments surveys

provide a good fit to analyze the activities of local health departments in rural areas.

Table 4.2

Number of LHDs Completing Questionnaire, Total Number of LHDs in the Study Population,
and Response Rate, by Size of Population Served

Size of Population Served	2013	
	No. of Respondents (Total No. of LHDs)	Response Rate
<25,000	745 (1,040)	72%
25,000–49,999	406 (504)	81%
50,000–99,999	329 (402)	82%
100,000–249,999	267 (299)	89%
250,000–499,999	125 (150)	83%
500,000–999,999	89 (96)	93%
1,000,000+	39 (41)	95%
Total	2,000 (2,532)	79%

Variables

Dependent Variables

Information Sharing

The structure of public health in the U.S. is a hierarchical system of federal, state, and

local/tribal governments. Each level of government has different responsibilities and capabilities

in fulfilling the public health roles of policy development, protection, and prevention. The

federal government plays a critical role in setting goals and policies, allocating monetary

resources, responding to a public health emergency, and providing solutions in regards to

jurisdiction of individual states. Under the federal agencies, a state government is primarily responsible for epidemiology and surveillance, including screening diseases and conditions, as well as technical assistance and training. Local health departments practice health care for the public, educate the public, contact health boards and other governments, and report collected health-related data. Therefore, contacting a different level of government is a kind of strategic communication to obtain more available resources and leverage information for policy development.

Among the many purposes of information sharing, LHDs share information as a problem-solving activity with other government agencies and healthcare providers for coalition of public health policymaking, with the aim to improve the public's health status (Institute of Medicine, 1988). Various LHD activities, including identifying and preventing diseases, educating the public, and researching, are related to the goals of implementing and improving public health policies with collected data from their daily practices. Therefore, this research regards such policy development activities as information sharing.

Scholars have measured information sharing at the individual level by the degree of willingness or intention to share information with co-workers, or attitude toward sharing resources with other work groups or agencies (Al-Alawi, Al-Marzooqi, & Mohammed, 2007; Bock, Zmud, Kim, & Lee, 2005; Chow & Chan, 2008; Kim & Lee, 2006). However, at the organizational level, a practical difficulty exists in counting the number of information-sharing activities in a daily practice because a certain degree of information sharing is already routinized in organizations. For that reason, measures for information sharing at the organizational level are less developed.

As discussed above, information sharing encompasses goals, target audiences (receivers), shared contents, and activities. From this perspective, the current research has two dependent variables to measure information sharing in terms of activities and target audiences.

A. The Variety of Information-Sharing Activities

The first variable is the variety of information-sharing activities, that is, the particular information-sharing activities in which an LHD is engaged in making public policies. The study specifies five information-sharing activities: preparing policy briefs for policy makers, giving public testimony to policy makers, communicating with legislators, providing technical assistance for drafting proposed regulations, and participating in an advisory panel for public health policy. Therefore, the variable of the variety of information-sharing activities is multivariate binary, which means if an LHD has performed an activity described above, the value is 1 for that activity. Otherwise, the value is 0 for the activity. Appendix 1 provides the questionnaire items for the variety of information-sharing activities variable in this study.

B. The Levels of Government

The other variable is the level(s) of government with which the information is shared – local, state, or federal. The levels of government is a trivariate dummy variable. Therefore, in this research, "more information sharing" means that a local health department has more activities in sharing information and knowledge with other local, state, and/or federal government agencies. Appendix 1 displays the questionnaire items for the levels of government variable in this study.

Independent Variables

Health Information Technology Tools

The Health Information Technology for Economic and Clinical Health (HITECH)

provision of the American Recovery and Reinvestment Act of 2009 (ARRA) impacts policy

changes by encouraging local health departments to participate in health information technology

networks such as the five tools that this study evaluates – an immunization registry (IR), an

electronic disease reporting system (EDRS), electronic lab reporting (ELR), electronic health

records (EHRs), and health information exchange (HIE) – systems to monitor diseases or hazards,

to collate health data, and to administer health services. In addition, benefits of the HIT networks

for LHDs include reduced administrative activities, better developed measures of transparency

for public health programs, reduced medical errors, and increased public health monitoring of

communicable disease (ONC, 2015; Wulsin & Dougherty, 2008).

This research regards a local health department's adoption of such HIT tools as the

department's compliance with the ARRA. Particularly, the study measures the impacts of the

ARRA enactment on information sharing by the number of HIT systems that an LHD uses

because these programs are primarily designed for building a nationwide health information

network. The range of the HIT Tool variable in this study was from 0 to 5. Appendix 1 provides

the exact specifications of the survey items for the health information technology tools variable

in this study.

In fact, even though such advantages and numerous policies and guidelines are provided

for local health departments to successfully implement HIT networks such as the EHR systems,

the use of the systems in public health departments is relatively low. As shown in Table 4.3,

surprisingly, only 1% of LHDs in 2013 had implemented all five HIT tools while 77.3% of

LHDs had none of the HIT tools.

Table 4.3

Local Health Department, by the Number of Adopted HIT Tools in 2013

Number of Adopted HIT Tools	Frequency	Percent
0	1,546	77.3%
1	63	3.1%
2	132	6.6%
3	166	8.3%
4	74	3.7%
5	20	1%

The Use of Advanced Information Technology

In this study, the advancement of technology primarily refers to "information and

communications technology (ICT) tools," which include hardware and social network platforms

to promote preventive health services and to share needed health information effectively and

efficiently. The research measures the hardware dimension of the advanced technology as the

variety of mobile technology tools that an LHD uses, for example, smartphones, electronic

tablets, text messaging, automated phone calling, email alert system, and fax broadcast. The

hardware variable is measured as the total number of the devices that an LHD uses and the range

of the variable is from 0 to 6. Also, the software dimension is labeled as the SNS variable and is

measured by the variety of social media used by an LHD such as a blog, Facebook, LinkedIn,

Twitter, YouTube, or other social media. The range of the SNS variable is from 0 to 6.

Appendix 1 displays the exact specifications of these survey items for the use of advanced

information technology variable in this study.

Centralization

Centralization refers to the hierarchical locus of power and authority affecting decision making in an organization (Rainey, 2014). Researchers have developed measurement for centralization in terms of hierarchy of authority (Glisson & Martin, 1980; Moynihan & Pandey, 2005) and the degree of participation in decision making (Carter & Cullen, 1984; Glisson & Martin, 1980; Hage & Aiken, 1967), by asking the frequency of participation in decision making and the distance to approval for a decision, at the individual level.

In this study, centralization is measured by the extent of authority that a local board of health has to approve an LHD's activities, for example, hiring or firing the agency head, approving the LHD's budget, or imposing taxes for public health. Exploratory Factor Analysis is used to find commonalities in eight measures of centralization. The results indicate that the eight measures can produce two common factors – 'decision-making on policies and regulations' and 'approval for budget', which are statistically significant and explain 52.18% of the variance in the data. Appendix 1 provides the exact specifications of these questionnaire items for the centralization variable in this study.

Table 4.4

Survey Items and Factor Analysis for Centralization

Measures	Factor 1	Factor 2
Decision-making		
Hire or fire agency head	0.6643	0.4340
Adopt public health regulations	0.6903	0.2171
Set and impose fees	0.6876	0.2876
Advise LHD or elected officials on policies, programs, and budgets	0.5519	-0.2727
Set policies, goals, and priorities that guide the LHD	0.8086	0.0295
Budget		
Approve the LHD budget	0.2375	0.6394
Impose taxes for public health	0.0510	0.7345
Request a public health levy	0.2230	0.6121
Eigenvalues	3.0006	1.1734
Cumulative variance	30.72	52.18
N = 1,371		

Formalization

Formalization is one of the main axes in organizational structure in presenting how bureaucratic an organization is and how rules in an organization are used, which is reflected in written documentations and organizational charts. In this study, formalization is measured by whether a local health department has formal written forms of agreement when an LHD provides certain functions or services, supplies human resources, or shares equipment with other organizations. The range of the formalization variable is from 0 to 4. Appendix 1 displays the exact specifications of these survey items for the formalization variable in this study.

Having an Information Officer

The Information Technology Management Reform Act (ITMRA) of 1996, also known as the Clinger-Cohen Act, established the position of Chief Information Officer (CIO) in the executive branch agencies. The Act states the importance of information management as well as IT operation in organizations. An information officer, sometimes referred to as "information systems specialist" or "public information specialist," is in the position responsible for the "overall computer system, network, and database administration and analyses" (NACCHO, 2013) to reduce the cost of data operation, to be involved in IT decision-making, and to improve public health and administration of the agency (Grover, Jeong, Kettinger, & Lee, 1993; McClure & Bertot, 2000). In addition to being responsible for IT management, information officers endeavor to meet the needs of internal and external stakeholders for collaborative governance (GAO, 2015). Therefore, this study supposes a positive impact of having an information officer(s) in an LHD on information-sharing activities and examines this association by determining the number of information officers in an LHD and the variety of information-sharing activities. Appendix 1 displays the questionnaire items for the having information officers variable in this study.

Strategic Plan

A strategic plan helps organizations maintain their principles and missions to achieve organizational goals, enhance ongoing practices, and adopt innovation (Berry, 1994; Bryson 1995; Poister & Streib, 2005). Similarly, the findings reported by Moon (2002) imply that municipalities implementing a long-term strategic plan over five years are likely to initiate e-government earlier and to practice a more specific e-government strategic plan than the ones executing a one- or two-year strategic plan. In this study, a strategic plan refers to a

comprehensive and agency-wide plan to make a long-term and systematic effort to solve

community health problems, and the variable of strategic plan measures as binary – whether an

LHD has developed a strategic plan to improve its performance in public health. If an LHD has a

strategic plan, it is 1. Otherwise, it is 0. It should be noted that this study does not attempt to

assess the quality or results of the strategic plan. Appendix 1 provides the exact specifications of

these survey items for strategic plan variable in this study.

Ratio of Contracted Out to Performed Directly

Targets of public health services provided by local health departments include individuals,

organizations such as schools and hotels, and the community-at-large for epidemiology,

surveillance, and environmental health. The variable of ratio of contracted out to performed

directly is measured as a fraction of the number of public health services that are contracted out

to those directly provided by an LHD. Appendix 1 displays the questionnaire items for the ratio

of contracted out to performed directly variable in this study.

Control Variables

Control variables in the analysis model are organizational characteristics such as budget

per employee, jurisdiction, and the governance type. The variable, budget per employee, is

calculated as the total amount of budget taken in logarithm divided by a total number of

employees in an LHD. The range of the budget (in logarithm) per employee variable is from 0 to

11.8454.

Jurisdiction refers to the type of municipality in which an LHD serves, such as city,

county, city-county, multi-city, or multi-county. As of 2013, 73.35% (1,467) of total LHDs in the

U.S. served a county. The jurisdiction variable is operationalized as binary whether an LHD works for a county or not. If an LHD serves a county, it is 1. Otherwise, it is 0.

Also, the governance type is determined by whether an LHD is operated as a regional unit of state government (state), an agency of local government (local), or an agency governed by both state and local authorities (shared governance). Of the total LHDs, 71.45% (1,429) are operated as local agencies. Therefore, a variable of the governance type is operationalized as binary, which is local or not. If an LHD is run as the unit of local government, it is 1. Otherwise, if an LHD is either a regional unit of state government or both state and local authorities, it is 0.

Appendix 1 provides the survey items for all the control variables in this study. Table 4.5 shows descriptive statistics and brief descriptions of the dependent, independent, and control variables in the research.

Table 4.5

Descriptive Statistics and Brief Descriptions of Dependent, Independent, and Control Variables

Variable	Description	Obs.	Mean	S.d.	Min	Max
Dependent Variables						
Policy Briefs	Prepared policy briefs = 1, otherwise = 0	2,000	.5450	.4980	0	1
Testimony	Gave a public testimony = 1, otherwise = 0	2,000	.5000	.5001	0	1
Participation	Participated on a board or advisory panel = 1, otherwise = 0	2,000	.6360	.4812	0	1
Communication	Communicated with legislators and policymakers = 1, otherwise = 0	2,000	.7775	.4160	0	1
Assistance	Provided technical assistance to legislators and policymakers = 1, otherwise = 0	2,000	.4915	.5000	0	1
Local	Local Government = 1, otherwise = 0	2,000	.7890	.4081	0	1
State	State Government = 1, otherwise = 0	2,000	.5605	.4964	0	1
Federal	Federal Government = 1, otherwise = 0	2,000	.1460	.3531	0	1
Independent Variables						
HIT Tools	The total number of HIT tools that an LHD uses	2,000	.6100	1.2299	0	5
Social Network Service	The total number of SNS that an LHD uses	2,000	.2375	.7465	0	6
Hardware	The total number of IT devices that an LHD uses	2,000	.8665	1.7123	0	6
Strategic Plan	Having a strategic plan = 1, otherwise = 0	1,959	.5058	.5000	0	1
Decision Making	Centralization on decision making	1,371	-1.47e-08	.8548	-2.1608	.8642
Approval for Budget	Centralization on approval for an LHD's budget	1,371	-1.06e-09	.7395	-1.5384	1.6998
Formalization	The total number of agreement when sharing resources with other LHDs	2,000	.1555	.5817	0	4
Information Officers	The total number of information officer(s) in an LHD	2,000	.5015	.7591	0	2
Ratio of Contracted-Out	Ratio of contracted out to directly provided services by an LHD	2,000	.4117	.1573	0	1
Control Variables						
Budget (ln) per Employee	Budget in logarithm per the total number of employees in an LHD	1,941	.7457	1.1638	0	11.8454

Local	Governance type. If an LHD at the local level1 = 1, otherwise = 0	2,000	.7145	.4517	0	1
County	Jurisdiction type. If an LHD serves a county = 1, otherwise = 0	2,000	.7335	.4422	0	1

Methods

This study employs multivariate probit models to test the hypotheses. A multivariate probit model provides goodness-of-fit and robustness of the estimates to assess relationships between independent variables and multiple dichotomous dependent variables (Chib & Greenberg, 1998). Therefore, a multivariate probit model is appropriate for the maximum likelihood estimation of the impacts of each policy, technological, and organizational factor on several aspects of information-sharing activities of local public health departments since each dependent variable is binary. The log-likelihood function to be estimated is based on a latent variable (Cappellari & Jenkins, 2003):

$$L = \quad \Phi \quad \mu \quad \Omega), i = 1, \dots, N \tag{1}$$

Where i denotes observation and M the different options given to a case.

The research presents two analysis models for each dependent variable: *the variety of information-sharing activities* (1.1) and *the levels of government with which the information is shared* (1.2).

$$= \quad \Phi \quad \mu \quad \Omega), i = 1, \dots, N \tag{1.1}$$

$$= \quad \Phi \quad \mu \quad \Omega), i = 1, \dots, N \tag{1.2}$$

In the first model for the variety of information-sharing activities, the case $M = 1$ for preparing issue briefs for policy makers, $M = 2$ for giving a public testimony for policy makers, $M = 3$ for participating in advisory panel for public health policy, $M = 4$ for communication with legislators, or $M = 5$ for providing technical assistance for drafting proposed regulations. For the second model for the levels of government with which the information is shared, the case $M = 1$ for the local, $M = 2$ for the state, or $M = 3$ for the federal government shared information. μ represents an LHD's features composed of the following elements: β_0 estimates the base level of the information sharing at local health departments; β_1 estimates the impact of the use of HIT networks as compliance with the ARRA enactment; β_2 estimates the impact of the use of hardware; β_3 estimates the impact of the use of social network services; β_4 estimates the marginal impact of centralization; β_5 estimates the marginal impact of formalization; β_6 estimates the marginal impact of having an information officer; β_7 estimates the impact of having strategic planning; and β_8 estimates the impact of contracted-out healthcare services.

CHAPTER 5

RESULTS: THE VARIETY OF INFORMATION-SHARING ACTIVITIES

Organizations access, process, and share information through various channels as part of their daily routine to yield improved outcomes. Through these activities, organizations meet different audiences and, therefore, need to develop diverse strategies by tailoring the content, setting, format, and timing of information sharing for the target audiences. From this perspective, information sharing is regarded as an interactive process to improve access to the needed information, ease communications with target audiences, and achieve policy integration by utilizing a shared understanding. This study categorizes information-sharing activities into five actions based on delivery methods: preparing policy briefs for policymakers and legislators, giving testimony to policymakers, participating on a board or advisory panel, communicating with legislators, and providing technical assistance to legislative, regulatory, or advocacy groups. In this analysis, the purpose was to assess the impacts of the policy, the use of advancing technology, and organizational characteristics on a variety of information-sharing activities in local government agencies.

Descriptive Statistics

This analysis aimed to determine which information-sharing activities an LHD is more likely to engage in, given the influence of the policy, technological, and organizational factors, and what the maximized likelihood is for each information-sharing activity. Each dependent variable is binary, asking whether an LHD had each of information-sharing activities with other

government agencies. The study proposed five information-sharing activities that LHDs could

have experienced in the policymaking process such as preparing policy briefs for legislators,

giving testimony to policymakers, participating on a board or advisory panel, communicating

with legislators, and providing technical assistance to legislative, regulatory, or advocacy groups.

Descriptive statistics in Table 5.1 indicate that most LHDs had various information-sharing

activities, and communicating with policymakers and/or legislators (mean = .7775) was the most

common activity for LHDs to share information with different government agencies.

Table 5.1

Descriptive Statistics

Variable	Obs	Mean	S.d.	Min	Max
Dependent					
Policy Briefs	2,000	.5450	.4980	0	1
Testimony	2,000	.5000	.5001	0	1
Board/Advisory Panel	2,000	.6360	.4812	0	1
Communication	2,000	.7775	.4160	0	1
Technical Assistance	2,000	.4915	.5000	0	1
Independent					
HIT Tools	2,000	.6100	1.2299	0	5
Social Network Service	2,000	.2375	.7465	0	6
Hardware	2,000	.8665	1.7123	0	6
Strategic Plan	1,959	.5058	.5000	0	1
Decision Making	1,371	-1.47e-08	.8548	-2.1608	.8642
Approval for Budget	1,371	-1.06e-09	.7395	-1.5384	1.6998
Formalization	2,000	.1555	.5817	0	4
Information Officers	2,000	.5015	.7591	0	2
Rate of Contracted-Out	2,000	.4117	.1573	0	1
Control					
Budget (ln) per Employee	1,941	.7457	1.1638	0	11.8454
Governance	2,000	.7145	.4517	0	1
Jurisdiction	2,000	.7335	.4422	0	1

Table 5.2 displays correlations among the dependent, independent, and control variables of the analysis. The variable of communication had positive correlations with all variables except budget (in logarithm) per employee, which, interestingly, had all negative correlations with most variables except centralization on decision-making and centralization on approval for budget variables. The hardware variable had strong positive relationships with HIT tools and SNS, which were .7919 and .6200, respectively.

Table 5.2

Correlations of Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Policy Briefs	1.0000												
2	Testimony	0.5603*	1.0000											
3	Board/ Advisory Panel	0.4920*	0.4635 *	1.0000										
4	Communication	0.4261*	0.4171 *	0.4348 *	1.0000									
5	Technical Assistance	0.5026*	0.4991 *	0.4590 *	0.4322*	1.0000								
6	HIT Tools	0.0736*	0.0626 *	0.0829 *	0.0581*	0.0735*	1.0000							
7	SNS	0.1495*	0.1387 *	0.1168 *	0.0832*	0.1361*	0.5019*	1.0000						
8	Hardware	0.1059*	0.0797 *	0.1061 *	0.0608*	0.0995*	0.7919*	0.6200*	1.0000					
9	Decision-Making	0.1360*	0.1377 *	0.1544 *	0.2285*	0.1390*	0.0207	0.0476	0.0625*	1.0000				
10	Approval for Budget	-0.0556*	-0.0086	0.0113	0.0712*	-0.0180	-0.0138	-0.0190	-0.0048	0.2582*	1.0000			
11	Formalization	0.0803*	0.0576 *	0.0951 *	0.0789*	0.0931*	-0.1326*	-0.0851*	-0.1353*	0.0457	0.0195	1.0000		
12	Info Officers	0.1738*	0.2207 *	0.1795 *	0.0795*	0.2082*	0.0858*	0.1852*	0.1085*	-0.0105	0.0173	0.0442*	1.0000	
13	Strategic Plan	0.1502*	0.1678 *	0.1463 *	0.1482*	0.1302*	0.0459*	0.0621*	0.0433	0.0347	0.0634 *	0.0204	0.1851*	1.0000
14	Ratio	0.2298*	0.2097 *	0.2009 *	0.2192*	0.2505*	0.0826*	0.0856*	0.0638*	0.0727*	0.0603*	0.0693*	0.3053*	0.2472 *
15	Budget (ln) per Employee	-0.0811*	-0.1280 *	-0.0991 *	-0.1021*	-0.1407*	-0.0554*	-0.0888*	-0.0601*	0.0964*	0.0202	-0.0351	-0.2111*	-0.1864 *
16	Governance	0.1561*	0.1384 *	0.1913 *	0.2075*	0.1254*	0.0057	0.0869*	0.0490*	0.4792*	0.0385	0.0529*	-0.1162*	-0.0593 *
17	Jurisdiction	-0.0489*	-0.0622 *	-0.0635 *	0.0174	-0.1109*	0.0571*	-0.0067	0.0171	-0.1211*	0.1381*	-0.0158	0.0675*	0.0892 *

		14	15	16	17
14	Ratio	1.0000			
15	Budget (ln) per Employee	-0.2825*	1.0000		
16	Governance	-0.1540*	0.2174*	1.0000	
17	Jurisdiction	0.0749*	-0.0932*	-0.0881*	1.0000

$* \ p < 0.05$

If high multicollinearity is present, it causes unstable parameter estimates and inaccurate variances that can cause confidence intervals for coefficients to be wider and t-statistics to be smaller. Even though Menard (2002) pointed out that multicollinearity may not be as problematic in other models as it is in OLS regression because multicollinearity is concerned about the strong relationship among independent variables, not about the dependent variable. A test to detect multicollinearity in the data was conducted to assess the variance inflation factors (VIFs) for each explanatory variable. Table 5.3 shows that the variable with the highest VIF (3.55) was hardware, and HIT tools had the second highest VIF (2.87). Given that the maximum acceptable threshold of VIF is 10.0, these variables did not cause the degree of multicollinearity that could considerably affect the standard errors in this model. The overall mean VIF was 1.60, indicating that the independent variables in the model were moderately correlated.

Table 5.3

Multicollinearity Statistics

Variable	VIF	SQRT VIF	Tolerance	R^2
Hardware	3.55	1.88	0.2815	0.7185
HIT Tools	2.87	1.69	0.3490	0.6510
SNS	1.85	1.36	0.5408	0.4592
Decision-Making	1.46	1.21	0.6846	0.3154
Governance	1.44	1.20	0.6956	0.3044
Ratio of Contracted Out	1.30	1.14	0.7720	0.2280
Information Officer(s)	1.22	1.10	0.8199	0.1801
Budget (ln) per Employee	1.20	1.10	0.8329	0.1671
Approval for Budget	1.12	1.06	0.8928	0.1072
Strategic Plan	1.10	1.05	0.9059	0.0941
Jurisdiction	1.07	1.04	0.9320	0.0680
Formalization	1.04	1.02	0.9650	0.0350
Mean VIF	1.60			

Heteroskedasticity is another possible threat to the assumption that the error terms are independently and identically distributed. If heteroskedasticity is present in the analysis model, it causes standard errors to be biased, which in turn leads to biased test statistics and confidence intervals. To control heteroskedasticity, robust standard errors were employed for the analysis.

Results of Multivariate Probit Analysis

This study aimed to examine the impacts of policy, the advancing information technology, and organizational characteristics on local government agencies' information sharing. Based on understanding which factors influence organizations' information-sharing capabilities, organizations can develop a comprehensive plan specifying targets, media, and strategies for effective information sharing in order to lower transaction costs and improve performance. More specifically, this analysis employed a multivariate probit model to jointly estimate such impacts on each information-sharing activity that an LHD performs to improve public policymaking.

Table 5.4 displays the analysis results indicating that the hypotheses proposing that the residuals of the joint models are correlated ($\rho_{21} = \rho_{31} = \rho_{32} = \rho_{41} = \rho_{51} = \rho_{32} = \rho_{42} = \rho_{52} = \rho_{43} = \rho_{53} = \rho_{54} = 0$) were rejected. This means that the multivariate probit model is appropriate for assessing the joint distribution of the errors by providing more efficient estimators than a series of biprobit models (Cameron & Trivedi, 2009). Also, the Wald ^{2} statistic (Wald ^{2} = 344.35, p = .000) in the results revealed that a set of parameters fit the analysis model to test simultaneously. In conclusion, the multivariate probit model was appropriate for jointly assessing the maximized likelihood of the policy, technological, and organizational factors on a variety of information-sharing activities of an LHD.

The ARRA and ACA legislation was designed to support information sharing and collaboration among public health government agencies, private clinics, laboratories, and research centers by encouraging the adoption of HIT tools for the interchange of patients' health data and community reports. Accordingly, this study proposed that an LHD that implements more HIT tools to comply with the enactment is likely to perform a variety of information-sharing activities to share information strategically. However, the results show that the coefficients of HIT tools were negative, implying that the use of HIT tools is not critical in determining an LHD's information-sharing activities. Therefore, H_1 was not supported.

The results on the use of advancing information technology were mixed. Using SNS channels was effective when an LHD shares information by preparing policy briefs for legislators and giving testimony to policymakers. However, the use of hardware for information sharing was not statistically significant. Therefore, H_{2a} was partially supported while H_{2b} was not supported.

The results indicate that organizational characteristics are more critical than the policy and technological factors on local government agencies' information-sharing activities. First, centralization of decision making had a positive impact on information sharing, especially such activities as preparing policy briefs, giving testimony to policymakers, and communicating with policymakers and legislators. Centralization of approval for budget had negative effects on information sharing; however, the impact of centralization of approval for budget on preparing policy briefs was statistically significant. Therefore, H_{3a} and H_{3b} were partially supported.

Formalization, which is an axis of organizational structure and which is revealed from a written agreement or rules, was expected to restrain LHDs' information sharing with other agencies. The results, however, show that formalization had positive effects on information

sharing, particularly, activities such as preparing policy briefs, participating on a board or advisory panel, and providing technical assistance to policymakers and legislators. The other information-sharing activities of giving testimony to policymakers and communicating with legislators were not statistically significant. Therefore, H_4 was partially supported.

This study predicted a positive relationship between having more information officers at an LHD and information-sharing activities. The results show that an LHD that hires more information officers is more likely to implement a variety of information-sharing activities, except communicating with policymakers and legislators. Therefore, H_5 was partially supported.

This study proposed that an LHD that has implemented a strategic plan over the years is more likely to share information through different channels with other government agencies to achieve organizational goals. The results support the hypothesis that developing a strategic plan had positive effects on a variety of information-sharing activities – preparing policy briefs (β = .2138), giving testimony (β = .2545), participating on a board or advisory panel (β = .2260), communicating with policymakers and legislators (β = .1852), and providing technical assistance to policymakers and legislators (β = .1506) – with statistical significance. Therefore, H_6 was supported.

Delivery of public services in more efficient and effective ways is one of the major concerns for government. Local government agencies adopt various methods such as contracting out, coalition, collaboration, and coproduction to achieve cost-efficient public services. Interestingly, the results demonstrate that LHDs which contract out more than directly provide public health services highly share information with other government organizations through a variety of information-sharing activities. The coefficients of each information-sharing activity – preparing policy briefs (β = 1.6337), giving testimony (β = .9380), participating on a board or

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advisory panel (β = 1.2089), communicating with policymakers and legislators (β = 1.4367), and

providing technical assistance to policymakers and legislators (β = 1.4900) – were considerably

positive and statistically significant. Therefore, H_7 was supported.

Table 5.4

Results of Multivariate Probit Analysis of the Variety of Information-Sharing Activities

	Policy Briefs	Testimony	Board/ Advisory Panel	Communication	Technical Assistance
	β /S.E.	β /S.E.	β /S.E.	β /S.E.	β /S.E.
HIT Tools	-0.0753 (0.0508)	-0.0489 (0.0503)	-0.0163 (0.0515)	-0.0080 (0.0638)	-0.0062 (0.0512)
SNS	0.1816* (0.0819)	0.1811** (0.0629)	0.0632 (0.0699)	0.1237 (0.0856)	0.1003 (0.0648)
Hardware	0.0621 (0.0381)	0.0148 (0.0392)	0.0636 (0.0395)	0.0122 (0.0497)	0.0542 (0.0399)
Decision-making	0.1116* (0.0501)	0.1045* (0.0515)	0.0925 (0.0540)	0.2054*** (0.0572)	0.0924 (0.0541)
Approval for Budget	-0.1621** (0.0507)	-0.0507 (0.0505)	-0.0164 (0.0534)	0.0502 (0.0576)	-0.0442 (0.0506)
Formalization	0.1227* (0.0620)	0.0694 (0.0593)	0.1545* (0.0736)	0.0885 (0.0900)	0.1667** (0.0641)
Information Officer(s)	0.1643** (0.0546)	0.2611*** (0.0564)	0.2122*** (0.0594)	0.0879 (0.0666)	0.1983*** (0.0567)
Strategic Plan	0.2138** (0.0742)	0.2545*** (0.0750)	0.2260** (0.0784)	0.1851* (0.0896)	0.1506* (0.0763)
Ratio of Contracted Out	1.6337*** (0.2882)	0.9380*** (0.2759)	1.2089*** (0.2928)	1.4367*** (0.3474)	1.4900*** (0.2841)
Budget (ln) per Employee	-0.0467 (0.0359)	-0.1225** (0.0461)	-0.0794* (0.0376)	-0.1363** (0.0432)	-0.1327*** (0.0373)
Local	0.4261*** (0.1104)	0.4688*** (0.1157)	0.4855*** (0.1171)	0.6068*** (0.1260)	0.4307*** (0.1165)
County	-0.1994* (0.0875)	-0.2845** (0.0896)	-0.3625*** (0.0983)	-0.1311 (0.1076)	-0.4751*** (0.0922)
Constant	-0.8994 (0.1871)	-0.6937 (0.1952)	-0.3354 (0.1997)	-0.0460 (0.2161)	-0.7426 (0.1909)
ρ_{21}	0.7350*** (0.0536)				
ρ_{31}	0.6112*** (0.0540)				
ρ_{41}	0.5549*** (0.0576)				
ρ_{51}	0.6344*** (0.0519)				
ρ_{32}	0.5733*** (0.0508)				

	0.6176***
	(0.0614)
	0.6421***
	(0.0490)
	0.5731***
	(0.0575)
	0.5845***
	(0.0542)
	0.6063***
	(0.0549)
Log Likelihood	-3245.1118
Wald x^2	344.35
p	0.0000
N	1,324

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Marginal Effects

This study assessed the marginal effects of policy, the advancing technology, and organizational characteristics on information sharing by using the maximized likelihood of each information-sharing activity. The marginal effects shown in Table 5.5 display average (percent point) change in the probability of each information-sharing activity when the independent variable of interest changes by one unit for continuous variables or increases from 0 to 1 for indicator variables.

In terms of the impact of the ARRA enactment on LHDs' information-sharing activities, additional adoption of HIT tools did not bring positive change in information sharing. This study supports that the use of more advanced information technology helps organizations share information with external agencies, and SNS, in particular, showed more marginal effects. When an LHD uses more SNS, it caused an 18.16 percentage point increase in preparing policy briefs for policymakers and legislators and an 18.10 percentage point increase in giving testimony to

policymakers. Additional adoption of mobile technology devices had positive marginal effects on LHDs' information sharing; however, it was not statistically significant.

Centralization of decision making had positive marginal effects on LHDs' information-sharing activities, particularly on preparing policy briefs (11.16 percent points), giving testimony to policymakers (10.15 percent points), and communicating with legislators (20.53 percent points). On the other hand, another dimension of centralization, approval for budget, had negative marginal effects. Only the activity of preparing policy briefs was statistically significant and its marginal effects were -16.20 percentage points on information sharing. The results suggest that centralization had opposite effects on interorganizational information sharing, depending on the concentration variable (decision-making on policies and regulations or approval for budget).

The marginal effects of formalization were positive on all information-sharing activities. However, activities of preparing policy briefs (12.27 percent points), participating on a board or advisory panel (15.45 percent points), and providing technical assistance to policymakers and legislators (16.66 percent points) were statistically significant.

The results support that having information officers at an LHD helps organizations share information with other agencies through a variety of activities, excluding communication with policymakers and legislators. An additional information officer at LHDs tended to increase 16.42 percent points of preparing policy briefs. Furthermore, the effects of having an information officer on information sharing were maximized as much as 26.10 percent points, when an LHD gives testimony to policymakers. Having an information officer had a 21.22 percent point increase in an LHD's participation on a board or advisory panel and a 19.82 percent point increase in providing technical assistance to policymakers and legislators.

The results of the marginal effects indicate that developing a strategic plan is key in promoting a culture of sharing information with other government agencies. Organizations that had already implemented a long-term and comprehensive strategic plan were more likely to have a variety of information-sharing activities than LHDs without a strategic plan. Among the variety of information-sharing activities, developing a strategic plan had marginal effects as much as 24.45 percentage points greater when an LHD gave testimony to public policymakers. Likewise, the marginal effects of a strategic plan were increased by 21.37 percentage points for preparing policy briefs, 22.60 percent points for participating on a board or advisory panel, 18.50 percent points for communicating with legislators, and 15.05 percent points for providing technical assistance to decision-makers. The results emphasize that a strategic plan helps organizations achieve goals by figuring out appropriate targets and evaluating suitable methods to share the needed information.

Lastly, contracting out had considerably large effects on LHDs' information sharing. LHDs that contracted out one additional percent of public health service were highly likely to share information with other government agencies through preparing policy briefs (163.36 percent points), giving testimony (93.80 percent points), participating on a board or advisory panel (120.88 percent points), communicating with policymakers and legislators (143.67 percent points), and providing technical assistance (149.00 percent points).

The results also indicate that control variables significantly influence local government agencies' information-sharing activities. For example, an increase in budget (in logarithm) per employee did not lead to improvement in any kinds of information-sharing activities. Regarding an LHD operated as a local government agency, the governance had a positive impact and a

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quantitatively large effect on information sharing. However, if an LHD serves a county with public health services, the likelihood of taking information-sharing activities decreased.

Overall, the results demonstrate that the technology and organizational characteristics play a critical role in determining LHDs' information-sharing activities. However, the impacts of those factors were relatively weak on the communication activity, which is the most commonly conducted activity at local government agencies. This implies that for such prevalent information-sharing activity, the impacts of policy and technological factors may be less influential because it is already routinized in organizational operations. In contrast, the activity of preparing policy briefs for policymakers and legislators was influenced by various aspects of technological and organizational factors.

Table 5.5

Marginal Effects of the Policy, Technological, and Organizational Factors on the Variety of Information-Sharing Activities

	Policy Briefs	Testimony	Board/ Advisory Panel	Communication	Technical Assistance
HIT Tools	-7.52	-4.88	-1.62	-0.80	-0.62
SNS	18.16*	18.10**	6.32	12.37	10.02
Hardware	6.21	1.48	6.36	1.21	5.41
Decision making	11.16*	10.45*	9.25	20.53***	9.24
Approval for Budget	-16.20**	-5.07	-1.63	5.01	-4.41
Formalization	12.27*	6.94	15.45*	8.84	16.66**
Information Officer(s)	16.42**	26.10***	21.22***	8.78	19.82***
Strategic Plan	21.37**	25.45***	22.60**	18.50*	15.05*
Ratio of Contracted Out	163.36***	93.80***	120.88***	143.67***	149.00***
Budget (ln) per Employee	-4.67	-12.25**	-7.94*	-13.63**	-13.26***
Local	42.60***	46.87***	48.54***	60.67***	43.07***
County	-19.93*	-28.45**	-36.25***	-13.11	-47.51***

$* \ p < 0.05, \ ** \ p < 0.01, \ *** \ p < 0.001$

Discussion

This analysis aimed to lay the foundation for further assessment of the extent to which surroundings and internal factors of local government agencies – the policy, the use of advancing technology, and organizational characteristics – determine information-sharing activities by employing multivariate probit models and calculating marginal effects. Overall, the results indicate that the relationships between the policy and technology features and LHDs' information-sharing activities are weak. However, the organizational characteristics of structure,

human resources, and service delivery options more significantly influence LHDs' engagement in sharing information with other agencies.

Analysis of the impact of policy and advancing technology on a variety of information-sharing activities showed mixed results. The results support that the use of more HIT tools and mobile technology devices is not critical in diversifying information-sharing activities. However, using more SNS channels contributes to increasing the likelihood of information-sharing activities, especially preparing policy briefs for legislators and giving testimony to policymakers. Considering that only one percent of all LHDs have implemented all five different HIT tools, information sharing through the health information infrastructure to achieve meaningful use of health-related data may not yet be realized.

Interestingly, centralization affected information sharing in opposite directions. Centralization on policy and regulation decision-making increased the likelihood of LHDs' information-sharing activities such as preparing policy briefs, giving testimony, and communicating with legislators while centralization on budget approval reduced the possibility of such activities. These mixed results indicate that, to some extent, information-sharing activities can be encouraged by a centralized body such as a board or top executives. In this light, another axis of organizational structure, formalization, was shown to have positive effects on information sharing. Although extensive formalized rules and regulations that limit flexibility prohibit employees and organizations from accessing and sharing information, to a certain degree formalization may help initiate information sharing through a formal network that is an already organized and framed system.

The findings emphasize that human resource management, the development of a strategic plan, and a collaborative network to deliver public service foster information sharing. For

instance, information officers who are responsible for IT management also play the role of facilitator in promoting information sharing with policymakers, legislators, and other government agencies. In addition, the findings support that local government can advantageously promote information sharing by developing a strategic plan to diffuse innovation among organizations. As previous studies have found, this study also supports the positive impact of an organization's strategic plan to enhance ongoing procedures and achieve the organizations' goals by planning from long-term and comprehensive perspectives (Bryson, 1995; Moon 2002). More importantly, the results indicate that contracting out of public health care for the community greatly increases the likelihood that an LHD engages in information-sharing activities to reduce costs and hence improve efficiency in policymaking. It is possible that the flow of information sharing occurs when contracts between an LHD and other organizations in different jurisdictions are made for service provision decisions and monitoring to ensure that service delivery is provided satisfactorily to the public.

This study revealed that, among the five information-sharing activities, an LHD was less likely to choose the option of communication with legislators to share information, given the conditions. This implies that the communication method has less impact on information sharing. To diversify activities for effective information sharing, LHDs need to secure essential resources such as information officers to develop a strategic plan.

In sum, the findings indicate that an LHD is more likely to perform a variety of information-sharing activities to improve policymaking when it uses more SNS channels, is more formalized, has a greater number of information officers, has developed a strategic plan, provides public healthcare through contracting out, and is operated as a local government agency. Furthermore, the findings strongly suggest that at the current stage in the health information

infrastructure, the U.S. government needs to profoundly exploit organizational features to

increase an LHD's information sharing capabilities, and not only to promote the adoption of HIT

network tools.

CHAPTER 6

RESULTS: THE LEVELS OF GOVERNMENT

Historically, the U.S. public healthcare has maintained a top-down system from the

federal to state and local government agencies and jurisdiction-based management to provide

public health service to the community. Such federalist system has shifted because of a growth of

state-administered federal programs and state-initiated policies that require LHDs to partner with

the levels of government as well as external organizations and share resources. LHDs have a

variety of partners from public to private and nonprofit sectors, from other public health agencies

to private clinics, schools, and research centers. Therefore, knowing a target with which to share

information is important for LHDs to develop a range of strategies for effective information

sharing to increase efficiency in public health service delivery and to improve policymaking. The

second analysis concerns, given the policy, technical, and organizational factors, which level of

government an LHD is most likely to share information with, i.e., local, state, or federal.

Descriptive Statistics

The purpose of the multivariate probit model was to assess the maximized likelihood of

each choice when given multiple options to select. In this analysis, the three dependent variables

were the three levels of government with which the LHD has shared information: local, state, or

federal government. Each dependent variable was binary, asking whether an LHD has

experienced sharing information with different levels of government. Table 6.1 indicates that

78.9% of LHDs have shared information with other local government agencies and 56.05% of

LHDs with the state level. However, only 14.6% of LHDs have shared information with the

federal level of government.

Table 6.1

Descriptive Statistics

Variable	Obs	Mean	S.d.	Min	Max
Dependent					
Local	2,000	.7890	.4081	0	1
State	2,000	.5605	.4964	0	1
Federal	2,000	.1460	.3531	0	1
Independent					
HIT Tools	2,000	.6100	1.2299	0	5
Social Network Service	2,000	.2375	.7465	0	6
Hardware	2,000	.8665	1.7123	0	6
Strategic Plan	1,959	.5058	.5000	0	1
Decision Making	1,371	-1.47e-08	.8548	-2.1608	.8642
Approval for Budget	1,371	-1.06e-09	.7395	-1.5384	1.6998
Formalization	2,000	.1555	.5817	0	4
Information Officers	2,000	.5015	.7591	0	2
Rate of Contracted-Out	2,000	.4117	.1573	0	1
Control					
Budget (ln) per Employee	1,941	.7457	1.1638	0	11.8454
Governance	2,000	.7145	.4517	0	1
Jurisdiction	2,000	.7335	.4422	0	1

Table 6.2 displays correlations among variables employed in this study. Each level of

government variable had a positive relationship with most of the other variables except budget

(in logarithm) per employee. Strong positive relationships between the use of HIT tools and

hardware (.5019), between the use of HIT tools and SNS (.7919), and between SNS and

hardware (.6200) were detected.

Table 6.2

Correlations of Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Local	1.0000														
2	State	0.2778*	1.0000													
3	Federal	0.1756*	0.3519*	1.0000												
4	HIT Tools	0.0792*	0.0804*	0.0862*	1.0000											
5	SNS	0.1022*	0.0969*	0.1720*	0.5019*	1.0000										
6	Hardware	0.0842*	0.0910*	0.1100*	0.7919*	0.6200*	1.0000									
7	Decision-Making	0.2000*	0.1696*	0.1151*	0.0207	0.0476	0.0625*	1.0000								
8	Approval for Budget	0.0305	0.0537*	0.0416	-0.0138	-0.0190	-0.0048	0.2582*	1.0000							
9	Formalization	0.0708*	0.0878*	0.0428	-0.1326*	-0.0851*	-0.1353*	0.0457	0.0195	1.0000						
10	Info Officers	0.0898*	0.1391*	0.1839*	0.0858*	0.1852*	0.1085*	-0.0105	0.0173	0.0442*	1.0000					
11	Strategic Plan	0.1242*	0.1556*	0.1015*	0.0459*	0.0621*	0.0433	0.0347	0.0634*	0.0204	0.1851*	1.0000				
12	Ratio	0.1990*	0.2018*	0.1442*	0.0826*	0.0856*	0.0638*	0.0727*	0.0603*	0.0693*	0.3053*	0.2472*	1.0000			
13	Budget (ln) per Employee	-0.0722*	-0.1145*	-0.0841*	-0.0554*	-0.0888*	-0.0601*	0.0964*	0.0202	-0.0351	-0.2111*	-0.1864*	-0.2825*	1.0000		
14	Governance	0.2347*	0.1518*	0.1516*	0.0057	0.0869*	0.0490*	0.4792*	0.0385	0.0529*	-0.1162*	-0.0593*	-0.1540*	0.2174*	1.0000	
15	Jurisdiction	-0.0179	0.0473*	0.0314	0.0571*	-0.0067	0.0171	-0.1211*	0.1381*	-0.0158	0.0675*	0.0892*	0.0749*	-0.0932*	-0.0881*	1.0000

* *p*<0.05

For accurately estimated coefficients, the error terms should be independently and identically distributed. A test to detect multicollinearity in the data was conducted to assess the variance inflation factors (VIFs) for each explanatory variable. The overall mean VIF was 1.60, which indicates that the independent variables in the model were moderately correlated. (For the results of the multicollinearity test, see Table 5.3). Also, robust standard errors were employed in the analysis to control heteroskedasticity.

Results of Multivariate Probit Analysis

The purpose of the analysis was to examine the maximized likelihood that an LHD has shared information with a local, state, or federal government, by using the multivariate probit model. Table 6.4 displays the analysis results indicating the hypotheses that the residuals of the joint models are correlated ($\rho_{21} = \rho_{31} = \rho_{32} = 0$) were rejected, so in this analysis the multivariate probit model provided more efficient estimators assessing the joint distribution of the errors (Cameron & Trivedi, 2009). In addition, the Wald ^{2} statistic of the results revealed that the set of parameters fit the analysis model to test simultaneously. Explicitly, the multivariate probit model was effective in simultaneously estimating the maximized likelihood of the policy, technological, and organizational factors on each level of government with which an LHD has shared information.

Broadly, the results in Table 6.4 provide empirical evidence supporting the effects of the SNS and organizational factors on LHDs' information-sharing activities, while the impacts of HIT tools and hardware on information sharing were not statistically significant. Organizational characteristics such as centralization of decision making and ratio of contracted out to directly provided significantly influence on an LHD's information sharing with all levels of government.

In detail, the study hypothesized that the use of HIT tools as compliance with the ARRA, which aims to build nationwide health information technology infrastructure for networking healthcare providers and sharing health-related information, increases information-sharing activities. However, the use of HIT tools did not have a substantial impact on LHDs' information sharing with any level of government. Therefore, H_1 was not supported.

In terms of the use of advancing technology, the findings show mixed results. While having more channels of SNS helped LHDs share information with the federal government, it did not support LHDs' information-sharing activities with local or state government. Equipped with hardware did not influence LHDs' information sharing with any level of government. Therefore, the hypothesis related to the effects of SNS (H_{2a}) was partially supported, while that related to hardware (H_{2b}) was not supported.

The study examined how organizational characteristics shape an LHD's information-sharing activities with different levels of government. The findings show that factors such as centralization of decision making, formalization, having information officer(s), strategic plan, and ratio of the services contracted out to directly provided had a statistically significant effect on LHDs' information sharing. Particularly, an LHD's centralization of decision making influenced its activities in sharing information with all levels of government; on the other hand, centralization of budget did not have an impact. Therefore, H_3 was partially supported.

The findings revealed that another axis of organizational structure, formalization, influenced an agency's information-sharing activities. In other words, LHDs that have more formal agreements such as written documentation when sharing resources with other agencies are more likely to share information with the state government. However, formalization did not

affect an LHD's information sharing with other local agencies or the federal government. Therefore, H_4 was partially supported.

Information officers are responsible for managing the flow of information in organizations by collecting, processing, and sharing, and operating information technology devices. Thus, it is expected that having information officers in LHDs helps the agencies access, handle, and disseminate health-related information with partners and organizations. The results also provided evidence to support that LHDs that have information officers are more likely to share information with the state and federal government. Therefore, H_5 was partially supported.

A strategic plan is regarded as a long-term and systematic effort to improve public health policy and healthcare services by setting priorities in collecting, analyzing, and disseminating information such as community health needs and status. Logically, an LHD that has developed a strategic plan is more likely to share information with external partner agencies to collaborate and enhance performance. The analysis results indicate that LHDs that have implemented a comprehensive strategic plan participate in sharing information with state government. Therefore, H_6 was partially supported.

Lastly, the results suggest that an LHD that contracts out public health services more than it directly provides is likely to share information with all levels of government. This provides empirical evidence that contracting out for service delivery promotes interorganizational information sharing with other agencies to network and collaborate. Therefore, H_7, proposing that an LHD that contracts out more to provide public health services with external agencies is more likely to share information, was supported.

Interestingly, budget (ln) per employee did not have statistically significant impacts on the levels of government with which an LHD shares information, except the state government.

Also, an LHD governed as a local agency tends to share information with all levels of government.

Table 6.3

Results of Multivariate Probit Analysis of the Levels of Government

	Local	State	Federal
	β (S.E.)	β (S.E.)	β (S.E.)
HIT Tools	0.0014 (0.0599)	-0.0172 (0.0531)	-0.0076 (0.0584)
Social Network Service	0.1855 (0.1014)	0.0419 (0.0687)	0.2074** (0.0656)
Hardware	0.0204 (0.0473)	0.0605 (0.0400)	-0.0092 (0.0447)
Decision Making	0.1157* (0.0564)	0.1569** (0.0511)	0.1301* (0.0633)
Approval for Budget	-0.0058 (0.0599)	0.0012 (0.0512)	0.0078 (0.0590)
Formalization	0.1177 (0.0867)	0.2732*** (0.0779)	0.1173 (0.0671)
Information Officer(s)	0.0453 (0.0666)	0.1251* (0.0545)	0.1926*** (0.0578)
Strategic Plan	0.1683 (0.0904)	0.1999** (0.0751)	-0.0015 (0.0875)
Ratio of Contracted Out	1.4299*** (0.3733)	1.1362*** (0.2806)	1.0493** (0.3321)
Budget (ln) per Employee	-0.0691 (0.0395)	-0.0893* (0.0347)	-0.0886 (0.0525)
Governance	0.7360*** (0.1203)	0.4681*** (0.1095)	0.4871*** (0.1364)
Jurisdiction	-0.2556* (0.1132)	0.1008 (0.0883)	0.1142 (0.1016)
Constant	-0.0818 (0.2250)	-0.7847 (0.1861)	-2.0561 (0.2433)
ρ_{21}	0.2213*** (0.0503)		
ρ_{31}	0.1973*** (0.0556)		
ρ_{32}	0.7665*** (0.0645)		
Log Likelihood	-1810.0165		
Wald x^2	254.99		
p	0.0000		
N	1,324		

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Marginal Effects

The study aimed to evaluate the marginal effects of the policy, the use of advancing information technology, and organizational features on an LHD's information-sharing activities. The marginal effects shown in Table 6.5 measure average (percent point) change in the probability of sharing information with each level of government when the independent variable of interest changes by one unit for continuous variables or increases from 0 to 1 for indicator variables.

Even though the impact of HIT tools on the levels of government with which an LHD shares information was not statistically significant, the marginal effects of HIT tools adoption were very low and negative. While the use of IT devices did not lead to an increase in LHDs' information-sharing activities with different levels of government, the use of one additional SNS channel increased LHDs' information sharing with the federal government by 20.73 percent points.

An LHD whose structure is centralized on decision-making was more likely to share information with all levels of government, displaying similar degrees of marginal effects. For example, the possibility of sharing information with the state government was 15.68 percent points and that with the federal government was 13.01 percent points. Formalization also affected LHDs' information sharing with state government as much as 27.31 percent points. Even though it was not statistically significant, formalization had positive marginal effects on sharing information with local and federal government agencies – 11.76 percent points for local agencies and 11.72 percent points for the federal government. This implies that, to an extent, having a formal written agreement helps organizations share resources and information across organizational boundaries.

It is logical to assume that having more information officers in an LHD helps the agency facilitate IT systems, administer a secure database, develop IT strategy, and share information with other government agencies and external partners. The analysis in this study demonstrated that having one more information officer in an LHD increased sharing information with the federal government as much as 19.26 percent points and 12.51 percent points with state government agencies. The marginal effects of having an information officer on information sharing with local government were 4.52 percent points; however, this was not statistically significant.

Comparing an LHD that has developed a strategic plan to improve policymaking and healthcare services to one that has not, the impact of having a strategic plan on information sharing with state government is increased by 19.99 percent points. Oddly, developing a strategic plan has a negative effect on LHDs' information sharing with the federal government, even though it is not statistically significant.

As the literature on collaboration implicates that information sharing helps organizations develop reciprocal partnerships with external agencies for the delivery of public service, the findings provide empirical evidence for the relationship between information sharing and contracted-out. The marginal effects of contracted-out on information sharing with all levels of government were statistically significant and these were quantitatively large effects. The effects were maximized when an LHD shares information with other local government agencies by 142.98 percent points, by 113.61 percent points for the state, and 104.92 percent points for the federal government.

Table 6.4

Marginal Effects of the Policy, Technological, and Organizational Factors on the Levels of Government with which an LHD Shares Information

	Local	State	Federal
HIT Tools	0.13	-1.71	-0.76
SNS	18.54	4.18	20.73**
Hardware	2.03	6.04	-0.91
Decision-Making	11.56*	15.68**	13.01*
Approval for Budget	-0.57	0.11	0.77
Formalization	11.76	27.31***	11.72
Information Officer(s)	4.52	12.51*	19.26***
Strategic Plan	16.83	19.99**	-0.15
Ratio of Contracted Out	142.98***	113.61***	104.92**
Budget (ln) per Employee	-6.90	-8.93*	-8.85
Local	73.60***	46.81***	48.70***
County	-25.56*	10.07	11.42

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Discussion

Information sharing allows organizations to access the needed information with lower costs, and continuous information sharing facilitates a culture of openness, accountability, and trust among organizations, which increases opportunities for collaboration. Accordingly, it is important for organizations to identify the determinants of information sharing and to develop a strategic plan for acquiring resources to promote interorganizational information sharing. Substantially, the findings provide empirical evidence that can help LHDs understand how the use of HIT tools and information technology, as well as organizational characteristics, facilitate and promote sharing information with the local, state, and federal government when making and implementing public health policies.

The empirical analysis in the study provided several significant findings. First, the results indicate that the use of HIT tools did not have any statistically significant effects on information sharing. In other words, the adoption of more HIT tools such as EHR, HIE, or IR did not promote LHDs' increasing information-sharing activities with government. Also, even though it was not statistically significant, the marginal effects of implementing HIT tools on information sharing were very weak – for example, only a .13 percent point increase in sharing information with the local government and even a 1.71 percent point decrease in sharing information with state agencies and a .76 percent point decrease with the federal government. Some previous studies reported that nationwide health information infrastructure through information technology accelerates networking and collaboration among LHDs and external partners, thereby enabling LHDs to achieve evidence-based decision making and policy integration; however, the results of this study did not support this (i.e., Buntin, Jain, & Blumenthal, 2010; Finkelstein, Barr, Kothari, Nace, & Quinn, 2011; Gold, McLaughlin, Devers, Berenson, & Bovbjerg, 2012; Jones & Furukawa, 2014; Maxson et al., 2010). It may be that LHDs need more time to fully prepare to adopt and implement HIT tools nationwide as the private sector does. For example, records show the steady success in adoption from a 19% adoption rate in 2007 up to 94% of hospitals using a certified EHR system in 2015 (ONC, 2015). However, the EHR adoption rates in LHDs were only 25% in 2013 and such a low adoption rate could hinder LHDs in effectively sharing health-related data and information with partner agencies. Considering the leading role of LHDs in policymaking for public health, it is incumbent upon the federal government to incentivize LHDs to adopt more HIT tools to sharing health-related information with all levels of government and across sectors.

Similarly, the impact of hardware adoption on LHDs' information sharing was not statistically significant, possibly because hardware (i.e., computers, mobile devices) is already prevalent in most offices and organizations for their routinized operation. This implies that just being equipped with such hardware is not enough to considerably improve organizations' information sharing; however, such devices are necessary as means of communication and access to information. Hence, information technology is part of the effort to enhance the information management capacity to integrate public services (Dawes, Cresswell, & Pardo, 2009).

The findings highlight the importance of management in fostering interorganizational information sharing. Technology such as HIT tools and advanced mobile devices is necessary but not sufficient for successful information sharing. Rather, management matters for developing long-term comprehensive plans to improve organizational performance, from securing IT tools to managing human resources for systematic information management. Thus, information officers can play a critical role in maintaining the systematic collection, process, storage, and evaluation of information and IT applications; hence, human resource management can contribute to advancing information-sharing activities. Setting a strategic plan facilitates organizations to maintain their missions to achieve organizational goals, thereby adopting innovation to enhance their routinized operation. An organization's development of a comprehensive plan can strategically expand the boundaries of networking by sharing information. This is also supported by the results that local organizations contracting out more than directly providing public health services greatly tend to share information with all levels of government.

Scholars note that the hierarchical structure of government organizations hinders informal communication and information sharing among employees and agencies. Fostering a

flow of information requires flexibility and less emphasis on rules and regulations (Andrews et al., 2011; Rainey, 2014). In contrast to this point, the study finds that to some extent centralization and formalization cultivate organizations' information sharing through making formal agreements with government agencies. Also, policymakers and leaders, who have authority in decision-making in a government agency, can promote information sharing by assessing the information that organizations need and providing them with strategic directions for obtaining the needed information. To the end, information sharing helps organizations achieve policy integration transcending horizontal and vertical intergovernmental boundaries as well as make evidence-based decisions.

CHAPTER 7

CONCLUSION

The significance of information sharing across the sectors has received much attention since the 9/11 attack, and the U.S. government has developed strategies to promote information sharing in public organizations. In the area of public health, since the enactment of the ARRA, HIT networks have the potential to connect public health agencies, private clinics, practitioners, and laboratories to share health-related data. Participating organizations can benefit from information sharing in a number of ways including reducing transaction costs, maintaining collaborative relationships, increasing efficiency in policymaking and implementation, being competitive, and finally, leading to desired policy changes and innovation. In addition, as information sharing makes all participating organizations equal entities to the formal agreement, the goals of policy integration and collaborative governance can be achieved.

In spite of its significance and mutual benefits, little is known about how external and internal features of organizations influence information sharing in public agencies. Research gaps still exist for the development of accurate definitions, measurement, theories, and empirical tests. Hence, this study not only addressed these issues but also aimed to provide further understanding of influential factors on the public organizations' information-sharing activities from three perspectives – the policy, technological, and organizational lenses. Also, the purpose of this research was to refine theories of the bounded rationality and innovation in information sharing with empirical analyses and results; thus, to this end, public health agencies can secure

the needed resources and develop strategic planning to improve the health care information system in effective and efficient ways.

Summary

Taking the perspective of the bounded rationality theory, this dissertation aimed to explore the determinants of information sharing in local government agencies. Public organizations are a collective of people who, as the theory assumes, are bounded by their limited cognitive abilities and a finite amount of time to make a decision, and who exist under fundamental uncertainty and risks coming from the surrounding environment. In addition, public organizations strive to deal with an intensive amount of information for the public's welfare, and they tend to gather more information for better decision-making and to show for symbolic purposes that they are well managed and perform well (Feldman & March, 1981). Hence, interorganizational information sharing can be a strategy for organizations to access and collect the needed information and, at the same time, to build partnerships with external organizations, which in turn can improve policymaking. For instance, the U.S. government has established a series of legislations, such as the ITMRA of 1996 and the HITECH provision, and provides incentives to promote interorganizational information sharing.

In addition, the development of information technology helps organizations manage a flow of information in searching, storing, processing, and sharing. For example, SNS channels provide convenience in contacting and communicating with a number of target audiences, and delivering information in a short time and with lower costs. The organizational characteristics including organizational structure, human resources, and strategies for better management also

affect information sharing. Therefore, it is necessary to examine which attributes jointly influence public organizations to engage in information sharing with other agencies.

Previous research on information sharing has been conducted at the individual level, focusing on individuals' willingness, or openness, to share information with other employees. Thus, the studies concerned individuals' activities and perceptions: for example, how much employees trust others in different departments, how much top management support their information sharing by providing rewards or incentives, and how much they are involved in networking to share information with partners (e.g., Kim & Lee, 2006, Li & Lin, 2006). However, information sharing at the organizational level is different in that organizational information sharing is mostly affected by organizations' IT capacity and organizational attributes. Hence, measurement for organizational information sharing should be different from that for individuals and should not simply aggregate individuals' information-sharing activities. This research suggested new measurement for organizational information sharing by specifying the target audience and the activities to share information.

This study hypothesized the impacts of the HITECH provision, the use of advancing information technology, and organizational attributes such as centralization, formalization, a strategic plan, human resources, and a type of public service delivery on information sharing in local health departments. More specifically, the findings of this study support that an LHD is more likely to share information with other organizations when it adopts more HIT tools to comply with the HITECH provision, uses more information technology devices such as mobile equipment and utilizes SNS channels, is less centralized and formalized, hires more information officers, has developed a strategic plan, and contracts out public health services more than it directly provides.

Using the 2013 National Profile of Local Health Departments datasets, this study assessed the hypotheses of relationships between the policy, technology, and organizational characteristics and information-sharing activities in local health departments. The survey was distributed to 2,532 local health departments during January-March 2013 to explore the workforce, finance, governance, policy advocacy activities, and the utilization of information technology. The response rate was 79%, which provides a good fit to analyze the activities of local health departments in the United States. This research employed the multivariate probit models to test the maximized likelihood estimation of the impacts of each policy, technological, and organizational factor on several aspects of information-sharing activities of local public health departments.

The results of the assessment showed that the impact of the HITCH provision was not statistically significant on organizational information sharing, the types of information-sharing activities, nor the levels of government. In addition, the study found that the utilization of advancing information technology has mixed effects on information sharing in local government agencies. While the use of more information technology hardware such as mobile technology did not affect organizational information sharing, the use of more SNS channels to connect with the public and other agencies had positive impacts on LHDs' information sharing.

The findings reveal that the impacts of the organizational characteristics of local health departments on information sharing are greater than the legislation and the use of information technology. Specifically, organizations that have a more centralized decision-making structure for hiring or firing a department head, that set goals that guide the LHD, and that adopt public health regulations performed a variety of information-sharing activities as well as diversified information-sharing targets – the local, state, and federal government. On the other hand, the

findings indicated that centralization of approval for budget did not promote LHDs to have more information-sharing activities nor to contact different levels of government to share health policy-related information. Also, it was shown that another dimension of organizational structure, formalization, has positive effects on information sharing. In sum, a certain degree of centralization and formalization – if they do not forbid flexibility too much – can help organizations share information with other agencies by setting organizational goals or providing guidance to achieve the goals.

This research also highlights critical roles of human resource management and a strategic plan for better outcomes. The impacts of having information officers, whose position is designed for information management, IT system administration, and data analysis, have a strong positive influence on increasing organizational information sharing, both the varieties of activities and the target government. Furthermore, a strategic plan increases the likelihood that an LHD performs a variety of information-sharing activities and contacts different levels of government to share information.

Lastly, this research found that a type of public service delivery greatly influences organizational information sharing – in determining the activities and the levels of government to share information with. In other words, an LHD which provides public health services through contracting out with other LHDs or clinics is exceedingly likely to share information. The results imply that information sharing can be an initiative step for organizations to seek further collaboration.

Taken together, this research found that these policy, technological, and organizational characteristics jointly determine local government agencies' information sharing. As the United States government has strived to promote information sharing among agencies across sectors to

improve policymaking, this study can contribute to identifying the determinants of information sharing and understanding how the federal government can help local and state governments prepare guidelines and secure needed resources to actively share information.

Theoretical Implications

This study provides significant implications for the field of public administration and, more specifically, for developing a better understanding of information sharing. In spite of the critical functions and benefits of information sharing to improving organizations' productivity, scholars have paid less attention to information sharing for theoretical development and empirical assessment. By using a dataset of nationwide local health departments, this study provided empirical evidence for the determinants of interorganizational information sharing, thereby, extending information sharing research in public administration.

First, this study suggested a definition and measurement for information sharing at the organizational level. Scholars and practitioners in public administration have used the terms information sharing and knowledge sharing interchangeably without a deep understanding of differences in such related concepts such as data, knowledge, and information. By offering definitions of each term, this study clarified differences in knowledge sharing and information sharing. In addition, most studies on information sharing have focused on information sharing at the individual level. Accordingly, scholars developed measurement for individual information-sharing behaviors by gauging an individual's willingness, intention, and perception on information sharing, given a certain organizational environment. Such individual-level studies contributed to understanding how an individual perceives information sharing and what motivates individuals to share information with others. However, applying the measurement for

individual information sharing to organizational information sharing is problematic in that the measurement for organizational information sharing should extend beyond simply aggregating individuals' information sharing activities.

Therefore, this research defined organizational information sharing as "a behavior, which can be a voluntary or based on the formal agreement, to provide information to other people and organizations which need the information to reach desired goals." Furthermore, this study suggested that measurement for organizational information sharing be specified according to the target audience (the levels of government with which information is shared – local, state, and federal) and the variety of activities performed to share information (preparing issue briefs for policymakers, giving a testimony to the public, participating on a board or advisory panel, communicating with legislators, and providing technical assistance for drafting proposed legislation). As a result, this study contributes to understanding the patterns of organizational information sharing under certain conditions and the ways to facilitate information sharing to achieve organizational goals.

This study also expands a theoretical perspective in information sharing research by applying the bounded rationality theory. Even though the previous studies have mostly been conducted in the fields of business administration and information management, they were not firmly grounded in a particular theory that could explain individual and organizational information sharing and identify the determinants (Wang & Noe, 2010). Rather, scholars have applied a wide range of theories from diverse disciplines – for example, interdependence theory (Kelley & Thibaut, 1978), rational choice theory (Williams et al., 2009), social exchange theory (Wang & Noe, 2010), theory of information sharing (Constant, Kiesler, & Sproull, 1994), theory of reasoned action (Chow & Chan, 2008), organization theory (Willem & Buelens, 2007), and

network theory (Hale, 2011). However, those theories do not fully reflect a strategic aspect of organizational information sharing to lower uncertainty and risks in surroundings in order to adjust organizations into policy changes. Also, they did not consider a function of information sharing in the process of policymaking as policy advocacy activities for policy changes. This study applies the bounded theory to describe why an organization, as a collective of individuals who are limited by available information and cognitive abilities to process acquired knowledge, and surrounded by an uncertainty-embedded environment, is motivated to share information to achieve the desired goals. The bounded rationality theory captures well why information sharing is a good option for individuals as well as organizations to reduce transaction costs and to lower uncertainty in policymaking.

In addition, this study extends information sharing research at the organizational level by expanding our knowledge about determinants. This study assumed that not only the policy changes and the advancement of information technology but also organizational attributes such as organizational structure and management supports affect information sharing. The findings indicate that the organizational characteristics are more critical in determining a local government agency's information-sharing activities than the policy and technological factors. It is somewhat surprising that, different from the previous literature on information sharing, no previous research has empirically examined all factors (policy, technological, and organizational) as the determinants of information-sharing activities. This study demonstrated that five organizational characteristics of local government agencies – centralization on decision making, formalization, human resources, a strategic plan, and the public service delivery options – are determinants of the levels of government with which information is shared and the variety of information-sharing activities. The findings provide useful points to the federal government on

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how the government can support local agencies to facilitate information sharing among organizations across sectors.

Practical Implications

In addition to theoretical implications, the findings of this study have practical implications for useful strategies that public organizations could apply to improve information sharing and positive organizational outcomes. Scholars have emphasized that interpersonal, intraorganizational and interorganizational information sharing can build a culture of trust between employees and organizations, increase accountability, and thus improve organizational performance (Kim & Lee, 2006; Li & Lin, 2006; Yang & Maxwell, 2011). Despite such obvious benefits of information sharing, little evidence has been available to help policymakers and organizations understand the conditions under which information sharing is likely to occur. This study provides empirical evidence of the determinants of information sharing at the level of local government and, therefore, allows organizations to strategically develop a comprehensive plan to facilitate information sharing to reach organizational goals.

First, this study began with a broad picture of the current utilization of HIT tools in local public health departments. The ONC set up a developmental plan from stage one to three to promote nationwide implementation of HIT tools and the meaningful use of health data as the HITECH provision proposed. Several studies tracked the current adoption rates of HIT tools in private clinics and by practitioners; however, such systematic research had not previously been conducted to investigate the current utilization of HIT tools in public health departments. This study found that only 1% of LHDs have adopted all the recommended HIT tools (EHR, HIE, IR, EDRS, and ELR) while 77.3% have implemented none of the systems. Although the private

healthcare providers have come up with satisfying results of HIT tool utilization as the ONC projected, public health departments, which play a leading role in public health policymaking and implementation, have not yet met the expectations. Based on the results, the federal government, including the ONC, needs to encourage LHDs to adopt and fully implement HIT tools, which enable healthcare service providers to access shared information, to achieve the goal of collaborative governance.

This study highlights that organizational design matters in determining organizations' information-sharing activity. Most scholars reported that formalized rules and regulations disturb information sharing because they hinder flexible communication and idea exchanges among employees and partner agencies (e.g., Blau & Schoenherr, 1971; Creed, Douglas, & Miles, 1996; Jarvenpaa & Staples, 2000; Kim & Lee, 2006; Mansfield, 1973; Rainey, 2014). However, the current research found that to a certain extent, centralization and formalization can be helpful in facilitating a culture of information sharing. A centralized decision-making body can help organizations initiate interorganizational information sharing and provide networking opportunities, and a formalized agreement can provide a certain degree of trusted relationship, which helps reduce time and effort in securing accurate information, defining issues, and ensuring better program outcomes (Dawes, 1996).

Public management is also critical in facilitating organizational information sharing. More specifically, the results of this study conveyed that interorganizational information sharing can be particularly facilitated through developing a strategic plan, securing human resources, and deciding appropriate options for efficient public service delivery. In particular, contracting out public services can be a good foundation for further collaboration, based on reciprocal information sharing. In sum, with the tremendous increase in information that organizations need

to deal with to improve the delivery of public services and goods, they play multiple roles as an information creator, processor, and evaluator with the support of the advancing information technology. For successful outcomes in managing information, public organizations need to consider the ways to support such outcomes, such as hiring information officers who have professional skills and knowledge in IT management, developing a strategic plan for the long term, and contacting out to provide quality public services to the public.

Limitations and Future Research Directions

Despite the contributions of this research to developing a better understanding of the determinants of information sharing by suggesting measurement for organizational information sharing and analyzing empirical tests, several limitations of this study should be noted for future research.

First, the findings of this research cannot be generally applicable to all organizations because it is designed to explore limited organizational settings of local public health departments in the United States. For example, the HITECH provision, which is one of the major interests in this study, is specifically designed to affects public health departments' performance. For future research, scholars can apply other universal policies and legislation to organizations' information-sharing activities to obtain generalizable results and to increase external validity of the findings.

This dissertation examined how the HITECH provision implementation has shaped the LHDs' information-sharing activities by taking a cross-sectional approach, and the results indicated that the provision has no statistically significant impacts on organizational information sharing. However, longitudinal research may help evaluate the acute impact of the HIT tools by

comparing LHDs' information-sharing activities before the HITECH enactment with those after the legislation. The advantages of longitudinal studies is to provide more accurate inferences of model parameters, to capture the complexity of human behaviors, and therefore to allow improving efficiency of estimates by tracking observations over time, rather than using cross-sectional data (Hsiao, 2007). A longitudinal design of research can find changes in LHDs' information-sharing activities, thereby leading to stronger conclusions about causality of the HITECH provision.

Fundamentally, scholars and practitioners in the field of public administration need to pay attention to the importance of information sharing to reduce transaction costs and improve policy outcomes as well as to develop a clear definition and measurement for information sharing. Historically, studies on information sharing have mainly been conducted in business administration for improving decision making in supply chains and information studies such as communication and information management (i.e., Constant, Kiesler, & Sproull, 1994; Gil-Garcia, Pardo, & Burke, 2010; Hatala & Lutta, 2009; Li & Lin, 2006; Pardo, Cresswell, Thompson, & Zhang, 2006; Tasi, 2002; Yang & Maxwell, 2011). However, scholars in public administration have not yet reached consensus on a term for information sharing, and little research has been conducted to examine the determinants, benefits, barriers, and development of measurement for information sharing. Considering that a fundamental attribute of public organizations is an information-intensified institution for providing the quality public service, it requires scholars to extend the study of information sharing in public administration, from a definition to strategies for wide-ranging information sharing.

This study examined a few organizational attributes; however, future research needs to explore diverse organizational characteristics because organizations have different origins,

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values, cultures, and settings. For example, previous literature found that other organizational features such as leadership, a culture of trust, rewards, and incentives are important to enhance organizations' information sharing (e.g., Dawes, 1996; Gil-Garcia, Pardo, & Burke, 2010; Kim & Lee, 2006; Landsbergen & Wolken, 2001; Li & Lin, 2006; Yang & Maxwell, 2011). Leadership can provide a clear vision and goals for partnerships and develop effective strategies to facilitate information sharing (Yang & Maxwell, 2011). Trust is a critical factor for organizations to determine whether to continue networking and information sharing because trusted relationships are more likely to enhance communication, share responsibility, decrease concerns of losing autonomy, and increase accountability (Gil-Garcia, Pardo, & Burke, 2010; Landsbergen & Wolken, 2001; Li & Lin, 2006). Reliable partnerships enable participating organizations to reduce costs and time to figure out social identification of each partner, while at the same time increasing efficiency, thereby allowing reciprocal return. Next, incentives and rewards can attract organizations to engaging in more information-sharing activities, as the HITECH provision offers monetary incentives for private clinics to adopt certified EHR systems to promote meaningful use of health-related data across sectors. In sum, future research is needed to investigate the impacts of potential organizational characteristics that closely affect information sharing.

Lastly, further research on the relationship between information sharing and collaboration is recommended. Despite the large body of literature on public network management and the effects of mutuality and trust on partnership (i.e., Agranoff & McGuire, 2001, 2003; Dawes, Cresswell, & Pardo, 2009; Lowndes & Skelcher, 1998; Ostrom, 1998; Thomson & Perry, 2006; Thomson, Perry, & Miller, 2009), there is little empirical evidence on causality or relationships between information sharing and collaboration.

Scholars differently define the levels of collaborative work, ranging from three to seven steps in terms of the purpose, communication patterns, the structure of decision-making, formal agreement, and process (i.e., Bailey & Koney, 2000; Frey, Lohmeier, Lee, & Tollefson, 2006; Gajda, 2004; Hogue, 1994; Peterson, 1991). In general, four steps in collaborative work include networking, coordination, cooperation, and collaboration. Networking refers to the very least formal collaboration with little communication and independent decision-making among partners. At this stage, the main goal of networking is to be aware of stakeholders or those loosely involved with other partners. Coordination is a stage of sharing information and resources through formal communication to achieve shared goals. Next, at the cooperation level, participants are more actively involved in integration such as exchanging formal agreements, altering activities, and making decisions with shared consensus. This stage requires a significant amount of time to communicate and to build up trust among participants. Collaboration is the highest level of co-working based on mutual trust and consensus. At this stage, all participating organizations belong to one integrated system not only to coproduce information, services, or goods, but also to enhance the capacity to increase mutual benefits of other partners.

Based on the categorization, information sharing is regarded as part of collaboration (Thomson & Perry, 2006). Past successful information-sharing experiences that have positively influenced trust and reciprocity can be incentives for organizations to decide whether to continue further collaborative work (McGuire, & Silvia, 2010; Ostrom, 1998; Ring & Van de Ven, 1994). Daley (2009) found that previous collaborative experience is critical for public health departments at the state and local levels to determine whether to engage in interagency collaboration with other organizations to solve policy problems together.

Therefore, future research can address a primary question of whether information sharing promotes collaborative work among agencies across sectors and hierarchical coordination. Specifically, if a local health agency plans to simply share basic knowledge on programs carried out in its community, networking is the most convenient choice because it does not require the department to spend a certain amount of time or effort (Provan, Fish, & Sydow, 2007). On the other hand, if a public health department tries to manipulate policymaking, it needs more intensive collective action with a larger body of participants to secure available resources including finance and to accumulate information (Mays & Scutchfield, 2010; Mischen, 2007; Percival, 2009; Wholey, Gregg, & Moscovice, 2009). By examining this developmental relationship, future research can clarify the significance of information sharing as an initiative for further collaboration, thereby polishing the literature on information sharing with evidence.

Table 7.1

Summary of Hypothesis Tests

Hypotheses	Results	
	The Variety of Information-sharing Activities	The Levels of Government
The Policy Perspective		
H$_1$: Local public health departments that adopt more health information technology (HIT) tools are more likely to share information with other organizations.	Not Supported	Not Supported
The Technological Perspective		
H$_{2a}$: Local public health departments that use more mobile technology tools are more likely to share information with other organizations.	Not Supported	Not Supported
H$_{2b}$: Local public health departments that use more channels of social network service (SNS) are more likely to share information with other organizations.	Partially Supported	Partially Supported
The Organizational Perspective		
H$_3$: Local public health departments with a higher degree of centralization are less likely to share information with other organizations.	Partially Supported	Supported
H$_4$: Local public health departments with a higher degree of formalization are less likely to share information with other organizations.	Partially Supported	Partially Supported
H$_5$: Local public health departments that employ more information officers are more likely to share information with other organizations.	Partially Supported	Partially Supported
H$_6$: Local public health departments that have developed a strategic plan for their health care services and programs are more likely to share information with other organizations.	Supported	Partially Supported
H$_7$: Local public health departments that have contracted out more public healthcare programs than they have directly provided are more likely to share information with other organizations.	Supported	Supported

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Measurement Items for all variables

Perspective	Variable	Survey Item
Information Sharing (Dependent Variable)	Variety of Information-Sharing Activities	Indicate whether your LHD has participated in any of the policy-related activities listed below during the past two years. If yes, check each level of government (local, state, or federal) at which these activities were directed. *(Options – No; Yes, at the local level; Yes, at the state level; Yes, at the federal level)*
	Levels of Government	• Communicated with legislators, regulatory officials, or other policy makers regarding proposed legislation, regulations, or ordinances • Provided technical assistance to legislative, regulatory or advocacy group for drafting proposed legislation, regulations, or ordinances • Participated on a board or advisory panel responsible for public health policy • Prepared issue briefs for policy makers • Gave a public testimony to policy makers
Policy	Health Information Technology Networks	Indicate your LHD's level of activity for each of the following information technology areas. *(Options – No activity, Have investigated, Planning to implement, or Have implemented)* • Electronic Health Records (EHRs) • Health Information Exchange (HIE) • Immunization Registry (IR) • Electronic Disease Reporting System (EDRS) • Electronic Lap Reporting (ELR)
The Advancement of Information Technology	Hardware	In the past year, which of the following types of mobile technology tools did your LHD use? • Smartphones • Automated phone calling • Electronic tablets • Email alert system • Text messaging • Fax broadcast
	Social Network Service	Please indicate which of the following communication channels your LHD uses. • Blogs • Twitter • Facebook • YouTube • LinkedIn • Other social media
Organizational	Centralization	Check each action that your local board of health has authority to do: • Hire or fire agency head

		• Approve the LHD budget • Adopt public health regulations • Set and impose fees • Impose taxes for public health • Request a public health levy • Advise LHD or elected officials on policies, programs, and budgets • Set policies, goals, and priorities that guide the LHD
	Formalization	Use the table below to describe how your LHD shares resources with other LHDs. • Our LHD provides certain functions or services for another LHD's jurisdiction Under a formal written agreement or Without a formal written agreement • Our LHD shares a staff member with another LHD Under a formal written agreement or Without a formal written agreement • Our LHD shares equipment with another LHD Under a formal written agreement or Without a formal written agreement
	Having an Information Officer	Indicate which of the following categories of public health workers are currently employed by your LHD. • Information systems specialist • Public information specialist
	Strategic Plan	Has your LHD developed a comprehensive, agency-wide strategic plan? • No • No, but plan to in the next year • Yes, within the last three years • Yes, more than three but less than five years ago • Yes, five or more years ago
	Ratio of Contracted Out to Performed Directly	For each activity in the charts below, check whether and how your LHD provided that activity or service in your jurisdiction during the past year. *(Options – Immunization, Screening for Disease/Conditions, Treatment for Communicable Diseases, Maternal and Child Health, and Other Health Services)* • Performed by LHD directly • Contracted out by LHD • Not available in community
Control Variable	Budget per Employee	Budget per Employee
	Jurisdiction	City, County, City-County, Multicity, or Multicounty
	Governance	State, Local, or Shared

APPENDIX 2

Acronyms

ACA	Affordable Care Act
ARRA	American Recovery and Reinvestment Act
CDC	Centers for Disease Control and Prevention
CHA	Community Health Assessment
CHIP	Community Health Improvement Plan
CIO	Chief Information Officer
EDRS	Electronic Disease Reporting System
EHR	Electronic Health Records
ELR	Electronic Lab Reporting
HHS	Department of Health and Human Services
HIE	Health Information Exchange
HIPAA	Health Insurance Portability and Accountability Act
HIT	Health Information Technology
HITECH	Health Information Technology for Clinical and Economic Health
ICT	Information and Communications Technology
IR	Immunization Registry
ITMRA	Information Technology Management Reform Act
LHD	Local Health Department
NACCHO	National Association of County and City Health Officers
NwHIN	Nationwide Health Information Network
OASIS	Online Analytical Statistical Information System
ONC	Office of the National Coordinator for Health Information Technology
SNS	Social Network Services