

Coordination Effectiveness During Public Health Emergencies: An Institutional Collective Action Framework

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Abstract

This article draws on the institutional collective action (ICA) framework and data from a survey of senior public health and emergency management professionals in the Dallas–Fort Worth metroplex following the Ebola outbreak to investigate coordination effectiveness during public health emergencies. Based on the study findings, the article recommends that having an identifiable lead agency, official statements from local authorities, a conducive environment for informal conversations, and communication activities that inform, connect, and involve professionals is essential for an effective coordination. Practical implications of the study extend to how to mitigate collective action dilemmas with regard to coordinating COVID-19 pandemic responses.

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Introduction

Responding to global challenges that are characterized by wicked problems require coordination (Head & Alford, 2015; Termeer et al., 2015; Weber & Khademian, 2008). One such global challenge is public health emergencies—the occurrence of sudden events that affect the public’s health, safety, and quality of life (Haffajee et al., 2014). The most recent global public health emergencies since 2000 include the 2002–2004 severe acute respiratory syndrome (SARS), the 2009 (H1N1) flu pandemic, the 2014–2016 Ebola virus epidemic, and the more recent and ongoing coronavirus (COVID-19) pandemic. Since the outbreak of COVID-19 in December 2019, it has infected more than 80 million people worldwide and claimed more than 1.7 million lives, with more than 336 thousand of the deaths being reported in the United States as of December 2020. Contagions are no respecter of borders and treat society as common property resource without regard to regions or the political fragmentation of metropolitan statistical areas (MSAs) while at the same time posing challenges to government responses during public health emergencies.

The political autonomy of governments often leads to confusion about who owns a public health emergency and who should oversee the response effort (Andrew et al., 2018; K. Kim et al., 2017). In addition, politically disintegrated organizations and agencies operate under different organizational cultures, institutions, and norms with divergent approaches in how to respond to emergencies that present challenges to working in concert. For instance, public health professionals and emergency management professionals respond to health crises differently. While health professionals are concerned with contact tracing to track where the contagion started, where it is headed, and who might have been infected (Rose et al., 2017), emergency management professionals usually focus on mass care and provide emergency assistance that can return society to normalcy (Kapucu, 2012). Given the complex nature of responding to public health emergencies, organizations need to coordinate their activities if they would be successful in combating contagions.

Current studies have used the institutional collective action (ICA) framework to examine solutions to collective action problems and identify formal and informal activities in a multijurisdictional setting to improve the response

to a shared concern (Terman et al., 2020). While formal mechanisms are formally enacted agreements, informal mechanisms are not legally binding (Terman et al., 2020). However, more recent studies emphasize information and communication networks that are formal or informal as necessary to integrate independent governments (Kapucu, 2006; K. Kim et al., 2017; Song & Jung, 2015). The ICA framework has been applied in the areas of environmental policy, emergency management, and climate change policy, among others (Andrew & Kendra, 2012; Feiock, 2013; Rydin & Pennington, 2000). However, scant literature exist that extends the theory to public health emergencies, although response to health crises is beset with several collective action challenges that require coordinated effort from regional allies and thus merits more scholarly attention.

The present study draws on the ICA framework for theoretical context to identify those mechanisms—formal, informal, and communication networks—that address barriers to coordination and test the determinants of coordination effectiveness between emergency management and public health professionals and their respective organizations (Benavides et al., 2017; K. Kim et al., 2017). More specifically, this study examines the following:

1. The effects of formal mechanisms on coordination effectiveness between health professionals and emergency managers during public health emergencies;
2. The effects of informal mechanisms on coordination effectiveness between health professionals and emergency management during public health emergencies; and
3. The effects of information and communication networks on coordination effectiveness between health professionals and emergency managers dealing with public health emergencies.

Before the COVID-19 pandemic, the Ebola virus disease of 2014–2016 was perhaps the most traumatic public health emergency of international concern. Although the 28,616 confirmed cases and more than 11,000 deaths (Elston et al., 2017; Emrick et al., 2016) fall far short of what has been reported for COVID-19 thus far, postinfection mortality rate is extremely high for the Ebola virus disease (Sullivan et al., 2003). Like COVID-19, the number, severity, and rapidity of the Ebola disease required coordination among organizations seeking ways to stop the disease from evolving and spreading across boundaries. The United States was unprepared during the Ebola outbreak of 2014, which first reached the Dallas–Fort Worth metropolitan area, threatening multiple local governments and exposed their vulnerability to the contagion (Andrew et al., 2018; Benavides et al., 2017).

Following the Ebola disease outbreak, the North Central Texas Council of Governments' (NCTCOG) Ebola After Action Review meeting was organized to discuss how to increase U.S. preparedness for a disaster like Ebola in January 2015. The participants from about 50 local agencies in the Dallas–Fort Worth region, who are leaders of their agencies and held management and decision-making positions, were invited to participate in a survey that contributed to the understanding of how to improve coordination effectiveness during public health emergencies that enhance U.S. readiness.

The present study uses survey data from professionals involved in the Ebola response effort, crosstabs, and chi-square tests of significance with Somers' *D* to assess the relationship between coordination effectiveness and its predictors. The study finds evidence that formal and informal mechanisms as well as perception of information and communication networks contribute to professional opinions of coordination effectiveness during the Ebola public health emergency. More specifically, the study reveals that crisis management professionals report higher coordination effectiveness when there is a clear leader among fragmented governments, when there is an official statement from local authority, when there is informal communication among professionals, and when administrators depart from established plans through improvisation. In addition, professionals report higher coordination effectiveness when first responders feel connected and involved in communication networks, are informed as crises events unfold, and they perceive the information they receive during public health emergencies to be of quality.

Overall, the study contributes to the ICA scholarship and advances the literature on how to resolve collective action dilemmas in public health emergencies and other traumatic events such as natural disasters that affect multiple jurisdictions. The first policy implication of the study is the need for independent governments to coordinate public health emergency response using both formal and informal mechanisms. The second implication is the fact that problems of fragmentation, spillover effects, and associated costs of coordination could be addressed through coordination efforts derived from solutions that the ICA framework offers. Consequently, local officials, both political and administrative, need to create authority mandates and designate leading agencies to push for coordination efforts that address health emergencies such as Ebola, COVID-19, and other health and local crises.

Coordination Effectiveness During Public Health Emergencies

Although local governments are independent political entities with clearly defined territorial boundaries, problems that they encounter spill over to

neighboring jurisdictions, and vice versa, making a regional approach to resolving complex problems more appropriate. The relationship among governments in an MSA may be vertical as in the relationship that exists between state and local governments, or horizontal for relationships among local governments, and those relationships they share with the private sector, nonprofit organizations, and regional organizations (Miller & Lee, 2011). Regions may, therefore, be conceptualized and studied as a the unit of analysis (Hamilton et al., 2004; Mitchell-Weaver et al., 2000).

Problems that would require regional efforts to resolve include a succession of public health emergencies that may be caused by natural disasters; biological, chemical, or radiological terrorism; accidents; or naturally occurring communicable contagion (Haffajee et al., 2014). Public health emergencies challenge the health preparedness and response capabilities of local governments and other government agencies within a metropolitan area. For instance, in the case of the lead found in the drinking water in Flint Michigan, the public health response involved the federal, state, and local governments coordinating together to provide relief to residents (Nukpezah, 2017). Similarly, federated governments collaborated to respond to homelessness during the COVID-19 pandemic (Benavides & Nukpezah, 2020).

While coordination and collaboration have been used interchangeably to describe the team efforts of fragmented governments within a region, there are differences between the terms. Collaboration entails

a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions. (Thomson & Perry, 2006, p. 24)

Coordination, on the contrary, involves “aligning one’s actions with those of other relevant actors and organizations to achieve a shared goal” (Comfort, 2007, p. 194). The differences between the terms lie with the level of interaction among partners, their level of integration, and commitment to shared goals, with collaboration being at the high end (Thomson & Perry, 2006, p. 24).

In focusing on coordination rather than collaboration, we follow scholars who use coordination when examining crises response in regional settings (Christensen et al., 2015; Comfort, 2007; Tierney, 1985) rather than the long-term integrated relationship that collaboration entails (Thomson & Perry, 2006). We also follow the lead of Christensen et al. (2015) to suggest that coordination occurs in degrees rather than binary—what Christensen et al.

describe as “perceived coordination quality,” but we term *perceived coordination effectiveness*. We define coordination effectiveness as the degree of success, or the quality of coordination, as perceived by the professional judgment of experts involved in responding to public health or other traumatic events.

Coordination is viewed as an essential governance feature of managing interdependencies between activities performed by various organizations to achieve the goal of returning a community to normalcy. Coordination requires task interdependencies and mechanisms such as partner-specific communications, rules and procedures, routines, liaison, integration of roles, and interim authorities (Hartgerink et al., 2014), which foster interorganizational coordination (Kozuch & Sienkiewicz-Małyjurek, 2016). Coordination is often required when legally independent entities such as local governments in an MSA need to work in concert to address complex and wicked problems such as a health crisis (Andrew et al., 2018; K. Kim et al., 2017). The challenge though is that numerous organizations are tied to their different cultures, procedures, and systems, which lead to lack of coordination (Salmon et al., 2011). Coordination is complicated due to uncertainty and unexpected events, severe resource shortages, large-scale impact and damage, structural interdependencies, multi-authority and massive personal involvement, conflict of interest, and the high demand for timely information (Chen et al., 2008).

During extreme events, resources and skills are in high demand from numerous organizations. As a result, it is more difficult to integrate multiple agencies and jurisdictions into a more functioning interorganizational response system that addresses large-scale disasters (Comfort & Kapucu, 2006). In a case study of two communities responding to disasters, Wenger et al. (1986) found that there were problems of communication due to autonomous units acting independently and not acting in concert. Comfort (1990) also notes that disaster response operations result in disrupted communications, differing priorities, inconsistent procedures, and contradictory approaches. For example, in collaborating with public health agencies, emergency management first responders have differed in the way they investigate bio-terroristic incidents because they follow different protocols that reflect their organizational culture, the uniqueness of their disciplines, and their institutional norms.

In the case of public health emergencies like the flu, a COVID-19 pandemic, or an Ebola epidemic, the threat of infectious disease outbreak is high and may cause excess mortality and morbidity because of the disaster (Andrew et al., 2018). Health crises threaten the functioning of society and morph into agents of change that cross geographical boundaries, threatening multiple cities, regions, and countries. Because of globalization, travel allows

Table 1. Functions of Emergency Management and Public Health During Public Health Emergencies.

Public health organizations	Emergency management organizations
<ul style="list-style-type: none"> • Isolation and decontamination • Contact tracing • Vaccination and related surveillance and control activities • Information collection and sharing • Training, exercising, and evaluation • Epidemiologic investigation and analysis • Lab investigation and analysis • Risk communication 	<ul style="list-style-type: none"> • Direction, control, and coordination • Warning • External affairs/emergency public information • Mass care, emergency assistance, • Public health and medical services • Threat and hazard analysis • Logistics management and resource support

Source. CDC: National Standard for State, Local, Tribal, and Territorial Public Health.

for rapid transmission of diseases. For example, COVID-19 originated in China in late 2019, but spread rapidly due to domestic and international travel and geographic mobility of people and morphed into a global pandemic. With regard to the Ebola health emergency, the contagion originated in Liberia, West Africa, reached the United States via Dallas, Texas, and evolved into a regional threat that was not easily contained within the boundaries of a single jurisdiction (Benavides et al., 2017). Because of these jurisdictional spillovers and disease transmission patterns, jurisdictions are faced with uncertainty and a lack of coordination, leading to ineffective public health responses.

Public health professionals and emergency managers view public health emergencies through different lenses; however, both lenses are needed for an effective response. Table 1 shows the different functions professionals affiliated with these two organizations typically care for, which demonstrates that coordinated efforts among these agencies are necessary if a response would be effective and successful. Therefore, if health professionals fail to address a particular area, the emergency management professionals would attend to it and vice versa. A mechanism that connects professionals from different institutions and organizational culture is therefore necessary.

Public Health Emergencies and the ICA Framework

The ICA framework draws from institutional analysis and development (Ostrom, 2011), actor-centered contract theory, and collective action theories

(Olson, 1965) to propose solutions for the ICA dilemmas that governments face in making joint decisions (Feiock, 2009, 2013); ICA dilemmas are problems that actors encounter that prevent them from coordinating their efforts to resolve collective challenges (S. Y. Kim et al., 2020). These dilemmas arise from political fragmentation, externality problems, and common property resource challenges (Feiock, 2009). Political fragmentation is manifested in partitioning of authority and policy responsibilities because of politically independent and autonomous governments within a geographic area producing negative and positive externalities that limit cooperation. For example, while the Dallas–Fort Worth area is an MSA of its own, the region has more than 200 politically independent local governments. Externality problems occur when changes in one jurisdiction have a spillover effect on neighboring jurisdictions. While common property, resource challenges arise when public goods are collective resources, and exclusion becomes difficult (Feiock, 2013). By coordinating their efforts, governments take advantage of the financial and administrative savings that occur when costs are aligned and shared by benefiting jurisdictions (Terman et al., 2020).

The ICA framework proposes mechanisms for resolving the dilemmas by articulating formal, informal, self-organizing, and imposed collaboration arrangements to streamline coordination efforts (Andrew, 2009; S. Y. Kim et al., 2020). Other studies have emphasized the role of information and communication networks in coordination among independent organizations to resolve collective action challenges (Kapucu, 2006; K. Kim et al., 2017; Song & Jung, 2015). Formal mechanisms are formally enacted contracts or agreements such as bilateral or multilateral agreements that clearly define expected roles and responsibilities for parties and protect collaborators when collaboration risk is high (Terman et al., 2020). Collaboration risk is the likelihood that a collaboration would fail to achieve the expected goal (S. Y. Kim et al., 2020). Informal mechanisms are not legally binding and include “information sharing networks and working groups that allow participants to self-organize as networks and meet in regional organization venues to exchange resources and coordinate decisions” (Terman et al., 2020, p. 35). Moreover, the formal and informal mechanisms may be self-organizing arrangements where governments willingly participate, such as interlocal agreements (Feiock, 2013), or are mandated by a higher tier government such as the state (Provan & Kenis, 2008). However, communication and information activities are necessary to integrate independent governments in coordinated efforts following formal and informal channels. Professionals involved in coordination need to feel connected, involved, informed, and receive quality information for it to affect coordination (Benavides et al., 2017).

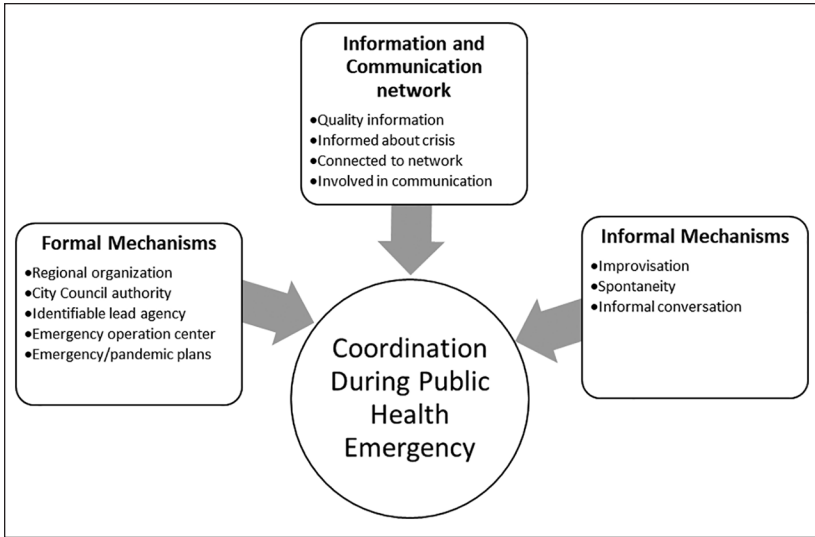


Figure 1. Coordination effectiveness during public health emergencies.

Drawing from the ICA framework, the following sections advance arguments for how formal and informal mechanisms as well as information and communication activities contribute to coordination effectiveness during public health emergencies. The selection of the elements of the structure is derived from the ICA framework that includes indicators that are already manifested in the framework and real contextualization of the health crisis that the study is investigating. These elements are also informed by discussions with professionals attending the Ebola after action meeting who responded to the survey. Therefore, we used the stated ICA indicators because they factored into the Ebola health crisis response and shaped the outcome of the health response. Figure 1 provides a conceptual description of the relationship among the variables.

Regional Organization

Formalized agreements that contribute to integration of independent political units within a region may include working groups, Councils of Governments (COGs), and centralized regional authorities that coordinate crises response, including those related to public health emergencies (Agranoff & McGuire, 2003; Benavides et al., 2017; Kwon & Feiock, 2010). COGs and metropolitan planning organizations are regional organizations established to promote

collective and multi-policy goals among local actors. Given that health emergencies produce ICA dilemmas because of negative externalities caused by movement of infected persons from one local government to another that may infect and spread the disease among residents, collective action is required among independent governments to address health crises.

Regional organizations such as COGs provide a mechanism for government actors involved in response efforts to coordinate their activities. Extant scholarship suggests regional organizations provide the channel for repeat interactions for actors, through which they build trust for one another and the necessary social capital for completing tasks (Tavares & Feiock, 2018). COGs also allow for participation in professional networks that allow professionals to gain insight into what other governments are doing. ICA argues that the professional meetings that characterize regional organizations disseminate technology, share information, and create the environment for exchanging ideas among independent but coordinated local governments (Kwon & Feiock, 2010). Because COGs enable public health professionals, emergency managers, elected officials, and other local executives to share information, we expect that the effectiveness of the COGs would produce desirable outcomes for coordinated public health emergencies.

Regional organizations may be created and imposed by higher-level governments. For example, some states use COGs to mitigate problems of fragmentation and consolidate services in areas of emergency management, health, and planning (Andrew et al., 2018; Benavides et al., 2017). The Mid-America Regional Council (MARC) is promoting the Kansas City Metropolitan Area Regional Coordination Guide (RCG) as an operational document to improve local capabilities that address all hazards, including COVID-19, that may affect the Metro area (RCG, 2020). Therefore, we suggest that perceived operational efficiency of regional organizations such as COGs is related to coordination effectiveness during public health emergencies.

Identifiable Lead Agency

The ICA framework focuses on the extent to which coordination of mechanisms and policy integration among local governments are achieved by a higher authority recommending authoritative coordination (Feiock et al., 2017). Lead agencies, as created by a higher-level authority, may use their leverage, incentives, persuasions, and bargaining power to shape the actions of local agencies (Feiock et al., 2017). In addressing ICA dilemmas, the higher authority creates a new government unit or a lead agency or intervenes directly in response efforts to integrate decision-making processes and direct the actions of the underlying units (Feiock, 2013). Many states have created

regional districts to mitigate the ICA dilemmas and solve the horizontal problem of metropolitan service provision and consolidate services across boundaries (Andrew, 2009). In a managed network structure, the federal or state government may designate a lead agency to manage and coordinate intergovernmental services across boundaries (Feiock, 2009).

A lead agency manages a network of organizations and to coordinate its policy. In that regard, a lead agency sets out the agenda and maintains cohesion and consensus among various agencies while keeping supervisory powers over other jurisdictions (Christensen et al., 2016). Lead agencies are found to pressure nonprofit organizations and other local agencies to participate in collaborative governance (Jang et al., 2016). An example that illustrates the coordination influence of identifiable lead agencies is the Medical Reserve Corps in the Greater Kansas area of Missouri that is leading the response effort of the COVID-19 pandemic by coordinating the activities of other government agencies. Medical Reserve Corps are known to be well positioned to lead public health emergency response efforts at regional levels, matching their volunteer skills with local needs and emergency response activities such as testing, contact tracing, and delivering personal protective equipment and vaccines. Therefore, we surmise that the existence of an identifiable lead agency during regional response to a public health emergency is related to coordination effectiveness.

Statement From City Council Authority

The literature on ICA and regional governance assume that local officials need to give up some authority to achieve regional coordination and are held accountable for the preferences of their local constituents (Kwon & Feiock, 2010). In this sense, elected city council members play a critical role in supplying institutional arrangements (Kwon & Feiock, 2010). Local officials decide between mechanisms to overcome ICA dilemmas and seek alternatives that generate collective benefits with lower decision costs (Tavares & Feiock, 2018). Decision costs are expenses incurred in making decisions and include the costs associated with searching for information, bargaining, and negotiating with partners (Feiock, 2013). Governments incur costs to reduce collaboration risk—the risk associated with or likelihood of collaboration failing (S. Y. Kim et al., 2020). City council officials and public administrators have roles to play in shaping cooperative alliances with other local governments, but they differ in their bargaining capacity and institutional policies (Feiock, 2013).

Because mayors and council members have the leverage over policy and the ability to enforce legally binding agreements for their cities and commit

agencies to contracts or agreements (Feiock, 2009), they could engage in intergovernmental relations to appease their base and use their authority to achieve regional coordination (Feiock, 2013). Therefore, we assert that a formal statement from the city council authority on efforts at addressing the health emergency at the regional level enhances coordination effectiveness during public health emergencies.

Emergency Operation Center (EOC)

ICA framework explores how regional organizations influence cooperation among local governments within metropolitan jurisdictions (Kwon et al., 2014). Like political institutions, regional organizations such as regional planning councils, special districts, interjurisdictional agreements, among others, are coordination mechanisms that address regional problems through mandates (Feiock & Scholz, 2009). Extant ICA studies examine the role of regional organizations such as Council of Governments in creating a region-wide government structure (Tavares & Feiock, 2018).

An EOC that serves a region could be a regional organization that coordinates a community's disaster response (Chen et al., 2008). An EOC is a depository of information, policies, and procedures that facilitates *coordination* and the management of disaster operations (Fagel, 2010). Activating an EOC requires notifying the EOC actors from different jurisdictions (Fagel, 2010). EOCs and other emergency entities seek to develop working relationships and establish policies and protocols to share information for effective coordination of emergency activities. In the event of a public health emergency, when the EOC is activated, professionals affiliated with public health organizations and emergency management organizations work together despite the independence of their individual organizations along with local political actors. Hence, we suggest that an activation of EOC increases coordination effectiveness among professionals during public health emergencies.

Emergency and Pandemic Plans

Collaborative institutions are designed to mitigate ICA dilemmas when partners voluntarily enforce legally binding agreements that specify roles and responsibilities (Frug, 2002; Hawkins & Andrew, 2011). These types of formalized agreements facilitate cooperation by stating what actions are to be carried out by the participants involved in the exchange. Regional governments contribute to the creation of intergovernmental networks; participation in these intergovernmental units enhances cooperation of local governments to work together to share information and develop policies. During emergency

planning, communities with resources rely on formalized processes that depend on written documentation and agreements, although informal relationships are used for risk identification by the less endowed governments (Perry & Lindell, 2003).

Emergency plans serve as roadmaps for emergency operations that address ICA problems such as a lack of coordination among responding organizations (Andrew & Carr, 2013). Emergency plans specify what will be done, where, when and by whom to meet the specific demands of emergency conditions (McLoughlin, 1985). Emergency response involves establishing response plans, conducting regular drills or exercises of regional plans, maintaining interagency coordination and communication, and medical capacity for decontamination, immunization, and treatment (Garfield, 2005). Therefore, we surmise that the existence of and quality of emergency or pandemic plans are related to coordination effectiveness during public health emergencies.

Informal Mechanisms

Although institutional actors may develop plans to address specific collective action situations, local conditions often require rule flexibility and adaptation for effective coordination (Hawkins & Andrew, 2011). Local authorities coordinate their emergency plans around central actors through informal networks that link to key actors who possess critical information (Feiock et al., 2010). Informal interactions mitigate governance costs by facilitating norms of reciprocity among local actors and help identify partners where defection is less likely (Feiock, 2009). Due to uncertainties that characterize complex public health events, emergency managers depart from their emergency plans and standard operating procedures (SOP) and use executive discretion when responding to crises (Benavides et al., 2017) to address collective action dilemmas. The ICA literature asserts that the dilemma of collective action is still persistent because plans are not adequate to resolve problems of collective action (Andrew & Kendra, 2012; Quarantelli, 2003). Using informal policy structures to help reduce transaction costs and preserve authority (Feiock et al., 2010), local government actors and elected officials exchange information informally without the benefit of formally verifiable arrangements (Shrestha et al., 2014).

Formal authority structures rely on informal relationships to be effective (Feiock, 2013). In the absence of formal mechanisms that shape the outcome of coordination, informal mechanisms emerge as alternative to reduce coordination risk and help local actors assess critical information. In the Ebola health emergency, emergency managers and hospital administrators were contacting NCTCOG for information because of uncertainty and

uncooperative behavior of local actors. While NCTCOG served as a formally enacted organization, it acted as an informal network that played a critical role in channeling important information about the Ebola outbreak. Formal and informal structures may concurrently exist, where governance arrangements may deviate toward using informal mechanisms because it is less costly and build informal relationships and trust. Therefore, informal mechanisms such as informal networks are a viable alternative to achieving coordination. Therefore, we submit that the ease of deviating from emergency plans (improvising), making decisions on the fly (spontaneity or executive discretion), and being involved in informal conversations with professionals affiliated with other organizations are associated with coordination effectiveness during public health emergencies.

Information and Communication Network

Policy networks emerge from interactions among organizations with or without formal planning that help them to be part of a connected group (Kapucu, 2006). Kapucu (2006) argues that to foster interorganizational coordination, networks provide an opportunity for public managers to access critical information for making key decisions. Extant communication studies argue that organizational members who are connected to the network of information sharing (Kapucu, 2006) and those who seek quality and real-time information (Andrew et al., 2018) advance effective response during disasters. Being connected to the network of information enables organizational members to sense who has critical information and who is well connected (Kapucu, 2006). This fact is equally applicable when coordinated organizations are responding to public health emergencies that cover a wide geographic area. Therefore, having quality information enables managers to make effective response and informed decision-making.

The ICA framework envisions local officials entering relationships with other organizations in their quest for information that enhances their coordination efforts (Kapucu, 2006; K. Kim et al., 2017). Coordination effectiveness depends on professionals responding to public health emergencies having access to quality information and being informed about important developments and operations that would help them identify and tap into the resources that are needed to respond to the crises (Andrew et al., 2016; Ki et al., 2020; Steelman et al., 2014). When responders are not in contact with each other and information does not flow to all responders, it is hard to envision a disaster response that is effective (Kapucu, 2006). Through formal and informal communication and shared knowledge, local responders share resources, coordinate activities, and increase their capacity to cope with emergencies (Andrew, 2009).

Coordination during or after disasters requires responders to engage in sense making and information sharing to develop situational awareness that guide coordinated response actions (Comfort & Kapucu, 2006). To respond to disasters, organizations deliver messages and share information effectively: collecting, collating, analyzing, and then deploying it (Kapucu, 2006). Effective coordination in the aftermath of disasters requires communication (Martin et al., 2016). Responders who are left out of the information network are denied the ability to make informed decisions (Kapucu, 2006). Extant research finds that improving the informational capacity of local disaster response efforts increases coordination and streamlines the flow of information and, therefore, helps decision makers make informed choices (Celik & Corbacioglu, 2010; French, 2011). Therefore, we suggest that the quality of information responders receive, their involvement in the information network, their feelings about their connection to the information network, and being informed about events are related to coordination effectiveness during public health emergencies.

Data and Methods

Data Collection

The data for the present study were collected in the summer of 2015 using purposive sampling method from executives and senior agency professionals participating in the NCTCOG's Ebola After Action Review meeting. They were invited to participate in a survey that informed research on U.S. preparedness for future public health emergencies. The participants belonged to more than 50 local agencies in the Dallas–Fort Worth region. The organizations included city and county governments, representatives of state and regional organizations, Texas Department of State Health Services (DSHS), the North Central Texas Trauma Regional Advisory Council (NCTTRAC), and the Texas Division of Emergency Management (TDEM), among others. The Ebola After Action Review meeting was for professionals representing first responders, namely, police and fire departments, Emergency Medical Technicians, hospital administrators, and public health officials in the Dallas–Fort Worth area, as such the survey and the data are an analysis of professional opinions on how to improve coordination effectiveness during public health emergencies and contribute to theory building.

A link to the online survey questionnaire was sent to individuals on the NCTCOG meeting attendance list via email. The survey questionnaire examined the perception of professionals located in public health and emergency management departments and asks about their response to the Ebola incident

in the Dallas–Fort Worth region and the strength of the coordination effort. Respondents were also asked questions about the role of formal, informal, and communication networks during coordination of the public health emergency. Specifically, respondents were asked questions about leadership, formal plans, regional organizations, and EOCs. The questions selected were the most relevant based on the literature and Ebola incident and from discussions during the Ebola After Action Review meeting. Of the 200 questionnaires that were sent out, 105 responded, representing 52.5% response rate. After cleaning the data, 90 observations were considered usable for analysis. No notable differences were detected between respondents and nonrespondents regarding the sociodemographic and organizational variables analyzed and those provided on the participant list.

Dependent Variable

The dependent variable is coordination effectiveness among disaster professionals during the recent public health emergency (Ebola). The respondents were asked to express their judgment on the quality of coordination using a 5-point Likert-type scale measured from *strongly disagree* (1) to *strongly agree* (5) with choices between them. Although there is a lack of a standardized measure for the concept of coordination effectiveness, previous research measured interagency relationship in degrees in which organizations work together (Cross et al., 2009). Like previous studies, the study finds merit in measuring coordination effectiveness using professional informed judgment in their role representing their organizations (K. Kim et al., 2017; Nukpezah & Abutabenjeh, 2018), which makes the variable latent.

Independent Variables

Six variables are computed for formal mechanisms. Respondents were asked to assess the quality of the local emergency plans as a mechanism for emergency response that facilitate coordination among local actors. This follows Andrew and Carr (2013) who used emergency plans as a mechanism to facilitate emergency response and coordination among local governments. The survey also asked the professionals about their confidence in *lead agencies* and *official statements* by local government council in coordinating response efforts between emergency managers and public health professionals. Also, respondents were asked about confidence in the coordination role of the region's council of governments (*regional organization*) in responding to the emergency. Each of these variables was coded on a 5-point scale from 1 to 5, where 5 is strongly agreed and consistent with the highest confidence. The

professionals also reported on whether their local governments had a *pandemic plan* or not, which is coded as 1, and 0 otherwise. Similarly, *Activate EOC* is a binary variable for whether the EOC was activated during the public health emergency, coded as 1 if it was activated, and 0 otherwise. Activation of an EOC is a formal mechanism designed to drive coordination between emergency managers and public health professionals. EOCs can enhance coordination; they are formal entities activated by a higher authority during a health emergency.

In this study, three variables are used for assessing informal mechanisms. Departing from emergency plans or SOP of the organization was used as informal situations during response to the public health emergencies. The extent of (1) *improvisation*, (2) *spontaneous* decision-making, and (3) *informal conversation* among professionals across organizations affect coordination effectiveness. Each variable was measured on a 5-point Likert-type scale where 1 is *strongly disagree* and 5 is *strongly agree* with the prompt asking the professionals to express their judgment about the role and importance of these ideas to coordination effectiveness. We assert that departing from rules, mandates, and SOP is tantamount to taking actions that are informal, whether these involve improvising or whether the decision is made spontaneously. Informal conversation is part of the informal mechanism, where professionals informally interact with each other to resolve collective action dilemmas.

To account for informal and communication networks, four variables measure whether professionals felt *involved*, *informed*, *connected*, and received *quality* communication during the Ebola public health emergency. These were also measured on a 5-point Likert-type scale with 5 reflecting whether the professionals strongly agreed and 1 if they strongly disagreed, with choices between the two polar options. In accordance with literature on risk communication, coordination can be established by relying on connection, informed contact, and being part of the information network (Andrew, 2009; Benavides et al., 2020; Feiock, 2009).

The study also tests whether race (*White*), gender (*male*), education (*college*), and income greater than US\$80,000, which is above the upper limit of the mean range (*high income*) of professionals surveyed affect their perception of coordination effectiveness among public health professionals and emergency management officials during the Ebola public health emergency. The socioeconomic variables are coded 1 if the respondent is White, male, college educated, and has high income, and 0 otherwise. In addition, variables that identify respondent's organization and profession are included. These are coded 1 and 0 otherwise for when respondent identifies with local government, state and regional organization, and private and nonprofit organization. Also, respondents are coded 1 when they identify with an emergency

management organization and 0 when they are with a public health or medical organization.

The descriptive statistics are shown in Table 2. For categorical variables measured on a Likert-type scale 1 to 5, the mean gives indication of the average scores of the respondent. For example, the mean score of the dependent variable, coordination effectiveness, is 3.61, which lies between Category 3 and 4. The mean for binary variables, on the contrary, is the percentage of respondents who are coded as 1. Thus, the table shows that 77% of respondents reported that their organizations had a pandemic plan while 42% activated their EOCs. Also, 67%, 88%, 80%, and 52% of the respondents were males, Whites, have college degrees, and have incomes above US\$80,000 (the mean), respectively.

Common Source Bias

Survey data have been faulted for possible biases because responses could be affected by respondent's personal feelings and opinions (Andrews et al., 2006) leading to common source bias (Harman, 1976; Podsakoff & Organ, 1986). However, the inherent limitations of survey data could be reduced when expert opinions and professional judgments are the focus of the data collection (Facione et al., 1997). Acknowledging this, we surveyed senior members and executives of local bureaucracies emphasizing their professional opinions and objectivity. We also tested for the possible presence of common source bias using the Harman's one factor test (Harman, 1976). We found that a single factor was extracting 13.971% of the variances in the variables, which is far below the 50% threshold to make common source bias a concern. We conclude that common source bias is not a problem in this study.

Data Analysis

Because both our dependent variable (coordination effectiveness) and independent variables are categorical, we used crosstabs with chi-square tests to determine the level of significance of our relationships, which is reported in Tables 3 and 4. The chi-square tests determine whether the observed distribution of responses depart significantly from the expected distribution to warrant a rejection of the null hypothesis. While observing the percentage distribution of independent variables in a crosstab with the dependent variable gives an indication of the direction of the relationship, Somers' *D*, which uses a proportional reduction in error approach to gauge the strengths and direction of a relationship, is considered more elegant and appropriate (Pollock, 2016).

Table 2. Descriptive Statistics.

Variables	N	Minimum	Maximum	M	SD
Perceived coordination	84	1.00	5.00	3.61	1.19
Formal mechanism					
Emergency plan	90	1.00	5.00	3.82	1.04
Pandemic plan	79	0.00	1.00	0.77	0.42
EOC activated	83	0.00	1.00	0.42	0.50
City council statement	73	0.00	1.00	0.53	0.50
Lead agency	81	1.00	5.00	2.85	1.39
Regional organization	78	1.00	5.00	2.65	1.15
Informal mechanism					
Improvised response	88	1.00	5.00	3.15	1.12
Spontaneous response	81	1.00	5.00	3.49	1.12
Informal conversations	79	1.00	5.00	4.30	0.85
Information & communication					
Feel involved	84	1.00	5.00	3.83	1.38
Feel informed	83	1.00	5.00	3.18	1.25
Feel connected	79	1.00	5.00	3.63	1.18
Quality of information	83	1.00	5.00	2.93	1.26
Sociodemographics					
Gender (Male) = I a	78	0.00	1.00	0.67	0.47
Race (White) = I b	77	0.00	1.00	0.88	0.32
Education (College) = I c	79	0.00	1.00	0.80	0.40
Income (High) (>80K) = I d	73	0.00	1.00	0.52	0.50
Organizational factors					
Local government = I e	93	0.00	1.00	0.57	0.50
State and regional org. = I e	93	0.00	1.00	0.18	0.39
Private and nonprofits = I e	93	0.00	1.00	0.23	0.42
Emergency management = I f	82	0.00	1.00	0.52	0.50

Note. Reference groups are (a) female; (b) non-White; (c) not college educated; (d) low income (below the average [$>80K$]); (e) other organizations; (f) public health/ medical professionals. EOC = Emergency Operation Center.

Although other measures such as Goodman and Kruskal's gamma, Kendall's Tau-b, and Kendall's Tau-c may be used to test the strength and direction of associations, these tests do not distinguish between two ordinal variables on the basis of which is dependent or independent variable (Göktaş & İşçi, 2011; Goodman & Kruskal, 1972). For any pair of ordinal variables, Somers' *D* produces two values for when either is specified as the dependent variable (Göktaş & İşçi, 2011; Pollock, 2016; Somers, 1962). This makes Somers' *D* preferred for use in our analyses because, in all cases, coordination effectiveness is the dependent variable and the value assigned it is reported. In describing the strength of association, the following classification is used:

Table 3. Crosstabs for When Professional’s Perceived Coordination Effectiveness Is “Strongly Agreed.”

Variables	SD	D	NAD	A	SA	Total count for SA
Formal mechanism						
Emergency plan	0.00	15.79	10.53	31.58	42.11	19
Lead agency	5.56	22.22	0.00	33.33	38.89	18
Regional organization	5.88	29.41	35.29	17.65	11.76	17
Informal mechanisms						
Improvised response	15.79	36.84	10.53	26.32	10.53	19
Spontaneous response	11.11	5.56	22.22	38.89	22.22	18
Informal conversation	0.00	5.88	5.88	29.41	58.82	17
Information & communication						
Feel involved	15.79	0.00	0.00	10.53	73.68	19
Feel informed	5.26	10.53	15.79	47.37	21.05	19
Feel connected	0.00	5.88	11.76	17.65	64.71	17
Quality of information	5.26	21.05	10.53	36.84	26.32	19

Note. The SD through SA columns are percentages (%). SD = strongly disagreed; D = disagreed; NAD = neither agree nor disagree; A = agreed; SA = strongly agreed.

values less than or equal to 0.1 are considered weak, values greater than 0.1 but less than 0.2 are moderate, values greater than 0.2 but less than or equal to 0.3 are moderately strong while those values greater than 0.3 are considered strong (Pollock, 2016).

Although a test of reliability is performed on related categorical variables to check the plausibility of producing a continuous variable from a scale, it produced an alpha score far below the .7 threshold, and therefore, such a scale could not be produced for use in the analysis (Cronbach, 1951). Thus, logistic regression that would have allowed for controls could not be used. We used the IBM SPSS statistics software package version 27 in analyzing the data.

Results and Discussion

We analyze expert perception of coordination effectiveness drawing from ICA framework for theoretical insight. The results of crosstabs and chi-square tests of significance between perceived coordination effectiveness among public health and emergency management professionals and the independent variables are shown in Tables 3 and 4. The results, which also report the Somers’ *D* strength of association and direction, indicate that perceptions

Table 4. Determinants of Professional's Perceived Coordination Effectiveness During the Ebola Public Health Emergency in DFW, Texas.

Predictors of coordination	N	DF	χ^2	Somers' D	p
Formal mechanism					
Emergency plan	90	16	16.59	-0.01	.51
Pandemic plan	79	4	1.70	0.15	.79
EOC activated	83	4	4.24	-0.04	.37
City council statement	73	4	9.09	0.26	.06
Lead agency	81	16	39.47	0.36	.00
Regional organization	78	16	21.49	0.16	.16
Informal mechanisms					
Improvised response	88	16	23.45	-0.09	.10
Spontaneous response	81	16	13.86	-0.03	.61
Informal conversation	79	16	45.37	0.08	.00
Information & communication					
Feel informed	83	16	43.34	0.31	.00
Feel connected	79	16	77.86	0.45	.00
Feel involved	84	16	29.33	0.14	.02
Quality of information	83	16	51.72	0.41	.00
Sociodemographics					
Male = 1 a	78	4	3.46	-1.00	.48
White = 1 b	77	4	1.73	-1.00	.79
College = 1 c	79	4	6.57	0.16	.16
High income (>80K) = 1 d	73	4	0.87	0.11	.93
Organizational factors					
Local government = 1 e	84	4	2.79	0.01	.59
State and regional org. = 1 e	84	4	2.60	0.06	.63
Private and nonprofits = 1 e	84	4	2.70	-0.12	.60
Emergency management = 1 f	74	4	9.33	0.05	.10

Note. Reference groups are (a) female; (b) non-White; (c) not college educated; (d) low income (below the average [$>80K$]); (e) other organizations; (f) public health/ medical professionals. DFW = Dallas-Fort Worth; DF = Degrees of Freedom; EOC = Emergency Operation Center.

about formal and informal mechanisms as well as perception about communication and information sharing activities are important influencers of the strength of coordination among response agencies and professionals.

We find evidence that the existence of formal governance mechanisms affects coordination effectiveness during public health emergency response efforts. An examination and analysis of the crosstabs and chi-squares show that city council official statement of support is moderately strongly associated with coordination effectiveness ($\chi^2 = 9.09$; $p < .05$; Somers' $D = 0.26$). City council officials have a role to play in shaping cooperative alliances with

other local governments and use bargaining capacity and institutional positions to shape collective action (Feiock, 2013). Hence, their official statements are perceived as endorsement of official cooperation with other agencies and local governments in combating traumatic events. Similarly, we find that the existence of a lead agency is strongly associated with coordination effectiveness among health professionals and emergency managers ($\chi^2 = 39.47$; $p < .01$; Somers' $D = 0.36$), which could lead to a successful response effort for public health emergencies that affects multiple fragmented governments within a region. This confirms the assertion that the existence of an identifiable lead agency that uses incentives, bargaining, and persuasion on other governments within a region improves interorganizational coordination (Feiock et al., 2017).

Although formal mechanisms such as regional governance organizations have authority to effectively reduce ICA dilemmas and encourage collaboration in metropolitan areas (DeHoog et al., 1990), this study found evidence suggesting that the existence of these organizations did not influence perceived coordination effectiveness and the results did not show that activation of EOCs or the existence of emergency or pandemic plans is related to coordination effectiveness. Extant scholarship suggests that because preparing emergency plans requires the involvement and commitment of many organizations and their personnel (Andrew & Carr, 2013), confidence in such plans should be associated with coordination effectiveness. Emergency management plans include response instructions, guidelines, templates, and forms to help promote and coordinate preparedness and assist in the response protocols to improve response and recovery in case of an emergency (Nukpezah & Soujaa, 2018). Contrary to expectations, the existence of such plans is not statistically related to coordination effectiveness that professionals perceive. It may be that because EOCs across jurisdictions are multiple and each entity has its own operating EOC, it is not associated with coordination effectiveness. In addition, emergency plans might not work during public health emergencies because they are designed to fit certain types of natural disasters by each local government. Often, health professionals and emergency management officials create emergency plans to fit ongoing emergency crises (Benavides et al., 2017).

We also find that response professionals value informal mechanisms, which consequently influence their perception of coordination effectiveness. While informal conversation is significant ($\chi^2 = 45.37$; $p < .001$; Somers' $D = 0.08$) and improvised response is weakly significant ($\chi^2 = 23.45$; $p < .1$; Somers' $D = -0.09$) and weakly associated with the coordination effectiveness, spontaneous response is not significant. Regions depend on relational communities that arise from long-term reciprocal linkages among co-located

organizations to foster coordination. Informal interactions, such as informal conversations among agencies and professionals, mitigate governance costs by facilitating norms and reciprocity among local actors and help identify partners where defection is less likely (Andrew, 2009; Feiock, 2009). The results also suggest that the ability of local governments to depart from formal procedures by improvising for effective public health emergency response increases coordination effectiveness. Therefore, along with formal mechanisms that are associated with coordination effectiveness, we find that informal mechanisms such as use of discretion that characterizes deviation from emergency plans as in improvisation and informal conversations among professionals engender stronger coordination efforts.

Regarding the effect of communication and information networks, the results show that response professionals being involved in communication ($\chi^2 = 29.33$; $p < .05$; Somers' $D = 0.14$), informed about traumatic events ($\chi^2 = 42.34$; $p < .001$; Somers' $D = 0.31$), feel connected to communication networks ($\chi^2 = 77.86$; $p < .001$; Somers' $D = 0.45$), and receiving quality information ($\chi^2 = 51.72$; $p < .001$; Somers' $D = 0.41$) are related to coordination effectiveness during public health emergency response efforts. Somers' D measures of the strength and direction of associations show that the relationships are positive for all the associations (Table 4). Except for the relationship between involved in communication and coordination effectiveness where the relationship is moderate, all the relationships are strong. Our study, therefore, finds support for the assertion that access to information and communication networks increases the likelihood of interactions among professionals and hence coordination effectiveness. Therefore, those professionals who perceive that they have received reliable and quality information, among others, are likely to feel and be involved in efforts at coordinating Ebola public health events. Intergovernmental relationships are embedded in larger social, political, and economic structures within which dense tightly clustered network of relationships reduce shirking and enhance credible commitment (Uzzi, 1997).

Our crosstabs and chi-square analyses show that there are no differences among professionals with regard to their perception of coordination effectiveness because of race, gender, income, or education as well as whether they are with local government, state, and regional organization or affiliated with private/nonprofit organization. Although a difference is reported among emergency management and public health professionals favoring the former, this is weak as is the strength of association ($\chi^2 = 9.33$; $p < .1$; Somers' $D = 0.05$). The lack of significance regarding these indicators may be because professional training levels off any differences that these variables might cause and confirm what prior studies have found about professional

training as a source of normative and mimetic isomorphism (Nukpezah & Abutabenjeh, 2018).

Conclusion

We draw on the ICA framework for theoretical context to investigate the determinants of perceived coordination effectiveness among public health and emergency management professionals. The findings revealed that coordination effectiveness is influenced by formal governance arrangements such as lead agency during response and official statement of support from city council. It also showed that informal mechanisms such as improvisation during emergency response and informal conversations with professionals are related to coordination efforts. Finally, the study found that the quality and extent to which professionals are engaged in the production and dissemination of information during crisis events are related to coordination effectiveness during public health emergencies.

The basic premise of ICA is that in the presence of collective action dilemmas, organizations make decisions strategically to reap the relative advantages of working with others (Feiock, 2013). The ICA framework contends that problems of political fragmentation that characterize local governments in the United States and the different institutions with which they operate are resolved with institutional arrangements such as formal and informal mechanisms that serve as an enforcement system that minimizes uncertainties. While extant studies have utilized the ICA framework to understand environmental policy (Rydin & Pennington, 2000) and emergency management (Andrew & Kendra, 2012), among others, its application to public health emergency remains unexplored yet very promising. An exception though is K. Kim et al. (2017) who uses the framework to examine collaboration effectiveness by testing bonding and bridging mechanisms during the 2015 MERS outbreak in Korea.

Our study differs from Kim et al.'s study in that it extends ICA framework to public health emergencies by examining solutions to politically disintegrated organizations and agencies that operate under different organizational cultures, institutions, and norms, which present challenges to working in concert and applied it to combating contagions such as an Ebola outbreak and offers implications for the COVID-19 pandemic and other traumatic events. Theoretically, the study identified formal mechanisms (such as regional organizations, EOC, city council authority expressed through official statements, lead agency, and pandemic plan), informal mechanisms (informal conversations and improvised response), and information and communication networks of professionals that

contribute specifically to coordination effectiveness of public health emergencies.

Policy implications that come out of this study include the need for informal arrangements to moderate formal mechanisms when coordinating public health emergency responses because formal rules have limitations in addressing crises situations. Webb (2004) identifies five possible ways of improvising during disaster response to include changes in established procedures, status, normative-order, equipment, and location for activities. We suggest these may be further investigated for their utility during disasters. Benavides et al. (2017) provide an in depth look at what they call executive discretion that describes how managers act absent a formal plan. A second implication is the fact that health emergency response is fraught with problems of fragmentation, spillover effects, and associated costs of coordination; hence, local officials and higher authority officials need to create authority mandates and leading agencies to push for coordination in an effort to address health emergencies such as Ebola and other crises, including COVID-19. When these governance arrangements are created, collective action dilemmas are mitigated.

The study is applicable to wicked problems such as traumatic events and the COVID-19 pandemic that is currently raging globally and in the United States. From Wuhan, China, the contagion traveled to the west coast of the United States from where it spreads to the rest of the country without regard to territorial boundaries posing collective action dilemmas because of state sovereignty and home rule authority. State and local governing bodies allow the discretion of enacting differing policies (such as wearing mask in public places, dining in restaurants, and curfews, among other things). Thus, while some jurisdictions mandate protocols that are more stringent for their residents, others offer lax requirements. If the easing of COVID-19 restriction increases infection rates, as health officials are warning, those governments that still have restrictions in place but have neighbors that do not will suffer negative externalities. Success in combating COVID-19 will require local governments to be dependent on one another. They cannot afford to act independently but should coordinate their response. Therefore, as governments respond to public health emergencies, the ICA framework as a tool helps to understand the dynamics among the various actors.

Health care professionals are finding that helpful advice in dealing with COVID-19 comes from informal interactions with other professionals over twitter and other informal communication channels and that “anecdotes shared over the phone are guiding critical decisions” during the COVID-19 pandemic response (Freyer, 2020). COVID-19 is novel; consequently, information about the contagion keeps changing. Our study finds that information

is critical to any successful pandemic coordination effort. Similarly, in COVID-19 response plans, professionals need to be informed and updated with quality information that enable them to accomplish their task. Moreover, being connected to information and communication networks and being involved in the production of information can be motivating to response professionals. Therefore, the findings from this study provide guidance to COVID-19 coordination efforts.

Finally, extant scholarship have suggested that professional opinions are important and often inform decisions (Kwon & Feiock, 2010; Nukpezah & Abutabenjeh, 2018). Moreover, the ICA framework assumes that local governments are represented by individual actors and have identifiable interests, perceptions and divergent interests within the community (Feiock, 2013; Kwon & Feiock, 2010). Thus, the opinions expressed by professionals represent their organizations. However, coordination effectiveness should be related to some measurable outcomes. For example, if coordination has been effective, then it should produce some measurable outcomes such as a reduction in morbidity and mortality rates during an outbreak or another objectively determined outcome, which could be further investigated. A future study could extend this study by testing it on coordination effectiveness for COVID-19 by examining whether regions that have better coordination among their governments—measured more objectively—report better outcomes. In addition, network analysis to examine relationships among health professionals and emergency managers regarding interactions, positions, actions among governmental and nongovernmental actors would enrich knowledge of coordination efforts. Local governments today have the capacity to work together and solve problems collectively. Public health emergencies—like other disasters—are best managed when all involved work together collaboratively. Like other studies, this article has obvious limitations. Subjective rather than objective measures are used, which may have respondent bias. The study is also restricted to one region of the United States and has limited generalizability. The study though is helpful for theory development and may be tested under different settings.

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