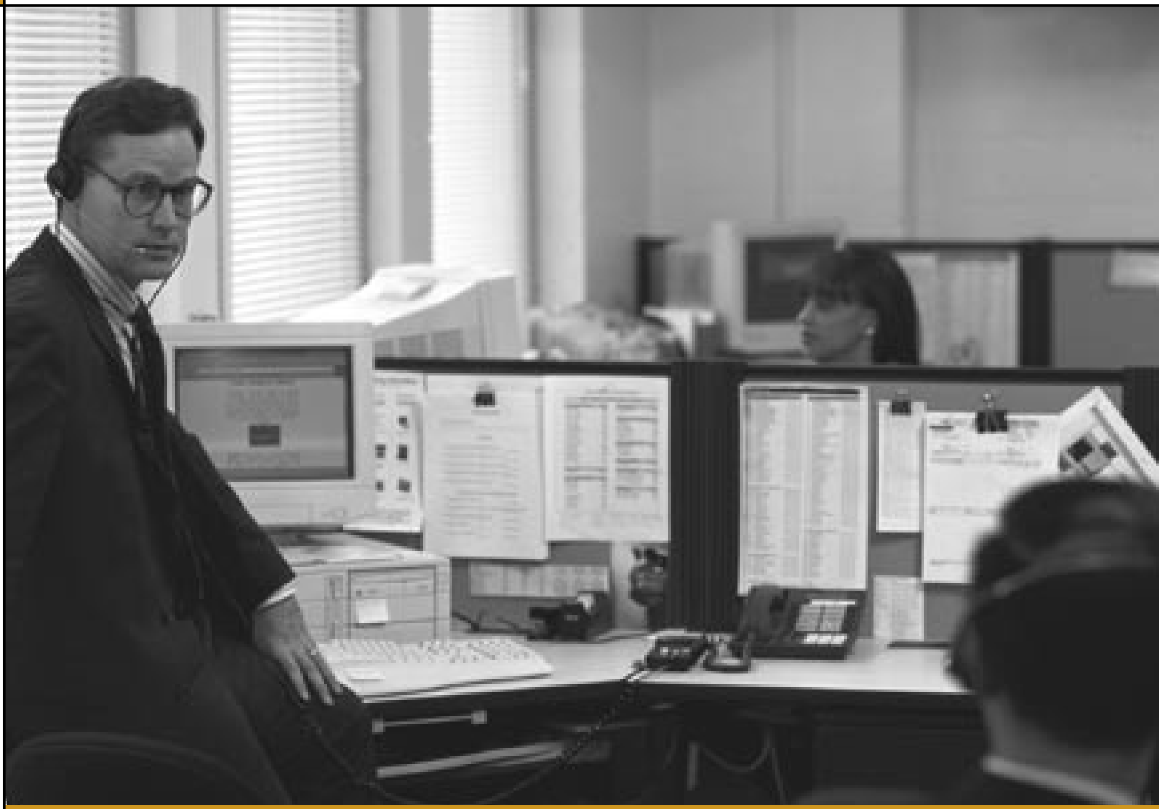
JUNE 2005

Leveraging Collaborative Networks in Infrequent Emergency Situations

Collaboration Series



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IBM Center for
The Business of Government

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June 2005

IBM Center for
**The Business
of Government**

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June 2005

On behalf of the IBM Center for The Business of Government, we are pleased to present this report, "Leveraging Collaborative Networks in Infrequent Emergency Situations," by Donald P. Moynihan.

Traditionally, a collaborative network depends on ongoing informal relationships and trust built among its members over a long period of time. This report addresses the question: "How can networks be effective in infrequent emergency event situations?" Infrequent emergency situations are characterized by team members not knowing each other and coming from different organizations, with different professional disciplines and different operational training.

This report summarizes insights from one such case, the outbreak of Exotic Newcastle Disease in California in 2002–2003. The disease is highly contagious and fatal to chickens, but not humans; however, it put the entire U.S. poultry industry at risk. In this infrequent emergency situation—which last occurred 30 years before—federal, state, and private sector partners used a task-force-based management framework, called the Incident Command System (ICS). ICS was originally developed by the Forest Service to combat forest fires. As a result of a Department of Homeland Security Presidential Directive issued in 2003, it is now increasingly being used in other emergency situations.

Adapting a task force approach to containing a fast-spreading disease was novel and successful. Participants found that the task force approach helped team members learn, codify, and share standard operating procedures based on field experience. The team also learned how to create staffing continuity over the course of the effort and apply developmental technology to speed the flow of information across a team highly distributed across several states.

The lessons learned and recommendations contained in this report are clearly applicable to the management of other "infrequent" public emergencies—for example, those increasingly faced by agencies such as the Centers for Disease Control and Prevention, the Federal Emergency Management Agency, the Department of Homeland Security, and others.

We trust that this report will provide practical advice to public executives who are engaged in preparing for infrequent public emergencies and ensuring their successful conclusion.

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EXECUTIVE SUMMARY

Public services are delivered less and less through single hierarchical organizations, and more and more through networks of multiple organizations that can come from any level of government, as well as from the private and nonprofit sectors. Networks provide governments with the flexibility to tackle problems that are beyond the scope of any single organization, and they have management characteristics and challenges that are distinct from hierarchies. In the aftermath of 9/11, networks have grown in importance in the area of homeland security, where a common theme has been an effort to exert clearer command and better coordination over the variety of relevant actors. This is particularly true in the area of emergency response, where recent national guidelines have called on emergency responders to employ a command and control approach to steer the network of organizations involved in each response.

An example of emergency response comes from the area of animal disease control. Highly contagious foreign animal diseases have the potential to cripple an industry and taint the nation's food supply. Exotic Newcastle Disease (END) is one such disease that affects poultry. An outbreak of the disease occurred in California and other Western states in 2002–2003. The disease was tracked, contained, and ultimately eradicated by a task force that involved 10 major state and federal agencies, local governments, and temporary employees from the private sector. There had not been a similar outbreak of END since the early 1970s. No single organization had the resources necessary to deal with the scope of the outbreak, creating the need for a network of relevant skills.

The task force had to overcome a number of challenges that most emergency networks dealing with large-scale or infrequent incidents will face. Because the last major outbreak of END had been in the early 1970s, there was a good deal of uncertainty about tasks, and what management principles and operational activities were applicable. The Incident Command System (a task-force-based approach originally created in the 1970s by the Forest Service to manage wildfires) provided some general guidelines, but these had to be applied to the particular context of the incident. Members of the task force drew parallels from other types of emergencies they were familiar with and tried to develop informed decisions about how to tackle END as the outbreak occurred.

Another major challenge was the unanticipated aspects of the outbreak. Efforts at preplanning for foreign animal diseases turned out to be only partly useful, because of assumptions that the outbreak would occur primarily among large-scale commercial providers, as it had in the past, and not among the large backyard population of birds that were frequently found in urban Hispanic neighborhoods. The third major challenge the task force faced was the issue of continuity. Apart from a handful of senior managers, and frontline temporary employees, the workforce was borrowed from parent agencies, and employees were able to commit to the task force only for three-week rotations. This fostered major problems in consistency of action, and added to the transaction costs of training, updating, and supervising employees amidst rapid turnover.

There were a number of keys to the success of the task force, all of which involved an ability to adapt to the environment and develop appropriate management responses. Networks are typically based on trust between members, trust that has developed over time. Time is not a resource in much supply in emergency networks. To the extent possible, the task force sought to establish trust, and leaders from the two main agencies involved offered a model of cooperation that was noted by members of the task force. Members of the task force also came to share norms based on the sense of urgency of their mission and the long workdays they faced together. Another success factor was the ability to adapt and apply a command and control structure—the Incident Command System—to an animal disease outbreak. Initial debates about the applicability of this approach gave way to a general acceptance of how to use it to battle END.

The task force also grew adept at learning, codifying, and communicating standard operating procedures that governed the daily operations of teams. Much of this learning was based on field experience and observations, and gradually increased the consistency and effectiveness of task force teams. A final success factor was the application of technology. During the outbreak, the task force developed a rapid diagnostic test for END that reduced the delay between testing and results from over a week to a matter of hours. This innovation proved an enormous benefit in tracking the disease and efficiently targeting resources to contain it. A second technological innovation was the use of tasking software called the Emergency Management Response System. The system was still in development at the beginning of the outbreak, but became essential to the rapid flow of information from field workers to the incident commanders.

Understanding Collaborative Networks

What Are Collaborative Networks?

In the last three decades, the popularity of the concept of networks has grown in the social sciences, hard sciences, and everyday life. The term has often been used to describe different aspects of the world that share the characteristic of interconnectedness. We see evidence of networks in how airlines organize their fleets, and the Internet is a particularly large, innovative, and rapidly changing network (Barabasi, 2003). Some describe networks in terms of interpersonal connections between individuals. An example here is Mark Granovetter's (1973) groundbreaking study of how weak ties formed a social network and increased the ability of individuals to interact with others for purposes such as finding a job. Another stream of research has looked at the ways by which social networks transfer information among their members—for instance, ideas about policy or management change tend to flow through policy or professional networks of interested individuals and organizations (Berry et al. 2004).

For managers in the public sector, the concept of networks has been a key aspect of the working environment for some years. From a public management perspective, networks refer to the connections between the variety of actors involved in the delivery of services, and have been defined as "structures of interdependence involving multiple organizations or parts thereof, where one unit is not merely the formal subordinate of the others in some larger hierarchical arrangement" (O' Toole 1997, 45).

The traditional model for public services assumed that a single organization would deliver services in a particular functional area. Gradually, this model has ceased to reflect reality for the bulk of public services. Increasingly, services are being provided by multiple organizations rather than a single organization. For decades, the delivery of most social services has involved a crowded web of federal, state, and local actors from the public sector, in addition to private or nonprofit organizations. Sometimes the network might remain restricted to public actors, but the variety of organizations involved from both different levels and the same level of government can ensure that the network is densely populated. The growing influence of the network approach over the public sector is reflected in the claim of one recent book that we live in a "network society" (Koppenjan and Klijn 2004). Goldsmith and Eggers (2004) state that networks are "the new shape of the public sector." Agranoff and McGuire (2001a, 277) declare that "the temporal relevance of this model is clear. The 'age of the network' has arrived, supplementing previous group, hierarchy, and bureaucratic eras."

The advent of networks has changed the way in which we think about public management. Changes in the vernacular of public management reflect this. As governments have followed the private sector trend among "hollow companies" to outsource, scholars have applied the term "hollow state" to the public sector (Milward and Provan 2000). We talk less about how to manage governments, and more about how to manage *governance*, reflecting the idea that services are no longer delivered by a single public entity but by multiple organizations.

Governance, then, is essentially government by network, facing many of the old challenges of traditional forms of service delivery, but also dealing with the complexity of the network form. How do networks of public, private, and nonprofit actors with different authority, motivations, interests, skills, and access to information coordinate to successfully deliver public services? The success of networks depends on the ability of leaders to organize structures, resources, and interactions in a way that answers this question.

What are some of the basic characteristics of public management networks? Networks are a nonhierarchical approach to management, reliant on horizontal relationships, information, expertise, and trust to direct a self-organizing process (Agranoff 2001). Organizations are attracted to networks for a variety of reasons, including the ability to access skills and resources that they themselves do not possess. Most treatment of networks emphasizes the voluntary nature of membership. The variety of actors involved may share overlapping goals, but each individual organization will have incentives to use the network to benefit financially or increase policy influence. A basic challenge for networks is to ensure norms and incentives that structure a balance between network goals and the interests of the individual organizations. Because of these complexities, maintaining and managing a network requires a wider range of management skills and attention. Agranoff and McGuire (2001b) identify the management tasks that are new or more important in a network setting:

- **Activation—**identifying participants and stakeholders, arranging, stabilizing, nurturing, and integrating the network structure.
- **Framing—**establishing and influencing the operating rules of the network, influencing its values and norms, altering the perceptions of participations.
- **Mobilizing—**creating a perception of the network as a strategic whole and identifying a common set of objectives; involves mobilizing organizations and coalitions, forging agreement on operations and the role of the network, motivating members and inspiring commitment.
- **Synthesizing—**creating conditions for favorable, productive interaction among network participants that lowers the cost of interaction; changing incentives, rules, and roles for the purposes of establishing a pattern of relationships that facilitates interaction, enables information exchange, creates cooperation, and minimizes disruption.

Networks provide governments with the ability to provide a breadth of services that no single organization can. Networks tend to be more flexible and adaptable than hierarchies, but less stable and more difficult to coordinate (Agranoff 2001). The fragmentation inherent in the network form creates coordination issues, but the routine nature of the services and ongoing relationships between member agencies create stability and reduce the severity of problems (Milward and Provan 2000).

Key related aspects of network management are time and stability, both of which are needed to allow network actors to interact with each other repeatedly—which in turn helps to foster agreements, establish shared norms, and build trust toward one another. O'Toole and Meier (2004) link the idea of stability, time, and performance: "Stability in at least some forms may be a platform on which managers and others can build effective performance in heavily networked settings … personnel stability may compensate for, and especially be important in, some of the disruptiveness of structurally less stable (more networked) settings. A second possibility is that personnel stability allows the manager to turn network interactions into repeat games, thus allowing each side to build trust and make credible commitments" (O'Toole and Meier 2004, 488). As we discuss later, a lack of time and high instability are critical challenges for emergency networks.

Why Networks Are Important in Today's World

Why have networks become more relevant to the delivery of public services? The federal nature of the United States governing system and a preference for market provision of services have created an environment where networks are flourishing. But we also see networks on the rise in other countries, so the particular nature of the U.S. system is only a partial explanation for the increasing influence of networks.

Current public management reform ideas also play a part. Reform prescriptions that emphasize specialization, outsourcing, flexibility, and steering rather than rowing will result in an increasing reliance on third parties to implement what was previously provided by a single government organization. The desire for smaller government, cheaper services, and greater choice in the delivery of services all have the effect of moving resources to lower levels of government, as well as to the private and nonprofit sectors.

Another explanation for the growth of networks is that government is increasingly responsible for dealing with "wicked problems"—problems so complex that no single organization has the ability to comprehensively respond. Koppenjan and Klijn (2004) argue that complex policy problems are more prevalent than in the past. Many problems cross traditional jurisdictions and functions, and key actors often disagree about the nature of the problem and/or the solution. The advent of new technologies and knowledge has also increased uncertainty and risks in a way that no single organization can keep up with. To solve these "wicked problems," networks of actors with a variety of skills and resources are required.

Homeland security is a very good example of a "wicked problem" for the public sector. In this report, we examine one area of homeland security where networks dominate that has been largely understudied: emergency response. Just as networks have become more important to governance in general, the issue of homeland security and emergency response has become a central issue for the public and governments in the past few years. The public management reaction to 9/11 has repeatedly underlined the inevitability, and difficulty, of multiple organizations trying to coordinate with one another. The creation of the Department of Homeland Security moved 22 different agencies into a single department, although internal coordination issues will remain a major management challenge for years (Moynihan 2005). The other main challenge for the Department of Homeland Security will be how to coordinate with first responders at the state level and especially the local level.

In the area of intelligence, failure to share information among intelligence agencies prior to 9/11 led to the passage of the Intelligence Reform and Terrorist Prevention Act. The legislation created the position of the director of national intelligence, with the expectation that the director and his staff will be able to foster clearer lines of communication and take central direction when necessary. The federal government has also been active in trying to solve coordination problems in emergency response, and the next section examines new policy efforts in this area.

National Emergency Response Policy and the Incident Command System

In the aftermath of 9/11, there has been a concerted effort to develop national policies on all aspects of homeland security, including emergency response. Homeland Security Presidential Directive 5, *Management of Domestic Incidents* (Feb. 28, 2003) asked then Secretary of the Department of Homeland Security Tom Ridge to develop a coordinated national policy for incident management. What emerged was the National Incident Management System (NIMS).

NIMS is an effort to introduce a shared national standard for how public actors deal with emergencies, and it elevates the Incident Command System (ICS) as the dominant approach to tackling emergency issues. NIMS is intended to be an overall framework for understanding and reacting to emergencies rather than an operational framework: "The NIMS represents a core set of doctrine, principles, terminology, and organizational processes to enable effective, efficient, and collaborative incident management at all levels. It is not an operational incident management or resource allocation plan" (DHS, 2004, ix).

NIMS recognizes that for most major emergencies, a network will be required. Major emergencies happen infrequently and may occur in an unpredictable fashion. The response is likely to demand such a wide variety of expertise, knowledge, and number of respondents that no single public agency has the resources to comprehensively tackle the emergency. These weaknesses of the network form will be prominent in emergencies where public response is expected to be rapid and decisive, but where fragmentation is compounded by problems of limited time, unfamiliarity among participants, and limited understanding of the roles each will assume.

Multiple agencies will require coordination, and NIMS identified the ICS as the preferred management form to organize responders. ICS was born in response to a network problem. Local, state, and federal agencies in California struggled to coordinate emergency response efforts in the face of a wildfire in California in 1970 that saw 16 lives lost, 700 structures destroyed, and half a million acres burned (FEMA, 2004). Congress responded by requiring that the U.S. Forest Service (USFS) design a way to avoid such problems in the future. USFS was helped in this process by the California Department of Forestry and Fire Protection (CDF), Office of Emergency Services (OES), and some local police and fire departments in California. The system was originally known as the FIRESCOPE (FIrefighting RESources of California Organized for Potential Emergencies) ICS.

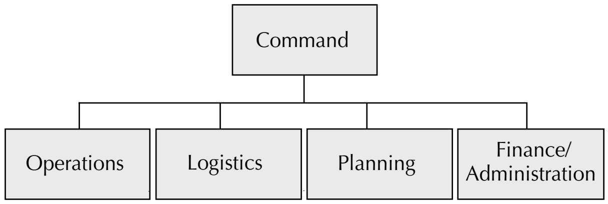
In managing emergencies, all federal agencies are required to use ICS. State and local responders are encouraged to adopt the program to fulfill ICS requirements in order to receive federal preparedness grants. ICS essentially creates a simple command and control system within which staff from different agencies should be placed. Structurally, the ICS organizes functions by critical management systems: planning, operations, logistics, and administration/finance. Each function reports to a single commander who has decision-making power for the ICS. Commanders are expected to set up at least one incident command post. If multiple incident command posts are necessary, they should be overseen by a single area command. Both incident command posts and area commands are expected to follow the ICS format. The structure of the ICS is illustrated in Figure 1.

ICS is intended to be flexible and widely applicable to different types of emergencies of different lengths and involving different disciplines. However, the NIMS document does warn that in certain instances ICS may have to be adapted: "Acts of biological, chemical, radiological, and nuclear terrorism represent particular challenges for the traditional ICS structure. Events that are not site-specific, are geographically dispersed, or evolve over longer periods of time will require extraordinary coordination between federal, state, local, tribal, private-sector, and non-governmental organizations" (DHS 2004, 7).

The management characteristics of ICS are (DHS 2004, 9–12):

- **Common terminology**
- **Modular organization—**the incident command develops in a top-down fashion in accordance with the needs of the incident and based on the decision of the incident commander. If the incident expands, different command units can be created.
- **Management by objectives—**actors should begin ICS by identifying overarching objectives; creating assignments, plans, procedures, and protocols to achieve these goals; identifying specific objectives; and documenting the results.

Figure 1: Basic Structure of the Incident Command System



- **Reliance on an incident action plan (IAP)**
- **Manageable span of control**
- **Pre-designated incident location and facilities—**preplanning usually involves likely locations and facilities for ICS operations.
- **Comprehensive resource management—**clear processes for categorizing, ordering, dispatching, tracking, and recovering resources give a timely account of resource utilization.
- **Integrated communications**
- **Establishment and transfer of command—**clearly established at the beginning, with the agency holding primary jurisdictional authority for establishing leadership.
- **Chain of command and unity of command—**clear lines of authority where everyone has a designated supervisor.
- **Unified command—**unified command is necessary for effective coordination where multiple organizations are involved.
- **Accountability—**to ensure accountability, all responders must check in via procedures established by the IC; the IAP must be followed; everyone reports to a specific supervisor; limited span of control, and procedures in place to track resources.
- **Deployment—**personnel or equipment respond only when requested or dispatched by an authority.
- **Information and intelligence management—**a process must be established for gathering and sharing incident-related intelligence.

An Example of Emergency Networks: Animal Disease Control

The context of 9/11 has made previous threats more serious. One example is the deliberate introduction of highly infectious diseases or deadly pathogens into the food chain. As he left his post as secretary of Health and Human Services in 2005, Tommy Thompson voiced this concern: "'For the life of me, I cannot understand why the terrorists have not attacked our food supply because it is so easy to do."

Acronyms and Abbreviations

AHFSS	Animal Health and Food Safety Services, part of CDFA
APHIS	Animal and Plant Health Inspection Service, part of USDA
APHIS-VS	Division of Veterinary Services, part of APHIS
BSE	Bovine Spongiform Encephalopathy
CAHFS	California Animal Health and Food Safety Laboratory System
CDF	California Department of Forestry and Fire Protection
CDFA	California Department of Food and Agriculture
DHS	U.S. Department of Homeland Security
EMRS	Emergency Management Response System
END	Exotic Newcastle Disease
GIS	Geographical Information Systems
IAP	Incident Action Plan
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
JIC	Joint Information Center
NIMS	National Incident Management System
NRMT	National Response Management Team
NVSL	National Veterinary Services Laboratory
OES	Office of Emergency Services
PCR	polymerase chain reaction
SOP	Standard Operating Procedure
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service, part of USDA

The threat of bioterrorism has become linked to animal disease outbreaks. The nation's food supply is a target for terrorists who seek to cause panic, illness, and even death among the general public, or to create economic hardship in the agricultural industry. Globalization has also made it more likely for such outbreaks to travel and become pandemics. The rapid movement of goods and people make geography an unreliable guard against the spread of diseases.

Here is the nightmare scenario: A highly contagious disease afflicts a cow, chicken, or other animal that is a major part of our food chain. The disease spreads quickly and enters multiple commercial flocks. When it is discovered, consumption of the product plummets among domestic customers and other nations establish trade bans. Millions of animals are slaughtered as the government seeks to catch up with the disease any way it can. A multi-billion-dollar industry is decimated and may take years to rebuild. But it could get worse. The disease mutates into a form that can be transferred between humans. As scientists frantically try to figure out how to stop the virus, the world faces the modern equivalent of the Spanish flu pandemic, which claimed tens of millions of lives in 1918, including half a million Americans.

This is what keeps epidemiologists awake at night. How realistic is this scenario? The World Organization for Animal Health (OIE) tracks highly contagious animal diseases. The organization is concerned about what appears to be an unprecedented increase in the potential for animal diseases to take on zoonotic characteristics, i.e., to transfer from animals to humans. "Most of the recent emerging diseases have an animal origin, and almost all of them have zoonotic potential" (Vallat, 2004).

Avian influenza provides the most worrying threat. In recent years, outbreaks of various forms of avian influenza have wiped out millions of chickens in different countries, including the United States. Up to the late 1990s, avian flu was found only in birds. In 1997, a form of avian flu killed a 3-year-old boy in Hong Kong, signaling the start of an outbreak that stopped only after the government culled all 1.4 million poultry on the island. In Thailand and Vietnam, avian flu has also been linked to the deaths of dozens of people in the last two years. This strain appears more virulent than previous versions, killing more fowl and also becoming transmissible between other species of animals (Reynolds, 2004).

While not reaching the nightmare scenario, recent years have seen a number of different animal disease outbreaks that have proved to be enormous public problems. If the disease turns up in a handful of animals or even a single one, it can cripple a major industry and cause ripple effects in the national economy. During Christmas of 2003, the world heard of the first confirmed case of bovine spongiform encephalopathy (BSE), more commonly known as mad cow disease, in the United States. Trading partners immediately banned U.S. beef. America exports about 10 percent of its beef, worth about $2.6 billion a year. The public health and economic consequences of an outbreak of such a disease are further illustrated by the outbreak of foot-and-mouth disease in the United Kingdom, which resulted in the slaughter of 6 to 10 million animals at a direct cost of over $10.6 billion (Royal Society, 2002, 2). How much bigger would the impact be in the United States? A computer model developed by the University of California at Davis suggested that in California alone, foot-and-mouth disease could cost the economy $13.5 billion (OES & CDFA, 2001, 1).

How do governments contain and eliminate such diseases? Any large-scale animal disease outbreak, or other type of emergency, will require the coordination of multiple public agencies, different levels of government, and private actors. An effective network must be built. The notion that stakeholders are interdependent actors lends itself well to a consideration of biosecurity and animal health where coordination must occur between multiple sets of public actors at each level of government, as well as between nonprofit and private actors.

Such outbreaks are a basic challenge for networks of public agencies with relevant competencies. The central question considered in this report is how public organizations react to such outbreaks. To explore this question, this report examines the outbreak and eventual containment of Exotic Newcastle Disease (END) in the state of California in 2002–2003. END is a highly contagious and generally fatal disease for poultry. If not contained, the outbreak would have threatened the national poultry industry. Examining the case helps us understand how multiple public agencies from each level of government worked together in a single task force.

This report, therefore, deals with a growing issue for all of government—the use of networks to deliver services—and a central issue in the area of homeland security—emergency response. How can networks be effective in infrequent emergency event situations? The task force assembled to fight END had to answer this question while dealing with a disease with which it had limited previous experience, certainly on the scope of the outbreak that occurred. The experience of the task force is discussed in the next section.

Collaborative Networks in Action: The Exotic Newcastle Disease Task Force in California

Why Was a Task Force Needed?

An outbreak of Exotic Newcastle Disease in the state of California was confirmed on October 1, 2002, and subsequently spread to Arizona, Nevada, and Texas. Quarantines were also placed in Colorado and New Mexico. By September 16, 2003, final quarantine restrictions related to END were removed, marking the conclusion of a highly successful effort to prevent the spread of the disease. One of the reasons that the public is not familiar with END is because the task force assigned with limiting and eliminating the disease did its job, and the national poultry industry was not dramatically affected. The task force was not perfect, and members of the task force freely admit it had problems. Such problems will be discussed later, in large part because other types of emergency networks will also face them. Respondents also agree that the task force became much more effective over time through a process of learning what was working, what was failing, and what needed to be done.[1]

A central question in the study of networks is why they form. Answering this question may also help us understand the logic of network effectiveness. So, why was a network required in dealing with END?

The primary reason for the network approach was that no single organization had the resources required to effectively battle END. Some statistics give a sense of the scope of the task force that worked to eliminate END:

- More than 7,000 workers rotated in and out of the task force, although the maximum task force size at any one time was approximately 2,500.
- 10 major state and federal agencies were involved.
- 19 counties across five different states were affected.
- 932 premises were found to have been infected.
- 4.5 million birds were destroyed.

What Is Exotic Newcastle Disease?

END affects the respiratory, nervous, and digestive systems of poultry and other birds. The disease is not harmful to humans but can be deadly for poultry. The Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) describes it as "so virulent that many birds or poultry die without showing any clinical signs. A death rate of almost 100 percent can occur in unvaccinated poultry flocks. END can infect and cause death even in vaccinated poultry" (Federal Register, 2003, 54797).

END spreads relatively quickly, making it difficult to track and contain. It can be spread in a number of ways and can survive for long periods in ambient temperatures, which increases the difficulty of limiting the spread of and eradicating the disease. The virus can travel both in the excrement of infected birds and in bird saliva. The virus can transfer via contaminated water, implements, premises, and human clothing. It can travel through bird waste on someone's boots or in a cage. It can infect commercial operations through the introduction of workers/machinery from an infected farm, workers with infected backyard fowl, or workers at cockfighting meets.

The commercialization of the poultry industry allows such diseases to have a huge impact. Chickens are maintained in very close proximity with one another. Dr. Travis Cigainero, corporate veterinarian for Pilgrim's Pride in the United States and Mexico, notes: "There's no doubt that the evolution of the industry has created more efficiency, but it's also made it more vulnerable to catastrophic diseases" (Romero, May 16, 2003).

- 42 countries, plus the 15 member countries of the European Union, imposed some form of trade restrictions based on END.
- The estimated impact of the trade restrictions arising from the outbreak was $167 million.
- The estimated weekly impact of indirect costs (loss of tourism, increased retail prices for the affected product, decreased consumer demand, more stringent regulatory controls, and increased cost of replacement stock) was $226.86 million.

Another way of pointing to the scope of the task force responsibilities is to look at the range of duties involved. The sidebar "Network Tasks in Dealing with END" outlines the basic tasks that had to be achieved by the network of agencies involved. Much of this was achieved by temporary workers, who provided 45 percent of the estimated 256,182 task force workdays. The next biggest contributor was APHIS, who provided 27 percent of the workdays. State of California employees provided 15 percent of the workdays, while other USDA agencies provided 9 percent (Werge 2004, Appendix A).[2] For the

Network Tasks in Dealing with END

Disease diagnosis and detection. Qualified veterinarians were dispatched to premises to diagnose clinical signs of END or other diseases, collect samples for laboratory testing, and impose quarantine restrictions as appropriate.

Conducting appraisals. Appraisers estimated the value of birds for the purpose of providing indemnity payments. Appraisal was difficult in that it involved determining the fair value of backyard game fowl, pets, and exotic birds, in addition to that of commercial poultry.

Euthanization and disposal. This involved the humane killing of birds on infected and dangerous contact premises and appropriately disposing of all bird carcasses to prevent disease spread.

Cleaning and disinfection. Cleaning and disinfection teams worked on site at infected and dangerous contact premises after euthanization and disposal were complete. They eliminated all materials that could harbor END virus and disinfected all facilities at the site.

Epidemiology. This task involved identifying the means by which END had spread to infected premises. It also involved identifying all premises with possible links to infected birds and the means by which END could spread further. Epidemiologists drew on diagnostics, laboratory testing results, knowledge of the local area, scientific research results, and surveillance information to resolve epidemiological links.

Surveillance and monitoring. Task Force personnel canvassed neighborhoods threatened by the disease to identify all bird owners and birds at risk. They also placed sentinel birds on premises previously affected by END and monitored the health of those sentinels until disease-free status could be confirmed.

Regulatory enforcement and quarantine. This task involved working with law enforcement officials to enforce quarantine restrictions and prevent the spread of END by illegal means.

Movement and permitting. This involved reviewing special requests for movement of birds or equipment, examining the circumstances that applied, and granting permits as appropriate. These decisions were typically made by animal health technicians or veterinary medical officers from APHIS-VS or AHFSS.

Biosecurity enhancement. Task Force personnel worked with bird owners, feed producers, distributors, and other local groups to ensure adequate biosecurity procedures were adopted. Establishing internal biosecurity measures for the END task force itself was also an important task.

Outreach and public information. The outreach and public information campaign played a key role in the eventual elimination of END by disseminating information about the disease. Task Force personnel met with bird owners, bird clubs and swap-meet organizers, pet store and feed store owners, and many other organizations. A broad spectrum of activities was conducted by personnel in connection with outreach. The task force employed public relations specialists from the state and federal agencies involved and also hired a commercial public relations firm.

Source: Adapted from Howell, 2004, 24–25.

bulk of the operational activities described, such as euthanization and disposal, cleaning and disinfection, surveillance and monitoring, teams were usually made up of temporary workers, members of the California Conservation Corps, and typically led by an animal health technician or veterinary medical officer from the Animal and Plant Health Inspection Service–Division of Veterinary Services (APHIS-VS) or the Animal Health and Food Safety Services (AHFSS), which is part of the California Department of Food and Agriculture (CDFA).

The scope of the outbreak grew over time, prompting the size and membership of the network to expand. The task force response can be divided into three phases (Werge 2004), as summarized in Table 1.

Phase 1: October–December 2002

The first phase began when the disease was discovered when an owner of backyard game fowl in Compton, a part of Los Angeles, consulted a local veterinarian over the death of some birds. The vet sent the birds to a California Animal Health and Food Safety (CAHFS) laboratory for testing on September 25, 2002. Over the following two days, additional samples of dead birds from separate locations in Lancaster, Los Angeles County, and Norco, Riverside County, were also sent for testing. The first sample was sent to the CAHFS laboratory at San Bernardino, part of the University of California at Davis, and an initial diagnosis was made on September 26. This diagnosis had to be confirmed by the National Veterinary Services Laboratory (NVSL) in Ames, Iowa.

On October 1, the NVSL confirmed the disease to the area veterinarian in charge of California, Dr. Paul Ugstad. Dr. Ugstad is based in California, but is a federal employee, a member of APHIS-VS, which is part of the USDA. Dr. Ugstad worked from the beginning with Dr. Richard Breitmeyer, the state veterinarian who oversees AHFSS. Together, the CDFA and USDA would be the central agencies in the emergency network that developed. The initial decisions that Dr. Breitmeyer and Dr. Ugstad made represent the origins of the task force as an identifiable entity. On September 29, the Compton location was quarantined and was depopulated the following day. This marked the beginning of the disease eradication efforts. The task force had acted aggressively, using existing resources within California rather than waiting for guarantees of federal funding.

The task force could never verify whether the Compton location contained the index case that brought the disease into California. Dr. Annette Whiteford, director of AHFSS, acted as joint area commander of the task force. She comments: “By the time we had discovered the disease, it had already spread fairly widely and it was impossible to trace back to the index case. So we don’t know exactly how it was introduced.” Since birds imported legally into the state must go through quarantine, it is unlikely that the index bird was legally imported (though not impossible, since the disease could have traveled in a bird cage, or even on someone’s feet or clothes). However, veterinarians believed that the early cases were game fowl that were likely bred for cockfighting. Cockfighting is illegal in California, but owning game fowl is not. Cockfighting meets provide ideal conditions for diffusing diseases. Unvaccinated animals and owners from different parts of the state interact in unsanitary conditions. This is but one example of how the backyard nature of this outbreak posed special challenges for the task force. Further challenges will be described later.

On October 1, 2002, the USDA confirmed the outbreak of END in California. The CDFA and the OES had undertaken some preplanning for dealing with

Organizations Participating in the Emergency Network

Federal Agencies

Department of Agriculture
- Animal and Plant Health Inspection Service (APHIS)
  - Veterinary Services
    - National Veterinary Services Laboratory
- United States Forest Service
- National Response Management Team

State Agencies

California Department of Forestry and Fire Prevention
- Animal Health and Food Safety Services
- Animal Health and Food Safety Laboratory

California Office of Emergency Services
California Highway Patrol
California Environmental Protection Agency
California Department of Health Services

Private Sector

Temp agencies
Temporary employees

Table 1: Timeline of Outbreak

Phase 1 October–December 2002	Phase 2 January–April 2003	Phase 3 May–August 2003
• Disease is discovered among backyard animals. • Task force is formed. • Countries impose trade restrictions. • Approximately 200 employees on average involved.	• Disease is discovered among commercial flock. • Declarations of emergency • Task force grows to maximum size. • Disease is discovered outside of California. • Approximately 1,400 employees on average involved.	• Number of new cases declines. • Quarantine lifted. • Task force disbands. • Trade restrictions lifted. • Approximately 1,000 employees on average involved.

foreign animal diseases (OES and CDFA, 2001), but as additional cases were confirmed, individuals from CDFA and VS began to realize the scope of the problem. "After about three days we realized this was a serious situation because the population of birds that the disease was spreading in were mobile and pretty far-reaching. It wasn't just one isolated case and birds had been moving," according to Dr. Whiteford.

The task force continued to act aggressively immediately after the announcement. State quarantines were placed on all potentially infected premises in order to stop bird movement. Another action was to quarantine poultry at county fairs. The task force also closed all poultry exhibits in the state and contacted commercial producers. A toll-free hotline was established to answer questions and collect information. OES located space for the first incident command post by October 3 in Los Alamitos, Calif., and 91 personnel were in place by October 15. At about the same time, the task force suspended any routine inspections of poultry by government agencies in order to reduce the unintended spread of the disease. By November it became clear that the disease was too widespread to render a property quarantine effective, so on November 13 the state veterinarian declared a regional quarantine on eggs and poultry from affected areas. The USDA issued an equivalent federal quarantine by November 21.

On December 21, 2002, END was first found in a commercial setting at an egg-laying facility in Riverside County. In the following days, commercial flocks housing approximately 1.2 million birds in San Bernardino and San Diego were confirmed as being infected with END. Task Force officials had feared this outcome, which signaled that the scope of the outbreak had just become dramatically bigger. On January 6, 2003, USDA declared an extraordinary emergency. Gray Davis, then governor of California, made a similar declaration two days later. The declarations of emergency brought practical benefits for the task force by freeing resources and enabling authorities, and helped justify the approval of $121.8 million in federal emergency funding for APHIS.

Phase 2: January–April 2003

During the second phase, the task force grew in response to the demands of the outbreak. Prior to the commercial outbreak, the task force fluctuated between 200 and 470 people, and had dropped to about 200 immediately before the commercial outbreak. By February, the task force had grown to 1,686 people from a variety of agencies. The growth of the task force posed a management challenge since an average of 40 new employees (and as many as 125) joined the task force on a daily basis (Speers and Webb, 2004, 11). Previous to the emergency declarations, the bulk of the employees came from the state of California. After the declarations, the number of USDA employees would grow quickly, soon outnumbering state counterparts. One significant addition to the task force during the second phase was the experience of the USFS and the CDF in dealing with fire emergencies. The growth of employees and spread of the disease led to the creation of a second incident command post (ICP) in California on January 15.

At the same time END appeared to be expanding in California, quarantines were also established in other states: in Nevada by mid-January, in Arizona and among the Colorado River Indian tribes by late January. A different strain of END was found in Texas at the beginning of April, and suspicion that the Texas index case had caught the disease at a cockfight in New Mexico led to a quarantine there also. Altogether six ICPs were established, with the Los Alamitos location designated as the area command that had oversight over the entire operation. Area command was responsible for establishing and communicating task force policy, deploying resources, and ensuring consistency and coordination across the different ICPs.

The scope of these later outbreaks never matched that of California. Indications of END in these states were investigated and responded to quickly. In part, this was because the task force was already activated when incidents were found elsewhere. Another major help was that state, local, and tribal governments were aware of the threat, were looking for the disease, and were swift in response. The task force began to ease quarantines in the middle of May.

Phase 3: May–August 2003

The last infected premises in California was found on May 31, 2003, and by July 30 only a handful of areas in California still remained under quarantine. In the latter months of its existence, the focus of the task force was on surveillance for any signs of infection. The task force devised a statistical sampling technique to test for the presence of END. The quarantine on California was lifted on September 16, 2003, signaling the end of the outbreak.

This was not the first outbreak of END in the United States or even in California, but previous outbreaks had not been large scale with one exception. In 1971, END was found among commercial California poultry. In terms of time and costs, the task force was more successful this time around. The previous outbreak lasted from November 1971 to July 1974, a period of 33 months. The cost of the eradication effort was approximately $250 million in 2003 dollars ($56 million in 1972) and about 12 million birds were destroyed. This compares with an estimated cost of $176 million for the 11-month outbreak in 2002–2003, where more than 4.5 million birds were killed. It is also worth noting that the more recent task force had to deal with the additional complexity posed by detecting END among backyard flocks.

What Were the Components of the Task Force?

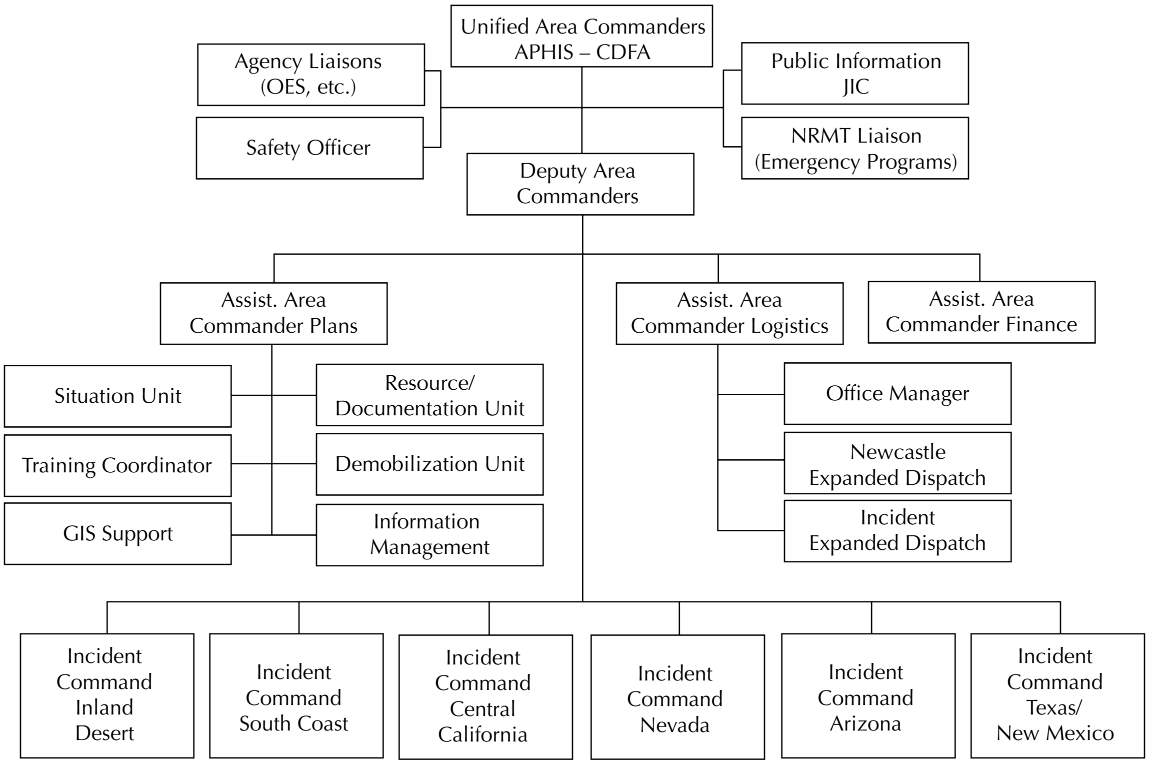
The variety of actors brought together in the task force is illustrated in Figure 2, which also demonstrates the application of the ICS framework discussed earlier and illustrated in Figure 1.

Social networks are generally characterized by regular contacts between a stable set of actors dealing with a recurring issue. The network that was developed to battle END does not meet these qualifications, and indeed might be termed a *latent* network. There was preplanning for animal health incidents, but not specifically for END. The preplanning was still helpful when the outbreak did occur, because staff at CDFA, OES, and USDA had a sense of what emergency resources existed and who should be contacted. But knowledge about who to contact is not the same as having a functioning network, and the early participants had to effectively construct a real network out of a latent one as the emergency developed. Staff from other government agencies were provided by means of mutual-aid agreements with the agencies in question, most of which had to be reached after the outbreak occurred. Coordinating groups were established to create such agreements and attract recruits from other agencies.

In constructing an emergency network, the operating criteria for inclusion was that member agencies offered resources that other agencies lacked. Consistent with Ashby's Law of Requisite Variety—that a highly varied environment requires a highly varied control system—the network needed a mix of resources to tackle a complex disease and environment. Resources included authorities, flexibilities, human resources, finances, and expertise. These resources complemented the strengths and weaknesses of other agencies in the network, allowing member agencies to focus on their specialty.

Table 2 on page 18 gives examples of the resources that some of the key participants brought to the task force and illustrates just what resources were required to deal with END. It is not intended to be exhaustive, but instead to demonstrate that no single organization had the resources to comprehensively tackle the disease. In any animal health issue, APHIS-VS can be expected to be involved, especially if a federal emergency is declared, as was the case with END. VS operated at the heart

Figure 2: Organizational Structure of Task Force



Source: Howell, 2004, 34.

of the task force, and its employees filled the bulk of the key decision-making roles. But there was no expectation that VS would seek to overcome the disease by itself. The resources needed to successfully contain the incident mean that there was never any real alterative to the network form. "This Exotic Newcastle Disease response clearly pointed out that VS, as an independent organization, did not have the resources to respond alone to the incident and mitigate it, and it was clear that they needed to depend on other organizations," said Tony Clarabut, a member of the task force.

The involvement of some organizations may not be immediately clear. Why, for example, did an animal disease task force come to rely on officials from the California Department of Forestry and Fire Prevention, and the U.S. Forest Service? Such officials did not have substantive expertise on animal disease. Instead, they offered a wealth of experience managing large-scale emergencies. This included an understanding of how to apply the ICS model and principles, expertise on the logistics involved in organizing thousands of workers, and experience with emergency planning on a daily planning cycle. The task force veterinarians lacked similar practical experience managing emergencies.

These actors also had the advantage that their involvement could be requested by actors already involved in the task force. The OES could call on any state organization to lend its support, and the USFS is part of the Department of Agriculture and therefore a sister agency of APHIS.

Some of the skills that each agency brought to the table were ones that could be transferred to others. This was most obviously true with vets who were learning to apply the principles of ICS in emergency management. Initially, they relied a great deal on USFS or CDF officials, but over time became more experienced with ICS and confident in its application. The following quote by one member of APHIS reflects this point:

> I was lucky enough to have a Forest Service mentor. At that time we had several Forest Service folks mentoring area command because APHIS had never used an area command structure, or California either. So we had some mentors who were helping us with those area command positions, and that was very helpful.… It was really the organizational structure, the ICS structure, that they were mentor-

ing us on and specific functions, because a lot of us were going into positions we had never, ever done before. So unlike their system where you don't do a position until you have been trained for it, we didn't have the luxury of that, and so we were throwing people into positions that they hadn't already shadowed or had some level of training, so we were really going in pretty cold. So there was a lot of just trying to give you a feel for what this position really is supposed to be, what it's supposed to cover.

Such learning from fellow task force members is likely to occur if the transaction costs of learning are not high (for instance, one does not need a specialist degree to understand ICS) and if the skills learned are of future value (which, because of NIMS policies, is clearly the case for ICS).

Table 2: Bringing Together Skills in an Emergency Network

Agency	Skill
Animal Health and Food Safety Services (part of California Department of Forestry and Fire Prevention)	• Veterinary expertise • Understanding of END; how to identify disease, cleaning and disinfectant procedures • Local knowledge • Preplanning for animal disease response in California
Veterinary Services (part of APHIS, part of USDA)	• Veterinary expertise • Understanding of END; how to identify disease, cleaning and disinfectant procedures • Experience with other types of animal disease outbreaks
California Department of Forestry and Fire Prevention U.S. Forest Service (part of USDA)	• Experience with applying ICS in emergency situations • Hiring flexibility • Expertise on emergency logistics • Experience in training and managing large number of emergency workers • Experience and expertise in emergency planning
California Office of Emergency Services	• Awareness of the emergency resources available in different parts of the California state government • Authority to coordinate the actions of state agencies toward emergency response • Preplanning for animal disease response in California
Temp agencies	• Personnel management of temporary workers • Hiring flexibility
Temporary employees	• Volume of work support • Continuity at front lines • Knowledge of local environment, language, and customs
California Animal Health and Food Safety Lab and National Veterinary Services Laboratory	• Ability to identify disease • Development of rapid diagnostic test
National Response Management Team (NMRT, part of USDA)	• Coordination of federal agencies • Development of interagency cooperation agreements with other USDA agencies • Development of financial requests and reports for U.S. Office of Management and Budget
California Highway Patrol	• Ability to enforce quarantine: created checkpoints at weigh stations to ensure that commercial vehicles observed quarantine; inspected trucks stopped for routine traffic violations
California Environmental Protection Agency	• Understanding of disposal and decontamination procedures
California Department of Health Services	• Understanding of health risk to humans • Understanding of risk communication to the public

Looking Forward: Increasing the Effectiveness of Collaborative Networks

The previous section discussed details of the END outbreak, how the task force formed, where the members came from, and what they did. If we wish to learn about the potential for emergency networks to be successful, we have to take a fuller account of the challenges faced by the network and how the task force overcame these challenges. Such difficulties and management responses are drawn from the END case, but are expected to be relevant to other complex emergency situations.

Challenges to the Effective Use of Emergency Networks

Some obvious variables make some emergencies more challenging to deal with than others. One is the scope of the emergency. The END outbreak was large, spread quickly, and rapidly outstripped local resources. A large emergency demands a large amount of manpower, which makes coordination difficult. And when a large-scale outbreak has some of the characteristics the END task force faced—a high level of uncertainty, unanticipated aspects of the disease, and its long-term nature—the challenges faced by the emergency network become much greater.

Key Emergency Network Challenges

- Uncertainty about task, management principles, and operations
- Unanticipated aspects of emergency
- Rotation of employees

Uncertainty About Task, Management Principles, and Operations

The most critical challenge facing the task force was uncertainty. At the beginning of the outbreak, very basic questions about how to defeat END were unanswered. The members of the task force who were used to fighting forest fires were unaccustomed to such uncertainty and believed that END should be similarly amenable to control. But END is different from forest fires in a number of crucial respects. Forest fires occur every year, and while there is some variation from fire to fire, the means of defeating them is reasonably well understood. A wealth of knowledge and experience on the most effective ways of controlling fires can be found among firefighting personnel, in training, and in formal procedures. Like all infrequent emergency events, the END outbreak lacked these qualities.

The last major outbreak of END occurred in the early 1970s. At a basic level, this meant there was not a readily available team whose experience had taught them the best ways of fighting the disease. There was not an "off-the-shelf" set of management principles and tactics for END that task force members could turn to as they decided on questions of how to organize (Who is in charge? How do we communicate? How are resources deployed? How centralized are decisions?) and how to operate (How do we track END? How do we eliminate it?). The ICS provided some general structural guidance, but this had to be applied to the context of END and the actors involved. Members of the task force drew parallels from other types of emergencies they were familiar with and tried to develop informed decisions about how to tackle END as the outbreak occurred. In doing so, the task force brought together different skill sets from different organizations (see Table 2).

Did the sum of the skill sets of task force participants offer a comprehensive answer to fighting END? No—or at least not right away. Important issues needed to be resolved and had to be learned on the job. Vets had to learn how to manage using the ICS framework. Forest Service officials had to learn to apply that framework to an unfamiliar setting. All members of the task force had to learn what specific procedures were likely to eliminate END. While previous planning documents had outlined basic strategies for dealing with foreign animal diseases (OES & CDFA, 2001), they had not provided specific guidelines for END. Such procedures would have to be written, and sometimes rewritten, in the middle of the outbreak.

Other challenges that add to the uncertainty of animal disease outbreaks include geographic mobility and the difficulty of tracking the disease. While most emergencies have clearly limited and observable geographic boundaries, this is not true of contagious diseases. Identifying where the disease is and how it is spreading is a major challenge. Clarabut, a task force member who comes from the CDF, comments: "When we are fighting a fire we can look out there, we can fly over it in an airplane, we can see exactly where it's going and what it's doing and what its potential is. The VS or CDFA job of epidemiology and surveillance is a hundred-fold more complicated than that."

To help eliminate the uncertainty, task force officials reviewed documents and interviewed officials associated with the last major outbreak of END, which was also in California. However, the passage of three decades and the basic differences between the incidents limited the parallels that could be drawn. Not only had technology changed, but the nature of the outbreak was markedly different.

Unanticipated Aspects of Emergency

One of the major complications facing the task force was the outbreak of END among backyard flocks. Preplanning had assumed that any major outbreak of disease among birds would occur in the commercial population, as it had in the 1970s. According to the USDA area veterinarian in charge, Dr. Ugstad: "I don't think any of us in our planning had any idea of how difficult it is dealing with an outbreak in an urban neighborhood. I don't think any of us understood the magnitude of the backyard poultry population. We are very comfortable with, and become accustomed to, working with traditional agricultural production facilities." The task force was not prepared for dealing with the spread of the disease among backyard fowl, which made up 96 percent of the premises investigated (Speers et al. 2004, 68). The task force had to become adept at dealing with an unanticipated additional layer of complexity.

If the outbreak had occurred only among commercial producers, many birds would have been infected and the financial cost still would have been high. However, managing the outbreak would have been simpler to deal with in many respects:

- **Coordination of bird owners:** Commercial owners are a clearly identifiable group with a preexisting relationship with state vets and APHIS-VS. Commercial birds are concentrated in specific, known areas that are easily accessible.
- **Co-production possibilities:** Commercial owners have staff on hand who could aid with the disposal of the birds. There is an informal network of connections between commercial producers, and key commercial producers were able to organize other producers.
- **Standardized procedures:** Commercial operations are relatively large and often similar in operation, increasing the potential for developing standard responses. With some exceptions, it is reasonably simple to appraise the value of commercial birds, and eradication, cleaning, and disposal could follow a standard set of procedures.

The backyard population was more challenging to deal with. Most obviously, there was a lower effort-to-payoff ratio. Whereas dealing with one commercial owner could mean accounting for hundreds of thousands of birds, task force members had to engage with lots of backyards owners with a much lower number of birds. The average number of birds depopulated in a backyard premises was 59, while the equivalent number for commercial premises was more than 120,000 (Speers et al., 2004, 75). In addition, the disease was easier to spread among backyard populations. In some neighborhoods, free-roaming chickens facilitated the spread of the disease from one premises to another, as did neighbors visiting one another. "Trying to understand movement in and out of a neighborhood is difficult. Movement control on a ranch is also much easier than in a neighborhood," says Dr. Whiteford.

Another challenge was that detection was more difficult. The task force did not know who these bird owners were unless they self-reported. Chances of self-reporting were low, at least until awareness of the disease increased. Many backyard owners have limited discretionary income, which reduces the likelihood that they will contact a vet if their birds become sick, eliminating another source of contact for the task force. According to Dr. Ugstad: "Most of the initial [carriers were] in the backyard, hobby-type flocks—people that don't normally apparently contact veterinarians when they have problems with birds. We felt like the disease had been circulating a few weeks before the initial diagnosis was made; therefore, we felt like it was more widespread than we could really handle with the resources in California."

Much of the backyard population was game fowl raised for the purposes of cockfighting. There are an estimated 1 million game fowl in California, about one-third of the estimated game fowl population in the country (Speers et al., 2004, 16). Although owning game fowl is not illegal, cockfighting is. As a result, there was deep suspicion of any sort of law enforcement officials in this community, reducing the chances of self-reporting. These individuals are also less likely to comply with a quarantine or offer their birds for testing. Rather than keep the birds on a single piece of land, they will interact regularly in the unsanitary conditions of fight meetings and by selling birds to one another. In addition, the traditional cockfighting season runs from Thanksgiving to the end of December, occurring just as the task force was trying to discourage the movement of poultry. In some cases, owners of game fowl were suspected of being involved in other illegal activities, raising safety concerns for task force employees. Some precautions were taken. Surveillance teams did not work in certain areas on weekends, and local law enforcement officials were notified of the presence of task force employees.

Instead of relying on self-reporting or inspection of a handful of commercial owners, task force surveillance teams had to go door-to-door, asking if there were birds on the premises and if they might be allowed to examine the birds or get access to them to eliminate them. Surveillance mostly occurred during working hours, when there often was no one at home to allow entry, meaning that surveillance teams would often have to return to the same premises multiple times. Each backyard premises was slightly different, making it more difficult to write standard procedures that would satisfy all situations. The types of birds might differ from one owner to another, making appraisal slower and more complicated. The owners often had strong attachment to their birds, meaning they could be deeply upset at the loss of a family pet and less likely to be cooperative. As it became clear how widespread the disease was, the task force took a more aggressive approach to depopulation.

When the task force epidemiologists determined that END was prevalent and that there had been possible movement of END within a neighborhood, the birds in that neighborhood were treated as if they were a single flock, meaning that all birds were destroyed, with or without further testing. Even when the birds were eradicated, there was still the risk that the backyard owners would violate the quarantine by purchasing new birds. The task force surveyed homes where birds had been eliminated and found that in some cases replacement birds were in place.

The backyard dimension also added a cultural complexity to the work of the task force, since a high portion of the backyard owners were Hispanic. Task force members had to go into poor Hispanic neighborhoods, where Spanish was the first language, and seek cooperation with the locals. This was a daunting task for many who did not speak the language, had little knowledge of local geography, were unfamiliar with the culture, and were from parts of the country with a much lower percentage of Hispanics. One way of overcoming this problem was to employ temp employees who were Hispanic to act as translators/guides and workers.

The backyard aspects required higher levels of external outreach to concerned bird owners, and figuring out what sort of communication would be effective was most difficult with the Hispanic population. The task force, advised by an advertising firm that specialized in Hispanic outreach, tried a variety of options, including:

- A toll-free hotline
- A dedicated website
- Leaflets and door hangers targeted to areas under surveillance

- Advertising in Spanish-language radio and newspapers
- Including END materials with municipal water bills
- Posters at rest stops
- Distributing information at holiday events such as Cinco de Mayo
- Town-hall meetings
- Direct mail to all residences in quarantine area
- Press releases

Rotation of Employees

Many respondents described turnover of staff as one of the primary, if not the primary, management challenge that the task force faced. The lack of continuity limited the ability to build up experience among personnel and consistency in action, and increased transaction costs in terms of additional training and supervision requirements. New employees would come into a position and have to learn their role, just as the old occupant had finally mastered his. Employees would also have unfamiliar supervisors, with different preferences and ways of operating.

This section seeks to explain why heavy turnover of staff occurs in certain types of emergencies and what can be done to lessen its effects. The degree of turnover was unavoidable given the long-term nature of the emergency, the borrowed nature of staff, and the potential for employee burnout.

The term *emergency* evokes images of problems that are pressing for immediate attention—earthquake relief, fires, and volcanoes. Once appropriate attention has been given, the threat behind the emergency quickly passes and some version of stability, if not normalcy, returns. But this is a misleading image for many types of emergencies, which continue for days, weeks, months, and sometimes years. Animal disease outbreaks fit into this category of emergency. Because many types of emergencies occur infrequently, the public sector does not have a requisite full-time, year-round staff to deal with them. There are obvious exceptions, such as paramedics or firefighters. But emergencies like END are infrequent and might not occur for decades. When such a disease occurs, there are not full-time specialists who have been waiting for this moment. Instead, we rely on an "all hands on deck" approach. Agencies with varying degrees of relevant expertise are pulled into the network of responders. They are also pulled away from their regular positions. The demands of their regular positions do not stop—their home agencies still have clients to serve, regulations to enforce, budgets to spend, and elected officials to satisfy. These "borrowed" staff have to juggle their regular role with their new emergency role.

Even if there were permanent staff to draw on, the nature of the work means that many would suffer burnout quickly. The emergency does not clock in 9 to 5, Monday to Friday, and neither can the staff responding to it. Staff are flown in from all over the country and are separated from their families. They stay in hotels, away from the familiar comforts of home. They deal with fellow workers they usually do not know and work in an environment that is unfamiliar to them. The workday is typically 11 to 12 hours, frequently for seven days a week. The basic tasks that make up the workday are new, and employees are acutely aware that failure in achieving their task is unthinkable, any delay is costly, and any mistake is subject to scrutiny. For all of these reasons, the job is highly stressful. Dr. Whiteford notes: "There is a burnout factor that needs to be considered. Observing our staff during the height of stress, I would say that it would take a week to adjust to the complexity of the incident and the complexity of the situation where the incident was located, and a week of really productive good work, and then that last week some of them really varied, but some of them you could see were reaching the point of exhaustion and were a little bit less effective. Others weren't, but I would think it would difficult to ask people to be in that kind of situation for more than three weeks." Dr. Denis Wilson, a member of AHFSS and an incident commander in the task force, says: "It can be a real burner to be away from home for an extended period of time, and under a stressful environment where you don't know the people. We had a number of people coming from small towns in other states, and all of a sudden they are thrown into the Los Angeles area with congested traffic and a different culture. It was kind of stressful, long hours, and away from their wives and kids."

The borrowed nature of most staff and the sheer demands of emergency response work meant that most employees worked on the task force for limited rotations. The typical rotation was about three weeks, at which point staff would return to their home agency with the possibility that they may return to the task force again in the future. For the agencies involved, the END task force was a drain on their human resources, whose primary work was reprioritized in favor of END. Since many employees were rotated in and out of the task force multiple times, this was often a frequent disruption to the home agency.

The task force gradually became better at dealing with rotation and developed some basic strategies that lessened the impact of turnover:

- **Ensure continuity in senior positions:** Some key individuals, including the joint area commanders, stayed with the task force throughout the bulk, if not all, of the outbreak. This ensured some measure of continuity in key decision situations. The hiring of temporary employees not affiliated with any of the public agencies involved also provided another form of continuity for frontline activities.
- **Rotate employees back into the same position:** The rotation schedule and staff process were structured to allow individuals to return to the same position they held previously. This allowed them to develop familiarity with a specific set of tasks, areas, and co-workers.
- **Create overlap and information exchange between different occupants of the same position:** As staff rotated in and out of the same position, they made contact with the employee filling that position in their absence, and were often kept up-to-date on major events via e-mails, phone conversations, or even debriefing memos. Most helpful of all was creating a three-day overlap between the departure of employees and the arrival of their replacements.
- **Rotate in and out entire teams:** By spring of 2003, the task force realized the benefits of rotating in and out entire emergency response teams, as USFS does during a fire emergency. This meant that employees not only had experience in their role, they also knew and had previously worked with their colleagues. VS plans to employ team rotation for future outbreaks and has begun to identify and train these teams.
- **Use standard operating procedures (SOPs):** Since the task force could not rely on continuity among its personnel, it sought to codify the accumulation of knowledge in formal standard operating procedures. The task force became more formalized as it grew in size, and all employees had to be familiar with SOPs relevant to their duties. Even employees rotating back into the same position they had before were required to reread the SOPs to ensure they were aware of any recent changes and sign a form acknowledging they had done so. The role of SOPs is further discussed in the next section under "Learning and Communicating Basic Procedures," beginning on page 26.

Success Factors in Using Collaborative Networks More Effectively

The ability to deal with the challenges outlined in the previous section was one of the major reasons why the task force succeeded. This section looks at other success factors. These factors all help to explain how individuals from multiple agencies were able to coordinate their activities, act decisively, and ultimately defeat END.

Success Factors

- Creating trust and mediating its importance
- Using and adapting the Incident Command System
- Learning and communicating basic procedures
- Making use of innovative technology

The network form of managing the outbreak was the only viable form given the challenges posed and the limits of different organizations. But the network had to be coordinated toward common action. In part, it was able to do so through creating some measure of trust between participants and building a sense of shared culture within the network. What makes emergency networks different from other types of networks is the need to allocate and deploy resources rapidly. In order to achieve this goal, the network took on components of standardization and hierarchy to operate successfully. The remainder of this section examines how the network was organized and other factors that enabled the task force to succeed, such as the use of technology and innovation.

Creating Trust and Mediating Its Importance

Processes that rely on cooperation from different organizations rely, to some degree, on trust. Trust in other actors inspires confidence, leads to delegation, and reduces transaction costs. Not surprisingly, trust is a factor that marks successful networks (Milward and Provan, 2000). Trust is based on repeated positive experiences of successful partnerships and met expectations. It takes time to develop, but time is not a luxury that emergency networks have. The END outbreak lasted longer than most emergencies, but was much shorter in duration than most network relationships, such as those between government and social service providers. The network was also subject to a high degree of staff turnover, further reducing the potential to build trust among members. Trust did develop between actors, but it could not be expected to be the glue that held the organization together. As long as a network is characterized by a limited duration and rotation of personnel, it is unrealistic to expect that trust will become the primary basis for emergency network action.

How can emergency networks ameliorate the absence of the basic conditions necessary for the development of trust? The END task force offers a number of lessons. First of all, there was not a high level of initial *distrust* among actors. The organizations involved were not rivals for resources or profits, so there was little reason to assume the motives and actions of others to be anything other than well intentioned and focused toward a shared goal. Where there were profit-seeking actors, there were more negative comments about the motivations of individuals or organizations involved—for example, some of the temp agencies and temp employees were criticized for poor quality of work or trying to maximize the amount of public money they made.

There were several potential sources of conflict among agencies. A main source of conflict was the different disciplinary and organizational backgrounds among the actors involved. The participants brought to the task force the perspectives of their home agency or training, which often clashed with the perspectives of others. For instance, the AHFSS and VS provided a high number of vets to the task force. Such individuals placed a high value on the judgment and discretion of experts. Individuals coming from the U.S. Forest Service and the California Department of Forestry and Fire Protection were more used to paramilitary-style hierarchies and command and control. While participants from different backgrounds generally realized the value and skills of the other, they sometimes disagreed on questions of how to run the task force.

If the organizational culture of the home agency shaped how individual task force members and the task force acted collectively, respondents also believed that the task force developed its own culture, which aided network effectiveness. The development of a new culture takes time. It is difficult to create and foster a new culture not only because of the influences of the home agency culture, but also because the task force was trying to define its own culture as it was engaging its task and was experiencing a vast influx of new individuals. Such an influx makes it difficult to establish and communicate a strong informal sense of organizational characteristics. These employees also came to the task force with a variety of motivations: Some were working for pay; some from a sense of public service. Some employees wanted to be there; some did not.

Respondents do speak to the development of a task force culture, however. This culture is characterized by a focus on mission and task, demanding work, a sense of shared crisis, and esprit de corps. This culture developed not so much because of deliberate actions by agency leaders, but by the nature and context of the task itself. Members of the task force understood the importance and immediacy of the mission, and the consequences of failure, and that they shared this challenge with a team. The following quotes from different members of the task force illustrate this point:

- "Emergencies can be a very easy thing to manage because most people are so motivated to get the job done."
- "Yes, there were individuals who maybe were not as productive as others, but by and large I saw, number one, an understanding that this was a serious incident, and number two, a real commitment on the part of the organization and individuals to resolve it."
- "The main thing I took away from this was that I was very pleased with how well these various different groups were able to work together. And I think part of it was that everyone recognized that we had a problem we had to resolve, and so we worked together and that was great.

We didn't throw up barriers; we tried to take the barriers down and figure out ways we could work together."

- "There is a sense of urgency. You are in these daily briefings. People who work for these state and federal agencies realize that these exotic diseases are something that are out of the ordinary. We know that the sooner we get our arms around it and get it stamped out, the better."
- "So I think that there was this shared 'we all know this is hard, we're all away from home, long days, long hours,' where people really are trying to do the best they can to get things done and work under those circumstances."
- "I think that the other thing that worked in everybody's favor is that there was unity and everybody was there to eradicate this disease, and so that helped work through some of the personality issues, some of the learning curves, that everybody just remained focused and committed to that."

A sense of shared mission and crisis has many of the same benefits of trust, and indeed is likely to build trust among individuals. It is also worth pointing out that the structure of the ICS reduced some of the elements that make trust so vital in networks. In networks, managers are characterized as mediators trying to develop consensus among voluntary actors. The ICS structure attempts to create a hierarchy within a network to reduce the need for voluntary agreement and consensus. The task force had a clear chain of command; actions were ordered, not requested. While managers in an ICS might have more hierarchical authority than managers in a network, it is important not to overstate this authority. Almost all employees are temporary in one way or another, and managers have little means of rewarding or punishing subordinates. Such carrots and sticks remain with the home organization, to which the employee will return.

A final point on the issue of trust: The development of trust-based relationships prior to an outbreak can have major benefits. Since participants will be largely focused on the task at hand during an emergency, getting to know one another will not be a high priority. But representatives of the organizations likely to form an emergency network can meet beforehand. Dr. Ugstad puts it this way: "Even if you deviate from what you have put together in that plan, you still have gained a lot by going through that planning process, just by knowing who or what agency you need to be in touch with. You can spend an awful lot of time just trying to find out where do you go to get the answers to this. If you do an adequate amount of planning, you can save a lot of time spinning your wheels trying to find out who to talk to."

The task force had an additional and significant advantage in the area of previous relationships. The USDA area veterinarian in charge, Dr. Ugstad, and his staff had strong positive relationships with the state veterinarian, Dr. Breitmeyer, and his staff at AHFSS. Initially, the outbreak was under the jurisdiction of the state, which kept federal counterparts involved. After the emergency was declared and the outbreak moved into its second phase, the feds returned the favor, keeping state officials involved in all decisions. In fact, senior managers saw the task force as a joint partnership from the beginning. This was most clearly reflected in the joint command structure at the apex of the task force. This meant that the AHFSS and VS were each represented by one of two joint incident commanders (and two joint area commanders as the task force expanded). Dr. Ugstad says that the pre-existing relationship was "a huge advantage.… If there were problems with the working relationships to start with, that might have been magnified with the emergency response situation. At the same time, I think the fact we have a good relationship might have been magnified by the emergency response." Dr. Mark Davidson, who worked as a deputy incident commander in the task force, comments: "There are definite advantages in that ongoing relationship because they work together on a routine basis on the management of day-to-day programs. So when you are thrown in the crisis mode you are in, they already have those established working relationships and don't have to develop them during the response."

A focus group of managers (Werge, 2004, Appendix C) identified positive interagency relations as one of the success factors of the task force. In doing so, they identified the importance of the previous state/federal relationships. Since the bulk of the USDA employees were new to California, cooperation could not be expected to emerge from previous personal relationships. However, the sharing of decisions among the joint command was useful in establishing basic norms of cooperation at lower levels. One task force participant notes: "The area commanders did a nice job of setting the tone for that. From the very beginning when I got there, if I drafted something, the first question out of the USDA area commander's mouth was, 'Have you run this through the state folks? What do the state people think about this?' So I think they really set a nice tone of 'we're going to work this very cooperatively and that's just the way it's going to be.' "

Using and Adapting the Incident Command System

The END case demonstrated the benefits of the ICS model for dealing with animal disease outbreaks, a type of emergency that had not used ICS frequently in the past. Many of the task force members, particularly the veterinarians, were not experienced with ICS. Rob Werge wrote the internal After Action Review for the USDA and notes, "We had done little or virtually no training in terms of an ICS. So the whole area of managing on this scale was something we had no experience in or had not built up our experience in." Task force members agreed that ICS was an appropriate and useful way of organizing the task force. Since the outbreak, USDA has expanded training on the principles and applications of ICS.

The ICS model brings clarity to the questions of structure and authority by imposing a hierarchy on a network. As different agencies come to work together, they first have to decide how they will organize to cooperate. The ICS provides a basic model that these agencies can take and use rather than spending time developing a wholly new structure. The agencies still have to decide who fills in the boxes that make up the ICS structure, but the structure itself is established. The ICS also establishes a clear line of command. Public networks tend to be characterized by a search for consensus. In an emergency situation, rapid response is more vital than consensus, and so clear lines of authority must be established. The positions of incident commanders and area commanders in the ICS model make clear who the key decision makers are.

Some participants did disagree about how the ICS might be best applied to animal health incidents. The ICS is essentially a series of management principles and a structural design. It offers a standard model for how to manage emergencies, but does not describe specific management procedures and actions. It was therefore up to the task force participants to apply and adapt these principles to END in California. The veterinarians in the task force were more likely to argue that the ICS be modified to a greater degree, while Forest Service staff that had the greatest experience in applying ICS were more likely to argue against adapting the ICS model they were used to. Howell (2004, 60–69) notes that ICS in foreign animal disease outbreaks, unlike forest fire situations, must take into account the following critical needs:

- Biosecurity
- Animal health expertise
- Epidemiology
- Surveillance
- Longer planning cycle and slower pace of operations
- More complex logistics
- Public information outreach

Learning and Communicating Basic Procedures

Organizations and individuals within organizations are prompted to learn for a number of reasons, such as a changing external environment or competition. Such learning is usually an incremental advance on existing ways of acting. Management systems are established and formalized, and employees implement approved ways of dealing with routine tasks, such as hiring individuals or keeping track of assets. Such systems may sometimes appear bound in red tape, but standardization has the benefit of reducing potential error or fraud, diffusing smart practices, and minimizing the search process for employees unfamiliar with a task.

A basic challenge for emergency networks is to establish and disseminate SOPs. Arguments in favor of SOPs and standardization run counter to prevailing ideas in management, as does the hierarchical nature of the ICS. Networks are praised as an alternative to traditional hierarchies that are bound in red tape (Goldsmith and Eggers 2004). However, the END case demonstrates the value of SOPs. Hierarchies and SOPs are both efforts to establish a form of managerial order where very little exists. The main challenge for employees in the task force was not an excess of red tape, but in finding the answers to such basic questions as: What are my tasks? How am I to achieve them? What resources do I have? Whom do I report to? How many days do I work? The main challenge for networks in emergency situations, therefore, is to take on the characteristics of an action-oriented organization: responsive, with clear direction and a shared understanding of processes and solutions.

SOPs are valuable because they provide structure, clarity, and knowledge that were not there before. They define which issues in the network have been resolved and which procedures all network actors agree to follow. For the END outbreak, the degree of uncertainty associated with the disease, the size of the task force, the backyard aspect of the outbreak, and the degree of turnover increased the need for SOPs. Most employees were working in an unfamiliar area with unfamiliar colleagues as they tried to figure out the most effective way to battle the disease. SOPs not only provided some basic guarantee of standardization and accountability, but also helped individuals understand their role in the organization and what specific actions they were to take in a given situation.

SOPs, such as standards for cleaning and disinfection, were sometimes straightforward. They were also sometimes controversial and indicative of the aggressive focus the task force maintained on eliminating the disease. An example was the requirement for depopulation of any birds (including pet birds) on both infected premises and any premises that were adjacent to or had an epidemiological link to an infected premises (Speers et al., 2004, 13).

As the task force grew over time, knowledge and procedures were formalized in an SOP manual that grew to over 400 pages.[3] The final manual covered all aspects of the task force work, including vehicle use, reporting of accidents and injuries, policy on media contacts, and policy on overtime. Under finance, the manual covered processing purchase orders, processing indemnity claims, and budget reconciliation. There were mobilization and demobilization SOPs aimed to help orient employees. One section covered personnel conduct and interacting with the public, and another covered animal control, human health, pet bird protocols, biosecurity and safety, non-commercial site surveillance, commercial site surveillance, quarantine, diagnostics, epidemiology, regulatory enforcement in quarantines, disposal, euthanasia, cleaning and disinfection, movement and permitting, indemnity, sentinel birds, area quarantine release, and commercial poultry planning.

The development of SOPs reveals a consistent pattern. Initial disorganization and lack of coordination creates problems for the task force in doing its job. Such problems are observed and procedural solutions are suggested and become formalized. If need be, the new procedure is further refined to better meet the needs of the task force. This pattern also applies to aspects of task force work that were not part of the SOP manual. For instance, the CNA Corporation's report noted the following about the development of new procedures for dispatching personnel: "Initially, disorganized recruitment and tracking of personnel prompted development of the new system to assign and deploy federal responders" (Speers et al., 2004, 97).

Cumulatively, such a pattern helps explain one of the widely made observations that task force members made. The task force took time to get its bearings, but improved in its ability to manage large numbers of individuals and effectively tackle the disease as the outbreak went on. In part, this was due to the growing experience and learning that took place by task force members who committed a significant amount of time to the task force. SOPs were also important, both in codifying this experience and in transferring the knowledge to those new to the task force.

Writing the SOPs during the outbreak took a good deal of time, and additional preplanning for some predictable tasks might have reduced the initial "confusion and delay" (Werge, 2004, 9) in the task force. But as one manager pointed out, it is impossible to preplan all eventualities that might occur in an infrequent emergency incident, and so some writing of SOPs will occur as the responders are figuring out how to best achieve their task:

> SOPs are key for continuity. The problem was that we had SOPs that were a little bit dated for responding to END in a commercial setting—that would be more appropriate for the central valley or Virginia. We really hadn't anticipated such a huge, large-scale response in somewhere like the L.A.

> Basin. So we really had to rewrite all of our SOPs to a level of detail that never had existed before. So that was a huge effort and that's another lesson learned: Early on in the response, it is good to have a team of people dedicated [to ensuring] that SOPs are appropriate for that particular response. Now, for fires, they have multiple fires every summer, and it's not so hard for things like that. But for animal disease, where you have to respond to a scare every 30 years, you need some kind of flexibility to write procedures during the response. You should preplan, they should be written out ahead of time, but no matter how good you pre-planned, the actual response won't fit what you preplanned for.

Of course, simply writing SOPs offers no guarantee they will be used. The APHIS After Action Review argues that SOPs were most utilized where they fit closely with a daily routine. Otherwise, the application of SOPs depended upon: (1) their relevance to the actual situation, (2) the emphasis placed on them by direct supervisors and colleagues, and (3) their clarity (Werge, 2004, 23). The report notes that developing SOPs for future outbreaks will be useful, particularly for functions that have predictable tasks, such as administration and logistics.

Making Use of Innovative Technology

Improved technology was a major advantage that the recent task force had over their counterparts fighting END in the early 1970s. A simple example is the use of cell phones, which gave task force employees a familiar communication tool that worked over long distances. Other technological innovations occurred during the task force, as task force members sought to develop technological solutions to basic problems. Two of these innovations were particularly important: the Emergency Management Response System (EMRS) and the development of a rapid diagnostic test for END.

The Emergency Management Response System

The EMRS is a tasking system for incident response. During the END outbreak, it pulled together in near real time relevant information about task force actions. This made the task of coordinating resources and activities much easier. A manager looking at the EMRS could tell whether a premises had been visited or not and what actions had taken place or needed to occur (e.g., cleaning and disinfection, depopulation, appraisal status). It reduced the potential of personnel visiting the same premises twice or reporting inconsistent information, and kept track of the location of personnel.

The EMRS was developed by APHIS employees and outside contractors, and had been used first in a test exercise in Florida in 2000. The software was still in development when it was used in 2001 during the outbreak of avian influenza in Virginia. Some members of the task force did not think it was ready for the END outbreak but felt they had little alternative but to use it. A chief advantage of the EMRS was that it was flexible enough to be adapted to different needs, and the task force could use experts from the Virginia outbreak to tailor it. Consistent with other aspects of the END response, the software continued to be developed while the outbreak was occurring. For example, during the outbreak, a tool to centrally track financial costs was added. In addition, an administrative component was added to track equipment, vehicles, personnel, contacts, training, and assignments. Finally, a task management component allowed the inclusion of information related to meetings and tasks.

Another addition to the EMRS was a mapping module, which allowed the task force to use it in conjunction with a Geographical Information System (GIS). Each field worker had a global positioning system receiver and a map that showed the grid the survey team or surveillance team was responsible for. Once premises in that zone were visited, that information was entered into the EMRS, and future maps would show that these premises had been completed. One task force member says: "The tasking and the monitoring of progress really couldn't have been done any other way without that GIS." GIS is an electronic system that creates spatial mapping. In this case, it was used to show where the disease was occurring, and the nearby locations where the disease was likely to spread, based on risk factors such as the number of poultry. This helped to prioritize which areas it made most sense to send survey teams.

The importance of centralizing information in one place cannot be overstated, since it allowed incident commanders comprehensive information to make operational decisions. Such information was used in daily management meetings to track progress in fighting END. It essentially created a direct line of communication between frontline employees and incident commanders. The comments of one member of the task force reflect this point, but also underline that while the EMRS provided good information, senior managers still had to decide what to do next: "Each incident [command] still had to put together their incident action plan, which is also a form of communication that basically says, 'Hey, if you're part of this unit, then this is what you are responsible for and this is your task for the day.' "

Many respondents consider the EMRS as being essential to the success of the task force. But its success was by no means certain. The task force could have opted to use another system developed in California, or members unfamiliar with EMRS might have chosen not to actively use it. The After Action Review (Werge 2004, 25) argues that the EMRS was successful because of the following factors:

- Consistent management over the course of the outbreak
- Insistence that it had to be used as the information system
- Continual support for programming and updates both on site and off site
- Its ability to expand to meet new and changing demands
- Its relative user-friendliness for a wide range of personnel with different skill levels

Some problems were associated with the EMRS. The main issue was making sure data was being entered in a timely fashion, a basic task that was compromised by the sheer scale of the outbreak in California. Data entry sometimes fell behind, meaning that teams visiting premises did not always have accurate information about the status of that site. A review of the outbreak by the CNA Corporation recommended investing in portable computers that would allow field personnel to interact directly and immediately with EMRS (Speers and Webb, 2004, 41).

Another criticism of the EMRS was the need to change it to meet the particular needs of END. The adaptability of the EMRS meant that in most respects the tool was changed according to the demands of the task force, but there were always additional ways improvements could be made. For instance, the staff responsible for appraising the compensation value of birds to be slaughtered would have preferred if the EMRS could provide more specific information on what types of birds could be expected to be found on a site. The requirements of an EMRS for another type of disease outbreak could be different in many respects, and adaptability of such software is an important characteristic.

Rapid Diagnostic Test

The standard diagnostic test for END took seven to 10 days at the beginning of the outbreak. The delay in waiting for a response created problems for the task force. The After Action Review (Werge 2004, 22) notes: "As the magnitude of the outbreak grew, it was apparent that the lack of a quick test had caused a critical bottleneck." In backyard flocks, it was sufficient to confirm that the disease existed in the neighborhood before killing flocks based on epidemiology. In commercial flocks, the cost was so great that the task force really needed to be certain that the pathogen was present. At the same time, there was a suspected outbreak of avian flu, which has many of the same symptoms and made it more difficult to do an accurate diagnosis based on external symptoms.

CAHFS, with approval of the NVSL, developed a polymerase chain reaction (PCR) test for END that reduced the turnaround time for diagnosis to one to two days. Typically, tests could be sent into the lab in the morning and results would be available the same afternoon.

The PCR test brought a number of benefits:

- More up-to-date information on the spread of the disease
- Ability to test animals without major time lag
- Ability to test a greater number of animals (tests no longer had to go to Ames, Iowa)
- Reduced need to eliminate entire bird populations, which reduced operation costs and conflict with backyard owners
- Increased the maximum productivity of the CAHFS labs from 182 tests per day to 1,500
- Ability to declare an area END-free and have its quarantine removed more quickly

A number of task force members noted the rapid PCR test as a success factor. Dr. Whiteford says: "With a rapidly spreading disease, you need to be able to make a decision within one or two days, not 10 days, and if you don't know where the disease really is, you can waste a lot of resources on sick birds that have symptoms of the disease but don't have the disease. So that rapid test is really what allowed us to pinpoint where the disease was and where it wasn't. Pinpointing where it wasn't was almost more important, so we could apply resources more appropriately."

Why was the CAHFS lab able to innovate so quickly? Preplanning helped. CAHFS had planned for an animal disease outbreak and what it would mean in terms of demand on their resources. CAHFS first used its own PCR test, but then transitioned to a test developed by the Southeast Poultry Research Laboratory (which had already received federal homeland security funding to find such a test before the outbreak) and the NVSL in January of 2003 (Speers et al., 2004, 133). Members of CAHFS also realized the cost of the delays in terms of resources for the task force and the value of a rapid test. They persevered despite some disagreements among federal officials about whether they should be given authority to use the PCR. Another advantage was that they had a specific goal, expertise in that area, and resources to achieve it. This facilitated what one observer referred to as a "tight focus" relative to the broader goal and variety of circumstances faced by other parts of the task force.

Conclusion

This case study details the efforts of a specially convened task force to track and eradicate a disease. The task force was ultimately successful, but not before thousands of employees had established operations in five states and depopulated 4.5 million birds. The case study is significant for a number of reasons. Foreign animal disease outbreaks have become more common and, in some cases, have the potential to mutate into diseases that affect humans. More broadly, the Department of Homeland Security has sought to standardize various types of emergency response in the aftermath of 9/11, and this case demonstrates how concepts such as the Incident Command System work in practice. Some lessons from the case emerge.

Lessons

1. For any major animal disease outbreak, an emergency network is necessary.
2. Participants learn how to manage emergency networks on the job.
3. Speed in establishing a network is vital in emergency conditions.
4. The Incident Command System is the primary model for managing emergency networks and is flexible enough that it can (and should) be adapted to different types of outbreaks.
5. A major challenge for emergency networks is to take on organizational characteristics, such as rules, chains of command, and SOPs.
6. Turnover of workers during long-term emergencies will create disruptions, but there are ways to reduce the impact of turnover.

Lessons

Lesson 1: For any major animal disease outbreak, an emergency network is necessary.

The task force that fought END was made up of multiple agencies from the federal, state, and sometimes local level. The task force also hired support from temp agencies and sought to work directly with commercial producers. The size of the outbreak, and the complexity and uncertainty of the disease, required a broad array of skills and resources from the task force. Resources included authorities, flexibilities, human resources, finances, and expertise. The resources that each agency brought complemented the strengths and weaknesses of other agencies in the network, allowing member agencies to focus on their specialty. No single agency could have comprehensively battled END, meaning that the task force necessarily took on a network form of governance.

Lesson 2: Participants learn how to manage emergency networks on the job.

The issue of coordinating multiple agencies was the central challenge faced by the task force and those involved say that they became much better at doing it as the outbreak progressed. In large part, this was because many of the skills involved in making the task force work were learned on the job. Preplanning and training help individual actors to understand the challenges they will face, but cannot substitute for the actual experience of working under such intense conditions.

Lesson 3: Speed in establishing a network is vital in emergency conditions.

In the days after the outbreak of END occurred, the task force was established and acted aggressively.

Rather than wait for a guarantee of federal funding, the task force used resources within California to tackle the disease. The importance of speed could be seen as the disease spread to other states, where detection was followed by rapid deployment of staff and targeting of nearby premises. Because the task force was already established, it was prepared for the outbreak of END in other states. In addition, state, local, and tribal governments in other states were aware of the disease and responded quickly while the task force deployed to their locations. As a result, the scope of the outbreak in these other states never matched that of California.

Lesson 4: The Incident Command System is the primary model for managing emergency networks and is flexible enough that it can (and should) be adapted to different types of outbreaks.
The Department of Homeland Security has proposed the Incident Command System, or ICS, as the management structure by which all emergency responses will be run. The goal of the ICS is to provide a hierarchical framework upon which to manage the network of agencies involved. The ICS is essentially a simple command and control system within which staff from different agencies are managed. Structurally, the ICS organizes functions by critical management systems: planning, operations, logistics, and administration/finance. Each function reports to a single command that has decision-making power for the ICS. The ICS design is intended to be widely applicable but flexible enough to be adapted to the needs of different outbreaks. In the case of END, the task force participants sometimes disagreed on the degree of adaptation that was necessary for animal disease outbreaks.

Lesson 5: A major challenge for emergency networks is to take on organizational characteristics, such as rules, chains of command, and SOPs.
Arguments in favor of hierarchy and standard operating procedures run counter to prevailing reform proposals in management. However, the END case demonstrates the value of SOPs. Both hierarchies and SOPs are efforts to establish a form of managerial order where very little exists. The main challenge for employees in the task force was not in sorting through an excess of red tape, but in finding the answers to such basic questions as: What are my tasks? How am I to achieve them? What resources do I have? Whom do I report to? How many days do I work? The main challenge for networks in emergency situations, therefore, is to take on the characteristics of an action-oriented organization: responsive with clear direction and a shared understanding of processes and solutions.

Lesson 6: Turnover of workers during long-term emergencies will create disruptions, but there are ways to reduce the impact of turnover.
Staff turnover, a major management challenge that the task force faced, created a lack of continuity that limited personnel's ability to build up experience and consistency in action and increased transaction costs in terms of additional training and supervision requirements. New employees would come into a position and have to learn their role just as the old occupant had finally mastered his. Employees would have unfamiliar supervisors with different preferences and ways of operating. The degree of turnover was unavoidable given the long-term nature of the emergency, the borrowed nature of staff, and the potential for employee burnout. However, the task force discovered ways in which to reduce the effects of turnover by maintaining continuity of key staff, ensuring overlap and communication between staff rotating in and out, rotating staff back to their old positions, rotating in entire teams that had experience working with one another, and creating SOPs.

Recommendations for Using Emergency Networks Effectively

Recommendation 1: Preplan—but expect to plan some more once the emergency occurs.
There was limited preplanning for foreign animal diseases in California, and no specific planning for END. The planning that took place was helpful, if for no other reason than it identified who the key actors in an emergency network would be and, in the process, introduced representatives of these agencies to one another. Once the emergency was declared, the task force had to continue to plan, developing both daily incident action plans that directed operations and longer-term plans on the overall strategy to defeat the disease. Plans need to be refashioned

during any outbreak to meet the specifics of the situation, some of which may have been unanticipated. For instance, preplanning for foreign animal disease response had focused on dealing with outbreaks among commercial flocks, but the END task force had to deal with an outbreak that occurred among backyard birds in urban areas, often in primarily Hispanic neighborhoods.

Recommendation 2: Identify the resources needed to deal with the emergency and match them with the competencies of organizations. The needs of the emergency should determine the agencies involved. In some cases, the match between these needs and the competencies of organizations may not be obvious. For instance, the task force relied a great deal on officials from the U.S. Forest Service and the California Department of Forestry and Fire Prevention. Why would Forest Service officials be required in fighting a bird disease? The answer is that Forest Service officials have decades of experience applying Incident Command System principles to different types of emergencies, and understand how to plan, organize logistics, and manage large numbers of individuals in emergency conditions.

Recommendation 3: Create trust where you can; find alternatives where you can't. The literature on social networks emphasizes the role of trust in helping the actors involved work together. But such trust takes time to develop, and in an emergency network such time is not available. Strong pre-existing relationships between federal Veterinary Services vets working in California and state vets helped establish a basic level of trust and cooperation between key actors. But the task force also found ways to reduce the need for trust in the network. The use of SOPs and a clear chain of command provided clarity in direction and reduced the need for consensus. The task force also developed its own network culture, characterized by a focus on mission and task, demanding work, a sense of shared crisis, and esprit de corps. This culture developed not so much because of deliberate actions by agency leaders, but by the nature and context of the task itself. Members of the task force understood the importance and immediacy of the mission and the consequences of failure, and that they shared this challenge with a team.

Recommendation 4: Take advantage of technology innovation to dramatically improve emergency network coordination and efficacy. Technological innovations occurred during the task force as task force members sought to develop solutions to basic problems. Two of these innovations were particularly important: the EMRS and the development of a rapid diagnostic test for END. The EMRS is an electronic tasking system for incident response, pulling together real-time relevant information about task force actions. This made the task of coordinating resources and activities much easier. A manager looking at the EMRS could tell whether a premises had been visited or not and what actions had taken place or needed to occur (e.g., cleaning and disinfection, depopulation, appraisal status). The EMRS was developed during previous outbreaks, and was still in development when the END outbreak occurred. Members of the task force tailored it to the needs of END, adding new components that aided administration, mapping, and financial management. At the same time, state labs came up with another innovation. They developed a rapid diagnostic test for END that reduced the wait time for test results from a period of seven to 10 days to a mere one to two days. As a result, the task force had more up-to-date information on the spread of the disease and was able to test more animals.

Recommendations

1. Preplan—but expect to plan some more once the emergency occurs.
2. Identify the resources needed to deal with the emergency and match them with the competencies of organizations.
3. Create trust where you can; find alternatives where you can't.
4. Take advantage of technology innovation to dramatically improve emergency network coordination and efficacy.
5. Establish, formalize, and communicate basic procedures that familiarize workers with their tasks.

Recommendation 5: Establish, formalize, and communicate basic procedures that familiarize workers with their tasks.

As members of the task force identified basic problems or smart practices in operations, they wanted to formalize and share this knowledge. They did this primarily through SOPs. SOPs are valuable because they provide structure, clarity, and knowledge that were not there before. They define which issues in the network have been resolved and the procedures all network actors agree to follow. For the END outbreak, the degree of uncertainty associated with the disease, the size of the task force, the backyard aspect of the outbreak, and the degree of turnover increased the need for SOPs. Most employees were working in unfamiliar areas, with unfamiliar colleagues, as they tried to figure out the most effective way to battle the disease. SOPs not only provided some basic guarantee of standardization and accountability, but also helped individuals understand their role in the organization and the specific actions they were to take in a given situation. Members of the task force learned relevant SOPs in training and were required to read new sections of the SOP manual appropriate to their work.

Endnotes

1. This report draws on three major sources that provide detailed accounts of the outbreak. First, the Policy and Program and Development Unit of APHIS developed a 289-page After Action Review (Werge, 2004). Second, APHIS also undertook an outside review of the outbreak, leading to a four-volume, 343-page series of reports by the CNA Corporation (Howell et al., 2004; Howell, 2004; Speers et al., 2004; Speers and Webb, 2004). Finally, the report draws on interviews with a number of senior managers involved in the task force.

2. These figures are based on a database that recorded the contributions of task force employees, but does not include the contribution of 1,327 workers from the California Conservation Corps.

3. The SOPs manual developed was for internal use only and is not available to the public.

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