Public Health Crisis Management: Community Level Roles and Communication Options

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ABSTRACT

Crisis management efforts in the United States public health sector aim to prepare and protect the life of an individual, family or group against a health-related event. These efforts span governmental, nongovernmental and private sectors. The need for coordination between these organizations has never been more apparent. A solution will depend heavily on standardized communication protocols using information and communication technology (ICT). Numerous initiatives are currently addressing the needs of our nation with respect to homeland security and public health, yet remain in the early stages for the nongovernmental sector. The emphasis of our research is at the local level where the governmental sector extends to the nongovernmental sector (NGO), particularly community outreach. Our analysis of the local community suggests focusing on the management of communication during public health crises to better understand the complexities and variations presented in these communities. Leveraging experiences from media-technology literature findings and emergency-response efforts, we seek to identify a framework and tools to enable effective communication for those public health practitioners who serve as front-line responders to public health crises. The major contributions of this research will be to extend the use of information systems and mobile technology to the local United States public health communities to increase effective communication between organizations, while providing a state of readiness for homeland security related events.

Keywords

Public health, crisis management, epidemics, bioterrorism, homeland security, community informatics, mobile technology. media richness, gap analysis

INTRODUCTION

Globalization is erasing our geographic boundaries and causing a shift towards collaboration and communities of interest, yet our local communities remain important for crisis management and immediate response. Public health in the United States (U.S.) is a well established, multi-discipline field that relies on collaboration and communities of interest for citizen outreach. Outreach, as used in our analysis, is defined as the provision of information or services to groups in society who might otherwise be neglected (Encarta, 2005). Given the diversity of urban, suburban, and rural populations in most U.S. states, communication between authorities is important for public health. In essence, the role of public health could form part of the crisis response team, depending on the nature of the crisis. A crisis response team is defined as "a real and virtual community of specialists and experts that must have unrestricted access to one another and is able to act as a collective (Turoff et al., 2004; Hardeman, et al, 1998; Weick 1993, 1995)". Moreover, government public health authorities have aligned with private sector health care providers, insurers, managed care companies, and nonprofit religious organizations to provide, directly or indirectly, various public health services (Gostin and Hodge, 2002).

Public health, as it is known in the United States, centers on preventing disease, prolonging life, and promoting physical and mental health through organized community efforts. "The U.S. based Institute of Medicine (IOM) has set out the domain of public health as dealing with: epidemiology, health promotion and education, public health administration, international health, maternal and child health, biostatistics, environmental health, and nutrition"

(Boylan, 2004). Heightened homeland security efforts, such as September 11, and epidemic outbreaks, such as SARS and HIV/AIDS attacks, have caused a recent shift from a reactive to a proactive strategy, imposing changes in the overall organizational structure (CDC, 2004).

Information technology and accurate data capture are essential for a proactive strategy. An understanding of the local community landscape and protocols for emergency response escalation can enable effective technology-based communication in emergency situations. Ideally, the ability of front-line responders to interface with first responders would enhance the preparedness of our local public health community practitioners. Public health responders who serve as front-line responders for health-related emergencies (i.e. epidemic outbreak, bioterrorism) may form part of the crisis response team, yet are not accustomed to the use of communication devices like two-way radios. Training and regular use of ICT can increase preparedness of these responders who may need to initiate a call for assistance from either inside or outside of the local community. Alert DC, an emergency communication system is an example of emergency alert notifications transmitted to a cell phone, pager, Blackerry, PDA, or email account (Alert DC, 2006).

Emergency management in of itself is a discipline dealing with risk and risk avoidance (Haddock and Bullock, 2003). The varying situations and evolution of events introduces teams who cross organizational boundaries. Understanding protocols within these organizations/agencies (i.e. fire, police, EMS) before an emergency occurs aids coordination and communication. Three levels to consider include: 1) single jurisdiction and/or single agency 2) single jurisdiction with multiple agency support 3) multiple jurisdictional and/or multiple agency support (Haddock and Bullock, 2003).

The community aspect of the public health sector offers scant literature with respect to information and communication technology. The private sector is where the emphasis has been placed until recent events, such as September 11(Institute of Medicine, 2003). In 1988, the soundness of public health law and public health goals were questioned, causing public health activities to fall into disarray (IOM, 2003, Gostin and Hodge 2002). Thereafter, the United States Department of Health and Human Services (DHSS) recommended public health law reform as part of the Healthy People 2010 initiative (Gostin and Hodge, 2002).

In the past decade, several states have passed public health reorganization acts, including Michigan, New Jersey, North Dakota, Texas and West Virginia (Gostin and Hodge, 2002). As part of the ongoing changes in public health is the need for modern definitions, ranging from a utopian conception of an ideal physical and mental state of the World Health Organization (WHO), and states such as New Jersey who adopt a fairly narrow view “Promoting the public health of the community preventing disease and controlling the communication of disease with the community (Gostin and Hodge, 2002)”.

This paper focuses on a preliminary analysis of the communication patterns and complexities presented in the organizations of local public health community to identify current status and flows. A literature-based analysis of the local public health community suggests further research on communication patterns is needed to identify current use of information technology.

U.S. PUBLIC HEALTH GOALS AND LOCAL ROLES

The mission of public health is to fulfill society's desire to create conditions so that people can be healthy (IOM, 1988). Public health in the United States (U.S.) is defined differently than in other western countries with social health care systems. The United States has a private health care system, yet the goal of protecting the citizens (i.e. disease outbreak, bioterrorism) through surveillance, control, and prevention is common with other nations. The means of protection, the approach, and the available services to reach citizens are what vary.

Nevertheless, public health plays an important role in heightened homeland security efforts. These efforts, started in June 2003, place emphasis on both emerging issues and the vision for safer, healthier people in every community and reflect an objective to move away from a disease control focus toward a more holistic aim of health protection (CDC, 2004). Two protection goals include:

1) Health promotion and disease prevention; and
2) Preparedness.

Preparedness in all communities requires initiatives for the protection from infectious, environmental, and terrorist threats. These initiatives will assure readiness to confront traditional and emerging public health threats (CDC, 2005).

What Local Communities Can Bring

"Healthy people 2010" is a national initiative and goal that focuses on the health and well-being of future generations. To reach this goal, interdisciplinary team problem-solving through secondary influencers, such as teachers and youth leaders (i.e. Girl Scouts, Boy Scouts, Red Cross Youth Council), is necessary (CDC, 2005). These leaders serve to reinforce the message and need the tools and techniques to do so. Practitioners from different fields are needed to reinforce this national initiative and convey the message that health is a driver of life's accomplishments. Informed and engaged citizens and communities can play key roles in homeland security (McDonald 2002). Without full engagement from individuals and communities, homeland security is unlikely to be achieved (McDonald 2002). Risk communication, as discussed by McDonald (2002), is the key to long-term homeland security. Systems should be designed to engage citizens and their communities globally in a manner that is sensitive to cultural diversity and addresses causal links to health and human prosperity.

PUBLIC HEALTH BOUNDARIES: THE NEED FOR ENABLING COMMUNICATION

Crisis management is defined in our research as a way to prepare and control an emergency. A problem-to-solve becomes a crisis when a time factor impacts the lives of citizens and influences the responders who are called upon. Emergency events, such as hurricane Katrina, place emphasis on the importance of preparation, timing, communication, and coordination. Hurricane Katrina also placed emphasis on the importance of the local public health community. Hooke and Rogers (2005) discuss health risks associated with disasters and remind us how important the role of public health is within a community and for homeland security. Timely and accurate health risk information must be communicated to the public to ensure human well-being. Rice and Katz (2001) mention the need to study the field of interactive health communication (IHC), which holds promise to communicate health information and to influence attitudes and behaviors of the public. The landscape of the public health sector community has multiple boundaries (Figure 1).

The definition of a community and its subsequent community capacity may be dramatically affected by the boundaries through which the community is defined (Norton et al, 2002). Geographic boundaries are found at the local, state, federal and global levels, whereas mission oriented, religious, cultural, and illness related boundaries also exist within each of these boundaries. Norton et al. (2002) state that "it is important to focus not only on geographical or geopolitical boundaries, but also on the nature of ties or connections that exist within communities, including network connections among individuals and interorganizational relationships". Establishing guidelines that tackle these issues will help control chaos in the event of a disaster where crisis management must be deployed.

Crisis management implies that communication patterns must be clearly mapped, enabled and coordinated across the multiple boundaries. Turoff et al. (2004), refer to organizational emergencies where implications can have a macro-social effect causing harm to people outside of the organizational jurisdiction or boundary, initiating a concern from local, state and federal agencies. Examples of such emergencies include: Bhopal, Three Mile Island, Tylenol, and Exxon Valdez (Turoff et al., 2004).

Figure 1 is a depiction of the U.S. Public Health Boundaries that show the thread within the communities and the level of coordination and interaction that will take place in the event of a crisis or disaster. This level of interaction requires training and coordination of a large number of players. For example, hospitals in New Jersey have been training their healthcare providers to respond to the threat of terrorism and deal with nuclear, radioactive, biological, explosive or chemical emergencies. On the forefront of this initiative is University Hospital in Newark, NJ, the teaching hospital for the University Of Medicine and Dentistry Of New Jersey (UMDNJ). "In its role as a Level 1 trauma center for northern New Jersey and the largest provider of EMS services in the State, University Hospital has been an active partner with UMDNJ's Center for BioDefense, a regional and national leader in bioterrorism science, preparedness, and response" (University Hospital, 2004).

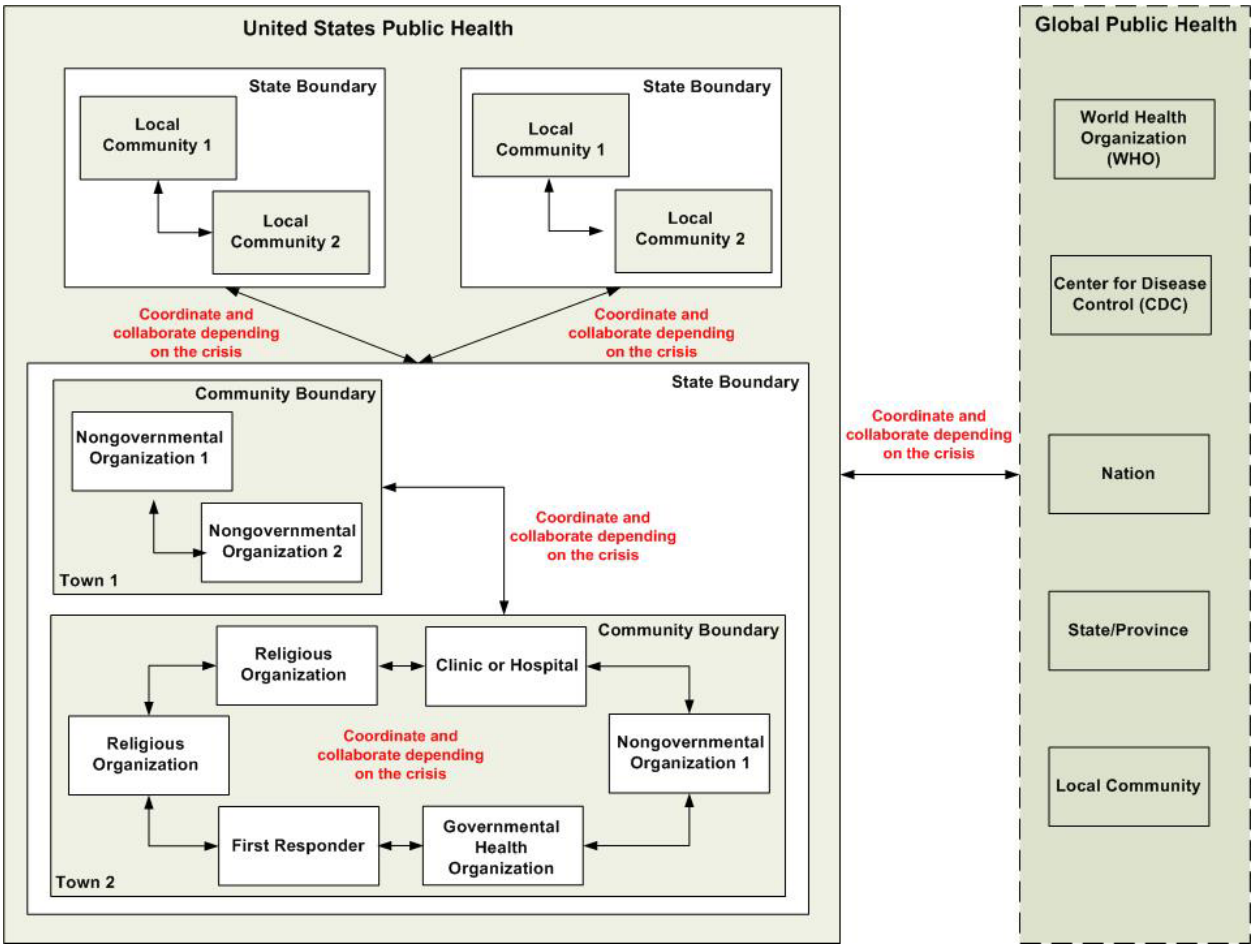

Figure 1. United States Public Health Boundaries

At present, governmental initiatives are focusing more on data management rather than communication management. These actions focus on the development of databases, data warehouses and knowledge management systems, which precede communication management. For example, the Center for Disease Control has developed a data model posted on its website (CDC, 2004). Many state and local public health offices have websites that can push information to individuals, yet the process of how the information is used across the local public health community remains undocumented. The complexities across a community are vast.

EFFECTIVE COMMUNICATION THROUGH ICT TOOLS: MEDIA RICHNESS AND MEDIA-FIT THEORIES

Daft and Lengel's (1986) media richness theory dates back to 1984 and is based on two forces: uncertainty and equivocality. Using rich media for rich information is predicted to resolve ambiguity and equivocality. Face-to-face (FtF) is considered a rich media. However, media of low richness is predicted to be most effective in resolving uncertainty. Text-messaging is considered a low-richness medium, yet one that could play an important role in large scale crisis communication management. Two examples of text-messaging for emergency preparedness alert notifications include: the District of Columbia (2006) and the City of San Francisco (Hicks, 2003).

Te'eni (2001) improves upon existing theories of communication by providing a new model. Effective means of communication are essential when dealing with today's computing technologies due to the vast amounts of information available. Over the past two decades, there has been an enormous shift in the role of task-oriented functions. Today's technologies allow us to measure and increase performance by linking tasks and communication mediums. The means and medium for the communication should be chosen according to goals and situations. Rather than building on either cognitive or affective aspects of communication, the model should capture both aspects, so as to build a more accurate representation of actual behavior.

Media synchronicity theory (MST), details the extent to which a communication environment encourages individuals to work together on the same activity, with the same information, at the same time (Dennis and Valacich, 1998; McGrath, 1991). MST differs from media richness theory by placing emphasis on an outcome-centered approach to media selection. Whereas media richness theory has taken a task-centered perspective on task-media fit, MST proposes that every group communication process is composed of two primary processes, conveyance and convergence that are necessary to reach a group outcome (Dennis and Valacich, 1998). Communication effectiveness will be enhanced when processes are aligned with media that support the communication process (Dennis and Valacich, 1998).

In the case of health emergencies, the task consists on trying to resolve crisis situations with limited information. This introduces a need for a task-technology fit, viewed as an important factor in determining whether the use of technology would result in performance improvements (Lim and Benbasat, 2000; Goodhue and Thompson, 1995; Tan and Benbasat, 1993; Vessey, 1991; Vessey and Galetta, 1991). Having the right technology for a task is essential. The communication medium must be suitable for that objective. We posit that mobile communication tools may support the communication processes and needs of emergency situations, *ceteris paribus* (that is assuming that these tools are connected and accessible during emergencies).

MOBILE COMMUNICATION MEDIA OPTIONS

Mobile devices can play a pivotal role in emergency situations as they can serve three purposes: to be reachable anywhere and at anytime, to obtain information while in an outreach situation; and, to be 'visible' and traceable through a device enabled with GPS positioning capabilities. A mobile device maximizes flexibility, increases timeliness to reach community partners, and increases readiness for a crisis related health alert. Recognizing the limitations of obtaining extensive information across a mobile device, protocols and standards for communicating with an individual who has access to limited display size with a limited connection speed can be created to ease interactions during emergencies. Although data transfer capabilities are increasing through wireless-wide area cellular network third generation channels, the need to shrink data and content of 'what' is communicated is vital for mobile devices in emergency scenarios. In addition to connectivity options on the mobile device, it is important to identify codes and alter messages that may quickly trigger responses, for example through a specific set of pre-loaded icons or tools (such as the already famous 'emoticons' used in chat rooms).

There are a number of mobile devices, connectivity options, and communication needs that may be suitable to manage response in an emergency situation. Each communication medium enables different levels of message richness (through multiple media such as voice, text, graphic and videos) that may in turn offer higher or lower rich capabilities (as presented in Table 1). Some of these communication tools may not be easily managed in an emergency context due to electrical and connectivity requirements (the same being true doe most communication tools). Therefore, while we can plan for their deployment, we always need to consider back up options, such as the possibility to roam on satellite links should the cellular towers become unavailable. For example, Iridium low-orbit satellites (LEO) that offer world-wide coverage when no other landline or wireless service is available, can provide a back up solution for computer, cellular and pager communications through a variety of satellite-compatible devices (USAID, 2006).

USAID, a U.S. foreign assistance program, has as its mission is to prevent suffering, save lives and create a brighter future for families in the developing world (USAID, 2006). The national initiatives extend to special needs, ethnic minorities and women. USAID presents a need in the U.S. for expertise in adapting technologies to meet the special needs of these populations. One focus is to foster ICT access in the underserved populations (i.e. special needs, aging, and minority populations) where task-technology fit disparities exist. Among the needs are: affordable access of ICT's, ensuring equal access for women and girls, and overcoming infrastructure limitations in rural or disadvantages areas.

Table 1. Mobile Media Communication Options

Mobile Tool	Example	Connection Details	Communication Options	Richness	Reach
Pager (text and voice pagers)		*Throughput: 512/1200/2400 bps* *Coverage: varies by area* *Frequency*: VHF (135 – 175MHz, 276 – 284 MHz), UHF (406 – 470MHz), 930MHz (928 – 932 MHz)	Text – one-way Voice pagers (already used in EMS, police, fire departments, hospitals)	Low→ Medium	High - Push-to-all software
Walkie-Talkie (and walkie-watch)	 	*Throughput: up to 1Mbps* *Coverage: up to 1,000 feet* *Frequency*: 49MHz	Voice – one way (half duplex)	Medium (cannot display images)	Medium
Cell Phone (basic)		GSM (2G). Global System for Mobile telecommunications *Throughput: Voice 13Kbps (full voice) and up to 115 Kbps for data rate* *Coverage: 1-5 miles* *Frequency*: 1.8, 1.9 GHz	Text-messaging (SMS)– Voice – Localization (one-way)	High	Pull and push options – high reach through SMS
Smart Phones (multimedia)		GPRS (2.5G) and 3G (Ev-DO and W-CDMA cellular broadband) *Throughput: 384Kbps- 2.4 Mbps* *Coverage: 1-5 miles* *Frequency*: 400, 800, 900, 1700, 1800, 1900, 2100MHz	Text-messaging (SMS)– Voice – Localization (two-way?); email and instant messaging; Internet browsing	High	Pull and push options – high reach through SMS; MMS
PDA Phones (also connected through Wi-Fi cards)		See Smart-Phones and Tablet PCs	Text-messaging – Voice – Localization (two-way?), Map Tools; email and instant messaging; Internet browsing; picture taking; video recording	High	Pull and push options – high reach through SMS; MMS
Tablet PC (connected through Wi-Fi cards)		Connected to WI-FI *Throughput: 11-54Mbps* *Coverage: Up to 300 feet* *Frequency*: 2.4GHz	Text-messaging – Voice – Localization (two-way?), Map Tools, Hand-Writing, Yahoo-Groups, email; instant messaging; Internet browsing.	High	Push-Pull limited to email / Internet connectivity

COMMUNITY-LEVEL IMPLICATIONS: THE NEED FOR ICT DEPLOYMENT

Our U.S. public health system is now forming part of homeland security efforts, yet the personnel differ from first responders-namely firefighters, police and ambulance personnel-who have been trained with communication equipment for decades. The public health domain also posits limited use of information technology in comparison to for-profit industry, civil defense, and other governmental agencies. Numerous initiatives are currently addressing the needs of our nation with respect to homeland security and public health, yet remain in-progress in the nongovernmental (private-non healthcare) sector (CDC 2004, CDC 2005; IOM, 2003: University Hospital 2004; DC, 2006; Hicks 2003; Levy 2006; Reuters, 2005).

The community where the crisis presents itself is by default the first responder, although auxiliary assistance may provide additional expertise where a call for assistance is initiated from the local community. Information technology provides opportunities for individuals within local nongovernmental organizations to collaborate and share resources. Telecommunications and portability enhance this situation by allowing individuals who often have more than one obligation (role, see figure 2) the opportunity to participate remotely. The citizen in a local community can serve multiple roles and need to be empowered with the relevant tools that enable accomplishing the specific role. Having multiple roles in a community provides the individual with additional training and resources that otherwise may not be available.

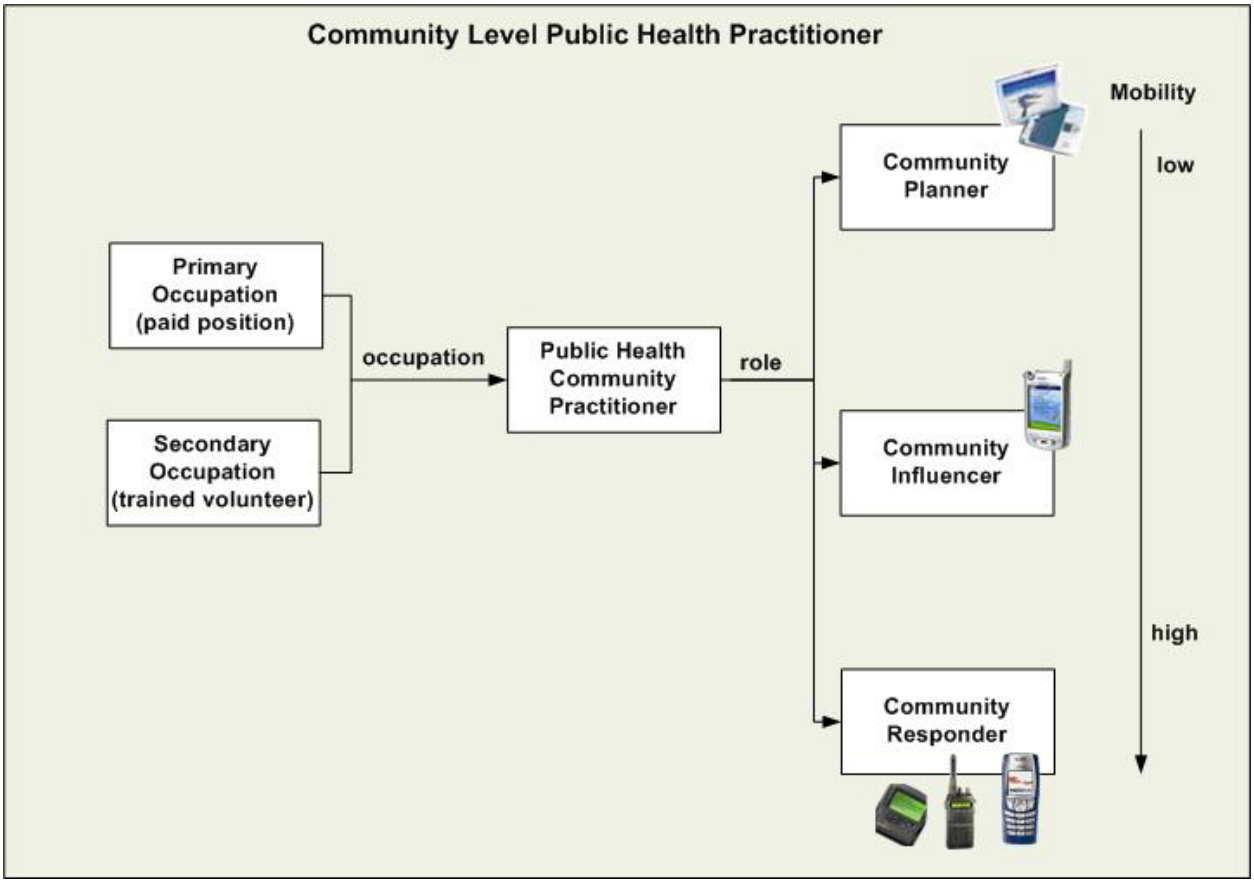

Figure 2. Public Health Community Practitioner Multiple Classifications

Recognizing where technology can improve communication with partners (Haddock and Bullock, 2003); community initiatives are being introduced as recently deployed in the District of Columbia and the City of San Francisco. Many communities are turning to wireless communication and for both public safety agencies and citizens of their communities with the limitations noted as experienced (Haddock and Bullock, 2003) in both the September 11 attack and hurricane Katrina. Clear lines of communication (Haddock and Bullock, 2003; Brown and Swartz, 1989) are but one gap between partnering agencies, practitioners and local community citizens. Brown and Swartz (1989) present the importance of service quality from both the provider and receiver perspective and the gaps that can arise due to inconsistent perceptions. We associate technology-based training as a way to improve service quality between the agencies, first and front-line responders, and the citizens as demonstrated by hurricane Katrina.

The 2005 hurricanes throughout Louisiana and Florida prompted, the District of Columbia (Washington) to dedicate two websites to the community and how they should respond in the event of a manmade or natural disaster. Viewing these catastrophes as lessons learned for the rest of the country, DC has initiated steps for its resident to adhere to as a means of preparedness in the event of an emergency evacuation (DC, 2006). Under the direction of Mayor Williams the DC Office of Emergency Management and the Emergency Information Center has been established which lists services and information, area maps with evacuation routes and agency news affecting the community (DC, 2006). On the emergency information center site community member can participate in "Alert DC" which is a three part notification system that has: text alerts (citizens enroll online, identify their text capable device and access number), voice alerts (citizens are automatically enrolled, information is transmitted about impeding or actual incident which gives proactive instructions to front-line responders for dissemination into the community) and the emergency alert system (local media outlets and radio stations where emergency messages are broadcast). The varying roles of the public health community practitioner (see Figure 2) demonstrate where the mobile devices could vary in relation to what is currently being utilized in DC for their emergency preparedness efforts.

In January 2002, The City of San Francisco began initiatives through wireless communications towards improved public safety (Haddock and Bullock, 2003), such as the becoming the first 9-1-1 center in California to receive wireless 9-1-1 calls placed from cell phones (Hicks, 2003). Google has proposed to the City of San Francisco free city-wide Internet Wi-Fi to test local Internet services (Reuters, 2005). However, Levy (2006) presents needs for underserved communities where affordable computers, appropriate training, and technical support are needed. The need for relevant content for local communities and information related to health care in neighborhoods and for non-English speakers (Levy, 2006). Community services to bridge free Internet access should complement these initiatives.

CONCLUSIONS AND FUTURE RESEARCH

The goal of future research is to identify patterns of communication based on the role of first and front-line responders, and the boundaries/ communities they have to reach, in order to recommend alternative low-cost mobile computer-mediated solutions. The objective is to enhance the efforts currently taking place in the governmental sector of public health and emergency management. Finding the right media fit that supports multiple roles is essential, based on the varied roles of the local public health community practitioners. These tools will complement those currently available or being developed, and will include suggestions on suitable media interfaces that may support and improve emergency response.

The major contributions of this research will be to extend the use of information systems and mobile technology to the local United States public health communities to increase effective communication between organizations while providing a state of readiness for homeland security related events.

In the Institute of Medicine literature (IOM, 2003), the increased need for technology, training, etc. is mentioned as essential. These findings, coupled with the increased need for collaboration toward initiatives such as homeland security and well-being suggest the need for a closer review of the local community, patterns of communication and interaction. Using technology to assist those community organizations with limited resources should empower them to increase effective communication across organizations and when interacting with our citizens.

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