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Noel Johnson
University of Nebraska Medical Center

Ann Fruhling
University of Nebraska Medical Center

Anthony Sambol
University of Nebraska Medical Center

Steven Hinrichs
University of Nebraska Medical Center

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Noel Johnson
University of Nebraska Medical Center
ndjohnso@unmc.edu

Ann Fruhling
University of Nebraska at Omaha
afruhling@mail.unomaha.edu

Anthony Sambol
University of Nebraska Medical Center
asambol@unmc.edu

Steven Hinrichs
University of Nebraska Medical Center
shinrich@unmc.edu

ABSTRACT

The STATPack™ is a health information system designed to support distance consultation, integrate statewide laboratory-based disease surveillance, and to facilitate prompt response to public health threats such as bioterrorism. This paper offers a preliminary evaluation of STATPack and the rationale for developing a survey instrument to measure user acceptance of this telemedicine system. It should be recognized as research in-progress for a new technology as it is being deployed by the Nebraska Public Health Laboratory. Initial experiences with this health information system have been encouraging.

Keywords

Public health, telehealth, surveillance, bioterrorism.

INTRODUCTION

An essential function of Public Health is to monitor the health status of populations for the purpose of identifying and solving community health needs (Baker, Melton, Strange, Fields, Koplan, Guerra and Satcher, 1994). In recent years, concerns about bioterrorism and emerging infectious deseases such as West Nile virus, SARS and now, avian influenza A/(H5N1), have accelerated the efforts of state public health laboratories to establish better communication networks with private clinical and hospital laboratories. The Centers for Disease Control and Prevention (CDC) maintain a list of nationally notifiable infectious diseases and have identified key biologic agents which have potential to be used for bioterrorism (CDC, 2006; Rotz, Khan, Lillibridge, Ostroff, and Hughes, 2005). Because the majority of infectious disease testing in the U.S. is done in private hospital and clinical laboratories, better integration with state public health laboratories is expected to improve both the timeliness and validity of disease reporting. During a health-related event, timely interpretation and dissemination of information are essential to reducing morbidity and mortality.

The STATPack™ (**S**ecure **T**elecommunications **A**pplication **T**erminal **P**ackage) is a telehealth consultation and emergency response system. Although several information systems for healthcare initiatives have been created at the national level, most states in the U.S. do not have the capability to share critical public health microbiology laboratory information in real time and at the local levels, especially in rural communities where laboratorians serve as the front line of disease recognition. The STATPack system was created to address the needs of a state public health laboratory for electronic diagnostics consultation, critical information sharing, and alert notification, in the case of a bioterrorism event or other public health emergency (Fruhling, Sambol, Hinrichs, and Vreede, 2006).

As with most telehealth technologies however, there is a lack of objective evidence to support the intuitive appeal of STATPack. In addition, despite increased investment in public health preparedness and bioterrorism response nationwide, a review of current literature suggests there is no consensus about how "preparedness" should be measured. Furthermore, outcomes in the area of preparedness are difficult to quantify because public health emergencies are rare and the averted morbidity and mortality difficult to ascertain. (Asch, Stoto, Mendex, Valdez, Gallagher, Halverson, and Lurie, 2005). This paper offers a current assessment of STATPack and the rationale for developing a survey instrument to measure user acceptance of this telehealth system.

METHODS

The microbiology laboratories currently using STATPack are still asked to submit their "suspect" culture samples to the NPHL for confirmatory testing in the same manner as the other laboratories. The perceived benefits of this system are that it will facilitate earlier detection and reporting of diseases which may be of public health significance. Laboratories equipped with STATPack are also able to receive alert notifications from the NPHL complete with digital images of pathogens which have been discovered by other laboratories in the network.

This evaluation relies primarily on literature review and subjective feedback from current system users. In addition, STATPack usage history has been reviewed to assess the system's performance during electronic consultations between client laboratories and the NPHL. More recently, STATPack was tested by the NPHL as part of a statewide bioterrorism exercise and the results are presented here. A survey instrument has been developed and administered to current system users to assess their acceptance of this technology (see appendix).

BACKGROUND

The Nebraska Public Health Laboratory is located in Omaha, Nebraska. There are several hospital systems in Nebraska with 6 larger hospital laboratories that serve as in-state regional reference laboratories for approximately 80 smaller physician/pathologist-based office laboratories.

The initial impetus behind the development of STATPack emerged from the anthrax bioterrorism events of 2001. Laboratory cultures of micro-organisms such as *Bacillus anthracis,*, which are reportable because of their public health significance, are generally submitted to state public health laboratories for confirmation and archiving. But sending a suspect microbiologic sample to the NPHL from remote areas of the state in a timely manner can be problemmatic, particularly during a typical Midwest winter. Officials from the NPHL felt that a presumptive laboratory diagnosis *of B. anthracis* could be rendered more efficiently from a digital image received electronically. Emergency response time for public health authorities in this type of scenario would be greatly improved.

SYSTEM DESCRIPTION

The STATPack application is a secure, Health Information Privacy and Accountability Act (HIPAA) compliant, web-based network system that connects the state's geographically dispersed microbiology laboratories to the NPHL. Equipment for STATPack consists of a dedicated computer (CL-10000 mini processor) with internet connectivity, a flat screen/ speaker unit, a mini-keyboard, a high-resolution digital camera, a bio-safe plexi-glass specimen container, and a microscope interface kit attached to a microscope (Fruhling and Vreede, 2006). The digital camera captures macroscopic images of culture plates and the microscopic interface kit works with the microscope to capture microscopic images. The images, along with text messages, can be sent to the NPHL with routine, urgent, or emergency notification. A corresponding pager alert system notifies contacts immediately if a suspicious organism is found. The NPHL can also use STATPack to alert laboratories throughout the state when a microbiologic "agent of concern" has been detected.

STATPACK IMPLEMENTATION

Currently, 13 clinical diagnostic laboratories are equipped with STATPack. In addition, the system is now operational in 3 non-clinical labs; the Nebraska Department of Agriculture (NDA) food testing laboratory, the Nebraska Health and Human Services System (NHHSS) water and environmental testing laboratory, and the University of Nebraska–Lincoln (UNL) Veterinary Diagnostic Center. According to the Assistant Director of the NPHL, connection with these non-clinical laboratories "is just another aspect of preparedness. You don't know if (an infectious or toxic agent) is going to be in the water, food, or livestock" (APHL, 2005).

SYSTEM REFINEMENTS

This application was a conceptual idea of one of the key stakeholders. It was expected to be a new and innovative laboratory emergency response system; no similar systems existed to evaluate or re-engineer. The system development team had to deal with changing software and technical requirements. For example, after the initial deployment of several STATPack systems to client laboratories, the NPHL users requested that they be able to "pan" the client cameras and control zoom functions remotely (Fruhling and Vreede, 2006).

Until recently, images captured by STATPack clients could, by design, only be sent to the NPHL. This design feature was intended to restrict private laboratories from using the images for anything other than public health purposes, and to preserve

the security of the system..The NPHL decided to change its policy in response to multiple requests from laboratorians to use these images for a variety of reasons. Now, the STATPack system allows laboratorians to save images, send them in a secured fashion to a pre-determined email adress, and distribute them further as needed.

RESULTS

The NPHL participated in a statewide bioterrorism exercise called TEREX 2005. This exercise involved several agencies and it was hoped that STATPack responses could be compared to those received through the Health Alert Network (HAN). The HAN component consisted of a "blast fax" notification which was to be sent to all 86 laboratories with a request for acknowledgement from the recipient laboratory. Unfortunately, the HAN encountered server problems on the day of the exercise and the blast fax data could not be interpreted.

The STATPack component of TEREX 2005 consisted of an emergency notification sent to nine hospital facilities. Emergency notification produces an audible alarm at each STATPack terminal. The message was successfully sent from the NPHL and received by all nine participating laboratories. All laboratories responded to the message within 15 minutes however, two of the labs were unable to reply through STATPack. Developers have addressed these two response failures by adding a simplified "Reply" button and making an enhancement which allows multiple log-ins at each laboratory. This enables the NPHL consultant to guide STATPack clients through the log-in process over the phone if they have forgotten or misplaced their passwords.

Since its introduction, there have been ten documented cases where referring laboratories have successfully used STATPack to consult with the NPHL about suspicious biological agents. In each of these cases, clients were able to capture and send images, send text messages, and receive guidance from experts at the NPHL about further testing or sample submission. The microorganisms most frequently encountered have been *Francisella tularensis* (tularemia) and *Bacillus* spp (anthrax suspects).

DISCUSSION

A review of current literature suggests that this telehealth system falls under the subcategory of "telepathology". While the feasibility of telepathology has long been proven, there is still a lack of validated or well-demonstrated approaches for evaluating telehealth systems (Bashshur, Shannon and Hasan, 2005; Currell, Urquhart, Wainwright, and Lewis, 2000; Lewin Group, 2000). A literature review conducted by Currell et al. (2000) also added that policy makers should be cautious about recommending increased use and investment in unevaluated technologies. A 2002 editorial in the *Journal of the American Medical Informatics Association* lamented that "the literature does not contain an adequate evaluation of telemedicine despite years of application of the technology and several calls to action" (Stead, Hersh, Patterson, and Kraemer, 2002).

At this stage of implementation, the NPHL has not discouraged the ocassional use of STATPack for consultation on routine cases. The prevailing wisdom has been that STATPack clients need to "put their hands" on the system from time to time to maintain proficiency. The stakeholders recognize that a system which is not used on a regular basis before an emergency will never be of use in an actual emergency (Turoff, Chumer, Van de Walle, and Yao, 2004). There do not appear to be any problems with clients abusing the consultation service but, as more systems are installed, NPHL acknowledges that it may need to develop stricter policies.

A hoped-for by-product of any laboratory integration project is greater referral of abnormal test results to the state public health laboratory so that emerging public health threats are identified quickly (APHL, 2005). It's too early to tell whether the deployment of STATPack has increased the number of reportable cases referred to the NPHL.

MEASURING USER ACCEPTANCE

User acceptance of STATPack is recognized as being critical to the overall success of the system. Developers have endeavored to make the system simple to operate while minimizing the "footprint" of the equipment. Informal discussions with current STATPack users have been encouraging. For example, most laboratorians have expressed confidence in their ability to get an immediate response from the NPHL using the STATPack in an emergency situation. Others have commented that although the STATPack system is not used very often, it was "reassuring" to have an instant link to the NPHL. Although STATPack is generally regarded as "easy to learn", several laboratorians have expressed uncertainty in their ability to capture and send images from the microscope interface.

A survey questionnaire has been developed to measure user attitudes about perceived usefulness and ease of use. It is also intended to assess whether these perceptions might be influenced by factors such as the user's geographic distance from the

NPHL, computer experience level, and overall capacity of the client laboratory. In the end, we may learn that perceived usefulness of STATPack correlates most closely with user attitudes toward bioterrorism preparedness in general.

CONCLUSION

Threats of bioterrorism and high-profile disease outbreaks have accelerated the efforts of public health laboratories to establish better communication networks with private clinical laboratories. The STATPack system is designed to support distance consultation, integrate statewide laboratory-based disease surveillance, and facilitate prompt response to public health threats such as bioterrorism. Because this health information system is still a work in progress, definitive evaluation is not yet possible, but the intuitive appeal of STATPack is supported by preliminary experiences in Nebraska.

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APPENDIX

For each of the following questions, please circle the response which best describes your opinion.

1 strongly agree	2 agree	3 neutral	4 disagree	5 strongly disagree

I received adequate training to use the STATPack system.	1 2 3 4 5
It was easy to learn to use the STATPack system.	1 2 3 4 5
It takes too long to learn how to use the system to make it worth the effort.	1 2 3 4 5
In an emergency, I could effectively complete the tasks required to consult with the Nebraska Public Health Laboratory (NPHL) using STATPack	1 2 3 4 5
I feel confident that I would get a quick response from NPHL using the STATPack in an emergency.	1 2 3 4 5
The STATPack is a useful tool for emergency response to acts of bioterrorism or naturally occurring disease outbreaks in Nebraska.	1 2 3 4 5
I believe it's important to be prepared for health related emergencies such as acts of bioterrorism or naturally occurring disease outbreaks.	1 2 3 4 5
The threats of bioterrorism and natural disease outbreaks have been greatly exaggerated. These are unlikely to occur in Nebraska.	1 2 3 4 5
The STATPack takes up too much space in my work area.	1 2 3 4 5
I feel comfortable using the system to capture and send (macro) images of colony growth.	1 2 3 4 5
I feel comfortable using the system to capture and send images from the microscope. (please circle N/A if your STATPack is not equipped with a microscope interface)	1 2 3 4 5 N/A
I feel that the STATPack is a useful system to have in my laboratory.	1 2 3 4 5
Overall, I am satisfied with how easy it is to use the system.	1 2 3 4 5
This system has all the functions and capabilities I expect it to have.	1 2 3 4 5
I like using the STATPack.	1 2 3 4 5