Public Health Informatics at APL: Guest Editor's Introduction

Joseph S. Lombardo

*P*ublic health agencies are increasingly asked to provide new services to their communities with limited resources. With the rapid spread of highly communicable diseases, public health officials are faced with the challenge of knowing the health status of their jurisdictions, as well as having worldwide knowledge of diseases that quickly could be present in their communities. Informatics is playing an increasing role in providing health agencies with the tools needed to meet these challenges. This issue of the Johns Hopkins APL Technical Digest highlights recent investigations conducted within the Center of Excellence in Public Health Informatics located at APL.

The health of the people is really the foundation upon which all their happiness and all their powers as a state depend.

Benjamin Disraeli (1877)[1]

INTRODUCTION

Work at APL in public health informatics began in 1998 with independent research and development funding and collaborations with the Maryland Emergency Management Agency and the Maryland Department of Health and Mental Hygiene. The leadership at both of these agencies recognized the possible consequences of a clandestine terrorist attack focused on the health of the citizens in Maryland and the need to find solutions to identify and mitigate the risk of such an attack. These concerns were brought to fruition during the transmission of the weapons-grade form of the bacterium *Bacillus anthracis* through the U.S. Postal Service.

HISTORICAL PERSPECTIVE

During the past decade, media coverage of naturally occurring diseases—such as the severe acute respiratory syndrome (SARS), West Nile virus, noroviruses, the retrovirus known as human immunodeficiency virus (HIV), and virulent strains of influenza—have highlighted the limitations of medicine and outdated public health practices. The Spanish influenza of 1918 killed between 20 and 40 million individuals with the exact numbers unknown because of inadequate reporting.[2] In the United States alone, the outbreak claimed 675,000 lives. In the 90 years since that outbreak, modern transportation and population mobility have compounded the

exposure component of disease transmission, making early identification, containment, and follow-up more critical to this public health mission.

PUBLIC HEALTH INFORMATICS: A NATIONAL INITIATIVE

The National Centers for Disease Control and Prevention (CDC) is the federal agency responsible for supporting state and local governments in performing surveillance and containment of major public health risks. The CDC's newly formed National Center for Public Health Informatics (NCPHI) sponsors public health informatics research within five academic Centers of Excellence. APL is fortunate to be counted within this group. The first seven articles in this issue of the *Johns Hopkins APL Technical Digest* report on research that the JHU/APL Center of Excellence has performed or is performing in support of NCPHI. The leadoff article by Lombardo provides an overview of the five NCPHI Centers of Excellence and the current public health informatics research at APL. The second article, by Burkom et al., highlights the series of tradeoffs required in making decisions regarding research directions for the automation of biosurveillance. Public health policy and practice often limit the practicality of many technologies; thus, researchers need to consider these constraints when investigating technologies intended to be of practical value for identifying urgent health risks.

The next two articles, by Burkom et al. and Mnatsakanyan and Lombardo, address analytical techniques for the early identification of disease outbreaks. Burkom et al. address improvements to traditional statistical and signal-processing detection techniques, and Mnatsakanyan and Lombardo describe a method of automating the probabilistic reasoning used by many epidemiologists. The next two articles, by Loschen and Sniegoski and colleagues, address methods for sharing information regarding the health of groups of individuals rather than details of an individual patient. Loschen focuses on the level of information that needs to be shared among public health

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Emerging infectious diseases present one of the most significant health and security challenges facing the global community.

Vice President Albert Gore (1996)[3]

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agencies, and Sniegoski and colleagues describe an initial experiment in information sharing among health departments during Super Bowl XLI in 2007.

An important ingredient in the development and evaluation of new informatics tools is having a wealth of data containing the health risk of concern. The article by Lombardo and Moniz addresses ongoing research into the creation of synthetic electronic medical records for the development and evaluation of disease surveillance systems and their components. The article discusses the creation of synthetic medical records by using realistic but not real data to identify treatment protocols within health care institutions. Those protocols then are used to create synthetic data based on requests for services from encounters with individuals who are a part of the outbreak scenario.

GLOBAL SURVEILLANCE FOR EMERGING INFECTIOUS DISEASES

The U.S. Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) has partnered with APL in the development of its surveillance applications for the military. Under a 1996 Presidential Decision Directive,[4] the DoD was given responsibility for global surveillance of emerging infectious diseases. The articles by Lewis and Chretien and Feighner et al. address two different aspects of the DoD-GEIS program. Lewis and Chretien discuss the role of the DoD-GEIS in supporting local health ministries in resource-limited third-world countries toward developing a capacity to perform automated disease surveillance. Feighner et al. address the implementation of a disease-transmission model for military installations that can be used to recommend actions designed to limit disease transmission during an outbreak.

LOCAL HEALTH DEPARTMENTS' CRITICAL ROLE

APL has played an important role in enhancing surveillance for health risks in the National Capital Region with the formation of a surveillance network among health departments in Maryland, the District of Columbia, and Virginia. This work has been supported by the Department of Homeland Security's Urban Area Security Initiative. Holtry describes a method for evaluating new surveillance functionality through joint exercises supported by health departments in the National Capital Region. State and local health departments are ultimately responsible for the health of the populations within their jurisdictions. The next article, by Babin et al., demonstrates the value of using surveillance data for addressing other community health issues, specifically diseases, such as asthma, that are aggravated by poor air quality. This work was performed under the sponsorship of the District of Columbia Department of Health. The final article in this issue, by Babin et al., describes an important initiative within the U.S. Environmental Protection Agency to perform surveillance of drinking water and correlate it to degraded health within two communities. This program fuses health data with water quality measurements to identify emerging health risks.

Our hope is that the compilation of articles in this issue demonstrates the various challenges facing the public health community with just a glimpse at the potential solutions being addressed by APL through its Center of Excellence in Public Health Informatics.

REFERENCES AND NOTES

[1]Disraeli, B. (British Prime Minister and First Earl of Beaconsfield), from a speech on 24 June 1877, reprinted in: Gould, E. R. L., "Some Results of Sanitary Reform," Chap. 4, in *The Housing of the Working People*, United States Bureau of Labor, Government Printing Office, Washington, DC, p. 71 (1895).

[2]Taubenberger, J. K., and Morens, D. M., "1918 Influenza: The Mother of All Pandemics," *Emerg. Infect. Dis.* **12**(1), 15–22 (2006).

[3]Gore, A. (Vice President), remarks made at the annual meeting of the National Council for International Health, Crystal City, VA (12 June 1996).

[4]National Science and Technology Council (NSTC), Executive Office of the President, *Presidential Decision Directive NSTC-7: Emerging Infections*, NSTC, Washington, DC (1996).

The Author

Joseph S. Lombardo has been employed by APL for the past 38 years performing research on various forms of surveillance, particularly sensors, signal coherence, background noise analysis, and data presentation. For the past 10 years, he has focused on developing and improving automated tools to enhance disease surveillance. He has led the development of the ESSENCE disease surveillance system, which is currently being used widely by the Department of Defense, the Department of Veterans Affairs, and several state and local health departments. Mr. Lombardo has degrees in engineering from the University of Illinois at Urbana–Champaign and from The Johns Hopkins University. He was the William S. Parsons Informatics Fellow with The Johns Hopkins University School of Medicine. His e-mail address is joe.lombardo@jhuapl.edu.

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