

WORKING P A P E R

Improving Global Influenza Surveillance

Strategies for the U.S. Government

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SUMMARY

Between December 2003 and November 2006, ten countries reported 258 confirmed human cases of illness caused by H5N1, a new strain of avian influenza. These H5N1 cases represent a clear warning that the world could face another human influenza pandemic if this virus—or another strain yet to emerge—mutates enough to pass easily from human to human. The stakes are high should an influenza pandemic materialize: In the United States alone, from 15 to 35 percent of the population could be affected, at an estimated cost of \$71 to \$167 billion.

The emergence of the H5N1 virus has led governments and international organizations to accelerate and intensify efforts to strengthen their public health systems to prepare for a possible human influenza pandemic. In May 2006, the U.S. government issued its comprehensive government-wide plan to prepare for the next influenza pandemic. This document, the *National Strategy for Pandemic Influenza Implementation Plan*, lays out responsibilities for federal agency actions in the United States and internationally. The *Implementation Plan* directs attention to the importance of international surveillance activities. To help address an important area of responsibility under the *Implementation Plan*, the Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR) asked the RAND Corporation to examine ways that HHS might strengthen its global influenza surveillance efforts. The RAND study team identified strategies for improving global influenza surveillance and suggested practical steps that HHS might consider for implementing them. The team also developed a prototype interactive tool that agencies can use to compare the relative merits of different strategies and thus potentially focus their program efforts.

THE RAND STUDY

Key to pandemic preparedness is the early detection of novel influenza viruses with pandemic potential, especially those that are transmitted from person to person. Such detection depends on effective public health surveillance, including laboratory diagnosis. The earlier a novel virus strain against which humans have no natural immunity can be detected, the better the chances are that actions can be taken to limit the spread of the disease. Although disease surveillance is the responsibility of individual nations, the World Health Organization (WHO) is responsible for coordinating public health surveillance on a global level. Through its Member State status in the United Nations, and hence in WHO, the United States is part of this effort. HHS, mostly through the Centers for Disease Control and Prevention (CDC), has a lead role for human influenza surveillance, both domestically and as part of the global system coordinated by WHO.

From October 2005 through November 2006, a multi-disciplinary RAND team conducted a systematic examination of how to detect early cases of novel influenza illness. The overall aim of the study was to provide results that could be used to guide HHS policy and resource allocation to improve global influenza surveillance.

This study sought answers to four main policy questions:

- 1) *What strategies can HHS employ to improve global influenza surveillance, and how can these be implemented?*
- 2) *How can HHS quantitatively compare different strategies in order to select promising ones?*
- 3) *How can HHS identify strategic partners to extend global influenza surveillance?*
- 4) *How can HHS monitor its partnerships over time?*

In seeking answers to these questions, the RAND team examined surveillance in a much broader and more systematic way than has been done before, with particular interest in identifying new strategies unconstrained by traditional public health approaches. The orientation of this study is consistent with the CDC's new framework for evaluating surveillance systems aimed at early outbreak detection, although this framework is not specifically aimed at influenza surveillance.

Conceptual Framework

Based on a review of the published literature related to public health surveillance systems and the *Implementation Plan*, as well as an iterative brainstorming process by the RAND study team to identify and then organize all important elements into a single logical structure, the team developed a conceptual framework suggesting a range of strategies and approaches to implementing them. The RAND team first synthesized surveillance system criteria recommended by CDC into four requirements, around which it could then identify specific surveillance improvement strategies:

- **Comprehensive surveillance coverage:** This encompasses a broad range of sources and signals for surveillance information.
- **High quality surveillance:** This requires accurate information based on standards, trained personnel, and quality-assured laboratory testing.
- **Timeliness:** This includes rapid data flow, analysis, and dissemination to trigger a timely investigation and response to limit or delay disease spread.
- **Transparency:** This necessitates open reporting and sharing of animal and human virus samples and virus genome information for purposes of global tracking and vaccine development.

Around these four requirements, the RAND team identified 16 strategies to improve surveillance: five strategies aimed at improving coverage; four strategies aimed at quality; six strategies aimed at timeliness; and a final strategy aimed at transparency. These strategies range from using new sources of disease information (e.g., the community, the electronic media, non-governmental organizations) to seeking new surveillance signals (e.g., disease events among persons who do not or cannot seek clinical services).

The RAND team then identified two major approaches to implementation: (1) direct actions that HHS can take itself and (2) leveraging strategic partners. The final conceptual framework ties together the improvement strategies and the approaches to their implementation by suggesting specific strategies that could be put into practice by HHS and by various illustrative partners (see Table S.1).

Process Model and Interactive Tool to Help Identify Promising Strategies

The RAND team sought a way to show how surveillance improvement strategies from the conceptual framework can be evaluated for effectiveness and how this evaluation could be used for planning purposes. In doing so, the team identified nine paths that can lead to case detection, and used them to build a process model that traces the steps involved in going from a sick individual to laboratory confirmation of a novel influenza strain. In each path, information is passed from step to step covering actions by the sick individual, reports, investigations, and tests. These steps are complex with many uncertainties, all of which can block or slow the ultimate confirmation of a novel strain of influenza virus. In the process model, each step is described in terms of probabilities and delays. Probabilities reflect that each step in the model is a possible point of failure where the flow of information regarding a sick patient may terminate: a report is not filed, an investigation is not conducted, or a viral sample is not sent for further testing. Delays are associated with the time until a step occurs (e.g., a report may only be filed once a week) or the time needed to perform a task.

Starting with the process model and incorporating 12 of the 16 strategies for improving surveillance (those that directly influence the probabilities and/or delays associated with capturing and passing along information within a country), the RAND team developed an interactive tool that allows users to evaluate the effects of different strategies or combinations of strategies on improving influenza surveillance in terms of probability and timeliness of case detection. The goal of the process model and interactive tool is to help find ways to improve the chances that a case of disease caused by a novel influenza strain will be detected and ultimately confirmed by a reference laboratory, and to reduce the time it takes to do so. HHS can use this tool to select promising strategies and thus target its resources efficiently.

Strategic Partnerships to Extend Global Influenza Surveillance

The RAND study identified the formation of strategic partnerships—with other U.S. government agencies, international organizations, foreign laboratory networks, foreign development agencies, and a range of nongovernmental organizations—as a key approach to improving global surveillance. Through strategic partnerships, HHS can extend its reach, potentially at little or no additional cost, and thus optimally direct its own resources while leveraging partners to help produce even greater improvements in surveillance globally.

The team analyzed the presence of a number of government agencies and nongovernmental organizations in more than 200 countries around the world, identifying agencies and organizations whose mandates, expertise, and mutual interests might lend themselves to potential partnership with HHS and/or other U.S. government agencies. These analyses included examples of practical applications of the information to identify potential partners to help address specific aspects of influenza surveillance in specific countries.

The team then suggested a possible approach to measuring relationships across a network of surveillance partners through an analytical approach called network analysis. The fundamental property of network analysis is the ability to measure the degree of interaction among organizations. As potentially applied to global influenza surveillance, this approach could quantify interactions among specific organizations related to coverage, quality, timeliness and transparency. Monitoring these over time helps identify both progress that has been made and gaps that should be addressed. Quantitative assessment of partnerships is a dimension that is not captured in traditional public health program monitoring and evaluation, but it is beginning to gain recognition in the public health community.

RECOMMENDATIONS

The RAND study led to the following recommendations for improving global influenza surveillance:

1. Consider the different strategies proposed in terms of anticipated improvements in the probability and timeliness of case detection. The interactive tool developed by RAND may be one way to assess the relative merits of different strategies and select promising ones.
2. Pursue strategic partnerships that will complement HHS' own technical expertise and extend its reach within and across countries worldwide to improve influenza surveillance.
3. Plan to measure over time the strength of surveillance partnerships with an appropriate assessment method, such as network analysis.