THE CENTER FOR FOODBORNE ILLNESS RESEARCH & PREVENTION

Tracking Microbes: Defining The Horizon For Molecular Surveillance Of Foodborne Disease

EXECUTIVE SUMMARY

Foodborne illness sickens an estimated 48 million Americans each year.[1] Yet, many of those sickened never seek medical attention, and very few cases – just the tip of the iceberg – get reported to the public health system. Identifying foodborne illness cases allows public health officials to detect outbreaks, pinpoint contaminated food, and get it off the market to limit the number of people sickened. In addition, the ongoing monitoring of foodborne illnesses by federal, state, local, territorial and tribal governments is the primary tool used to identify outbreaks of foodborne illness and otherwise unrecognized problems with food production and distribution. Investments in foodborne disease surveillance over the past 15 years transformed public health and improved our ability to detect foodborne illness.

Recent advances in science and technology once again hold new promise for revolutionizing foodborne illness surveillance. The use of faster diagnostic tests, using fewer resources, providing rapid "yes-or-no" results, and enabling doctors to treat patients more quickly and accurately, is increasing. However, these new tests do not involve growing the organism that is causing the illness ("culture") and do not result in a pure sample of the bacteria ("isolate"). They are, in fact, culture-independent and therefore, do not generate the type of information our current surveillance system often relies on to detect many outbreaks of foodborne diseases.

Without new investments to modernize our surveillance infrastructure, these culture-independent diagnostic tests, or CIDTs, could pose a significant threat to the detection of foodborne diseases and, consequently, to public health.

FINDINGS

(1) Widespread CIDT use may make detecting and investigating outbreaks more difficult.

(2) Changing diagnostic practices could hinder the ability of public health officials to track trends in incidence of foodborne illness and to monitor antibiotic resistance over time.

(3) CIDTs could make the regulatory oversight of food safety more difficult.

(4) With investments in technology and surveillance infrastructure, CIDTs offer an opportunity to increase the detection of foodborne illness in the long run.

(5) Policy makers must develop short- and long-term strategies to prevent disruption to our foodborne illness surveillance network during the transition to CIDTs.

RECOMMENDATIONS

A sudden shift to CIDTs without an appropriate public health response could have a cascading effect with significant consequences that take our surveillance system back decades. At the same time, CIDTs offer a new opportunity to revolutionize food safety surveillance – if the transition is managed properly. There are some immediate needs that, if addressed, could provide a significant first step forward in preserving, and ultimately enhancing, our food safety surveillance system. Specifically, the government should:

(1) Provide resources to public health laboratories to isolate pathogens from patient specimens.

(2) Expand state and local capacity for foodborne illness response.

(3) Invest in infrastructure and research to modernize our foodborne illness surveillance system.

How does PulseNet work?

Source: Centers for Disease Control and Prevention (CDC), "PulseNet, Frequently asked questions," accessed Sep. 18, 2014, http://www.cdc.gov/pulsenet/about/faq.html#future and CDC, "Fast facts about PulseNet," accessed September 18, 2014, http://www.cdc.gov/pulsenet/about/fast-facts.html.

Sample Collection	When someone becomes sick and seeks medical help, a clinical specimen - usually a stool sample - is collected and sent to a laboratory.
Culture	Living cells are grown (or cultured) using special pathogen-specific enrichments that promote growth. This process usually takes 24-72 hours.
Isolate Bacteria	If the pathogen grows, the particular species or strain is separated (or isolated) from all other bacteria.
Notify Public Health	Depending on state laws, public health officials as well as CDC, are notified of positive test results. Often the clinical laboratory is asked to send the isolate to a public health laboratory for DNA fingerprinting.
Molecular Characterization	The isolates are used to identify the distinct variation of bacteria (known as serotype) as well as the bacteria's ability to cause disease and be treated with antibiotics. DNA fingerprints are also found at this time.
Submit to PulseNet	DNA fingerprints are submitted to CDC and entered into PulseNet. Regulatory agencies also collect DNA fingerprints from animal, food, and environmental sources for uploading into PulseNet.
Outbreak Detection	Specialized software is used to compare patterns, identify disease clusters, and link cases from across the country. The emergence of a new pattern or a larger than expected number of matches might suggest a potential outbreak.
Outbreak Investigation	If an outbreak is suspected, local, state, or CDC epidemiologists are notified, and an investigation may be launched. Identifying the specific food that caused the outbreak and tracing it to its source can take weeks or months.
Improved Food Safety	Outbreak investigations have led to changes in regulatory oversight/focus and have driven industry-wide changes in food production and processing as well as food safety prevention strategies.

For years, culturing stool samples from patients in clinical laboratories has been the accepted best practice for detecting foodborne pathogens. Much of what we know about foodborne illness has come from the study of patients whose diagnoses have been confirmed using these cultures. While reliable and accurate, this method is time and resource intensive. CIDTs, on the other hand, offer a faster and potentially cheaper alternative that should result in more cases of foodborne illness being diagnosed. Unfortunately, they lack information on serotype, subtype, molecular and antimicrobial susceptibility that is used by our current foodborne disease surveillance system, making it more difficult to identify outbreaks, evaluate trends, and facilitate regulatory oversight of food safety.

A critical piece of our current foodborne illness surveillance system – culture based testing – is in jeopardy. Long-term, we need to develop a new system for tracking microbes that takes advantage of modern molecular methods and is compatible with clinical diagnostics (e.g., is culture-independent), while at the same time utilizing the volumes of information collected through 16 years of PulseNet.

Short-term, the ability to culture foodborne pathogens needs to be maintained and isolates need to be preserved. Simultaneously enhancing other aspects of surveillance, such as improving our ability to identify how people contract foodborne illness (also known as exposure assessment), could offset some of the negative effects of CIDTs by improving our ability to identify potential exposures and link cases at a state and local level.

Dr. Barbara Kowlacyk, author of this report, co-founded CFI with Patricia Buck, and serves as a CFI Board Director.

The full report is available at:
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