

Figure 1: Detail View Single Hospital

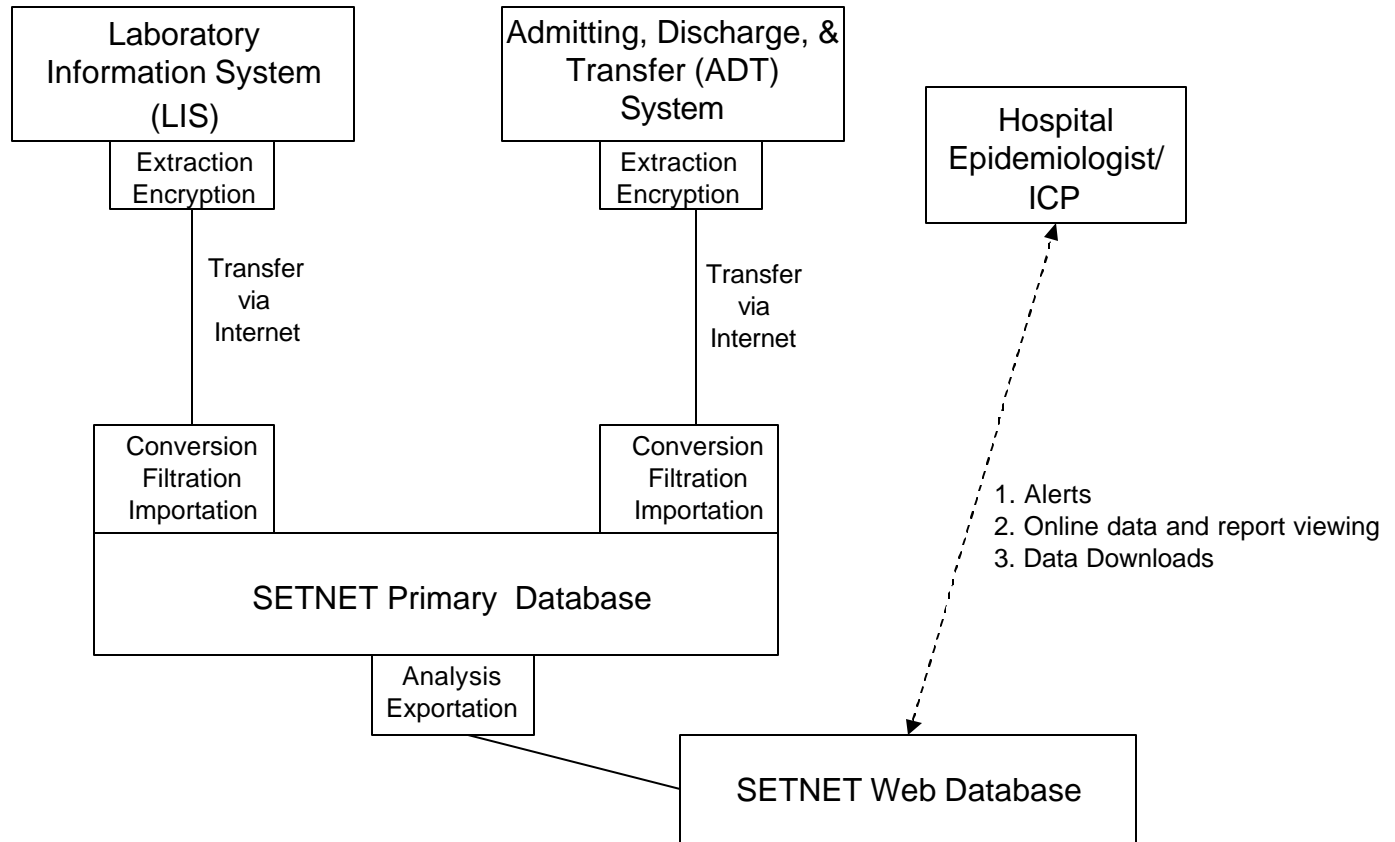


Figure 2 - Emergency Dept (ED) Visits by Date

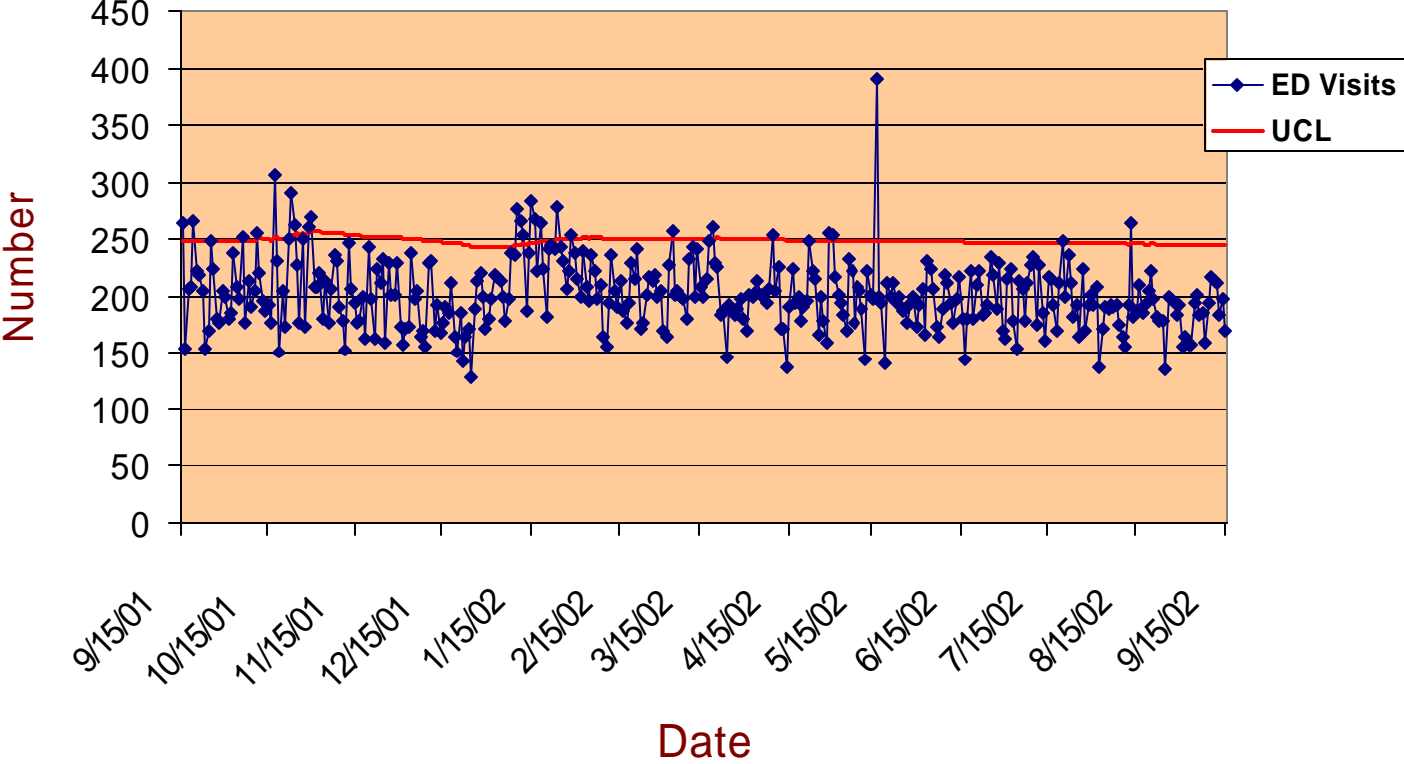


Figure 3 - ED visits with Blood Cultures by Date

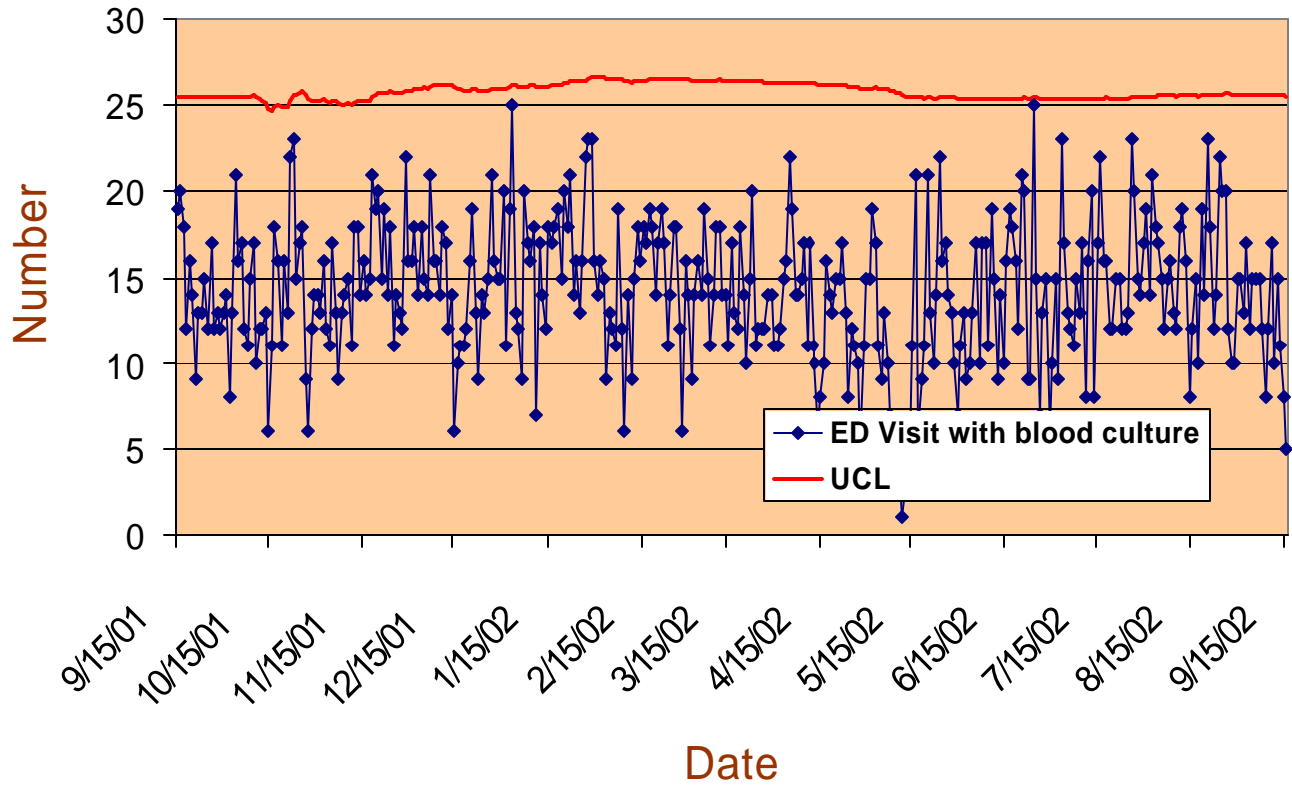


Figure 4 - ED Visits with Respiratory Tests, and Influenza Virus Positive Tests, by Date

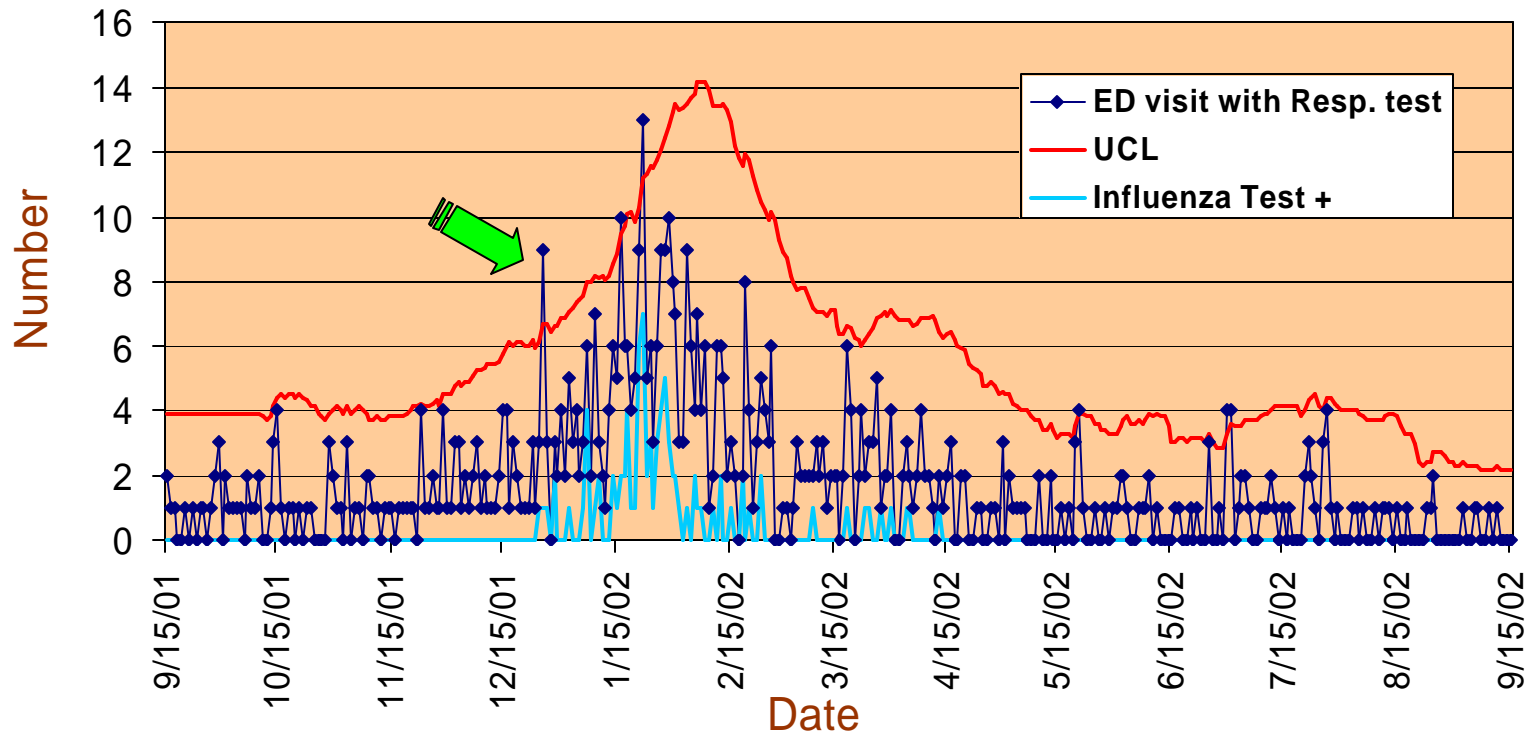


Figure 5 - ED Visits with Stool Culture, and Positive Shigella Results, by Date

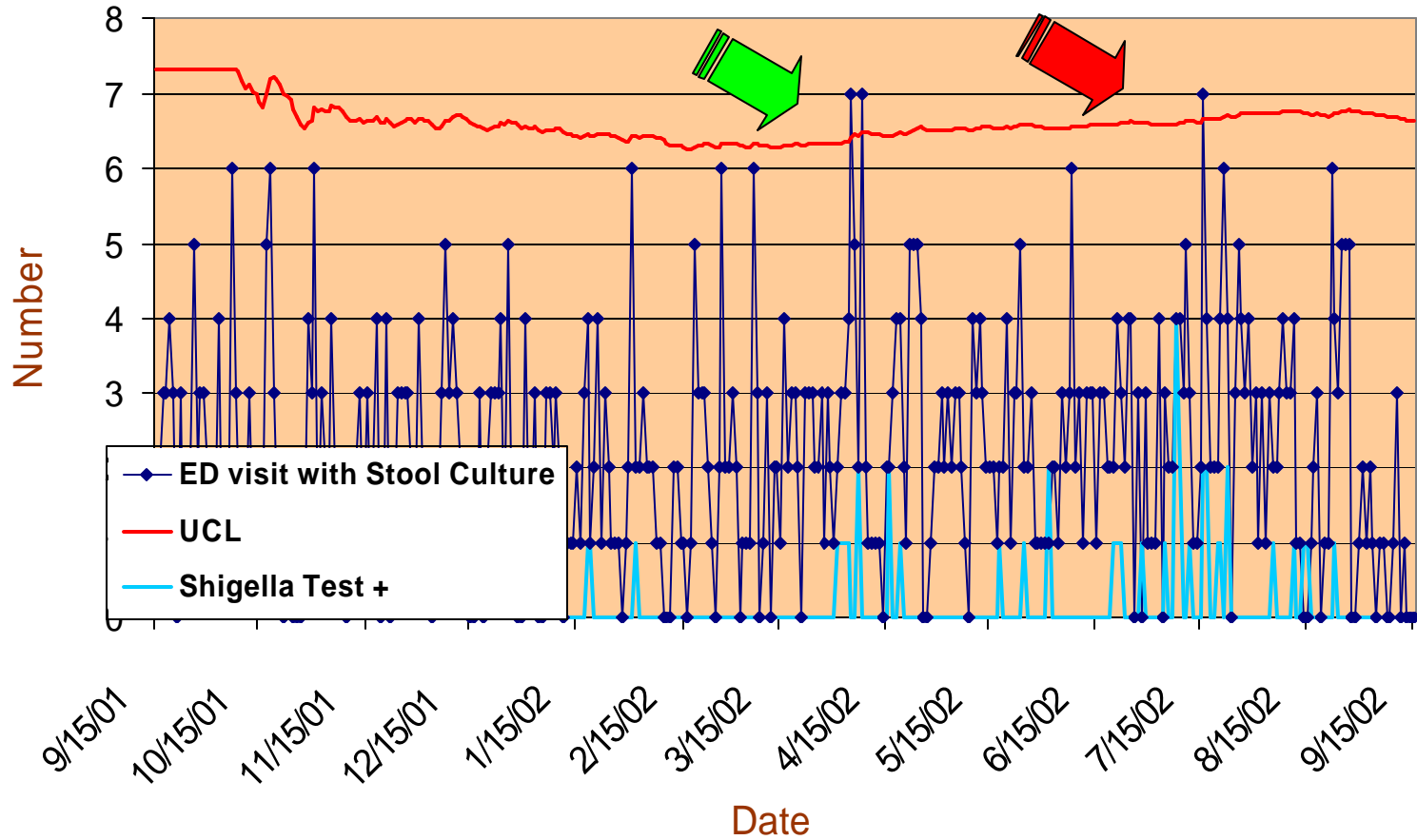
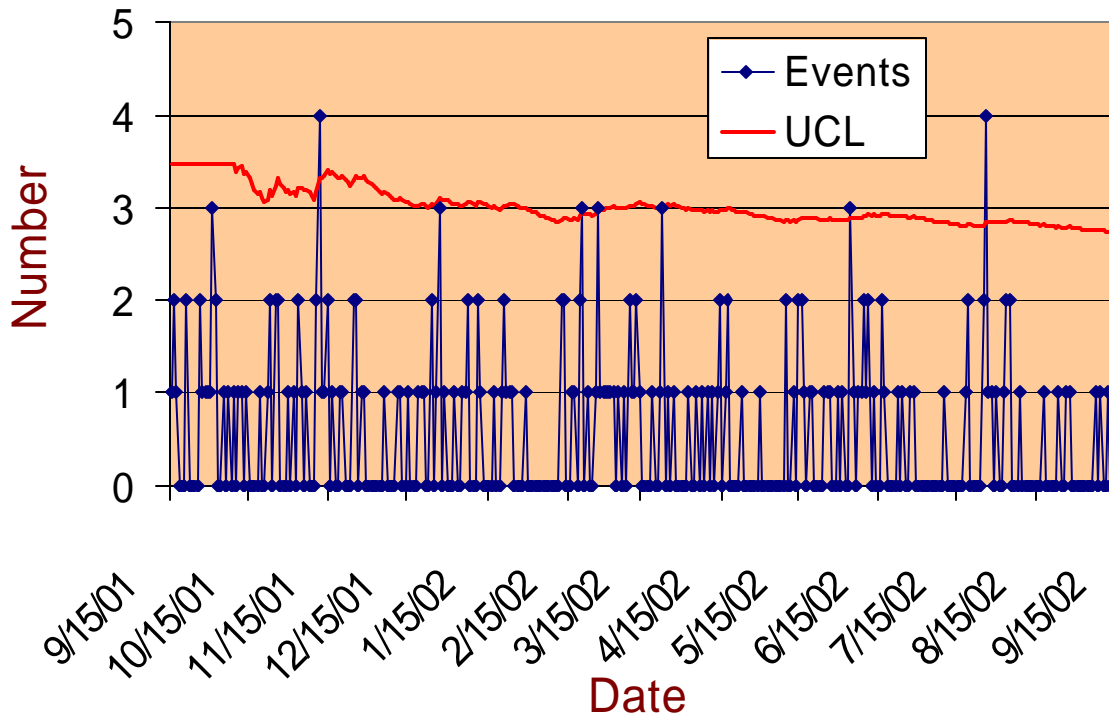


Figure 6 - ED visits with respiratory tests and subsequent medical service admission, recently admitted patients excluded (Events)



Using Existing Electronic Hospital Data for Syndromic Surveillance

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Authors: Dan Peterson, MD, MPH*, Eli Perencevich, MD, MS**, Anthony Harris, MD, MPH**, Chris Novak, MD, MPH*, Steven Davis, MSEE*

Affiliations: *Cereplex, **University of Maryland

Background:

Obstacles to the implementation of syndromic surveillance include:

- The need to secure the cooperation of diverse healthcare systems and busy providers,
- The lack of standardization of electronically stored data,
- The financial and manpower costs of data acquisition and manual entry for data not currently electronically captured, and
- The legal issues related to privacy and confidentiality.

Further, because syndromic surveillance is not yet a proven technique with demonstrated (prospective) efficacy, there is uncertainty as to what data is most useful and which analyses should be implemented.

Methods:

We developed an approach that uses existing hospital ADT (Admission, Discharge, and Transfer) and LIS (Laboratory Information System) data to perform syndromic surveillance analyses. A large part of the effort was developing a robust methodology for receiving and incorporating data on a daily basis that is kept by hospitals in widely different information systems and formats (Figure 1) Data available from ADT systems included Emergency Department (ED) visits, admissions, and admission location and service. Data available from the LIS included bacteriology, virology, and serology tests, including positive and negative results.

Syndromic analyses shown were performed on data from a large university hospital for the dates September 15, 2001- September 15, 2002. The syndromic analyses included indicators of gastrointestinal/diarrheal illness (ED visit with stool culture), severe acute medical illness (ED visit followed by admission to a medical service), and severe acute respiratory illness (ED visit with medical admission and microbiologic tests done on respiratory sources). We also looked at reducing the potential noise created by chronically ill patients and readmissions by restricting control charting to patients not admitted within the previous 60 days at the hospital.

We plotted data as control chart p-graphs using standard statistical process control methods. Upper Control Limit (UCL) lines were plotted at the 3-sigma level. On the graph of ED visits and stool culture, we also plotted the number of results that were subsequently positive for *Shigella*, and similarly included positive influenza results on the graphic of ED visits with microbiologic respiratory testing.

In addition, we provided daily and weekly analyses and alerts, related to infection control, directly to participating hospitals.

Results:

There were 73,910 adult and pediatric ED visits to this hospital for the 1 year period. ED visits alone (whether divided into pediatric and adult, or combined) showed wide variation, and frequently exceeded the Upper Control Limits (Figure 2). ED visits with blood cultures did not exceed the UCL at any time

(Figure 3), whereas ED visits with microbiology respiratory test orders (e.g. virus screens, Influenza antigen tests, respiratory virus cultures) showed discrete episodes of exceeding its UCL. On 12/26/01 this measure first exceeded the UCL, and this corresponded to the start of a large number of patients seen in the ED who eventually tested positive for influenza (Figure 4).

Similarly, a peak in ED visits with stool cultures ordered (as a proxy for diarrheal disease) on 4/5/02 corresponded to a cluster of cases testing positive for *Shigella*. However, stool testing levels did not correspond as well to other episodes of *Shigella* positive tests (Figure 5).

Of the 73,910 total ED visits, 11,619 (16%) were by patients who had been admitted within the previous 60 days. When we looked for severe acute respiratory disease, by using the combination of ED visit, medical admission, and microbiologic respiratory testing (Figure 6), using this 60 day exclusion criteria reduced the number of patients by year from 24% (from 252 to 191 for the one year period).

Hospitals found the routine reports and alerts we provided for infection control to be highly valuable.

Discussion:

We concluded:

As regards these syndromic measures:

- We found that we could construct and measure, with existing electronic data, syndromes that were at least conceptually plausible. ED visit was a marker of acute onset; specimen source, type of testing, and service acted as markers for body system affected; and admission status (not, floor, or ICU) as a marker of disease severity.
- The apparent relationship between increases in testing and subsequently increases in positive results, noted for respiratory tests and influenza, and for stool cultures and *Shigella*, further indicates this approach could work.
- Rigorous testing was not feasible as part of this exploratory analysis. Clearly further testing and evaluation is needed.

From a systems perspective:

- Using data from hospitals in essentially their native format, without requiring that hospitals implement data content or format standards before submission, substantially reduces a major disincentive to their participation.
- By providing timely and valuable feedback to infection control and hospital epidemiology, we provided a clear incentive for hospitals to participate. In the process we became a HIPAA “business associate” for quality assurance and improvement, providing a legal basis for receiving confidential patient information.
- Sending notifiable disease (with identifiers) and other data to local or state health departments (without identifiers, but with duplicates removed) would be a simple extension of this approach.

For further information, or an electronic copy of poster graphics, please contact:

Dan Peterson, MD, MPH
dpeterson@cereplex.com
800-706-1604 ext 206
www.cereplex.com