INDICATOR: A Cyberenvironment for Biosurveillance and Response

Ian S Brooks, Wendy Edwards

National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign

OBJECTIVE

This paper describes INDICATOR, a biosurveillance cyberenvironment used to analyze hospital data and generate alerts for unusual values.

BACKGROUND

Infectious disease outbreaks require rapid access to information to support a coordinated response from healthcare providers and public health officials. They need to know the size, spread, and location of the outbreak, and they also need access to models that will help them to determine the best strategy to contain the outbreak.[1]

There are numerous software tools for outbreak detection, and there are also surveillance systems that depend on communication between health care professionals. Most of those systems use a single type of surveillance data (e.g., syndromic, mandatory reporting, or laboratory) and focus on human surveillance.

However, there are fewer options for planning responses to outbreaks. Modeling and simulation are complex and resource-intensive. For example, EpiSims[2] and EpiCast[3], developed by the National Institute of Health (NIH) Models of Infectious Disease Agent Study (MIDAS) involve large, diverse datasets and require access to high-performance computing.

Cyberenvironments are an integrated set of tools and services tailored to a specific discipline that allows the community to leverage the national cyberinfrastructure in their research and teaching. They provide data stores, computational capabilities, analysis and visualization services, and interfaces to shared instruments and sensor networks.

The National Center for Supercomputing Applications (NCSA) is applying the concept of cyberenvironments to infectious disease surveillance to produce INDICATOR.

METHODS

INDICATOR uses the concept of "workflow" to describe processes and technologies in ways that can be shared, analyzed, and reused. INDICATOR's workflow will require processing of heterogeneous data and support for different levels of information sharing.

We are working to develop a secure collaborative cyberenvironment and data repository. Users will be allowed to add data using email, uploads, or feeds, and INDICATOR will provide spatial and temporal analysis software, e.g., WSARE[4] and SatScan[5] as services. INDICATOR will also offer visualization and data anonymization service.

RESULTS

INDICATOR has been partially implemented using patient advisory nurse (PAN) data from a local hospital. Records are emailed each day, and INDICATOR automatically parses them, runs the WSARE algorithm, and emails the results. INDICATOR also uses Liferay[6] to provide a collaborative web environment with custom portlets that allow users to browse and visualize data.

Users are allowed to define groups of chief complaints that correspond to possible diagnoses. INDICATOR supports visualization and custom reports based on these groups.

CONCLUSIONS

The cyberenvironment concept has the potential to provide valuable collaborative tools for the public health community. The current implementation of INDICATOR has been used for data collection, analysis, sharing, and visualization.

We are currently working to move the chief complaint surveillance into production and implement workflows for SATSCAN.

Future plans include support for multiple diverse data sets, enhanced security, provenance tracking, additional analytic tools and algorithms, and more sophisticated workflow management.

REFERENCES

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Further Information:
Wendy Edwards, wedwards@ncsa.uiuc.edu