Multiple Data Sources and Reverse Engineering Could Improve Sensitivity of Surveillance Algorithms

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OBJECTIVE

Our research questions were: 1.) could we use existing data to empirically improve our syndrome surveillance algorithms? 2.) Is it feasible to combine disparate data sources to detect the same event? We studied these questions using the meningoencephalitis (MEE) syndrome and the West Nile Virus Chicago outbreak in 2002.

BACKGROUND

Clinicians can pursue the clinical findings for specific patients until reaching a diagnosis in real time. When using electronic ED complaints, one relies on symptoms volunteered by patients in the triage setting. Patients seek emergency care at different stages of disease and there is scant information detailing how they respond when allowed only 2-3 complaints. Our emergency department (ED) clinical data warehouse includes date, demographics, complaints, diagnosis, laboratory results, and disposition. We used a process similar to reverse engineering to augment our ability to detect chief complaints and test results consistent with MEE. We started with the diagnosis of MEE and examined the chief complaints and diagnostic findings in patients diagnosed with MEE to develop expanded algorithms.

METHODS

The MEE syndromic algorithms were developed sequentially. The standard case definitions were #1.) Diagnosis of MEE; viral encephalitis/meningitis. #2.) Chief complaint of fever and headache. To augment these definitions, we examined all patients in 2000-2001 with the diagnosis of MEE to determine additional common chief complaints and test results. Definition #3.) additional chief complaints and measured Temp >100. #4) Any patient with CSF protein consistent with MEE: greater than 90 mg/dL. #5.) Absolute numbers of CSF performed. We performed successive limited comparisons and measured the seasonal correlation between diagnosis of MEE, complaints, CSF test results, and absolute numbers of CSF tests performed for years 2000-2004.

RESULTS

Over 500,000 visits were available for analysis. Definition #1.) showed significant seasonal increases in all 5 years; ($P < 0.05$). #2.) Complaints of headache plus fever alone did not predict the diagnosis of MEE or ordering of CSF. 3.) Adding T>100 increased the detection of MEE diagnoses and CSF orders by 3-fold. Six complaints (vomiting, back or neck pain, dizziness, rash, weakness) increased MEE detection compared to headache & fever ($P < 0.05$). #4) CSF protein levels did correlate with MEE in 2000-2002 but not 2003-2004. #5.) #CSF tests ordered showed significant seasonal increases in all 5 years; ($P>0.05$). (See Figure 1)

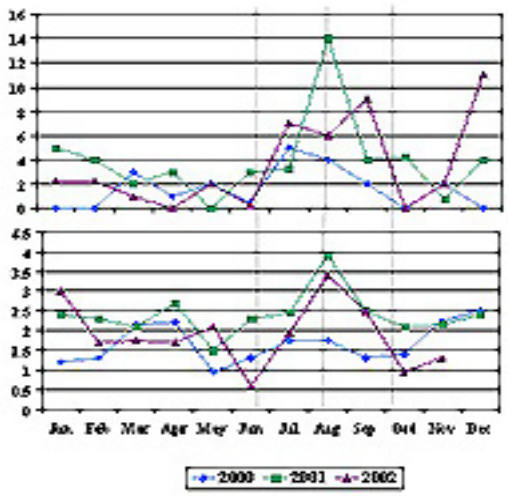

Figure 1 –Monthly plots for Definitions #1 & #5 in 2000-2.

CONCLUSIONS

Using existing data from our own institution, and techniques similar to reverse engineering, we were able to expand and improve our syndromic surveillance algorithms. We found a seasonal correlation of chief complaints, diagnoses, test results, and billing data for labs ordered. Public health agencies could feasibly combine data elements from diverse sources within a region for improved surveillance of public health events.

REFERENCES

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