# Reverse Engineering of a Syndrome Definition for Influenza

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## OBJECTIVE

We report here on the use of the North Carolina Bioterrorism and Emerging Infection Prevention System (NC BEIPS, www.ncbeips.org) to reverse engineer a syndrome definition of influenza for the purpose of influenza surveillance.

## BACKGROUND

Currently, influenza surveillance in the US occurs primarily through participation in the US Influenza Sentinel Surveillance Program[1]. Although advantages exist to this type of traditional public health surveillance, it is relatively untimely when compared to computerized syndromic surveillance systems.

NC BEIPS is being developed as the early event detection component of the North Carolina Public Health Information Network (NC PHIN)[2,3]. Through the use of this system, we are able to develop, evaluate and refine syndrome definitions in response to actual disease outbreaks. Because influenza is a widespread, annual epidemic with a known symptom complex, it lends itself well to the development of electronic biosurveillance systems. We have previously reported on the initial development of a syndrome definition for influenza[4]. We report here on the further refinement of this definition with a goal of increasing sensitivity.

## METHODS

Patient visits from the 2003-2004 influenza season (9/28/03-3/27/04) contained within the NC BEIPS database were analyzed. Those given a final ICD-9-CM diagnosis of influenza (487.0-487.9) were identified and common presenting symptoms were examined. As influenza is fundamentally a febrile illness, a combination of evidence of fever and another common symptom was used. The frequency of this combination of symptoms in patients diagnosed with influenza was compared to the frequency of the same symptoms in all patients in the NC BEIPS database. Our initial attempt at influenza syndrome definition development did not combine evidence of fever with other common symptoms in the symptom frequency analysis. Additionally, we updated our evidence of fever term to include fever related symptoms (e.g. chill, rigor, shiver).

## RESULTS

Mention of the term "flu" in either the chief complaint (CC) or triage note (TN) field (without evidence of fever) was highly associated with a diagnosis of influenza. The most common CCs (in combination with the evidence of fever term) associated with a diagnosis of influenza were: viral terms, ache terms, upper respiratory infection terms, cough, headache, congestion, dyspnea terms, fatigue terms, nausea/vomiting, chest pain and fussy/cranky. These same terms were also more frequently associated with patients given a diagnosis of influenza when found in the TN field. Additional terms found more frequently in the TN field include myalgia, sick, sputum/phlegm, anorexia terms, pneumonia, sore throat and wheezing. Headache, nausea/vomiting and chest pain are frequent pertinent negative findings which, when documented in the TN field, result in the identification of many false positive records. Due to lack of recognition of negation terms (e.g. no headache vs. headache), these search terms were excluded from the TN field in the final definition. Considering an ICD-9-CM diagnosis of influenza as true positives, a syndrome definition for influenza based on these findings yielded a specificity of 93.3% and a sensitivity of 56.3%. Our initial attempt at reverse engineering and influenza syndrome definition produced a specificity of 96.2% and a sensitivity of 35.5% [4].

## CONCLUSIONS

Through revision of our evidence of fever term, as well as inclusion of this term in the initial symptom frequency analysis, we were able to increase sensitivity of our influenza definition while maintaining a high specificity. In terms of syndromic surveillance, this translates to an increased likelihood of detecting an actual outbreak while minimizing false alarms.

## REFERENCES

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Funding was provided by the NC Division of Public Health. The authors wish to acknowledge the contributions of Dr. Megan Davies and Dennis Falls.