Automated Detection of Tuberculosis Using Electronic Medical Record Data

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OBJECTIVE

To develop algorithms for case detection of tuberculosis (TB) using electronic medical record (EMR) data to improve notifiable disease reporting.

BACKGROUND

Approximately one quarter of people treated for TB have no supporting microbiology [1], and thus are not detectable through laboratory reporting systems. Health departments depend upon clinicians to report these cases, but there is important underreporting [2]. We previously described the performance of several algorithms for TB detection using EMR and claims data, and noted good sensitivity when screening for ≥2 anti-TB drugs; however, the positive predictive value was only 30% [2]. We re-evaluated this and other algorithms in light of evolving TB treatment practices and enhanced ability to apply complex decision rules to EMR data in real time [3].

METHODS

We developed 12 candidate algorithms to detect cases of active TB diagnosed or treated within Atrius Health, a multi-specialty group practice with over 600,000 patients in eastern Massachusetts. Algorithms sought combinations of ICD9 diagnostic codes, laboratory orders and results, and medication prescriptions suggestive of TB. The algorithms were tested using EMR encounter data spanning June 2006 to July 2007. The charts of all patients identified by the algorithms were reviewed to determine the accuracy of each diagnosis. The number of true cases captured by each algorithm was compared to a master list of all Atrius Health patients known to have TB during the test period on the basis of 1) Atrius Health infection control records, 2) all confirmed cases of TB found by any of the 12 candidate algorithms, and 3) the state health department's case list of all TB cases diagnosed in Massachusetts.

RESULTS

Eight patients were identified who were diagnosed or treated for TB at Atrius Health during the test period. Four had culture negative disease. The various algorithms detected between 13% and 88% of confirmed cases. Positive predictive values (PPV) ranged from 16% to 100%. The three algorithms with the highest PPV are presented in Table 1. The union of these three algorithms (A. Prescription for pyrazinamide, B. Acid-fast bacillus (AFB) smear or culture order followed by TB ICD-9 code within 60 days, and C. Prescription for 2 anti-TB medications plus TB ICD-9 code) captured 100% of known TB cases with a combined positive predictive value of 82%. By comparison, the most sensitive single algorithm (any ICD9 code for TB) captured 88% of known cases but with a positive predictive value of only 16%. One of the culture negative cases was previously unknown to the state health department.

TABLE #1: THREE PROMISING ALGORITHMS

Algorithm	Sensitivity	PPV
Prescription for PZA	6/8 (75%)	6/7 (86%)
AFB order & TB ICD9	2/8 (25%)	2/3 (67%)
2 TB Meds & TB ICD9	6/8 (75%)	7/7 (100%)
Combined	**8/8 (100%)**	**9/11 (82%)**

CONCLUSIONS

These results suggest it may be possible to achieve both high sensitivity and positive predictive values for identification of TB, including culture negative cases, using decision rules that can be applied in real time to EMR data. Further validation is warranted.

REFERENCES

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Further Information:

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