Performance of an e-Trigger to Detect Missed Stroke Diagnosis In Patients with Headache or Dizziness Symptoms in Emergency Department

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Background:
Statistical analysis of large data sets using the ‘Symptom-Disease Pair Analysis of Diagnostic Error’ (SPADE) approach has been proposed as a method to determine frequency of misdiagnosis-related harm.1,2 Conversely, electronic triggers (or e-trigger tools) first mine vast amounts of clinical and administrative data and are followed by validation record reviews on highly-selected records to confirm presence/absence of diagnostic error. We developed an e-trigger of two symptom-disease pairs (headache and dizziness followed by stroke) and examined its performance for identifying missed opportunities in stroke diagnosis in emergency departments (ED).

Methods:
We developed a stroke e-trigger using a knowledge discovery framework, the Safer Dx Trigger Tools Framework.3 Using a previously published “look-back” SPADE methods2, we identified all patients admitted to VA facilities in 2016-17 for stroke (based on ICD-10 codes) that also had a “treat-and-release” ED visit with discharge diagnosis as headache or dizziness within prior 30 days. We then conducted record reviews for validating this method. A trained physician reviewed each record for a) presence/absence of red-flags and stroke risk factors associated with stroke or transient ischemic attack (based on American Stroke Association guidelines, such as speech abnormalities, limb weakness, hypertension, hyperlipidemia); and b) actions in response to red-flags, such as neurological consultation or appropriate imaging. A second physician reviewed 20% of randomly selected records to assess reliability. We defined missed opportunity in diagnosis (MODs) when no additional action or evaluation was undertaken despite stroke-related red-flags and potential missed opportunity in diagnosis (P-MODs) when red-flags at ED visit were absent but patient had multiple stroke risk factors and abnormal or incomplete neurological examination.

Results:
From an electronic health record data warehouse containing >9 million patient-records, we identified 398 trigger positive records. Reviewers identified 124 (31.20%) “Missed” cases (MODs or P-MODs), 162 (40.70%) miscoded as having stroke, 93 (23.40%) “Non- missed”, and 19 (4.80%) were inconclusive. The PPV of SPADE method was thus 31.2%. Agreement between reviewers was 87.3% (Cohen’s kappa=0.81). Average numbers of red flags in missed (MODs and P-MODs) was higher compared to non-missed group (0.49 vs 0.19; p=0.002).

Conclusion:
Using the SPADE method, we developed and tested an e-trigger using data mining and confirmatory record reviews to identify patients with missed strokes in emergency departments. The SPADE measurement method has modest PPV for misdiagnosis by itself and would require confirmatory reviews for validation because a majority of patients either did not encounter delays in stroke diagnosis or had miscoded strokes.

References: