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## Accuracy and Coverage of Using the Assigned International Classification of Diseases, 9th and 10th Revision, Clinical Modification Codes for Detecting Bleeding Events in Electronic Health Record


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## ACCURACY AND COVERAGE OF USING THE ASSIGNED INTERNATIONAL CLASSIFICATION OF DISEASES, 9<sup>TH</sup> AND 10<sup>TH</sup> REVISION, CLINICAL MODIFICATION CODES FOR DETECTING BLEEDING EVENTS IN ELECTRONIC HEALTH RECORD

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**Background:** Hemorrhages are common events that confer significant risk for in-hospital and post-discharge morbidity and mortality among cardiovascular disease (CVD) patients treated with anticoagulation. International Classification of Diseases, 9th and 10th Revision, Clinical Modification (ICD-9-CM, ICD-10-CM) codes have been widely used in CVD research and managements.

**Objective:** To determine the accuracy and coverage of assigned ICD-CM codes for reporting bleeding events.

**Methods:** From the University of Massachusetts Medical School electronic health record (EHR) database we identified 21k patients on anticoagulation with high bleeding risks based on their ICD-9-CM or ICD-10-CM codes. Through manual chart review, we selected one unstructured note (i.e., physical exam findings, historical narratives) from each patient and identified 299 notes with and 102 free from bleeds using convenience sampling. We extracted bleeding events, labeled them as “current” or “historical”, and determined their severity (major/minor, clinically relevant/irrelevant) based on International Society on Thrombosis and Haemostasis (ISTH) criteria. Using the chart extractions as gold standard, we calculated the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of ICD-9-CM and ICD10-CM for detecting bleeding.

**Results:** In Administrative claims data, ICD-9-CM had a sensitivity of 35.3%, 96.1% specificity, 96.7% PPV, and 31.2% NPV for detecting bleeding, whereas ICD-10-CM codes had a sensitivity of 55.0%, 96.3% specificity, 97. 9% PPV, and 40.6% NPV. Both ICD-CM codes exhibited better sensitivity for detecting current bleeds (41.1%, 73.4%) and major bleeds (50.0%, 62.9%) as compared with historical (32.4%, 43.8%) and minor ones (31.6%, 56.8%).

**Conclusions:** Half of all bleeding events among patients with CVD were not reflected in administrative claims data. Although the code’s precision is acceptable, the low sensitivity suggests bleeding events may be under-reported by claims data. Our findings have important clinical implications and suggest that novel methods are needed to enhance bleeding identification to improve clinical decision making.

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