

## Text Search Tool for Electronic Medical Records Shows Promise for Identifying Postoperative Complications



Use of natural language processing, such as in the form of free-text searches of electronic medical records (EMRs) of clinical and progress notes of patients performed better at identifying postoperative surgical complications than the commonly used administrative data codes in EMRs, according to a study in the August 24/31 issue of JAMA.

To improve on identifying patient safety concerns, the Agency for Healthcare Research and Quality developed a set of 20 measures, known as the patient safety indicators, which use administrative data to screen for potential adverse events that occur during hospitalisation, according to background information in the article. "Currently most automated methods to identify patient safety occurrences rely on administrative data codes; however, free-text searches of electronic medical records could represent an additional surveillance approach," the authors write. "The development of automated approaches, such as natural language processing, that extract specific medical concepts from textual medical documents that do not rely on discharge codes offers a powerful alternative to either unreliable administrative data or labor-intensive, expensive manual chart reviews. Nevertheless, there have been few studies investigating natural language processing tools for the detection of adverse events. It is not known whether a surveillance approach based on language processing searches of free-text documents will perform better than currently used tools based on administrative data."

Harvey J. Murff, M.D., M.P.H., of the Veterans Affairs Medical Center and Vanderbilt University, Nashville, Tenn., and colleagues conducted a study to evaluate a language processing-based approach to identify postoperative complications within a multi-hospital healthcare network using the same EMR. The study included 2,974 patients (median [midpoint] age, 64.5 years; 95 percent men) undergoing inpatient surgical procedures at 6 Veterans Health Administration (VHA) medical centers from 1999 to 2006. Among the outcomes measured were postoperative occurrences of acute renal failure requiring dialysis, deep vein thrombosis, pulmonary embolism, sepsis, pneumonia, or heart attack identified through medical record review as part of the VA Surgical Quality Improvement Program. The researchers determined the sensitivity and specificity of the natural language processing approach to identify these complications and compared its performance with patient safety indicators that use discharge coding information.

Within each analytic sample the percentage of postoperative acute renal failure requiring dialysis was 2 percent (39 of 1,924); for pulmonary embolism, 0.7 percent (18 of 2,327); for deep vein thrombosis, 1 percent (29 of 2,327); for sepsis, 7 percent (61 of 866); for pneumonia, 16 percent (222 of 1,405), and for heart attack, 2 percent (35 of 1,822). The researchers found that in general, using a natural language processing-based approach had higher sensitivities and lower specificities than did the patient safety indicator. "The increase in sensitivity of the natural language processing-based approach compared with the patient safety indicator was more than 2-fold for acute renal failure and sepsis and over 12-fold for pneumonia. Specificities were 4 percent to 7 percent higher with the patient safety indicator method than the natural language processing approach."

"Natural language processing correctly identified 82 percent of acute renal failure cases compared with 38 percent for patient safety indicators. Similar results were obtained for venous thromboembolism (59 percent vs. 46 percent), pneumonia (64 percent vs. 5 percent), sepsis (89 percent vs. 34 percent), and postoperative myocardial infarction (91 percent vs. 89 percent). Both natural language processing and patient safety indicators were highly specific for these diagnoses."

The authors suggest that a natural language processing-based approach offers several potential advantages over administrative-code based strategies to identify healthcare quality concerns. "First is the flexibility of the approach to meet the individual institutional needs. Once documents have been processed, different approaches and query strategies to identify a specific outcome can be implemented at a relatively low programming effort using standard database query applications. Second, as opposed to administrative codes, search strategies using daily progress notes, microbiology reports, or imaging reports could be monitored on a prospective basis. Thus, this approach could potentially identify complications while a patient is still in the hospital, which could greatly facilitate real-time quality assurance processes. ... Finally, in systems with highly integrated EMRs, prospective surveillance could be extended to the outpatient setting for individuals remaining with the healthcare system."

Editorial: The Promise of Electronic Records -- Around the Corner or Down the Road?

Ashish K. Jha, M.D., M.P.H., of the Harvard School of Public Health, Boston, writes in an accompanying editorial that "although the promise of natural language process is substantial, its benefits will not be realised without considerable new investment in research and development."

"Murff and colleagues focused on one specific application of identifying adverse events after surgery. Dozens of permutations and combinations of syntax were tested and customised to identify the optimal strategy for finding complications in an electronic health record (EHR). To realise the benefits of natural language process, this kind of research will need further development not only to find better algorithms but also to investigate EHR analysis for disciplines other than surgery and optimise automated EHR searches for different types of clinicians. Although there are private-sector companies capitalising on the benefits of natural language process to help clinicians and organisations improve care delivery, the federal government can play a helpful role by funding the basic research needed to launch this field forward."

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