The Use of Decision Support to Measure Documented Adherence to a National Imaging Quality Measure

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Rationale and Objectives: Present methods for measuring adherence to national imaging quality measures often require a resource-intensive chart review. Computerized decision support systems may allow for automated capture of these data. We sought to determine the feasibility of measuring adherence to a national quality measure (NQM) regarding computed tomography pulmonary angiograms (CTPAs) for pulmonary embolism using measure-targeted clinical decision support and whether the associated increased burden of data captured required by this system would affect the use and yield of CTs.

Materials and Methods: This institutional review board–approved prospective cohort study enrolled patients from September 1, 2009, through November 30, 2011, in the emergency department (ED) of a 776-bed quaternary-care adults-only academic medical center. Our intervention consisted of an NQM-targeted clinical decision support tool for CTPAs, which required mandatory input of the Wells criteria and serum D-dimer level. The primary outcome was the documented adherence to the quality measure prior and subsequent to the intervention, and the secondary outcomes were the use and yield of CTPAs.

Results: A total of 1209 patients with suspected PE (2.0% of 58,795 ED visits) were imaged by CTPA during the 12-month control period, and 1212 patients were imaged in the 12 months after the quarter during which the intervention was implemented (2.0% of 59,478 ED visits, $P = .84$). Documented baseline adherence to the NQM was 56.9% based on a structured review of the provider notes. After implementation, documented adherence increased to 75.6% ($P < .01$). CTPA yield remained unchanged and was 10.4% during the control period and 10.1% after the intervention ($P = .88$).

Conclusions: Implementation of a clinical decision support tool significantly improved documented adherence to an NQM, enabling automated measurement of provider adherence to evidence without the need for resource-intensive chart review. It did not adversely affect the use or yield of CTPAs.

Key Words: Quality measures; computerized decision support; imaging; emergency department.

Present health care reform initiatives focus on increasing value, improving quality, and reducing waste, often through the use of publicly reported national quality measures (NQMs) (1–3). Much of this activity has been directed toward the use of high-cost imaging such as computed tomography (CT), the use of which has increased significantly over the past two decades (4,5). Although CT is useful because of its diagnostic speed and accuracy (6), it has come under scrutiny because of its potential for inappropriate use, especially in the emergency department (ED) (7,8), and its potential risks of radiation exposure and contrast-induced nephropathy (9,10).

One area of intense focus is the ED use of CT for patients with suspected pulmonary embolism (PE). Although validated, evidence-based decision tools designed to help clinicians to identify patients who need imaging have been available for more than 12 years (11) and are now endorsed by multiple specialty societies (7,12,13), inappropriate use continues, and educational interventions have not been shown to improve appropriateness (8,14–19). An evidence-based NQM was recently endorsed by the National Quality Forum (20) but, in a recent study, one-third of the CT pulmonary angiograms (CTPAs) performed in ED patients with suspected PE did

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Figure 1. First-generation clinical decision support.

not adhere to it (16). Another recent study demonstrated that pretest probabilities are rarely documented by emergency physicians before obtaining CTPAs (21). Additionally, a number of public comments regarding the NQM cited concerns regarding the level of intensive manual chart review that would be necessary to gather the granular data required to determine whether CTPAs were adherent to evidence (20).

Computerized physician order entry (CPOE) systems with integrated clinical decision support (CDS) have been suggested as a method for improving overall quality of care (22,23), and their use has been mandated by the Health Information Technology for Economic and Clinical Health Act and federal meaningful use regulations (24,25). Although the use of electronic health records (EHRs) to collect data for quality measures has been discussed, CDS has not yet been used to measure adherence to NQMs (26).

An earlier study demonstrated that the implementation of CDS at our institution was associated with a decrease in the use, and an increase in the yield, of CTPAs in the ED (27). However, this first-generation CDS did not allow capture of the granular data necessary to measure the adherence to evidence described in the NQM for each CTPA order. We subsequently developed an NQM-targeted CDS tool, which was based on the same evidence-based recommendations as the first-generation CDS but designed to streamline this data capture. However, this NQM-targeted CDS required an increased number of provider mouse clicks to enter data, and it was unknown whether this would lead to provider reluctance to order CTPAs and deleterious effects on both their use and yield. Therefore, in this study, we sought to determine the feasibility of using an NQM-targeted CDS tool to measure CTPA orders' adherence to an evidence-based NQM and whether the associated increased burden of data capture would affect the use and yield of CTPAs.

MATERIALS AND METHODS

Study Design and Setting

The study was performed in a 776-bed quaternary-care, adults-only academic medical center with an annual ED volume of ~60,000 patients. A Level 1 Trauma and Burn Center, the ED hosts an emergency medicine residency and all attending emergency physicians are board-eligible/certified. Institutional review board approval with a waiver of informed consent was obtained for this Health Insurance Portability and Accountability Act–compliant, prospective controlled study, conducted from September 1, 2009 to November 30, 2011.

Study Participants

The study population included all the patients who presented to the ED and received a CTPA during the 12-month periods before (control) and subsequent (intervention) to the quarter during which an NQM-targeted CDS was implemented (September–November 2010).

Intervention

Before the study, all imaging orders were placed via a CPOE system (Percipio; Medicalis Corporation, San Francisco, CA), by a licensed provider (28). A first-generation CDS, implemented in late 2007, had asked the clinicians to enter only their clinical suspicion for PE (high, medium, or low) and the D-dimer level (elevated, normal, or not done), and required three provider mouse clicks to complete the CTPA order (Fig 1) (27,29). This study's intervention consisted of the implementation of an NQM-targeted CDS tool for a CTPA within the CPOE system. Like the first-generation CDS, the evidence base for the NQM-targeted CDS was the Wells criteria (11). However, the NQM-targeted CDS required mandatory data input (a discrete "yes" or "no" response) for each unique clinical attribute of the Wells criteria for the patient being imaged (clinical signs and symptoms of deep vein thrombosis [DVT], PE as the leading diagnosis, heart rate > 100 beats/min, immobilization at least 3 days or surgery in the previous 4 weeks, previous PE or DVT, hemoptysis, and malignancy with treatment within the past 6 months) and the serum D-dimer level (normal, elevated, not ordered, or not yet known), and it required a total of nine provider mouse clicks for completion of each CTPA order (Fig 2). These granular Wells criteria data and the D-dimer data were combined to determine whether CTPA imaging for the patient being evaluated was adherent to evidence.

NQM-adherent imaging orders received no further intervention. Those CTPA orders that were nonadherent received specific CDS messages tailored to the reasons for nonadherence and based on the NQM evidence-base. Providers entering CTPA orders for patients with low pretest probabilities for PE who had not had a D-dimer ordered (or who had a D-dimer ordered for which results were not yet known) received the message, "Based on the information you have provided, a CT may not be appropriate for your patient. Published guidelines suggest that a patient with a low clinical probability of PE should have a D-dimer measured to further guide decision-making. A negative D-dimer result, in combination with your patient's risk via the Wells Criteria, may safely exclude PE." Those in whom a serum D-dimer level