EDITORIAL

Adding YEARS to optimize emergency department pulmonary embolism diagnostic workup

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Computerized clinical decision support systems aim to augment clinicians' complex decision-making processes and have rapidly evolved since their first use in the 1980s. Clinical decision support is commonly administered through electronic health records and other computerized clinical workflows, facilitating the increasing global adoption of electronic medical records. In this Canadian Journal of Emergency Medicine (CJEM) issue, Duffy and colleagues report that integrating the YEARS criteria into electronic clinical decision support may avoid unnecessary imaging in low-risk patients with suspected pulmonary embolism and streamline the diagnostic process [1]. In the context of the relatively recent COVID-19-related severe global shortage (and any similar future supply crunch) of iodinated contrast media, the report by Duffy and colleagues is timely to inform contrast use mitigation strategies and protocols in emergency departments (EDs) to reduce using computed tomography (CT) pulmonary angiography for suspected pulmonary embolism without sacrificing diagnostic accuracy. As the authors state, researchers have shown that the YEARS criteria, a clinical decision rule, improves the efficiency of ruling out pulmonary embolism (without imaging) without compromising safety. The YEARS criteria incorporate a probability-adjusted D-dimer threshold with clinical characteristics (hemoptysis, signs of deep vein thrombosis, and pulmonary embolism as the most likely diagnosis) to guide imaging decisions to rule out pulmonary embolism [1]. Duffy and colleagues conducted a single-center quality improvement initiative involving 2639 patients (over 18 years) over 1 year in an ED of an academic tertiary care hospital [1]. By creating an electronic clinical decision support algorithm based on the YEARS criteria and completing a plan-do-study-act (PDSA) cycle, they increased by 14% the CT pulmonary angiograms ordered with a screening D-dimer without increasing the rate of imaging ordered. This study adds to the evidence base supporting the clinical utility (and potential cost-effectiveness) of the YEARS diagnostic algorithm by demonstrating that the CT pulmonary angiogram diagnostic yield was higher in YEARS positive patients (13.2%) compared to YEARS negative patients (0%) or if YEARS was not applied (8.1%) [1].

Not all published clinical decision rules are ready for routine clinical practice use [2]. Therefore, institutions should guard against garbage in and garbage out when conducting any quality improvement initiative based on integrating a clinical decision rule into a clinical decision support system, because a poor quality clinical decision rule (i.e., one with limited or no external validation) could have a significant impact on the clinical decision support system's output and reliability. To guard against this concern, institutions should select and review the quality of the derivation and validation studies that underpin the

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clinical decision rule of interest. Fortunately, researchers have validated the YEARS algorithm in multiple settings and through multi-center randomized trials [3]. It has also undergone an impact analysis showing that it changes behavior and decreases cost and radiation exposure without signs of significant harm (Level 1 evidence) [3]. This external validation at multiple settings with an impact analysis of the YEARS algorithm enhances the scientific validity and robustness of Duffy and colleagues' findings [1].

Moreover, integrating a high-quality clinical decision rule into a clinical decision support system does not necessarily mean that the endeavor will be successful. Prior attempts to integrate clinical decision support for evidence-based clinical decision rules for pulmonary embolism have yielded mixed results. One study found that in 96% of cases, clinicians ignored the clinical decision support prompts and continued with CT pulmonary angiogram ordering [4]. Effective clinical decision support requires institutional and clinician-level buy-in with particular attention to user-centered workflow. The mixed results from attempts to integrate clinical decision support and evidence-based clinical decision rules for pulmonary embolism suggest that institutions should supplement the integration with multifaceted interventions to enhance the impact of clinical decision support on physician ordering behavior. Examples of supplementary multifaceted interventions include performance feedback reporting or real-time peer-to-peer consultation when a physician attempts to override the clinical decision support recommendations. Furthermore, what works at one center does not necessarily guarantee success in other settings. An additional understanding of design choices and operationalization can help understand the mechanisms and differentiate what makes a clinical decision support implementation attempt effective or not.

Duffy and colleagues used the PDSA cycle methodology for their quality improvement initiative [1]. PDSA provides a structured experimental learning approach to testing changes. However, a pitfall of this methodology is falling victim to the Dunning–Kruger effect, because while the PDSA method is conceptually simple, simple does not mean easy [5]. The fact that while Duffy and colleagues' quality improvement initiative resulted in emergency physicians appropriately applying the YEARS criteria in 60% of patients who underwent CT pulmonary angiography to diagnose pulmonary embolism required a multidisciplinary team (emergency medicine, radiology, thromboembolism, and laboratory) demonstrates that a PDSA's success depends on a significant investment in leadership, expertise, and resources for change [1]. Furthermore, before the present quality improvement initiative, the authors state that they had

previously implemented the YEARS algorithm in their ED with multi-stakeholder engagement and education sessions, demonstrating a significant time and resource commitment to implementing the initiative [1]. Therefore, other EDs interested in this quality improvement initiative should not underestimate the required investment. The considerable investment required is highly relevant when considering the findings (external validity or generalizability) of a single-center quality improvement initiative such as Duffy and colleagues' [1]. Resource-constrained EDs without the multidisciplinary team (emergency medicine, radiology, thromboembolism, and laboratory) that guided Duffy and colleagues' project may find it challenging to replicate their results. Inadequate human resources and financial support doom many projects to fail and undermine organizational culture, contributing to change fatigue and disillusionment as yet another project produces no real improvement. It is therefore crucial, at both the project and programmatic levels, that the resource requirements for successfully applying PDSA cycle methodology for a given project are well understood and that the process is well managed [5].

Declarations

Conflict of interest The authors declare no conflict of interest.

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