

Cues for PE Diagnosis in the Emergency Department: A Sociotechnical Systems Approach for Clinical Decision Support

Brian Patterson¹, MD, Erkin Otles¹, MS, Ann Schoofs Hundt², PhD, Peter Hoonakker², PhD, and Pascale Carayon^{2,3}, PhD

¹ Department of Emergency Medicine, University of Wisconsin School of Medicine and Public Health

² Center for Quality and Productivity Improvement, University of Wisconsin-Madison

³ Department of Industrial and Systems Engineering, University of Wisconsin-Madison

Pulmonary embolus (PE) is among the most challenging diagnoses made in the emergency department (ED). While missed or delayed diagnosis of PE is a major problem in the ED¹, overtesting, which subjects patients to harm from radiation, overdiagnosis, and increased cost, is also a concern². Health information technology, such as clinical decision support, has the potential to reduce diagnostic errors and support the diagnostic process.³ However, this requires that the technology be useful and usable, and fit within the clinical workflow, providing justification for a sociotechnical systems approach.⁴ The purpose of this study is to understand cues in the PE diagnosis process in the ED sociotechnical system and to compare these cues to the information available in the EHR. This will help in defining design requirements for a clinical decision support for PE diagnosis in the ED.

Using the Critical Decision Method,⁵ we interviewed 16 attending physicians and residents in three EDs of two academic medical centers and one community hospital. The total duration of the interviews was over 12 hours. Using an iterative qualitative content analysis, we identified 4 categories of cues: (1) patient signs and symptoms (e.g., leg swelling, chest pain), (2) patient risk factors (e.g., immobilization, surgery or trauma, cancer), (3) explicit risk scoring (e.g., PERC), and (4) clinical judgment. We then mapped these cues to information available in the EHR at one of the participating hospitals. About 80-90% of the cues may be available in the EHR; many of them rely on the physical exam and information obtained by talking to the patient. This finding underlines the need to identify the various roles involved in obtaining, documenting and reviewing the information that informs the PE diagnostic process. The PE diagnostic process in the ED is distributed across multiple roles, individuals and technologies in a sometimes chaotic and often busy physical and organizational environment.

Acknowledgments

This project was supported by grant number R01HS022086 from the Agency for Healthcare Research and Quality. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research and Quality.

References

1. Torres-Macho J, Mancebo-Plaza AB, Crespo-Giménez A, et al. Clinical features of patients inappropriately undiagnosed of pulmonary embolism. *The American Journal of Emergency Medicine*. 2013;31(12):1646-1650.
2. Venkatesh AK, Kline JA, Courtney DM, et al. Evaluation of pulmonary embolism in the emergency department and consistency with a national quality measure: quantifying the opportunity for improvement. *Arch Intern Med*. 2012;172(13):1028-1032.
3. Balogh EP, Miller BT, Ball JR. *Improving Diagnosis in Health Care*. Washington, DC: National Academies Press;2015.
4. Carayon P, Hundt AS, Karsh B-T, et al. Work system design for patient safety: The SEIPS model. *Quality & Safety in Health Care*. 2006;15(Supplement 1):i50-i58.
5. Klein GA, Calderwood R, MacGregor D. Critical decision method for eliciting knowledge. *Systems, Man and Cybernetics, IEEE Transactions on*. 1989;19(3):462-472.