



**Fig. 2.** Large thrombus in the right pulmonary artery (top). Segmental emboli in the left lower lobe pulmonary artery (bottom).

## References

- [1] Bastiampillai T, Sharfstein SS, Allison S. Increase in US suicide rates and the critical decline in psychiatric beds. *JAMA, J Am Med Assoc* 2016;316(24):2591–2. <https://doi.org/10.1001/jama.2016.16989>.
- [2] Nicks BA, Manthey DM. The impact of psychiatric patient boarding in emergency departments. *Emerg Med Int* 2012;2012:1–5. <https://doi.org/10.1155/2012/360308>.
- [3] American College of Emergency Physicians. ACEP Psychiatric and Substance Abuse Survey. <http://newsroom.acep.org/download/ACEP+Psychiatric+and+Substance+Abuse+Survey+-+April+2008.pdf>; 2008.
- [4] Schafermeyer RW, Asplin BR. Hospital and emergency department crowding in the United States. *Emerg Med (Fremantle)* 2003;15(1):22–7. <https://doi.org/10.1046/j.1442-2026.2003.00403.x>.
- [5] Pines JM, Hollander JE, Localio AR, Metlay JP. The association between emergency department crowding and hospital performance on antibiotic timing for pneumonia and percutaneous intervention for myocardial infarction. *Acad Emerg Med* 2006;13(8):873–8. <https://doi.org/10.1197/j.aem.2006.03.568>.
- [6] Pines JM, Localio AR, Hollander JE, et al. The impact of emergency department crowding measures on time to antibiotics for patients with community-acquired pneumonia. *Ann Emerg Med* 2007;50(5):510–6. <https://doi.org/10.1016/j.annemergmed.2007.07.021>.
- [7] Fordyce J, Blank FSJ, Pekow P, et al. Errors in a busy emergency department. *Ann Emerg Med* 2003;42(3):324–33. [https://doi.org/10.1016/S0196-0644\(03\)00398-6](https://doi.org/10.1016/S0196-0644(03)00398-6).
- [8] Schull MJ, Vermeulen M, Slaughter G, Morrison L, Daly P. Emergency department crowding and thrombolysis delays in acute myocardial infarction. *Ann Emerg Med* 2004;44(6):577–85. <https://doi.org/10.1016/j.annemergmed.2004.05.004>.
- [9] Miró O, Antonio MT, Jiménez S, et al. Decreased health care quality associated with emergency department overcrowding. *Eur J Emerg Med* 1999;6(2):105–7. <https://doi.org/10.1097/00063110-199906000-00003>.
- [10] Richardson DB. Increase in patient mortality at 10 days associated with emergency department overcrowding. *Med J Aust* 2006;184(5):213–6.
- [11] Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. *Ann Emerg Med* 2008;52(2). <https://doi.org/10.1016/j.annemergmed.2008.03.014>.
- [12] Liu SW, Thomas SH, Gordon JA, Hamedani AG, Weissman JS. A pilot study examining undesirable events among emergency department-boarded patients awaiting inpatient beds. *Ann Emerg Med* 2009;54(3):381–5. <https://doi.org/10.1016/j.annemergmed.2009.02.001>.
- [13] Hearn RG. DOI's Investigation into the Circumstances Surrounding the Death of Esmin Green; 2009.
- [14] Bakhsh HT, Perona SJ, Shields WA, Salek S, Sanders AB, Patanwala AE. Medication errors in psychiatric patients boarded in the emergency department. *Int J Risk Saf Med* 2014;26(4):191–8. <https://doi.org/10.3233/JRS-140634>.
- [15] Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit Care Med* 2007;35(6):1477–83. <https://doi.org/10.1097/01.ccm.0000266585.74905.5a>.

## Correspondence to 1-hour bundle, an updated version of 3-hour bundle☆

Dear Editor,

We would like to thank the reviewer for sharing their concerns and views after reading our study. We appreciate the comments and questions and hope the answers below will help address these concerns.

The reviewer raises concerns about the study including patients with severe sepsis and septic shock but not patients with sepsis. The Centers for Medicare and Medicaid Services (CMS) and The Joint Commission (TJC) released the Sepsis Core Measure (SEP-1) in October of 2015 which included early management bundle goals for patients with severe sepsis or septic shock only [1]. We selected this population to be consistent with the CMS core measures focused on severe sepsis and septic shock patients for both internal quality improvement and external applicability. However, the screening tool is used in the emergency department (ED) on every patient.

We agree that assessment of the test characteristics of the ED sepsis screening tool in relation to other screening tools such as the quick Sepsis-Related Organ Failure Assessment (q-SOFA) and systemic inflammatory response syndrome (SIRS) is needed [2]. Indeed, we in the process of determining the sensitivity, specificity and overall accuracy of our screening tool in a separate project that we hope to publish soon. However, the focus of this study was to determine the impact of the screening tool on compliance with the 3-hour sepsis bundle, which we felt was important for quality improvement.

In regards to the comment on the new 1-hour bundle, the present study was conducted between 2012 and 2015, so in practice relied on the guidelines and definitions that were endorsed at that time [3, 4]. Furthermore, our focus has been maximizing compliance with the CMS guidelines and definitions; even to date, CMS has not adopted the Sepsis-3 definitions or commented on the new 2018 1-hour bundle. Our study demonstrated that appropriate antimicrobials were initiated in a timelier manner and there was a trend towards decreased mortality. This study also identified elements our institution needs to improve on, such as appropriate fluid resuscitation. Delivering the highest quality patient care in sepsis has always been a top priority at our institution and these findings show that the sepsis screening tool has improved care for severe sepsis and septic shock patients in our ED.

Tanvi Shah\*

Ethan Sterk

Megan A. Rech

Department of Pharmacy (Shah, Rech), Department of Emergency Medicine (Sterk), Loyola University Medical Center, Maywood, IL, USA

\*Corresponding author at: Loyola University Medical Center, 2160 S. 1st Ave, Maywood, IL 60153, USA.

E-mail address: [tanvi.shah@lumc.edu](mailto:tanvi.shah@lumc.edu).

14 July 2018

<https://doi.org/10.1016/j.ajem.2018.07.037>

## References

- [1] Centers for Medicare and Medicaid Services. Sepsis Bundle Project (SEP) specifications manual for national hospital inpatient quality measures discharges 10-01-15 (4Q15) through 06-30-16 (2Q16). [Available at] [https://www.nhfca.org/psf/resources/Updates1/SEP-1%20Measure%20Information%20Form%20\(MIF\).pdf](https://www.nhfca.org/psf/resources/Updates1/SEP-1%20Measure%20Information%20Form%20(MIF).pdf); 2012.
- [2] Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA* 2016;315(8):801–10.

☆ Conflicts of interest: T Shah, MA Rech, E Sterk: no conflicts to disclose.

- [3] Levy MM, Evans LE, Rhodes A. The surviving sepsis campaign bundle: 2018 update. *Crit Care Med* 2018;46(6):997–1000.
- [4] Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016. *Crit Care Med* 2017;45(3):486–552.

### Will publishing evidence-based guidelines for low back pain imaging decrease imaging use?☆☆☆



Patients frequently present to the emergency department (ED) with low back pain (LBP). While few have emergent diseases, imaging utilization has increased [1], with wide practice variation [2]. The American College of Physicians (ACP) and American Pain Society (APS) developed guidelines for LBP imaging in 2007 [3] that were widely circulated. We aimed to quantify ED utilization of imaging for LBP before and after publication of the ACP/APS guideline. We also sought to determine the extent to which the imaging adhered to the recommendations in the ACP/APS guideline.

This Institutional Review Board-approved retrospective study was performed at a Level-1 trauma center ED in an urban academic medical center with approximately 60,000 annual visits. Eligible patients were aged 18–64 (as per the guideline) with an ED visit for LBP. We compared data from a 2-year period one year pre-guideline publication (calendar years 2005–2006) to a 2-year period 5 years after publication (calendar years 2013–2014). We used ICD-9 diagnosis codes to identify eligible patients from the electronic health record. The ACP/APS guideline criteria outline a series of appropriate indications for CT/MRI for LBP and these imaging indications were identified by CPT and ICD-9 procedure codes and diagnosis codes.

To verify the accuracy of the ICD-9 diagnoses, and to ensure that all relevant diagnoses were captured in the billing codes, 160 charts were randomly selected from the study cohort for manual review, and sensitivity and specificity were calculated. The unit of analysis was an ED visit for LBP. The primary outcome was the proportion of LBP visits that resulted in CT/MRI utilization, and the secondary outcomes were the proportion of LBP patients who had CT/MRI and did/did not have documented indications for imaging. Chi-square tests compared pre- and post-publication groups.

Chart review of ICD-9/CPT codes yielded sensitivity and specificity of 89% (143/160) and 96% (153/160) for capture of relevant documented diagnoses by the billing data. A total of 3221 ED visits for LBP were included in 2005–2006, with an average patient age of 40.4 years (38.3% female, Table 1). In 2013–2014, there were a total of 3766 ED visits for LBP, with an average patient age of 42.5 years (43.0% female). Overall use of imaging remained unchanged from 26.5% (855/3221) of LBP visits in 2005–2006 to 28.4% (1072/3766) of LBP visits in 2013–2014 ( $p = 0.17$ ). However, use of advanced imaging (CT and MRI) increased from 13.1% (421/3221) of LBP visits in 2005/2006 to 17.8% (673/3766) in 2013/2014 ( $p = 0.0001$ ).

Table 2 depicts overall imaging use, along with the proportion of patients who received imaging among those for whom documentation indicated that it was or was not indicated. The proportion of LBP patients

who did have documented indications for CT/MRI imaging and were imaged increased, from 17.4% of visits (167/960) to 27.6% (272/983) ( $p < 0.0001$ ); however, the proportion of LBP patients who did not have documented indications for CT/MRI imaging and were imaged also increased, from 11.2% (254/2261) to 14.4% (401/2783) ( $p = 0.003$ ).

Overall, use of CT and MRI for ED patients with LBP increased between 2005/2006 and 2013/2014, despite publication of multispecialty imaging appropriateness guidelines in the interim. These findings expand upon those of Schlemmer et al., who reported 30.1% of patients without imaging indications received imaging in 2011–2012 [4]. However, our analysis of a baseline period pre-guideline publication informs the understanding of whether the release of the guidelines correlated with a decrease in documented inappropriate imaging; it did not. This result is especially timely given recent emphasis on LBP imaging as a Priority Clinical Condition noted by the Centers for Medicare and Medicaid Services as a target for clinical decision support (CDS) mandated by the Protecting Access to Medicare Act (PL 113-93), beginning January 1, 2020.

We found an increase in advanced imaging of patients in whom imaging was indicated after guideline publication. This may have resulted from increased awareness of the indications for appropriate imaging, again potentially due to the guideline. While this increase in appropriate imaging is not concerning by itself, we also saw a similar increase in advanced imaging for patients who did not have indications for imaging.

These results suggest that publication of imaging appropriateness guidelines alone may, paradoxically, prompt increased imaging due to the identification of greater numbers of patients who have appropriate indications for imaging — and is also unlikely to decrease imaging in patients without indications. Prior work has demonstrated that CDS built on evidence-based guidelines, supplemented by provider practice pattern variation reporting, may help turn this tide [2,5]. Our results have significant implications for guideline developers, as publication should be seen as only the first step towards changing imaging ordering practices. To be most effective, guidelines may need to be converted into clinical logic statements consumable by CDS [6], embedded in provider workflow, and implemented as part of broader quality improvement initiatives.

Ali S. Raja, MD, MBA, MPH\*

Ivan K. Ip, MD, MPH

Laila Cochon, MD, PhD

Sarvenaz Pourjabbar, MD

Brian J. Yun, MD, MBA, MPH

Jeremiah D. Schuur, MD, MHS

Ramin Khorasani, MD, MPH

Center for Evidence-Based Imaging, Brigham and Women's Hospital, Brookline, MA 02445, USA

\*Corresponding author.

E-mail addresses: [asraja@partners.org](mailto:asraja@partners.org) (A.S. Raja),

[iip@partners.org](mailto:iip@partners.org) (I.K. Ip),

[lcochon@bwh.harvard.edu](mailto:lcochon@bwh.harvard.edu) (L. Cochon),

[sarvenaz.pourjabbar@yale.edu](mailto:sarvenaz.pourjabbar@yale.edu) (S. Pourjabbar),

[byun@partners.org](mailto:byun@partners.org) (B.J. Yun),

[jschuur@partners.org](mailto:jschuur@partners.org) (J.D. Schuur),

[rkhosani@bwh.harvard.edu](mailto:rkhosani@bwh.harvard.edu) (R. Khorasani),

<https://doi.org/10.1016/j.ajem.2018.07.039>

\* Financial support: National Institute of Biomedical Imaging and Bioengineering, 1UC4EB012952/EB.

☆☆ Presented: The (Lack of) Impact of Published Guidelines on Appropriate Imaging for Low Back Pain in the Emergency Department. RSNA (Radiological Society of North American) Scientific Assembly and Annual Meeting 2016. November 27–December 2. Chicago, IL.

## References

- [1] Friedman BW, Chilstrom M, Bijur PE, Gallagher EJ. Diagnostic testing and treatment of low back pain in United States emergency departments: a national perspective. *Spine* 2010 Nov 15;35(24):E1406–11.