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### 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.

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**Table 1**  
Patient demographics pre- (2005–2006) and post- (2013–2014) guideline publication

2005–2006				
	Received imaging n = 855		No imaging n = 2366	
	n	% (95% CI)	n	% (95% CI)
Female	345	40.4 (37–43.7)	890	37.7(35.7–39.6)
Age (mean [years] ± standard deviation [SD])	40.4 ± 10.8			
18–34	254	29.7 (26.7–32.9)	750	31.6 (29.8–33.6)
35–54	475	55.5 (52.2–58.9)	1402	59.2(57.2–61.2)
55–64	126	14.7 (12.4–17.3)	214	9.0 (8–10)
Potentially acute low back pain (LBP) event	591	69.1 (65.9–72.2)	1538	65.0 (63.0–66.9)
2013–2014				
	Received imaging n = 1072		No imaging n = 2694	
	n	% (95% CI)	n	% (95% CI)
Female	492	45.9 (42.9–48.9)	1129	41.9 (40.0–43.8)
Age (mean [years] ± standard deviation [SD])	42.4 ± 12.1			
18–34	281	26.2 (23.6–29.0)	899	33.4 (31.6–35.2)
35–54	523	48.7 (45.8–51.8)	1298	48.2 (46.3–50.1)
55–64	268	25.0 (22.4–27.7)	497	18.4 (17.0–20.0)
Potentially acute LBP event	741	69.1 (66.3–71.9)	1916	71.1 (69.4–72.8)

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**Table 2**  
Imaging utilization during pre- and post-guideline publication periods.

2005–2006						
	Total patients n = 3221		Indicated for imaging n = 960, 29.8% (28.2%–31.4%)		Not indicated for imaging n = 2261, 70.2% (68.6%–71.8%)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
ED visit characteristics						
Female	1235	38.3 (36.7–40.0)	374	38.9 (35.9–42.1)	861	38.0 (36.1–40.1)
Age (y)						
18–34	1004	31.2 (29.6–32.8)	202	21.0 (18.5–23.8)	802	35.5 (33.5–37.5)
35–54	1877	58.3 (56.5–60.0)	602	62.7 (59.6–65.8)	1275	56.4 (54.3–58.4)
55–64	340	10.6 (9.5–11.7)	156	16.3 (14.0–18.7)	184	8.1 (7.0–9.3)
Received imaging						
Yes – any imaging	855	26.5 (25.0–28.1)	337	35.1 (32.1–38.2)	518	22.9 (21.2–24.7)
Yes – advanced imaging	421	13.1 (11.9–14.3)	167	17.4(15.0–19.9)	254	11.2 (10.0–12.6)
LBP diagnosis history						
Acute	2129	66.1 (64.4–67.7)	438	45.6 (42.4–48.8)	1691	74.8(72.9–76.6)
Chronic	1092	33.9 (32.3–35.6)	522	54.4 (51.2–57.6)	570	25.2 (23.4–27.1)
2013–2014						
	Total patients n = 3766		Indicated for imaging n = 983, 26.1% (24.7%–27.5%)		Not indicated for imaging n = 2783, 73.9% (72.5%–75.3%)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
ED visit characteristics						
Female	1621	43.0 (41.5–44.6)	455	46.3 (43.1–49.5)	1166	41.9 (40.1–43.8)
Age (y)						
18–34	1180	31.3 (29.9–32.8)	188	19.1 (16.7–21.7)	992	35.6 (33.9–37.5)
35–54	1821	48.3 (46.7–50.0)	481	48.9 (45.8–52.1)	1340	48.1 (46.3–50.0)
55–64	765	20.3 (19.0–21.6)	314	31.9 (29.0–35.0)	451	16.2 (14.9–17.6)
Received imaging						
Yes – any imaging	1072	28.5 (27.0–29.9)	412	41.9 (38.8–45.1)	660	23.7 (22.1–25.3)
Yes – advanced imaging	673	17.8 (16.7–19.1)	272	27.6 (24.9–30.6)	401	14.4 (13.1–15.8)
LBP diagnosis history						
Acute	2657	70.5 (69.1–72.0)	454	46.2 (43.0–49.4)	2203	79.4 (77.6–80.7)
Chronic	1109	29.5 (28.0–30.9)	529	53.8 (50.6–57.0)	580	20.8 (19.3–22.4)