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RESEARCH BRIEFS

Physical Therapy or Advanced Imaging as First Management Strategy Following a New Consultation for Low Back Pain in Primary Care: Associations with Future Health Care Utilization and Charges

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Objective. Compare health care utilization and charges for low-back-pain (LBP) patients receiving advanced imaging or physical therapy as a first management strategy following a new primary care consultation.

Data Source. Electronic medical record (EMR) and insurance claims data.

Study Design. Retrospective analysis of propensity-matched groups.

Data Collection/Extraction. Claims and EMR data were used. Utilization and LBP-related charges over a 1-year period were extracted from claims data.

Principal Findings. In the propensity-matched sample (n = 406), advanced imaging recipients had higher odds of all utilization outcomes. Charges were higher with advanced imaging by an average $4,793 (95 percent CI: $3,676, $5,910).

Conclusions. For patients with LBP whom newly consulted primary care referred for additional management, advanced imaging as a first management was associated with higher health care utilization and charges than physical therapy.

Key Words. Physical therapy, low back pain, primary care, imaging

Low back pain (LBP) imposes a large socioeconomic burden on individuals and health care systems. Average annual direct costs per individual are estimated from $1,500 to $2,000 (Fritz et al. 2012; Martin et al. 2012), with total direct costs for LBP in the United States estimated at over $86 billion in 2005 (Martin et al. 2008). For individuals with LBP seeking health care, a common entry point is primary care (Sundararajan et al. 1998). One of every 17 primary care visits involves LBP (Licciardone 2008). Considering the prevalence

of LBP in primary care and its strategic position as the entry point, efforts to improve care increasingly focus on primary care decisions (Scott, Moga, and Harstall 2010; Slater et al. 2012).

A focus of efforts to reduce costs is advanced imaging, particularly magnetic resonance imaging (MRI), for uncomplicated LBP (Chou et al. 2011; Baker et al. 2013) due to high costs and increasing use (Deyo et al. 2009; Lehnert and Bree 2010; Hughes et al. 2011) despite no evidence of benefit to patients in the absence of specific indications (Chou et al. 2009). American College of Radiology guidelines recommend against imaging during the first 6 weeks for uncomplicated LBP with or without radiculopathy (Davis et al. 2009). Indications of complicated LBP that may require imaging include trauma, findings suggestive of neoplasm or infection, and rapidly progressing neurologic deficits (Davis et al. 2009; Chou et al. 2011). Common MRI findings can reduce patients' well-being (Modic et al. 2005) despite a lack of correlation with symptoms (Jensen et al. 1994; de Schepper et al. 2010). Concern about overuse of imaging is highlighted by inclusion in the "Choosing Wisely" campaign as a top five primary care activity for which change could lead to higher quality and better resource use (Group 2011).

There have been several published efforts to reduce inappropriate LBP imaging in primary care (Rosenthal et al. 2006; Curry and Reed 2011; Georgiou et al. 2011). Effectiveness of these efforts is impacted by several factors, including whether an alternative strategy is available (Roshanov et al. 2013). Patients have expectations around receiving something perceived as beneficial. Breaking an expectation by denying imaging may be unacceptable to patients or providers (Zusman 2013). Consumer research suggests offering an alternative to replace the broken expectation is important to patients (Santa 2013). Physical therapy has been used as an alternative management because it is often viewed as credible and meets patient and provider expectations (Blackmore, Mecklenburg, and Kaplan 2011; Srinivas, Deyo, and Berger 2012), but comparisons of these alternatives (advanced imaging or physical therapy) are lacking. Purposes of this study were to examine patients with a new primary care consultation for uncomplicated LBP who received advanced imaging or physical therapy as the first management strategy. We evaluated associations between the management

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received and health care utilization and LBP-related charges in the year following primary care consultation.

METHODS

Patients

We included patients with a new LBP consultation between January 1, 2004 and July 1, 2010, from four community-based primary care clinics seen by 21 different providers around Salt Lake City, Utah, operated by Intermountain Healthcare, a private, nonprofit, integrated health care system. The study was approved by the Institutional Review Board at Intermountain Healthcare. The sample was identified using claims data of SelectHealth, a nonprofit integrated subsidiary of Intermountain Healthcare. We identified patients with a primary care visit associated with a LBP-related ICD-9 code (719.55, 721.3, 722.1, 722.52, 722.73, 722.83, 722.93, 724.xx, 729.2, 737.3, 756.11, 756.12, 846.xx, 847.2, 847.3, 847.9, 922.31). Date of the primary care visit was defined as the index visit. Patients with any claim in the year preceding the index visit with a LBP-related code were excluded to identify new consulters. We excluded patients younger than age 18 on the index visit and those not continuously enrolled with SelectHealth for at least 1 year preceding and following the index visit.

We used the electronic medical record (EMR) for additional information by evaluating provider notes from the index visit, patient's problem list, and medication record. Sex, height, and weight at index visit, or the closest date, were extracted. We sought to include patients fitting the American College of Radiology definition of uncomplicated LBP (Davis et al. 2009); thus, we excluded patients presenting with concurrent diagnosis based on ICD-9 codes in claims data or EMR indicative of a complicating red-flag condition, including kidney stones, uterine fibroids, urinary tract infection, spinal fracture, infection, cauda equina, ankylosing spondylitis, or spinal neoplasm. We excluded patients pregnant at index visit or who delivered within the previous 4 weeks and those with a neurologic condition (stroke, quadriplegia, etc.) which could impact management decisions. We excluded patients who died or entered hospice within a year.

Covariates

We recorded covariates that may be associated with initial management and outcomes from ICD-9 codes in claims data or diagnoses in EMR within 1 year of the index visit, including osteoporosis (733.xx), mental health

condition (296.xx, 297.xx, 298.xx, 300.xx, 301.xx, 308.xx, 309.xx, 311.xx), neck pain (353.2, 721.0, 721.1, 722.0, 722.71, 722.81, 722.91, 723.xx, 847.0), diabetes (250.xx), and hypertension (401.xx) (Fritz et al. 2012, 2013). We noted previous lumbar surgery occurring greater than 1 year before the index visit. We categorized the LBP diagnosis as specific or nonspecific using ICD-9 codes at the index visit (nonspecific: 724.xx, 846.xx, 847.2, 847.3; specific: all others) (Cherkin et al. 1992). If both specific and nonspecific codes were used, we categorized the diagnosis as specific. We recorded index visit medications from claims and EMR data if received or prescribed within 14 days using the following categories: nonsteroidal anti-inflammatories, muscle relaxants, opioids, and corticosteroids.

Initial Care Received

We evaluated claims for the first 6 weeks (42 days) following the index visit to determine if advanced imaging (CT or MRI of pelvis, lumbar, or thoracic spine) or physical therapy was received, and which was used first if both occurred.

Outcome Variables

We evaluated a 1-year period following the index visit to record the following utilization outcomes related to a LBP ICD-9 code: (1) surgery (discectomy, laminectomy, fusion, or rhizotomy of the lumbosacral region); (2) spine surgeon specialist visit (office visit with orthopedic or neurosurgeon); (3) spine specialist visit (office visit with surgeon or nonsurgical specialists), fluoroscopically guided epidural injection of the lumbar spine or sacroiliac joint, or emergency department visit. Charges submitted by practices from claims associated with a LBP-related ICD-9 code during the year following the index visit were summed to compute total LBP-related charges.

Data Analysis

We compared baseline characteristics between patients receiving advanced imaging or physical therapy as first management using chi-square or *t*-tests. Because we anticipated important differences between these groups, we used a propensity score approach to manage the effects of confounding (Heinze and Jüni 2011). We generated the propensity score with a binary logistic regression predicting initial management (Rosenbaum and Rubin 1983). We

entered all baseline covariates including index visit year, primary care clinic, physician, and two-way interactions between these variables into the model, and developed the final model using backwards selection with a significance criteria of $p < .10$ (Austin, Grootendorst, and Anderson 2007). We used nearest neighbor matching with a caliper width of 0.2 of the pooled standard deviation of the logit of the propensity score to create matched pairs with similar characteristics (Austin 2011).

We evaluated percentages of patients within each management strategy with each utilization outcome over the year follow-up and computed odds ratios (OR) with 95 percent confidence intervals (CIs) using binary logistic regression. Total charges were reported for descriptive purposes as mean (95 percent CI) and median values. Comparisons based on initial management were made using a generalized linear model. A gamma distribution and log link function were used due to the skewness typical of cost data (Moran et al. 2007), while permitting parametric analytic methods with inferences about mean charges without requiring retransformation (Barber and Thompson 2004).

RESULTS

Exactly 3,355 patients with a new LBP-related primary care consultation were identified, of which 2,893 (86.2 percent) were included (Table 1). Reasons for exclusion are outlined (Figure 1). Among included patients, 841 (29.1 percent) received management outside primary care in the initial 6 weeks. First care received was advanced imaging ($n = 385$, 45.8 percent) or physical therapy ($n = 377$, 44.8 percent) in most cases. In the unmatched sample, patients receiving advanced imaging received the image a mean 9.2 days (SD = 9.2) after the index visit, and 112 (29.9 percent) eventually received physical therapy over the 1-year follow-up. Almost all imaging was an MRI ($n = 363$, 94.3 percent). Mean charges for the imaging were $1,306 (SD = $460). Patients receiving physical therapy began treatment a mean 8.4 days (SD = 8.7) after the index visit, receiving a mean 3.8 visits (SD = 3.0). Seventy-three (19.7 percent) eventually received advanced imaging. Mean physical therapy charges were $504 (SD = $441). There were no instances of beginning physical therapy and advanced imaging on the same date. Patients ($n = 79$) receiving management outside primary care in the initial 6 weeks (other than advanced imaging or physical therapy) received a physician specialist visit ($n = 63$, 7.5 percent) or other care (e.g., chiropractic, $n = 16$, 1.9 percent).

Table 1: Descriptive Characteristics for Unmatched and Propensity Score-Matched Samples of Patients

	Unmatched Sample			*Propensity Score-Matched Sample*		
	Advanced Imaging (n = 385)	*Physical Therapy (n = 377)*	*P**	*Advanced Imaging (n = 203)*	*Physical Therapy (n = 203)*	*P**
Age (mean, SD)	43.7 (12.2)	40.2 (12.2)	<.001	42.5 (12.2)	42.3 (12.5)	.91
Sex (female)	46.0%	54.1%	.025	51.2%	50.7%	.92
BMI (mean, SD)	30.0 (6.4)	29.4 (6.5)	.20	29.7 (6.8)	30.0 (6.8)	.63
Year of index visit (%)						
2004	16.6	19.9	.001	19.2	18.2	.94
2005	13.5	19.9		14.8	15.8	
2006	20.3	14.9		19.2	18.2	
2007	24.9	15.1		19.7	21.7	
2008	11.7	12.5		12.3	9.9	
2009	6.5	11.4		6.9	9.4	
2010	6.5	6.4		7.9	6.9	
Prior surgery (%)	6.8	1.9	.001	3.9	3.0	.59
Specific diagnosis	13.8	6.4	.001	13.3	8.9	.16
Diabetes comorbidity (%)	10.6	4.5	.001	8.4	7.9	.86
Hypertension comorbidity (%)	23.1	12.5	<.001	18.7	15.3	.36
Mental health comorbidity (%)	32.5	26.3	.060	35.5	29.6	.20
Osteoporosis comorbidity (%)	3.9	4.0	.95	4.9	5.4	.82
Neck pain comorbidity (%)	11.9	11.1	.73	12.3	10.8	.64
Nonsteroidal anti-inflammatory medication (%)	29.4	35.0	.094	36.0	29.6	.17
Muscle relaxant medication (%)	33.2	35.8	.46	35.5	37.4	.68
Opioid medication (%)	53.0	32.1	<.001	40.4	39.4	.84
Corticosteroid medication (%)	17.4	6.6	<.001	11.8	11.3	.88
Lumbar radiographs at initial visit (%)	24.9	24.1	.80	28.1	27.6	.91

*Significance values from chi-square or *t*-tests.
BMI, body mass index.

Baseline differences were identified indicating the advanced imaging group was older, more likely to be male, have more comorbidities, a specific LBP diagnosis, history of previous surgery, and have received opioid or corticosteroid medications at the index visit (Table 1). Propensity matching resulted in 203 pairs with no baseline differences (Table 1).

Odds of each utilization outcome were higher for patients who first received advanced imaging compared with physical therapy (Table 2). Odds ratios attenuated only slightly in the matched sample (Table 2). Mean total

1-year LBP-related charges in the unmatched sample were $6,193 (95 percent CI: $4,826, $7,560, median = $2,261) for advanced imaging and $1,467 (95 percent CI: $1,180, $1,755, median = $540) for physical therapy. Mean charges were similar in the matched sample (mean charges = $6,664 [95 percent CI: $5,589, $7,740] median = $2,415) for advanced imaging and $1,871 ([95 percent CI: $1,569, $2,173 $629] median = $629) for physical therapy (mean difference = $4,793 [95 percent CI: $3,676, $5,910]).

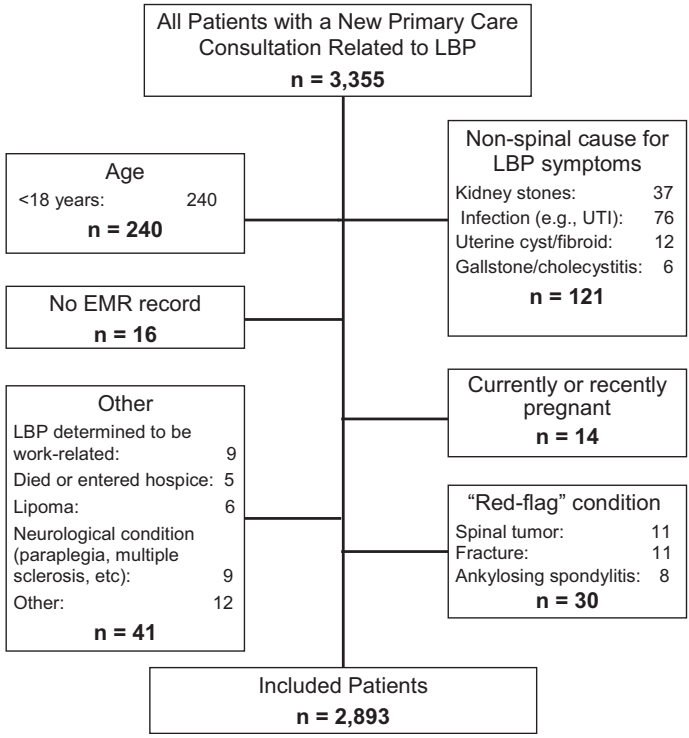
Discussion

This study found that if care beyond primary care was provided during the first 6 weeks after a new consultation for uncomplicated LBP, beginning with advanced imaging instead of physical therapy increased the odds of surgery, injections, specialist, and emergency department visits within a year. Propensity-matched comparisons shifted the odds minimally, indicating much of the difference between advanced imaging and physical therapy was attributable to factors other than patient characteristics. One-year LBP-related health care charges were about $4,700 higher with advanced imaging.

Our findings support studies reporting increased risk of additional health care when patients with uncomplicated LBP received an early MRI (Webster and Cifuentes 2010; Graves et al. 2012). It is unlikely these findings only indicate those receiving an early MRI have a more severe condition. For example, a randomized trial comparing early MRI to radiographs also found increased rates of injections and surgery in the MRI group (Jarvik et al. 2003). These results support our finding that patient characteristics do not fully explain the increased risk for future health care utilization with early advanced imaging. Labeling effects may offer a partial explanation. Advanced imaging often "labels" a patient's LBP that might otherwise be viewed as nonspecific and uncomplicated, causing heightened concern in some patients and providers and motivating additional care-seeking (Kendrick et al. 2001; Modic et al. 2005).

Reasons for early advanced imaging in patients with uncomplicated LBP, in contradiction to guidelines, are likely multifactorial. Patients' level of insistence on pursuing imaging cannot be determined. Although the insurance benefit design did not require our sample to obtain advanced imaging prior to specialist referral, individual specialists may have this requirement. Financial interest in imaging services can motivate utilization (Paxton et al. 2012). Some cases in our sample may have had indications consistent with guidelines for

Figure 1: Study Sample and Reasons for Exclusion



early imaging, such as rapidly progressing neurologic loss. Regardless of motivation, our findings support others in recognizing the early use of advanced imaging increases patients' risk of exposure to more costly, invasive procedures.

We compared early advanced imaging with an alternative of physical therapy. Both unadjusted and adjusted comparisons found early physical therapy was associated with decreased risk of all utilization outcomes and lower LBP-related charges over 1 year. These findings are consistent with other observational studies reporting reduced risk of subsequent health care utilization and lower costs for patients receiving physical therapy within 2–4 weeks of a new primary care consultation, compared to delayed physical therapy (Fritz et al. 2012; Gellhorn et al. 2012). Physical therapy may avoid the negative consequences of a labeling effect from imaging. When evidence-based, physical therapy should provide patients with an active approach to LBP,

Table 2: Health Care Utilization Outcomes within One year Following the Index Primary Care Visit in the Matched and Unmatched Samples

	Unmatched Sample			*Propensity Score-Matched Sample*		
	Advanced Imaging (n = 385)	*Physical Therapy (n = 377)*	*OR (95% CI)*	*Advanced Imaging (n = 203)*	*Physical Therapy (n = 203)*	*OR (95% CI)*
Surgery	12.7	2.1	6.73 (3.14, 14.41)	14.3	3.0	5.47 (2.22, 13.49)
Injections	36.6	9.3	5.65 (3.77, 8.47)	34.0	12.3	3.67 (2.20, 6.10)
Spine surgeon specialist visit	30.1	5.8	6.96 (4.30, 11.27)	28.1	8.9	4.01 (2.26, 7.11)
Any spine specialist visit	56.6	16.4	6.63 (4.73, 9.31)	53.7	20.2	4.58 (2.95, 7.11)
Emergency department visit	4.7	1.3	3.65 (1.34, 9.93)	5.4	1.5	3.82 (1.05, 13.90)

CI, confidence interval; OR, odds ratio indicating odds of outcome given an initial management strategy of advanced imaging relative to physical therapy.

enhancing patients' perceived ability to self-manage their condition (Breese and French 2012). Evidence indicates that when physical therapy is adherent to guidelines, it can be effective in reducing additional care-seeking; however, variability in the delivery of evidence-based care is evident (Fritz et al. 2012; Gellhorn et al. 2012).

The goal of preventing patients with LBP from progressing to invasive and costly procedures has increased focus on initial primary care decisions. Early decisions appear to have important implications for the subsequent course of care (Webster, Verma, and Gatchel 2007; Webster and Cifuentes 2010; Fritz et al. 2012, 2013; Graves et al. 2012, 2014; Webster et al. 2013, 2014). Many patients approach an initial consultation with expectations for aggressive actions that may include imaging (Kendrick et al. 2001; Hoffman et al. 2013). Dismissing this expectation can result in dissatisfaction (Staiger et al. 2005), prompting the need for an alternative (Srinivas, Deyo, and Berger 2012). Some pathways recommend physical therapy (Blackmore, Mecklenburg, and Kaplan 2011; Flynn, Smith, and Chou 2011). Our results support physical therapy as an alternative to advanced imaging for patients or providers with expectations for additional care. The question of which patients should receive care beyond the primary care setting remains an important consideration for future research. Our results indicate that if additional care is sought, physical therapy may be the preferred initial step instead of advanced imaging.

Our results should be considered in light of several limitations. We could not assess all possible confounders. Potentially important variables such as pain intensity or symptom duration were not attainable. We could not measure indirect costs, which are substantial for LBP (Dagenais, Caro, and Haldeman 2008). We did not have patient-centered outcomes including function or satisfaction. We could not evaluate management with complimentary or alternative providers (e.g., chiropractic, massage, etc.) that may have occurred but was not represented in claims data. The question of which patients need care beyond primary care was not addressed. In our sample about 70 percent of patients did not receive care beyond primary care in the first 6 weeks. Our sample included a single health care system and cannot reflect geographic variability in spine care.

In conclusion, this study found patients newly consulting primary care for uncomplicated LBP who received care beyond primary care had lower risk for future health care and lower charges if they started with physical therapy compared to advanced imaging. Initial management with advanced imaging was associated with increased risk of subsequent utilization and higher LBP-related charges in the year following primary care consultation in analyses using propensity matching to control confounding. These findings support care models recommending physical therapy instead of advanced imaging for initial management of patients with uncomplicated LBP who want or need care beyond the primary care setting.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.