Worsening Trends in the Management and Treatment of Back Pain

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**IMPORTANCE** Back pain treatment is costly and frequently includes overuse of treatments that are unsupported by clinical guidelines. Few studies have evaluated recent national trends in guideline adherence of spine-related care.

**OBJECTIVE** To characterize the treatment of back pain from January 1, 1999, through December 26, 2010.

**DESIGN, SETTING, AND PATIENTS** Using nationally representative data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey, we studied outpatient visits with a chief symptom and/or primary diagnosis of back or neck pain, as well as those with secondary symptoms and diagnoses of back or neck pain. We excluded visits with concomitant “red flags,” including fever, neurologic symptoms, or cancer. Results were analyzed using logistic regression adjusted for patient and health care professional characteristics and weighted to reflect national estimates. We also present adjusted results stratified by symptom duration and whether the health care professional was the primary care physician (PCP).

**MAIN OUTCOMES AND MEASURES** We assessed imaging, narcotics, and referrals to physicians (guideline discordant indicators). In addition, we evaluated use of nonsteroidal anti-inflammatory drugs or acetaminophen and referrals to physical therapy (guideline concordant indicators).

**RESULTS** We identified 23,918 visits for spine problems, representing an estimated 440 million visits. Approximately 58% of patients were female. Mean age increased from 49 to 53 years (P < .001) during the study period. Nonsteroidal anti-inflammatory drug or acetaminophen use per visit decreased from 36.9% in 1999-2000 to 24.5% in 2009-2010 (unadjusted P < .001). In contrast, narcotic use increased from 19.3% to 29.1% (P < .001). Although physical therapy referrals remained unchanged at approximately 20%, physician referrals increased from 6.8% to 14.0% (P < .001). The number of radiographs remained stable at approximately 17%, whereas the number of computed tomograms or magnetic resonance images increased from 7.2% to 11.3% during the study period (P < .001). These trends were similar after stratifying by short-term vs long-term presentations, visits to PCPs vs non-PCPs, and adjustment for age, sex, race/ethnicity, PCP status, symptom duration, region, and metropolitan location.

**CONCLUSIONS AND RELEVANCE** Despite numerous published clinical guidelines, management of back pain has relied increasingly on guideline discordant care. Improvements in the management of spine-related disease represent an area of potential cost savings for the health care system with the potential for improving the quality of care.
Spinal symptoms are among the most common reasons for visiting a physician and significantly contribute to health care expenditures. More than 10% of visits to primary care physicians (PCPs) relate to back or neck pain (hereafter referred to as back pain), representing the fifth most common reason for all physician visits and accounting for approximately $86 billion in health care spending annually.\textsuperscript{1-3} Indirect costs related to lost productivity amount to an additional $20 billion per year, which likely is an underestimate because the prevalence of chronic back pain may be increasing.\textsuperscript{3-5} Moreover, spending for these conditions has increased more rapidly than overall health expenditures from 1997 to 2005.\textsuperscript{6}

Well-established guidelines for routine back pain stress conservative management, including use of nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen and physical therapy, but avoiding early imaging or other aggressive treatments, except in rare cases, such as acute neurologic compromise or other “red flags,” including a history of malignant neoplasms. In the absence of these features, routine back pain will usually improve with such conservative treatments within 3 months.\textsuperscript{7-9} Prior research among patients with back pain revealed significant increases in the use of computed tomography (CT) or magnetic resonance imaging (MRI), outpatient surgical procedures, and narcotic prescriptions, but many of these studies are more than a decade old, are limited to specific populations (eg, Medicare recipients), or study different measures, such as operations or hospitalizations.\textsuperscript{6,10-15}

In this context, we used nationally representative data on outpatient visits to physicians to evaluate trends in use of diagnostic imaging, physical therapy, referrals to other physicians, and use of medications during the 12-year period from January 1, 1999, through December 26, 2010. We hypothesized that with the additional guidelines released during this period,\textsuperscript{8,16-21} use of recommended treatments would increase and use of nonrecommended treatments would decrease.

**Methods**

**Data Sources**

We used nationally representative data on visits to physicians available from the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) for 1999-2010. These surveys are designed to be combined to represent outpatient care in the United States.\textsuperscript{22} The NAMCS comprises a probability sample of outpatient visits to nonfederal, office-based physician practices. Designed in parallel, the NHAMCS consists of outpatient visits to hospital-based ambulatory departments, including outpatient clinics, and visits to emergency departments. The NAMCS and NHAMCS share common design and survey variables and patient visit weights and when analyzed together reflect national estimates.\textsuperscript{23} Further documentation of survey methods are available at the National Center for Health Statistics (NCHS) website.\textsuperscript{24}

**Data Collection Procedures**

Both the NAMCS and NHAMCS use a multistage probability sample design to obtain nationally representative samples of ambulatory patient visits in the United States.\textsuperscript{22} In the first stage of sampling, 112 primary sampling units were selected from among those used in the National Health Interview Survey. For the second stage, physician practices or hospitals were selected from within these primary sampling units. Finally, in the last stage, physicians or clinics sampled a subset of visits in their practices during a predefined period. This design enables calculation of national-level estimates and associated SEs using survey weights provided by the NCHS.\textsuperscript{24}

Data are collected using a standardized form completed during each patient visit. Both the NAMCS and NHAMCS include data on the patient’s primary reason for visit (eg, chief symptom), 2 other nonprimary reasons for visit, up to 3 diagnoses derived from the International Classification of Diseases, Clinical Modification, Ninth Revision (ICD-9-CM), expected payer for the visit (eg, Medicare or commercial insurance), various patient demographic characteristics, and medications listed during the visit.

**Study Sample**

To identify visits for spine-related conditions, we selected outpatient visits (excluding emergency department visits) with a chief symptom and/or a primary diagnosis of back or neck pain, as well as those with secondary symptoms and diagnoses of back or neck pain but unrelated primary reasons for the visit (eg, hypertension). We used reason for visit codes from both the NAMCS and NHAMCS to identify visits with a chief or secondary symptom of back pain (eAppendix, eTable 1, and eTable 2 in the Supplement).

In the subset of visits with a chief symptom of back or neck pain (>50% of visits in our sample), the NAMCS and NHAMCS provide the duration or context of symptoms in 5 categories: (1) new onset (<3 months’ duration), (2) acute on chronic flare-up, (3) chronic routine, (4) routine or preventive care visit, and (5) preoperative or postoperative visit. This variable was missing 1.3% of the time. We defined acute visits by combining those with new-onset symptoms with those with acute on chronic flare-up. We then compared the acute group with those with chronic routine symptoms. Our results were not substantially different when the acute on chronic flare-up category was categorized as chronic.

We excluded visits with concomitant “red-flag” diagnoses or symptoms, including fever, weight loss, cachexia, neurologic symptoms, cancer, spinal fracture, myelopathy, or postlaminectomy syndrome, that might be indicative of something other than routine musculoskeletal back pain.\textsuperscript{25-27} As a sensitivity analysis, we also excluded visits with a coexistent diagnosis with similar treatment options (eg, knee pain and spasm of muscle) and those with concomitant trauma, fracture, various abdominal, musculoskeletal, neurologic, pulmonary, and infectious diagnoses. When including these visits, however, the results were similar (eTable 3 in the Supplement), so we included these visits in our final analyses.
Main Outcomes Measures
We focused on 3 types of measures: (1) referrals for physical therapy or to other physicians; (2) use of imaging, including both CT or MRI and plain radiography (eTable 4 in the Supplement); and (3) use of medications, including NSAIDs (eg, cyclooxygenase-2 inhibitors) and acetaminophen (NSAIDs or acetaminophen both prescription and over the counter), narcotics, tramadol, benzodiazepines and muscle relaxants (eg, cyclobenzaprine hydrochloride), and agents to treat neuropathic pain (eg, gabapentin). We considered NSAIDs or acetaminophen use as guideline discordant and considered narcotic prescriptions as guideline discordant.22 Before 2003, the NAMCS and NHAMCS only collected data on up to 6 drugs; therefore, to maintain consistency over time, we limited analysis of all years to the first 6 drugs listed.

We considered referrals for physical therapy to be concordant with current guidelines, but referrals to other physicians, presumably for consideration of treatments such as injections or surgery, to be discordant with current guidelines. We also considered use of imaging studies for routine back pain to be discordant with clinical guidelines. Although the American College of Physicians guidelines were published in 2007, clinical guideline recommendations have remained generally consistent across specialties and around the world since the 1990s (eTable 8 and eTable 9 in the Supplement).28-29 Moreover, although some visits classified as guideline discordant might in fact be appropriate if additional clinical data (eg, neurologic examination) were available, our focus is less on the proportion of guideline adherent treatments and more on trends over time. We have no reason to suspect that the proportion of visits with indications for various procedures or treatments would have changed over time.

Finally, using logistic regression pooled across the entire study sample and including a control variable for year, we evaluated factors independently associated with ordering CT or MRI studies, narcotic medication use, and referring to another physician—the 3 outcomes we thought were most important.

Stratified Analyses
To evaluate the degree to which symptom duration affected our results, we analyzed the subset of visits with a chief symptom of back pain after stratifying by acute vs chronic presentations as defined above.

We also stratified our analyses of the full sample based on whether the health care professional identified himself or herself as the patient’s PCP. We also assessed interactions between visit year and symptom duration and visit year and PCP status. In addition, we stratified results by data from the NAMCS vs NHAMCS (eTable 10 in the Supplement). Finally, because comorbid conditions were not collected until 2005, we examined trends in the 14 comorbid conditions collected in 2005-2010 using χ² tests.

Statistical Analysis
We assessed unadjusted trends using bivariable logistic or linear regression when appropriate and evaluated categorical variables using χ² tests. For each outcome measure, we report proportions of use for each interval after pooling the survey data into six 2-year intervals as recommended by the NCHS (1999-2000, 2001-2002, 2003-2004, 2005-2006, 2007-2008, and 2009-2010). For adjusted and stratified analyses, we estimated logistic regression models for each outcome of interest, focusing on a linear trend for each 2-year interval and adjusting for age, sex, race/ethnicity, insurance status, whether the health care professional was the PCP, location in a metropolitan area, region, and the duration of symptoms when available (because physician specialty information was only available in the NAMCS, this variable was not included in our models; however, sensitivity analyses in the NAMCS subset revealed that the presence of specialty variables did not alter our results). Race/ethnicity was defined by the health care professionals completing the survey instruments. We divided race into 3 categories: white, black, and other, which includes persons of Asian, Native Hawaiian, Pacific Islander, American Indian, or multiple races. We then recategorized patients of any race who were identified as Hispanic to create a single 4-level race/ethnicity variable.

All analyses were performed using SAS-callable SUDAAN, version 10.0 (RTI International) to account for the complex survey sample design. As noted above, we followed the NCHS recommendations for combining the NAMCS and NHAMCS data sets.21 The Harvard Medical School Committee on Human Studies determined that this study was exempt from review.

Results
We identified 23,918 visits related to back pain, representing an estimated 440 million visits during the 12-year period or a mean of 73 million visits biennially. The number of patient visits related to back pain increased during the period from 3,350 visits in 1999-2000 (representing 61 million visits or 3.1% of all visits) to 4,078 visits during 2009-2010 (representing 87 million visits or 3.5% of all visits). Table 1 summarizes trends in visit characteristics among patients presenting with back pain (eTable 5 in the Supplement provides year-by-year trends). Mean age increased from 49 to 53 years (P < .001), whereas the proportion of females remained stable at approximately 58%. A total of 17.0% of visits were from Medicare enrollees in 1999-2000 compared with 28.4% in 2009-2010 (P = .01). Among those with a chief symptom of back pain (51.8% of the sample), the proportion with acute or new-onset symptoms decreased from 63.7% in 1999-2000 to 58.6% in 2009-2010, whereas those with long-term symptoms increased from 29.7% to 37.1% during the same period (P < .001). Comorbidities did not significantly change with the exception of asthma, which increased from 3.6% in 2005-2006 to 6.5% in 2009-2010 (P < .001, eTable 6 in the Supplement).

Unadjusted Trends in Use
Medications
Use of NSAIDs or acetaminophen decreased from 36.9% in 1999-2000 to 24.5% in 2009-2010 (P < .001, Table 2). In contrast, use of narcotics increased from 19.3% to 29.1% during the same period (P < .001 for trend). Use of muscle relaxants and...
Benzodiazepines increased from 19.6% in 1999-2000 to 23.7% in 2009-2010 ($P < .001$), and use of neuropathic agents more than doubled, from 3.4% to 7.9%, during the same period ($P < .001$).

**Referrals and Imaging**

Referrals to physical therapy remained unchanged at approximately 20.0% across the study period, but referrals to other physicians increased from 6.8% in 1999-2000 to 14.0% in 2009-2010 ($P < .001$). There was no observed change in the use of plain radiographs (approximately 17.0% across the study period), but use of MRI or CT increased from 7.2% in 1999-2000 to 11.3% in 2009-2010 ($P < .001$).

**Adjusted and Stratified Trends in Use**

After adjustment, trends in use did not differ substantively from the unadjusted findings. The Figure shows adjusted proportions of referrals to physical therapy, referrals to physicians, and narcotic and NSAID or acetaminophen use over time. Stratified analyses of visits with a chief symptom of back pain comparing visits with acute vs chronic pain revealed similar trends for the 2 groups during the study period (Table 3). Among patients with chronic symptoms, however, referrals to other physicians increased more rapidly when compared with those with acute symptoms ($P = .01$ for interaction with time), with referrals to physicians increasing from 3.0% to 13.4% for chronic symptoms and from 6.7% to 10.5% for those with acute symptoms during the study period ($P < .001$ and $P = .07$ for trend, respectively). Although changes in referrals to other physicians among patients with acute symptoms and CT or MRI use among patients with chronic symptoms did not achieve statistical significance, use of these indicators also increased over time for both groups.
Comparing visits to PCPs and non-PCPs also revealed similar trends, albeit with a few exceptions (Table 4). Among non-PCPs, CT or MRI use increased somewhat more rapidly when compared with visits to PCPs, increasing from 4.9% to 6.6% among PCPs \( (P = .02) \) vs 9.5% to 14.3% for non-PCPs \( (P = .002) \) throughout the study period; however, interactions with time were nonsignificant. Finally, NSAID or acetaminophen use decreased by almost half among PCPs \( (P < .001 \) for trend) and remained flat among non-PCPs \( (P = .47 \) for trend), and this difference was statistically significant \( (P = .01) \).

**Correlates of Use**

eTable 7 in the Supplement presents the results of multivariable logistic regression models estimating use of CT or MRI studies, referrals to physicians, and narcotic prescriptions with visits pooled for the entire period. Patients of black, Hispanic, and other race/ethnicity had lower odds ratios (ORs) for receiving narcotic medications (OR, 0.77; 95% CI, 0.65-0.92; OR, 0.51; 95% CI, 0.40-0.65; and OR, 0.60; 95% CI, 0.39-0.95; respectively), as did female patients (OR, 0.86; 95% CI, 0.77-0.96). Uninsured patients had a lower OR for being referred to other physicians (OR, 0.74; 95% CI, 0.57-0.97). A subanalysis of specialists revealed that neurologists and orthopedic surgeons had a higher OR for ordering CT and MRI (OR, 3.57; 95% CI, 2.60-4.90). Finally, health care professionals in the Southern and Western United States had greater ORs for prescribing narcotic medications (OR, 1.56; 95% CI, 1.21-2.02; and OR, 1.57; 95% CI, 1.22-2.03; respectively).

**Discussion**

In this nationally representative study of treatment patterns for patients presenting to physicians with back pain during the...
last decade, we observed several notable findings. First, we observed a significant increase in the frequency of treatments that are considered discordant with current guidelines, including use of advanced imaging (ie, CT or MRI), referrals to other physicians (presumably for procedures or surgery), and use of narcotics. Second, we also observed a decrease in use of first-line medications, such as NSAIDs or acetaminophen, but no change in referrals to physical therapy. Third, although opi-
ate prescriptions increased markedly during this period, we also observed lower odds of receiving narcotics among female, black, Hispanic, and other race/ethnicity patients, which may signify potential disparities in pain management that have also been noted previously.30

The 106% increase in referrals to other physicians is a previously unrecognized and important finding because such referrals likely contributed to the recent increase in costly, morbid, and often ineffective outpatient spine operations observed in other studies.30-34 Recent meta-analyses and research35,36 of lumbar fusion surgery have not revealed improvement in patient outcomes and demonstrate that these procedures lead to significant adverse consequences, including 5.6% with life-threatening complications and 0.4% mortality. Further, when comparing visits with the patient’s self-identified PCP vs those with another health care professional, we found that non-PCPs were much more likely to order advanced imaging. Presumably, this group includes those who perform procedures such as spinal surgery. Thus, these referrals from PCPs are likely to result in substantial downstream use that is discordant with current guidelines.

We also found a 50.6% decrease in first-line NSAID or acetaminophen use accompanied by a 50.8% increase in narcotic prescriptions, including a near doubling among patients presenting with chronic back pain. These results are unexplained by a change in the frequency of short-term vs long-term presentations or the extent to which patients were seen by their PCP vs another physician because similar trends were

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Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging; NSAIDs, nonsteroidal anti-inflammatory drugs; PCP, primary care physician.

* Logistic regression models adjusted for age, sex, race, region, insurance type, visit year, duration of symptoms or context of visit (eg, acute or new onset or chronic presentation), and whether the visit was located in a metropolitan area.

b Interaction with time was significant (\( P = .01 \)).
observed for each of these groups in our stratified analyses. Although some of the decrease in NSAID use might have been due to the decrease in use of cyclooxygenase-2 inhibitors, the marked decrease in use of first-line therapies accompanied by the rapid increase in narcotic prescriptions raises significant concerns. A recent meta-analysis revealed that narcotics provide little to no benefit in acute back pain, they have no proved efficacy in chronic back pain, and 43% of patients have concurrent substance abuse disorders, with aberrant medication-taking disorders as high as 24% of cases of chronic back pain. Although we lack adequate data to make firm recommendations on narcotic medications, which may be indicated in certain circumstances, such increases in narcotic prescriptions may be contributing to a current crisis in public health: the rapid increase in narcotic overdose deaths parallels a reported 300% increase in the US sales of prescription narcotics since the 1990s. In 2008, overdoses in narcotic analgesics led to an estimated 14,800 deaths—more than cocaine and heroin combined.

Our findings also confirm an inappropriate increase in advanced diagnostic imaging that has been seen previously, with use of CT or MRI increasing by 56.9% in our study sample. Six randomized controlled trials have found that imaging in the acute care setting provides neither clinical nor psychological benefit to patients with routine back pain, and multiple prospective studies have found the lack of serious disease in the absence of red-flag symptoms. In addition to being of low value, the overuse of diagnostic imaging leads to more exposure to ionizing radiation. In 2007, a projected 1200 additional future cancers were created by the 2.2 million lumbar CTs performed in the United States. Finally, the significant increase in spine operations seen during the last decade is almost certainly related to the overuse of imaging. One study revealed that early MRI for acute back pain was associated with an 8-fold increased risk of surgery, whereas another found that regions with more MRIs perform more operations, with 22% of the variability in spine surgery rates explained by rates of spine MRI use—more than twice the predictive power of patient characteristics.

Our study is subject to several limitations. Although we lacked complete data on the duration of symptoms, we presented stratified results for short-term vs long-term presentations that showed similar trends. Moreover, these visits comprised more than half of our sample. In addition, because the NAMCS and NHAMCS are visit-level data sets, we lacked longitudinal data on treated patients. Consequently, we could not measure treatment patterns over time for individual patients. Because these visit-level data are collected in the same way each year, however, trends over time are likely to be reflective of changes in practice patterns and not changes in the patient population presenting for treatment. A lack of major changes in most of our own population characteristics also supports this assessment, and those factors that did change (e.g., age and insurance status) were accounted for in our model. Furthermore, our analyses control for important potential confounders that might have changed over time, such as the proportion of visits for short-term vs long-term presentations and whether the visit was with a self-identified PCP. Finally, because comorbidity data were not collected until 2005, we could not use comorbidities in our adjusted analyses. However, our evaluation of trends in the 14 comorbid chronic conditions (including arthritis and depression) in our sample revealed significant increases only for asthma, which had very low prevalence rates that were unlikely to alter our results.

Despite numerous published national guidelines, management of routine back pain increasingly has relied on advanced diagnostic imaging, referrals to other physicians, and use of narcotics, with a concomitant decrease in NSAID or acetaminophen use and no change in physical therapy referrals. With health care costs soaring, improvements in the management of back pain represent an area of potential cost savings for the health care system while also improving the quality of care.

REFERENCES


