RESEARCH LETTERS

HEALTH CARE REFORM

Variation in Head Computed Tomography Use for Emergency Department Trauma Patients and Physician Risk Tolerance

Physician risk intolerance and malpractice fear have been implicated as leading to defensive behaviors and increased use of health care resources.[1] In the emergency department (ED), physician risk aversion has been associated with higher rates of testing and hospitalization for low-risk patients with chest pain,[2,3] greater use of diagnostic imaging for patients with abdominal pain,[4] and an increased likelihood of performing head computed tomography (CT) in scenarios involving pediatric patients with minor head injury.[5]

In this study, we explore predictors of head CT use for ED trauma patients, including assessing the impact of physician risk intolerance and malpractice fear. Patients with trauma were chosen because (1) the most common indication for head CT in the ED is trauma,[6] (2) head CT can definitively exclude life-threatening injuries, and (3) missed diagnoses can have dire consequences for both patients and physicians. Furthermore, because emergency physicians overestimate the likelihood of clinically significant findings on head CT and the medicolegal risk of not obtaining diagnostic imaging,[7] head CT use may be associated with defensive practice. We hypothesized that variation exists in head CT use and is predicted by physician risk intolerance and malpractice fear.

Methods. This prospective study included a physician survey and review of administrative data at an urban academic level 1 trauma center with 60 000 annual visits. We first surveyed attending emergency physicians to quantify their risk tolerance and malpractice fear using 3 previously validated risk scales: the Risk Taking Scale (RTS), Stress from Uncertainty Scale (SUS), and Malpractice Fear Scale (MFS).[2-4] Physician demographic characteristics, including age, sex, years in practice, clinical hours worked, 3- or 4-year residency training, and prior lawsuit involvement, were also captured. We reviewed all patient visits to the ED during calendar year 2009. Visits were eligible for inclusion if they included patients 16 years or older and their medical charts included *International Classification of Diseases, Ninth Revision, Clinical Modification* codes for either "head trauma" or "trauma." For each patient encounter we recorded patient age, sex, triage acuity as measured by the Emergency Severity Index, time of day at presentation, and emergency attending physician of record. The primary outcome was whether head CT was performed during the ED visit. All statistical analyses were performed using JMP software (version 8.0.2; SAS Institute Inc, Cary, North Carolina). A multivariate logistic regression model was used to assess the impact of patient and physician factors on use of head CT.

Results. Thirty-seven of 39 physicians (95%) completed the survey. Physician risk tolerance scores were reasonably normally distributed and differed significantly among ED physicians for each of the RTS, SUS, and MFS scales (analysis of variance; $P<.001$). A total of 55 281 patient encounters during the study period were reviewed; of these, 7905 patient encounters were eligible for inclusion, including 329 with a diagnosis of "head trauma" and 7576 with a diagnosis of "trauma." A head CT was performed in 1145 of these encounters (14.5%), yielding a median of 28.5 head CT scans performed per ED physician. There was wide variation in head CT use by physician, ranging from 7.2% to 24.5% of patient encounters, with a single outlier of 41.7%.

Head CT use was associated with increasing patient age ($P<.001$), male sex ($P=.001$), higher triage acuity ($P<.001$), and time of presentation (overnight greater than evening or day) ($P<.008$) (**Table**). Physician demographic char-

Table. Predictors of Head Computed Tomography Use From Multivariate Logistic Regression

Variable	Odds Ratio[a]	*P* Value[b]
Patient Factors		
Age, y		
16-34	1 [Reference]	<.001
35-49	1.39	
50-64	1.98	
65-79	2.96	
≥80	6.06	
Sex		
Male	1.28	.001
Female	1 [Reference]	
Triage acuity, Emergency Severity Index		
1	210.02	<.001
2	104.0	
3	28.27	
4	3.90	
5	1 [Reference]	
Time of presentation		
Morning	1 [Reference]	.008
Afternoon/evening	1.11	
Overnight	1.48	
Physician demographic factors		
Age	2.26	.15
Sex		
Male	0.82	.06
Female	1 [Reference]	
Residency training		
4-y program	1.03	.82
3-y program	1 [Reference]	
Years in practice	0.55	.34
Clinical hours worked	1.05	.80
Prior lawsuit involvement		
Yes	0.97	.78
No	1 [Reference]	
Physician risk tolerance		
Risk Taking Scale	1.21	.32
Stress from Uncertainty Scale	0.72	.30
Malpractice Fear Scale	0.80	.26

[a] For continuous variables, the odds ratio is expressed as per change in the variable over the entire range.
[b] *P* value calculated from effect likelihood ratio test.

©2012 American Medical Association. All rights reserved.

Downloaded From: http://archinte.jamanetwork.com/ on 02/12/2016

acteristics and risk taking ($P = .32$), stress from uncertainty ($P = .30$), and malpractice fear ($P = .26$) were not predictive of head CT use. Even after controlling for the patient factors, physician identity was still strongly associated with head CT use ($P < .001$), suggesting that significant variation in head CT use exists among physicians.

Comment. We found significant variation in head CT use for ED trauma patients that was not explained by patient factors and was not associated with physician risk tolerance or malpractice fear. Variation in head CT use by ED physicians has been demonstrated previously,[8,9] but not specifically for ED trauma patients. Because well-validated decision rules are available to guide imaging for patients with mild traumatic brain injury, this suggests that an opportunity for quality improvement exists.

The lack of association between physician risk tolerance and head CT use contrasts with prior findings of physician risk aversion being associated with increased use of diagnostic imaging and health care resources.[3-5,7] One reason for this discrepancy may be the shared decision making involved in the care of ED patients at our academic center, which, at a minimum, includes either a resident physician or physician assistant in addition to the attending physician. For patients with trauma team activation, the surgical trauma service and possibly other consulting services may be involved. Because this study measured only the risk tolerance of ED attending physicians, its impact on use may have been diluted by the influence of other decision makers. Initiatives to reduce variation and inappropriate imaging for ED trauma patients should consider all decision makers involved in patient care and might ultimately require institution-level support for clinical decision rules or appropriateness measures.

James E. Andruchow, MD, MSc
Ali S. Raja, MD, MBA, MPH
Luciano M. Prevedello, MD, MPH
Richard D. Zane, MD
Ramin Khorasani, MD, MPH

Published Online: March 26, 2012. doi:10.1001/archinternmed.2011.2243
Author Affiliations: Center for Evidence-Based Imaging (Drs Andruchow, Raja, Prevedello, Zane, and Khorasani) and Departments of Radiology (Drs Prevedello and Khorasani) and Emergency Medicine (Drs Andruchow, Raja, and Zane), Brigham and Women's Hospital, and Harvard Medical School (Drs Andruchow, Raja, Prevedello, Zane, and Khorasani), Boston, Massachusetts.
Correspondence: Dr Andruchow, Brigham and Women's Hospital Center for Evidence-Based Imaging, 20 Kent St, Second Floor, Brookline, MA 02445 (jandruchow@partners.org).
Author Contributions: *Study concept and design:* Andruchow, Raja, Zane, and Khorasani. *Acquisition of data:* Andruchow, Raja, and Prevedello. *Analysis and interpretation of data:* Andruchow, Raja, Zane, and Khorasani. *Drafting of the manuscript:* Andruchow, Raja, Zane, and Khorasani. *Critical revision of the manuscript for important intellectual content:* Andruchow, Raja, Prevedello, and Khorasani. *Statistical analysis:* Andruchow, Raja, and Prevedello. *Obtained funding:* Raja and Khorasani. *Administrative, technical, and material support:* Khorasani. *Study supervision:* Raja, Zane, and Khorasani.
Financial Disclosure: None reported.

1. Studdert DM, Mello MM, Sage WM, et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA*. 2005; 293(21):2609-2617.
2. Katz DA, Williams GC, Brown RL, et al. Emergency physicians' fear of malpractice in evaluating patients with possible acute cardiac ischemia. *Ann Emerg Med*. 2005;46(6):525-533.
3. Pines JM, Isserman JA, Szyld D, Dean AJ, McCusker CM, Hollander JE. The effect of physician risk tolerance and the presence of an observation unit on decision making for ED patients with chest pain. *Am J Emerg Med*. 2010;28 (7):771-779.
4. Pines JM, Hollander JE, Isserman JA, et al. The association between physician risk tolerance and imaging use in abdominal pain. *Am J Emerg Med*. 2009; 27(5):552-557.
5. Wong AC, Kowalenko T, Roahen-Harrison S, Smith B, Maio RF, Stanley RM. A survey of emergency physicians' fear of malpractice and its association with the decision to order computed tomography scans for children with minor head trauma. *Pediatr Emerg Care*. 2011;27(3):182-185.
6. Raja AS, Andruchow JE, Zane R, Khorasani R, Schuur JD. Use of Neuroimaging in US Emergency Departments. *Arch Intern Med*. 2011;171(3):259-262.
7. Baskerville JR, Herrick J. Head multidetector computed tomography: emergency medicine physicians overestimate the pretest probability and legal risk of significant findings. *Am J Emerg Med*. 2012;30(2):367-370.
8. Kirsch TD, Hsieh Y-H, Horana L, Holtzclaw SG, Silverman M, Chanmugam A. Computed tomography scan utilization in emergency departments: a multistate analysis. *J Emerg Med*. 2011;41(3):302-309.
9. Prevedello LM, Raja AS, Zane RD, et al. Variation in use of head computed tomography by emergency physicians [published online February 10, 2012]. *Am J Med*. doi:10.1016/j.amjmed.2011.06.023.

Treatment Intensity at the End of Life in Older Adults Receiving Long-term Dialysis

Life expectancy after the initiation of long-term dialysis is often severely limited in the elderly,[1] and it is becoming increasingly clear that many older patients who are receiving dialysis experience a significant burden of concomitant illness,[2] functional limitation,[3] and symptoms.[4] Such considerations have fostered a growing interest in end-of-life care and advanced care planning in this population.

Relatively little is known about the contemporary patterns and determinants of end-of-life care among older patients who are receiving long-term dialysis. Available data indicate that hospice referral is infrequent in this population and that rates of hospice referral and dialysis discontinuation vary substantially across regions.[5] To our knowledge, detailed information on other aspects of health care utilization at the end of life, including hospitalization, intensive care unit (ICU) admission, and use of intensive procedures, has not been reported for this population. Herein, we present the results of a retrospective mortality study to characterize the end-of-life care practices among older Medicare beneficiaries who are receiving long-term dialysis.

Methods. Using data from the United States Renal Data System (USRDS), a comprehensive registry for end-stage renal disease (ESRD), we identified 99 329 fee-for-service Medicare patients aged 65 years and older who initiated long-term dialysis between January 1, 2004, and Decem-

©2012 American Medical Association. All rights reserved.

Downloaded From: http://archinte.jamanetwork.com/ on 02/12/2016