ORIGINAL ARTICLE

Changes in Emergency Department Imaging: Perspectives From National Patient Surveys Over Two Decades

Andrew B. Rosenkrantz, MD[a], *Tarek N. Hanna, MD*[b], *James S. Babb, PhD*[a], *Richard Duszak Jr, MD*[b]

Abstract

Purpose: To use patient-generated data to assess the changing role of emergency department (ED) imaging for a spectrum of clinical indications.

Methods: The Household Component Emergency Room Visits File was obtained from 1996 through 2014 for the Medical Expenditure Panel Survey, a nationally representative survey of US households. Percentage of visits associated with various imaging modalities was computed annually, stratified by respondents' self-reported primary condition during the visit. Modality characteristics were assessed for conditions most frequently imaged in 1996 or 2014.

Results: For most conditions, use of advanced imaging (defined by Medical Expenditure Panel Survey as CT or MRI) in the ED increased significantly ($P < .001$). The largest growth occurred for urinary calculus (from 0% to 48.5%) and headache (from 17.5% to 33.3%), which were the most commonly imaged conditions by CT or MRI in 2014. For ultrasound, the most commonly imaged condition was pregnancy in 1996 (32.9%) and 2014 (44.5%). No other condition was associated with ultrasound in >20% of visits. For radiography, the most commonly imaged conditions were extremity wounds and fractures in 1996 (range 84.5%-90.2%) and 2014 (range 93.4%-93.9%). Use of radiography decreased for urinary calculus from 67.4% to 24.2% ($P < .001$).

Conclusion: For many conditions, ED utilization of advanced imaging increased significantly, though growth was variable across conditions. In certain scenarios, advanced ED imaging is adding to, rather than replacing, other modalities. Ultrasound and radiography utilization was overall unchanged. That national patient survey data mirror traditional claims-based studies suggests an expanded role for patient-generated data in identifying areas of imaging utilization that may benefit from targeted optimization efforts.

Key Words: Imaging utilization, emergency medicine, patients, surveys, health services research

J Am Coll Radiol 2017;■:■-■. Copyright © 2017 American College of Radiology

Emergency department (ED) visits in the United States have increased at twice the rate of population growth [1,2]. All the while, the number of ED visits associated with advanced imaging has increased at an exponential rate [3,4]. In one study, from 1995 to 2007, the number of ED visits in which CT was performed increased at a compound annual growth rate of 16%, the percentage of ED visits associated with CT increased at a compound annual growth rate of 14%, and the fraction of patient visits associated with CT increased for all evaluated chief complaints [3]. Numerous reasons likely contribute to this increase [3,5,6]. Because the US population is aging, patient complexity is increasing, and patients increasingly present to the ED with more comorbidities and chronic conditions. Widespread ED overcrowding, which affects more than 90% of large hospitals, places greater pressures on ED provider time and may contribute to the overutilization of imaging through inadequate pre-imaging patient screening [2,7]. In addition, imaging may in part meet a growing expectation from patients and providers for diagnostic certainty and alleviate

[a]Department of Radiology, NYU School of Medicine, NYU Langone Medical Center, New York, New York.

[b]Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, Georgia.

Corresponding author and reprints: Andrew B. Rosenkrantz, Department of Radiology, Center for Biomedical Imaging, NYU School of Medicine, NYU Langone Medical Center, 660 First Avenue, 3rd Floor, New York, NY 10016; e-mail: Andrew.Rosenkrantz@nyumc.org.

Dr Rosenkrantz and Dr Duszak are supported by research grants from the Harvey L. Neiman Health Policy Institute. The authors have no conflicts of interest related to the material discussed in this article.

1546-1440/17/$36.00 ■ http://dx.doi.org/10.1016/j.jacr.2017.03.004

provider medicolegal concerns. Finally, technological advances have resulted in imaging being applied for an expanded array of clinical conditions.

Several emerging counterbalancing forces are poised to oppose the earlier sharp rise in ED imaging. These include a greater national emphasis on cost containment, increasing application of evidence-based guidelines, increasing implementation of clinical decision support systems, and a growing concern of risks associated with radiation exposure [3,8]. However, a relative paucity of literature has explored recent trends in ED imaging. Using Medicare fee-for-service claims data, Levin et al reported that imaging increased substantially in the ED from 2002 to 2012 [9]. However, Medicare patients reflect only a fraction of the ED population, and given their age and often associated comorbidities, they may be more predisposed to undergo imaging and thus may not be representative of the US population. Although the study by Levin et al provided useful high-level trends information about ED imaging, it did not account for concurrent changes in the number of ED visits, so as to evaluate the frequency of imaging on a per-encounter basis. In addition, the use of aggregated claims data precluded stratification of imaging utilization by presenting condition—particularly important because ED imaging utilization varies considerably among conditions [3]. Awareness of such variation is important given that efforts to address excess imaging utilization may best be achieved by targeting clinical scenarios in which imaging, or imaging growth, has been most concentrated.

Most prior work evaluating imaging utilization, both in and outside of the ED setting, has focused on administrative claims data [10-12]. One complementary approach for assessing the role and use of imaging is through the patient's perspective [13]. Patients are uniquely positioned to know the underlying reasons that prompted them to seek emergency care and are potentially free of classification biases and errors that may impact claims data. By leveraging patients' self-reports of their ED visits, the reasons for the visits, and the associated use of imaging, it importantly becomes possible to explore ED imaging utilization stratified by medical condition, including ED visits for which imaging *did not* occur. In this study, our aim was to use patient-generated data to assess the changing role of ED diagnostic imaging for a broad spectrum of clinical indications.

METHODS

This study used de-identified public use files and thus did not require review from our institutional review board.

Administered by the Agency for Healthcare Research and Quality, the Medical Expenditure Panel Survey (MEPS) represents a set of surveys of a sample of the US civilian noninstitutionalized population, collecting information regarding use of a broad range of health care services [14,15]. A long-standing complex large-scale sampling strategy is used to obtain a sample representative of the national population [16]. The Household Component of MEPS obtains data from individuals who complete computer-assisted personal interviews to provide information regarding all members of their household [16]. Since 1996, overlapping panels of survey participants have undergone five rounds of interviews over 2 years, with a new panel being introduced on a continual annual basis [16]. The Household Component [17] encompasses a range of data files addressing specific topics, including the Emergency Room Visits File [18] that contains a separate record for each unique ED encounter reported for any member of a respondent's household. In 2014, the Household Component contained data for a total of 13,421 households and 33,162 individuals [19].

The MEPS Emergency Room Visits File was obtained for all years from 1996 through 2014. For each visit, we recorded the first medical condition listed by the responding patient or family member. The medical condition reflects the participant's response to the question regarding whether the visit related to any specific health condition or whether any conditions were discovered during the visit [20]. MEPS initially captures respondents' verbatim responses, which are then converted by professional coders to International Classification of Diseases, Ninth Revision, Clinical Modification codes, which in turn are aggregated into mutually exclusive clinically meaningful categories using Clinical Classification Software [21,22]. The conditions are recorded in the order temporally prioritized by the respondent, regardless of their perceived severity. ED visits with a medical condition of "inapplicable" or "not ascertained" were excluded from further analysis. From this population data set, we identified all conditions that had at least 100 ED visits in either 1996 or 2014 (a total of 27 conditions) for further analysis.

We also recorded whether each ED encounter was reported to include radiography (termed "X-RAYS" in the MEPS questionnaire), CT or MRI (combined as a single item termed "MRI OR CATSCAN"), or ultrasound (termed "SONOGRAM OR ULTRASOUND"). Although MEPS also asks about use of mammography, we did not include this test given its minimal relevance in