ORIGINAL ARTICLE HEALTH SERVICES RESEARCH AND POLICY

# Utilization Trends in Diagnostic Imaging for a Commercially Insured Population: A Study of Massachusetts Residents 2009 to 2013

*Stephen Flaherty, MBA, RT-R, MR*[a,b], *Koenraad J. Mortele, MD*[c,d], *Gary J. Young, JD, PhD*[a]

## Abstract

**Purpose:** To report utilization trends in diagnostic imaging among commercially insured Massachusetts residents from 2009 to 2013.

**Materials and Methods:** Current Procedural Terminology codes were used to identify diagnostic imaging claims in the Massachusetts All-Payer Claims Database for the years 2009 to 2013. We reported utilization and spending annually by imaging modality using total claims, claims per 1,000 individuals, total expenditures, and average per claim payments.

**Results:** The number of diagnostic imaging claims per insured MA resident increased only 0.6% from 2009 to 2013, whereas non-radiology claims increased by 6% annually. Overall diagnostic imaging expenditures, adjusted for inflation, were 27% lower in 2009 than 2013, compared with an 18% increase in nonimaging expenditures. Average payments per claim were lower in 2013 than 2009 for all modalities except nuclear medicine. Imaging procedure claims per 1,000 MA residents increased from 2009 to 2013 by 13% in MRI, from 147 to 166; by 17% in ultrasound, from 453 to 530; and by 12% in radiography (x-ray), from 985 to 1,100. However, CT claims per 1,000 fell by 37%, from 341 to 213, and nuclear medicine declined 57%, from 89 claims per 1,000 to 38.

**Conclusion:** Diagnostic imaging utilization exhibited negligible growth over the study period. Diagnostic imaging expenditures declined, largely the result of falling payments per claim in most imaging modalities, in contrast with increased utilization and spending on nonimaging services. Utilization of MRI, ultrasound, and x-ray increased from 2009 to 2013, whereas CT and nuclear medicine use decreased sharply, although CT was heavily impacted by billing code changes.

**Key Words:** Diagnostic imaging utilization, expenditures, trends

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## INTRODUCTION

Utilization of diagnostic imaging has exhibited consistent annual growth throughout the 1990s and early 2000s. Diagnostic imaging, which includes MRI, CT, ultrasound, radiography (x-ray), and nuclear medicine (NM), accounts for more than $100 billion of US health care spending annually [1] and more than 14% of Medicare Part B spending [2]. Studies that examined the rates of imaging use among Medicare enrollees report annual increases in overall utilization between 1993 and 2005 [3,4]. In particular, annual utilization increases of more than 10% were seen for general and Medicare populations during the late 1990s and 2000s in some advanced modalities (eg, MRI, CT, and NM) as newer technologies and imaging techniques became more available [5-9]. PET, a type of NM imaging, exhibited rapid growth during this period [7,10]. Utilization of CT and MRI in emergency department settings increased [11-13]. The cost of

[a]Center for Health Policy and Healthcare Research, Bouve College of Health Sciences, Northeastern University, Boston, Massachusetts.

[b]Department of Radiology-MRI, Brigham and Women's Hospital, Boston, Massachusetts.

[c]Harvard Medical School, Cambridge, Massachusetts.

[d]Department of Radiology, Division of Abdominal Imaging, Beth Israel Deaconess Medical Center (BIDMC), Boston, Massachusetts.

Corresponding author and reprints: Stephen Flaherty, MBA, RT-R, MR, Northeastern University, Population Health, Bouve College of Health Sciences, 360 Huntington Ave, Boston MA 02115; e-mail: sflaher11@gmail.com.

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advanced imaging for Medicare totaled $3.6 billion in 2000 and more than doubled to $7.6 billion in 2006 [14]. Cross-sectional imaging (such as CT and MRI) accounted for over 70% of total imaging costs in 2006, compared with 54% in 1997 [9].

Prior studies [15,16] noted that utilization growth for diagnostic imaging began to decline around 2009, perhaps a reflection of the impact of regulatory changes that addressed excess Medicare spending growth, such as those in the Deficit Reduction Act of 2007, and efforts to reduce radiation exposure like the Choosing Wisely initiative [17]. More recent work has identified signs of increasing utilization after the slowdown in imaging utilization from 2009 to 2011 [12,18]. However, there is a lack of recent research with more current data (eg, after 2011) that report on statewide or national trends in utilization across modalities for commercially insured populations.

The purpose of this retrospective study is to report utilization trends in diagnostic imaging among commercially insured Massachusetts residents from 2009 to 2013. We sought to determine whether utilization of imaging was continuing to increase after 2011. We also reported on imaging utilization at the modality level and on imaging-related expenditures.

## METHODS

The primary data source for this retrospective study was the Massachusetts All-Payer Claims Database (APCD), from which we have obtained claims data for the years 2009 to 2013. This study was approved by our Institutional Review Board because the APCD data contains personal information for members and physicians. All data were stored and processed on a secure server setup approved by the Massachusetts Center for Health Information and Analysis. Our data set included all medical claims (commercial health insurance products) reported by health insurers in Massachusetts over this period. For the purpose of comparison, we reported spending and utilization for imaging claims and nonimaging claims. Current Procedure Terminology (CPT) codes were used to identify claims pertaining to diagnostic imaging procedures.

Massachusetts has the highest percentage of health insurance coverage in the United States [19]. The total percentage of residents with health care insurance during the 2009 to 2013 years was above 95% each year, well above the national average of 84% for the same period. There were approximately 6.6 million Massachusetts residents in each year of our study and roughly two thirds (mean = 64%, SD = 2.7%) of the population had commercial health insurance [20]. We excluded non-Massachusetts residents and imaging services performed outside of Massachusetts.

We identified diagnostic imaging claims using CPT codes ranging from 70000 to 79999 and additional codes in the 90000s for ultrasound procedures. We excluded claims that pertained to radiation therapy or radiation oncology procedures (codes in the range 77261-77799), and codes in the 30000 to 60000 range for interventional or surgical procedures that may use imaging. We also did not include separate charges for radiology contrast agents or radiopharmaceuticals in utilization or spending totals. Claims were labeled with indicator variables for six imaging modalities (MRI, CT, ultrasound, x-ray, NM, and PET) using lists of specific codes for imaging procedures in each modality. Imaging procedures can be billed as a global or bundled charge that includes the technical and professional components or as separate technical and professional claims. For procedure totals, we counted global charges and professional charges only to avoid double counting, and we excluded second opinion reads. For spending totals, we combined all global, technical, and professional charges for each modality. We report changes in utilization and spending over time for diagnostic imaging claims. For each modality utilization, we divided the number of claims by the number of commercially insured Massachusetts residents to calculate rates per 1,000. A billing code change for CT occurred in 2011 that introduced a combined code for abdomen and pelvis procedures, replacing the separate codes. For CT, in addition to overall utilization, we report results for abdomen and pelvis and for all other CT claims. We also report utilization of PET imaging, a type of NM imaging. All analyses were performed using SQL, SAS 9.4, (SAS Institute, Cary, North Carolina) and Excel software (Microsoft Corporation, Redmond, Washington, USA).

## RESULTS

Despite annual variability, the number of diagnostic imaging claims per commercially insured Massachusetts resident did not change substantially over the study period, with a 5-year growth trend of 0.6% (see Table 1). For comparison, the annual number of nonimaging claims had a 5-year average growth rate of 7%. There was little difference in the distribution of imaging utilization across age groups between 2009 and 2013, with patients over age 40 accounting for roughly three-quarters of diagnostic imaging claims annually