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## Dramatically increased musculoskeletal ultrasound utilization from 2000 to 2009, especially by podiatrists in private offices

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**TITLE:** Dramatically Increased Musculoskeletal Ultrasound Utilization from 2000-2009, Especially by Podiatrists in Private Offices

## INTRODUCTION

Policy makers, health care payers, health care providers and patients are increasingly aware of the cost of providing health care in the United States.

Medical imaging is one of the main drivers of increasing healthcare costs (1). For musculoskeletal (MSK) imaging, Parker, et al demonstrated that MSK ultrasound (US) is relatively underutilized in the United States, and that substituting US for MRI in specific clinical scenarios could substantially reduce imaging costs (2).

Paradoxically, insurers have recently raised concerns of MSK US overutilization (3). In particular, wide availability and relatively low cost of US technology have led to widespread proliferation of US units and potential for overutilization.

The purpose of this study is to examine MSK US used for the diagnosis of tendon, muscle, ligament, nerve, and joint abnormalities and does not address studies performed for US guided intervention. We investigated which types of health care providers in what settings utilize diagnostic MSK US, their relative utilization frequencies and geographic variations.

## **METHOD AND MATERIALS**

The source data sets were the Centers for Medicare and Medicaid Services Part B Physician/Supplier Procedure Summary Master Files (PSPSMFs) for 2000 through 2009. This data set summarizes the complete billing record for all procedures paid under Medicare Part B. For every Current Procedural Terminology®, Version 4, (CPT®-4) code in each year, the PSPSMFs provide the volume of services performed nationwide. There were 32,823,781 fee-for-service beneficiaries enrolled in Medicare Part B in 2000, 34,937,790 in 2009 with a peak enrollment in 2004 of 36,543,143. Beneficiaries enrolled in health maintenance organizations (17.2% in 2000 and 24.4% in 2009), are not included in this data set. The PSPSMF is a government published anonymized aggregated data set that does not follow individual patients or outcomes and our study is therefore IRB exempt.

The PSPSMF data categorize claims by including the specialty of the providers, practice setting and geographic region. There are over 100 such physician specialty codes. Practice settings are characterized as hospital inpatient, hospital outpatient, private offices, emergency departments, and various others such as ambulatory surgical centers, nursing homes, and rehabilitation centers. The vast majority of imaging studies are performed in the first four settings. Claims are also labeled by the geographic region of the beneficiary who received the treatment. Geographic regions in this dataset correspond to CMS

administrative regions and are named for the city in which the regional CMS office is located: Atlanta, Boston, Chicago, Dallas, Denver, Kansas City, New York, Philadelphia, San Francisco, or Seattle.

For this study, we analyzed allowed primary claims submitted for CPT®-4 Code 76880: "Ultrasound Extremity, Nonvascular, real time with image documentation." This CPT code is utilized for diagnostic MSK US examinations. We classified billing claims by provider type, setting of procedure and region of service. To determine utilization, we tabulated global claims and professional-component-only claims but did not include technical component only claims, because doing so would have led to double counting procedures. We also used Medicare Advantage State/County Market Penetration reports to determine the fee-for-service beneficiary population for all of Medicare and for the regions. Specialties accounting for <3% of total utilization were aggregated for analysis. We then calculated MSK US utilization rate per 100,000 beneficiaries per year. Utilization trend lines were plotted from 2000 through 2009.

Primary care specialties were aggregated for data analysis. For the purposes of this study, "primary care" specialties include family practice, general practice, general internal medicine, and osteopathic providers. Specialties using more than three percent of total procedural volume were reported separately. All providers utilizing less than three percent of total volume were aggregated as

“all other providers.” Nonradiologist market share was defined as the utilization rate by nonradiologists per total MSK US utilization rate. We also determined growth rates and new procedure volume accrued by each specialty between 2000 and 2009.

To evaluate for possible substitution effects, the total volume and rate of musculoskeletal MR (MSK MR) examinations were also tabulated.

Data were tabulated using MS-Excel: Mac 2008 v12.2.5 (Redmond, WA) and analyzed using SAS 9.2 for Windows (SAS Institute, Cary, North Carolina).

## RESULTS

MSK US volume increased from 56,254 procedures in 2000 to 233,964 in 2009 (+316%). The total utilization rate of MSK US was 171/100,000 in 2000 and 669/100,000 in 2009 (+291%).

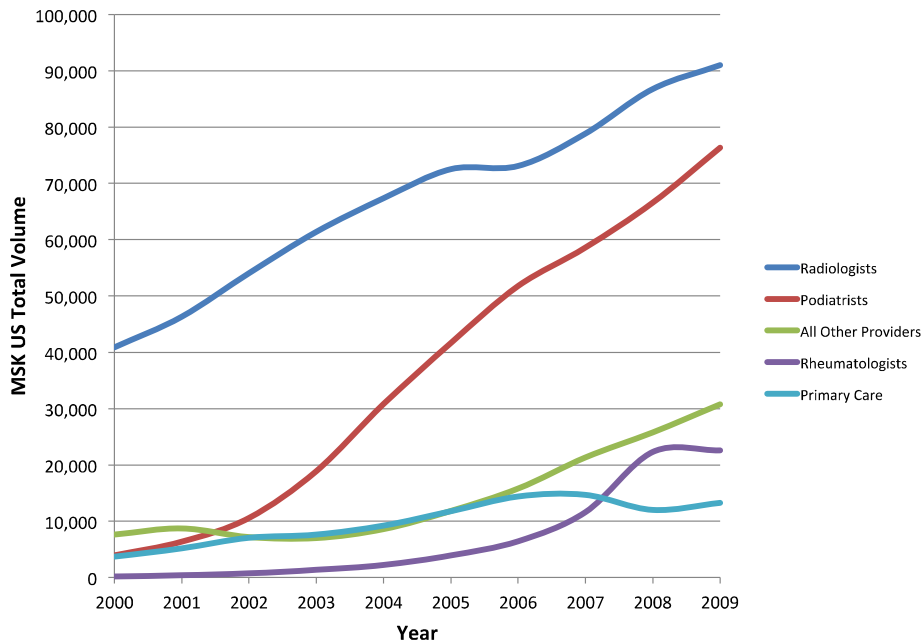


Figure 1: MSK US imaging claim volume by provider type from 2000 to 2009 for all practice settings. Between 2000 and 2009, podiatrists increased their overall MSK US volume more any other type of provider.

Figure 1 shows that MSK US procedure volume varied by provider type. The largest number of MSK US procedures in every year from 2000 to 2009 was performed by radiologists, who performed 40,877 procedures in 2000 and 91,022 in 2009 (+123%). Radiologist volume accounted for 72.7% of 2000 procedures and 38.9% of 2009 procedures. Radiologist increased volume accounted for 28.2% of the growth from 2000 to 2009.



Podiatrists performed the next largest number of MSK US procedures. Podiatrists accounted for 3,920 of 2000 procedures and 76,332 of 2009 procedures (+18,472%). Podiatrists accounted for 7.0% of total MSK US utilization in 2000 and 32.6% of total MSK US utilization in 2009. Podiatrists' increased volume accounted for 40.7% of the total growth from 2000 to 2009.

Other nonradiologist utilization increases occurred among rheumatologists, primary care physicians, and all other providers as a group. Rheumatologists accounted for 22,581 procedures in 2009, compared with 176 in 2000 (+12,730%). Primary care physicians accounted for 13,271 procedures in 2009 compared with 4,675 in 2000 (+261%). All other providers accounted for 30,758 procedures in 2009, compared with 7,606 in 2000 (+304%).

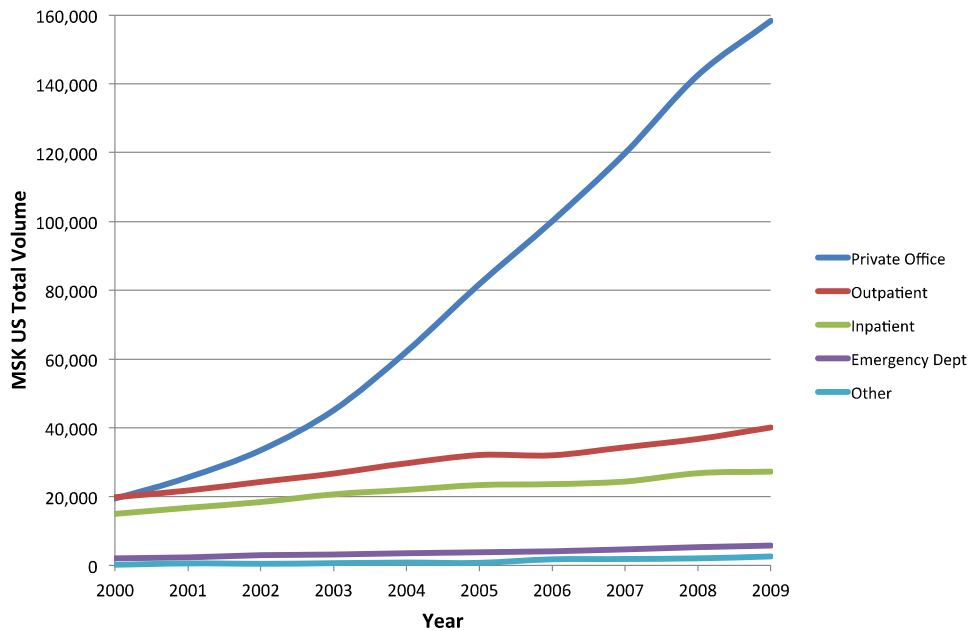


Figure 2: MSK US volume by practice setting from 2000 to 2009. There has been significantly more growth in MSK US performed in private offices than in any other practice setting.

Figure 2 shows MSK US procedure volume varied by practice setting. The total number of MSK US procedures performed by private offices increased from 19,372 in 2000 to 158,351 in 2009 (+717%). The next largest increase in volume was in hospital outpatient facilities, where volume increased from 19,799 in 2000 to 40,054 in 2009 (+102%).

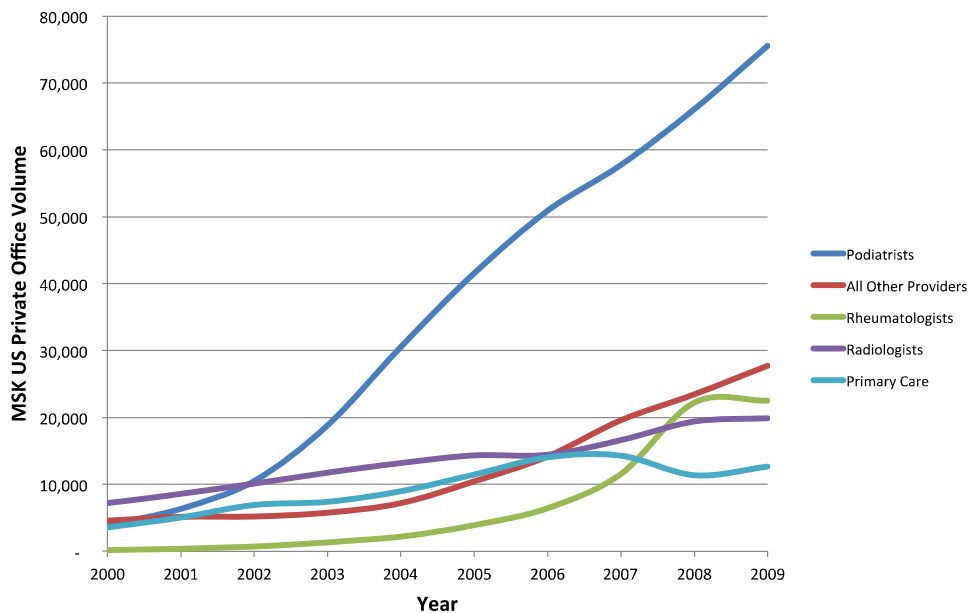


Figure 3: MSK US private office imaging procedure volume from 2000 to 2009. Providers are presented by decreasing order of 2009 MSK US private office volume. Podiatrists have significantly increased their utilization of MSK US in private offices and, in 2009, podiatrists utilized 48% of all private office MSK US volume.

As can be seen in figure 3, the vast majority of private office MSK US imaging procedures were performed by podiatrists. Podiatrists performed 3,913 private office procedures in 2000 and 75,544 in 2009. Growth in private office MSK US utilization by podiatrists from 2000 to 2009 accounted for 51.5% of the total private office growth during this time period. Rheumatologists performed 176 private office MSK US procedures in 2000 and 22,517 in 2009. Growth in private office MSK US utilization by rheumatologists accounted for 16.1% of the total private office growth during this time period. Other types of providers accounted for comparatively less new volume. Radiologist growth from 2000 to 2009 accounted for 9.2% of the total growth in private office MSK US utilization during this time period.

**Table 1. Medicare MSK US utilization rates in 2000 and 2009 by CMS geographic region. 2000 to 2009 growth, as well as compound annual growth rate (CAGR).**

CMS Region	2000 Utilization Rate	2009 Utilization Rate	2000 – 2009 Utilization Rate Increase	CAGR
San Francisco	218	874	656	16.7%
New York	168	770	602	18.4%
Dallas	158	674	516	17.5%
Chicago	170	661	491	16.3%
Atlanta	165	608	443	15.6%
Philadelphia	146	583	437	16.6%
Seattle	207	576	369	12.0%
Denver	135	428	293	13.7%
Kansas City	124	362	238	12.6%
Boston	204	289	85	3.9%

Utilization rates are presented per 100,000 Medicare beneficiaries.

Table 1 shows overall MSK US utilization varied by geographic region. The highest utilization in 2009 occurred in the San Francisco region. The San Francisco MSK US utilization rate was 218/100,000 in 2000, 874/100,000 in 2009 (+301%), and also accounted for the greatest numerical increase in rate during the period. Boston had the lowest utilization rate in 2009, 204/100,000 in 2000 and 289/100,000 in

2009 (+41.7%). The ratio of the highest to lowest MSK US utilization by regions was 3.02 (874 per 100,000 / 289 per 100,000).

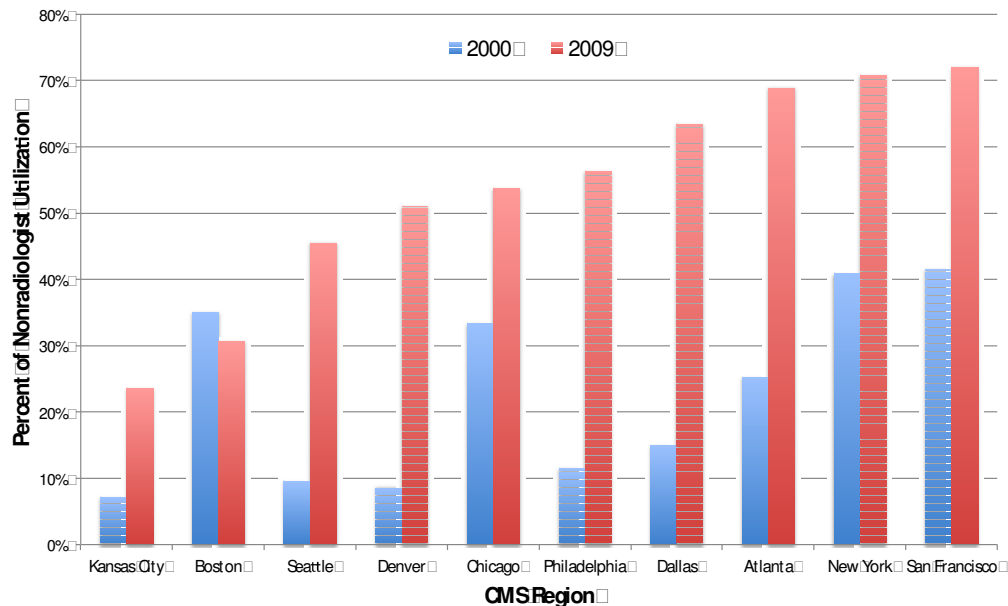


Figure 4: Nonradiologist market share in 2000 and 2009 by CMS geographic region. Results are presented in order of increasing nonradiologist market share in 2009. Nonradiologists gained market share from 2000-2009 in every region, except Boston.

Figure 4 shows nonradiologist MSK US market share by geographic region. Nonradiologist market share increased from 2000 to 2009 in every region except Boston. The largest market share gains by nonradiologists occurred in the Dallas region, increasing from 15.2% in 2000 to 63.5% in 2009. Boston region nonradiologist market share decreased from 35.3% in 2000 to 30.8% in 2009. Nonradiologist market share in 2009 in the San Francisco region was triple (72%/24%) the nonradiologist market share in the Kansas City region.

The total volume of MSK MR examinations performed in Medicare patients was 466,384 in 2000 and 1,282,933 in 2009 (+175%). The overall utilization rate for all MSK MR procedures in the same population was 1,421 per 100,000 in 2000 and 3,668 per 100,000 (+158%) in 2009.

## DISCUSSION

The Government Accountability Office (GAO) stated that from 2000 to 2006, spending for medical imaging more than doubled, to \$14 billion (1). The GAO has also reported that from 2000 through 2006, Medicare spending for physician imaging services doubled from about \$7 billion to about \$14 billion, an average annual increase of 13 percent, compared to an 8 percent increase in spending for all Medicare physician-billed services over the same time period (4). The GAO has further concluded that there was substantial geographic variation of in-office imaging spending per beneficiary and suggested that consequently not all utilization was necessary or appropriate (1).

Ultrasound continues to be a much less expensive imaging modality than MRI. Given that there is similar accuracy between US and MRI for the diagnosis of certain MSK conditions such as rotator cuff tears, the literature supports the cost effectiveness of MSK US (5). Parker, et al estimated that, in the Medicare population, the substitution of MSK US for MSK MRI, when appropriate, would lead to savings of more than \$6.9 billion in the period from 2006 to 2020 (6). Given the large increases in both MSK US and MSK MR volume reported in our study, we find no significant evidence of MSK MR being substituted for MSK US.

Potential cost savings resulting from the substitution of MSK US for MSK MR could be negated if US is overutilized. On September 1, 2009, Blue Cross / Blue Shield insurers in Illinois, New Mexico, Oklahoma, and Texas issued the "Non-Operative Spinal and Musculoskeletal Ultrasound, RAD602.016" policy that changed the classification of MSK US studies covered by CPT code 76880 to "experimental" (7). Some of the motivation behind this decision may have been recent increases in MSK US utilization. After much advocacy, education and discussion, this policy was reversed 5 months later. However, increases in MSK US utilization remain of significant concern.

Although overutilization is difficult to define, it has been consistently demonstrated that provider specialty and situations that permit self-referral for imaging may impact the costs experienced by the healthcare system. Numerous studies have shown that supplier induced demand leads to increased numbers of imaging studies when persons performing the examinations have a financial stake in doing so (8,9,10,11,12,13,14). The current in-office ancillary services exception to the federal Stark laws has motivated many nonradiologist imagers to acquire imaging equipment and begin performing and interpreting examinations previously performed by radiologists (12,13,14). A recent metaanalysis calculated the cost to Medicare of self-referral to be in the billions, and estimated that nonradiologist self-referrers of medical imaging are approximately 2.48 times more likely to order imaging than clinicians with no



financial interest in imaging, which translates to an increased imaging utilization rate of 59.7% (15).

Nonradiologists are currently the highest users of MSK US in the office setting and account for 71.8% of the increased musculoskeletal ultrasound volume from 2000-2009. Podiatrists, in particular, have increased their MSK US utilization more than any other type of healthcare provider and now use nearly as much MSK US as radiologists. The highest rates of increase occurred in private offices, where nonradiologists are currently the highest users of MSK US. These findings are consistent with GAO general observation that there are significant increases in the amount of private office imaging.

It is surprising that podiatrists increased utilization of MSK US without observable utilization increases by other physician providers that are likely to treat similar patients. Podiatrists, for example, increased their utilization by more than 14 times the increase among orthopedic surgeons during the same time period. It is possible that the marginal increase in revenue for performing more MSK US is more attractive to a podiatrist than to an orthopedic surgeon.

Private office MSK US examinations may be relatively free of scrutiny, peer review, validation or regulation. It is possible, particularly in a slow economy, that MSK US examinations are being performed more frequently to subsidize US

equipment that has already been procured. When imaging equipment has already been purchased and is idle in practice settings, it may become used for situations and indications where it was not previously perceived as necessary. These situations may not necessarily yield a patient benefit, but do increase the costs of delivering health care.

Evaluation of MSK US utilization by geographic region shows that only in one region have radiologists maintained or gained market share for MSK US. All other regions showed significant market share increases for nonradiologists ranging from 16% to 48% during the studied interval. The compound annual growth rate of MSK US in regions where nonradiologists had gained market share was in the double digits, ranging from 12.0 to 18.4%.

Our study could be considered limited in that it examines utilization only within the Medicare population and results may not be generalizable to the entire population. However, it is likely that analysis of different insurers will reflect a similar trend. This study also does not address the ranges of quality of MSK US studies. Analyses of billing records, such as this data set cannot describe image quality and indeed different study designs are recommended for such investigation. Indications for, and quality of, MSK US among different specialties are additional topics for further study.

In a healthcare climate where increased utilization deserves further scrutiny, this study has demonstrated significant utilization increases by specialties that are not traditional imagers who may be in a position to self-refer.

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