EDITOR'S CHOICE

Feasibility of Quality Measures for the Diagnosis and Treatment of Carpal Tunnel Syndrome

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Purpose The American Academy of Orthopaedic Surgeons and the American Society for Surgery of the Hand developed candidate quality measures for potential inclusion in the Merit-Based Incentive Program and National Quality Forum in the hope that hand surgeons could report specialty-specific data. The following measures regarding the management of carpal tunnel syndrome (CTS) were developed using a Delphi consensus process: (1) use of magnetic resonance imaging (MRI) for diagnosis of CTS, (2) use of adjunctive surgical procedures during carpal tunnel release (CTR), and (3) use of formal occupational and/or physical therapy after CTR. This study simulated attempts to identify outlier regions in an insurance claims database, which is an important step in establishing feasibility of these measures.

Methods Using the Truven Health MarketScan, we identified 643,357 patients who were given a diagnosis of CTS between 2012 and 2014. We reported the percentage of metropolitan statistical areas (MSA) with one or more claims for MRI within 90 days of CTS diagnosis, one or more adjunctive surgical procedures, and one or more formal referrals for physical and/or occupational therapy within 6 weeks of CTR, and we calculated the rate of use for each of these diagnostic or treatment modalities. In addition, we report the precision ratio (signal to noise), SD, and 95% confidence interval.

Results A high percentage of patients given a diagnosis of CTS did not have MRI (99%), and the precision ratio was considered high (0.99). Over 30% of all observed MSAs had at least one claim for MRI as a diagnostic modality in CTS. Most patients (98%) did not have adjunctive surgical procedures. For the observed years, over 28% of MSAs had at least one insurance claim for an adjunctive procedure. A total of 86% of patients did not receive formal occupational or physical therapy after CTR. In addition, 92% of MSAs had at least one claim for therapy. The precision ratio was considered high (approximately 0.85).

Conclusions There is regional variation in the utilization rate of diagnostic MRI for CTS, adjunctive surgical procedures, and formal referral for physical and occupational therapy. For the proposed quality measures, outlier regions can be detected in insurance claims data.

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Clinical relevance Use of MRI in diagnosis, adjunctive surgical procedures, and formal therapy after surgery are feasible quality measures for the Merit-Based Incentive Program and National Quality Forum. *(J Hand Surg Am. 2020;45(9):813–819. Copyright © 2020 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words AAOS, adherence, adjunctive surgical procedures, ASSH, carpal tunnel syndrome.

CARPAL TUNNEL SYNDROME (CTS) is a common upper-extremity illness with a substantial economic impact.[1,2] There is considerable surgeon-to-surgeon variation in the management of CTS that is not based on evidence, which highlights the potential for quality measure development for value-based health care models such as the Merit-Based Incentive Program (MIPS) and the National Quality Forum (NQF).[3–6] In an attempt to improve quality of care and provide hand surgeons with the ability to report specialty-specific data to MIPS and NQF, the American Academy of Orthopaedic Surgeons (AAOS) and the American Society for Surgery of the Hand (ASSH) developed quality measures using a Delphi consensus process in 2016.[7] An important step in establishing the feasibility of these quality measures is to identify outliers in the rate of resource use that indicate regional variation in care.

In this study, we describe the Delphi consensus process for CTS quality measures developed by the AAOS and ASSH. We tested a subset of measures deemed suitable for the ability to identify outlier regions using insurance claims data in the Truven Health Analytics (IBM Company, Ann Arbor, MI) data for 2012 to 2014.

MATERIALS AND METHODS

Development of quality measures through Delphi consensus process

A multidisciplinary group of field experts was recruited through medical societies and research organizations that have an interest in treating CTS: the AAOS, ASSH, American Academy of Neurology, American Academy of Physical Medicine and Rehabilitation, American College of Radiology, American Society of Hand Therapists, American Society of Plastic Surgeons, American Association for Hand Surgery, and Hand Surgery Quality Consortium. Candidate quality measures were founded on the AAOS "Management of Carpal Tunnel Syndrome" evidence-based clinical practice guideline created in 2016 by a separate workgroup.[8] The recommendations based on strong or moderate evidence were translated into candidate measures with language relevant to daily practice. Using a modified RAND/University of California at Los Angeles Delphi voting process, the workgroup evaluated the validity of the preliminary candidate measures according to the NQF criteria.[7] In 2 voting rounds, each candidate measure was rated on a 9-point scale ranging from 1 (definitely not valid) to 9 (definitely valid) for face validity regarding importance for clinical care, scientific acceptability, feasibility, and usability. A candidate measure was considered valid when the median rating on all 4 domains was in the upper tertile for validity (median, 7–9). Six candidate measures were deemed valid and 3 were suitable for testing using insurance claims data, avoiding (1) use of magnetic resonance imaging (MRI) for diagnosis of CTS, (2) use of adjunctive surgical procedures during carpal tunnel release (CTR), and (3) use of formal occupational and/or physical therapy after CTR.

Validation of quality measures with insurance data

We used a commercial insurance claims database (Truven Health Analytics; IBM Company) to investigate (1) the rate of MRI as a diagnostic modality for CTS, (2) the use of adjunctive surgical procedures during CTR, and (3) the use of physical or occupational therapy after CTR for 2012 through 2014 by metropolitan statistical area (MSA). We identified all adult patients with a diagnosis of CTS using International Classification of Disease, Ninth Revision, Clinical Modification diagnosis code 354.0 and 10th Revision, Clinical Modification diagnosis code G56.0x. Through Current Procedural Terminology codes (ie, 73218, 73219, 73220, 73221, 73222, 73223), we identified patients with CTS who received an upper-extremity MRI 90 days before or after the diagnosis. In addition, we identified patients who had CTR during the enrollment period using Current Procedural Terminology codes 64721 and 29848, and determined the number of patients who simultaneously had adjunctive surgical procedures: internal neurolysis with an operating microscope (64727), radical 9-tendon flexor synovectomy (25115), and

TABLE 1. Routine Use of MRI for Diagnosis of CTS by MSA in United States

Variable	2012	2013	2014
N (%)	262,190 (41)	179,990 (28)	201,177 (31)
MSA (total)	390	391	406
Not using MRI (mean ± SD)	0.99% ± 0.0033%	0.99% ± 0.0058%	0.99 ± 0.0063
Range	0.97% to 1.0%	0.90% to 1.0%	0.89% to 1.0%
MSAs with >1 claim	38%	31%	32%
Precision ratio (95% confidence interval)	0.998 (0.998–0.999)	0.998 (0.998–0.999)	0.998 (0.998–0.999)

flexor or extensor tenolysis of the forearm and/or wrist (25295). We also identified the number of patients who had occupational (97165, 97166, and 97167) or physical (97161, 97162, and 97163) therapy within 6 weeks after CTR. Patients with multiple CTRs were excluded from analysis. Institutional review board approval was not required for this analysis of deidentified data.

Statistical analysis

The use of MRI for CTS was calculated by dividing the number of patients diagnosed with CTS without an MRI of the upper extremity by the total number of those diagnosed with CTS. The use of adjunctive surgical procedures during CTR was determined by dividing the number of patients who did not have adjunctive surgical procedures by the total number of those who had CTR. The use of physical or occupational therapy after surgery was determined by dividing the number of patients who received physical or occupational therapy within 6 weeks after surgery by the total number of those who had CTR. Carpal tunnel syndrome was diagnosed in 643,357 patients, 1,036 patients of whom had an associated MRI (0.002%). From the group of 83,159 patients who had CTR, 1,392 had an adjunctive surgical procedure (1.7%) and 17,037 had physical or occupational therapy after surgery (20%). We identified outliers by geographical area in insurance claims as (1) patients who had an upper-extremity MRI within 90 days of CTS diagnosis; (2) any claim that listed adjunctive surgical procedures; or (3) any claim for formal referral to physical or occupational therapy within 6 weeks of CTR.

Assessment of measurement precision in database

To determine the precision of the database to distinguish utilization rates between MSAs, we calculated the ratio of variation in practice (signal) to variation due to potential measurement error (noise) as described in a 2009 RAND tutorial.[9] This ratio demonstrates the repeatability and reproducibility of results within the same population and period, and is contingent upon the sample size, the difference in utilization rate among providers, and measurement error in the database. The signal in this study is variation in the use of MRI for the diagnosis of CTS, the use of adjunctive surgical procedures, and physical or occupational therapy that can be explained by differences in clinician behavior. Noise in this study is the variability in care attributable to measurement error. A ratio of 0 means that all variation is attributable to measurement error. A ratio of 1 means that all variation is due to real differences in performance. The signal-to-noise ratios for each measure are reported with SDs and 95% confidence intervals. Ratios of 0.7 and above are considered sufficient to detect differences between practices of specific regions or physicians compared with the mean rate.[9]

RESULTS

Magnetic resonance imaging

A high percentage of patients did not receive an MRI within 90 days of receiving the diagnosis of CTS (99%), with little variation between years (Table 1). The precision ratio was high (around 0.99) for each year. The highest rate of MRI use was 2.9/1,000 patients; the second highest rate was 1.8/1,000 patients (Fig. 1, Supplemental Figs. 1–6, available online on the Journal's Web site at www.jhandsurg.org). The vast majority of MSAs (70%) billed no MRIs. There was a low rate of MRI use in the remaining 30% of MSAs.

Adjunctive surgical procedures

A high percentage of patients (98%) did not receive adjunctive surgical procedures in addition to CTR (Table 2, Fig. 2). As many as 28% of MSAs performed more than one adjunctive procedure each year. The precision ratio was high (greater than 0.98 or 0.99).

Physical and occupational therapy use

On average, 86% of patients did not receive formal physical or occupational therapy after CTR (Table 3).

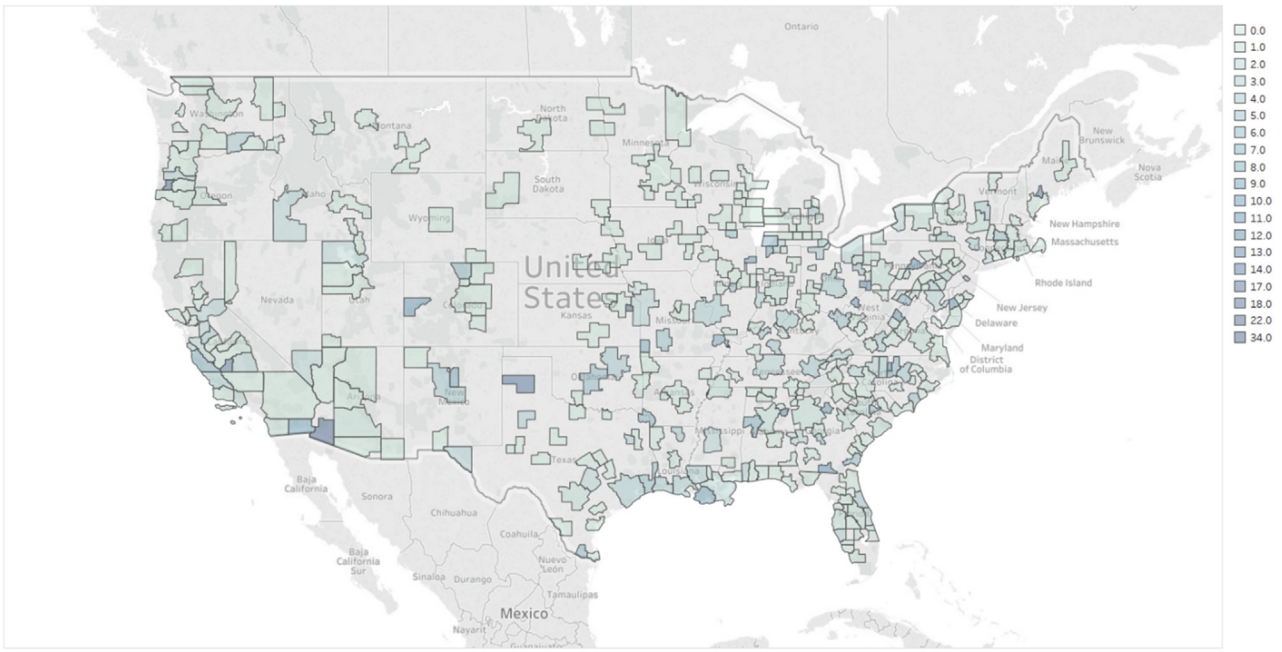

FIGURE 1: Routine use of MRI for the diagnosis of CTS by MSA in the United States in 2012.

TABLE 2. Use of Adjunctive Surgical Procedures During CTR by MSA in United States

Variable	2012	2013	2014
N (%)	31,920 (38)	22,912 (28)	28,327 (34)
MSA (total)	385	385	401
Not using adjunctive procedures (mean ± SD)	0.99% ± 0.031%	0.99% ± 0.029%	0.99% ± 0.030%
Range	0.71% to 1.0%	0.75% to 1.0%	0.67% to 1.0%
MSAs with >1 claim	33%	30%	28%
Precision ratio (95% confidence interval)	0.984 (0.981–0.987)	0.994 (0.981–0.987)	0.994 (0.993–0.996)

There was a substantial SD (11%) in therapy use between MSAs (Fig. 3). Up to 92% of MSAs had more than one referral to therapy during the enrollment period (range, 80–92). The precision ratio was considered high (approximately 0.85).

DISCUSSION

We developed 3 candidate quality measures for managing CTS using a Delphi consensus process[7] and identified outliers by region using a large insurance claims database. The findings suggest that claims data can be used to identify outlier region variation in the utilization rate of tests and treatments for CTS. Therefore, claims data with provider- or practice-level data should be able to identify outlier performance, making these measures suitable for inclusion in MIPS and the NQF. Such measures are not intended to reprimand specific clinicians, practices, or geographical areas that have outlier use rates. They are intended to inform efforts to align practice with best evidence to optimize quality and value.

Readers should consider the following limitations. First, the data were derived from a commercial insurance database; therefore, results may not be applicable to patients with noncommercial insurance plans (such as Medicare and Medicaid). These populations may have lower or higher rates of diagnostic modalities and interventions, depending on coverage. Second, the research relied on diagnostic coding of CTS, and misclassification of disease, tests, and treatments may have occurred. Some patients with CTS in the observed years may not have been included in the study or may have received one of the studied diagnostic modalities or treatment without appropriate coding. Moreover, some patients may have received upper-extremity MRI or physical therapy for conditions unrelated to the diagnosis of CTS, which could not be distinguished

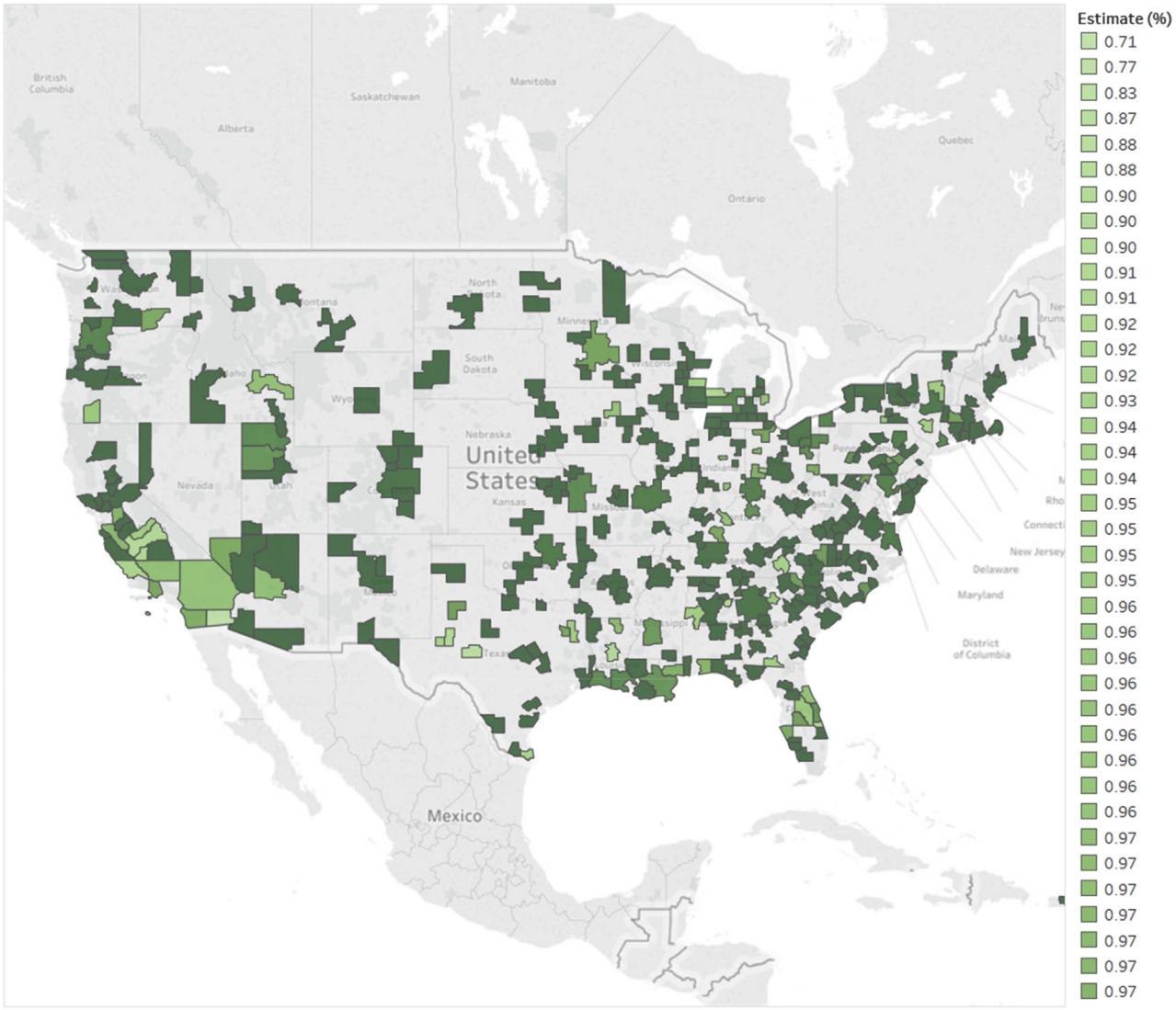

FIGURE 2: Use of adjunctive surgical procedures during CTR by MSA in the United States in 2012.

TABLE 3. Routine Referral to Formal Physical or Occupational Therapy After CTR by MSA in United States

Variable	2012	2013	2014
N (%)	31,920 (38)	22,912 (28)	28,327 (34)
MSA (total)	387	387	402
Without physical therapy/occupational therapy claims (mean ± SD)	0.86% ± 0.11%	0.86% ± 0.11%	0.88% ± 0.11%
Range	0.0% to 1.0%	0.0% to 1.0%	0.42% to 1.0%
MSAs with >1 claim	92%	86%	80%
Precision ratio (95% CI)	0.859 (0.849–0.868)	0.861 (0.851–0.870)	0.855 (0.875–0.875)

through claims data. Third, a small percentage of patients may have changed to another insurance provider, and therefore may have had incomplete data. Based on experience and prior studies, this percentage is not expected to change the results of this study notably. Fourth, the data used for this study derive from the 2012 to 2014, and there may have been slight changes in practice in the following years up to the dissemination of these quality measures. The findings of the AAOS clinical practice guideline that we tested were released

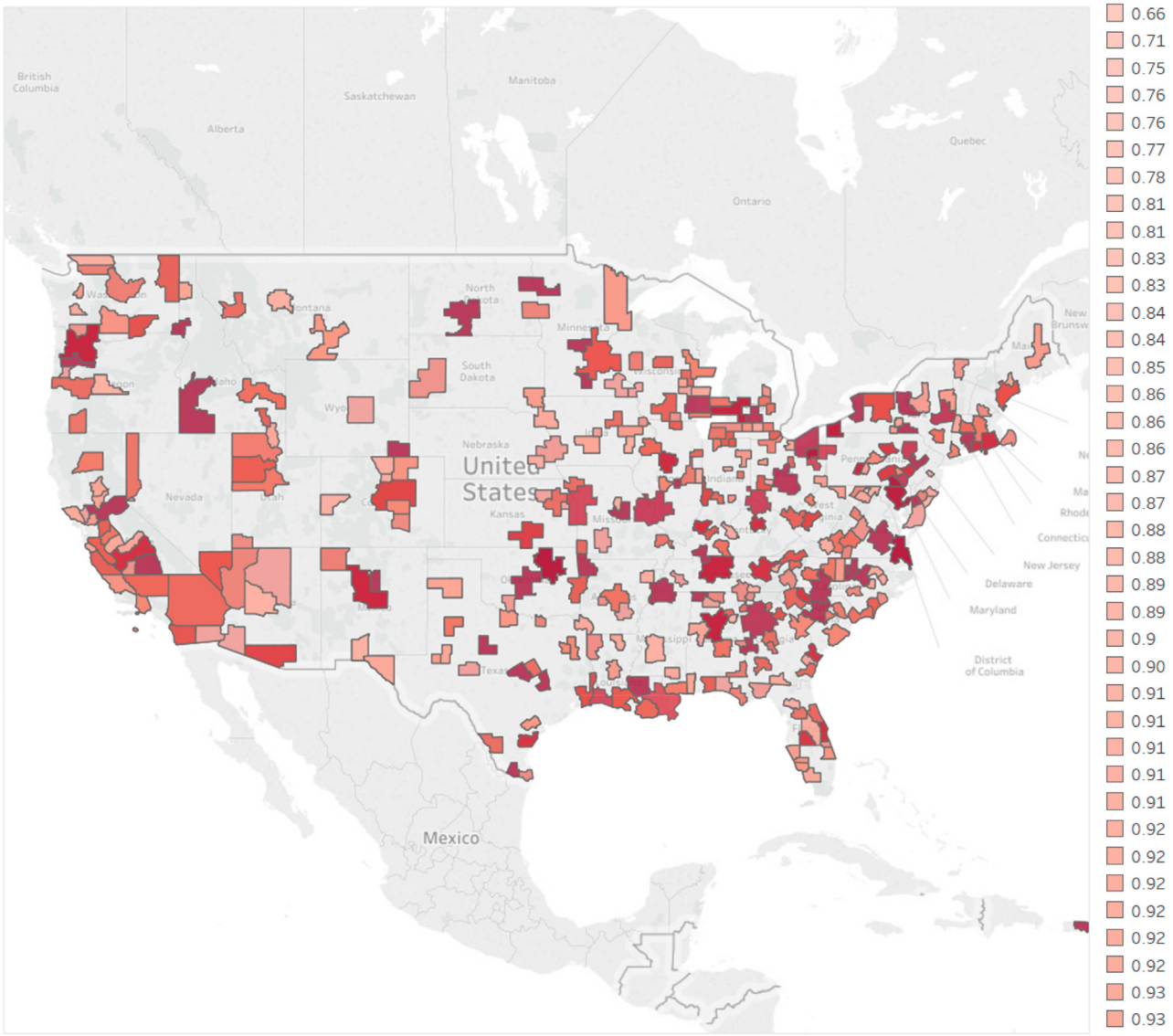

FIGURE 3: Routine referral to formal physical or occupational therapy after CTR by MSA in the United States in 2012.

in 2016. Furthermore, this study was not designed to determine a correct rate of the use of these treatment and diagnostic modalities. The purpose was to test the feasibility of using claims data to detect outliers at the MSA level. The ability to identify outliers is critical to gaining approval as an MIPS and NQF measure.

That a high percentage of patients did not have MRI as part of the diagnostic workup of CTS (99%), although there were detectable outlier MSAs, suggests that this is a feasible and reliable measure that might meet criteria for inclusion in MIPS and the NQF. The recommendation not to use MRI routinely as a diagnostic modality for CTS has a strong basis in current evidence and was voted as valid by a panel of field experts using the Delphi method. This was based on the notion that sensitivity for diagnosing CTS using MRI was moderate compared with traditional diagnostic criteria, and that it has low specificity.[10]

That a high percentage of patients (98%) did not receive adjunctive surgical procedures in addition to CTR, but more than 28% of MSAs were outliers, supports the potential utility of these measures for MIPS and NQF. These outliers persist despite several high-quality studies (many were published years or decades ago) demonstrating that epineurotomy, neurolysis, flexor tenosynovectomy, and flexor retinaculum reconstruction or lengthening in addition to CTR does not provide a substantial improvement in clinical outcome, symptom recurrence, pain, and electrodiagnostic parameters.[11–16]

A high percentage of patients (86%) did not receive formal referral for physical or occupational

therapy after CTR, which suggests that this can be used as a quality measure. This measure had the highest utilization rate out of the quality measures that were tested, and the greatest proportion of outliers. In some MSAs, all patients received formal referral for physical therapy. This quality measure assumes that formal therapy referral may be appropriate for a small percentage of patients; it is meant to identify outliers that may be using therapy inconsistent with current best evidence.[8,17,18]

We used national commercial insurance data to assess the feasibility of quality measures suitable for reporting to MIPS and NQF that were selected through a Delphi consensus process. The documented outlier variation by region in the use of these diagnostic and treatment interventions runs counter to current best evidence as reviewed in the AAOS Clinical Practice Guideline for the management of CTS. Our analysis supports the feasibility of measures recommending that physicians not use MRI routinely for diagnosis, not routinely use adjunctive surgical procedures, and not routinely refer patients to physical or occupational therapy after surgery for inclusion in MIPS and the NQF.

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