CENTER FOR HEALTH AND SAFETY IN THE WORKPLACE

A study by the RAND Institute for Civil Justice and RAND Health

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REPORT

RAND/UCLA Quality-of-Care Measures for Carpal Tunnel Syndrome

Tools for Assessing Quality of Care and Appropriateness of Surgery

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Supported by the California Commission on Health and Safety and Workers' Compensation and by the Zenith Insurance Company

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Preface

Claims relating to carpal tunnel syndrome (CTS) are common in workers' compensation systems. Given that the economic and human costs connected with CTS are considerable, it is critical that claims analysts, claims managers, medical personnel, and medical organizations be ready to offer high-quality care to workers who may be affected by this condition. The study on which this report is based is a step toward making that possible. It has produced two unique tools for institutions to use, one for assessing the quality of care received by a population of patients who may have CTS, and the other for identifying the necessity of surgery for individual patients. When provided with optimal care, workers can be quickly diagnosed, receive appropriate treatment, and experience greater recovery of health, thus possibly offsetting costs of claims and enabling patients to return to work faster.

This project was carried out in the RAND Center for Health and Safety in the Workplace and in the Division of General Internal Medicine and Health Services Research at the David Geffen School of Medicine at the University of California at Los Angeles (UCLA). Several coauthors were based at institutions other than RAND or UCLA: Neil G. Harness, Kaiser Permanente Medical Group, Fontana Medical Center, Fontana, California; Walter T. Chang, Kaiser Permanente Medical Group, Yorba Linda, California; Kevin C. Chung, Section of Plastic Surgery, University of Michigan School of Medicine, Ann Arbor, Michigan; Charles K. Jablecki, Department of Neurosciences, University of California at San Diego, La Jolla; Karl J. Sandin, Sister Kenny Rehabilitation Institute, Minneapolis, Minnesota; Douglas A. Benner and Joanne Jerome, Occupational Health, Kaiser Permanente Medical Group, Northern California Region, Oakland, California; Haoling H. Weng, Amgen Pharmaceuticals, Thousand Oaks, California; and Erika Bruce and Mary Cassidy, California State Compensation Insurance Fund, San Francisco, California.

The project was jointly supported by the California Commission on Health and Safety and Workers' Compensation, a state-sponsored joint labor-management body charged with overseeing the health and safety and workers' compensation systems in California and recommending administrative or legislative modifications to improve their operation, and by Zenith Insurance, a workers' compensation insurance company based in Woodland Hills, California.

The RAND Center for Health and Safety in the Workplace

The RAND Center for Health and Safety in the Workplace is dedicated to reducing workplace injuries and illnesses. The center provides objective, innovative, cross-cutting research to improve understanding of the complex network of issues that affect occupational safety,

health, and workers' compensation. Its vision is to become the nation's leader in improving workers' health and safety policy.

The center is housed at the RAND Corporation, an international nonprofit research organization with a reputation for rigorous and objective analysis on leading policy issues. It draws on expertise in three RAND research units:

- RAND Institute for Civil Justice, a national leader in research on workers' compensation
- RAND Health, a trusted source of objective health policy research in the world
- RAND Infrastructure, Safety, and Environment, a national leader in research on occupational safety.

The center's work is supported by funds from federal, state, and private sources. For additional information about the center, please contact

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Summary

Claims relating to carpal tunnel syndrome (CTS) are common in workers' compensation systems. CTS leads to more lost time at work than any other nonfatal work-related injury, with a single claim ranging from $1,468 to $11,941, depending on whether surgery is performed. Workers with CTS are affected negatively as well: The loss of earnings born by an injured worker can range from $45,000 to $89,000 over the course of six years. Given the sizable economic and human costs associated with CTS, it is critical that workers receive optimal care for this condition.

Our aim was to promote optimal care of people with CTS by providing two new tools for institutions interested in assessing the quality of care received by a population of patients who may have CTS and determining the necessity of surgery for individual patients. Studies suggest that CTS may be diagnosed and treated in a suboptimal manner throughout the United States. Despite existing treatment guidelines, great variability remains in the kinds of diagnostic evaluations and therapies that patients receive. With optimal care, workers would be quickly diagnosed, receive appropriate treatment, experience greater recovery of health, and return to work faster. Tools that assist in consistently measuring both the quality of care and the appropriateness of surgery can improve the clinical circumstances and economic outcome for people with CTS.

The RAND/UCLA (University of California at Los Angeles) Appropriateness Method informed our development of both tools. This method is a multidisciplinary, two-round, modified-Delphi process that enables its users to obtain a quantitative assessment reflective of the judgment of a group of experts. We constructed draft measures and clinical scenarios addressing the appropriateness of carpal tunnel surgery and then had a panel of national experts in CTS judge the validity and feasibility of the measures. They also judged whether surgery was necessary, inappropriate, or optional for each surgical scenario. On the basis of their judgments about the appropriateness of surgery, we created 12 appropriateness measures and an algorithm. Subsequently, we created the two tools, which we provide in appendixes to this document. A large workers' compensation provider organization and a large workers' compensation payer assisted us with pilot testing. These tests enabled us to examine assessment feasibility issues, such as ease with which relevant patients can be identified, availability of medical records required to assess eligibility for and adherence to individual measures, and clarity and usefulness of the scoring tool.

The two quality-of-care tools are as follows:

- The *quality measures tool*, which is intended to be fairly comprehensive, enables institutions to assess whether people receive optimal diagnostic evaluations and treatments for

their CTS. The quality-of-care measures themselves can be found in Appendix I. The instructions, definitions, and forms needed to adequately apply the measures in assessing the care of a population of patients and to properly analyze the results are provided in Appendixes II through VII.

- The *tool for determining the appropriateness of surgery for CTS* is an algorithm that can be used to determine whether carpal tunnel surgery is appropriate for a particular patient. This tool can be used prospectively—that is, before care is provided, such as in utilization management activities. As with any algorithm in medicine, however, specific clinical circumstances can justify exceptions. This algorithm can also be used retrospectively, meaning after the care has been provided, such as during quality assessment activities. However, the quality measures tool contains sections—included within Appendix IV—designed specifically to assess the appropriateness of surgery retrospectively.

Together, these two tools can provide assistance to provider organizations, medical groups, medical certification boards, and other associated decisionmakers that are attempting to assess, monitor, and provide appropriate care for people with CTS. Payers, particularly workers' compensation payers, could use the algorithm and measures as a guideline for when to authorize surgery. Individual users could find it helpful to adapt both tools to their own purposes, as not all measures may be relevant to all providers or organizations.

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The members of the Carpal Tunnel Quality Group who participated as panelists in the project put a great deal of thought into refining and rating the quality measures. They included Denis Chagnon (Family Practice, Albany Memorial Hospital, New York); Kevin Chung (Hand Surgery, University of Michigan, Ann Arbor); Jeff Harris (Occupational Medicine, Kaiser Permanente Medical Group, Northern California); David Kilmer (Physical Medicine and Rehabilitation, University of California, Davis; deceased 2009); Peter Mandell (Orthopedics, Burlingame, California), Daniel Mass (Hand Surgery, University of Chicago); Victoria Masear (Hand Surgery, Birmingham, Alabama); Mark Melhorne (Hand Surgery, Wichita, Kansas); Cuong Pho (Physical Therapy, Kaiser Permanente, Harbor City, California); Rick Strain (Orthopedics, Hollywood, Florida); and coauthor Charles Jablecki (Neurology, San Diego, California).

The members of the project's advisory board offered seminal advice and feedback in the early stages of the project, when we were developing and refining the draft measures. They included Doug Benner (Medical Director, Regional Occupational Health, Kaiser Permanente Northern California); D. Lachlan Taylor (Workers' Compensation Judge, Commission on Health and Safety and Workers' Compensation); Gideon Letz (Medical Director, California State Compensation Fund); Bernyce Peplowski (past Medical Director, Zenith Insurance); Kathryn Mueller (Professor, University of Colorado, and Medical Director for the Colorado Division of Workers' Compensation); Jane Dereberry (past Chairman, Concentra Occupational Health Research Institute, Austin, Texas); and Philip Harber (Professor, Division of Occupational and Environmental Medicine, Department of Family Medicine, David Geffen School of Medicine at the University of California, Los Angeles, and UCLA Center for Occupational and Environmental Health, UCLA School of Public Health).

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CHAPTER ONE

Introduction

Carpal tunnel syndrome (CTS) is one of the most important musculoskeletal disorders in workers' compensation settings. CTS affects about three out of every 10,000 full-time workers, leads to more than four times as many days away from work as the average nonfatal work-related injury (National Institute for Occupational Safety and Health, 2004), and accounts for more than half of the workers' compensation costs for upper-extremity disorders (Feuerstein et al., 1998). Median costs per workers' compensation claim for CTS range from $1,468 to $11,941 (adjusted to reflect 2009 dollars), depending on whether surgery is performed (Daniell et al., 2005; U.S. Department of Labor, 2009). For each worker with CTS, the cumulative loss of future earnings equals $45,000 to $89,000 (Foley, Silverstein, and Polissar, 2007).

To minimize the human and economic costs associated with CTS and similar occupational injuries, affected individuals must receive optimal medical therapy so that they can rapidly return to full, productive lives. Yet the quality of the medical care provided in the United States is not optimal. In 2003, on the basis of a landmark RAND study, McGlynn et al. reported that, overall, adults in the United States receive only 55 percent of the care recommended by published literature and a consensus of experts (across all care settings). Suboptimal care likely occurs in workers' compensation settings because care for musculoskeletal disorders is little better than average. In the RAND study, patients with low back problems received 68 percent of recommended care, and those with shoulder and knee problems received 57 percent (McGlynn et al., 2003). In two other studies, patients with rheumatoid arthritis received recommended care 62 percent of the time (MacLean et al., 2000), and elders with osteoarthritis received recommended care 57 percent of the time (Ganz et al., 2006).

Both workers and payers have substantial vested interests in assuring that the quality of care for CTS is optimal. With optimal care, workers would be diagnosed with CTS faster, obtain effective treatments sooner, receive appropriate recommendations regarding activity and strategies for mitigating functional limitations, experience greater recovery of health and function, and return to work faster. One randomized controlled trial demonstrated that improving care for workers with musculoskeletal injuries, including CTS, can markedly affect disability and its costs. In this program, about 13,000 workers with musculoskeletal injuries received either usual care or a quality improvement program in which rheumatologists managed patients in accordance with treatment protocols and provided patient counseling and education on appropriate activity levels and return to work. The program reduced time on temporary disability by 37 percent, the percentage of temporarily disabled workers going on to permanent disability by 50 percent, and total medical and disability costs by 37 percent. Each dollar invested in the program saved $11.00 (Abasolo et al., 2005). A smaller, Washington State program produced similar results: Disability costs were reduced by 30 percent by improv-

ing adherence to treatment protocols and encouraging providers to prescribe activity and plan for return to work (Wickizer et al., 2001). The savings could be even greater if worker productivity were considered, since CTS is a common cause of absenteeism (Wilson d'Almeida et al., 2008). Thus, improving quality of care may represent a unique "win-win" situation for workers and payers, the two central stakeholders in workers' compensation systems.

There are two specific reasons to believe that the quality of care received by patients with CTS may be suboptimal. First, such care is highly variable, which suggests that factors other than patient characteristics and published literature influence providers' decisions. A study of 74 patients diagnosed with CTS found that the history and physical examination elements specified in common treatment guidelines were performed inconsistently and that the chosen therapies varied widely depending on the provider's specialty (Townsend et al., 2006). Another study showed that physicians differ in the criteria they use to diagnose CTS, even within a single specialty (Graham et al., 2006). One study found a 3.5-fold variation in the receipt of carpal tunnel release surgery across health service areas in Maine, ranging from 0.82 to 2.87 operations per thousand individuals in a service area (Keller et al., 1998). Because the underlying rate of need is unlikely to vary this greatly, these data suggest that surgeons apply different indications for this surgery across regions.

The second specific reason for believing that care may be suboptimal is that this variability in diagnostic and therapeutic practices appears to affect not only when patients receive a CTS diagnosis but also such outcomes as how long they stay off work and the severity of their symptoms after treatment. A Washington State study found that half of workers' compensation claims for CTS were initially filed for other conditions, and 20 percent of the time the CTS was not diagnosed until more than three months into the claim. Later diagnoses were associated with longer disability (Daniell et al., 2005). Also, while many patients achieve optimal results following carpal tunnel release surgery, 10 to 15 percent experience an unsatisfactory result (McDonald and Lourie, 2005; Schreiber et al., 2005; al-Qattan, Bowen, and Manktelow, 1994; Gerritsen et al., 2002; Katz et al., 1998; Katz et al., 2001; Boya, Ozcan, and Oztekin, 2008), and an incorrect pre-operative diagnosis is a leading reason that symptoms fail to improve (Steyers, 2002). In a randomized trial, minor complaints, such as scar pain and wrist stiffness, were common following CTS, and one of 87 patients developed reflex sympathetic dystrophy, a continuous intense pain out of proportion to the severity of the injury that gets worse rather than better over time (Gerritsen et al., 2002; National Institute of Neurological Disorders and Stroke, 2010). One recent study observed that 20 months after open carpal tunnel release surgery, 7.3 percent of patients had scar tenderness, 12.7 percent had wrist pain, and 18 percent had burning discomfort (Boya, Ozcan, and Oztekin, 2008). Thus, carpal tunnel release surgery carries a small chance of severe post-operative symptomatic morbidity and a moderate chance of persistent bothersome symptoms. These risks can be minimized by ensuring that the surgery is performed for appropriate indications and with optimal perioperative care.

To verify whether care for patients with CTS warrants improvement, specific assessment tools are required. These tools, called *quality measures*, can make quantitative distinctions between higher- and lower-quality care and are useful for assessing quality across a population rather than for individual patients. Because measures are sometimes linked to incentives, such as public reporting or financial rewards, they usually describe basic standards rather than best practices and are silent when there are multiple equally appropriate approaches. Measures are scored in a systematic, highly structured fashion to ensure consistent results (Walter et al.,

2004). Relevant populations need to be defined for each measure so that the denominator (i.e., when care is eligible for a measure) and numerator (i.e., when care adheres to the measure) can be determined. Terms need to be defined and sometimes explained in detail, and justifiable exceptions to the measure need to be clarified. Rules are needed for how to handle missing information, an issue that often arises when medical records are being reviewed to assess provided care. Given the substantial variability in documentation practices across providers, particularly the terms used, specific guidance is needed on what types of wording to accept and to exclude.

While quality measures that focus on care processes share development methods and clinical content with treatment guidelines, guidelines and quality measures serve complementary functions. Many states have implemented workers' compensation treatment guidelines in recent years in efforts to standardize and improve care for people with occupational injuries.[1] Several professional societies and other organizations have issued treatment guidelines for CTS (American College of Occupational and Environmental Medicine, 2008, 2006; Jablecki et al., 2002; American Academy of Orthopaedic Surgeons, 2007, 2008). However, guidelines cannot be accurately or reliably used as quality assessment tools. In contrast to quality measures, as described above, guidelines are generally designed to be flexible and advisory. They permit providers to use their experience when recommending treatment for individual patients and acknowledge that there is often more than one acceptable approach. Thus, the use of both guidelines and quality measures would help to ensure that people with CTS receive high-quality care.

Project Objectives and Scope

In direct response to the need for consistent and high-quality tools that can help claims and medical professionals evaluate and offer appropriate care to workers affected by CTS, we developed two tools that can be used to assess, via medical record review, the quality of the diagnostic, therapeutic, and surgical management of populations of patients who have either symptoms often ascribed to CTS or an actual diagnosis of CTS.

The first tool is a set of quality-of-care measures. The complete list of quality measures is available in Appendix I of this report.[2] The information and forms needed to score the measures for a population of patients and to analyze the results are provided in Appendixes II through VII. Because the measures need to be scored in a highly structured fashion, we developed scoring instructions (parts A within Appendixes IV, V, and VI) that can be used to examine whether care adheres to the measures, data forms (parts B within Appendixes IV, V, and VI) that can be used to record data (since the worksheet is more than 60 pages), and guidance documents (parts C within Appendixes IV, V, and VI) that include definitions and qualifications useful for users during training and, later, when questions arise.

The second tool is an algorithm for determining whether carpal tunnel surgery is necessary, optional, or inappropriate for a particular type of patient. This tool, available in Appendix VIII, can be used *prospectively*, meaning before care is provided, such as during utilization man-

[1] Phil Denniston, Work Loss Data Institute, personal communication, August 29, 2007.

[2] The appendixes are stand-alone documents accessible via links on the RAND web page for this report: http://www.rand.org/pubs/technical_reports/TR809/

agement activities. As with any algorithm in medicine, however, ours is not absolute in that specific clinical circumstances can warrant deviations from it (e.g., not providing care that the algorithm indicates is necessary or providing care that the algorithm indicates is inappropriate). This algorithm can also be used *retrospectively*, meaning after care has been provided, such as during quality assessment activities. However, the quality measures tool contains sections (within Appendix IV) designed specifically to assess the appropriateness of surgery retrospectively.

Users may find it helpful to adapt the tools to suit their purposes. Not all measures may be relevant to all providers or organizations. Additionally, users may prefer to interpret the measures and define associated terms differently than we have. We ask that when reporting results publicly, users cite the current report and disclose any deviations from the tools.

Report Outline

The overarching goal of this report is to describe the empirical and theoretical foundations of the two CTS tools that we developed. Chapter Two outlines the development methods we used; Chapter Three describes the results of our development, which, in sum, form the assessment frameworks that were the basis for our two tools. Chapter Four examines the limitations of the measures, and finally, Chapter Five offers conclusions and recommendations for use of the tools, including ways in which potential users may adapt the tools to their own needs.

CHAPTER TWO

Methods

We developed the CTS quality-of-care measures using a variation of the well-established RAND/UCLA Appropriateness Method, which considers available literature and is able to overcome any gaps in the research evidence by rigorously synthesizing the experience of expert clinicians (see Fitch et al., 2001, and Shekelle, 2004, for detailed descriptions of this method). The Appropriateness Method has also been used to develop quality measures for other musculoskeletal disorders and surgical procedures (McGlynn et al., 2003; MacLean et al., 2000; Ganz et al., 2006; Quintana et al., 2006).

Measure development involved a four-step process: (1) developing draft measures by integrating guidelines and literature; (2) refining and selecting measures, in this case using a variation of the RAND/UCLA panel method; (3) developing a tool that specifies how measures are to be applied; and (4) pilot testing the measures and tool against a data source. Several papers describe in detail how the current measures were developed, as well as the relevant literature and rationale for each measure (Maggard et al., 2010; Sandin et al., 2010; Nuckols et al., 2010; Nuckels et al., in press). The methods used are described next.

Development of the Draft Measures

Our development of the draft measures was an iterative process involving collaboration among two hand surgeons, a physiatrist, a rheumatologist, and two internists with expertise in quality measurement. First, we identified aspects of care relevant to improving quality for CTS (e.g., the initial physical examination) using relevant clinical practice guidelines and other summary literature. We conducted a general literature search on CTS (meaning we sought clinical review articles, systematic reviews and meta-analyses, position statements, and other summary literature that would suggest important aspects of care for CTS), updated a 2004 search for relevant guidelines (Nuckols et al., 2005) by searching MEDLINE® and National Guideline Clearinghouse, and accessed personal reference collections. Team physicians reviewed the guidelines and literature, chose care processes either likely to affect patient outcomes or widely recommended, and then wrote draft measures.

Next, we conducted directed MEDLINE® searches to identify evidence pertinent to the draft indicators. A reference librarian conducted the searches, excluding case reports and animal studies. The searches included the terms *carpal tunnel syndrome* OR *median neuropathy*, with additional Medical Subject Headings (MeSH) terms for specific subtopics. Team physicians sequentially reviewed titles, abstracts, and articles to assess the relevance to each draft measure. Draft measures were refined, added, and deleted on the basis of search results.

Next, physicians summarized, for each draft measure, the evidence supporting the relationship between the care process and patient outcomes, emphasizing the highest-quality evidence identified. Because most of the evidence was not high quality, they used a simplified classification scheme: level 1, randomized controlled trial; 2, observational study; and 3, case reports, case series, and expert opinion. Where level 1 evidence was not available, the summary described a chain of evidence or clinical rationale.

Appropriateness of Surgery. One particularly important aspect of care that the project considered was the appropriateness of carpal tunnel surgery. As noted in the previous chapter, some of the quality measures within the quality measures tool (in Appendixes I and IV) and the algorithm (Appendix VIII) address the appropriateness of surgery. Methods for developing the surgical appropriateness measures and algorithm differed slightly from those used to develop the other measures. Drawing from the literature, we created clinical scenarios (indications) by combining five characteristics: (1) severity of carpal tunnel symptoms based on symptoms, signs, and electrodiagnostic test results (three categories: mild, moderate, severe); (2) probability that symptoms represent CTS (two categories: high probability, less than high probability); (3) symptom duration (three categories: <3, 3–12, >12 months); (4) response to any non-operative treatment (two categories: non-operative treatment attempted without satisfactory resolution of symptoms, non-operative treatment not attempted or attempted with satisfactory resolution of symptoms); and (5) results of any electrodiagnostic testing (three categories: performed with positive result, performed with negative result, performed with indeterminate result or not performed). The panel voted on definitions for the characteristics, categories within each characteristic, and associated terms (these definitions are included in Appendixes IV and VIII). Each of the clinical scenarios represented patients having a particular set of characteristics. For example, an individual patient could have mild symptoms, symptoms that have a less than high-probability likelihood of actually representing CTS, no experience trying non-operative treatments, and a negative electrodiagnostic test.

Using all of the different possible combinations of these five characteristics, we created a matrix (i.e., a table) of 90 scenarios. In the matrix, similar scenarios were listed together using columns and rows; this made it easier for the panelists to rate similar scenarios. Some scenarios (i.e., combinations of characteristics) were intentionally omitted from the matrix because they are likely to apply to very few patients. For patients with severe CTS, nearly all would also have high probabilities of having CTS under our definitions; therefore, the matrix did not include scenarios with high symptom severity together with a low probability of having CTS.

Refinement and Selection of the Measures

The RAND/UCLA Appropriateness Method is a multidisciplinary, two-round, modified-Delphi process that enables researchers to obtain a quantitative assessment reflective of the judgment of a group of experts (Fitch et al., 2001; Shekelle, 2004). In adapting this method for the current project, we employed the following steps.

First, we obtained preliminary feedback on the draft measures from the project's advisory board (the members of which are named in the Acknowledgments). This feedback was used to refine the draft measures.

Next, we selected panelists by asking national specialty societies to recommend leaders in each specialty, after which we reviewed curriculum vitae, interviewed candidates, and con-

tacted references. The panel had 11 members: an occupational medicine physician, a neurologist, a physiatrist, a family physician, a physical therapist, four hand surgeons (one with primary board designation in plastic surgery; three, in orthopedic surgery), and two orthopedists. Panelists represented a variety of expertise, geographic locations across the United States, and academic and community practice settings. The panelists we selected became members of the Carpal Tunnel Quality Group, together with members of the research team who were involved in developing the measures.

The Appropriateness Method involved two rounds of ratings. For the first round, panelists rated the measures at home, prior to meeting as a group. To do so, panelists received the evidence summaries, draft measures, ballots, and instructions. For the second round, panelists met in person, and members of our research team moderated discussions of each draft measure, the evidence, and first-round ratings.

We used a modified-Delphi panel method (rather than a consensus-panel method, which forces agreement) so that different attitudes could be expressed and discussed and true agreement or disagreement could emerge. Each panelist received a summary of the first-round ratings for each measure or scenario, including the median, standard error, his/her rating relative to the distribution, and the analytic interpretation. Panelists suggested modifications to definitions of key terms and measures; these were adopted when a majority voted to do so. After all opinions had been voiced for a measure, panelists marked private, equally weighted ballots. Panelists were asked to rate the validity, feasibility, and importance of the quality measures on 9-point scales (9 = highest) during both rounds. Panelists were instructed that a measure should be considered valid if (1) there was adequate scientific evidence or professional consensus to support a link between the performance of care specified by the measure and improved clinical outcomes and (2) based on the panelists' professional experience, health professionals with significantly higher rates of adherence to the measure would be considered higher-quality providers (Fitch et al., 2001). Feasibility was defined as the potential ability to use medical records to evaluate adherence to the measure. Importance was defined as the magnitude of the potential effect on patient outcomes.

After panelists rated validity, feasibility, and importance, we interpreted the ratings as follows. For a measure to be considered valid overall, the panelists' median rating on the validity dimension had to be 7 to 9, and panelists could not disagree about whether the measure was valid (disagreement is defined below). If a measure had a median validity rating of 1 to 3, and panelists did not disagree, the measure was considered to be not valid overall. If the median rating was 4 to 6 or panelists disagreed about validity, the measure was considered to be of uncertain validity. Disagreement was defined as three or more panelists rating in the 1-to-3 range and three or more in the 7-to-9 range (Fitch et al., 2001). Only measures that were judged valid overall were included in the later stages of this project.

Prior RAND/UCLA appropriateness studies have not included feasibility or importance as separate variables because these can be considered dimensions of validity (e.g., a measure cannot be a valid reflection of quality if it is not feasible or important). However, we felt that it would be helpful to have these dimensions rated separately as a way to anticipate feasibility issues in advance of pilot testing and to facilitate prioritization of the measures. We considered measures to be potentially feasible if the panelists' median rating on the feasibility dimension was 4 or above. We selected a low cutoff value to be inclusive, because the later pilot-testing activities would shed further light on feasibility. There was no minimum threshold for panel-

ists' median ratings of importance; we included this variable so that end users could, if they chose to, prioritize measures.

Appropriateness of Surgery. Panelists rated the appropriateness of carpal tunnel release surgery for each of the clinical scenarios (i.e., combinations of clinical characteristics). As noted above, the scenarios were listed in a matrix that grouped similar scenarios together. We asked panelists to consider, for each scenario, the potential benefits of surgery relative to the risks; for example, "How appropriate is performing carpal tunnel surgery in a patient with mild CTS, a high probability presentation, less than a 3-month duration of symptoms, a trial of conservative therapy that failed, and a positive electrodiagnostic test?" Additionally, they were asked to rate appropriateness on a 9-point scale (9 = highest) and were instructed in the definitions of necessary, inappropriate, and optional care, as well as the planned interpretation of ratings. Care was defined as *necessary* when the potential benefits to the patient were found to exceed the risks to a degree such that the surgery must be offered, as *inappropriate* when the risks of harm were found to exceed the potential benefits by a wide margin, and as *optional* when determined to be neither necessary nor inappropriate.

Surgery was considered inappropriate if the median rating was 1 to 3 without disagreement, necessary if the median rating was 7 to 9 without disagreement, and optional if the median rating was 4 to 6 or there was disagreement. Disagreement was defined as three or more panelists rating in the 1-to-3 range and three or more in the 7-to-9 range.

Development of the Tool for Using the Measures

Two RAND staff members with extensive experience in quality measurement—one with a background in public health, and the other a practicing nurse—operationalized the measures, working with an internal medicine physician on the team. Operationalization involved developing the tools described in this document, including defining terms, timeframes, inclusion and exclusion rules, etc.

Appropriateness of Surgery. Physicians on the research team grouped scenarios sharing clinical characteristics and judgments about necessity and inappropriateness. These groupings were used to create the quality measures addressing the appropriateness of surgery (in Appendixes I and IV), which are worded as If-Then statements, as well as the algorithm, which is structured as a flow chart (Appendix VIII).

Pilot Testing

We pilot tested these measures in conjunction with a large workers' compensation provider organization (Occupational Health, Kaiser Permanente, Northern California Region) and a large workers' compensation payer (California's State Compensation Insurance Fund, commonly referred to as State Fund). Pilot testing enabled us to examine feasibility issues—such as ease with which relevant patients can be identified, availability of the medical records required to assess eligibility for and adherence to individual measures, and clarity and usefulness of the scoring tool—and preliminary rates of adherence to the measures.

RAND staff members led a two-day training session for the personnel (six claims-review nurses and one physical therapist from the two organizations) who were to serve as

abstractors—i.e., individuals with relevant clinical backgrounds who obtain, or "abstract," specific clinical information from medical records. The training included an explanation of the quality measurement's purpose, the intended use of the measures, numerators and denominators for each measure, the tool's various sections, and some practice cases. For each case, two abstractors reviewed the patients' workers' compensation records to determine adherence to the measures.

Next, the State Fund team selected patients by applying pre-specified criteria (time period and diagnostic category) to its administrative databases. The diagnostic categories included CTS and conditions commonly confused with CTS (State Fund does not use International Classification of Diseases, Revision 9 [ICD-9] or Current Procedural Terminology [CPT] codes). State Fund provided the Kaiser Permanente abstractors with a list of 50 patients that Kaiser Permanente had treated. The State Fund abstractors reviewed workers' compensation claim reports and associated clinical records routinely collected for claims processing. The Kaiser Permanente abstractors reviewed the complete electronic medical records for each patient, as well as the workers' compensation claim reports. The pilot-test activities were approved by each of the institutional human subjects' protection committees; informed consent was not required. The abstractors from both organizations provided RAND with completed data forms (which carried study identification numbers but were otherwise de-identified).

Both during the training and during and at the end of the pilot-testing process, the claims-review nurses provided detailed feedback on issues that arose when using the tool. The tool was modified in response to this feedback—for example, clarifications were made to the guidance document. RAND staff reviewed the data forms, identified missing or inconsistent responses, requested additional information from the abstractors when necessary, and conducted simple frequency analyses of the results. RAND staff were unable to compare the data on the data forms with information in the subjects' medical records because RAND did not have access to the medical records.

CHAPTER THREE

Results

Development of the Measures

In all, we developed 73 draft measures. Of the 40 that addressed the diagnosis and non-operative management of CTS, the panelists judged 31 (78 percent) to be valid and feasible. Of the seven for electrodiagnostic testing, two were combined, and the resulting six were judged to be valid and feasible. For the matrix of 90 scenarios for carpal tunnel surgery appropriateness, the panelists judged surgery to be necessary for 16 scenarios, inappropriate for 37, and optional for 37. We combined the related scenarios into 12 measures. Lastly, of the 26 draft measures for pre-operative, intra-operative, and post-operative care for patients undergoing carpal tunnel surgery, 23 (88 percent) were judged to be valid and feasible.

Table 3.1 lists the names of the measures that panelists judged to be both valid and feasible. The complete texts of these measures are included in Appendix I.

Operationalization and Pilot Testing of the Tool for Using the Measures

The appendixes to this report represent the most useful results of the operationalization and pilot-testing steps. However, readers are also likely to be interested in our preliminary data on rates of adherence to the measures, as well as our observations from the pilot-testing activities.

Regarding preliminary rates of adherence, the pilot study included a total of 28 unique patients. Sixteen had been diagnosed with CTS, and the remaining 12 had been diagnosed with upper-extremity disorders commonly confused with CTS. Twenty-four patients were eligible for one or more measures. Patients diagnosed with CTS were eligible for an average of 16 measures each. Care was eligible for a measure a total of 559 times, and adhered to the measures 419 times (an overall adherence rate of 75 percent). Adherence rates were 66 percent for initial evaluation, 79 percent for non-operative treatment, 81 percent for management of activities and functional limitations, 100 percent for surgical appropriateness (see below), and 75 percent for peri-operative care. These results illustrate the ability to assess quality of care for CTS and should not be considered representative of the care provided by these organizations.

Appropriateness of Surgery. Fourteen patients with CTS underwent carpal tunnel surgery for the first time during the study period, and one had undergone surgery in the past. For ten patients, their medical records were complete enough to determine the appropriateness of surgery, and since all of them had undergone surgery, we were unable to assess the underuse of necessary surgery. Four patients underwent necessary surgery for mild CTS, three for

Table 3.1
Titles of RAND/UCLA Quality-of-Care Measures for Carpal Tunnel Syndrome That Panelists Judged to Be Both Valid and Feasible

- Measures for the initial evaluation of hand and forearm symptoms
  - New symptoms characteristic of CTS require detailed assessment
  - New symptoms characteristic of CTS should lead to suspicion
  - New hand or forearm pain requires evaluation for "red flags"
  - New symptoms inconsistent with CTS require evaluation
  - New CTS diagnosis requires assessment of medical risk factors
  - New suspicion of CTS requires specific physical examination
  - New suspicion of CTS requires evaluation for excessive weight
  - Imaging should be used selectively for suspected CTS
  - Symptoms should be monitored after new diagnosis of CTS
- Measures for electrodiagnosis in suspected CTS
  - Essential components of electrodiagnostic evaluation for CTS
  - Skin temperature measured during test
  - Low skin temperature normalized before electrodiagnostic testing
  - Criteria for calling electrodiagnostic test consistent with CTS
  - Criteria for calling positive test for CTS severe
- Measures for the non-operative treatment of CTS
  - Splints should be placed in neutral position
  - An attempt at splinting should last at least six weeks
  - Nonsteroid anti-inflammatory drugs (NSAIDs) should not be used for CTS
  - Muscle relaxants should not be used for CTS
  - Opioids should not be used for CTS
  - Diuretics should not be used for CTS
  - First-time steroid treatment requires discussion of risks
  - Discuss benefits of surgery when offering steroids to patients with severe CTS
  - Steroids for work-associated symptoms require follow-up
  - Limit steroid injections to four
  - Low-level laser therapy should not be used for CTS
- Measures for addressing activities and functional limitations potentially associated with CTS symptoms
  - New CTS diagnosis requires detailed occupational history
  - New CTS diagnosis requires assessment of occupational factors
  - New CTS diagnosis requires assessment of non-occupational factors
  - Exacerbating activities should be identified when symptoms limit functioning
  - Rationale for work association should be documented
  - Patients newly diagnosed with CTS should be educated about the condition
  - Exposures to vibration, force, and repetition should be minimized
  - Work-associated CTS symptoms require prompt follow-up
  - Work status should be monitored when CTS appears work associated
  - Return to work after CTS-related disability requires follow-up assessment that includes functional limitations
  - Prolonged CTS-related disability should trigger evaluation
- Measures for determining when carpal tunnel release surgery is necessary
  - Indications for carpal tunnel surgery are not changed by diabetes
  - Prompt surgery in wrist injury
  - *Appropriateness of Surgery*[a]
    - Compelling indications for surgery when CTS is MILD
    - Compelling indications for surgery when CTS is MODERATE, part I
    - Compelling indications for surgery when CTS is MODERATE, part II
    - Compelling indications for surgery when CTS is SEVERE, part I
    - Compelling indications for surgery when CTS is SEVERE, part II
    - Compelling indications for surgery when CTS is SEVERE, part III
- Measures for determining when carpal tunnel release surgery is inappropriate
  - Avoidance of carpal tunnel surgery during pregnancy
  - *Appropriateness of Surgery*[a]
    - Compelling CONTRA-indications for surgery when CTS is MILD, part I
    - Compelling CONTRA-indications for surgery when CTS is MILD, part II
    - Compelling CONTRA-indications for surgery when CTS is MODERATE, part I
    - Compelling CONTRA-indications for surgery when CTS is MODERATE, part II
    - Compelling CONTRA-indications for surgery when CTS is MODERATE, part III
    - Compelling CONTRA-indications for surgery when CTS is MODERATE, part IV

Table 3.1 (continued)

Pre-operative care measures
Pre-operative electrodiagnostic testing for work-associated CTS
Recent pre-operative visit with surgical team
Elements of general pre-operative history: medical co-morbidities
Elements of general pre-operative history: past surgical history
Elements of general pre-operative history: medications
Elements of general pre-operative history: allergies (medication intolerances)
Elements of general pre-operative history: review of systems including at least two organ systems
Elements of CTS-specific surgical evaluation
Documentation of prior treatments for CTS
Pre-operative evaluation of suspected cervical radiculopathy
Consent for open procedure in planned endoscopic release
Intra-operative care measures
Indications for primary open rather than endoscopic release
Documentation of proximal transverse incision location in endoscopic release
Identification of deep surface of transverse carpal ligament (TCL) in endoscopic release
Documentation of TCL release
Limit superficial epineurotomy to specific indications
Limit internal neurolysis to specific indications
Limit flexor tenosynovectomy to specific indications
Avoidance of routine TCL repair
Post-operative care measures
Requirement for a post-operative visit
Elements of post-operative visit with surgical team
Monitoring of post-operative stiffness
Management of post-operative finger stiffness
Patients who don't improve after surgery require evaluation
Management of lack of improvement after surgery

[a] The content of these measures is also conveyed by the algorithm (Appendix VIII); the only difference is in how the information is presented. As explained in Chapter Two, the methods used to determine the appropriateness of carpal tunnel surgery differed slightly from the methods used for the other quality measures.

moderate CTS, and one for severe CTS. No inappropriate surgeries were performed. The remaining two surgeries were for optional indications.

While conducting this pilot test, we made a number of observations that may be helpful. First, tool users must be able to accurately identify patients who have or might have CTS. Usually administrative (i.e., claims) databases are used to identify patients. Databases that include CPT and ICD-9 codes are ideal, when possible. The absence of specific coding systems makes identifying relevant patients more challenging but not impossible.

Second, assessing adherence to the measures requires a complete record of the care provided for CTS. Claims databases provide the necessary information for no more than a few of the measures—i.e., this set of measures cannot be scored solely on the basis of CPT and ICD-9 codes or similar variables. Workers' compensation claims forms, as standardized within many states, may suffice if they are easily obtained and contain all or nearly all the information in the medical record. However, as we now know, much of the necessary information is generally missing from these forms, which means that medical records are required to score most of the measures.

Third, individuals with appropriate skill levels are needed to assess quality using this tool. Most measures can be rated by nurses or other providers with claims-review backgrounds. However, the electrodiagnostic and intra-operative care measures require physicians with expertise in those fields.

CHAPTER FOUR

Limitations

Like all quality measures, the ones we developed have general limitations. First, not all of the important aspects of care for patients with CTS are amenable to measurement. For example, patients can be sensitive about discussing potential barriers to returning to work, and some providers may conduct these discussions more effectively than others do. There is no way to measure this aspect of care, anymore than the differences in surgeons' skills in handling tissues and instruments. Second, for each measure, unique clinical circumstances will warrant exceptions to the rule. Justifiable exceptions are not problematic so long as they are rare and randomly distributed among populations of patients.

In addition, our quality measures and the data collection tools have specific limitations. First, the literature examining these practices is rather limited, and most of the measures are based on expert consensus. In contrast to some fields, such as cardiology, musculoskeletal disorders suffer from a lack of large, high-quality randomized controlled trials. However, randomized controlled trials are not feasible for all aspects of care. The panel method we used offers an alternative approach to determining the right care in such clinical situations. In the past, the panel method has successfully overcome similar limitations in the literature for osteoarthritis, rheumatoid arthritis, arthroplasty of the knee and hip, and many other clinical situations (MacLean et al., 2000; Ganz et al., 2006; Quintana et al., 2006). Second, the ultimate test of the feasibility of measures and data collection tools is to apply them to medical records, and the ultimate test of their validity is to assess whether better adherence is associated with better patient outcomes. We were able to pilot test these measures and tools using 28 medical records, but the relationship between adherence and outcomes has yet to be assessed. However, it should be noted that neither has it been assessed for most of the quality measures in wide use today.

CHAPTER FIVE

Conclusions and Recommendations

We developed 78 measures that can be used to evaluate the quality of care provided to patients with CTS. In the near future, we plan to use these measures to assess the extent of quality-of-care problems for CTS in an occupational setting, as well as to study the relationships between measure adherence and patient outcomes and costs to patients and employers. Beyond the research context, the measures can facilitate a variety of efforts to improve quality of care for patients with CTS, whether those efforts are initiated by providers, medical groups, payers, or even state or federal policymakers.

Provider organizations or medical groups could use these quality measures in internal efforts to monitor and improve quality of care for CTS, as is commonly done for heart attack prevention, diabetes, and other chronic diseases. This is probably the most beneficial use for these measures, for two reasons: (1) the burden of quality assessment activities is minimized when the focus is at an organizational rather than an individual level, and (2) the ability to produce improvement often requires the participation of many individuals and system changes possible only at the organizational level. An extensive literature exists on organizational quality-improvement activities.

Payers, particularly workers' compensation payers, could use the algorithm and measures in various ways. The surgical appropriateness algorithm can be used as a guideline on when to authorize surgery. It would standardize and streamline payers' prospective utilization management practices and make them more consistent with the standard of care practiced by hand surgeons today. However, adequate documentation of specific clinical findings is a necessary step in assessing the appropriateness of surgery, so wide implementation of the algorithm may necessitate changes to documentation practices.

Using the quality measures, payers could also participate in quality-improvement or quality-reporting activities. To do so, they will need to work closely with provider organizations in order for comprehensive quality reviews to become feasible, since providers have full sets of medical records, which usually is not the case for payers. However, two concise documents are often routinely included in payers' claims documents—electrodiagnostic test reports and operative reports—both of which are important aspects of care whose quality would be easy to assess using our quality-measure tools. The principal hurdle would be the possible need to have the reports reviewed by physicians with specific expertise in electrodiagnosis and by hand surgeons.

Ultimately, payers might consider using the data produced by quality assessments as a basis for referring patients to higher-quality providers or for offering higher-quality providers greater remuneration. Employers will surely value the improved outcomes that may result for

their workers who have CPS, as well as the possibility of reduced costs of workers' compensation claims.

Policymakers could facilitate or require the use of the algorithm and measures within state workers' compensation systems. Payers could be authorized to use the surgical appropriateness algorithm in utilization management activities, supplementing the treatment guidelines currently mandated in many states. This would be helpful, because while the existing treatment guidelines offer only very general advice on when to perform surgery, the algorithm is far more specific. To facilitate quality reporting and improvement activities, policymakers could support communication about quality-of-care issues in public forums attended by relevant stakeholders, such as representatives of workers, employers, and payers. Policymakers could also sponsor research on quality-of-care issues. Lastly, they could sponsor or mandate public reporting of quality-of-care data.

The provider community could put these measures to use in other ways, one of which is board-certification activities. Periodic retrospective review of one's own medical records is a central component of maintenance-of-certification processes in several fields, and participation is already required for the occupational and preventive medicine specialties—the American College of Occupational and Environmental Medicine (undated) and the American Board of Preventive Medicine (2010). Standardized quality measures, such as those developed in our project, would be helpful tools for these programs.

Additionally, the measures can be used as part of a needs assessment for continuing medical education activities. The Accreditation Council for Continuing Medical Education now requires providers of continuing medical educational activities to "use a planning process(es) that links identified educational needs with a desired result in its provision of all CME activities" (Accreditation Council for Continuing Medical Education, 2008, p. 1). For example, electrodiagnosticians could submit examples of electrodiagnostic tests to educators before a continuing medical education activity. The educators could assess the studies using the current quality measures and then tailor a workshop to the knowledge deficiencies of the group. Similarly, to determine when hand surgeons' understandings of the indications for surgery differ from accepted standards, the scenarios we developed could be incorporated into clinical vignettes. Such vignettes could be used to assess baseline knowledge at the start of a course, and the course then tailored to meet any deficiencies revealed.

In summary, the quality measures can be used in many ways. And since CTS is just one of many work-related disorders, additional sets of measures should be developed for other conditions. We hope that by placing these measures and the supporting documentation into the public domain and encouraging potential users to tailor them to their needs, patients, providers, provider groups, medical specialty societies, employers, payers, and governments will begin to explore quality-of-care issues. The two central stakeholders in workers' compensation systems—workers and employers—stand to gain much from improved quality of care, especially for a condition as common and disabling as CTS.

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