



Time From Booking Until Appointment and Healthcare Utilization in Hand Surgery Patients With Discretionary Conditions

Citation

Kuntz, Michael T. 2015. Time From Booking Until Appointment and Healthcare Utilization in Hand Surgery Patients With Discretionary Conditions. Doctoral dissertation, Harvard Medical School.;Kuntz M, Teunis T, Blauth J, Ring D. (2015) Time from Booking Until Appointment and Healthcare Utilization in Hand Surgery Patients with Discretionary Conditions. Journal of Hand and Microsurgery [ePub ahead of print]. DOI: 10.1007/s12593-015-0198-y.

Published Version

<http://link.springer.com/article/10.1007/s12593-015-0198-y>

Permanent link

<http://nrs.harvard.edu/urn-3:HUL.InstRepos:17295874>

Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA>

Share Your Story

The Harvard community has made this article openly available.
Please share how this access benefits you. [Submit a story](#).

[Accessibility](#)

Abstract

Delaying medical therapy for benign musculoskeletal conditions may allow patients to develop coping strategies, resulting in less need for medical intervention and reduced cost. Our primary question was whether time from booking until appointment is associated with healthcare costs. Our secondary question was whether time from booking to appointment is associated with healthcare utilizations, including imaging, injections, nerve conduction studies, occupational therapy visits, surgery, referrals, and second opinions.

We identified 16,750 patients making a first clinic visit to a hand surgery practice from 2003 through 2012. Utilizations were determined until the patient's second visit. Costs were determined in Relative Value Units. In multivariable models, duration between booking and office visit was not associated with higher cost. Duration between booking and office visit was associated with a higher rate of nerve conduction studies ($P < 0.001$) and a lower rate of occupational therapy ($P < 0.001$). We observed substantial variation in cost and utilization based on treating surgeon. In a setting with relatively short wait times, greater wait time was not therapeutic, but is associated with different diagnostic and treatment measures. The variations by surgeon may make variations based on other factors including time between booking and appointment difficult to discern.

Table of Contents

Glossary of Abbreviations.....	4
Introduction.....	5
Methods.....	9
Results.....	12
Discussion, Conclusions, and Suggestions for Future Work.....	15
References.....	23
Tables and Appendices Legend.....	25
Acknowledgements.....	25
Tables.....	26
Appendices.....	35

Glossary of Abbreviations

β : Regression coefficient

CI: Confidence Interval

CPT: Current Procedural Terminology

ICD-9: International Classification of Disease, 9th Revision

OR: Odds ratio

ρ : Pearson's correlation coefficient

RVU: Relative value unit

Introduction

Many musculoskeletal illnesses are self-limiting. Most are benign although pain rarely feels benign because the normal human response to pain is to feel protective and prepare for the worst (i.e., catastrophic thinking). A delay in medical evaluation might be therapeutic in that the patient learns management strategies and grows self-efficacy; learns that most pains are nonspecific, benign, self-limiting, and do not benefit from medical attention; and avoids unnecessary testing and interventions that can cause iatrogenic harm (1). Such a potentially therapeutic delay occurs in the interval between scheduling a clinic visit and seeing a hand surgeon—a delay that can be quite long in a national health service, but is generally quite short currently in the United States.

Catastrophic thinking is the tendency to overly concentrate on pain and mentally magnify the negative aspects of such a pain (2). Such thinking can be measured through the Pain Catastrophizing Scale, a validated scale which measures three components, including: rumination (consistent preoccupation with the pain), magnification (tendency to amplify perceived pain or think that a pain represents an undiagnosed problem), and helplessness (inability to overcome pain) (3, 4). The relationship between catastrophizing and perceived pain has been well established. For example, one study demonstrated a positive correlation between a patient's pain catastrophizing score and their level of pain perceived to both heat and muscle exertion (5). It has also been demonstrated that patients presenting to hand surgery offices with complaints of idiopathic pain (vague complaints with inconsistent exams) have higher pain-magnification and helplessness scores, as well as higher overall total pain catastrophizing scores, than do patients with discrete pains (single identifiable causes of pain) (3).

This relationship between catastrophizing and pain perception has been demonstrated across a number of different patient populations, including patients with chronic pain conditions, acute injuries, and even among asymptomatic individuals in experimental pain procedures (6). One survey of patients with chronic pain conditions, the majority of which were musculoskeletal, demonstrated that chronic pain patients who catastrophize experience not only more pain intensity, but also experience more disability due to their pain and are more psychologically distressed (7). Sullivan, et al., examined patients who sustained soft-tissue injuries which resulted in chronic pain (8). This study showed an association between catastrophizing and higher disability within all domains of

the pain disability index, which assesses pain-related disability in several areas of daily living (including home, social, recreational, occupational, sexual, self-care, and life support).

Various types of pain have been shown to be related to catastrophic thinking. In particular, neuropathic pain intensity has been shown to be positively correlated with catastrophizing (9). In this study, among the three components of the pain catastrophizing scale, helplessness is was most strongly associated with neuropathic pain intensity. Patients included in this study had a number of subtypes of neuropathy, including diabetic, post-herpetic, post-surgical, and post-traumatic. Interestingly, the relationship between helplessness and pain intensity was not dependent on the cause of neuropathy. Studies have also demonstrated the role of catastrophizing in modulating the pain experience for patients diagnosed with spinal cord injury (10). Finally, patients with numerous other medical conditions have been shown as having catastrophic thinking related pain intensity, including those with fibromyalgia, temporomandibular disorders, sickle cell disease, osteoarthritis, and rheumatoid arthritis (10).

The relationship of pain catastrophizing with other factors known to modulate pain intensity has also been studied. For example, resting paraspinal muscle tension and cardiovascular reactivity are known to be related to pain severity. Although this relationship is not mediated through catastrophizing, combining catastrophizing scores with these measurements can more accurately predict pain severity (11). It has even been predicted that catastrophizing can account for up to 31% of the variance in pain ratings (6). Although it is not fully understood why catastrophizing ultimately leads to an increased response to painful stimuli, theories include physiological, genetic, and cortical response factors (11).

Catastrophic thinking is the patient factor that may underlie differences in cost and healthcare resource utilization as they relate to booking time. We are theorizing that patients who demonstrate more catastrophic thinking may be more compelled to schedule their appointment sooner. Given these patients' higher level of catastrophic thinking, we would further theorize that they are more likely to opt for more diagnostic tests and treatment procedures, ultimately resulting in overall higher costs. Patients who catastrophize less may be more likely to take an appointment whenever it is convenient for them, which may not necessarily be the soonest available.

The relationship between catastrophic thinking and booking time has been examined elsewhere in the literature. For example, one study examined patients awaiting cataract

surgery (12). Patients in this study who were shown to have less tolerance for waiting also had worse self-assessed vision according to the Cataract Symptom Score. Furthermore, patients were more likely to consider their wait too long if they considered themselves to have “a great deal of trouble” with their vision. Interestingly, there was no association between waiting time tolerance and clinical visual acuity. In this study, the patients with poor self-assessed vision are demonstrating a higher degree of catastrophic thinking; the fact that there is no correlation between waiting time tolerance and actual visual acuity suggests a discrepancy between perceived and actual visual acuity, i.e., more catastrophic thinking. This ultimately results in a desire to have surgery sooner.

Another study examined characteristics of patients able to schedule appointments on a same-day basis within general practices in the United Kingdom (13). This study independently associated age, expecting a prescription, and having the problem for a short time with the utilization of same-day care. As the same-day patients experienced their problems for a shorter length of time than patients utilizing traditional scheduling methods, same-day patients appear to be demonstrating more catastrophic thinking, resulting in their desire to schedule a same-day appointment. This study further demonstrates a relationship between catastrophic thinking and the desire for increased resource utilization, given the association of expecting a prescription.

A different study examined patients attending open access appointments with no pre-scheduling and compared them to patients attending traditional pre-scheduled appointments (14). Patients who arrived at open access appointments were more likely to consider their complaint urgent (89% vs. 66% in the traditional group). Despite this, the physician given diagnosis was considered self-limiting more often in the open access group (75% vs. 48% in the traditional group). This study also demonstrates an apparent correlation between catastrophic thinking and the desire to see a physician within a shorter time interval: patients with open access to immediately see a physician saw their problems as urgent despite a relatively higher rate of self-limiting diagnoses.

Not only has catastrophic thinking been linked to scheduling time, it has also been associated with cost related measures. For example, in one study of patients undergoing carpal tunnel release surgery, less catastrophic thinking was associated with an earlier return to full work duty (15). Patients' anxiety due to pain was also found to correlate with delayed return to work. Catastrophizing has also been associated with length of hospital

stay, post-operative analgesic use, over-the-counter medication use, and frequency of healthcare visits (6). There has even been a relationship demonstrated between catastrophizing and unemployment (8).

The study questions are as follows: (1) Is time from booking until appointment, an interval we feel may be related to a patient's catastrophic thinking, associated with healthcare costs, accounting for patient demographics, anatomic site, and treating surgeon? (2) Is the length of time from booking to appointment related to healthcare utilization, including imaging procedures, injections, nerve conduction studies, occupational therapy visits, surgery, referrals, and second opinions, accounting for patient demographics, anatomic site, and treating surgeon?

Methods

Patient Selection

This study was first approved by the institutional review board of the institution at which the work was conducted. Review of the protocol was then ceded by the Harvard University Faculty of Medicine, making permissible the use of the work as a scholarly project. We then retrospectively examined a database containing clinical encounters with hand surgeons at our institution (16). We included patients whose first clinic visit to the hand and upper extremity service was between January 1, 2003 and December 31, 2012 (n= 37,997). Patients were excluded from the study if there was missing procedure or diagnosis data (n = 1,399), they were seen for a nondiscretionary condition (e.g., fracture or laceration; n = 13,672) (Appendix 1), or they had more than 30 days between booking their appointment and the actual clinic visit (n = 5,645). We then limited the analysis to the three busiest hand surgeons in the department. The final cohort included 16,750 patients with an average age of 50 ± 17 years; 45% (n = 7,557) of our cohort were men (Table 1).

Outcome Measures

Booking time was defined as the number of days between when a patient scheduled their appointment and their actual office visit. Anatomic site of symptoms was determined by assigned ICD-9 codes (International Classification of Disease, 9th Revision codes) after the visit. Patients with multiple locations were classified as “mixed,” and patients with ambiguous locations based on ICD-9 codes were classified as “nonspecific” (Appendix 1). Cost was determined as the sum of the RVUs (relative value units) for all imaging procedures, injections, nerve conduction studies and electromyography, occupational therapy visits, and surgical operations, defined using the 2012 Medicare Physician Fee Schedule (Appendix 2) (17).

Using CPT codes (Current Procedural Terminology codes) we determined utilization of imaging procedures, injections, nerve conduction studies and electromyography, occupational therapy visits, and surgeries between the first and second visit by the treating surgeon (Appendix 2). To prevent overlap between appointments, we captured procedures up to three days prior to the second encounter. If a patient had no second encounter, we included procedures up to 90 days after the first appointment. Imaging included all

radiographs, computed tomography, magnetic resonance imaging, and arthrograms of the upper extremity. Aspiration of ganglion cysts was included with injections.

Referrals were determined by searching for CPT codes billed by other departments (neurology, rheumatology, and psychiatry) until 3 days before the next hand clinic visit, or up to 90 days after the visit if the patient did not return to clinic. All referrals (n = 128) were subsequently manually verified by reviewing notes in the electronic medical record; 11 records could not be verified because of missing electronic records and were excluded. Second opinions were defined as a patient seeing another hand surgeon in our department for the same symptoms within one year. All second opinions (n = 115) were manually verified, and 19 patients with missing electronic notes were excluded.

Reliability of Database

The final dataset used for analysis was manually compared against the medical records of one hundred randomly selected patients for accuracy. Imaging was identified correctly at a rate of 99%, injection 96%, nerve conduction tests and electromyography 96%, occupational therapy visits 96%, and surgery 99%. Referrals and second opinions were not manually verified as they were manually determined.

Statistical Analysis

All utilization measures except cost are summarized dichotomously. Dichotomous and categorical variables are summarized with number and percentage, interval variables as mean (\pm standard deviation).

For bivariate analysis of costs, we used Pearson's correlation for interval variables, Student t-test for dichotomous variables, and analysis of variance for categorical variables. Dichotomous utilization measures and interval variables were compared using the Student t-test, dichotomous variables using Fisher's exact, and categorical variables using Fisher's exact (surgeon) or Chi² (anatomic location).

Multivariable linear regression was used to test for independent influence of all independent variables on cost, after converting categorical variables into indicator variables, with the first category as the reference value. We conducted multivariable logistic regression analyses to test for independent influence of independent variables on each utilization measure in a similar fashion.

P values < 0.05 are considered significant; all statistical analyses were conducted using Stata 13.0 (StataCorp LP, Texas, USA).

Results

The average booking time for all patients in our study was 10.8 ± 8.2 days. The average cost per patient was 4.7 ± 8.6 RVUs. The most common site of complaint was the hand or fingers ($n = 4,839$, 29%) and the least common the shoulder ($n = 302$, 1.8%). The surgeon who saw the most patients during the study period was surgeon 3 ($n = 8,711$, 52%) and the surgeon seeing the lowest volume of patients was surgeon 1 ($n = 3,789$, 25%). Imaging procedures ($n = 3,898$, 23%) and occupational therapy visits ($n = 3,567$, 21%) were the most common utilization measures. Second opinions ($n = 115$, 0.7%) and referrals ($n = 128$, 0.8%) were the least common utilization measures (Table 1).

Without controlling for potential confounding between factors in bivariate analysis (Table 2), there was a positive correlation between booking time and cost (Pearson's correlation coefficient [ρ] 0.049, $P < 0.001$) as well as age (ρ 0.030, $P < 0.001$). Booking time varied based on the presence of several utilization measures, including: imaging (11.9 ± 8.84 vs. 10.5 ± 7.92 days, $P < 0.001$ for no imaging), injection (12.0 ± 8.12 vs. 10.7 ± 8.16 days, $P < 0.001$ for no injection), nerve conduction studies (12.3 ± 8.51 vs. 10.7 ± 8.12 days, $P < 0.001$ for no nerve conduction studies), occupational therapy (10.3 ± 8.08 vs. 10.9 ± 8.19 days, $P < 0.001$ for no occupational therapy), and surgery (11.4 ± 8.46 vs. 10.7 ± 8.13 days, $P < 0.001$ for no surgery).

In the bivariate analysis, cost varied based on sex (4.95 ± 9.14 RVUs for men, 4.51 ± 8.12 for women; $P < 0.001$). Utilizations measures including imaging ($P < 0.001$), injections ($P < 0.001$), and occupational therapy ($P < 0.001$) also varied base on sex. The sex with the higher utilization rate varied. Men more often had imaging procedures (26% vs. 21% of women), whereas women more often had injections (8.3% vs. 6.9% of men) and saw occupational therapy (23% vs. 19% of men).

Cost also varied per anatomic site ($P < 0.001$) in the bivariate analysis. The anatomic sites with the highest associated costs were those considered mixed (7.92 ± 11.6 RVUs) and the arm (7.49 ± 15.6), whereas the anatomic site with the lowest associated cost was the elbow (2.26 ± 4.72 RVUs). We additionally observed variation in the rate of utilization per anatomic site for imaging ($P < 0.001$), injections ($P < 0.001$), nerve conduction studies ($P < 0.001$), occupational therapy ($P < 0.001$), surgery ($P < 0.001$), referrals ($P = 0.021$), and second opinions ($P = 0.002$). The anatomic site with the highest rate of each utilization varied. The most common site for an imaging procedure was the elbow (48%), for

injection the hand or fingers (18%), for nerve conduction studies the wrist (24%), for occupational therapy visits the shoulder or mixed locations (31%), for surgery the wrist (17%), for referral the forearm (1.3%) or shoulder (1.3%), and for second opinion the arm (2.2%).

Cost varied per surgeon (surgeon 1: 8.28 ± 12.0 RVUs; surgeon 2: 3.97 ± 6.80 RVUs; surgeon 3: 3.52 ± 7.09 RVUs; $P < 0.001$). The use of all utilizations measured also varied per surgeon ($P < 0.001$ for all utilizations). The surgeon utilizing different resources at the highest rate varied. Imaging procedures were utilized at the highest rate by surgeon 1 (49%), injections by surgeon 2 (2.2%), nerve conduction studies by surgeon 1 (10%), occupational therapy by surgeon 2 (38%), surgery by surgeon 1 (20%), and referrals by surgeon 2 (1.7%). Surgeon 3 resulted in the highest rate of second opinions (0.9%).

Accounting for potential confounding using multiple linear regression, duration between booking and office visit was not associated with higher cost (regression coefficient [β] 0.0023, semipartial R^2 0.0000051, 95% confidence interval [CI] -0.013 to 0.018, $P = 0.77$) but male sex (β 0.55, semipartial R^2 0.0011, 95% CI 0.29 to 0.80, $P < 0.001$), age (β 0.011, semipartial R^2 0.00049, 95% CI 0.0036 to 0.019, $P = 0.004$), specific anatomic sites, and specific surgeons were independently associated with higher costs (adjusted $R^2 = 0.094$, $P < 0.001$; Table 3). In particular, the wrist (β 4.1 relative hand/fingers as reference value, semipartial R^2 0.26, 95% CI 3.7 to 4.4, $P < 0.001$) and mixed locations (β 4.2, semipartial R^2 0.020, 95% CI 3.8 to 4.6, $P < 0.001$) were associated with relatively higher costs. Surgeon 3 (β -4.6 relative to surgeon 1 as reference value, semipartial R^2 0.043, 95% CI -4.9 to -4.2, $P < 0.001$) was associated with the lowest cost, and surgeon 1 (reference value) was associated with the highest costs.

Accounting for potential confounding using multiple logistic regression, longer time between booking and office visit was associated with a higher rate of nerve conduction studies (odds ratio [OR] 1.02, 95% CI 1.01 to 1.02, $P < 0.001$) and a lower rate of occupational therapy (OR 0.98, 95% CI 0.98 to 0.99, $P < 0.001$). Booking duration was not associated with imaging procedures (OR 1.0, 95% CI 0.999 to 1.01, $P = 0.088$), injections (OR 1.0, 95% CI 0.999 to 1.01, $P = 0.099$), surgery (OR 1.0, 95% CI 0.996 to 1.01, $P = 0.57$), referrals (OR 1.0, 95% CI 0.98 to 1.0, $P = 0.82$), or second opinions (OR 0.99, 95% CI 0.96 to 1.0, $P = 0.36$). Except for referrals and second opinions, all other utilization measures were associated with male sex and age. Male sex was associated with more

imaging procedures, nerve conduction studies, and surgery. Older age was associated with more injections, nerve conduction studies, and surgery. Healthcare utilization differed per anatomical site and by specific surgeons (Tables 3-6).

Discussion, Conclusions, and Suggestions for Future Work

Discussion

Many musculoskeletal illnesses are self-limiting and a delay in seeing a doctor might be therapeutic in that the patient learns management strategies and grows self-efficacy. Such a delay occurs when time between scheduling an appointment and seeing a hand surgeon increases. Our primary study question was whether the booking duration (the time between scheduling an appointment and seeing a hand surgeon) was associated with healthcare costs; our secondary study question was whether this interval was associated with utilization of various healthcare resources including imaging, injection, nerve conduction studies, occupational therapy visits, surgery, referrals, and second opinions. When accounting for confounding using multivariable analyses, we found no association between costs and the time between scheduling an appointment and seeing a hand surgeon. Among utilization measures, only nerve conduction studies (positive correlation) and occupational therapy visits (negative correlation) showed associations with longer booking time. Given the large variability between surgeons and among anatomic sites for both cost and various utilization measures, we feel it is only valid to draw conclusions based on the multivariable models, where the confounding effects are removed.

This study has some limitations. First, the RVU value from the Medicare Physician Fee Schedule reflects relative healthcare use costs but does not account for nonmedical costs such as time from work; therefore, the Fee Schedule does not reflect total costs. This is particularly relevant in light of other studies which have shown correlations of various patient psychosocial factors and unemployment (8); our study would miss this effect. In addition, we were only able to measure RVUs from specifically billed procedures; this fails to capture medication costs (both prescription and over-the-counter), as well as costs accrued indirectly by physicians who may have to spend extra time counseling certain patients. Secondly, we could not track patients leaving our system after referral to another hospital or outside second opinion. These resultant costs and utilizations are not measured in our study. Third, our study was limited to a very small group of hand surgeons practicing in a single large urban academic medical center. We therefore may have failed to capture a correlation that may exist in either a wider population or a different subset of patients.

In our study, healthcare costs were not associated with time between scheduling an appointment and seeing a hand surgeon, when other factors were controlled for in a

multivariable model. One study found that immediate surgery for patients undergoing total hip arthroplasty revision reduced healthcare expenditure (18). Another study found that waiting more than 6 months for total hip arthroplasty resulted in higher overall costs (including medical, personal, and societal) (19). These studies differ considerably from ours in that the patients in those studies were in a queue for surgery, whereas our study was aimed at determining costs immediately after initial orthopaedic evaluation.

Longer time between booking and office visit was associated with a higher rate of nerve conduction studies and a lower rate of occupational therapy. We found no association with imaging procedures, injections, surgery, referrals, or second opinions in the multivariable models. In our offices the average time from phone call to appointment was very short (10.8 days; median 8.2 days). In a system with easy access, it may be that people well-adjusted to long-standing problems request later visits out of convenience and because they are at ease with their problem. Perhaps those patients are more likely to be offered tests in planning for surgery. Our intention was to measure the effect of wait time on the more common transient acute or intermittent and remittent musculoskeletal problems. For example, a previous study found that patients with knee injuries who waited longer for treatment had improved coping strategies (1). The reduced need for occupational therapy observed in our study might reflect patient adaptation when waiting longer before seeing a doctor, but it might also reflect a prevalence of illnesses less responsive to occupational therapy among later presenters or even that they had already tried those treatments. Another study in rheumatology randomized patients into a 'fast track' group (mean waiting time 45 days) and an 'ordinary' group (mean waiting time 105 days) (20). More patients in the 'fast track' group were prescribed analgesics or underwent routine lab testing. There was no difference between groups in terms of non-analgesic prescriptions, radiology, or referrals. Like our study, there was no difference in radiology or referral rates based on waiting time. Our study, however, did not measure rates of medication prescription or routine lab testing. The waiting times in these studies highlight one important difference between our study and many others conducted regarding waiting time. Many other studies are conducted in the United Kingdom, where long waits are necessitated given the National Health Service. Average waits in our system are considerably shorter than even their experimental 'fast track' group (10.8 days and 45 days, respectively).

Increased use of imaging procedures, nerve conduction studies, and surgery were associated with male sex. Increased use of injections, nerve conduction studies, and surgery were associated with older age. This might simply reflect an increasing burden of disease with age. But a study focused on newly diagnosed hand osteoarthritis patients found that younger age was associated with more healthcare utilization the year after diagnosis (21). Our study included a larger variety of conditions. Previous studies of hip, knee, and hand osteoarthritis found that male sex was associated with a higher rate of surgery (21, 22). This might be explained by differences in attitudes toward surgery between men and women, because some data suggest that women are more fearful of surgery and more concerned about the postoperative recovery time, postoperative pain, risks of anesthesia, and complications (23). One study found women are more willing to delay surgery in order to prevent the disruption of their caregiving roles (24).

The variation in utilization by anatomical site is probably related to a higher rate of diagnosis with a higher likelihood of surgery, e.g. carpal tunnel syndrome. We also found a difference in utilization between surgeons. Surgeon-to-surgeon variations in care are well documented (21). For example, Becker et al., examined patients receiving a new diagnosis of hand osteoarthritis and measured their healthcare utilizations in the first year after initial diagnosis. Variation between providers was staggering for numerous utilizations, including number of visits (1.5-fold variation), imaging (3-fold variation), injections (51-fold variation), occupational therapy (2-fold variation), and even surgery (7-fold variation). This same level of variation was observed in our own study, where we demonstrate large differences in the odds ratios for various utilizations based on surgeon including imaging (8-fold), injections (1.4-fold), nerve conduction studies (1.7-fold), occupational therapy (2.4-fold), surgery (7-fold), and referral (3.8-fold). This may explain why some statistically significant effects were observed in the bivariate analysis but disappeared in the multivariable analysis. The variation between providers (and anatomic locations) simply overwhelms effects due to other factors.

This study does have a number of surprising results. First, the mean booking time for patients in our study was 10.8 days (± 8.2). This was surprisingly short for a subspecialty clinic, particularly in light of literature wherein 45 days was considered expedited (20). The results we initially obtained in bivariate analysis were somewhat unexpected as well. In particular, we were hoping this study would show shorter booking durations to be

associated with higher utilization rates. Instead, the bivariate analysis showed that, for numerous utilizations, patients having the given procedure actually had longer booking times. This is true for imaging, injections, nerve conduction studies, and surgery. Bivariate analysis even showed longer booking time to be associated with higher cost. Only for occupational therapy did utilizers demonstrate lower booking times than non-utilizers. These results must be interpreted in light of the multivariable analyses, in which the only associations to remain significant were those between booking time and nerve conduction studies as well as occupational therapy visits. As the results were not reflected in the multivariable model, we should be cautious when considering them.

The multivariable analyses contained a number of surprising results as well. For instance, there is considerable variation between the relative costs per anatomic site. In particular, the wrist and arm had relatively high costs, and the regression coefficient for no other specific anatomic site reached significance. Although the high cost for the wrist might be expected given procedures such as carpal tunnel release, the reason for the arm is much less clear. Although the cost variation per surgeon might appear staggering, the growing body of evidence demonstrating wide variation in utilization based on provider makes this less surprising (21). More interesting is to consider how that information might actually be useful. It would be difficult with only the information we have currently to propose any form of policy that might balance such utilization. It would be necessary to first demonstrate associated variation in outcomes, both objectively measurable and in terms of overall patient satisfaction, before entertaining such an idea. In addition, it would be pertinent to compare the types of patients referred to different surgeons, as some variation may be related to a surgeon's patient population.

If we had found a correlation between booking time and cost or other utilizations, or if the correlation with utilizations we found were of greater magnitude, it is interesting to consider what use that information would be. The first thing to consider is that we did not use longer booking time as an intervention, but rather measured the patient's choice of booking time. It would be difficult to extrapolate that forcing patients to wait longer would lead to lower cost and utilization, as the treatment effect that might occur during longer booking times may be dependent on patient specific psychological factors. Such information could certainly be of use to providers. If a physician knew that an appointment were booked on extremely short notice, and that the diagnosis arrived at clinically were deemed benign

and self-limiting, it may remind the provider that the patient is one who may expect more investigations or interventions, even when unnecessary. Physicians could therefore set their expectations accordingly and avoid unnecessary spending and utilization.

Conclusions

In a setting with relatively short wait times, our findings do not support a therapeutic effect of a longer wait time between scheduling an appointment and seeing a hand surgeon. Rather, our data raise the possibility that when access is readily available there may be differences between people that schedule appointments several weeks in advance and those that take the first available appointment. As in prior studies, we observed wide variation in cost and resource utilization based on provider, patient sex, and patient age. In particular, the variations by surgeon seem to outweigh variations based on other factors including time between booking and appointment.

Suggestions for Future Work

Our study ultimately failed to demonstrate an overall difference in cost based on patient waiting time. Notably, we conducted our study on a relatively limited patient population: patients seeing a hand surgeon for a discretionary condition. If we expanded our study to other orthopaedic sub-specialties, and other specialties in general, we may be able to demonstrate a correlation between booking time and cost or resource utilization.

Our study also makes an underlying assumption that catastrophic thinking may be linked to both a patient's booking time and resource utilizations. Our study, however, never directly measured catastrophic thinking; it was an underlying connection that could have explained any correlation between shorter booking time and higher cost or utilizations. It would be interesting to perform a study in which we directly measure catastrophic thinking in patients to determine if a correlation exists with their booking time. This could be easily accomplished using the Pain Catastrophizing Scale (4).

It would also be interesting to consider a related prospective study. Our retrospective study only reveals information about patient behavior and patterns. A prospective study would allow the effect of an intervention aimed at booking time to be measured. For example, some patients calling to book an appointment could be offered an earlier clinic

day, while others could be offered a later clinic day. We could then directly compare the short and long booking time cohorts. There are shortcomings to this design. First, there is a considerable problem with informed consent. If patients were asked if they wished to take place in a study regarding the time until their actual appointment, those displaying more catastrophic thinking would likely be unwilling to partake, fearing their participation would delay the time until they saw a physician. Enrollment in the study would therefore be greatly affected by the very factor that we were attempting to measure. In addition, if a patient chose to partake and were placed in the prolonged booking time cohort, they could feasibly withdraw their consent to the study in hopes of moving their office visit to a closer date. Second, although the ideal patient population for such a study would involve benign self-limiting pains, the prospect of delaying the appointment of a patient with a more serious, undiagnosed condition, remains troublesome. Although study exclusion criteria would ideally exclude patients with such conditions, or those suspected to have one, it would be difficult to know with full certainty without a physician having examined the patient.

Perhaps a more useful prospective intervention could be to modify the way in which schedulers present appointment availability. If schedulers always offer patients the next available appointment, any correlation between a patient's willingness to wait and their resource utilization would be nullified; there does not seem to be sufficient opportunity for the patient to modify the time until the appointment. It seems very unlikely that a patient, when offered an appointment within only a few days, would specifically inquire regarding more delayed appointments. If, instead, schedulers offered patients not only the soonest available appointment, but also offered a number of appointments on a longer interval, the patient would exercise more control over their booking time. This may expose the association we seek.

The most effective way to answer our question may involve a more open ended line of questioning when booking appointments. If schedulers were specifically instructed to ask patients when they would like to see a physician, it may remove any bias produced by the dates offered. This would also help remove any effect that patient personal schedules have on the data. For example, a patient's personal conflict may artificially delay (or shorten) the time until their chosen appointment, particularly if a physician has limited availability within the immediate timeframe. Allowing the patient to establish when they desire their appointment would more directly reflect their self-perceived sense of urgency. External

factors such as personal conflicts with available appointments and specific options given by the scheduler would be avoided in this design. The pain catastrophizing scale could then be directly measured during the actual office visit for patients with discretionary conditions. We could then correlate desired booking time with catastrophic thinking, as well as with various utilizations. A prospective study design would offer other benefits. Specifically, our large sample size (16,750 total patients) made it impractical to extract all information from patient charts and provider notes. We therefore relied on large databases of ICD-9 and CPT codes. This resulted in a large proportion of patients with codes that were difficult to classify precisely. For example, 34% (n = 5,726) of patients had anatomic locations that were either unspecified in coded data or involved mixed anatomic locations (e.g., “upper extremity”). If the study were performed prospectively, it may be possible to code these details more specifically at the time of study enrollment. This would also offer the opportunity to capture other utilizations we failed to measure, such as medications.

Contributions of the Candidate

I was the primary researcher involved in all phases of this project. I began the project by writing the initial proposal and doing the initial literature search that provided the foundation for the project. The proposal received feedback and revisions under the guidance of post-doctoral research fellows working in the research group, as well as from Dr. Ring. Once the raw data was obtained from data repositories, I was the primary researcher responsible for all data processing. This involved extracting patient wait times based on data from schedulers, searching diagnosis codes to appropriately exclude patients with nondiscretionary conditions, searching procedural codes to determine resource utilization, and finally producing data reports. Numerous parts of the project required reviewing patient records, including verifying all second opinions and referrals, as well as manually verifying the accuracy of data that was processed and analyzed in bulk. All manual review was performed by myself. Once the data was fully processed, I was responsible for conducting all statistical analyses using STATA 13.0. I wrote all syntax required to generate the statistical models we used. For all stages of the project I was under the guidance of both the principal investigator as well as the research fellows. The syntax used for data processing and analysis was ultimately written by myself, although much of it was based off of suggestions and examples from other projects shared with me by the

group's research fellows. All manuscripts resulting from the work, this scholarly project included, were initially drafted by myself before being modified using feedback from both research fellows as well as the principal investigator.

References

1. Robling M, Pill R, Hood K, Butler C. Time to talk? patient experiences of waiting for clinical management of knee injuries. *Qual Saf Health Care*. 2009;18:141-6.
2. Moradi A, Ebrahimzadeh M, Ring D. Nonspecific arm pain. *Arch Bone Joint Surg*. 2013;1(2):53-8.
3. Ring D, Kadzielski J, Malhotra L, Lee S, Jupiter J. Psychological factors associated with idiopathic arm pain. *J Bone Joint Surg Am*. 2005;87-A(2):374-80.
4. Sullivan M, Bishop S, Pivik J. The pain catastrophizing scale: Development and validation. *Psychol Assess*. 1995;7(4):524-32.
5. Weissman-Fogel I, Sprecher E, Pud D. Effects of catastrophizing on pain perception and pain modulation. *Exp Brain Res*. 2008;186:79-85.
6. Sullivan M, Thorn B, Haythornwaite J, Keefe F, Martin M, Bradley L, Lefebvre J. Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain*. 2001;17(1):52-64.
7. Severeijns R, Vlaeyen J, van den Hout M, Weber W. Pain catastrophizing predicts pain intensity, disability, and psychological distress independent of physical impairment. *Clin J Pain*. 2001;17(2):165-72.
8. Sullivan M, Stanish W, Waite H, Sullivan M, Tripp D. Catastrophizing, pain, and disability in patients with soft-tissue injuries. *Pain*. 1998;77(3):253-60.
9. Sullivan M, Lynch M, Clark A. Dimensions of catastrophic thinking associated with pain experience and disability in patients with neuropathic pain conditions. *Pain*. 2005;113(3):310-5.
10. Turner J, Jensen M, Warme C, Cardenas D. Catastrophizing is associated with pain intensity, psychological distress, and pain-related disability among individuals with chronic pain after spinal cord injury. *Pain*. 2002;98:127-34.
11. Wolff B, Burns J, Quartana P, Lofland K, Bruehl S, Chung O. Pain catastrophizing, psychological indexes, and chronic pain severity: Tests of mediation and moderation models. *J Behav Med*. 2008;31(2):105-14.
12. Dunn E, Black C, Alonso J, Norregaard J, Anderson G. Patients' acceptance of waiting times for cataract surgery: What makes a wait too long? *Soc Sci Med*. 1997;44(11):1603-10.

13. Stoddart H, Evans M, Peters T, Salisbury C. The provision of 'same-day' care in general practice: An observational study. *Family Practice*. 2003;20:41-7.
14. Virji A. A study of patients attending without appointments in an urban general practice. *Br Med J*. 1990;301:22-6.
15. Cowan J, Makanji H, Mudgal C, Jupiter J, Ring D. Determinants of return to work after carpal tunnel release. *J Hand Surg*. 2012;37A:18-27.
16. Partners HealthCare System. Research Patient Data Registry (RPDR) [Internet]. cited 4 August 2014]
17. Physician fee schedule search. Centers of Medicare & Medicaid Services web site. [Internet].
18. Saleh K, Wood K, Gafni A, Gross A. Immediate surgery versus waiting list policy in revision total hip arthroplasty. *The Journal of Arthroplasty*. 1997;12(1)
19. Fielden J, Cummings J, Horne J, Devane P, Slack A, Gallagher L. Waiting for hip arthroplasty: Economic costs and health outcomes. *The Journal of Arthroplasty*. 2005;20(8):990-7.
20. Hurst N, Lambert C, Forbes J, Lochhead A, Major K, Lock P. Does waiting matter? A randomized controlled trial of new non-urgent rheumatology out-patient referrals. *Rheumatology*. 2000;39:369-76.
21. Becker S, Teunis T, Blauth J, Kortlever J, Dyer G, Ring D. Medical services and associated costs vary widely among surgeons treating patients with hand osteoarthritis. *Clin Orthop Relat Res*. 2014;[Epub ahead of print]
22. Hawker G, Wright J, Coyte P, Williams J, Harvey B, Glazier R, Bradley E. Differences between men and women in the rate of use of hip and knee arthroplasty. *N Engl J Med*. 2000;342:1016-22.
23. Alderman A, Arora A, Kuhn L, Wei Y, Chung K. An analysis of women's and men's surgical priorities and willingness to have rheumatoid hand surgery. *J Hand Surg Am*. 2006;31:1447-53.
24. Karlson E, Daltroy L, Liang M, Eaton H, Katz J. Gender differences in patient preferences may underlie differential utilization of elective surgery. *Am J Med*. 1997;102:524-30.

Tables and Figures

Table 1: Baseline Characteristics

Table 2: Bivariate Analysis

Table 3: Multivariable Analysis Factors Associated with Cost and Imaging

Table 4: Multivariable Analysis Factors Associated with Injections and Nerve Conduction Studies

Table 5: Multivariable Analysis Factors Associated with Occupational Therapy Visits and Surgery

Table 6: Multivariable Analysis Factors Associated with Referrals and Second Opinions

Appendices

Appendix 1: ICD-9 Codes and Diagnosis Location, Nondiscretionary Codes

Appendix 2: CPT Codes for Utilization Measures and Associated RVUs

Acknowledgements

I would like to thank first and foremost Dr. Ring for taking me into his research group. In even a short time he has taught me an incredible amount, particularly in how to ask meaningful and feasible research questions. His perspective on illness and the psychology behind illness is also incredibly interesting, and something that will shape the way I approach patients with self-limiting conditions for the remainder of my career. All of the post-doctoral research fellows in the group deserve thanks as well. This includes Teun Teunis, who exercised great patience while I learned the statistics programs necessary to complete this work. His advising contributed considerably to this project. Johann Blauth, as well, was indispensable in helping obtain and process the initial raw data. Both Teun and Johann are to thank for their expert opinions regarding statistics.

Table 1. Baseline Characteristics	
Variables	Mean (\pm standard deviation)
Age (years)	50 (\pm 17)
Cost (RVU)	4.7 (\pm 8.6)
Booking time (days)	10.8 (\pm 8.2)
	Percentage (number; total = 16,750)
Men	45% (7,557)
Anatomic location	
Hand/fingers	29% (4,839)
Wrist	18% (3,035)
Forearm	8.0% (1,345)
Elbow	5.9% (996)
Arm	3.0% (507)
Shoulder	1.8% (302)
Mixed	11% (1,864)
Unspecified	23% (3,862)
Surgeons	
Surgeon 1	23% (3,789)
Surgeon 2	25% (4,250)
Surgeon 3	52% (8,711)
Utilization	
Imaging procedure	23% (3,898)
Injection	7.7% (1,287)
Nerve conduction study	8.0% (1,341)
Occupational therapy	21% (3,567)
Surgery	11% (1,905)
Referral	0.8% (128)
Second opinion	0.7% (115)

Table 2. Bivariate analysis of factors associated with healthcare utilization and cost

Variables	Imaging Procedure	No Imaging Procedure	P value	Injection	No Injection	P value
Booking time (days)	11.9 (\pm 8.84)	10.5 (\pm 7.92)	<0.001	12.0 (\pm 8.12)	10.7 (\pm 8.16)	<0.001
Age (years)	48.6 (\pm 16.9)	50.3 (\pm 16.7)	<0.001	59.7 (\pm 14.3)	49.1 (\pm 16.7)	<0.001
Sex						
Men	1,944 (26%)	5,613 (74%)	<0.001	521 (6.9%)	7,036 (93.1%)	0.001
Women	1,954 (21%)	7,239 (79%)		766 (8.3%)	8,427 (91.7%)	
Anatomic location						
Hand/fingers	1,109 (23%)	3,730 (77%)	<0.001	850 (18%)	3,989 (82.4%)	<0.001
Wrist	208 (6.9%)	2,827 (93.1%)		131 (4.3%)	2,904 (95.7%)	
Forearm	641 (48%)	704 (52%)		27 (2.0%)	1,318 (98.0%)	
Elbow	112 (11%)	884 (89%)		43 (4.3%)	953 (95.7%)	
Arm	234 (46%)	273 (54%)		6 (1.2%)	501 (98.8%)	
Shoulder	94 (31%)	208 (69%)		1 (0.3%)	301 (99.7%)	
Mixed	884 (47%)	980 (53%)		138 (7.4%)	1,726 (92.6%)	
Unspecified	616 (16%)	3,246 (84%)		91 (2.4%)	3,771 (97.6%)	
Surgeons						
Surgeon 1	1,865 (49%)	1,924 (51%)	<0.001	326 (8.6%)	3463 (91.4%)	<0.001
Surgeon 2	1,248 (29%)	3,002 (71%)		419 (9.9%)	3831 (90.1%)	
Surgeon 3	785 (9.0%)	7,926 (91.0%)		542 (6.2%)	8169 (93.8%)	

RVU = relative value unit.

Continuous variables as mean (\pm standard deviation), dichotomous as n(%)

Table 2 (cont...). Bivariate analysis of factors associated with healthcare utilization and cost

Variables	Nerve conduction study	No nerve conduction study	P value	Occupational therapy	No occupational therapy	P value
Booking time (days)	12.3 (\pm 8.51)	10.7 (\pm 8.12)	<0.001	10.3 (\pm 8.08)	10.9 (\pm 8.19)	<0.001
Age (years)	54.2 (\pm 15.9)	49.5 (\pm 16.8)	<0.001	50.1 (\pm 16.3)	49.8 (\pm 16.9)	0.33
Sex						
Men	574 (7.6%)	6,983 (92.4%)	0.076	1,419 (19%)	6,138 (81%)	<0.001
Women	767 (8.3%)	8,426 (91.7%)		2,148 (23%)	7,045 (77%)	
Anatomic location						
Hand/fingers	42 (0.9%)	4,797 (99.1%)	<0.001	1,128 (23%)	3,711 (77%)	<0.001
Wrist	735 (24%)	2,300 (76%)		633 (21%)	2,402 (79%)	
Forearm	22 (1.6%)	1,323 (98.4%)		291 (22%)	1,054 (78%)	
Elbow	11 (1.1%)	985 (98.9%)		285 (29%)	711 (71%)	
Arm	22 (4.3%)	485 (95.7%)		71 (14%)	436 (86%)	
Shoulder	6 (2.0%)	296 (98.0%)		93 (31%)	209 (69%)	
Mixed	259 (14%)	1,605 (86%)		575 (31%)	1,289 (69%)	
Unspecified	244 (6.3%)	3,618 (93.7%)		491 (13%)	3,371 (87%)	
Surgeons						
Surgeon 1	383 (10%)	3,406 (90%)	<0.001	760 (20%)	3,029 (80%)	<0.001
Surgeon 2	357 (8.4%)	3,893 (91.6%)		1,619 (38%)	2,631 (62%)	
Surgeon 3	601 (6.9%)	8,110 (93.1%)		1,188 (14%)	7,523 (86%)	

RVU = relative value unit.

Continuous variables as mean (\pm standard deviation), dichotomous as n(%)

Table 2 (cont...). Bivariate analysis of factors associated with healthcare utilization and cost

Variables	Surgery	No Surgery	P value	Referral	No Referral	P value
Booking time (days)	11.4 (\pm 8.46)	10.7 (\pm 8.13)	<0.001	10.8 (\pm 7.98)	10.8 (\pm 8.17)	0.99
Age (years)	51.8 (\pm 17.4)	49.6 (\pm 16.7)	<0.001	50.7 (\pm 15.7)	49.9 (\pm 16.8)	0.57
Sex						
Men	899 (12%)	6,658 (88%)	0.053	54 (0.7%)	7,503 (99.3%)	0.53
Women	1,006 (11%)	8,187 (89%)		74 (0.8%)	9,119 (99.2%)	
Anatomic location						
Hand/fingers	495 (10%)	4,344 (90%)	<0.001	25 (0.5%)	4,814 (99.5%)	0.021
Wrist	525 (17%)	2,510 (83%)		21 (0.7%)	3,014 (99.3%)	
Forearm	99 (7.4%)	1,246 (92.6%)		18 (1.3%)	1,327 (98.7%)	
Elbow	21 (2.1%)	975 (97.9%)		4 (0.4%)	992 (99.6%)	
Arm	70 (14%)	437 (86%)		2 (0.4%)	505 (99.6%)	
Shoulder	11 (3.6%)	291 (96.4%)		4 (1.3%)	298 (98.7%)	
Mixed	264 (14%)	1,600 (86%)		19 (1.0%)	1,845 (99.0%)	
Unspecified	420 (11%)	3,442 (89%)		35 (0.9%)	3,827 (99.1%)	
Surgeons						
Surgeon 1	762 (20%)	3,027 (80%)	<0.001	18 (0.5%)	3,771 (99.5%)	<0.001
Surgeon 2	147 (3.5%)	4,103 (96.5%)		70 (1.7%)	4,180 (98.3%)	
Surgeon 3	996 (11%)	7,715 (89%)		40 (0.5%)	8,671 (99.5%)	

RVU = relative value unit.

Continuous variables as mean (\pm standard deviation), dichotomous as n(%)

Table 2 (cont...). Bivariate analysis of factors associated with healthcare utilization and cost

Variables	Second opinion	No second opinion	P value	Costs (RVU)	P value
Booking time (days)	9.39 (\pm 7.52)	10.8 (\pm 8.17)	0.063	0.049	<0.001
Age (years)	49.7 (\pm 16.1)	49.9 (\pm 16.8)	0.94	0.030	<0.001
Sex					
Men	52 (0.7%)	7,505 (99.3%)	1.0	4.95 (\pm 9.14)	<0.001
Women	63 (0.7%)	9,130 (99.3%)		4.51 (\pm 8.12)	
Anatomic location					
Hand/fingers	22 (0.5%)	4,817 (99.5%)	0.002	3.17 (\pm 6.65)	<0.001
Wrist	21 (0.7%)	3,014 (99.3%)		6.90 (\pm 8.77)	
Forearm	12 (0.9%)	1,333 (99.1%)		4.33 (\pm 8.04)	
Elbow	7 (0.7%)	989 (99.3%)		2.26 (\pm 4.72)	
Arm	11 (2.2%)	496 (97.8%)		7.49 (\pm 15.6)	
Shoulder	1 (0.3%)	301 (99.7%)		3.44 (\pm 7.33)	
Mixed	11 (0.6%)	1,853 (99.4%)		7.92 (\pm 11.6)	
Unspecified	30 (0.8%)	3,832 (99.2%)		3.87 (\pm 7.82)	
Surgeons					
Surgeon 1	6 (0.2%)	3,783 (99.8%)	<0.001	8.28 (\pm 12.0)	<0.001
Surgeon 2	29 (0.7%)	4,221 (99.3%)		3.97 (\pm 6.80)	
Surgeon 3	80 (0.9%)	8,631 (99.1%)		3.52 (\pm 7.09)	

RVU = relative value unit.
Continuous variables as mean (\pm standard deviation), dichotomous as n(%)

Table 3. Multivariable analysis factors associated with costs & imaging procedures

Cost (RVU) factors	β regression coefficient	Standard error	95% confidence interval	P value	Semi-partial R ²	Adjusted R ²
Male sex	0.55	0.13	0.29,0.80	<0.001	0.0011	
Age	0.011	0.0040	0.0036,0.019	0.004	0.00049	
Booking Duration (Days)	0.0023	0.0080	-0.013,0.018	0.77	0.0000051	
<i>Anatomic Site</i>						
Hand/Fingers	<i>Reference Value</i>					
Wrist	4.1	0.19	3.7,4.4	<0.001	0.026	
Forearm	0.47	0.26	-0.042,0.98	0.072	0.00019	
Elbow	-0.56	0.29	-1.1,0.0042	0.052	0.00023	
Arm	3.3	0.39	2.5,4.1	<0.001	0.0043	0.094
Shoulder	-0.045	0.49	-1.0,0.91	0.93	0.00000051	
Mixed	4.2	0.22	3.8,4.6	<0.001	0.020	
Nonspecific	0.96	0.18	0.60,1.3	<0.001	0.0016	
<i>Surgeon</i>						
Surgeon 1	<i>Reference Value</i>					
Surgeon 2	-4.1	0.19	-4.5,-3.8	<0.001	0.029	
Surgeon 3	-4.6	0.17	-4.9,-4.2	<0.001	0.043	
Imaging Procedures	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R ²	
Male sex	1.2	0.049	1.06,1.3	0.001		
Age	0.99	0.0013	0.988,0.993	<0.001		
Booking Duration (Days)	1.0	0.0025	0.999,1.01	0.088		
<i>Anatomic Site</i>						
Hand/Fingers	<i>Reference Value</i>					
Wrist	0.24	0.020	0.20,0.28	<0.001		
Forearm	2.2	0.16	1.9,2.6	<0.001		
Elbow	0.42	0.046	0.34,0.52	<0.001	0.22	
Arm	2.1	0.23	1.7,2.6	<0.001		
Shoulder	1.2	0.17	0.90,1.6	0.24		
Mixed	2.6	0.17	2.3,3.0	<0.001		
Nonspecific	0.59	0.036	0.52,0.66	<0.001		
<i>Surgeon</i>						
Surgeon 1	<i>Reference Value</i>					
Surgeon 2	0.49	0.025	0.45,0.54	<0.001		
Surgeon 3	0.12	0.0062	0.11,0.13	<0.001		

Bold indicates statistically significant difference.

Table 4. Multivariable analysis factors associated with injections & nerve conduction studies					
Injection	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R²
Male sex	0.88	0.054	0.78,0.99	0.031	
Age	1.03	0.0021	1.02,1.03	<0.001	
Booking Duration (Days)	1.0	0.0037	0.999,1.01	0.099	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	0.23	0.023	0.19,0.28	<0.001	0.14
Forearm	0.13	0.025	0.085,0.19	<0.001	
Elbow	0.26	0.043	0.19,0.36	<0.001	
Arm	0.074	0.031	0.033,0.17	<0.001	
Shoulder	0.019	0.019	0.0026,0.13	<0.001	
Mixed	0.38	0.037	0.31,0.46	<0.001	
Nonspecific	0.16	0.018	0.13,0.20	<0.001	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	1.1	0.093	0.96,1.3	0.13	
Surgeon 3	0.69	0.055	0.59,0.81	<0.001	
Nerve Conduction Studies	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R²
Male sex	1.2	0.073	1.04,1.33	0.010	
Age	1.02	0.0019	1.02,1.02	<0.001	
Booking Duration (Days)	1.02	0.0037	1.01,1.02	<0.001	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	43	7.0	31,59	<0.001	0.19
Forearm	2.2	0.59	1.3,3.7	0.003	
Elbow	1.5	0.52	0.78,3.0	0.22	
Arm	5.7	1.5	3.3,9.6	<0.001	
Shoulder	2.7	1.2	1.1,6.3	0.027	
Mixed	19	3.1	13,26	<0.001	
Nonspecific	10	1.7	7.3,14	<0.001	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	0.77	0.065	0.65,0.91	0.002	
Surgeon 3	0.60	0.046	0.52,0.70	<0.001	

Bold indicates statistically significant difference.

Table 5. Multivariable analysis factors associated with occupational therapy & surgery					
Occupational Therapy	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R ²
Male sex	0.74	0.030	0.68,0.80	<0.001	
Age	0.997	0.0012	0.994,0.999	0.010	
Booking Duration (Days)	0.98	0.0025	0.98,0.99	<0.001	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	0.85	0.050	0.75,0.95	0.004	0.080
Forearm	0.83	0.066	0.71,0.97	0.020	
Elbow	1.3	0.11	1.1,1.6	0.001	
Arm	0.57	0.078	0.44,0.74	<0.001	
Shoulder	1.4	0.18	1.0,1.8	0.029	
Mixed	1.4	0.088	1.2,1.6	<0.001	
Nonspecific	0.46	0.029	0.41,0.52	<0.001	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	2.4	0.13	2.1,2.6	<0.001	
Surgeon 3	0.60	0.032	0.54,0.67	<0.001	
Surgery	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R ²
Male sex	1.2	0.059	1.1,1.3	0.003	
Age	1.01	0.0016	1.00,1.01	<0.001	
Booking Duration (Days)	1.0	0.0030	0.996,1.01	0.57	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	2.1	0.14	1.8,2.3	<0.001	0.078
Forearm	0.62	0.074	0.49,0.78	<0.001	
Elbow	0.21	0.048	0.14,0.33	<0.001	
Arm	1.1	0.16	0.85,1.5	0.42	
Shoulder	0.32	0.010	0.17,0.59	<0.001	
Mixed	1.4	0.11	1.1,1.6	<0.001	
Nonspecific	1.2	0.085	1.0,1.3	0.058	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	0.14	0.013	0.11,0.17	<0.001	
Surgeon 3	0.49	0.028	0.44,0.55	<0.001	

Bold indicates statistically significant difference.

Table 6. Multivariable analysis factors associated with referral & second opinion					
Referral	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R ²
Male sex	0.93	0.17	0.65,1.3	0.69	
Age	1.0	0.0055	0.998,1.02	0.12	
Booking Duration (Days)	1.0	0.011	0.98,1.0	0.82	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	1.4	0.42	0.78,2.5	0.26	0.046
Forearm	3.1	0.98	1.6,5.7	0.001	
Elbow	0.78	0.42	0.27,2.3	0.64	
Arm	1.0	0.75	0.24,4.3	0.99	
Shoulder	2.7	1.5	0.92,7.9	0.070	
Mixed	2.0	0.62	1.1,3.7	0.023	
Nonspecific	2.1	0.56	1.2,3.5	0.008	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	3.8	1.0	2.3,6.5	<0.001	
Surgeon 3	1.1	0.3	0.60,1.9	0.82	
Second Opinion	Odds Ratio	Standard error	95% confidence interval	P value	Pseudo R ²
Male sex	0.92	0.18	0.63,1.3	0.66	
Age	1.0	0.0059	0.995,1.02	0.29	
Booking Duration (Days)	0.99	0.013	0.96,1.0	0.36	
<i>Anatomic Site</i>					
Hand/Fingers	<i>Reference Value</i>				
Wrist	1.5	0.46	0.82,2.7	0.19	0.038
Forearm	2.7	0.99	1.3,5.5	0.008	
Elbow	1.5	0.66	0.63,3.5	0.36	
Arm	6.7	2.6	3.2,14	<0.001	
Shoulder	0.83	0.85	0.11,6.2	0.85	
Mixed	1.6	0.58	0.75,3.2	0.24	
Nonspecific	1.8	0.52	1.0,3.2	0.047	
<i>Surgeon</i>					
Surgeon 1	<i>Reference Value</i>				
Surgeon 2	5.0	2.3	2.1,12	<0.001	
Surgeon 3	6.6	2.8	2.8,15	<0.001	

Bold indicates statistically significant difference.

Appendix 1. ICD-9 Codes used for Anatomic Location; Nondiscretionary

ICD-9 Code	Location/Nondiscretionary	Description
726.39	Elbow	Other enthesopathy of elbow region
726.32	Elbow	Lateral epicondylitis
726.3	Elbow	Enthesopathy of elbow, unspecified
841.1	Elbow	Ulnar collateral ligament sprain
841.3	Elbow	Ulnohumeral (joint) sprain
841	Elbow	Radial collateral ligament sprain
923.11	Elbow	Contusion of elbow
V43.62	Elbow	Elbow joint replaced by other means
726.33	Elbow	Olecranon bursitis
726.31	Elbow	Medial epicondylitis
703.8	Fingers	Other specified diseases of nail
703	Fingers	Ingrowing nail
736.1	Fingers	Mallet finger
755	Fingers	Polydactyly, unspecified digits
703.9	Fingers	Unspecified disease of nail
736.2	Fingers	Unspecified deformity of finger
755.1	Fingers	Syndactyly of multiple and unspecified sites
V49.62	Fingers	Status post amputation of other finger(s)
755.57	Fingers	Macroductyilia (fingers)
755.11	Fingers	Syndactyly of fingers without fusion of bone
736.29	Fingers	Other acquired deformities of finger
755.12	Fingers	Syndactyly of fingers with fusion of bone
955.6	Fingers	Injury to digital nerve, upper limb
736.22	Fingers	Swan-neck deformity
736.21	Fingers	Boutonniere deformity
996.93	Fingers	Complications of reattached finger(s)
923.3	Fingers	Contusion of finger
755.01	Fingers	Polydactyly of fingers
757.5	Fingers	Specified congenital anomalies of nails
959.5	Fingers	Other and unspecified injury to finger
718.33	Forearm	Recurrent dislocation of forearm joint
715.33	Forearm	Osteoarthritis, localized, not specified whether primary or secondary, involving forearm
719.83	Forearm	Other specified disorders of forearm joint
718.53	Forearm	Ankylosis of forearm joint
715.23	Forearm	Osteoarthritis, localized, secondary, involving forearm
719.63	Forearm	Other symptoms referable to forearm joint

719.43	Forearm	Pain in joint involving forearm
719.53	Forearm	Stiffness of joint, not elsewhere classified, involving forearm
718.93	Forearm	Unspecified derangement of forearm joint
719.23	Forearm	Villonodular synovitis involving forearm
712.33	Forearm	Chondrocalcinosis, cause unspecified, involving forearm
716.93	Forearm	Arthropathy unspecified, involving forearm
718.83	Forearm	Other joint derangement, not elsewhere classified, involving forearm
715.93	Forearm	Osteoarthritis, unspecified whether generalized or localized, involving forearm
712.93	Forearm	Unspecified crystal arthropathy involving forearm
755.53	Forearm	Radioulnar synostosis
716.43	Forearm	Transient arthropathy involving forearm
V49.65	Forearm	Status post amputation below elbow
718.43	Forearm	Contracture of forearm joint
712.23	Forearm	Chondrocalcinosis, due to pyrophosphate crystals, involving forearm
736.09	Forearm	Other acquired deformities of forearm, excluding fingers
715.13	Forearm	Osteoarthritis, localized, primary, involving forearm
718.03	Forearm	Articular cartilage disorder involving forearm
736	Forearm	Unspecified deformity of forearm, excluding fingers
716.83	Forearm	Other specified arthropathy involving forearm
719.03	Forearm	Effusion of forearm joint
716.03	Forearm	Kaschin-Beck disease involving forearm
730.13	Forearm	Chronic osteomyelitis involving forearm
V54.12	Forearm	Aftercare for healing traumatic fracture of lower arm
923.1	Forearm	Contusion of forearm
718.13	Forearm	Loose body in forearm joint
719.93	Forearm	Unspecified disorder of forearm joint
736.07	Hand	Club hand (acquired)
923.2	Hand	Contusion of hand(s)
728.6	Hand	Contracture of palmar fascia
727.03	Hand	Trigger finger (acquired)
718.04	Hand	Articular cartilage disorder involving hand
719.04	Hand	Effusion of hand joint
715.34	Hand	Osteoarthritis, localized, not specified whether primary or secondary, involving hand
718.44	Hand	Contracture of hand joint
716.54	Hand	Unspecified polyarthropathy or polyarthritis involving hand
718.24	Hand	Pathological dislocation of hand joint
716.94	Hand	Arthropathy unspecified, involving hand

719.64	Hand	Other symptoms referable to hand joint
719.44	Hand	Pain in joint involving hand
715.14	Hand	Osteoarthritis, localized, primary, involving hand
730.14	Hand	Chronic osteomyelitis involving hand
719.84	Hand	Other specified disorders of hand joint
719.94	Hand	Unspecified disorder of hand joint
715.04	Hand	Osteoarthritis, generalized, involving hand
736.06	Hand	Claw hand (acquired)
712.24	Hand	Chondrocalcinosis, due to pyrophosphate crystals, involving hand
959.4	Hand	Other and unspecified injury to hand, except finger
715.24	Hand	Osteoarthritis, localized, secondary, involving hand
842.1	Hand	Sprain of unspecified site of hand
996.92	Hand	Complications of reattached hand
716.44	Hand	Transient arthropathy involving hand
991.1	Hand	Frostbite of hand
716.84	Hand	Other specified arthropathy involving hand
842.12	Hand	Sprain of metacarpophalangeal (joint) of hand
842.19	Hand	Other hand sprain
718.14	Hand	Loose body in hand joint
718.84	Hand	Other joint derangement, not elsewhere classified, involving hand
842.13	Hand	Sprain of interphalangeal (joint) of hand
715.94	Hand	Osteoarthritis, unspecified whether generalized or localized, involving hand
719.54	Hand	Stiffness of joint, not elsewhere classified, involving hand
718.34	Hand	Recurrent dislocation of hand joint
719.24	Hand	Villonodular synovitis involving hand
718.94	Hand	Unspecified derangement of hand joint
716.24	Hand	Allergic arthritis involving hand
842.11	Hand	Sprain of carpometacarpal (joint) of hand
712.34	Hand	Chondrocalcinosis, cause unspecified, involving hand
718.54	Hand	Ankylosis of hand joint
715.92	Arm	Osteoarthritis, unspecified whether generalized or localized, involving upper arm
718.32	Arm	Recurrent dislocation of upper arm joint
719.82	Arm	Other specified disorders of upper arm joint
718.42	Arm	Contracture of upper arm joint
719.62	Arm	Other symptoms referable to upper arm joint
718.02	Arm	Articular cartilage disorder involving upper arm
727.62	Arm	Nontraumatic rupture of tendons of biceps (long head)
716.32	Arm	Climacteric arthritis involving upper arm

715.22	Arm	Osteoarthritis, localized, secondary, involving upper arm
712.12	Arm	Chondrocalcinosis, due to dicalcium phosphate crystals, involving upper arm
715.32	Arm	Osteoarthritis, localized, not specified whether primary or secondary, involving upper arm
923.03	Arm	Contusion of upper arm
718.52	Arm	Ankylosis of upper arm joint
730.12	Arm	Chronic osteomyelitis involving upper arm
719.22	Arm	Villonodular synovitis involving upper arm
726.12	Arm	Bicipital tenosynovitis
718.12	Arm	Loose body in upper arm joint
712.32	Arm	Chondrocalcinosis, cause unspecified, involving upper arm
V54.21	Arm	Aftercare for healing pathologic fracture of upper arm
V54.11	Arm	Aftercare for healing traumatic fracture of upper arm
719.12	Arm	Hemarthrosis involving upper arm
718.92	Arm	Unspecified derangement of upper arm joint
719.42	Arm	Pain in joint involving upper arm
718.82	Arm	Other joint derangement, not elsewhere classified, involving upper arm
716.92	Arm	Arthropathy unspecified, involving upper arm
719.02	Arm	Effusion of upper arm joint
715.12	Arm	Osteoarthritis, localized, primary, involving upper arm
719.92	Arm	Unspecified disorder of upper arm joint
719.52	Arm	Stiffness of joint, not elsewhere classified, involving upper arm
842	Mixed	Sprains and strains of wrist and hand
906.6	Mixed	Late effect of burn of wrist and hand
841.9	Mixed	Sprain of unspecified site of elbow and forearm
959.3	Mixed	Other and unspecified injury to elbow, forearm, and wrist
959.2	Mixed	Other and unspecified injury to shoulder and upper arm
841.8	Mixed	Sprain of other specified sites of elbow and forearm
715.31	Shoulder	Osteoarthritis, localized, not specified whether primary or secondary, involving shoulder region
840.5	Shoulder	Subscapularis (muscle) sprain
840.8	Shoulder	Sprain of other specified sites of shoulder and upper arm
955.7	Shoulder	Injury to other specified nerve(s) of shoulder girdle and upper limb
719.41	Shoulder	Pain in joint involving shoulder region
923	Shoulder	Contusion of shoulder region
715.11	Shoulder	Osteoarthritis, localized, primary, involving shoulder region
955.8	Shoulder	Injury to multiple nerves of shoulder girdle and upper limb
726.2	Shoulder	Other affections of shoulder region, not elsewhere classified
V43.61	Shoulder	Shoulder joint replaced by other means

715.91	Shoulder	Osteoarthritis, unspecified whether generalized or localized, involving shoulder region
719.91	Shoulder	Unspecified disorder of joint of shoulder region
718.01	Shoulder	Articular cartilage disorder involving shoulder region
840.3	Shoulder	Infraspinatus (muscle) (tendon) sprain
840	Shoulder	Acromioclavicular (joint) (ligament) sprain
718.81	Shoulder	Other joint derangement, not elsewhere classified, involving shoulder region
170.4	Shoulder	Malignant neoplasm of scapula and long bones of upper limb
840.6	Shoulder	Supraspinatus (muscle) (tendon) sprain
726.1	Shoulder	Disorders of bursae and tendons in shoulder region, unspecified
726.11	Shoulder	Calcifying tendinitis of shoulder
726.19	Shoulder	Other specified disorders of bursae and tendons in shoulder region
726	Shoulder	Adhesive capsulitis of shoulder
840.9	Shoulder	Sprain of unspecified site of shoulder and upper arm
719.81	Shoulder	Other specified disorders of joint of shoulder region
716.91	Shoulder	Arthropathy, unspecified, involving shoulder region
840.4	Shoulder	Rotator cuff (capsule) sprain
719.51	Shoulder	Stiffness of joint, not elsewhere classified, involving shoulder region
719.01	Shoulder	Effusion of joint of shoulder region
716.41	Shoulder	Transient arthropathy involving shoulder region
718.91	Shoulder	Unspecified derangement of joint of shoulder region
718.41	Shoulder	Contracture of joint of shoulder region
955.9	Shoulder	Injury to unspecified nerve of shoulder girdle and upper limb
727.61	Shoulder	Complete rupture of rotator cuff
718.31	Shoulder	Recurrent dislocation of joint of shoulder region
842.02	Wrist	Sprain of radiocarpal (joint) (ligament) of wrist
736.05	Wrist	Wrist drop (acquired)
842	Wrist	Sprain of unspecified site of wrist
727.64	Wrist	Nontraumatic rupture of flexor tendons of hand and wrist
V43.63	Wrist	Wristjoint replaced by other means
755.54	Wrist	Madelung's deformity
727.63	Wrist	Nontraumatic rupture of extensor tendons of hand and wrist
727.05	Wrist	Other tenosynovitis or hand and wrist
736.03	Wrist	Valgus deformity of wrist (acquired)
727.04	Wrist	Radial styloid tenosynovitis
842	Wrist	Wrist sprain
923.21	Wrist	Contusion of wrist
726.4	Wrist	Enthesopathy of wrist and carpus

842.01	Wrist	Sprain of carpal (joint) of wrist
354	Wrist	Carpal tunnel syndrome
755.56	Wrist	Accessory carpal bones
842.09	Wrist	Other wrist sprain
711.93	Nondiscretionary	Unspecified infective arthritis, forearm
730.92	Nondiscretionary	Unspecified infection of bone, upper arm
812.59	Nondiscretionary	Other open fracture of lower end of humerus
815	Nondiscretionary	Fracture of metacarpal bone(s); closed
814	Nondiscretionary	Fracture of carpal bone(s)
944.31	Nondiscretionary	3rd deg burn finger
927.2	Nondiscretionary	Crushing injury of hand(s)
812.03	Nondiscretionary	Fracture of greater tuberosity of humerus, closed
887.4	Nondiscretionary	Traumatic amputation of arm and hand (complete) (partial), unilateral, level not specified, without mention of complication
811	Nondiscretionary	Closed fracture of scapula, unspecified part
832	Nondiscretionary	Closed dislocation of elbow, unspecified site
903.5	Nondiscretionary	Injury to digital blood vessels
815.04	Nondiscretionary	Closed fracture of neck of metacarpal bone(s)
943	Nondiscretionary	Burn of unspecified degree of unspecified site of upper limb
881.12	Nondiscretionary	Open wound of wrist, complicated
41.6	Nondiscretionary	Proteus (mirabilis) (morganii) infection in conditions classified elsewhere and of unspecified site
829	Nondiscretionary	Fracture of unspecified bone, closed
814.13	Nondiscretionary	Open fracture of triquetral (cuneiform) bone of wrist
832.02	Nondiscretionary	Closed posterior dislocation of elbow
832.01	Nondiscretionary	Closed anterior dislocation of elbow
817	Nondiscretionary	Multiple closed fractures of hand bones
816.1	Nondiscretionary	Open fracture of phalanx or phalanges of hand, unspecified
816.03	Nondiscretionary	Closed fracture of multiple sites of phalanx or phalanges of hand
927.9	Nondiscretionary	Crushing injury of unspecified site of upper limb
814.03	Nondiscretionary	Closed fracture of triquetral (cuneiform) bone of wrist
816	Nondiscretionary	Closed fracture of phalanx or phalanges of hand, unspecified
810	Nondiscretionary	Closed fracture of clavicle, unspecified part
815.19	Nondiscretionary	Open fracture of multiple sites of metacarpus
944.01	Nondiscretionary	Burn of unspecified degree of single digit (finger (nail) other than thumb
813.51	Nondiscretionary	Colles' fracture, open
927	Nondiscretionary	Crushing injury of shoulder region
813.2	Nondiscretionary	Fracture of shaft of radius or ulna, unspecified, closed
883.2	Nondiscretionary	Open wound of fingers, with tendon involvement
882.1	Nondiscretionary	Open wound of hand except fingers alone, complicated

834.12	Nondiscretionary	Open dislocation interphalangeal (joint), hand
813.81	Nondiscretionary	Fracture of unspecified part of radius (alone), closed
686.9	Nondiscretionary	Unspecified local infection of skin and subcutaneous tissue
923.03	Nondiscretionary	Contusion of upper arm
815	Nondiscretionary	Closed fracture of metacarpal bone(s), site unspecified
813.07	Nondiscretionary	Fractures of proximal end of radius (alone), other and unspecified closed
815.14	Nondiscretionary	Open fracture of neck of metacarpal bone(s)
816.11	Nondiscretionary	Open fracture of middle or proximal phalanx or phalanges of hand
813.33	Nondiscretionary	Fracture of shaft of radius with ulna, open
813.54	Nondiscretionary	Fracture of lower end of radius with ulna, open
810.02	Nondiscretionary	Closed fracture of shaft of clavicle
810.03	Nondiscretionary	Closed fracture of acromial end of clavicle
41.09	Nondiscretionary	Other Streptococcus infection in conditions classified elsewhere and of unspecified site
814.08	Nondiscretionary	Closed fracture of hamate (unciform) bone of wrist
886.1	Nondiscretionary	Traumatic amputation of other finger(s) (complete) (partial), complicated
944.23	Nondiscretionary	Blisters with epidermal loss due to burn (second degree) of two or more digits of hand, not including thumb
923	Nondiscretionary	Contusion of shoulder region
882	Nondiscretionary	Open wound of hand except fingers alone, without mention of complication
716.12	Nondiscretionary	Traumatic arthropathy involving upper arm
812.44	Nondiscretionary	Fracture of unspecified condyle(s) of humerus, closed
816.13	Nondiscretionary	Open fracture of multiple sites of phalanx or phalanges of hand
944.05	Nondiscretionary	Burn of unspecified degree of palm of hand
815.12	Nondiscretionary	Open fracture of base of other metacarpal bone(s)
927.1	Nondiscretionary	Crushing injury of forearm
923.3	Nondiscretionary	Contusion of finger
885.1	Nondiscretionary	Traumatic amputation of thumb (complete) (partial), complicated
813.32	Nondiscretionary	Fracture of shaft of ulna (alone), open
815.1	Nondiscretionary	Open fracture of metacarpal bone(s), site unspecified
811.03	Nondiscretionary	Closed fracture of glenoid cavity and neck of scapula
681.02	Nondiscretionary	Onychia and paronychia of finger
834.1	Nondiscretionary	Open dislocation of finger, unspecified part
730.02	Nondiscretionary	Acute osteomyelitis involving upper arm
730.26	Nondiscretionary	Unspecified osteomyelitis involving lower leg
814.1	Nondiscretionary	Open fracture of carpal bone, unspecified
915.9	Nondiscretionary	Other and unspecified superficial injury of fingers, infected
730.04	Nondiscretionary	Acute osteomyelitis involving hand

881.02	Nondiscretionary	Open wound of wrist, without mention of complication
883	Nondiscretionary	Open wound of fingers, without mention of complication
881	Nondiscretionary	Open wound of forearm, without mention of complication
813.9	Nondiscretionary	Fracture of unspecified part of forearm, open
881.21	Nondiscretionary	Open wound of elbow, with tendon involvement
885	Nondiscretionary	Traumatic amputation of thumb (complete) (partial), without mention of complication
887	Nondiscretionary	Traumatic amputation of arm and hand (complete) (partial), unilateral, below elbow, without mention of complication
813.1	Nondiscretionary	Fracture open of upper end of forearm, unspecified
813.21	Nondiscretionary	Fracture of shaft of radius (alone), closed
733.11	Nondiscretionary	Pathologic fracture of humerus
943.01	Nondiscretionary	Burn of unspecified degree of forearm
944.3	Nondiscretionary	Full-thickness skin loss due to burn (third degree NOS) of unspecified site of hand
812.01	Nondiscretionary	Fracture of surgical neck of humerus, closed
833.19	Nondiscretionary	Open dislocation of other part of wrist
816.12	Nondiscretionary	Open fracture of distal phalanx or phalanges of hand
815.09	Nondiscretionary	Closed fracture of multiple sites of metacarpus
816	Nondiscretionary	Closed fracture of one or more phalanges of hand
886	Nondiscretionary	Traumatic amputation of other finger(s) (complete) (partial), without mention of complication
816.02	Nondiscretionary	Closed fracture of distal phalanx or phalanges of hand
41.11	Nondiscretionary	Staphylococcus aureus infection in conditions classified elsewhere and of unspecified site
711.91	Nondiscretionary	Unspecified infective arthritis involving shoulder region
887.6	Nondiscretionary	Traumatic amputation of arm and hand (complete) (partial), bilateral (any level), without mention of complication
814.09	Nondiscretionary	Closed fracture of other bone of wrist
110.1	Nondiscretionary	Dermatophytosis of nail
882.2	Nondiscretionary	Open wound of hand except fingers alone, with tendon involvement
915.7	Nondiscretionary	Superficial foreign body (splinter) of fingers, without major open wound, infected
686.8	Nondiscretionary	Other specified local infections of skin and subcutaneous tissue
730.24	Nondiscretionary	Unspecified osteomyelitis involving hand
914.2	Nondiscretionary	Blister of hand(s) except finger(s) alone, without mention of infection
881.11	Nondiscretionary	Open wound of elbow, complicated
711.04	Nondiscretionary	Pyogenic arthritis involving hand
914.9	Nondiscretionary	Other and unspecified superficial injury of hand(s) except finger(s) alone, infected

811	Nondiscretionary	Fracture of scapula
813.41	Nondiscretionary	Fracture, closed, colles'
816.01	Nondiscretionary	Closed fracture of middle or proximal phalanx or phalanges of hand
915.3	Nondiscretionary	Blister of fingers, infected
815.03	Nondiscretionary	Closed fracture of shaft of metacarpal bone(s)
923.21	Nondiscretionary	Contusion of wrist
914.6	Nondiscretionary	Superficial foreign body (splinter) of hand(s) except finger(s) alone, without major open wound and without mention of infection
903.2	Nondiscretionary	Injury to radial blood vessels
813.83	Nondiscretionary	Fracture of unspecified part of radius with ulna, closed
913	Nondiscretionary	Abrasion or friction burn of elbow, forearm, and wrist, without mention of infection
813.45	Nondiscretionary	Torus fracture of radius
923.11	Nondiscretionary	Contusion of elbow
711.92	Nondiscretionary	Unspecified infective arthritis involving upper arm
681	Nondiscretionary	Cellulitis and abscess of finger, unspecified
813.93	Nondiscretionary	Fracture of unspecified part of radius with ulna, open
923.9	Nondiscretionary	Contusion of unspecified part of upper limb
815.13	Nondiscretionary	Open fracture of shaft of metacarpal bone(s)
814.07	Nondiscretionary	Closed fracture of capitate bone (os magnum) of wrist
927.11	Nondiscretionary	Crushing injury of elbow
880.23	Nondiscretionary	Open wound of upper arm, with tendon involvement
958.91	Nondiscretionary	Traumatic compartment syndrome of upper extremity
811.01	Nondiscretionary	Closed fracture of acromial process of scapula
831.09	Nondiscretionary	Closed dislocation of other site of shoulder
833.04	Nondiscretionary	Closed dislocation of carpometacarpal (joint)
813.3	Nondiscretionary	Fracture of shaft of radius or ulna, unspecified, open
927.21	Nondiscretionary	Crushing injury of wrist
944	Nondiscretionary	Burn of unspecified degree of unspecified site of hand
815.02	Nondiscretionary	Closed fracture of base of other metacarpal bone(s)
711.03	Nondiscretionary	Pyogenic arthritis involving forearm
813.18	Nondiscretionary	Fracture of radius with ulna, upper end (any part), open
923.1	Nondiscretionary	Contusion of forearm
813	Nondiscretionary	Fracture of radius and ulna
813.31	Nondiscretionary	Fracture of shaft of radius (alone), open
829.1	Nondiscretionary	Fracture of unspecified bone, open
814.04	Nondiscretionary	Closed fracture of pisiform bone of wrist
814	Nondiscretionary	Closed fracture of carpal bone, unspecified
812.5	Nondiscretionary	Fracture of unspecified part of lower end of humerus, open
814.01	Nondiscretionary	Closed fracture of navicular (scaphoid) bone of wrist

767.2	Nondiscretionary	Fracture of clavicle due to birth trauma
728.86	Nondiscretionary	Necrotizing fasciitis
814.11	Nondiscretionary	Open fracture of navicular (scaphoid) bone of wrist
812.4	Nondiscretionary	Fracture of unspecified part of lower end of humerus, closed
815	Nondiscretionary	Fracture of metacarpal bone(s)
832.2	Nondiscretionary	Nursemaids elbow
814.06	Nondiscretionary	Closed fracture of trapezoid bone (smaller multangular) of wrist
833.01	Nondiscretionary	Closed dislocation of radioulnar (joint), distal
813.8	Nondiscretionary	Closed fracture of unspecified part of forearm
815.01	Nondiscretionary	Closed fracture of base of thumb [first] metacarpal
810.11	Nondiscretionary	Open fracture of sternal end of clavicle
912.6	Nondiscretionary	Superficial foreign body (splinter) of shoulder and upper arm, without major open wound and without mention of infection
834	Nondiscretionary	Closed dislocation of finger, unspecified part
813.5	Nondiscretionary	Open fracture of lower end of forearm, unspecified
812.54	Nondiscretionary	Fracture of unspecified condyle(s) of humerus, open
730.08	Nondiscretionary	Acute osteomyelitis involving other specified sites
813.08	Nondiscretionary	Fracture of radius with ulna, upper end (any part), closed
833.03	Nondiscretionary	Closed dislocation of midcarpal (joint)
41.01	Nondiscretionary	Group A Streptococcus infection in conditions classified elsewhere and of unspecified site
812.42	Nondiscretionary	Fracture of lateral condyle of humerus, closed
813.4	Nondiscretionary	Fracture of lower end of radius and ulna, closed
711.9	Nondiscretionary	Unspecified infective arthritis, site unspecified
915.6	Nondiscretionary	Superficial foreign body (splinter) of fingers, without major open wound and without mention of infection
812.49	Nondiscretionary	Other closed fractures of lower end of humerus
833.05	Nondiscretionary	Closed dislocation of metacarpal (bone), proximal end
813.23	Nondiscretionary	Fracture of shaft of radius with ulna, closed
915	Nondiscretionary	Abrasion or friction burn of fingers, without mention of infection
41.19	Nondiscretionary	Other Staphylococcus infection in conditions classified elsewhere and of unspecified site
811.02	Nondiscretionary	Closed fracture of coracoid process of scapula
834.02	Nondiscretionary	Closed dislocation of interphalangeal (joint), hand
813.92	Nondiscretionary	Fracture of unspecified part of ulna (alone), open
881.1	Nondiscretionary	Open wound of forearm, complicated
814.18	Nondiscretionary	Open fracture of hamate (unciform) bone of wrist
812.41	Nondiscretionary	Fracture of humerus, supracondylar closed
832.04	Nondiscretionary	Closed lateral dislocation of elbow
832.1	Nondiscretionary	Open dislocation of elbow, unspecified site
716.14	Nondiscretionary	Traumatic arthropathy involving hand

711.02	Nondiscretionary	Pyogenic arthritis involving upper arm
716.13	Nondiscretionary	Traumatic arthropathy involving forearm
915.2	Nondiscretionary	Blister of fingers, without mention of infection
813.04	Nondiscretionary	Other and unspecified closed fractures of proximal end of ulna (alone)
813.03	Nondiscretionary	Fracture monteggia's, closed
915.1	Nondiscretionary	Abrasion or friction burn of fingers, infected
810	Nondiscretionary	Closed fracture of clavicle
813	Nondiscretionary	Fracture closed of upper end of forearm, unspecified
813.82	Nondiscretionary	Fracture of unspecified part of ulna (alone), closed
831.04	Nondiscretionary	Closed dislocation of acromioclavicular (joint)
813.52	Nondiscretionary	Other open fractures of distal end of radius (alone)
812.53	Nondiscretionary	Fracture of medial condyle of humerus, open
730.2	Nondiscretionary	Unspecified osteomyelitis, site unspecified
681.01	Nondiscretionary	Felon
833.02	Nondiscretionary	Closed dislocation of radiocarpal (joint)
812.43	Nondiscretionary	Fracture of medial condyle of humerus, closed
813.11	Nondiscretionary	Fracture of olecranon process of ulna, open
813.15	Nondiscretionary	Fracture of head of radius, open
944.5	Nondiscretionary	Deep necrosis of underlying tissues due to burn (deep third degree) of unspecified site of hand, with loss of hand
812.31	Nondiscretionary	Fracture of shaft of humerus, open
832.09	Nondiscretionary	Closed dislocation of other site of elbow
812.2	Nondiscretionary	Closed, fracture of unspecified part of humerus
812.11	Nondiscretionary	Fracture of surgical neck of humerus, open
832.03	Nondiscretionary	Closed medial dislocation of elbow
730.22	Nondiscretionary	Unspecified osteomyelitis involving upper arm
881.22	Nondiscretionary	Open wound of wrist, with tendon involvement
914.7	Nondiscretionary	Superficial foreign body (splinter) of hand(s) except finger(s) alone, without major open wound, infected
834.01	Nondiscretionary	Closed dislocation of metacarpophalangeal (joint)
813.14	Nondiscretionary	Other and unspecified open fractures of proximal end of ulna (alone)
730.23	Nondiscretionary	Unspecified osteomyelitis involving forearm
815.11	Nondiscretionary	Open fracture of base of thumb [first] metacarpal
812.09	Nondiscretionary	Other closed fractures of upper end of humerus
814.05	Nondiscretionary	Closed fracture of trapezium bone (larger multangular) of wrist
813.22	Nondiscretionary	Fracture of shaft of ulna (alone), closed
810.12	Nondiscretionary	Open fracture of shaft of clavicle
813.53	Nondiscretionary	Fracture of distal end of ulna (alone), open
880.09	Nondiscretionary	Open wound of multiple sites of shoulder and upper arm, without mention of complication

682.9	Nondiscretionary	Cellulitis and abscess of unspecified sites
812.21	Nondiscretionary	Closed, fracture of shaft of humerus
813.01	Nondiscretionary	Fracture of olecranon process of ulna, closed
716.11	Nondiscretionary	Traumatic arthropathy involving shoulder region
785.4	Nondiscretionary	Gangrene
682.3	Nondiscretionary	Cellulitis and abscess of upper arm and forearm
811.09	Nondiscretionary	Closed fracture of other part of scapula
730.94	Nondiscretionary	Unspecified infection of bone, hand
813.05	Nondiscretionary	Fracture of head of radius, closed
730.33	Nondiscretionary	Periostitis, without mention of osteomyelitis, involving forearm
881.2	Nondiscretionary	Open wound of forearm, with tendon involvement
831	Nondiscretionary	Closed dislocation of shoulder, unspecified site
15.8	Nondiscretionary	Tuberculosis of other specified joint, unspecified examination
880.03	Nondiscretionary	Open wound of upper arm, without mention of complication
41.84	Nondiscretionary	Other anaerobe infection in conditions classified elsewhere and of unspecified site
812	Nondiscretionary	Fracture of unspecified part of upper end of humerus, closed
834.11	Nondiscretionary	Open dislocation of metacarpophalangeal (joint)
730.03	Nondiscretionary	Acute osteomyelitis involving forearm
814.02	Nondiscretionary	Closed fracture of lunate (semilunar) bone of wrist
730	Nondiscretionary	Acute osteomyelitis, site unspecified
41.89	Nondiscretionary	Other specified bacterial infection in conditions classified elsewhere and of unspecified site
733.12	Nondiscretionary	Pathologic fracture of distal radius and ulna
813.42	Nondiscretionary	Other closed fractures of distal end of radius (alone)
813.02	Nondiscretionary	Fracture of coronoid process of ulna, closed
810	Nondiscretionary	Fracture of clavicle
682.4	Nondiscretionary	Cellulitis and abscess of hand, except fingers and thumb
813.44	Nondiscretionary	Fracture of lower end of radius with ulna, closed
923.2	Nondiscretionary	Contusion of hand(s)
903.3	Nondiscretionary	Injury to ulnar blood vessels
881.01	Nondiscretionary	Open wound of elbow, without mention of complication
944.03	Nondiscretionary	Burn of unspecified degree of two or more digits of hand, not including thumb
30.9	Nondiscretionary	Leprosy, unspecified
711	Nondiscretionary	Pyogenic arthritis, site unspecified
812.1	Nondiscretionary	Fracture of unspecified part of upper end of humerus, open
831.01	Nondiscretionary	Closed anterior dislocation of humerus
814.19	Nondiscretionary	Open fracture of other bone of wrist
813.12	Nondiscretionary	Fracture of coronoid process of ulna, open
711.94	Nondiscretionary	Unspecified infective arthritis involving hand

813.4	Nondiscretionary	Fracture closed of lower end of forearm, unspecified
681.9	Nondiscretionary	Cellulitis and abscess of unspecified digit
41.1	Nondiscretionary	Unspecified Staphylococcus infection in conditions classified elsewhere and of unspecified site
686.1	Nondiscretionary	Pyogenic granuloma of skin and subcutaneous tissue
883.1	Nondiscretionary	Open wound of fingers, complicated
944.2	Nondiscretionary	Blisters with epidermal loss due to burn (second degree) of unspecified site of hand
88.81	Nondiscretionary	Lyme disease
813.06	Nondiscretionary	Fracture of neck of radius, closed
833	Nondiscretionary	Closed dislocation of wrist, unspecified part
813.13	Nondiscretionary	Fracture, monteggia's open
927.3	Nondiscretionary	Crushing injury of finger(s)
880.11	Nondiscretionary	Open wound of scapular region, complicated
813.43	Nondiscretionary	Fracture of distal end of ulna (alone), closed
833.09	Nondiscretionary	Closed dislocation of other part of wrist
833.1	Nondiscretionary	Open dislocation of wrist, unspecified part
813.91	Nondiscretionary	Fracture of unspecified part of radius (alone), open
912	Nondiscretionary	Abrasion or friction burn of shoulder and upper arm, without mention of infection
41.85	Nondiscretionary	Other gram-negative organism infection in conditions classified elsewhere and of unspecified site
110.2	Nondiscretionary	Dermatophytosis of hand

Appendix 2. CPT Codes used for Utilization Measures and Associated RVUs

CPT Code	Utilization Measured	RVU	Description
73225	Imaging	27.38	magnetic resonance angiography, upper extremity, with or without contrast material(s)
73030	Imaging	1.84	radiologic examination, shoulder; complete, minimum of two views
73080	Imaging	2.02	radiologic examination, elbow; complete, minimum of three views
73200	Imaging	12.5	computed tomography, upper extremity; without contrast material
73000	Imaging	1.74	radiologic examination; clavicle, complete
73140	Imaging	2.04	radiologic examination, finger(s), minimum of two views
73130	Imaging	1.94	radiologic examination, hand; minimum of three views
73223	Imaging	32.26	magnetic resonance (eg, proton) imaging, any joint of upper extremity; without contrast material(s), followed by contrast material(s) and further sequences
73110	Imaging	2.26	radiologic examination, wrist; complete, minimum of three views
73220	Imaging	34.34	magnetic resonance (eg, proton) imaging, upper extremity, other than joint; without contrast material(s), followed by contrast material(s) and further sequences
73120	Imaging	1.66	radiologic examination, hand; two views
73040	Imaging	6.4	radiological arthrography exam
73202	Imaging	19.74	computed tomography, upper extremity; without contrast material, followed by contrast material(s) and further sections
73115	Imaging	6.9	radiologic examination, wrist, arthrography, radiological supervision and interpretation
23350	Imaging	1.47	Injection for shoulder arthrogram
25246	Imaging	2.16	injection procedure for wrist arthrography
73100	Imaging	1.96	radiologic examination, wrist; two views
73060	Imaging	1.74	radiologic examination; humerus, minimum of two views
73020	Imaging	1.42	radiologic examination, shoulder; one view
73090	Imaging	1.66	radiologic examination; forearm, two views
73070	Imaging	1.72	radiologic examination, elbow; two views
73218	Imaging	25.28	magnetic resonance (eg, proton) imaging, upper extremity, other than joint; without contrast material(s)
73201	Imaging	15.38	computed tomography, upper extremity with contrast
73221	Imaging	24.16	magnetic resonance (eg, proton) imaging, any joint of upper extremity; without contrast material(s)

73222	Imaging	26.04	magnetic resonance (eg, proton) imaging, any joint of upper extremity; with contrast material(s)
73010	Imaging	1.92	radiologic examination; scapula, complete
20615	Injection	4.72	aspiration and injection for treatment of bone cyst
20600	Injection	1.13	arthrocentesis, aspiration and/or injection; small joint or bursa (eg, fingers, toes)
20550	Injection	1.21	injection(s); single tendon sheath, or ligament, aponeurosis
20551	Injection	1.25	injection(s); tendon origin/insertion
20610	Injection	1.47	arthrocentesis, aspiration and/or injection; major joint or bursa (eg, shoulder, hip, knee joint, subacromial bursa)
20605	Injection	1.2	arthrocentesis, aspiration and/or injection; intermediate joint or bursa (eg, temporomandibular, acromioclavicular, wrist, elbow or ankle, olecranon bursa)
20612	Injection	1.22	aspiration and/or injection of ganglion cyst(s)
95900	Nerve Conduction	3.92	nerve conduction, amplitude and latency/velocity study, each nerve; motor, without f-wave study
95903	Nerve Conduction	4.6	nerve conduction, amplitude and latency/velocity study, each nerve; motor, with f-wave study
95904	Nerve Conduction	3.48	nerve conduction, amplitude and latency/velocity study, each nerve; sensory
95885	Nerve Conduction	3.28	needle electromyography, each extremity, with related paraspinal areas, when performed, done with nerve conduction, amplitude and latency/velocity study; limited
95886	Nerve Conduction	5.14	needle electromyography, each extremity, with related paraspinal areas, when performed, done with nerve conduction, amplitude and latency/velocity study; complete, five or more muscles studied, innervated by three or more nerves or four or more spinal levels
97110	Occupational Therapy	0.92	therapeutic procedure, one or more areas, each 15 minutes; therapeutic exercises to develop strength and endurance, range of motion and flexibility
97762	Occupational Therapy	1.38	checkout for orthotic/prosthetic use, established patient, each 15 minutes
97530	Occupational Therapy	1.01	therapeutic activities, direct (one-on-one) patient contact by the provider (use of dynamic activities to improve functional performance), each 15 minutes
97003	Occupational Therapy	2.47	occupational therapy evaluation
97140	Occupational Therapy	0.86	manual therapy techniques (eg, mobilization/manipulation, manual lymphatic drainage, manual traction), one or more regions, each 15 minutes
97124	Occupational Therapy	0.76	manual therapy techniques, including soft tissue and joint mobilization, manipulation, etc

97750	Occupational Therapy	0.96	Physical performance test or measurement
97112	Occupational Therapy	0.97	therapeutic procedure, one or more areas, each 15 minutes; neuromuscular reeducation of movement, balance, coordination, kinesthetic sense, posture, and/or proprioception for sitting and/or standing activities
97004	Occupational Therapy	1.54	occupational therapy re-evaluation
97799	Occupational Therapy	0	unlisted physical medicine/rehabilitation service or procedure
97760	Occupational Therapy	1.11	orthotic(s) management and training (including assessment and fitting when not otherwise reported), upper extremity(s), lower extremity(s) and/or trunk, each 15 minutes
25065	Surgery	4.9	biopsy, soft tissue of forearm and/or wrist; superficial
64784	Surgery	21.91	excision of neuroma; major peripheral nerve, except sciatic
64788	Surgery	11.83	excision of neurofibroma or neurolemmoma; cutaneous nerve
25085	Surgery	13.33	capsulotomy, wrist (eg, contracture)
25119	Surgery	14.82	synovectomy, extensor tendon sheath, wrist, single compartment; with resection of distal ulna
26531	Surgery	18.47	arthroplasty, metacarpophalangeal joint; with prosthetic implant, each joint
64708	Surgery	14.81	neuroplasty, major peripheral nerve, arm or leg; other than specified
26499	Surgery	24.21	correction claw finger, other methods
24066	Surgery	12.19	biopsy, soft tissue of upper arm or elbow area; deep (subfascial or intramuscular)
25312	Surgery	21.32	tendon transplantation or transfer, flexor or extensor, forearm and/or wrist, single; with tendon graft(s) (includes obtaining graft), each tendon
25415	Surgery	28.54	repair of nonunion or malunion, radius and ulna; without graft (eg, compression technique)
25825	Surgery	22.47	arthrodesis, wrist; with autograft (includes obtaining graft)
24345	Surgery	20.76	repair medial collateral ligament, elbow, with local tissue
64856	Surgery	30.25	suture of major peripheral nerve, arm or leg, except sciatic; including transposition
24351	Surgery	15.55	fasciotomy, lateral or medial (eg, tennis elbow or epicondylitis); with extensor origin detachment
25118	Surgery	11.31	synovectomy, extensor tendon sheath, wrist, single compartment
24360	Surgery	26.52	arthroplasty, elbow; with membrane (eg, fascial)

26546	Surgery	29.19	repair non-union, metacarpal or phalanx, (includes obtaining bone graft with or without external or internal fixation)
26145	Surgery	15.19	synovectomy, tendon sheath, radical (tenosynovectomy), flexor tendon, palm and/or finger, each tendon
14040	Surgery	19.09	adjacent tissue transfer or rearrangement, forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands and/or feet; defect 10 sq cm or less
24140	Surgery	20.81	partial excision (craterization, saucerization, or diaphysectomy) bone (eg, osteomyelitis), humerus
20690	Surgery	17.41	application of a uniplane (pins or wires in one plane), unilateral, external fixation system
20103	Surgery	10.46	exploration of penetrating wound (separate procedure); extremity
24075	Surgery	9.79	excision, tumor, soft tissue of upper arm or elbow area; subcutaneous
25066	Surgery	10.61	biopsy, soft tissue of forearm and/or wrist; deep (subfascial or intramuscular)
26035	Surgery	25.29	decompression fingers and/or hand, injection injury (eg, grease gun)
24105	Surgery	10.34	excision, olecranon bursa
26357	Surgery	25.37	repair or advancement, flexor tendon, in zone 2 digital flexor tendon sheath (eg, no man's land); secondary, each tendon
26750	Surgery	5.47	closed treatment of distal phalangeal fracture, finger or thumb; without manipulation, each
25290	Surgery	12.94	tenotomy, open, flexor or extensor tendon, forearm and/or wrist, single, each tendon
26010	Surgery	4.09	drainage of finger abscess; simple
25107	Surgery	18.26	arthrotomy, distal radioulnar joint including repair of triangular cartilage, complex
25350	Surgery	19.95	osteotomy, radius; distal third
25800	Surgery	21.64	arthrodesis, wrist; complete, without bone graft (includes radiocarpal and/or intercarpal and/or carpometacarpal joints)
26567	Surgery	19.92	osteotomy; phalanx of finger, each
25076	Surgery	15.34	excision, tumor, soft tissue of forearm and/or wrist area; deep (subfascial or intramuscular)
24134	Surgery	22.04	sequestrectomy (eg, for osteomyelitis or bone abscess), shaft or distal humerus
64727	Surgery	5.49	internal neurolysis, requiring use of operating microscope (list separately in addition to code for neuroplasty) (neuroplasty includes external neurolysis)

24575	Surgery	21.71	open treatment of humeral epicondylar fracture, medial or lateral, with or without internal or external fixation
25447	Surgery	24.53	arthroplasty, interposition, intercarpal or carpometacarpal joints
10121	Surgery	5.51	incision and removal of foreign body, subcutaneous tissues; complicated
29845	Surgery	17.13	arthroscopy, wrist, surgical; synovectomy, complete
25355	Surgery	22.59	osteotomy, radius; middle or proximal third
24340	Surgery	18.18	tenodesis of biceps tendon at elbow (separate procedure)
24354	Surgery	15.55	fasciotomy, lateral or medial (eg, tennis elbow or epicondylitis); with stripping
26426	Surgery	14.84	repair of extensor tendon, central slip, secondary (eg, boutonniere deformity); using local tissue(s), including lateral band(s), each finger
11602	Surgery	4.88	excision, malignant lesion including margins, trunk, arms, or legs; excised diameter 1.1 to 2.0 cm
23485	Surgery	28.38	osteotomy, clavicle, with or without internal fixation; with bone graft for nonunion or malunion (includes obtaining graft and/or necessary fixation)
25320	Surgery	29.36	capsulorrhaphy or reconstruction, wrist, open (eg, capsulodesis, ligament repair, tendon transfer or graft) (includes synovectomy, capsulotomy and open reduction) for carpal instability
64898	Surgery	42.8	nerve graft (includes obtaining graft), multiple strands (cable), arm or leg; more than 4 cm length
23430	Surgery	22.17	tenodesis of long tendon of biceps
26170	Surgery	12.05	excision of tendon, palm, flexor, single (separate procedure), each
26541	Surgery	23.46	reconstruction, collateral ligament, metacarpophalangeal joint, single; with tendon or fascial graft (includes obtaining graft)
26460	Surgery	11.54	tenotomy, extensor, hand or finger, open, each tendon
24366	Surgery	20.15	arthroplasty, radial head; with implant
26440	Surgery	18.21	tenolysis, flexor tendon; palm or finger, each tendon
26236	Surgery	13.07	partial excision (craterization, saucerization, or diaphysectomy) bone (eg, osteomyelitis); distal phalanx of finger
26536	Surgery	20.88	arthroplasty, interphalangeal joint; with prosthetic implant, each joint
11623	Surgery	6.34	excision, malignant lesion including margins, scalp, neck, hands, feet, genitalia; excised diameter 2.1 to 3.0 cm
26542	Surgery	19.93	reconstruction, collateral ligament, metacarpophalangeal joint, single; with local tissue (eg, adductor advancement)

24350	Surgery	15.55	fasciotomy, lateral or medial (eg, tennis elbow or epicondylitis)
26116	Surgery	15.63	excision, tumor or vascular malformation, soft tissue of hand or finger; deep (subfascial or intramuscular)
25337	Surgery	26.36	reconstruction for stabilization of unstable distal ulna or distal radioulnar joint, secondary by soft tissue stabilization (eg, tendon transfer, tendon graft or weave, or tenodesis) with or without open reduction of distal radioulnar joint
26020	Surgery	12.88	drainage of tendon sheath, digit and/or palm, each
12032	Surgery	5.82	layer closure of wounds of scalp, axillae, trunk and/or extremities (excluding hands and feet); 2.6 cm to 7.5 cm
25820	Surgery	18.26	arthrodesis, wrist; limited, without bone graft (eg, intercarpal or radiocarpal)
26011	Surgery	5.49	drainage of finger abscess; complicated (eg, felon)
26951	Surgery	19.15	amputation, finger or thumb, primary or secondary, any joint or phalanx, single, including neurectomies; with direct closure
25645	Surgery	16.77	open treatment of carpal bone fracture (other than carpal scaphoid (navicular)), each bone
26117	Surgery	22.29	radical resection of tumor (eg, malignant neoplasm), soft tissue of hand or finger
24999	Surgery	0	unlisted procedure, humerus or elbow
24149	Surgery	34.8	radical resection of capsule, soft tissue, and heterotopic bone, elbow, with contracture release (separate procedure)
26115	Surgery	9.86	excision, tumor or vascular malformation, soft tissue of hand or finger; subcutaneous
26516	Surgery	20.62	capsulodesis, metacarpophalangeal joint; single digit
29840	Surgery	13.52	arthroscopy, wrist, diagnostic, with or without synovial biopsy (separate procedure)
26740	Surgery	6.36	closed treatment of articular fracture, involving metacarpophalangeal or interphalangeal joint; without manipulation, each
25405	Surgery	30.63	repair of nonunion or malunion, radius or ulna; with autograft (includes obtaining graft)
26230	Surgery	14.77	partial excision (craterization, saucerization, or diaphysectomy) bone (eg, osteomyelitis); metacarpal
26520	Surgery	19.09	capsulectomy or capsulotomy; metacarpophalangeal joint, each joint
64831	Surgery	20.43	suture of digital nerve, hand or foot; one nerve
25075	Surgery	9.41	excision, tumor, soft tissue of forearm and/or wrist area; subcutaneous

11755	Surgery	2.32	biopsy of nail unit (eg, plate, bed, matrix, hyponychium, proximal and lateral nail folds) (separate procedure)
11200	Surgery	2.16	removal of skin tags, multiple fibrocutaneous tags, any area; up to and including 15 lesions
11626	Surgery	8.8	excision, malignant lesion including margins, scalp, neck, hands, feet, genitalia; excised diameter over 4.0 cm
25400	Surgery	23.82	repair of nonunion or malunion, radius or ulna; without graft (eg, compression technique)
64890	Surgery	33.53	nerve graft (includes obtaining graft), single strand, hand or foot; up to 4 cm length
11420	Surgery	2.42	excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 0.5 cm or less
20670	Surgery	4.39	removal of implant; superficial, (eg, buried wire, pin or rod) (separate procedure)
26215	Surgery	16.59	excision or curettage of bone cyst or benign tumor of proximal, middle, or distal phalanx of finger; with autograft (includes obtaining graft)
15240	Surgery	24.15	full thickness graft, free, including direct closure of donor site, forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands, and/or feet; 20 sq cm or less
26485	Surgery	23.72	transfer or transplant of tendon, palmar; without free tendon graft, each tendon
25111	Surgery	9.48	excision of ganglion, wrist (dorsal or volar); primary
25040	Surgery	16.69	arthrotomy, radiocarpal or midcarpal joint, with exploration, drainage, or removal of foreign body
29838	Surgery	17.53	arthroscopy, elbow, surgical; debridement, extensive
64834	Surgery	22.01	suture of one nerve, hand or foot; common sensory nerve
26498	Surgery	33.36	transfer of tendon to restore intrinsic function; all four fingers
25805	Surgery	24.9	arthrodesis, wrist; with sliding graft
24363	Surgery	44.37	arthroplasty, elbow; with distal humerus and proximal ulnar prosthetic replacement (eg, total elbow)
26540	Surgery	19.3	repair of collateral ligament, metacarpophalangeal or interphalangeal joint
29847	Surgery	16.05	arthroscopy, wrist, surgical; internal fixation for fracture or instability
64790	Surgery	24.74	excision of neurofibroma or neurolemmoma; major peripheral nerve
26525	Surgery	19.12	capsulectomy or capsulotomy; interphalangeal joint, each joint
64704	Surgery	9.25	neuroplasty; nerve of hand or foot
26055	Surgery	9.2	tendon sheath incision (eg, for trigger finger)

14020	Surgery	17.14	adjacent tissue transfer or rearrangement, scalp, arms and/or legs; defect 10 sq cm or less
29846	Surgery	15.51	arthroscopy, wrist, surgical; excision and/or repair of triangular fibrocartilage and/or joint debridement
25248	Surgery	12.35	exploration with removal of deep foreign body, forearm or wrist
26390	Surgery	24.39	excision flexor tendon, with implantation of synthetic rod for delayed tendon graft, hand or finger, each rod
26850	Surgery	20.27	arthrodesis, metacarpophalangeal joint, with or without internal fixation
25000	Surgery	9.95	incision, extensor tendon sheath, wrist (eg, dequervains disease)
24342	Surgery	23.02	reinsertion of ruptured biceps or triceps tendon, distal, with or without tendon graft
26370	Surgery	22.31	repair or advancement of profundus tendon, with intact superficialis tendon; primary, each tendon
25670	Surgery	17.83	open treatment of radiocarpal or intercarpal dislocation, one or more bones
23480	Surgery	24.22	osteotomy, clavicle, with or without internal fixation
26210	Surgery	13.1	excision or curettage of bone cyst or benign tumor of proximal, middle, or distal phalanx of finger
26437	Surgery	18.22	realignment of extensor tendon, hand, each tendon
25112	Surgery	11.47	excision of ganglion, wrist (dorsal or volar); recurrent
64895	Surgery	41.39	nerve graft (includes obtaining graft), multiple strands (cable), hand or foot; up to 4 cm length
24120	Surgery	15.65	excision or curettage of bone cyst or benign tumor of head or neck of radius or olecranon process
24346	Surgery	32.44	reconstruction medial collateral ligament, elbow, with tendon graft (includes harvesting of graft)
24430	Surgery	31.39	repair of nonunion or malunion, humerus; without graft (eg, compression technique)
24102	Surgery	18.22	arthrotomy, elbow; with synovectomy
24615	Surgery	21	open treatment of acute or chronic elbow dislocation
26123	Surgery	24.72	fasciectomy, partial palmar with release of single digit including proximal interphalangeal joint, with or without z-plasty, other local tissue rearrangement, or skin grafting (includes obtaining graft)
20205	Surgery	4.53	biopsy, muscle; deep
64713	Surgery	22.59	neuroplasty, major peripheral nerve, arm or leg; brachial plexus
64721	Surgery	12.66	neuroplasty and/or transposition; median nerve at carpal tunnel

26080	Surgery	11.54	arthrotomy, with exploration, drainage, or removal of loose or foreign body; interphalangeal joint, each
25240	Surgery	12.68	excision distal ulna partial or complete (eg, darrach type or matched resection)
20525	Surgery	7.44	removal of foreign body in muscle or tendon sheath; deep or complicated
29837	Surgery	15.71	arthroscopy, elbow, surgical; debridement, limited
26480	Surgery	22.11	transfer or transplant of tendon, carpometacarpal area or dorsum of hand; without free graft, each tendon
26121	Surgery	17.7	fasciectomy, palm only, with or without z-plasty, other local tissue rearrangement, or skin grafting (includes obtaining graft)
25280	Surgery	16.72	lengthening or shortening of flexor or extensor tendon, forearm and/or wrist, single, each tendon
24650	Surgery	7.11	closed treatment of radial head or neck fracture; without manipulation
11421	Surgery	3.29	excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 0.6 to 1.0 cm
25130	Surgery	13.24	excision or curettage of bone cyst or benign tumor of carpal bones
24305	Surgery	17.15	tendon lengthening, upper arm or elbow, each tendon
24115	Surgery	21.75	excision or curettage of bone cyst or benign tumor, humerus; with autograft (includes obtaining graft)
64718	Surgery	17.65	neuroplasty and/or transposition; ulnar nerve at elbow
20902	Surgery	9.06	bone graft, any donor area; major or large
15770	Surgery	20.28	graft; derma-fat-fascia
24356	Surgery	15.55	fasciotomy, lateral or medial (eg, tennis elbow or epicondylitis); with partial ostectomy
24344	Surgery	32.66	reconstruction lateral collateral ligament, elbow, with tendon graft (includes harvesting of graft)
26160	Surgery	9.91	excision of lesion of tendon sheath or joint capsule (eg, cyst, mucous cyst, or ganglion), hand or finger
24365	Surgery	18.84	arthroplasty, radial head
26040	Surgery	9.23	fasciotomy, palmar (eg, dupuytren's contracture); percutaneous
24435	Surgery	31.95	repair of nonunion or malunion, humerus; with iliac or other autograft (includes obtaining graft)
24666	Surgery	21.68	open treatment of radial head or neck fracture, with or without internal fixation or radial head excision; with radial head prosthetic replacement
24065	Surgery	5.02	biopsy, soft tissue of upper arm or elbow area; superficial

64857	Surgery	31.43	suture of major peripheral nerve, arm or leg, except sciatic; without transposition
20692	Surgery	33.09	application of a multiplane (pins or wires in more than one plane), unilateral, external fixation system (eg, ilizarov, monticelli type)
25430	Surgery	20.86	insertion of vascular pedicle into carpal bone (eg, hori procedure)
64820	Surgery	22.64	sympathectomy; digital arteries, each digit
24301	Surgery	22.27	muscle or tendon transfer, any type, upper arm or elbow, single (excluding 24320-24331)
64832	Surgery	10.19	suture of digital nerve, hand or foot; each additional digital nerve (list separately in addition to code for primary procedure)
26560	Surgery	17.21	repair of syndactyly (web finger) each web space; with skin flaps
25270	Surgery	14.66	repair, tendon or muscle, extensor, forearm and/or wrist; primary, single, each tendon or muscle
26535	Surgery	12.27	arthroplasty, interphalangeal joint; each joint
24130	Surgery	15.03	excision, radial head
24006	Surgery	21.11	arthrotomy of the elbow, with capsular excision for capsular release (separate procedure)
26445	Surgery	16.93	tenolysis, extensor tendon, hand or finger; each tendon
25115	Surgery	22.55	radical excision of bursa, synovia of wrist, or forearm tendon sheaths (eg, tenosynovitis, fungus, tbc, or other granulomas, rheumatoid arthritis); flexors
26034	Surgery	15.95	incision, bone cortex, hand or finger (eg, osteomyelitis or bone abscess)
26200	Surgery	13.36	excision or curettage of bone cyst or benign tumor of metacarpal
26478	Surgery	18.26	lengthening of tendon, flexor, hand or finger, each tendon
24361	Surgery	29.7	arthroplasty, elbow; with distal humeral prosthetic replacement
25310	Surgery	18.36	tendon transplantation or transfer, flexor or extensor, forearm and/or wrist, single; each tendon
25600	Surgery	9.18	closed treatment of distal radial fracture (eg, colles or smith type) or epiphyseal separation, with or without fracture of ulnar styloid; without manipulation
64782	Surgery	13.39	excision of neuroma; hand or foot, except digital nerve
64719	Surgery	11.86	neuroplasty and/or transposition; ulnar nerve at wrist
26593	Surgery	17.6	release, intrinsic muscles of hand, each muscle
25126	Surgery	17.6	excision or curettage of bone cyst or benign tumor of radius or ulna (excluding head or neck of radius and olecranon process); with allograft

35761	Surgery	11.92	exploration (not followed by surgical repair), with or without lysis of artery; other vessels
64836	Surgery	24.06	suture of one nerve, hand or foot; ulnar motor
28024	Surgery	8.85	arthrotomy, including exploration, drainage, or removal of loose or foreign body; interphalangeal joint
69990	Surgery	6.44	microsurgical techniques, requiring use of operating microscope (list separately in addition to code for primary procedure)
26045	Surgery	13.81	fasciotomy, palmar (eg, dupuytren's contracture); open, partial
64896	Surgery	48.21	nerve graft (includes obtaining graft), multiple strands (cable), hand or foot; more than 4 cm length
11621	Surgery	4.48	excision, malignant lesion including margins, scalp, neck, hands, feet, genitalia; excised diameter 0.6 to 1.0 cm
64897	Surgery	39.51	nerve graft (includes obtaining graft), multiple strands (cable), arm or leg; up to 4 cm length
26340	Surgery	9.9	manipulation, finger joint, under anesthesia, each joint
26860	Surgery	16.51	arthrodesis, interphalangeal joint, with or without internal fixation
10120	Surgery	2.76	incision and removal of foreign body, subcutaneous tissues; simple
15736	Surgery	34.79	muscle, myocutaneous, or fasciocutaneous flap; upper extremity
25440	Surgery	22.8	repair of nonunion, scaphoid carpal (navicular) bone, with or without radial styloidectomy (includes obtaining graft and necessary fixation)
26070	Surgery	9.31	arthrotomy, with exploration, drainage, or removal of loose or foreign body; carpometacarpal joint
11750	Surgery	5.09	excision of nail and nail matrix, partial or complete, (eg, ingrown or deformed nail) for permanent removal
29844	Surgery	14.86	arthroscopy, wrist, surgical; synovectomy, partial
64702	Surgery	15.01	neuroplasty; digital, one or both, same digit
25230	Surgery	12.76	radial styloidectomy (separate procedure)
29834	Surgery	14.61	arthroscopy, elbow, surgical; with removal of loose body or foreign body
26600	Surgery	8.21	closed treatment of metacarpal fracture, single; without manipulation, each bone
20680	Surgery	12.64	removal of implant; deep (eg, buried wire, pin, screw, metal band, nail, rod or plate)
11620	Surgery	3.6	excision, malignant lesion including margins, scalp, neck, hands, feet, genitalia; excised diameter 0.5 cm or less
26565	Surgery	20.01	osteotomy; metacarpal, each

25275	Surgery	20.11	repair, tendon sheath, extensor, forearm and/or wrist, with free graft (includes obtaining graft) (eg, for extensor carpi ulnaris subluxation)
25210	Surgery	14.49	carpectomy; one bone
25116	Surgery	17.81	radical excision of bursa, synovia of wrist, or forearm tendon sheaths (eg, tenosynovitis, fungus, tbc, or other granulomas, rheumatoid arthritis); extensors, with or without transposition of dorsal retinaculum
25035	Surgery	17.28	incision, deep, bone cortex, forearm and/or wrist (eg, osteomyelitis or bone abscess)
20900	Surgery	6.24	bone graft, any donor area; minor or small (eg, dowel or button)
29836	Surgery	17.28	arthroscopy, elbow, surgical; synovectomy, complete
26587	Surgery	26.97	reconstruction of polydactylous digit, soft tissue and bone
24343	Surgery	20.87	repair lateral collateral ligament, elbow, with local tissue
24101	Surgery	14.76	arthrotomy, elbow; with joint exploration, with or without biopsy, with or without removal of loose or foreign body
24076	Surgery	16.17	excision, tumor, soft tissue of upper arm or elbow area; deep (subfascial or intramuscular)
25390	Surgery	22.78	osteoplasty, radius or ulna; shortening
25120	Surgery	14.74	excision or curettage of bone cyst or benign tumor of radius or ulna (excluding head or neck of radius and olecranon process)
20005	Surgery	6.8	incision of soft tissue abscess (eg, secondary to osteomyelitis); deep or complicated
29999	Surgery	0	unlisted procedure, arthroscopy
26125	Surgery	8.15	fasciectomy, partial palmar with release of single digit including proximal interphalangeal joint, with or without z-plasty, other local tissue rearrangement, or skin grafting (includes obtaining graft); each additional digit (list separately in addition to code for primary procedure)
25999	Surgery	0	unlisted procedure, forearm or wrist
26432	Surgery	14.61	closed treatment of distal extensor tendon insertion, with or without percutaneous pinning (eg, mallet finger)