RESEARCH BRIEF

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The Latest Trends in Time to Treatment

INTRODUCTION

The COVID-19 pandemic and resultant shelter-in-place orders disrupted nearly all business activity, especially access to medical care. While the specific timing of disruptions varied by state, April 2020 saw many healthcare facilities suspend all nonurgent medical procedures. This action preserved resources for the potential surge of COVID-19 patients requiring hospitalization. As a result, the entire healthcare sector saw a decline in medical care utilization. For workers compensation (WC) in particular, a significant drop in claim volume due to less business activity compounded the decline. Even when many medical care facilities started to resume more normal operations, fear of infection continued to keep many patients from seeking professional medical care.

In this study, we associate costs with the time to treatment for WC claims based on historical information to provide some insight into the impact of postponed medical care for specific WC injuries. We also compare 2020 data to 2019 and provide our findings on time to treatment and the potential cost impact of the COVID-19 pandemic.

BACKGROUND

Studies have questioned whether WC cases are sensitive to the timing of medical care and whether delay can sometimes be associated with adverse consequences, both in higher costs and poorer outcomes. On the other hand, treatment guidelines recommend waiting an appropriate time to allow for natural healing prior to authorizing complex imaging or invasive care.

The term “delay” in this context often has a negative connotation. The reality is time to treatment is much more nuanced. Some delays are beneficial while others may be harmful, depending on the injury and many other considerations, both medical and nonmedical. In this article, delay is quantitative and measures the length of time between two events, such as from injury to surgery.

For WC cases, the pandemic raised a concern due to certain medical facilities shutting down for a short period of time and limiting or not performing many procedures. This is true particularly for surgeries. Shoulder, knee, and low back pain injuries are of special interest, as those can be serious and debilitating for injured workers but are typically not life-threatening. This study looks specifically at the time to surgery for some of those injuries, recognizing that surgery may be delayed to allow for natural healing or to address other medical conditions, such as hypertension or obesity, that may be contraindications for the surgery. While we associate delays and costs with the timing of the pandemic, we do not speak to causal relationships.

KEY FINDINGS

We found that delays in care associated with the pandemic were limited in both the time frame during which they occurred and in their duration. The overall impact on claim costs directly associated with postponed medical care is uncertain. While still preliminary, we found no convincing evidence that access to quality care was adversely impacted.

The pandemic's impact on medical services includes:

- A decline in active claim volume
- An increased use of telemedicine
- Minimal change in both the share and seriousness of injuries treated in an emergency room (ER)
- An increase (after April 2020) in the use of ambulatory surgical centers (ASCs) above pre-pandemic levels

With respect to time to treatment, the pandemic:

- Did not adversely impact access to care, as measured by the time from injury to initial treatment
- Produced a backlog of surgeries in April and May 2020 that diminished throughout the summer
- May have resulted in greater use of noninvasive treatments that, with comparable outcomes, are often preferred over invasive procedures

For four common WC injuries (one back, one shoulder, and two knee injuries), we studied historical experience of how the total incurred cost per case is associated with the time from injury to surgery and found:

- Post-pandemic delays are typically too short to impact the average incurred cost per case
- The largest cost increases occur for back and shoulder injuries—and only after exceptionally long delays to surgery
- For these four WC injuries, the cost impact due to pandemic-based suspensions is minimal

DATA AND METHODOLOGY

The experience for this study is from two NCCI data calls: The Medical Data Call (MDC) and Workers Compensation Statistical Plan (WCSP). The MDC captures transaction-level details on medical bills for services provided on or after July 1, 2010. The details include dates of service, charges, payments, procedure codes, and diagnosis codes. The WCSP data is not reported on a transaction basis. Rather, NCCI collects the WCSP data on a yearly reporting schedule based on the policy effective date. The WCSP captures both individual claim level and policy level data that includes payrolls and premiums, together with medical and indemnity paid amounts and case reserves. NCCI collects the data for 37 jurisdictions included in this analysis where NCCI provides ratemaking services.[1]

The MDC information used for this study is from Accident Years 2014 through 2020. The WCSP data is from Accident Years 2014 through 2018. The WCSP claim data is used to compare total costs. Having case reserves gives a better gauge of ultimate costs, but cost comparisons often require more time for data to mature. NCCI uses claim identification numbers to cross-reference the MDC and WCSP data.

The time to treatment (TTT) for a medical procedure is the number of days from the date of injury (DOI) for a claim to the date of service (DOS):

$$TTT = DOS - DOI$$

TTT = 0 (indicates care provided on the date of injury)

The exhibits on pandemic-related delays compare TTT statistics by month between 2019 and 2020.[2] When data is organized by the time of injury, we look forward from the DOI to a DOS and call this the prospective perspective. With the prospective perspective:

1 Jurisdictions included in this study are AK, AL, AR, AZ, CO, CT, DC, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MO, MS, MT, NC, NE, NH, NM, NV, OK, OR, RI, SC, SD, TN, UT, VA, VT, and WV. More information on the MDC and WCSP can be found on ncci.com.

2 Here, "average" is synonymous with "mean." When a t-test indicates that a difference in mean has a 95% or greater confidence (p-value ≤ 0.05) of not being 0, we use the terms "statistically meaningful" or "significant" to characterize the difference.

- The focus is on how the pandemic impacts the treatment of recent post-pandemic injuries.
- To account for 2020 experience having a shorter time window (from injury to report date) than for 2019, we use equal time reporting windows by month of injury for both accident years. While the window is the same for each month, different months have different windows: the month of January, for example, has a longer window than June, at more than 12 months compared with about 9 months.[3]
- Because reporting for a given month may be disrupted and more delayed in 2020 than in 2019, a greater proportion of 2019 injuries may have been reported within the window than for the same month in 2020. All else equal, this may tend to increase TTT for accident months in 2019 compared with 2020.

When data is organized by the time of service, we look backward from a DOS to the DOI and call this the *retrospective perspective*. With the retrospective perspective:

- The focus is on how the pandemic impacts treatment of older injuries.
- It is necessary to use an appropriate and consistent starting time window for the DOI relative to the DOS for both Service Years 2019 and 2020.
- Due to the drop in 2020 claim volume, the injuries treated during a service month in 2020 have a greater share occurring before 2020 than the same service month had in 2019 from injuries occurring before 2019. All else equal, this may tend to increase TTTs for service months in 2020 compared with 2019.

We clarify this last observation with a simplified numeric example. We compare the hypothetical average TTT for surgery performed on April 1, 2019, with those performed on April 1, 2020, under several simplifying assumptions:

- All months have 30 days
- No same-day surgeries
- All surgeries are done within 180 days of injury
- Two injuries resulting in surgery occur uniformly each day until the last day of 2019
- One injury resulting in surgery occurs uniformly each day beginning January 1, 2020

Assume 90 surgeries were performed on April 1, 2020, having uniform injury dates in 2020 (TTT amounts of 1, 2, 3, ⋯, 90 days). The average TTT is 45.5 days.[4] The following table summarizes the calculation of the hypothetical 2019 and 2020 average TTT amounts:

	Fourth Quarter of Prior Year		First Quarter of Current Year		Two Quarters Combined
Current Year	**Number of Injuries**	**Average TTT days**	**Number of Injuries**	**Average TTT days**	**Average TTT Days**
2019	180	135.5	180	45.5	90.5
2020	180	135.5	90	45.5	105.5

The only difference is the drop in the emergence of injuries starting in 2020, and yet *the average TTT increased by 15 days*, despite no change in the timing from injury to surgery. The impact of a change in claim emergence on retrospective comparisons is more pronounced given longer delays from injury to treatment, such as with some complex surgeries.

Using retrospective comparisons, the measurement of time to surgery can be distorted when an impactful drop in claim volume occurs, similar to what happened during the first half of 2020 due to the pandemic.

[3] About 90% of transactions from January 2020 claims were reported to the MDC within 12 months from DOI; about 90% of June 2020 claims were reported within 9 months.
[4] 45.5 = (1 + 90) / 2.

EXHIBITS

The first set of exhibits examines the impact on TTT associated with the pandemic by looking at access to care. One metric for access to care is the time from injury to initial treatment. We also observe the pandemic's impact on the use of telemedicine, ERs, ASCs, and on the time to surgery for all surgeries combined.

- Delay of care is a much more complex and nuanced notion than access to care. To investigate delays, one must:
  - Look beyond initial encounters
  - Consider that not all delays are equal
  - Deal with the complex and evolving interaction of medical procedures and medical conditions

We focus on definitive steps of care, such as an MRI or a surgery[5] and look at four specific injuries. Finally, we relate TTT with incurred indemnity and medical costs combined. Because findings are generally similar for the four injuries, we discuss cruciate ligament injuries in detail, relegating the detail for the other three injuries to the Appendix.

Access to Care: First Encounter of Any Kind

We begin with a plot of the average, or mean, time to treatment by month of injury for 2019 and 2020. Exhibit 1 gives a prospective perspective of the mean time to initial care of any kind over all services combined:

Exhibit 1: Mean Days to First Treatment by Month of Injury
2019 vs. 2020

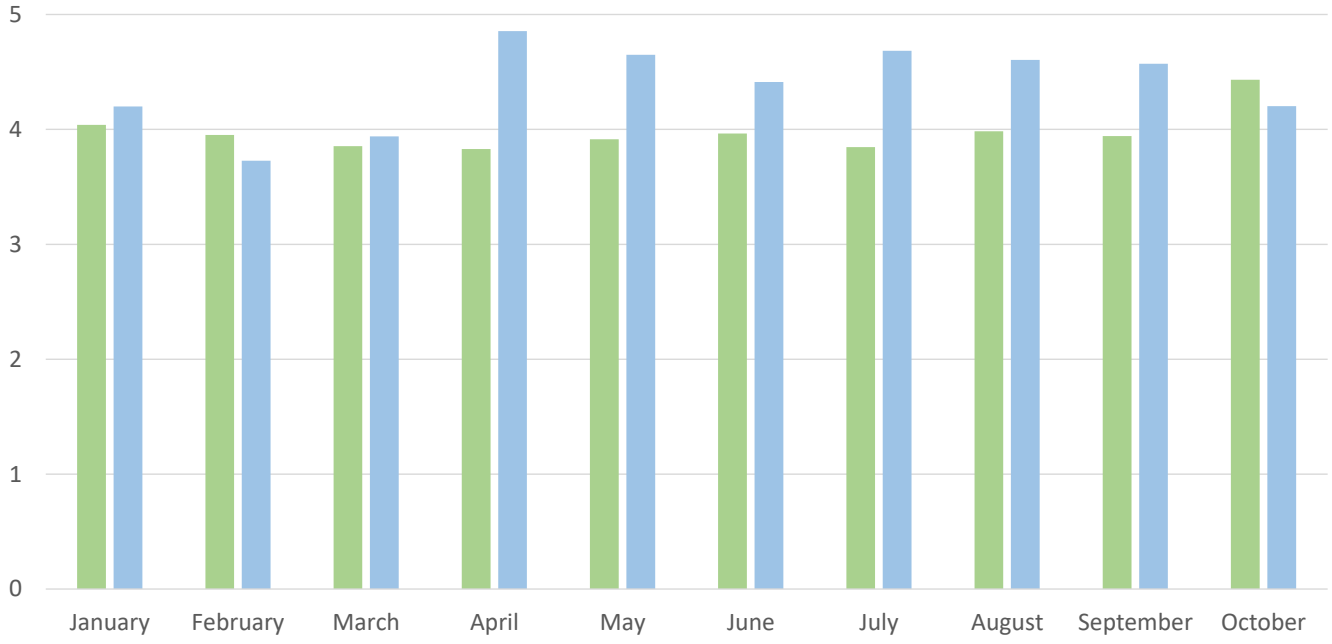


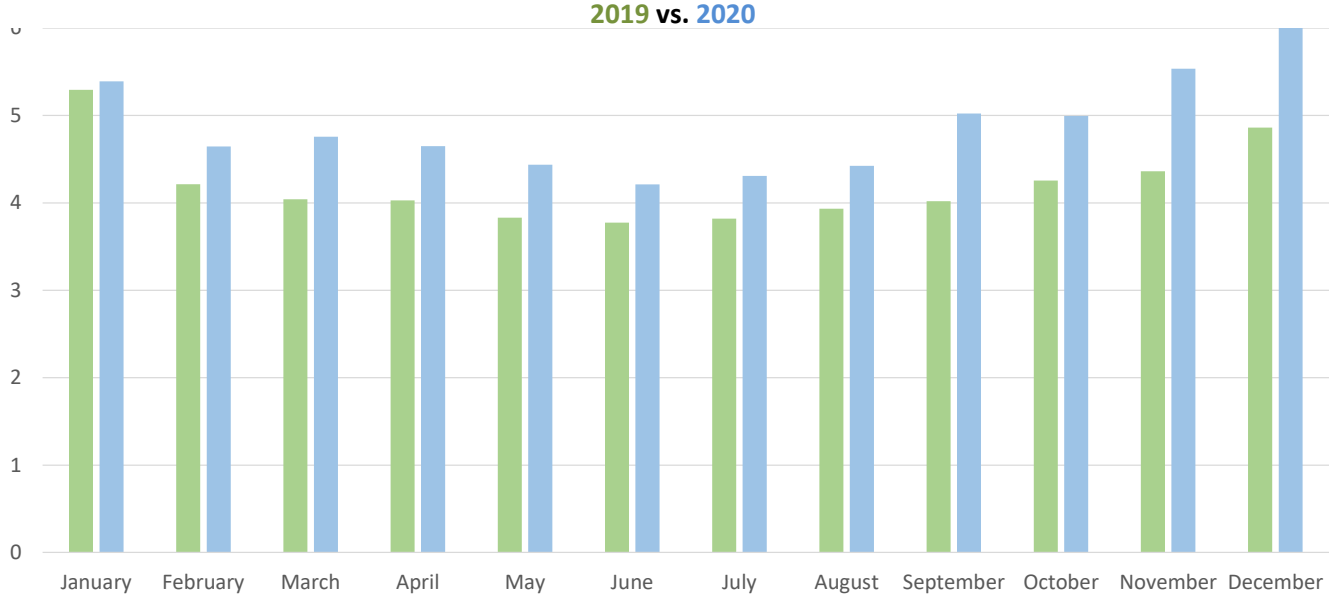
Exhibit 1 compares the initial access of care for Accident Year 2020 monthly injuries with those that emerged in comparable months for 2019. All differences are statistically significant except March. The impact of medical facilities shutting down in April 2020 combined with fear of infection, produced an increase of nearly a day in the average TTT for 2020 above 2019. That increase declined, but the longer delay remained for the second and third quarters of 2020, compared with 2019. However, the mean TTT for October 2020 injuries is less than for October 2019 injuries. While very preliminary, this suggests pandemic-based postponements beginning in April and May of 2020 diminished by the fourth quarter of 2020. From a prospective view, it is too soon to assess the impact on access to care from the infection surges of November and

[5] We use the term "surgery" to refer to a major procedure, such as an arthroscopy or disc excision, that identifies a definitive step in the treatment of the injury. A procedure to remove sutures, for example, is not regarded as a "surgery," even though technically it may be classified as a "surgical" procedure.

December 2020, mainly due to MDC data transactions reported to NCCI for the fourth quarter still being preliminary. Therefore, Exhibit 1 does not show values after October 2020.

Exhibit 2 plots the average, or mean, time to treatment by service month for 2019 and 2020 and provides a retrospective look at TTT over all services:[6]

Exhibit 2: Mean Number of Days From DOI to First Treatment by Service Month
2019 vs. 2020



The average number of days to initial encounter of any kind were significantly higher in 2020 than in 2019 for every service month except January, but at most only by about a day. With the response to the pandemic, the differences generally increased throughout 2020, with them all becoming statistically significant (except for January). Even after June 2020, when medical facilities had largely reopened, the longer times to seek treatment in Exhibit 2 suggest that people remained hesitant to use them through the end of 2020, perhaps for fear of being exposed to COVID-19. The smaller differences in the summer are consistent with patient behavior responding to a lower infection rate—lower rates are typical of respiratory seasonal viruses in warmer temperatures and more sunlight.[7]

The seasonality pattern of 2020 in Exhibit 2 appears exaggerated compared with 2019. That the largest differences occur in November and December, in concert with the post-holiday surge in COVID-19 cases, is consistent with such risk avoidance behavior. While not shown, the mean times by month of service for 2017 and 2018 are very close to those for 2019 and differ similarly from 2020. Some large urban hospital ERs were very hard hit in late 2020, when the overall average delay for 2020 over 2019 grew a fraction more than a day in December.

For the 2020 to 2019 comparisons to be meaningful, it is necessary to control the time window being studied. When more than 90 days elapse before the first medical encounter, the relationship between injury and treatment becomes tenuous as a measure of access to care. Accordingly, only injuries seen within 90 days after the date of injury are included in the mean TTTs of Exhibits 1 and 2. Limiting the service time window to 90 days yields smaller TTT amounts; however, it makes those amounts more compatible between the two years.

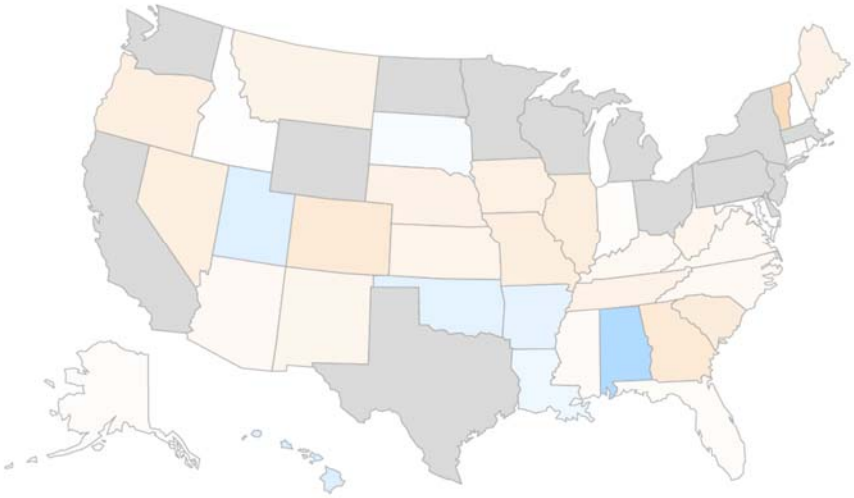
[6] Injuries in which more than 90 days elapse prior to any medical encounter are excluded. In such instances, the connection becomes too tenuous between the injury event and the care to provide a useful observation for measuring access to care. For example, a cumulative trauma injury in which the activity began years before the worker sought treatment.

[7] See, for example, "The role of seasonality in the spread of COVID-19 pandemic" by Xiaoyue Liu, Jianping Huang, Changyu Li, Yingjie Zhao, Danfeng Wang, Zhongwei Huang, and Kehu Yang; Elsevier Inc. 2021, available online at: www.ncbi.nlm.nih.gov/pmc/articles/PMC7892320.

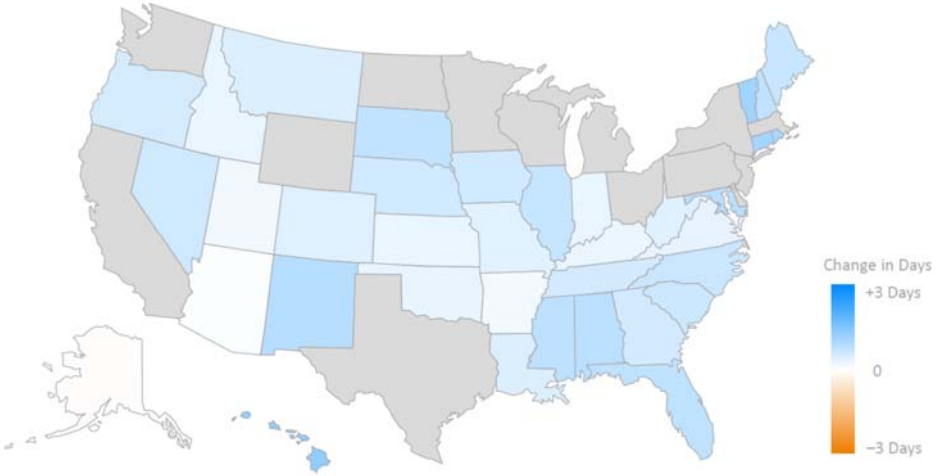
Exhibit 3 illustrates how the impact of the pandemic on access to medical care varied by state, both in intensity and timing. It uses 2019 as a benchmark for measuring the impact in 2020. Four maps plot changes by state and accident quarter in the mean TTT of initial care from 2019 to 2020.

- The first quarter shows a pattern of small changes in number of days from injury to first treatment across states with a mixture of both upward (in blue) and downward (in orange)
- The second quarter pattern is consistently upward with nearly all the states staying or turning blue
- The third and fourth quarter maps show more varied changes by state, with longer TTT differences for some states (shifting to a darker blue) together with reductions in TTT in other states (shifting to lighter blue or orange)

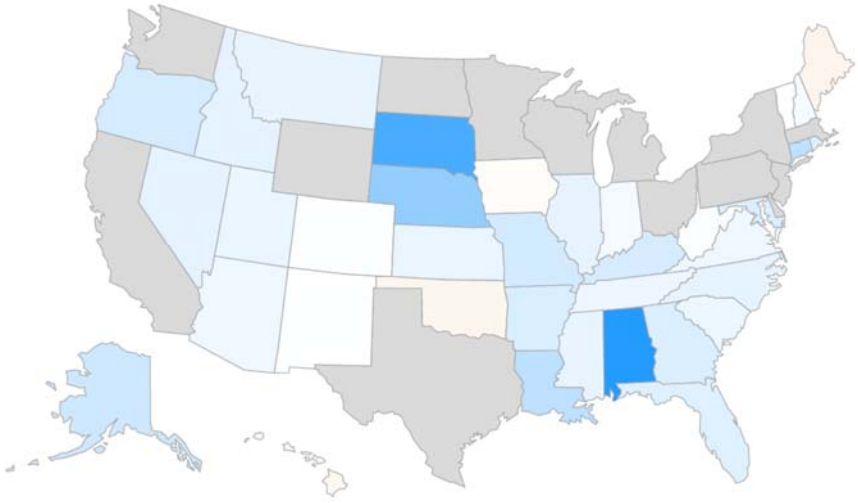
Exhibit 3: Changes in the Mean Number of Days From Injury to First Treatment Quarterly Comparison by State: 2020 Minus 2019



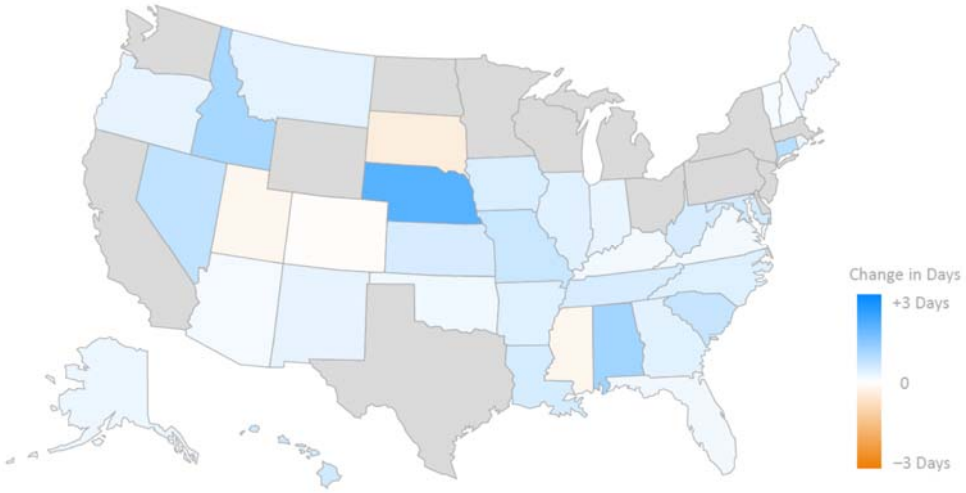
First Quarter Changes: 2019 to 2020



Second Quarter Changes: 2019 to 2020



Third Quarter Changes: 2019 to 2020



Fourth Quarter Changes: 2019 to 2020

Using 2019 as a pre-pandemic baseline, Exhibit 3 shows consistent, yet very modest, increases in TTT among the states during the first half of 2020, followed by more varied changes among states in the second half of 2020.

Access to Care: New Modalities[8]

It is too soon to predict the longer-term impacts of the pandemic on access to care as measured by the TTT. Many believe that a greater use of telemedicine and virtual consultations will result in a permanent change in how injured workers receive medical care.

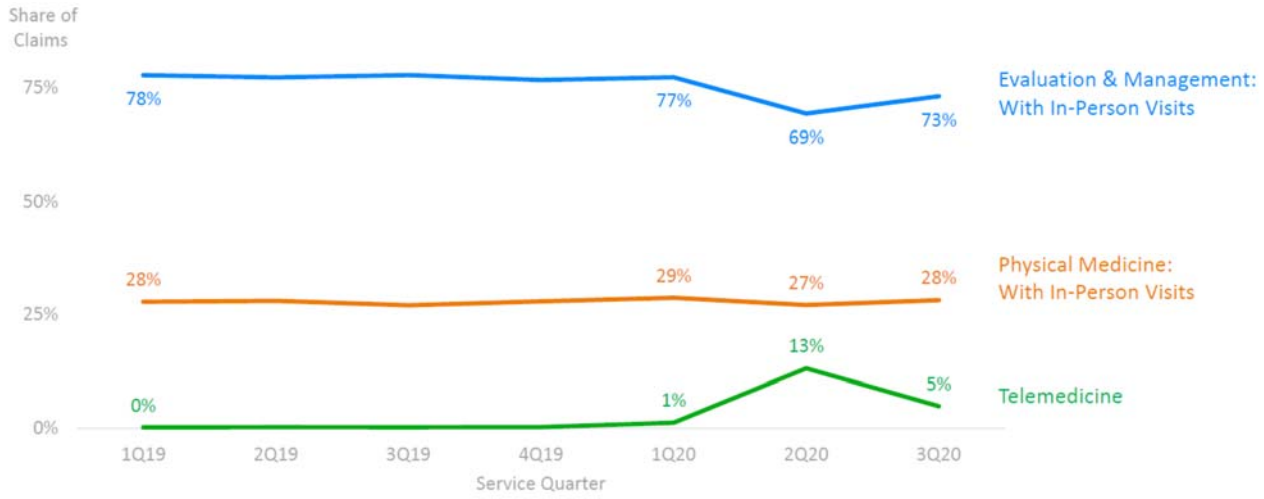
Exhibit 4 again uses 2019 to benchmark changes in 2020. It plots movement in three metrics related to virtual medical care:

- The share of claims with in-person evaluation and management (E&M) visits
- The share of claims with in-person physical therapy (PT) visits
- The share of claims with a telemedicine encounter

The most dramatic change is the increase in use of telemedicine in the second quarter of 2020. That change is directly attributable to the pandemic and perhaps also to insurance companies following Medicare's lead and beginning to reimburse physicians for treating patients in a virtual environment. The use of telemedicine fell in the third quarter of 2020, and the long-term impact of the pandemic on its use remains unclear.

- In-person visits continue to dominate, both for E&M and PT
- There was little movement in the share of claims with only in-person PT visits; there was only a small drop in the second quarter of 2020
- In the second quarter of 2020, concurrent with the greater use of telemedicine, E&M saw a drop in the share of claims with only in-person E&M visits, declining below 70% from a pre-pandemic average of 77%
- The E&M share saw a partial rebound in the third quarter

Exhibit 4: Telemedicine Grew Dramatically



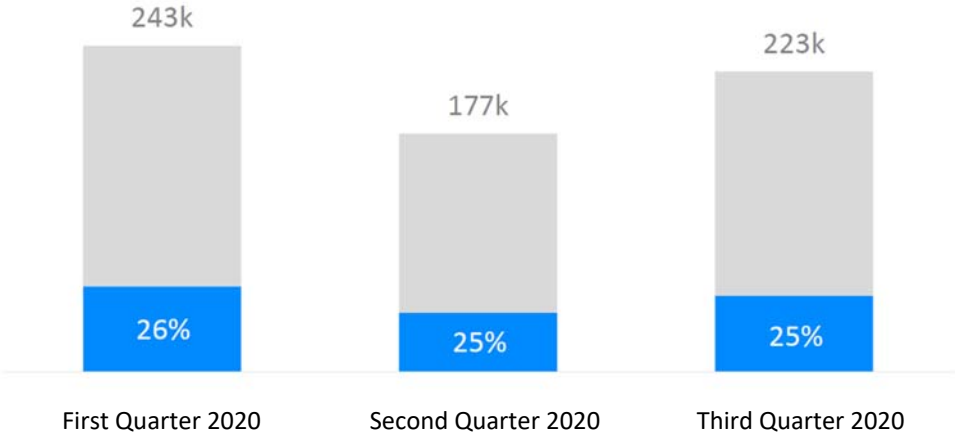
E&M and Physical Medicine: share of all active claims with at least one in-person visit
Telemedicine: share of all active claims with at least one E&M telehealth or one Physical Medicine telehealth session
Source: NCCI Medical Data Call for the following states: AK, AL, AR, AZ, CO, CT, DC, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, NE, NH, NJ, NM, NV, OK, OR, RI, SC, SD, TN, UT, VA, VT, WI, and WV

[8] For additional information on the topics discussed in this section, please see the article "COVID-19's Impact on Medical Treatment in Workers Compensation—A Third Quarter 2020 Perspective" by David Colón and Raji Chadarevian; available on ncci.com.

Exhibits 5 and 6 indicate little change in the share of WC cases treated in the ER or in the composition of ER visits. This may be surprising given a general concern that the pandemic would impact access to care and make many reticent to use medical facilities, particularly the ER. As such, one might expect a significant change in the use of the ER for WC claims. For example, a greater use of self-treatment may be expected to lower the share of less complex cases, shifting the composition of ER visits toward more serious cases. Exhibits 5 and 6 show, however, that at least for WC injuries, such concerns may be overstated.

Exhibit 5 highlights the overall share of WC injuries being treated in an ER. It plots the volume of new claims in the first nine months of 2020 and the share having an ER visit. Despite the pandemic resulting in a decline of more than 25%[9] in newly active claim volume from the first to second quarter, the share with an ER visit remained about 25%. And even in the third quarter, when the volume of cases increased by more than 25%,[10] the ER share held steady at 25%.

Exhibit 5: Share of 2020 Newly Active Claims With an ER Visit

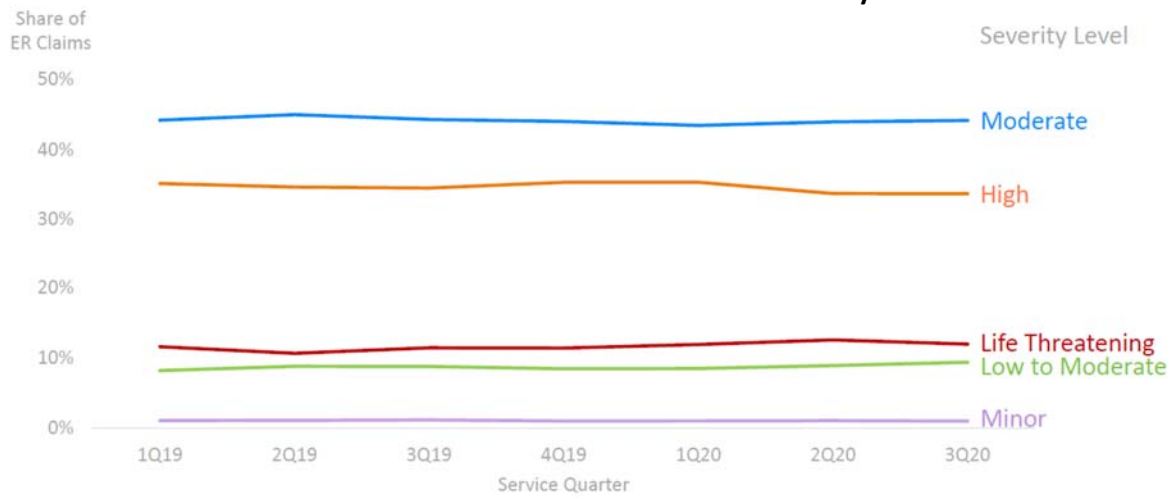


Share represents ER visits as the first encounter
Newly active claims with at least one medical transaction in the same quarter the injury occurred
Source: NCCI Medical Data Call for the following states: AK, AL, AR, AZ, CO, CT, DC, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, NE, NH, NJ, NM, NV, OK, OR, RI, SC, SD, TN, UT, VA, VT, WI, and WV

[9] 177k / 243k = 0.73.
[10] 223k / 177k = 1.26.

Exhibit 6 examines whether there has been a recent shift of ER visits toward more serious cases. ER visits are coded by complexity.[11] The chart plots quarterly shares from 2019 to 2020 for five levels of ER visits based on their severity level. While second quarter of 2020 witnessed a small increase in the share of life-threatening cases, it also saw a small decrease in the share of high-complexity visit cases. The five levels of severity shares each remain quite steady from the pre-pandemic base year 2019 to year 2020. Therefore, there is no convincing evidence that the pandemic shifted the seriousness mix of the cases being treated in the ER.

Exhibit 6: ER Claim Mix Remains Steady



New claims with ER visits based on Procedure Codes 99281–99285

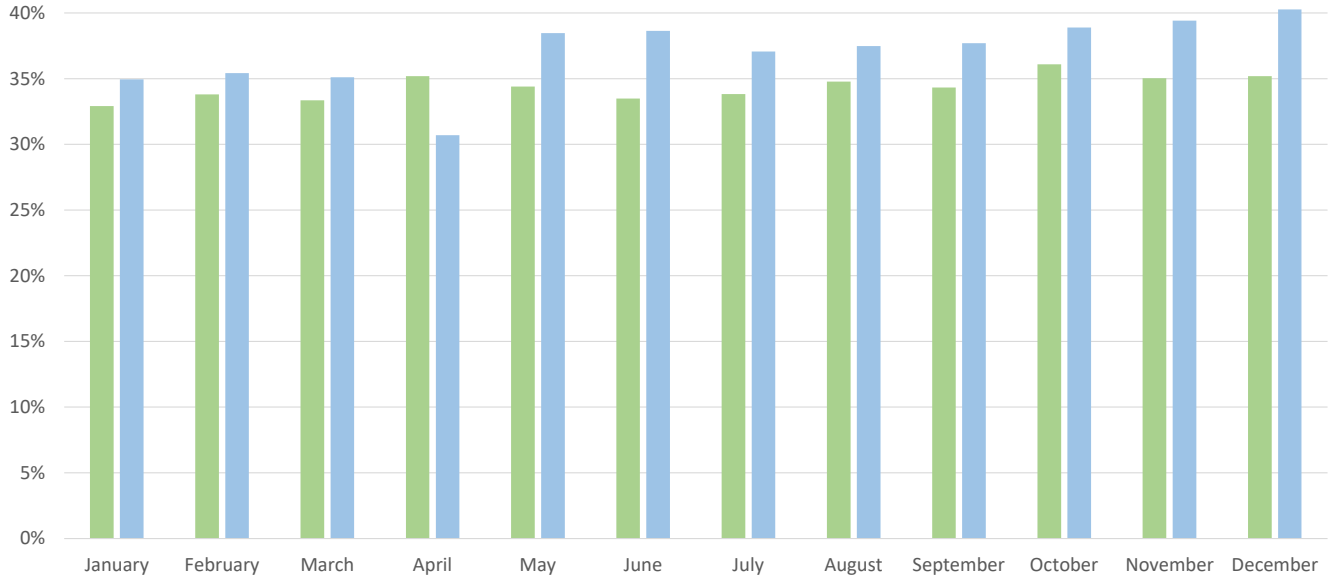
While the share of cases treated in the ER has remained steady throughout the pandemic (Exhibit 5), there has been an increase in the use of ambulatory surgical centers (ASCs). That increase is consistent with a potential reticence to have surgery in a hospital. Injured workers needing surgery may regard ASCs as a safer choice, as ASCs do not treat infectious disease cases.

[11] Current Procedural Terminology (CPT) is a standard coding scheme in medical billing to identify specific procedures. CPT is a registered trademark of the American Medical Association. CPT Procedure Codes 99281–99285 indicate increasing complexity of care for an ER visit.

Exhibit 7 shows the monthly share of surgeries performed in ASCs for 2019 and 2020.

- The 2019 shares show an increase of about 2%, spread out in small up and down movements over the 12 months, starting at 33% and ending at 35%
- However, the pattern for Accident Year 2020 is quite different:
  - Although it begins at 35%, near where 2019 left off, there is a distinct drop in April 2020
  - The drop in April is due both to the suspension of nonurgent surgical procedures of the sort performed in an ASC and to the shift of ASC medical personnel to hospitals to treat COVID-19 cases
  - After April 2020, the ASC shares increased above 35% and all are higher than for the same month in 2019 by statistically meaningful amounts

Exhibit 7: Share of Surgeries Performed in ASCs by Month of Surgery
2019 vs. 2020



Time to First Surgery for All Injuries

When observing changes in time to first surgery, we plot the number of surgeries for Service Years 2019 and 2020. We organized Exhibit 8a by the month of the surgery to provide a retrospective look at surgery volume. Unlike initial treatment of any kind, which measures access to care and typically happens within a few days of the injury, surgeries often occur many months later. Processing surgery billings also can take additional time, as well as the time to report and capture data in the MDC.

Because the active claim volume declined in 2020, the volume of surgeries performed in the second half of 2020 is likely understated when compared with 2019. Accordingly, Exhibit 8a shows only the first nine months of the two years. The chart shows that April 2020 is a transition month when many surgeries were suspended; the number of surgeries performed on WC injuries were reduced by more than half when compared to 2019. The drop in volume was both sudden and short-lived. By June 2020, the number of surgeries had rebounded to the 2019 level and is near the volume for January and February of 2020.[12] The number of surgeries then declined for a few months after June 2020. Much of that rebound around June 2020 can be attributed to clearing a backlog from the suspension of surgeries in April 2020.

Exhibit 8a: All Injuries Combined
Number of Injuries With Surgery by Month of Surgery
2019 vs. 2020

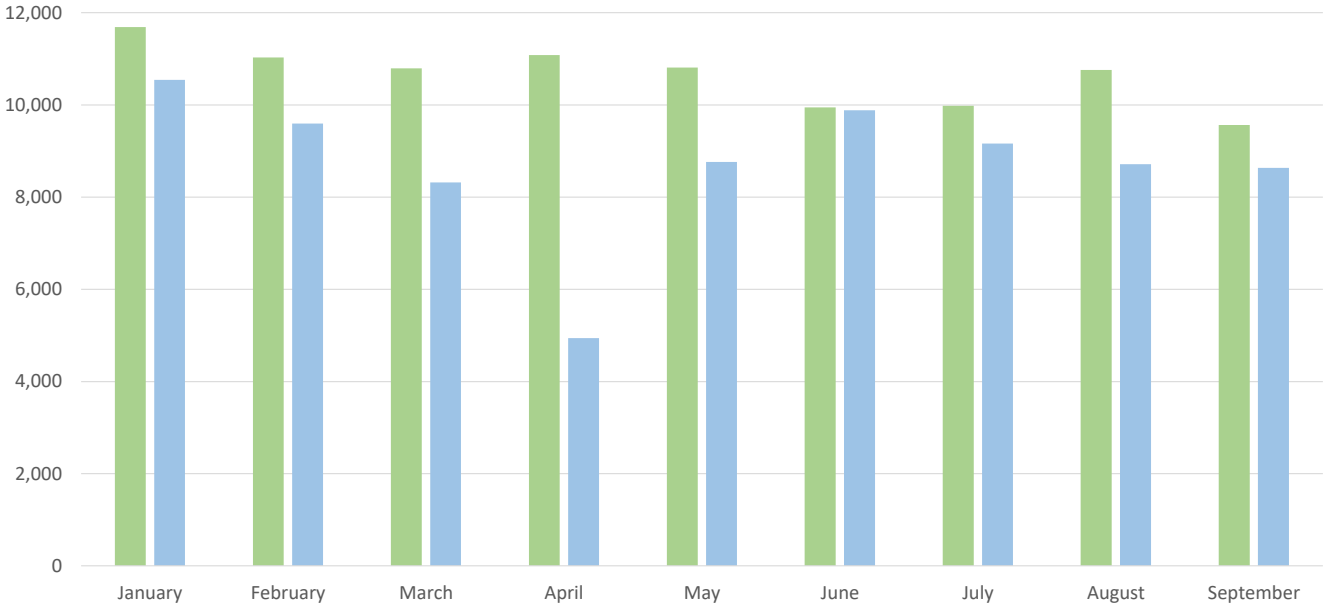


Exhibit 8a shows a considerable drop in the volume of surgeries in 2020.

While the pandemic dramatically reduced the number of surgeries around April 2020, we are interested in measuring time to treatment. While there is concern for the potential harm to injured workers from treatment delays, those concerns are heightened when dealing with postponed surgeries.

[12] Injuries in which more than 450 days elapsed prior to the initial surgery are excluded because the connection between the injury event and the surgery becomes too tenuous.

Exhibit 8b compares the distributions of days to initial surgery between 2019 and 2020 grouped by the surgery month.

- The bars plot the interquartile range (25th to 75th percentile) and markers show the mean and median of the two distributions
- The positioning of the mean and median can reveal a lot of information about the shape of a distribution
- For time to treatment distributions, the mean is typically greater than the median because the mean is more sensitive to outliers
- A longer interquartile range typically suggests that amounts are more dispersed

The retrospective Exhibit 8b shows that the days to initial surgery were similar between the first quarters of 2019 and 2020. However, they were significantly longer after April 2020 compared with the same time frame in 2019. The 75th percentiles show a very similar pattern to the means.

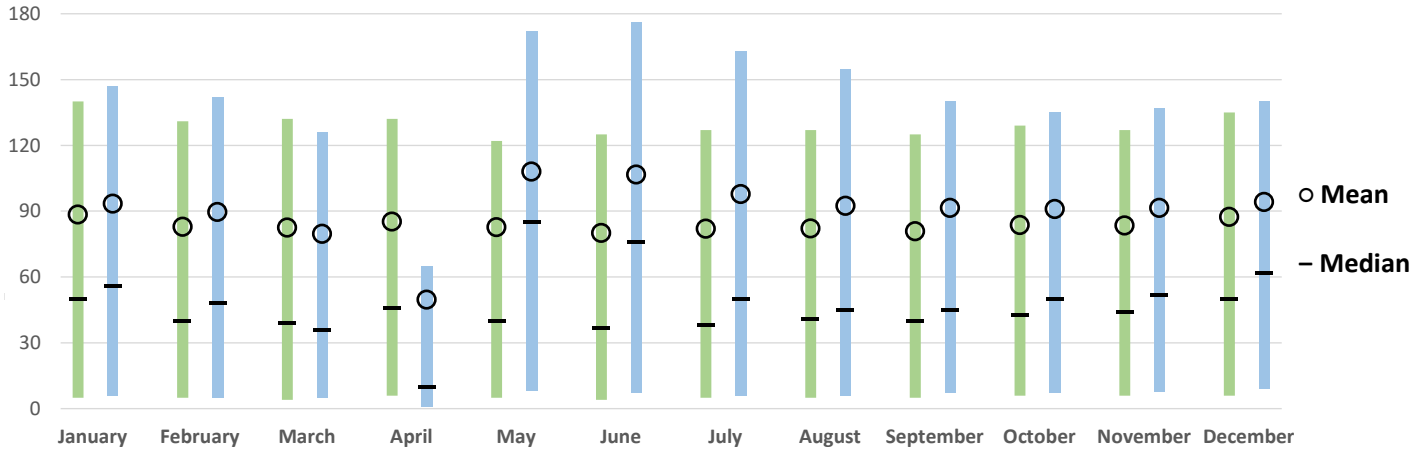
The shorter time to surgery for the transitional April 2020 time period is primarily due to the rescheduling of surgeries for injuries from prior months. This removed many of the longer observations from April 2020, dramatically lowering the April 2020 median. Those surgeries were shifted into subsequent months in 2020, which in turn increased their mean, median, and 75th percentiles. For computing time to surgery, the retrospective perspective is distorted due to the decline in 2020 claim volume, and this inflates the average time to surgery for service months in 2020 compared with 2019.

While rescheduling appears to be the main reason for the lower April 2020 figures, the restrictions on performing surgeries also triggered a triage effect:

- Surgeries in April 2020 focused on the more time-critical cases and such restrictions may have incentivized, deeming some cases as urgent, as they may be the only cases eligible for the operating room schedule
- The proportion of same-day surgeries in April 2020 is higher than in any other month of both 2019 and 2020
- After July, the longer average times to surgery in 2020 over 2019 shown in Exhibit 8b stabilized, shrinking to around two weeks

Even after June 2020, with medical facilities largely reopened, Exhibit 8b shows a longer time to surgery in 2020 than in 2019. Combining this longer time with the June 2020 rebound in the volume of surgeries (Exhibit 8a), we presume that longer time to surgery after the summer of 2020 is more likely due to risk averse behavior than access to care. Because some surgeries performed at the end of 2020 may still be reported, it remains to be seen what ultimately happens with time to surgery in Fourth Quarter 2020, especially given the concurrent post-holiday surge in US COVID-19 cases.

Exhibit 8b: All Injuries Combined
Mean and Quartiles* of Days to Surgery by Month of Surgery
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery and vary more for 2020.

Exhibit 9:

- Is organized by month of injury
- Plots the mean and quartiles for Accident Years 2019 and 2020
- Provides a prospective perspective for time from injury to an initial surgery

The prospective perspective constrains the time frame for which meaningful comparisons can be determined: a longer time window from injury to surgery provides a more meaningful comparison. Our decision on what time frame to use balances the need for allowing for the longer time frames associated with surgery and the need for timely reporting.

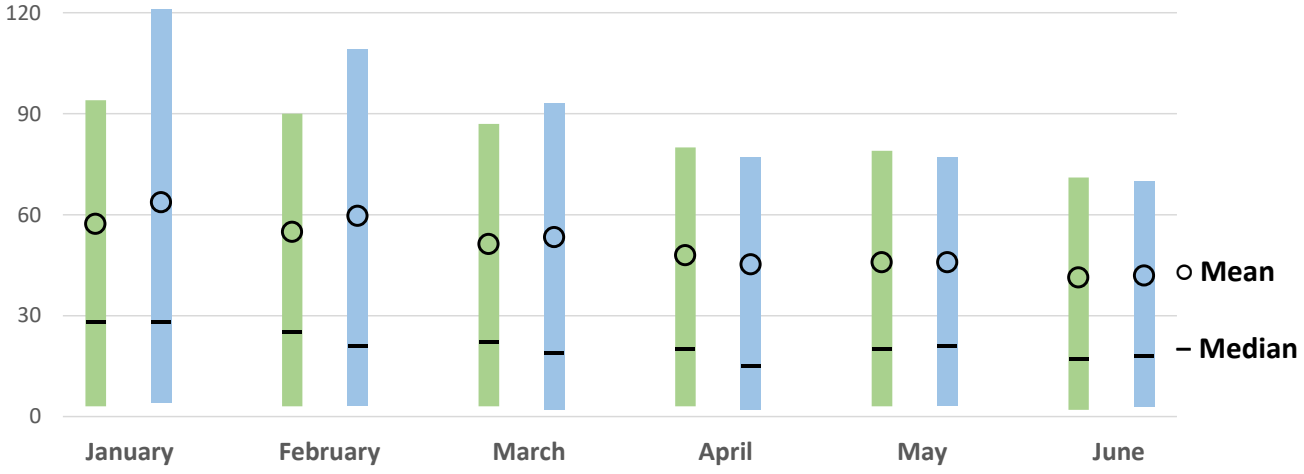
Considering claims that have naturally long times to surgery, Exhibit 9 does not show values after June of 2020. We expect the monthly report time windows to capture 95% of the surgeries on January 2020 injuries and more than 75% for June 2020 injuries. However, even a small share of later reported surgeries with longer TTT amounts can significantly increase the average TTT for each of the first six months of 2020. Surgeries for some injuries occurring from January through March of 2020 would not be performed until well after the pandemic hit; and some more complicated injuries that will ultimately require surgery may still not have had it, much less have it reported within the time window.

While two events simply occurring at the same time do not imply a causal relationship, they can be evidence of some association. Significantly longer average times to surgery from January through March 2020 are associated with the reaction to the pandemic. The mean differences between 2019 and 2020 are not significant for May and June injuries, and the median and 75th percentile differences are small and in opposite directions.

Regarding the timing of surgery on 2020 injuries, Exhibit 9 suggests that the pandemic's impact was mostly limited to injuries occurring in the first quarter.

- The mean and 75th percentile are higher in 1Q 2020 than in 1Q 2019, while the median is the same or lower. This means that there is a shift in the distribution toward more variation
  - Compared with 2019, the lower median in 2020 indicates movement toward lower times to surgery for a large share of injuries
  - On the other hand, the higher 75th percentile in 2020 also shows movement toward longer times to surgery
- For the second quarter, the prospective view for the monthly report time window is shorter and shows less variation in the distribution between 2019 and 2020

Exhibit 9: All Injuries Combined
Mean and Quartiles* of Days From Injury to Surgery by Month of Injury
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery. For each month of injury, the same report cutoff month and day is applied for both 2019 and 2020. For example, the January cutoff is January 12 of the following year while the June cutoff is March 3 of the following year.

Path to Surgery

For some injuries, recovery without surgery is impossible. But few would disagree that full recovery without surgery is often better than with surgery or contend that reducing unnecessary surgeries is not desirable. Another common perception—one driving the concern about pandemic-based delays—is that regarding medical care, "sooner is better."

It is a truism that delaying doing something typically makes it more likely that it does not get done. But delay is not the same as procrastination. In the case of surgery, delay may be associated with pursuing alternative or more readily available treatments, such as physical therapy, that often prove successful. So, for some injuries, it is not surprising that conservative treatment may be associated with lower surgery rates.

One such injury is lumbosacral disc herniation. For this injury, as with many common WC injuries, surgery may be postponed to allow for natural healing or to address common medical conditions, such as:

- Hypertension
- Diabetes
- Smoking
- Obesity

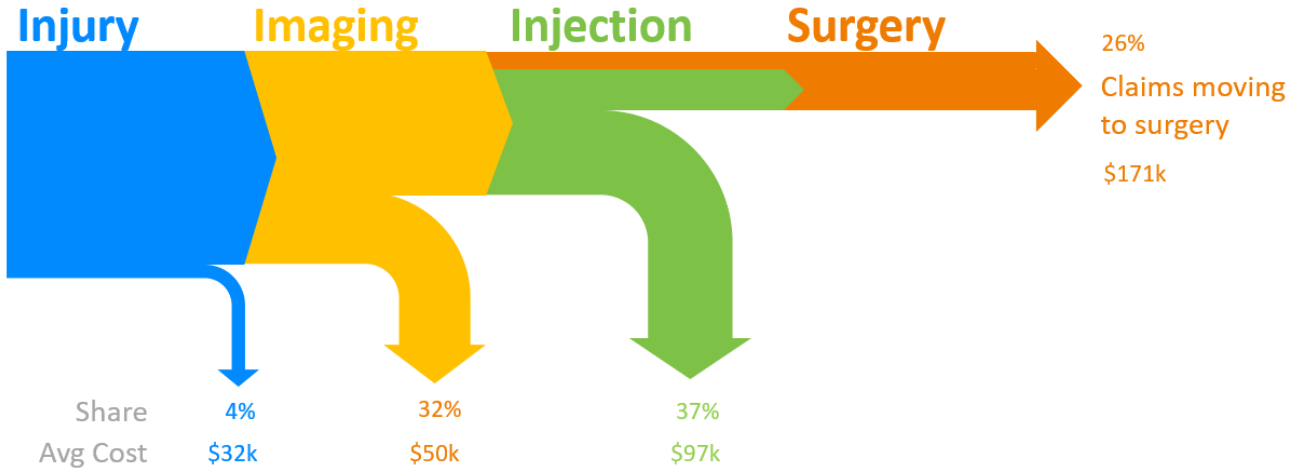
We include the cessation of smoking because smoking can retard bone growth (very important for lumbar fusion surgery).

Most lumbar disc herniation injuries resolve without surgery, as shown in Exhibit 10. This exhibit depicts the progression of three treatment steps:

- From a preliminary diagnosis to diagnostic imaging
- Then potentially to steroidal injection
- And eventually to excision surgery

Exhibit 10 also shows the percentage of injuries that drop out at each step and how the average cost per case for that subset of injured workers increases with each step. We did not track the resolution or outcomes for any drop-out claims beyond their final stage of progression depicted in Exhibit 10.

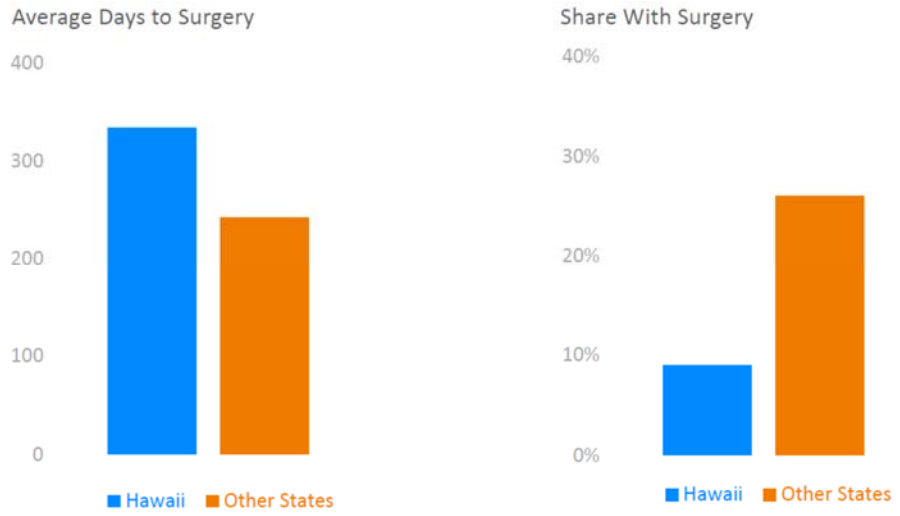
Exhibit 10: Over 70% of Lumbar Disc Herniation Injuries Did Not Receive Surgery



Claims with a surgical procedure but no MRI were excluded from this analysis
Not represented here are 1% of claims that only receive an injection and no imaging or surgical services
Average reported incurred indemnity + medical cost; latest report for Accident Years 2016–2018
Source: NCCI Medical Data Call; NCCI ***Statistical Plan*** data for all states where NCCI provides ratemaking services, except Texas

Comparing the treatment of lumbar disc herniation injuries in Hawaii with the other states in the study, as illustrated in the two bar charts in Exhibit 11, reveals significant differences in the time to surgery and in the share of injuries requiring surgery.

Exhibit 11: Lumbar Disc Herniation Injuries in Hawaii Compared to Other States



Both differences are statistically significant at 1%
Accident Years 2016–2018
Source: NCCI Medical Data Call for all states where NCCI provides ratemaking services, except Texas

The differences in days to surgery in Exhibit 11 can largely be explained by Hawaii's greater use of physical therapy as an alternative to surgery.[13] Hawaii is not the only state with comparatively low surgery rates, and PT is not the only alternative treatment (other treatments could include injections).

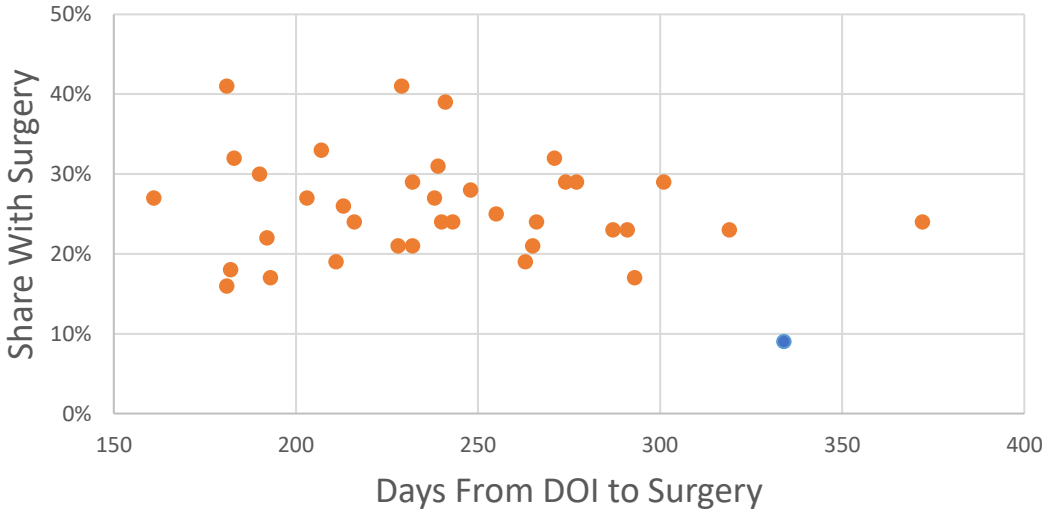
[13] For Accident Year 2019, Hawaii had the highest shares of lumbar disc herniation and low back pain injuries treated with acupuncture. In January 2020, the CMS approved the use of acupuncture for chronic low back pain, see www.cms.gov/newsroom/press-releases/cms-finalizes-decision-cover-acupuncture-chronic-low-back-pain-medicare-beneficiaries.

Exhibit 12:

- Plots relationships between states for the mean days to surgery and the share of injuries with surgery
- Plots each point to represent a state

In contrast to Hawaii at the lower right (lowest surgery share and second highest mean days to surgery), three other states at the lower left also have a comparatively low surgery share—less than 20%—but are coupled with comparatively low average days to surgery—under 200 days.

Exhibit 12: Lumbar Disc Herniation Injuries
State Share of Injuries With Surgery vs. Days From Date of Injury to Surgery



Accident Years 2016–2018
Source: NCCI Medical Data Call for all states where NCCI provides ratemaking services, except Texas

So, there are significant examples, such as with the case with Hawaii, that run counter to the "sooner is better" mantra, emphasizing the need for individualized care. When looking at delays in medical care, there are no "one-size-fits-all" answers, and "the right treatment at the right time for the best outcome for the injured worker" summarizes the situation best.

MRI to Surgery for Specific Injuries

We now explore specific injuries to evaluate the impact of postponing surgeries. We examine two knee injuries, a back injury, and a shoulder injury. We focus on the timing of care leading to surgery and compare monthly averages in TTT between Accident Years 2019 and 2020. Comparing the two years corresponds to a prospective view.

We do not show any retrospective exhibits for these four injuries, because:

- The volume of observations by month is not very credible relative to the first treatment of any kind
- As explained already, measuring times from injury to surgery by service month is distorted by greater contributions from older Accident Years

By using the prospective view, as was done in Exhibit 9, January shows a longer time to surgery than more recent months for either year studied, because the data cutoff date includes only transactions billed just beyond year-end 2020 (and year-end 2019, respectively). Comparisons between Accident Years 2020 and 2019 are only meaningful within a particular month, and not across months, because the time horizon from date of injury to surgery varies by month.

For all surgeries, the median and 75th percentiles in Exhibits 8b and 9 are disproportional between 2019 and 2020. The pandemic did not simply shift treatment times by a constant factor; rather, it changed the shape of the distribution. For the four injuries, we graph the mean and quartiles of the time to surgery and begin by discussing the cruciate ligament knee injury in the next section. Discussions of the other three injuries are similar and provided in the Appendix.

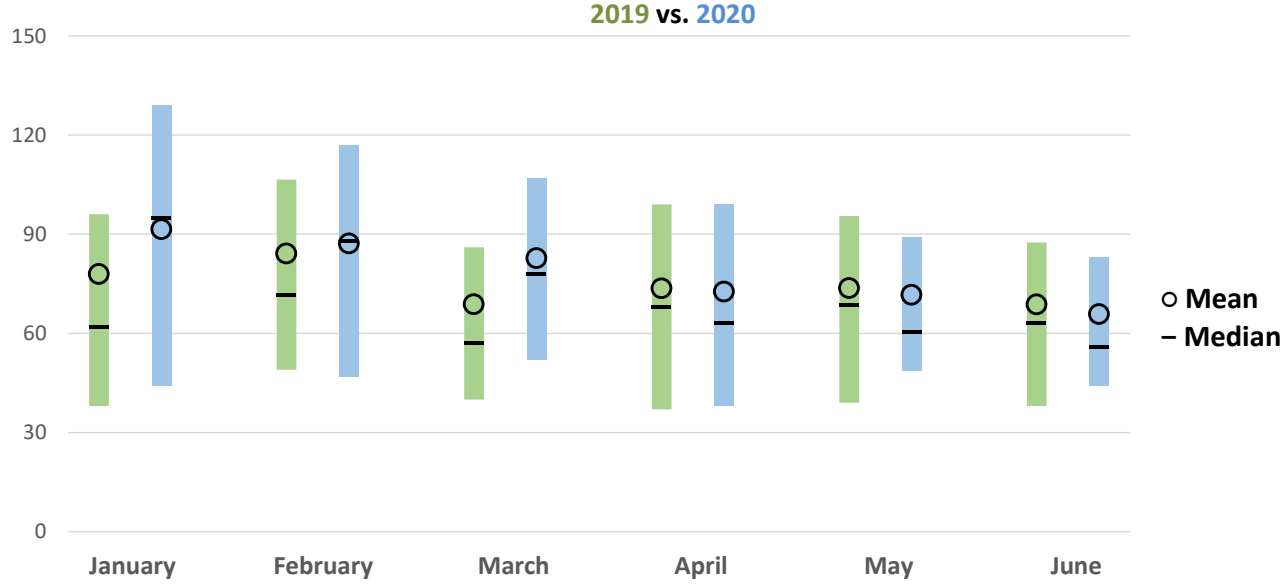
Knee: Cruciate Ligament Injury

Exhibit 13 shows the average days from injury to arthroscopy for cruciate knee ligament injuries (ACL and PCL).

- As with Exhibit 8b, medians and interquartile ranges are also shown.
- We grouped observations by month of injury, illustrating a prospective perspective comparing the first six months of the two years.
- The average pre-pandemic times for 2019 range between two and three months.
- It is common for a significant time to elapse before the payment for an arthroscopy is reported and flows into the MDC data. Consequently, an unknown share of injuries occurring in the second half of 2020 are not captured in the MDC extract used in this study, and June is the latest month of injury published.

Many injuries occurring in the first quarter of 2020 would not result in surgery until the second quarter, or later. For injuries occurring in January and March, mean differences are significantly greater in 2020 than in 2019, signifying longer times to surgery post-pandemic. Knee injuries occurring in the second quarter of 2020 saw their time to surgery return closer to pre-pandemic times.

Exhibit 13: Knee-Cruciate Ligament Injury
Mean and Quartiles* of Days From DOI to Surgery by Month of Injury
2019 vs. 2020



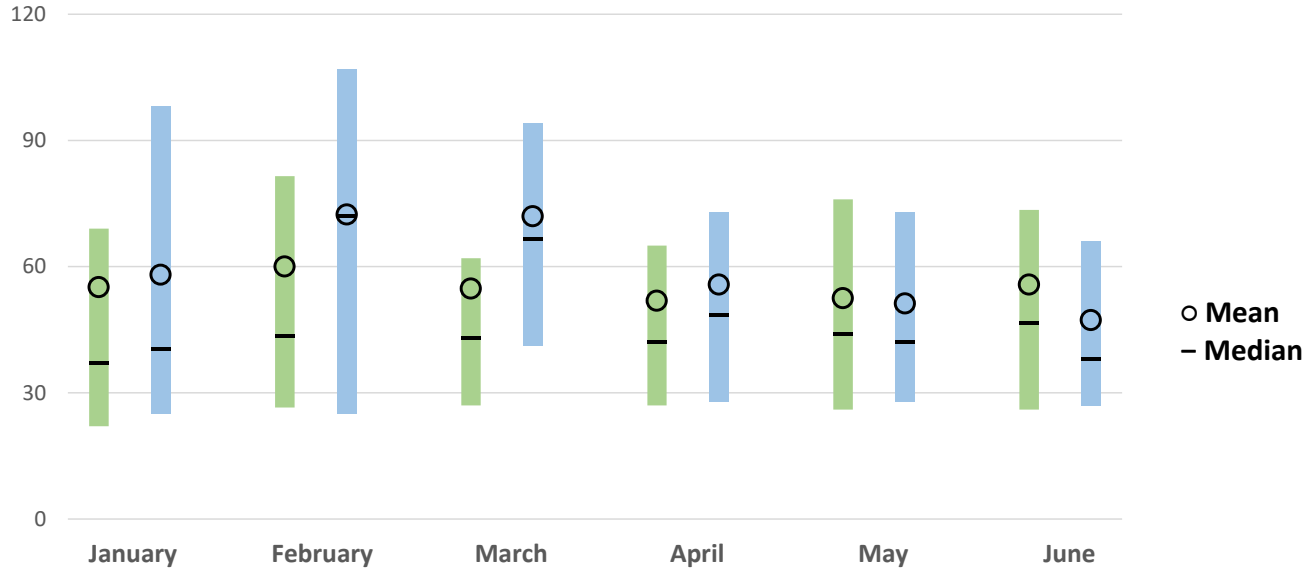
* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery.

An MRI is typically required to assess whether a knee injury requires surgery. For cruciate ligament injuries, we use the date of service of an MRI as a proxy for the date of scheduling an arthroscopy. To assess the impact of deferring nonurgent procedures in April and May of 2020, Exhibit 14 looks at the number of days from MRI to surgery. We grouped injuries by service month of the MRI over the first six months of 2019 and 2020.

Compared with 2019, the average times to schedule surgeries in 2020 are longer from January to April and are especially longer for February and March injuries. Since it typically takes several weeks to schedule, it is likely that many MRIs performed during February and March 2020 were for injuries that would normally be scheduled for surgery in April or May 2020, and subsequently rescheduled or postponed due to nonemergent procedures being suspended. This associates comparatively longer times from MRI to surgery for this WC injury specifically with the response to the pandemic.

The shorter average time for June 2020 suggests a return to pre-pandemic times from MRI to knee arthroscopy. While the evidence does reveal pandemic-driven delays, that impact seems confined to a few months in both duration and time frame.

Exhibit 14: Knee-Cruciate Ligament Injury
Mean and Quartiles* of Days From MRI to Surgery by Month of MRI
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time from MRI to surgery.

Much of what was seen comparing 2019 and 2020 for cruciate ligament injuries is also true of three other injuries that may involve nonurgent surgeries, which are shown in Appendix A. They include:

- Torn meniscus—another knee injury that may require surgery
- An intervertebral herniated lumbar disc injury—a back injury that may be treated with injections but may also need surgery
- A rotator cuff injury—a shoulder injury that is typically treated with physical therapy but may still require surgery

While the pandemic did result in delays of varying durations, for each injury that impact is confined to a few months, both in time frame and duration.

In addition to the four injuries, we also looked at the following, but they did not provide much insight into the impact of delays for the reason provided:

- Low back pain—the high proportion of cases that resolve largely on their own complicate identifying meaningful delays
- Ankle fractures—the high proportion of injuries treated on the day of injury, or very shortly thereafter, make postponements essentially a nonissue
- Carpal tunnel injuries—the assignment of date of injury makes it difficult to analyze the timing of care

Cost by Time Interval From Date of Injury to Surgery

For the four injuries, we relate the total incurred cost of a WC claim (both medical and lost time, including case reserves) to the time from injury to surgery. Based on our observations, there is a somewhat common pattern:

- Injuries treated on the day of injury are among the highest cost cases
- A time period follows—varying in length depending on the injury—when costs are comparatively indifferent to the time to surgery
- Eventually, costs begin to increase with the time to surgery

Each injury exhibits its own timing of the progression. For each we plot some descriptive statistics of indemnity and medical incurred claim costs combined based upon two mature Accident Years 2014 and 2015. We group injuries into 11 intervals of time from injury to surgery.

Same-day surgery is performed for the most serious injuries. Accordingly, the first bucket consists of injuries with surgery on the day of injury. This bucket includes only a small share of the injuries of the given type. The other 10 buckets have roughly the same number of injuries (about 10%) and fall into ranges of time to surgery.[14]

The cost amounts include the total incurred cost per case, including both medical and indemnity benefits, as well as case reserves. They are the latest matured costs for injuries from 2014–2015. As such, they show the relationship of cost with time to surgery based on pre-pandemic experience. While increasing time is generally associated with higher costs, each of the four injuries exhibits its own cost versus time to treatment pattern.

The widespread and strong effects of the pandemic make it difficult to isolate the pandemic's impact on costs and compromises relating its impact with historical, pre-pandemic, experience. That noted, when combined with the minimal disruption observed for pandemic-based delays, we infer that their cost impact is limited in both dollar amounts and time frame.

For the four injuries, we show the mean, median, and 75th percentile of the incurred cost per injury for 11 buckets of the time from injury to surgery. Again, we begin with the cruciate ligament knee injury discussed in the next section. Discussions of the other three injuries are quite similar and are found in Appendix B.

Knee: Cruciate Ligament Injury

For several ranges of days from injury to arthroscopy, Exhibit 15 plots the mean, median, and 75th percentile of the total incurred cost per case for cruciate ligament knee injuries (ACL and PCL).

- Both mean and median are much greater for injuries with surgery on the day of injury:
  - The median is about $110,000
  - The mean is almost $130,000
- When the surgery is performed over the subsequent four months from injury (i.e., when the surgery is performed from day 1 to day 120), the cost remains fairly constant:
  - The median fluctuates around $45,000
  - The mean around $60,000
  - 79% of injuries are performed from day 1 to day 120
- When the surgery is performed beyond four months from injury, the average cost per claim increases with a longer time to surgery:
  - But not close to amounts near the average for injuries with same-day surgeries
  - The median increases to more than $50,000
  - The mean increases to almost $80,000

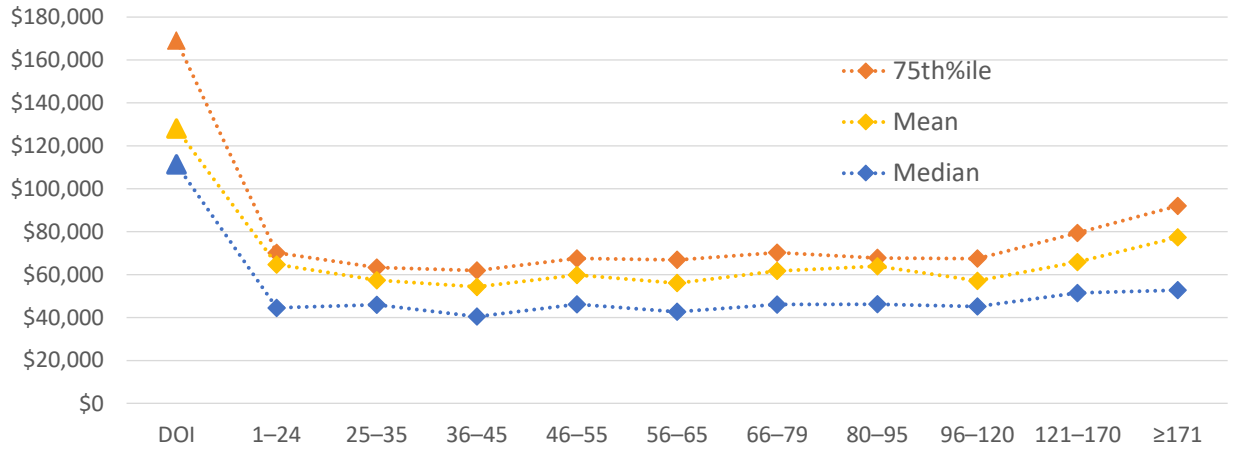
[14] Because the time for each injury is a whole number, the buckets do not contain exactly the same number of injuries.

Exhibit 15 shows an association between costs and time from injury to surgery. It does not imply a causal relationship.

The four-month period after the injury showing comparatively little change in average cost includes the time frame of about three months post injury during which, for many cases, surgery can be postponed with little additional medical harm. In fact, allowing for some natural healing of associated injuries prior to surgery could be beneficial to the outcome.[15]

Based on what we observed for pandemic-based delays to surgery for cruciate ligament injuries (Exhibits 13 and 14), the delays would largely fall within a time frame having a limited impact on expected costs.

Exhibit 15: Knee-Cruciate Ligament Injury
Median, Mean, and 75th Percentile of the Incurred Cost per Case*



* Reported incurred indemnity plus medical cost based upon latest report for Accident Years 2014–2015
Source: NCCI Medical Data Call; NCCI ***Statistical Plan*** data for all states where NCCI provides ratemaking services, except Texas

The difference between the median and the 75th percentile in Exhibit 15 suggests a considerable degree of dispersion in costs even within the time intervals. The association of costs with time to surgery for cruciate ligament knee injuries is far from deterministic: some of the highest cost injuries have some of the shortest times to surgery and some of the lowest cost injuries have some of the longest times. Having surgery performed sooner does not necessarily result in lower costs. The pattern in Exhibit 15 is more suggestive of trade-offs; for example, less/more healing time before surgery may lengthen/shorten the time to recuperate after surgery.

What we observed for cruciate ligament injury regarding a window when costs are less sensitive to delay is also observed for the three other injuries discussed in Appendix B. However, there are some significant timing differences among the four injuries. For example, time to surgery is noticeably greater for intervertebral herniated lumbar disc injuries than for the other three. And a higher share of those back injuries cost more, with higher costs associated with longer times from injury to back surgery.

[15] For practical information on ACL injuries, the Guy's and St Thomas' NHS Foundation Trust publishes a patient-oriented leaflet (number: 4413/VER2: www.guysandstthomas.nhs.uk/resources/patient-information/therapies/physiotherapy/acld-knee.pdf.

CONCLUSION

While we found clear evidence of small delays in access to care associated with the pandemic, we found no convincing evidence that either access to care or the quality of care was adversely impacted. For 2020, the impact on claim costs is uncertain.

As for other aspects of utilization, the pandemic's impact:

- Increased the use of telemedicine (Exhibit 4)
- Did not change the share and severity of ER visits (Exhibits 5 and 6)
- Decreased the use of ASCs in April 2020, which then reversed above pre-pandemic levels (Exhibit 7)

With respect to time to treatment, the pandemic's impact:

- Did not adversely impact access to care, as measured by the time from injury to initial treatment
- Is associated with just a one-day increase over 2019 in the average time from injury to initial care for all injuries combined (beginning April 2020) as shown in Exhibit 1:
  - NCCI states showed small increases in delays for the second quarter of 2020 relative to 2019, ranging from nearly zero to at most two days (Exhibit 3)
  - By the fourth quarter of 2020, NCCI states showed both increases and decreases in delays relative to 2019 (Exhibit 3)
- Produced a backlog of surgeries in April and May 2020 that diminished throughout the summer (Exhibit 8a)
- May have resulted in greater use of noninvasive treatments that, with comparable outcomes, are often preferred over invasive procedures

For four common WC injuries, we examined historical experience and related the total incurred cost per case with the time from injury to surgery. This revealed that the mean cost remains relatively insensitive to delays in care for several months after an injury.

Differences in the mean times from injury to surgery between 2020 and 2019 suggest that a large portion of postponements associated with the pandemic fall into these time periods when cost is relatively unaffected by the delay. After those time periods, costs are observed to increase, sometimes dramatically. The greatest cost increases occur for back and shoulder cases having long delays to surgery. Many such surgeries may not yet appear in the data or may have not yet occurred. Based on the evidence to date, however, we find that the cost impact of postponing care due to the pandemic, while still uncertain, is limited both in its time frame and in its impact on the expected cost per case.

ACKNOWLEDGMENTS

The authors acknowledge our consultant Dr. David Deitz, who provided us with his valuable medical expertise throughout the analysis. The authors also acknowledge the many contributions of the doctor members of NCCI's Medical Data Call Research Committee and thank them for their input.

APPENDIX

A: Time to Surgery for Specific Injuries

Knee: Meniscus Injury

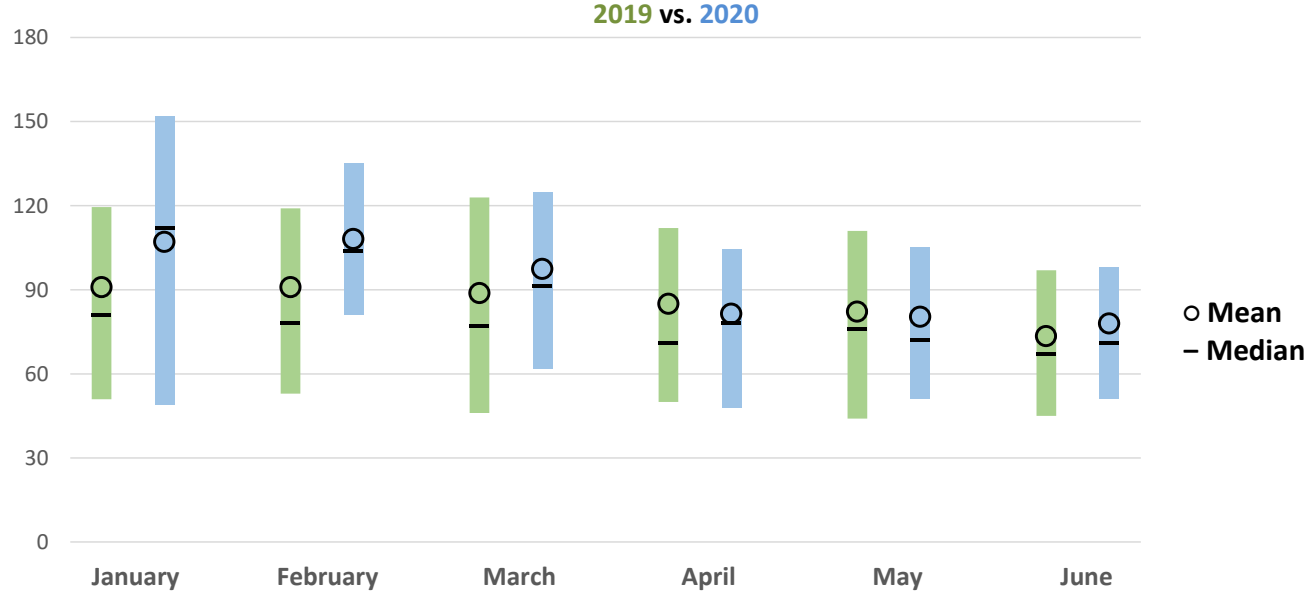
For another internal derangement knee injury, a meniscus injury, Exhibit A1:

- Plots the average days from injury to arthroscopy, together with the corresponding quartiles
- Groups claims by month of injury for the first six months of 2019 and 2020

For more than one-fourth of these injuries, based on 75th percentiles from the first quarter of pre-pandemic 2019, four or more months pass from injury to surgery. As such, a large share of meniscus injuries occurring in the first quarter of 2020 would typically not receive surgery until well into the second quarter or later.

- Exhibit A1 shows mean times from injury to surgery were significantly greater in 2020 than in 2019 for each of January, February, and March
- The results are comparable to cruciate ligament injuries, having longer times to surgery in 2020, as compared with 2019 injuries
- Mean times from injury to surgery were not significantly different in 2020 than in 2019 for each of April, May, and June, and return to pre-pandemic times as measured from injury to arthroscopy

Exhibit A1: Knee—Meniscus Injury
Mean and Quartiles* of Days From DOI to Surgery by Month of Injury
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery.

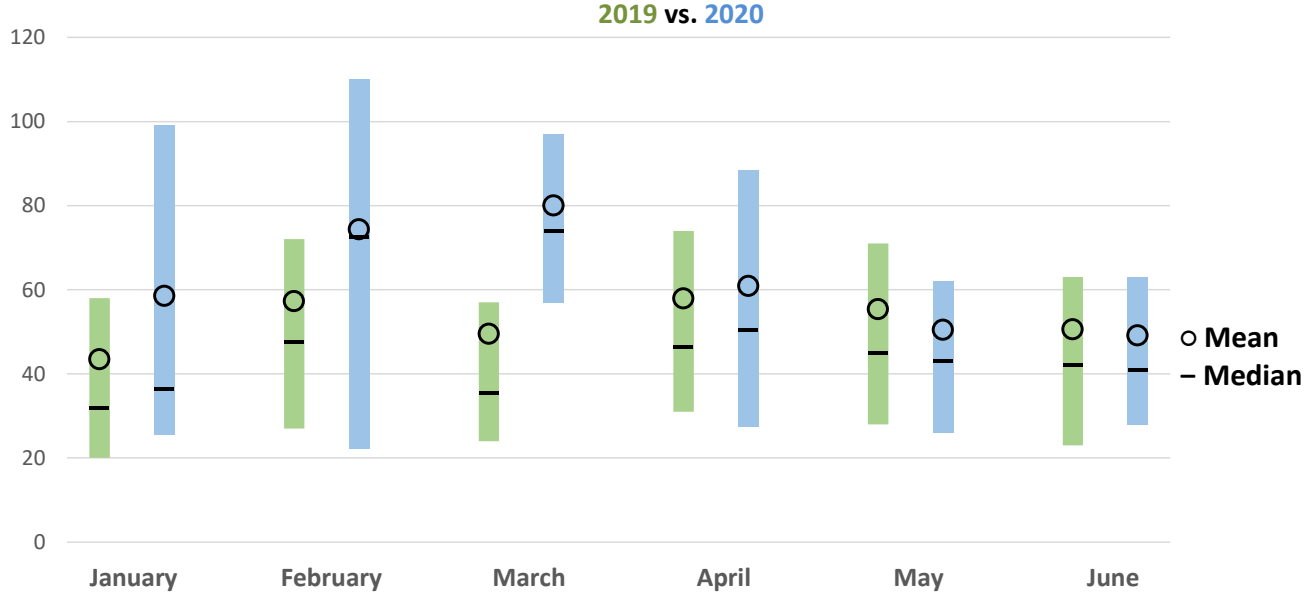
To assess the pandemic's impact of deferring nonurgent procedures, Exhibit A2 looks at the average number of days from MRI to surgery.

- The date of service of an MRI is used to proxy the date of scheduling an arthroscopy
- The chart looks at MRIs performed over the first six months of 2019 and 2020
- Injuries are grouped by the month of the first MRI

Compared with 2019, the average times to schedule surgeries for 2020 are significantly longer from January to March. This associates comparatively longer times to schedule surgery with the pandemic. For example, an MRI performed in January 2020 and surgery originally scheduled for April 2020 would likely have been rescheduled. Like cruciate ligament injuries (Exhibit 14), the shorter average time for June 2020 suggests a return to pre-pandemic times from MRI to knee arthroscopy.

The experience of meniscus injuries again shows that while the pandemic did result in delays, that impact is confined to a few months, both in duration and in time frame.

Exhibit A2: Knee—Meniscus Injury
Mean and Quartiles* of Days From MRI to Surgery by Month of MRI
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time from MRI to surgery.

Back: Lumbosacral Herniated Disc

Back injuries, especially complaints of low back pain, are among the most common WC injuries. They are also more challenging and take longer to diagnose and treat than many other WC injuries. Most low back pain injuries can resolve by themselves, while a relative few require invasive measures.[16]

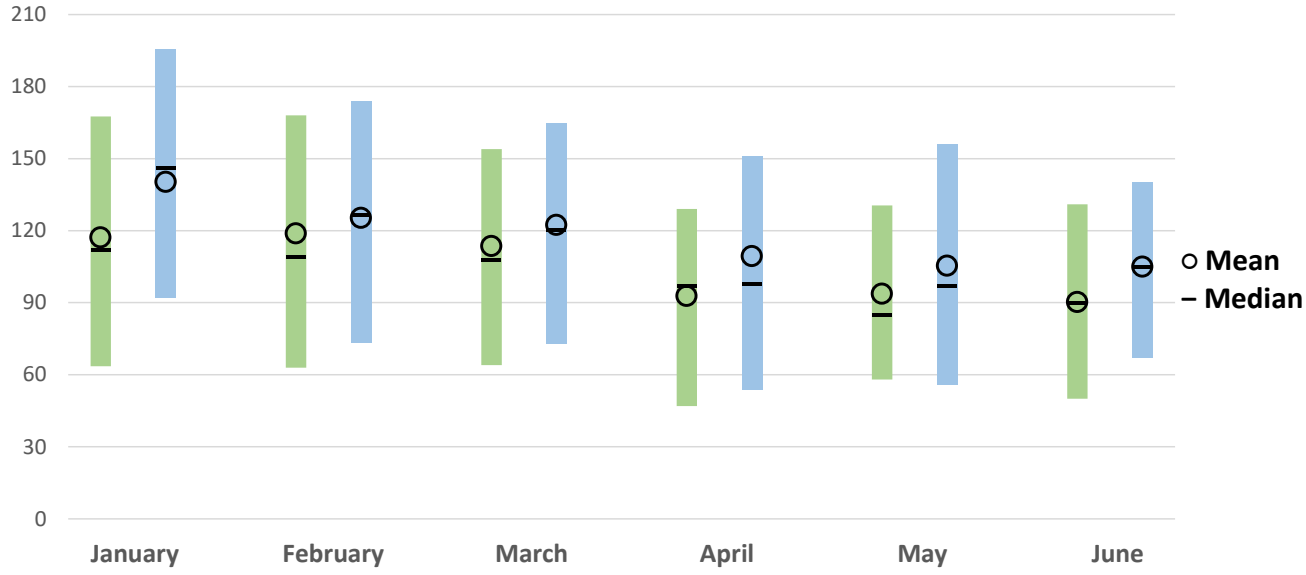
Exhibit A3:

- Looks at a subset of the more serious back injuries, lumbosacral herniated disc disorders
- Plots the mean and quartiles of the days from injury to an excision surgery
- Organizes claims by month of injury for the first six months of Accident Years 2019 and 2020

The mean and median times are about four months for the first quarter of 2019. Surgeries for this injury are not typically performed in the first few weeks after the injury. For example, only 12% of injuries in January 2020 had surgery before March 2020. A large share of injuries occurring in the first quarter of 2020 would typically not receive surgery until well into the second or third quarter of 2020 (with some surgeries likely not yet performed and captured in the MDC data extract for this study).

Longer times to surgery for each month, as compared with 2019 injuries, associates longer times with the response to the pandemic. However, only the January difference is statistically significant. Preliminary evidence from May and June suggests some recovery; however, with longer times from injury to surgery than observed for knee injuries, the experience does not yet indicate a return to pre-pandemic times for this injury.

Exhibit A3: Back—Lumbosacral Herniated Disc
Mean and Quartiles* of Days From DOI to Surgery by Month of Injury
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery.

[16] See www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Low-Back-Pain-Fact-Sheet

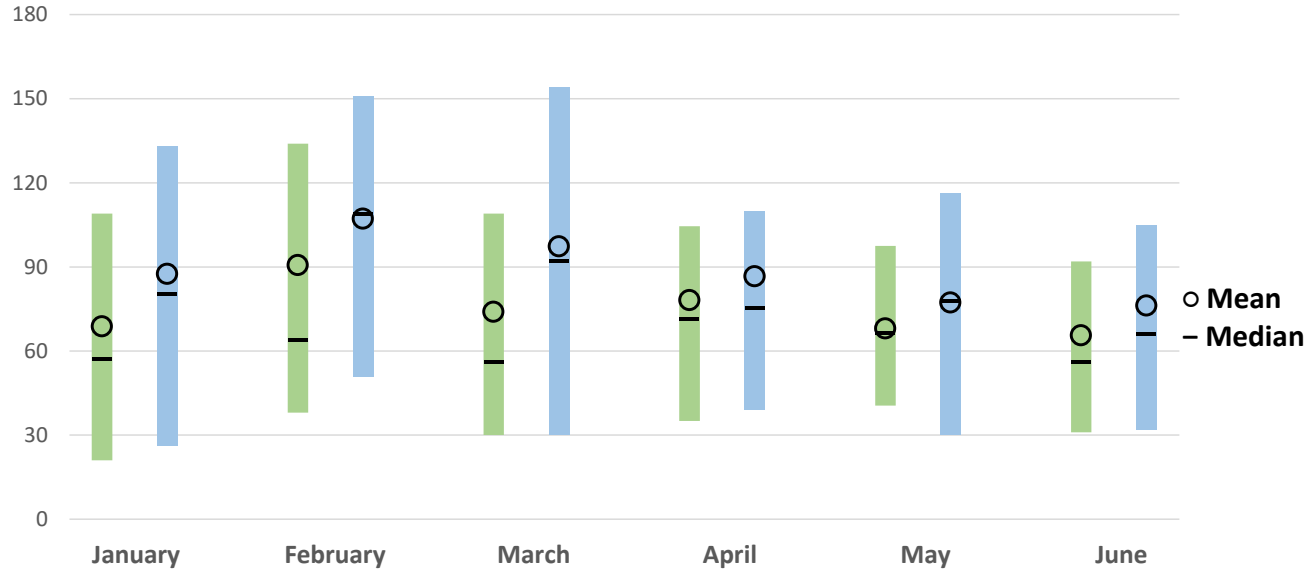
To assess the pandemic impact of deferring nonurgent procedures, Exhibit A4 looks at the average number of days from MRI to surgery.

- The date of service of an MRI is used to proxy the date of scheduling a lumbosacral disc excision
- The chart looks at MRIs performed over the first six months of 2019 and 2020
- It also groups injuries by the month of the first MRI

Compared with 2019, the average lead times to schedule surgeries for 2020 are longer for all months but is significant only for March. For all six months, the mean, median, and 75th percentiles are greater for 2020 than for 2019. This associates the pandemic with comparatively longer times to schedule surgery for these WC injuries.

The experience of lumbosacral herniated disc injuries confirms what we observed for the two knee injuries (Exhibits 14 and A2): the pandemic did result in delays, albeit confined to a few months, both in durations and in their time frame. Differences in the means between 2019 and 2020 in Exhibit A4 are not significant for April, May, and June. Although Exhibit A3 for the mean time from injury to surgery does not show a return to pre-pandemic times before June 2020, the time from MRI to surgery in Exhibit A4 does rebound, suggesting that time from injury to surgery will return soon after June 2020.

Exhibit A4: Back—Lumbosacral Herniated Disc
Mean and Quartiles* of Days From MRI to Surgery by Month of MRI
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time from MRI to surgery.

Shoulder: Rotator Cuff Injury

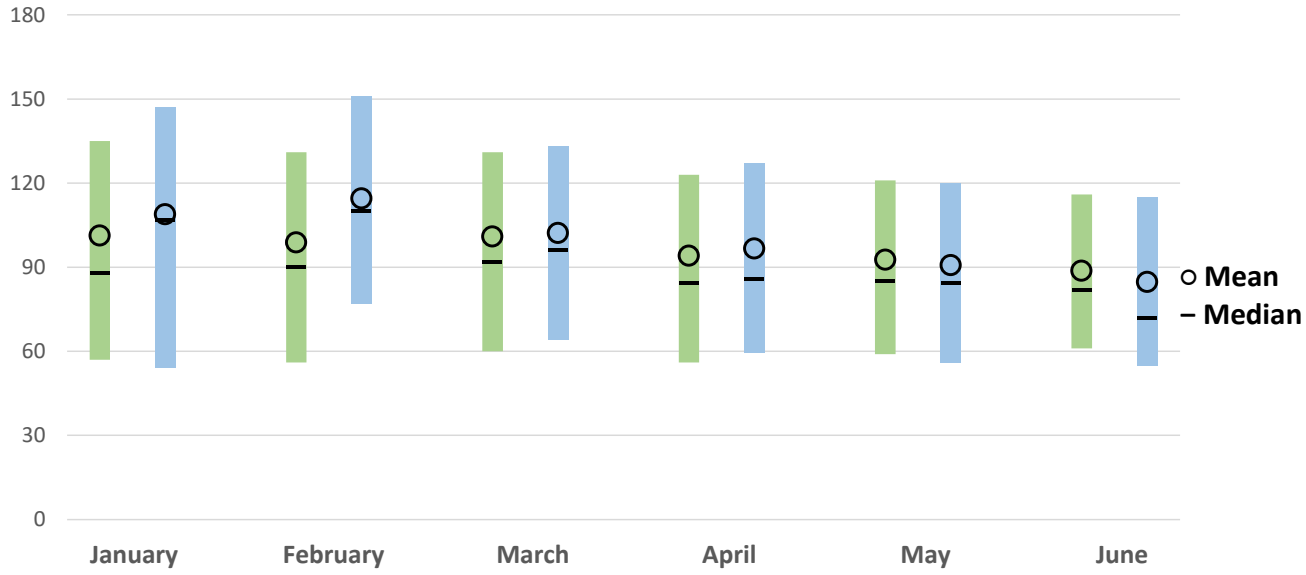
Perhaps more than knee injuries, shoulder injuries are challenging to diagnose and treat. Pain is linked to range of motion, which in turn is often critical for performing routine tasks. Exhibit A5:

- Plots the mean and quartiles of the days from injury to arthroscopy for rotator cuff injuries
- Has figures by month of injury, so the chart is from a prospective perspective over the first six months of Accident Years 2019 and 2020

Like knee injuries, it is common for a significant time to elapse until we capture billings for an arthroscopy into the MDC data. Consequently, a large share of injuries occurring in the second half of 2020 are not yet captured in the MDC data. Many rotator cuff injuries occurring in the first quarter of 2020 would not receive surgery until the second quarter or later.

As compared with 2019 injuries, significantly longer times to surgery for injuries in January and February 2020 associate longer times to surgery with the rescheduling in April and May. Differences for the subsequent four months are not significant. Like what was seen for knee injuries and for surgeries generally, Accident Year 2020 saw a return to pre-pandemic times from injury to shoulder arthroscopy after April.

Exhibit A5: Shoulder—Rotator Cuff Injury
Mean and Quartiles* of Days From DOI to Surgery by Month of Injury
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time to surgery.

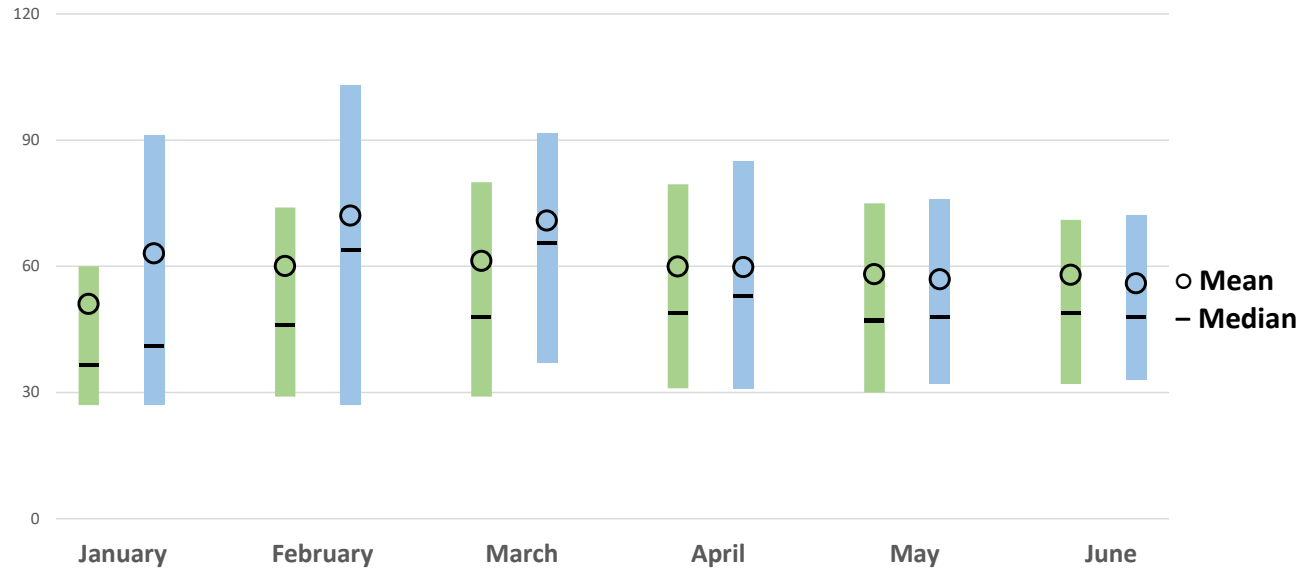
Treatment of shoulder pain often starts with physical therapy (PT), as that course of care is very often successful. The decision for invasive care may be predicated on how successful PT reduces pain and extends range of motion. Although a course of PT is a definitive treatment step and a standard of care:

- A course of PT is less definitive in timing than the date of service of an MRI
- The temporal relationship between PT and surgery can be ambiguous, as PT can both precede and follow surgery
- The relationship between PT and surgery can be complicated by a possible substitution relationship

While PT is very important in the treatment of rotator cuff injuries, we continue to use the time between MRI and surgery to identify pandemic-based delays. Organized by month of the MRI, Exhibit A6 plots the mean, median, and 75th percentile of days from an MRI to arthroscopy for rotator cuff injuries.

Compared with 2019, the average times from MRI to surgery in 2020 are significantly longer for MRIs performed in the first quarter but essentially the same for the second quarter. Exhibits A5 and A6 suggest that the impact of the pandemic on the time from shoulder injury to surgery is mostly confined to a four-month time frame and is about a couple of weeks in duration.

Exhibit A6: Shoulder—Rotator Cuff Injury
Mean and Quartiles* of Days From MRI to Surgery by Month of MRI
2019 vs. 2020



* The lengths of the bars measure the interquartile range (i.e., 25th to 75th percentile) for each month's time from MRI to surgery.

B: Cost by Time From Injury to Surgery for Specific Injuries

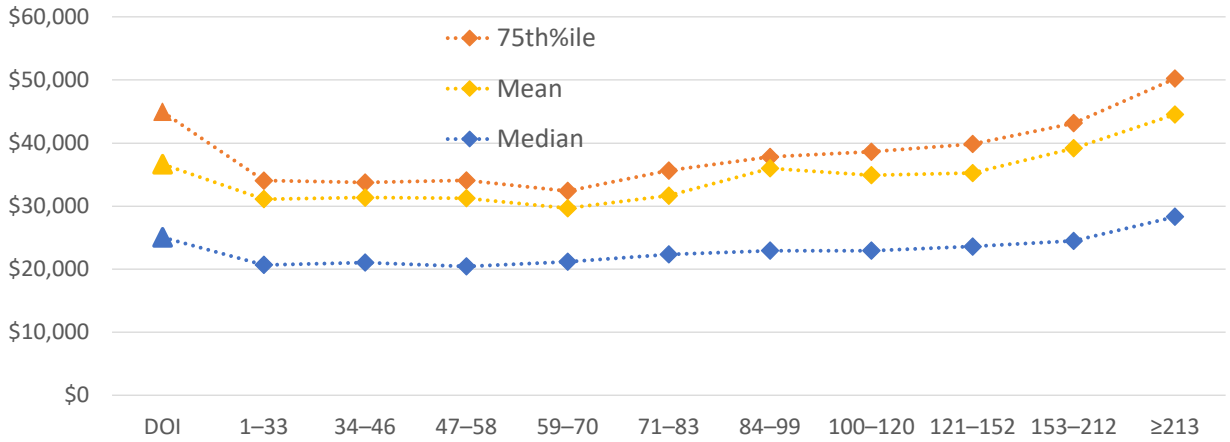
Knee: Meniscus Injury

For several ranges of days from injury to arthroscopy, Exhibit B1 plots the mean, median, and 75th percentile of the total incurred cost per case for meniscus knee injuries that eventually have surgery.

- Both mean and median are much greater for injuries with surgery on the day of injury:
  - A median of around $25,000
  - A mean of around $37,000
- When the surgery is performed between day 1 and day 70 (41% of surgeries), the cost remains fairly constant:
  - The median fluctuates around $22,000
  - The mean fluctuates around $30,000
- When the surgery is performed after 10 weeks from injury, the average cost per claim increases with a longer time to surgery:
  - To almost $45,000, an amount greater than for injuries with same-day surgery
  - To around $28,000 for the median

Exhibit B1 shows an association between costs and time from injury to surgery. It does not imply a causal relationship.

Exhibit B1: Knee—Meniscus Injury
Median, Mean, and 75th Percentile of the Incurred Cost per Case*



* Reported incurred indemnity plus medical cost based upon latest report for Accident Years 2014–2015
Source: NCCI Medical Data Call; NCCI ***Statistical Plan*** data for all states where NCCI provides ratemaking services, except Texas

The 10-week period after the injury with comparatively little change in average cost is shorter than the analogous period for cruciate ligament injuries. As with cruciate ligament injuries, allowing for some natural healing prior to surgery can be beneficial.[17] Unlike cruciate ligament tears, the worker suffering a meniscus injury may still have some mobility, albeit likely with pain. Accordingly, there is a greater concern for aggravating damage to the knee, especially when surgery is clearly indicated and too many weeks pass before the surgery is performed.

The difference between the median and the 75th percentile suggests a considerable degree of dispersion in costs even within the time intervals. The association between costs and time to surgery is not deterministic: some of the highest cost meniscus injuries have some of the shortest times from injury to surgery and some of the lowest cost have some of the longest times.

Based on what was observed for pandemic-based delays in surgery for meniscus injuries (Exhibits A1 and A2), the delays may increase costs for some, while most would fall within a 100-day time frame and before the sharpest increases in the expected cost.

Back: Lumbosacral Herniated Disc

Exhibit B2 plots the mean, median, and 75th percentile of the total incurred cost per case for several ranges of days from injury to excision for lumbosacral herniated disc injuries.

- Both mean and median are much greater for injuries with surgery on the day of injury:
  - A median of around $115,000
  - A mean of around $180,000
- When the surgery is performed over the subsequent four months (i.e., when the surgery is performed between day 1 and day 120) the cost distribution varies with increasing time to surgery:
  - The median increases from about $65,000 to nearly $80,000
  - The mean varies between $99,000 and $120,000
  - Only 40% of the surgeries are performed between day 1 and day 120
- When the surgery is performed after 45 days from injury, the cost increases with a longer time to surgery:

[17] For practical information on meniscus knee injuries, the Guy's and St Thomas' NHS Foundation Trust publishes a patient-oriented leaflet (number: 4770/VER1) available at: www.guysandstthomas.nhs.uk.

- The median more than doubles, from just under $64,000 to more than $145,000, to an amount greater than for same-day surgeries
- The mean increases from just under $100,000 to more than $187,000 and to an amount greater than that for same-day surgeries

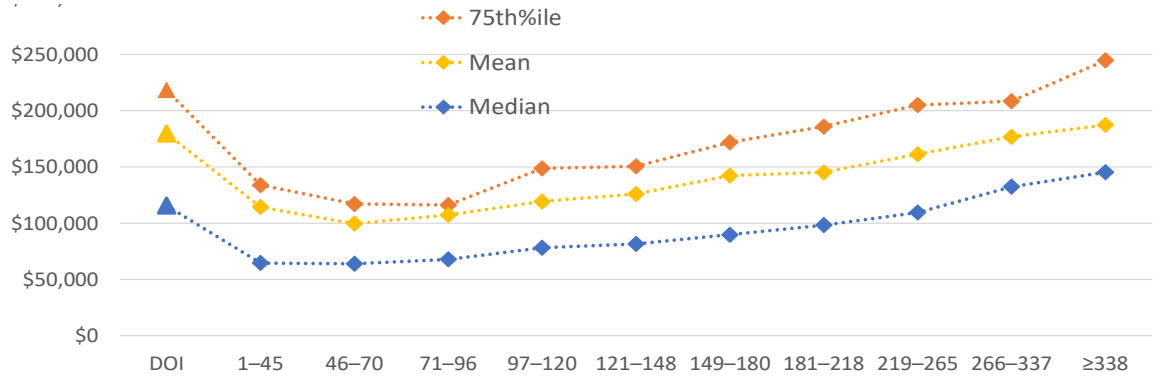
Exhibit B2 shows an association between costs and time from injury to surgery. It does not imply a causal relationship.

A consistent cost increase with the time to surgery begins only 45 days post injury. So, the cost of disc surgeries is more sensitive to delay than knee injuries, as well as being more costly. Prior to resorting to surgery, this injury is often treated with physical therapy and injections.[18] The increase in cost over time may reflect the cost for failed alternatives to surgery.

Based on what was observed for pandemic-based delays in surgery for lumbosacral herniated disc injuries (Exhibits A3 and A4), the delays may increase the cost for many such injuries while many others would fall within the four-month time window prior to the most dramatic cost increases.

We find that the pandemic-based surgery delays are a greater concern for lumbosacral herniated disc injuries than for knee injuries. On the other hand, it may be that physical therapy and injections became comparatively more attractive and a more utilized treatment option because of the pandemic. This comparison focuses on costs associated with the timing of a surgery. It does not consider any potential for savings from successfully treating some lumbosacral herniated disc injuries without surgery.

Exhibit B2: Back—Lumbosacral Herniated Disc
Median, Mean, and 75th Percentile of the Incurred Cost per Case*



* Reported incurred indemnity plus medical cost based upon latest report for Accident Years 2014–2015
Source: NCCI Medical Data Call; NCCI ***Statistical Plan*** data for all states where NCCI provides ratemaking services, except Texas

The difference between the median and the 75th percentile indicates a considerable degree of dispersion in costs even within the time intervals. Some of the highest cost lumbosacral herniated disc injuries have some of the shortest times from injury to surgery and some of the lowest cost injuries have some of the longest times.

Shoulder: Rotator Cuff Injury

For several ranges of days from injury to arthroscopy, Exhibit B3 plots the mean, median, and 75th percentile of the total incurred cost per case for rotator cuff injuries. The findings resemble what was observed for cruciate ligament injuries:

- Both mean and median are much greater for injuries with surgery on the day of injury:
  - The median is about $60,000
  - The mean is more than $90,000
- When the surgery is performed over the subsequent four months from injury (i.e., when the surgery occurs day 1 to day 127) the cost remains fairly constant:
  - The median fluctuates around $52,000

[18] For practical information on low back pain injuries, the Guy's and St Thomas' NHS Foundation Trust publishes a patient-oriented leaflet (number: 4876/VER1) available at: www.guysandstthomas.nhs.uk/Home.aspx.

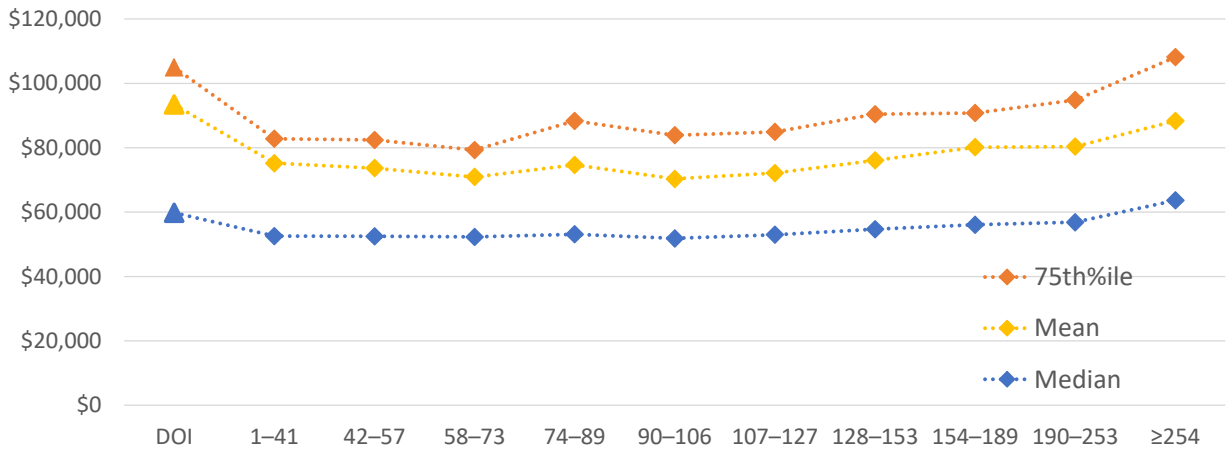
  - The mean fluctuates around $72,000
  - 59% of the surgeries are performed between day 1 and day 127
- When the surgery is performed after four months from injury, the average cost increases with a longer time to surgery and:
  - Does not exceed the average cost for injuries with surgery on the date of injury
  - The median increases to more than $60,000
  - The mean increases to more than $88,000

Exhibit B3 shows an association between costs and time from injury to surgery. It does not imply a causal relationship.

The four-month period after the injury with comparatively little change in average cost includes a post-injury time frame during which, for some cases, surgery can be deferred with little medical harm.[19] However, for this type of injury, with delay there is the risk of progression to higher costs and possibly worse outcomes. While resting the shoulder is a natural response to the pain—and can be beneficial—prolonged inactivity also increases the risk of worsening the outcome. Physical medicine plays a very critical role in diagnosing and treating rotator cuff injuries.

Based on what was observed for pandemic-based delays in surgery for rotator cuff injuries (Exhibits 5 and 6), those delays would largely fall within a time frame associated with limited impact on cost.

Exhibit B3: Shoulder—Rotator Cuff Injury
Median, Mean, and 75th Percentile of the Incurred Cost per Case*



* Reported incurred indemnity plus medical cost based upon latest report for Accident Years 2014–2015
Source: NCCI Medical Data Call; NCCI ***Statistical Plan*** data for all states where NCCI provides ratemaking services, except Texas

The difference between the median and the 75th percentile suggests a considerable degree of dispersion in costs even within the time intervals. Some of the highest cost rotator cuff injuries have some of the shortest times from injury to surgery and some of the lowest cost injuries have some of the longest times.

[19] For practical information on rotator cuff injuries, the Guy's and St Thomas' NHS Foundation Trust publishes two patient-oriented leaflets (numbers: 5055/VER1 and 3288/VER3) available at: www.guysandstthomas.nhs.uk.