RESEARCH BRIEF

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March 2020

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The Use of Networks to Care for Injured Workers—What's Been the Impact?

Medical provider networks (MPNs) for workers compensation have become increasingly popular over the last two decades. We've seen not only an increase in the share of services performed by in-network providers, but also a leap in sophistication. They have evolved from simple lists of in-network doctors to complex provider networks that provide a spectrum of medical care—from primary to specialty care—for on-the-job injuries.

In this report, we look at the impact of these networks on workers compensation prices and utilization, including the:

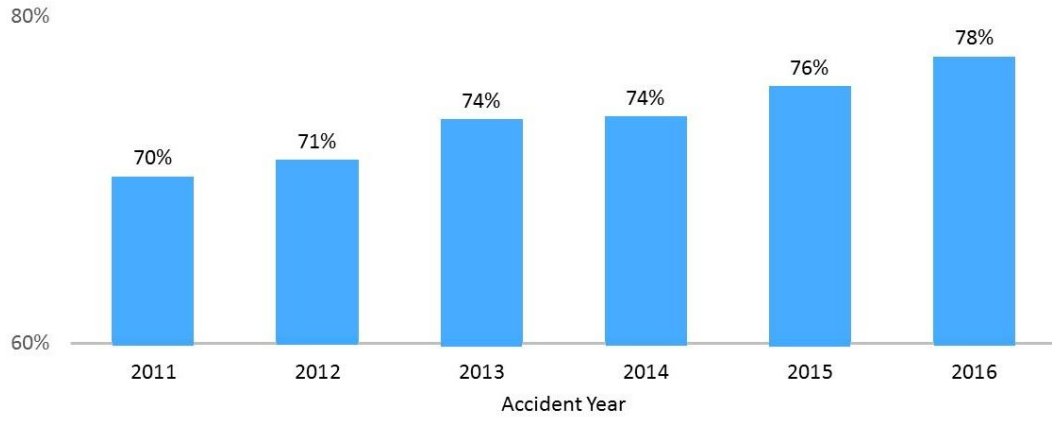
- Growth in the use of these networks
- Difference between in-network and out-of-network prices
- Relationship between the share of service done in-network to payments allowed by physician fee schedules relative to Medicare prices
- Impact of networks on the utilization of physician services and prescription drugs

FINDINGS

Use of Medical Provider Networks in Workers Compensation

There has been a significant and steady increase in the use of medical provider networks (MPNs) in workers compensation (WC), as evidenced by the growing share of payments going to in-network providers (Exhibit 1):

Exhibit 1: Medical Provider Networks Have Seen Steady Growth in Recent Years
Share of In-Network Payments by Accident Year



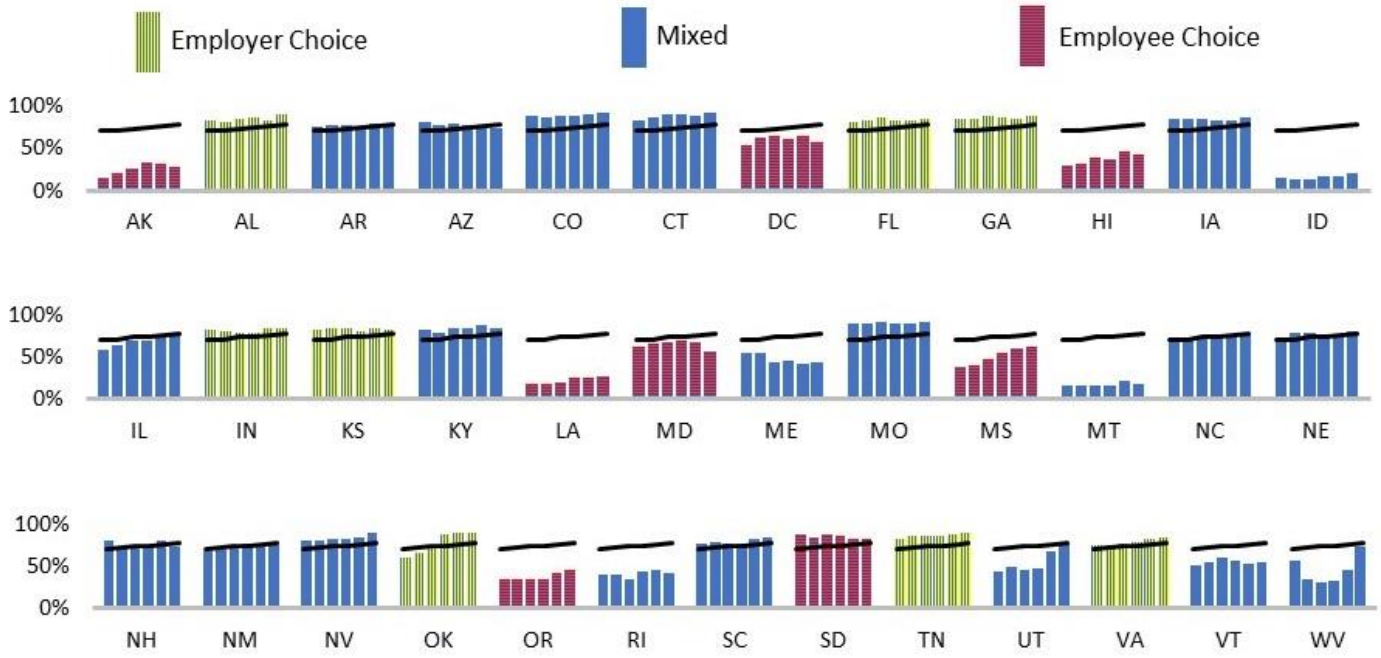
Source: NCCI's Medical Data Call for 37 states—states where NCCI provides ratemaking services, excluding TX. Includes lost-time and medical-only claims.

The use of MPNs varies by state but has increased in most (Exhibit 2—the lines plot the countrywide growth from Exhibit 1). Generally, MPNs provide a smaller share of the care in states where WC statutes specify employee over employer choice of physician. This is illustrated in Exhibit 2, where the bars for the employee choice states are typically below the countrywide line. An exception is South Dakota, with a statute that grants the initial choice of provider to the employee but also requires use of a claim management service.

Appendix E relates state variation in MPN penetration to the utilization of medical services to treat a claim.

Exhibit 2: In-Network Payment Share Varies by State

Accident Years 2011–2016



Source: NCCI's Medical Data Call for 37 states—states where NCCI provides ratemaking services, excluding TX. Includes lost-time and medical-only claims. Black lines represent weighted averages across all states.

Price Departures From Physician Fee Schedules

This study looks at the prices paid to physicians for individual medical services for nonemergency care. We exclude emergency care as, by its nature, that care is not expected to be directed into or out of a network. We consider services provided between January 1, 2011 and December 31, 2016, and reimbursed by a positive amount.

In addition to state of jurisdiction, nonemergency physician services are itemized into the following seven categories:

- Evaluation and Management (E&M)
- Major Surgery
- Minor Surgery
- Physical Medicine
- Complex Imaging
- Simple Imaging
- Other

We compare payments between those made to in-network doctors and out-of-network doctors. We do this by relating both payments to the maximum allowed reimbursement (MAR) of the physician fee schedule (PFS). We call our measure of the difference between a set of prices and their MARs the *price departure.* We compare price departures for services of in-network physicians with those of out-of-network physicians.

The price departure for a set of medical services is determined by:

- Calculating the ratio of the actual total paid amount for those services divided by what would have been paid for that same set of services if all the services were reimbursed at the MAR
- Subtracting 1 from that ratio and expressing the result as a percentage

Example: If an office visit with a MAR of $100 were paid at a discounted amount of $75, the price departure would be:

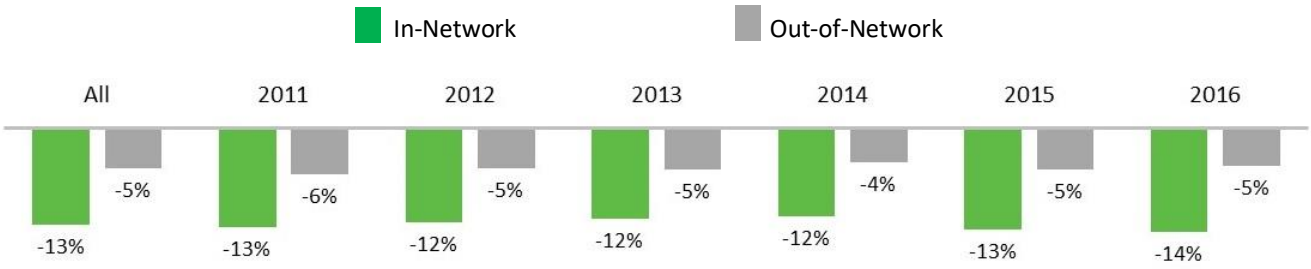
–25% [= ($75 – $100)/$100 = –0.25]

A price departure less than zero means that, on average, prices are discounted below the maximum allowed by the physician fee schedule. When prices exceed the maximum allowed by the physician fee schedule, the corresponding price departure is greater than zero.

When we compare in-network and out-of-network price departures over recent years (Exhibit 3), we find that both have remained stable with price departures of about 13% and 5% below the MAR, respectively. Generally, negotiating prices within an MPN has lowered them by about 8%.

Exhibit 3: In-Network and Out-of-Network Price Departures Have Been Stable

Physician Services by Service Year



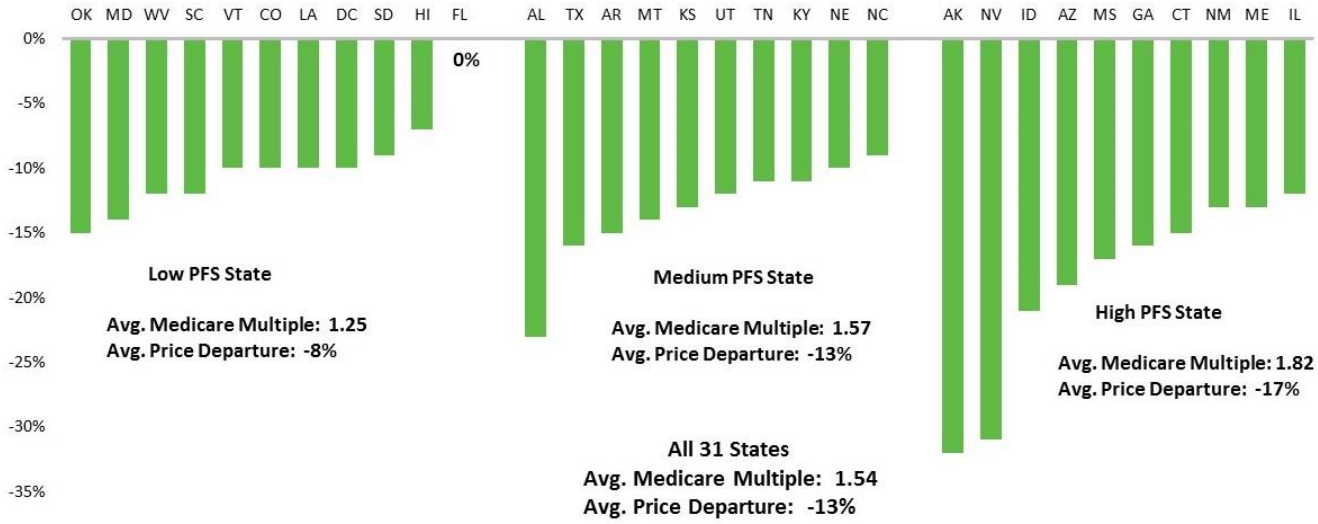
Sources: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use Data File. Includes lost-time and medical-only claims for 33 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA. Price Departure is the average of the ratios of actual paid to Maximum Amount Reimbursable (MAR) set by the physician fee schedule (PFS).

We chart in-network price departures by state in Exhibit 4. Here, the states are arranged into three groups according to their level of reimbursement allowed by the PFS, as measured by comparing the PFS with Medicare:

- The in-network price departure is less than or equal to zero for all states; this means that, on average, in-network doctors are reimbursed at or below the PFS
- In-network reimbursement for the low PFS group of states (at 125% of Medicare) has the smallest price departure, at 8% below MAR
- By contrast, in-network reimbursement for the high PFS group of states (at 182% of Medicare) has the largest price departure, at 17% below MAR

Exhibit 4: In-Network Price Departures Sometimes Reflect How State Physician Fee Schedules Relate to Medicare Fees

Physician Services 2011–2016



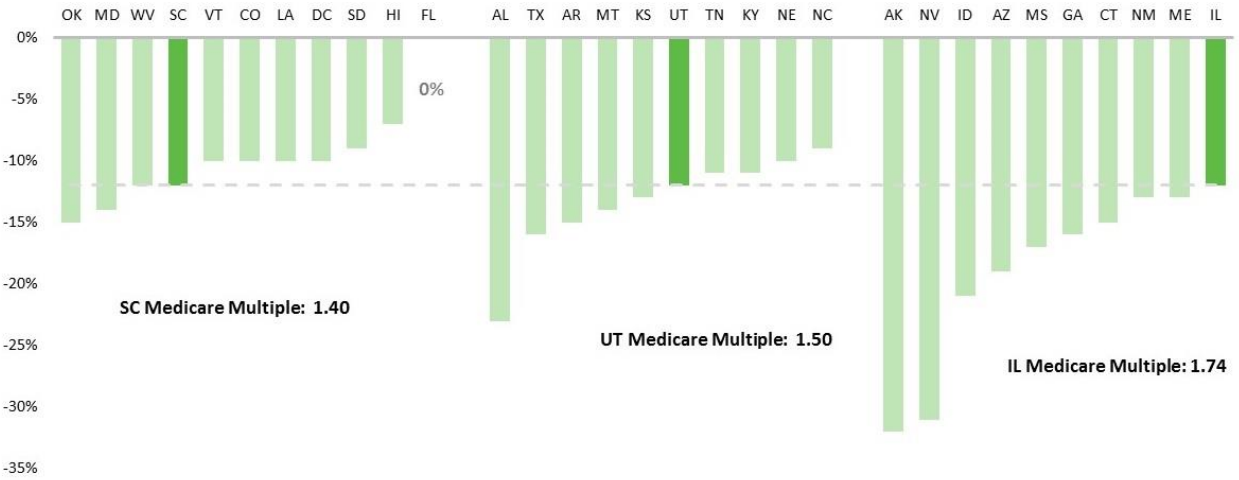
Sources: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use Data File. Includes lost-time and medical-only claims for 31 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA—and two other states with unique fee schedule features—OR, RI. Average Medicare Multiples are from "Designing Workers' Compensation Medical Fee Schedules, 2016," WCRI, 2016. Price Departure is the average of the ratios of actual paid to MAR set by the physician fee schedule. NCCI designates Low PFS States as states with average Medicare Multiple at most 1.42; NCCI designates High PFS States as states with average Medicare Multiple at least 1.73.

Typically, the more generous physician fee schedules, relative to Medicare prices, are offset by a larger price departure below the MAR. Therefore, in-network reimbursement tends to shrink price differences among the states relative to the difference in MARs.

Two more visuals may help to relate in-network price departures to the level of reimbursement allowed by state physician fee schedules. As shown in Exhibit 5, in-network price departures by state do not always respond to differences in the MARs, as the same 13% departure below the MAR occurs for states contained in all three state groups.

Exhibit 5: In-Network Price Departures Do Not Always Reflect How State Physician Fee Schedules Relate to Medicare Fees

Physician Services 2011–2016

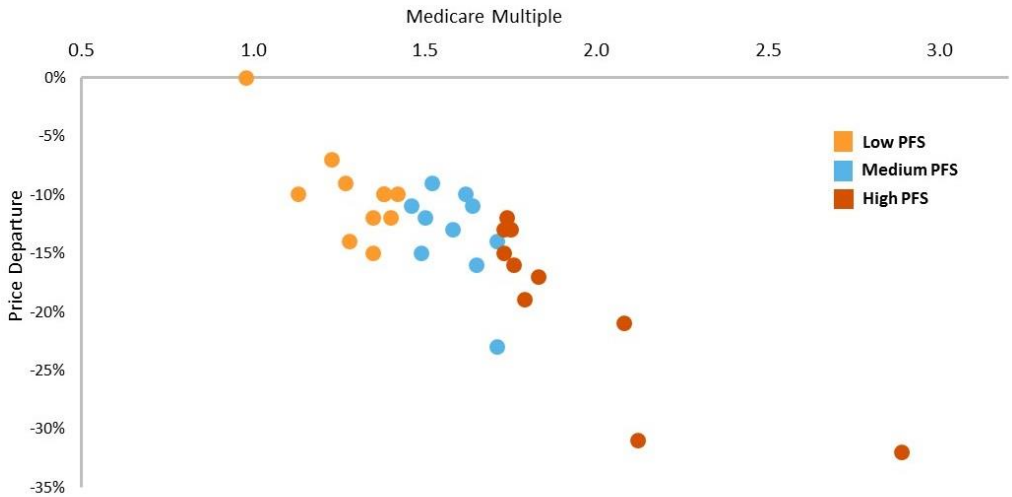


Sources: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use Data File. Includes lost-time and medical-only claims for 31 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA—and two other states with unique fee schedule features—OR, RI. Average Medicare Multiples are from "Designing Workers' Compensation Medical Fee Schedules, 2016," WCRI, 2016. Price Departure is the average of the ratios of actual paid to MAR set by the physician fee schedule. NCCI designates Low PFS States as states with average Medicare Multiple at most 1.42; NCCI designates High PFS States as states with average Medicare Multiple at least 1.73.

While state price departures do not vary strictly with how the state PFS relates to Medicare fees, they do tend to move with that relationship. Exhibit 6 shows that an increasing allowable reimbursement level of the state PFS (scanning from left to right) relative to Medicare is associated with a greater magnitude price departure below the PFS (scanning from top to bottom).

Exhibit 6: In-Network Price Departures Sometimes Reflect How State Physician Fee Schedules Relate to Medicare Fees

Physician Services 2011–2016



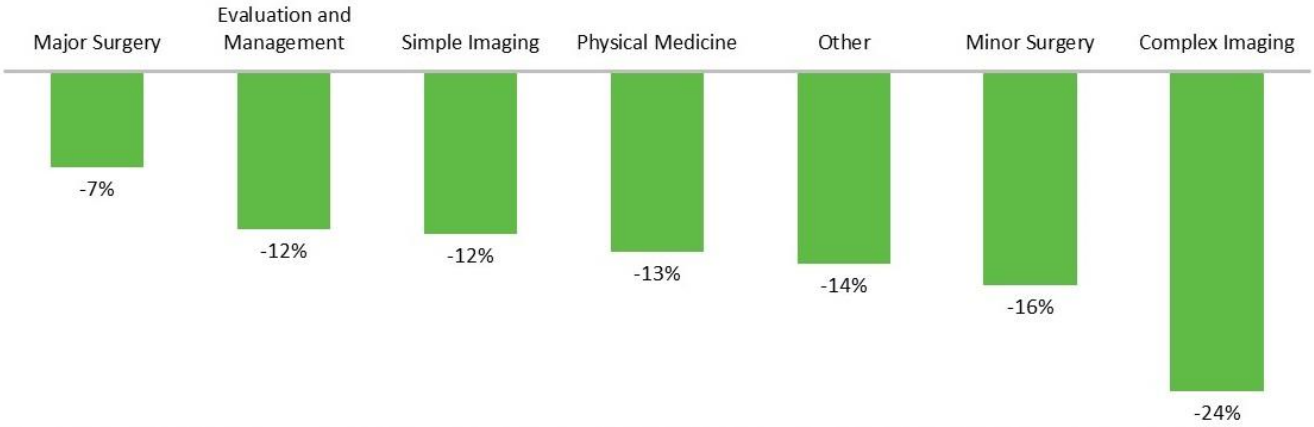
Sources: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use Data File. Includes lost-time and medical-only claims for 31 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA—and two other states with unique fee schedule features—OR, RI. Average Medicare Multiples are from "Designing Workers' Compensation Medical Fee Schedules, 2016," WCRI, 2016. Price Departure is the average of the ratios of actual paid to MAR set by the physician fee schedule. NCCI designates Low PFS States as states with average Medicare Multiple at most 1.42; NCCI designates High PFS States as states with average Medicare Multiple at least 1.73.

Comparing in-network price departures by type of service reveals a wide range of departures across types of specialized care such as major surgery or complex imaging (Exhibit 7):

- For all service types, average in-network reimbursement levels are below the maximums allowed by the PFS
- The comparatively low departure for major surgery suggests that provider networks are willing to reimburse at prices closer to the allowed maximums (and sometimes even higher) to bring surgeons into the network, especially in areas where there are few specialists
- The larger in-network discounts off the PFS for complex imaging indicate that, when negotiating with provider networks, insurers took advantage of lower prices. Advances in digital processing and communications have revolutionized radiology, expanding supply, and lowering prices.

Exhibit 7: In-Network Price Departures Vary by Service Type

Physician Services 2011–2016



Source: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use File. Includes lost-time and medical-only claims for 33 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA. Price Departure is the average of the ratios of actual paid to MAR set by the physician fee schedule.

Exhibit 7 uses the PFS as a benchmark to illustrate how in-network price departures differ by physician service type. A related—but technically more challenging—question is whether in-network and out-of-network prices differ by how comparatively expensive, or "intense," the service is. For example, are proportional differences in price between in-network and out-of-network providers greater for MRIs than for X-rays?

Appendix A considers this question and finds:

- In general, in-network prices are lower than out-of-network prices by around 10%
- The proportional difference varies by state
- The proportional difference does not vary with the intensity of the service

MPNs and Physician Fee Schedules

The share of payments below the MAR provides a simple, but revealing, look at how MPNs strengthen the ability of physician fee schedules to control costs (Exhibit 8):

- The share of payments below the MAR is greater for in-network claims
- By negotiating prices based on an applicable PFS, provider networks can act to reinforce those MARs
- Only about 1 in 8 payments to in-network providers are at or above the MAR
- By contrast, 2 of 3 payments to out-of-network providers are at or above the MAR

Some possible reasons for the difference in those shares:

- For negotiating prices within a network, the MAR is often an upper starting point
- The prospect of getting additional cases from belonging to a network may make prices below MAR more acceptable to providers
- Absent negotiation, the MAR may become a target price for out-of-network providers

Exhibit 8: Share of Payments Below MAR Is Much Larger In-Network
Physician Services 2011–2016

Source: NCCI's Medical Data Call and Texas DWC's Medical State Reporting Public Use File. Includes lost-time and medical-only claims for 33 states: states where NCCI provides ratemaking services, excluding five states without physician fee schedules—IA, IN, MO, NH, VA.

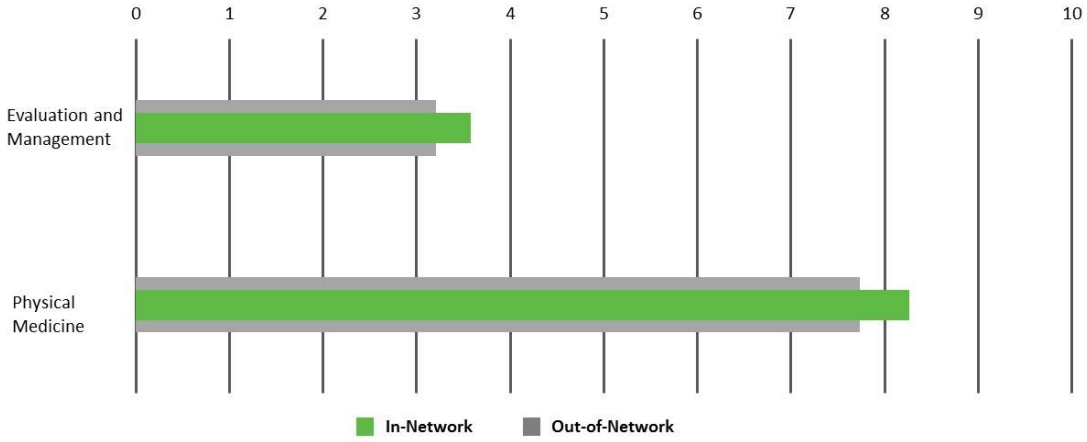
A more in-depth look at how in-network and out-of-network payments relate to the PFS is provided in Appendix B. That discussion includes plots of the entirety of the two payment distributions that reveal patterns for in-network discounts below the MAR. For all seven physician service types, the plots show higher shares of in-network payments below the MAR than out-of-network payments.

Utilization of Physician Services for E&M and Physical Therapy

Utilization refers to both the number and the intensity mix of services. The two most common types of medical services on WC cases are evaluation and management (E&M) and physical medicine. We classify claims as in-network or out-of-network based on the proportion of payments going to in-network providers—80% or more assigns the claim as in-network, 20% or less as out-of-network—and compare the average number of services for in-network claims to out-of-network claims, as shown in Exhibit 9. In-network claims average a greater number of E&M services, possibly indicating more deliberate management of medical services. In-network claims also have a greater average number of physical therapy visits, which may be less invasive than alternative treatments, and may be in line with treatment guidelines.

Exhibit 9: In-Network Providers Use More Evaluation and Management and Physical Medicine Services per Claim

Number of Physician Services 2011–2016



Source: NCCI's Medical Data Call for Accident Years 2011 to 2016 for 37 states—states where NCCI provides ratemaking services, excluding TX. Includes lost-time and medical-only claims. Adjusted for mix of claims. A claim is in-network if at least 80% of payments for services through 2016 are in-network. A claim is out-of-network if at most 20% of such payments are in-network.

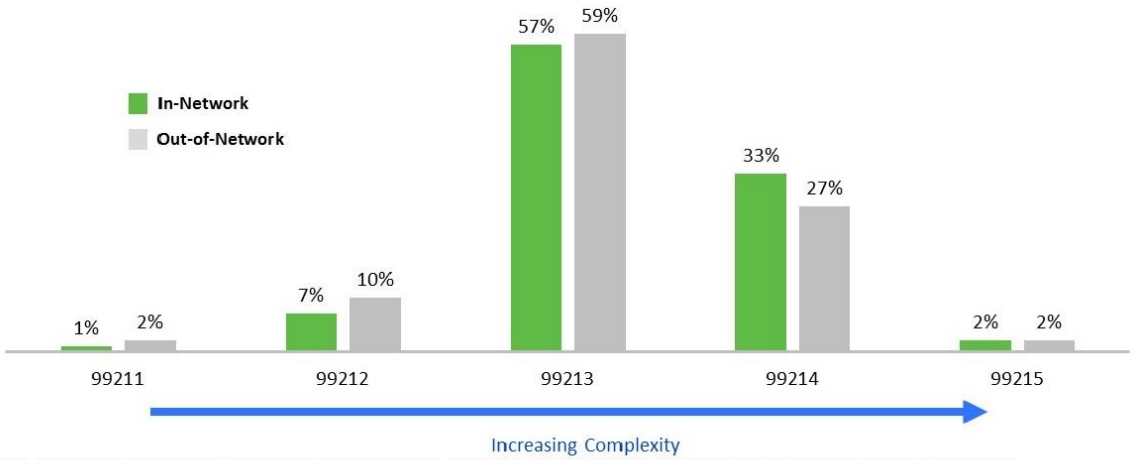
Because office visits are coded for complexity, we can compare the intensity mix of services for E&M services for in-network and out-of-network claims. Not only do in-network claims average more E&M services per claim, they also receive a greater share of complex visits (see Exhibit 10 for established patient E&M):

- For established patients, the share of *more* complex (CPT 99214) office visits is *greater* for in-network than for out-of-network claims (at 33% vs. 27%)
- For established patients, the share of *less* complex (CPT 99212) office visits is *less* for in-network than for out-of-network claims (at 7% vs. 10%)
- Office visits for new patients show a similar pattern

The very small shares for bills coded as routine follow-up visits (CPT 99211) suggest prevalent *up-coding*—billing for more expensive than necessary procedures—by both in-network and out-of-network physicians.

Exhibit 10: In-Network Providers Have a Higher Proportion of More Complex Evaluation and Management Visits

Share of Established Patient E&M Visits by CPT® Code



Source: NCCI's Medical Data Call for Accident Years 2011 to 2016 for 37 states—states where NCCI provides ratemaking services, excluding TX. Includes lost-time and medical-only claims. Adjusted for mix of claims. CPT® is a registered trademark of the American Medical Association and denotes Current Procedural Terminology. A claim is in-network if at least 80% of payments for services through 2016 are in-network. A claim is out-of-network if at most 20% of such payments are in-network.

Overall Utilization of Physician Services and Drugs

A good way to measure utilization differences between two courses of treatment is to see what each would cost if they were both reimbursed using a common fee schedule, and then take their ratio. The same applies to any two sets of services.

For such an analysis, using a common fee schedule is key. For example, ratios of state average costs per case need not measure differences in utilization. This is because price differences between states (in combination with the number and mix of services) impact the average costs per case and may confound the comparison.[1]

When the price for each service is the same:

- Adding more services to just one set increases its cost, compared to the original set of services
- Changing to a more intense and expensive mix of services (say replacing a less expensive X-ray with a more expensive MRI) increases its cost, compared to the original set of services

Accordingly, the ratio responds to differences in both the number and mix of services and therefore gives a measure of how two sets of services compare regarding utilization of medical services.

The two sets of services may correspond to treating two groups of claims. The comparison is more meaningful if the two sets of claims are adjusted to account for differences in claim characteristics or claimant demographics. For example, one group may have a higher proportion of back injuries or a lower proportion of male claimants than the other group. Suppose that the claim mix is adjusted to associate the two sets of services with the same number of back injuries and male claimants, etc. Then comparisons between the services utilized to treat the two groups of claims would have more meaning. Appendix C discusses the case when one group consists of claims treated in-network and the other treated out-of-network.

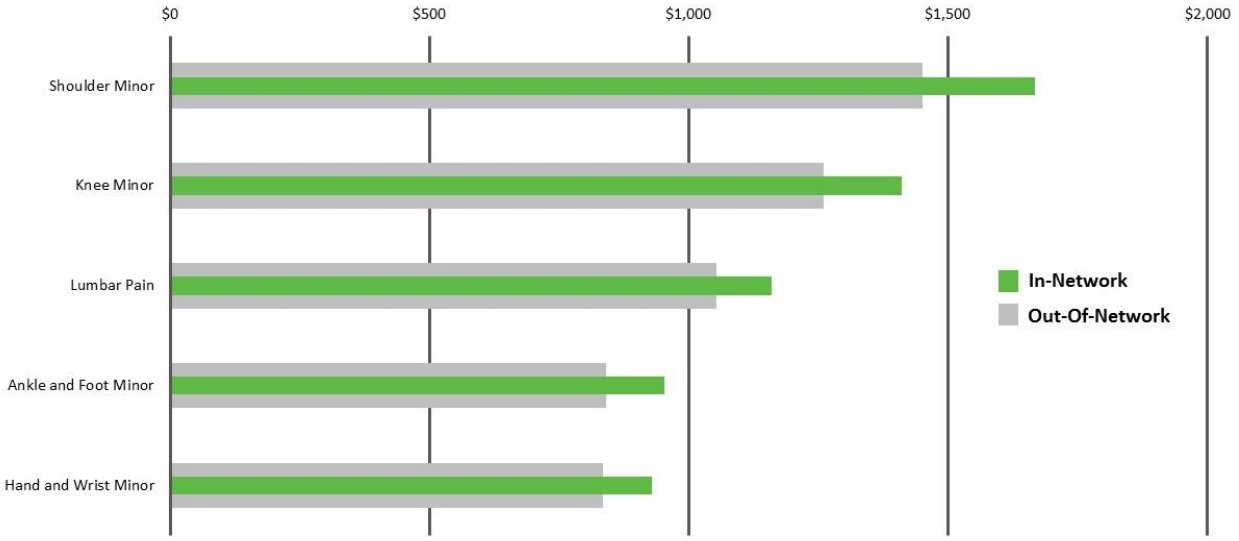
[1] As a tool to measure utilization differences, NCCI recently constructed its Workers Compensation Relative Price Index (WCRPI). The WCRPI is resource based, applies by CPT and place of service, and does not vary by state. The WCRPI measures the relative intensity of medical services and is used in deriving the figures in Exhibit 11 and in Appendices A and E.

Exhibit 11 compares utilization between in-network and out-of-network claims for several types of injury:

- The five groups include many of the most frequent WC injuries. (The table in Appendix D provides additional detail on the medical conditions included in the five groups of injuries)
- The five groups cover a range of medical conditions, including injuries to upper and lower extremities, as well as the back
- The comparisons are mix adjusted to account for patient age and gender
- The dollar amounts reflect a common, countrywide fee schedule for physician services

For each group of injuries, in-network claims show higher utilization than out-of-network claims.

Exhibit 11: For Common Injuries, In-Network Utilization Is Higher



Source: NCCI's Medical Data Call for Accident Years 2011 to 2016 for 37 states—states where NCCI provides ratemaking services, excluding TX. Includes lost-time and medical-only claims. Adjusted for mix of claims. A claim is in-network if at least 80% of payments for services through 2016 are in-network. A claim is out-of-network if at most 20% of such payments are in-network. Utilization is measured as the cost of services using a common set of prices across states.

Considering the growth in the use of MPNs, the differences in utilization shown in Exhibit 11 prompt the question of whether they vary with network penetration. In fact:

- There is substantial variation in MPN penetration by state, as measured by the shares of claims that are classified as in-network or out-of-network
- MPN penetration is generally greater for states whose statutes favor employer choice
- Greater MPN penetration is found to be associated with higher utilization of physician services to treat in-network claims, compared to out-of-network claims

Appendix E gives the basis for these conclusions.

Utilization of physician services for in-network claims is greater than that for out-of-network claims. While it is beyond the scope of this report to ascertain why, we offer a few possible reasons for this:

- In-network referral may select the more medically severe claims
  - Quickest to heal and lowest utilization cases have less opportunity to be directed in-network
  - Higher costs on some claims, because of higher medical severity, may prompt them to be directed in-network
- Provider networks may have more efficient billing or referral practices
  - Precertification and referrals may be easier and quicker, and follow-up care better monitored
  - Expertise in treating WC cases may lead to treatment patterns geared to maximizing reimbursement, even while negotiating price discounts
- The incentive to *up-code* (bill for a more complex procedure) may be greater in-network to offset negotiated price discounts

Finally, we compare the use of drugs between in-network claims and out-of-network claims. Prescriptions are often made in consultation with the patient's primary care physician. Accordingly, we ask whether the greater in-network utilization of E&M services results in a greater (or less) use of drugs. Claims here are classified as in-network or out-of-network based on the proportion of E&M payments going to in-network providers (80% or more assigns the claim as in-network, 20% or less as out-of-network). Here we are not looking at whether the drugs themselves are provided by an in-network provider, such as pharmacy benefit manager (PBM) or a local in-network pharmacy, or an out-of-network provider.

Exhibit 12 shows that:

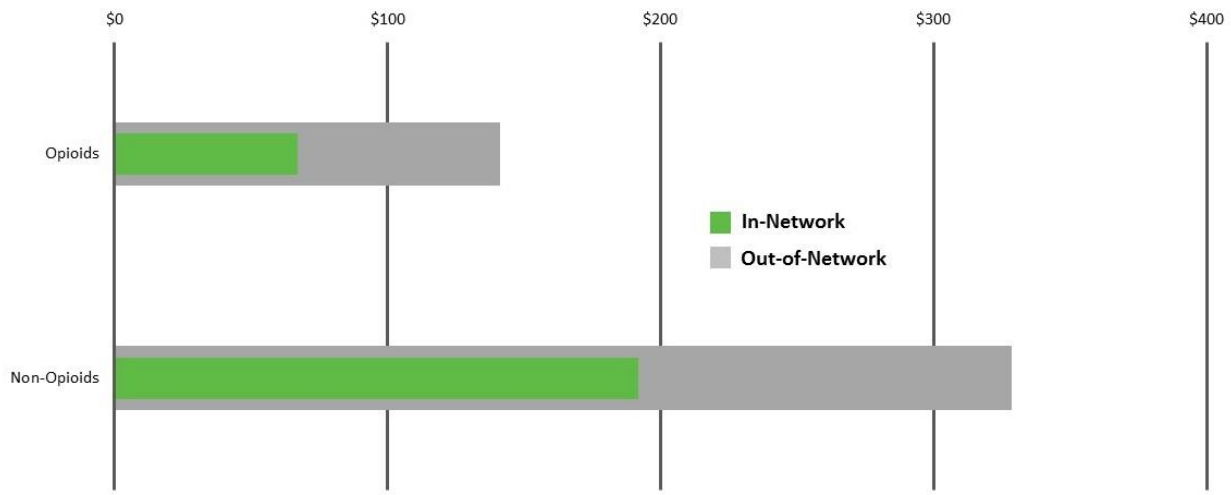
- On average, out-of-network cases have greater drug costs
- This holds true for both opioids and other medications

Lower drug costs on in-network claims, especially for opioids, suggests that in-network care may be more:

- Focused on underlying conditions rather than prescribing medication to lessen symptoms
- Open to nondrug alternatives (e.g., physical therapy)
- Consistent with treatment guidelines

Exhibit 12: Out-of-Network Claims Have Greater Drug Costs

Prescription Drug Costs per Active Claim
Service Year 2016



Source: NCCI's Medical Data Call for 36 states—states where NCCI provides ratemaking services, excluding TX and WV—plus MA, MN, NJ, NY, WI. Includes lost-time and medical-only active claims. Prescription drugs in this analysis are those with a National Drug Code. A claim is in-network if at least 80% of payments for evaluation and management services through 2016 are in-network. A claim is out-of-network if at most 20% of such payments are in-network.

SUMMARY OF KEY FINDINGS

Prices paid for individual services to physicians in a network are consistently lower than those paid to other doctors:

- More generous physician fee schedules relative to Medicare are often associated with greater network price discounts (Exhibit 6)
- Discounts from physician fee schedules vary by service category, being smallest for major surgery and greatest for complex imaging (Exhibit 7)
- In states with physician fee schedules, the share of payments at or above the fee schedule maximums is greater for out-of-network services than in-network services (Exhibit 8)

When we turn to the utilization of physician services—the mix and the number of services to treat an injury—networks are generally associated with higher utilization:

- Compared to out-of-network claims, in-network claims have:
  - More evaluation and management services per claim (Exhibit 9)
  - More physical medicine services per claim (Exhibit 9)
  - A greater share of more complex level office visits (Exhibit 10)
- For many common WC injuries, utilization is higher for in-network claims (Exhibit 11)

For drug costs, we find that in-network claims have lower costs for both opioids and for other medications (Exhibit 12).

APPENDICES

A: Price Differences by Intensity and State

In this appendix, we determine whether the proportional differences between prices paid to in-network and out-of-network doctors increases or decreases with the relative expense, which we call the "intensity" of the specific medical procedure.

Our previous comparisons between in-network and out-of-network prices are based on the empirical mix of physician services in-network and out-of-network, by category, year, and state. That mix can vary, in-network versus out-of-network, in the proportion of services that are routine and comparatively inexpensive—like low intensity office visits—and the proportion that demand more resources and are very costly—like high intensity surgeries to treat severe burns.

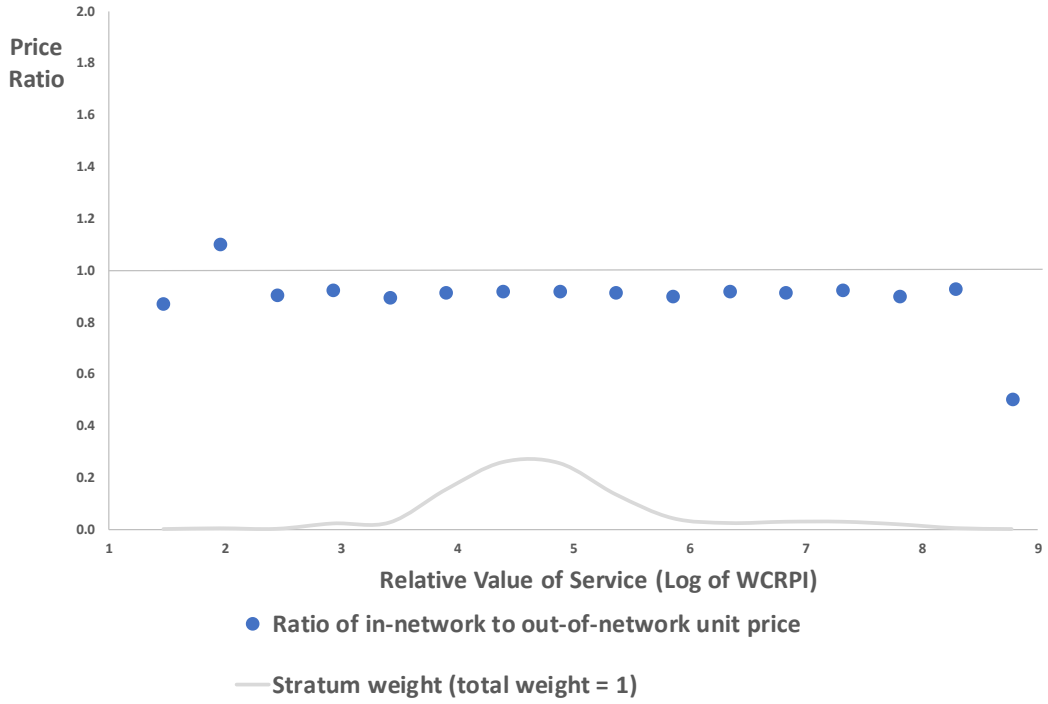
To determine whether the price differences vary with intensity, we need price comparisons that control for the intensity mix of services. To achieve this, we stratify the payment data. The stratification combines physician services in the same state and year that are of the same type and are of similar intensity. Within each stratum, physician services are identified as in-network or out-of-network. And for each stratum we determine two corresponding mean unit prices.

Each stratum becomes an observation in our comparisons. The total intensity for all the physician services in a stratum—both in-network and out-of-network—is summed and the stratum observation is assigned that amount as a frequency weight when making calculations.

This construction makes no reference to the MAR, and so we include the experience of states with no physician fee schedule. This results in about 50k strata. In making charts, we further group the strata by service intensity. We then use the in-network and out-of-network unit prices by strata to calculate a ratio of in-network payments divided by out-of-network payments for those groups. The result over all service categories is plotted in Exhibit A.1:

- The dots are located at the price ratios for all physician services by groups of strata
- The curve at the bottom plots the weight of each group (normalized to sum to 1)
- The in-network to out-of-network payment ratio is quite steady (about 0.9) over the range where the frequency weight is more concentrated (the hump in the bottom curve from about 3 to 7 along the horizontal axis)
- Payments to in-network doctors are typically lower by about 10% and that holds for services ranging from the comparatively simple and less costly to the more complex and expensive

Exhibit A.1: Ratio of In-Network to Out-of-Network Prices
By Relative Price Index

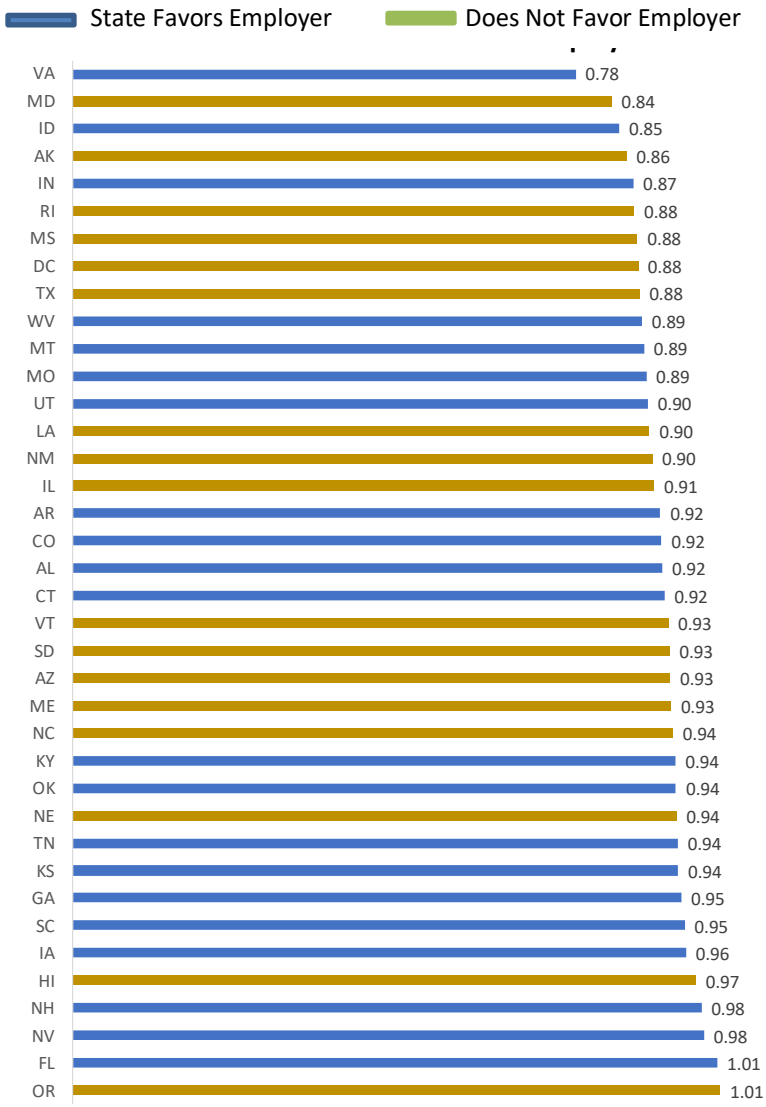


The weighted strata database is also suited for comparing in-network versus out-of-network prices within a state, after controlling for the mix of complex and simple medical services (Exhibit A.2):

- The bars plot the price ratio by state for in-network providers over out-of-network providers
- A price ratio less than one indicates comparatively lower prices in-network
- Bars are colored according to whether the state WC statute favors employer or employee choice of provider
- We find variation in the price ratio among states but no convincing evidence of a relationship with the statute's choice of provider

Exhibit A.2: Ratio of In-Network to Out-of-Network Mean Price

For States That Do and That Do Not Favor Employer Choice



The price ratio between in-network and out-of-network prices for a comparable set of physician services hovers around 0.9 for many states. Nevertheless, Exhibit A.2 shows variation among states, both over and under that ratio. For some states with a ratio away from 0.9, there is a ready explanation:

- A low physician fee schedule in Florida concentrates both in-network and out-of-network prices near the MAR and thus near each other (ratio near 1)
- A high PFS in Alaska and no schedule in Virginia[2] helps network agreements pull down prices (ratio less than 0.9)
- The Oregon statute regards the physician fee schedule amount more as the recommended price than as a MAR, concentrating both in-network and out-of-network prices at that amount and thus near each other (ratio near 1)

[2] Virginia did not have a WC physician fee schedule for WC during the period of this study; Virginia implemented a physician fee schedule on 1/1/2018.

B: Distribution of Payments as a Percentage of the MAR

Exhibit 8 shows that MPNs act to enforce physician fee schedules, inasmuch as a significantly higher share of the payments to in-network physicians are at or below the PFS MAR, compared with payments to out-of-network physicians. This appendix refines and expands on that observation by looking at the entire payment distribution.

Relating prices paid for services to the physician fee schedule maximum amounts payable (MARs) reveals a common pattern to price differences between services provided in-network and services provided out-of-network. We observe two reasons why the MAR is especially suited for this purpose:

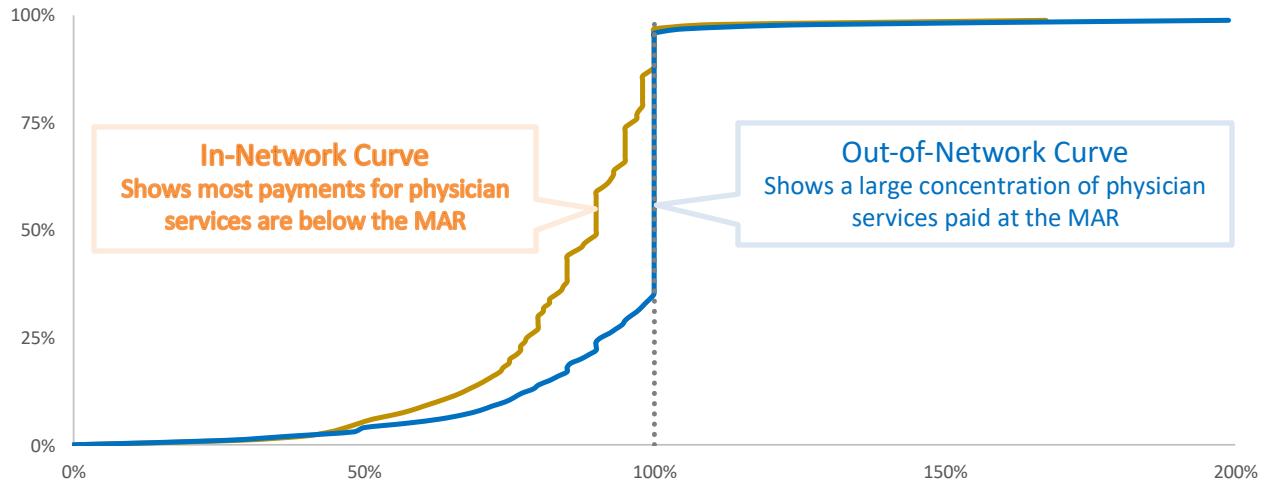
- The MAR can become a target price, especially for out-of-network care
- The MAR can provide a reference point when negotiating provider network agreements

To show how MPNs impact prices, we plot two cumulative distribution functions (CDFs) of the prices paid to physicians, one for payments to in-network doctors and the other for payments to out-of-network doctors.[3]

Prices are expressed as percentages of the physician fee schedule MAR for the specific procedure. This normalization lets us refine Exhibit 8. The CDFs for the experience of all seven physician service categories combined over the six service years from 2011 to 2016 show that (Exhibit B.1):

- The lengths of the two vertical segments over 100% show that 62% of payments to out-of-network doctors were made at the MAR while only 10% of the payments to in-network doctors were at the MAR
- About 87% of payments to in-network doctors were below the MAR, compared with only about a third of the payments for out-of-network physicians
- The vertical segments on the in-network CDF graph positioned above 95%, 90%, and 85% correspond to price departures below the fee schedule MAR of 5%, 10%, and 15%, respectively; those segments suggest that some network provider agreements reference price discounts from physician fee schedules
- For every percentile, prices for in-network physician services are at or below those for out-of-network services

Exhibit B.1: CDF of In-Network and Out-of-Network Price as a Percentage of the MAR
Service Years 2011–2016, 33 States With Physician Fee Schedules



[3] The CDF completely specifies a distribution. A point (x, y) is on its graph exactly when y is the probability that an observation is less than or equal to x. Graphs of CDFs are particularly good for showing concentrations. A concentration of probability p at amount a is represented by a segment of length p on the vertical line x = a.

When specialized to each of the seven physician service categories, the pattern is similar, with the in-network CDF typically above and to the left of the out-of-network curve and showing a smaller concentration at the MAR. We next provide the CDF plots for each, with some added commentary.

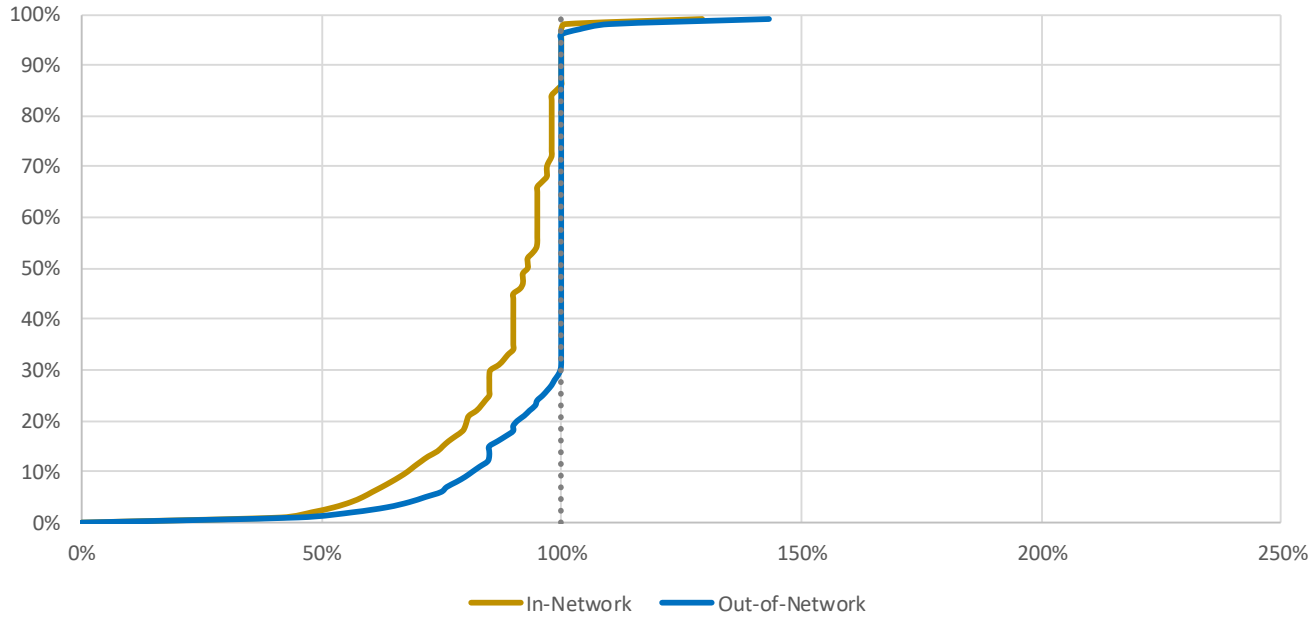
For the Evaluation and Management service category (Exhibit B.2):

- The pattern follows the general one of lower prices in-network and out-of-network payments being mostly at the MAR
- The lengths of the two vertical segments over 100% show that a very large portion, about 85%, of payments to out-of-network doctors were made at the MAR while only about 15% of the payments to in-network doctors were at the MAR
- About 85% of payments to in-network doctors were below the MAR, compared with only about 30% of the payments to out-of-network physicians
- The vertical segments on the in-network CDF graph positioned above 97.5%, 95%, 90%, and 85% correspond to price departures below the fee schedule MAR of 2.5%, 5%, 10%, and 15%, respectively

Exhibit B.2: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016

Evaluation and Management, 33 States With Physician Fee Schedules

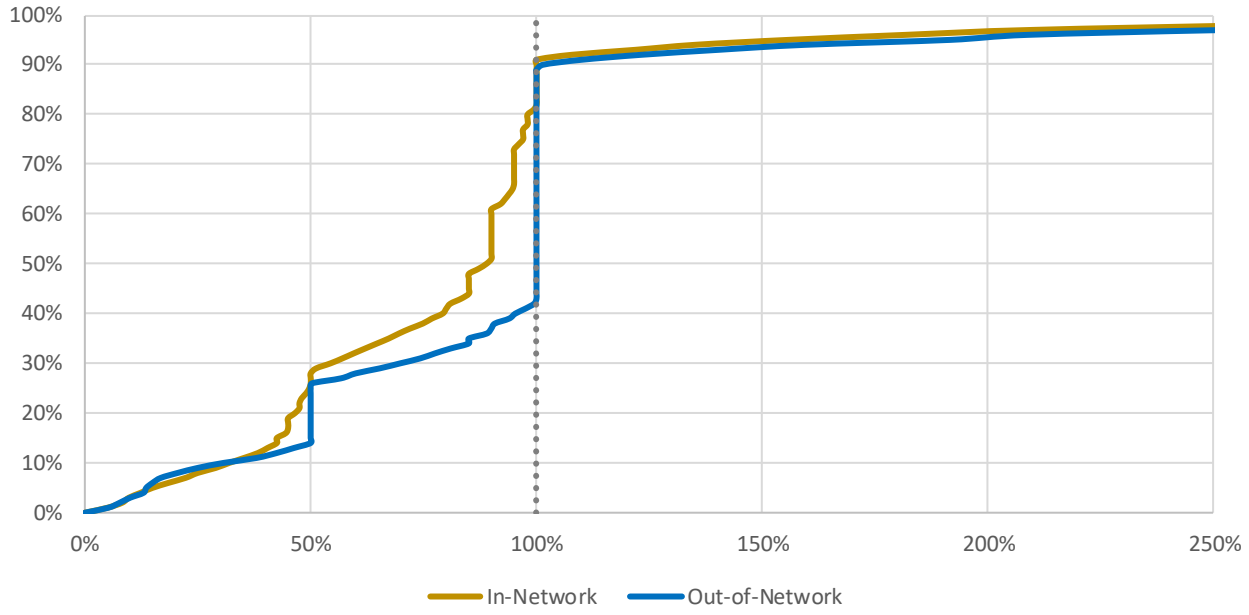


For the Major Surgery service category (Exhibit B.3):

- The pattern follows the general pattern of lower prices in-network
- The lengths of the two vertical segments over 100% show that nearly half of payments to out-of-network doctors were made at the MAR while only about 10% of the payments to in-network doctors were at the MAR
- Over 80% of payments to in-network doctors were below the MAR, compared with only about 45% of the payments to out-of-network physicians
- The vertical concentrations above 50% correspond to payments at half the MAR, which relates to a rule to compensate at half the rate when multiple surgical procedures are performed during one operation

Exhibit B.3: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Major Surgery, 33 States With Physician Fee Schedules

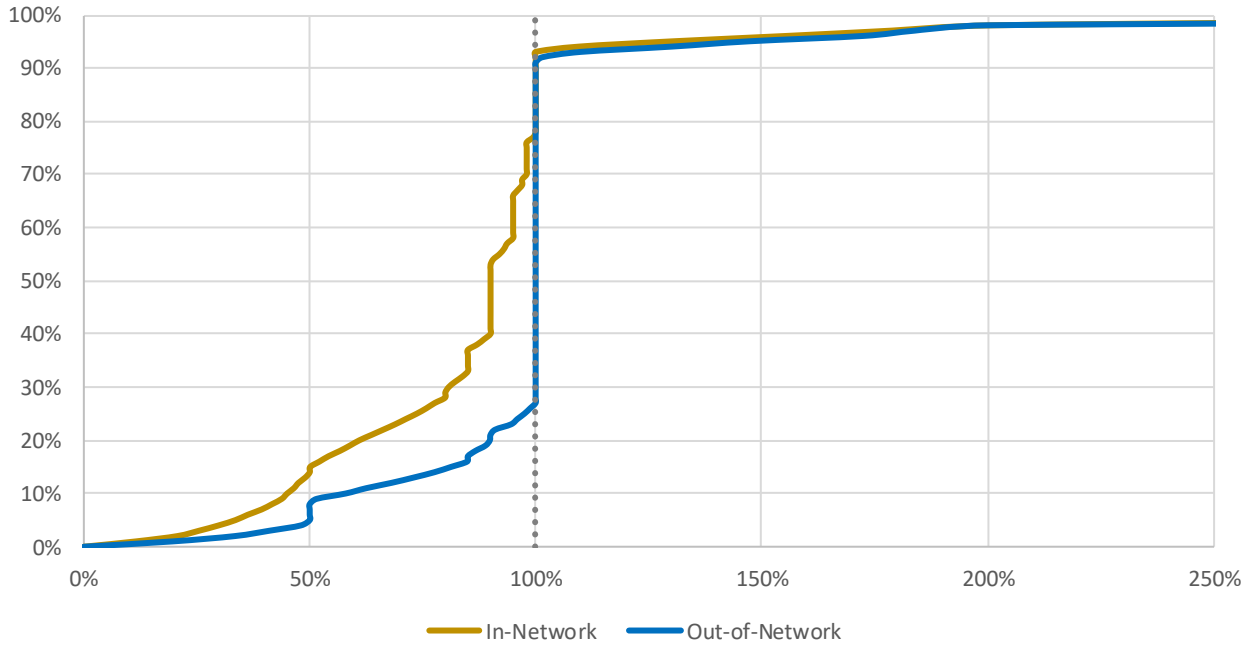


For the Minor Surgery service category (Exhibit B.4):

- The pattern follows the general pattern of lower prices in-network
- The lengths of the two vertical segments over 100% show that over 60% of payments to out-of-network doctors were made at the MAR while less than 20% of the payments to in-network doctors were at the MAR
- Over 75% of payments to in-network doctors were below the MAR, compared with less than 30% of the payments to out-of-network physicians

Exhibit B.4: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Minor Surgery, 33 States With Physician Fee Schedules

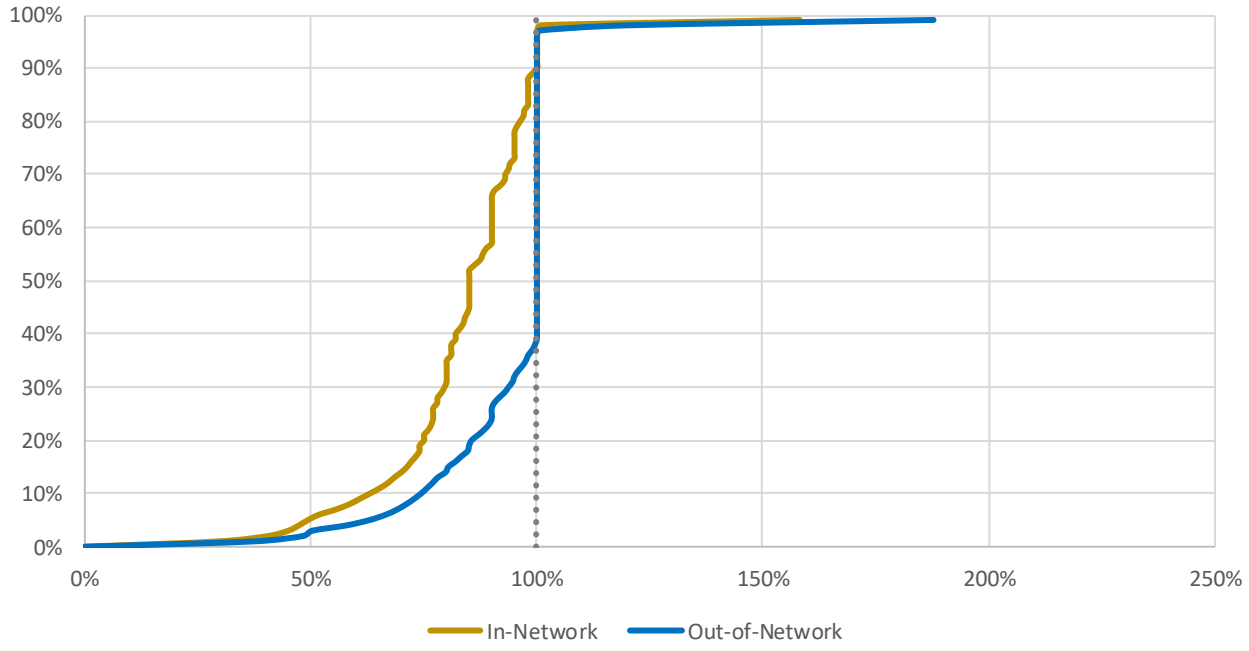


For the Physical Medicine service category (Exhibit B.5):

- The pattern follows the general pattern of lower prices in-network
- The lengths of the two vertical segments over 100% show that about 60% of payments to out-of-network doctors were made at the MAR, while less than 10% of the payments to in-network doctors were at the MAR
- About 90% of payments to in-network doctors were below the MAR, compared with less than 40% of the payments to out-of-network physicians

Exhibit B.5: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Physical Medicine, 33 States With Physician Fee Schedules

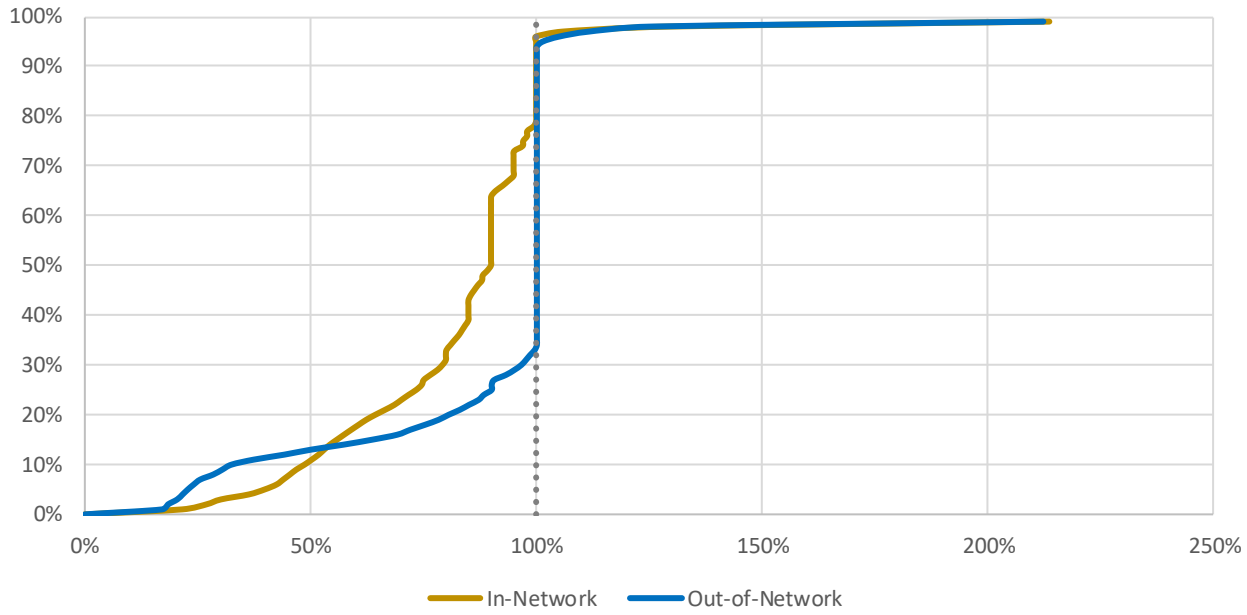


For the Complex Imaging service category (Exhibit B.6):

- Except below the 10th percentile, this pattern follows the general pattern of lower prices in-network
  - This suggests that a higher portion of out-of-network radiology billings are unbundled, billing separately for the technical and professional components
  - Partial payments show up as smaller amounts when expressed a percentage of an unbundled MAR amount
- The lengths of the two vertical segments over 100% show that over 60% of payments to out-of-network doctors were made at the MAR while less than 20% of the payments to in-network doctors were at the MAR
- Nearly 80% of payments to in-network doctors were below the MAR, compared with less than 35% of the payments to out-of-network physicians

Exhibit B.6: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Complex Imaging, 33 States With Physician Fee Schedules

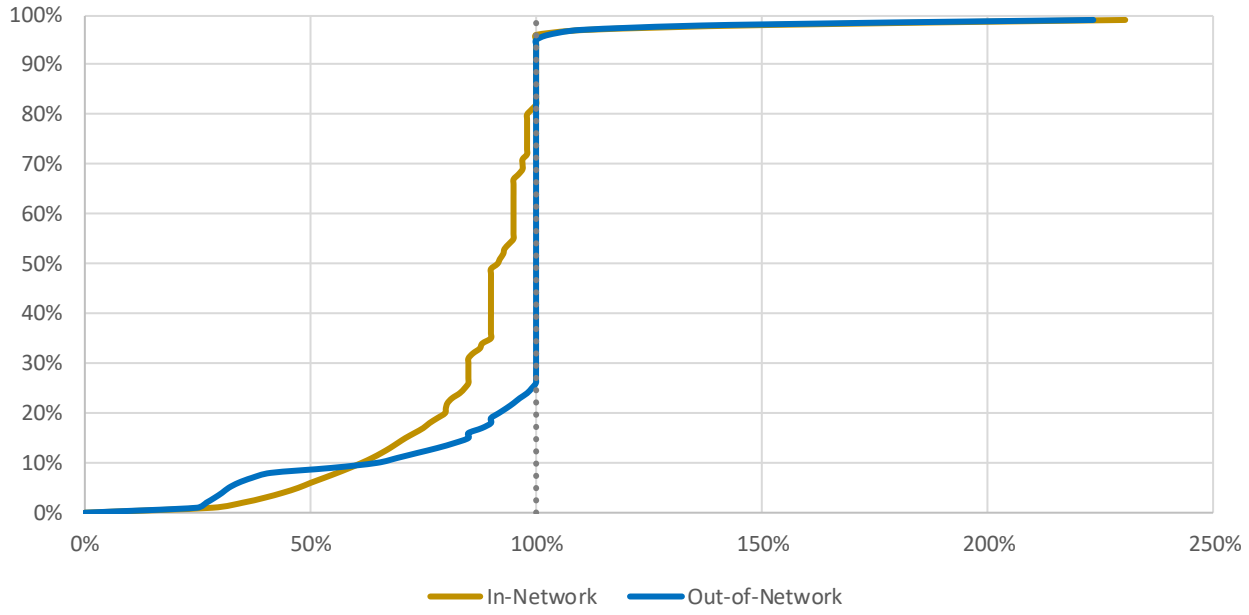


For the Simple Imaging service category (Exhibit B.7):

- Like complex imaging, this pattern follows the expected pattern of lower prices in-network, except below the 10th percentile
- The lengths of the two vertical segments over 100% show that over 60% of payments to out-of-network doctors were made at the MAR, while less than 20% of the payments to in-network doctors were at the MAR
- About 80% of payments to in-network doctors were below the MAR, compared with about 25% of the payments to out-of-network physicians

Exhibit B.7: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Simple Imaging, 33 States With Physician Fee Schedules

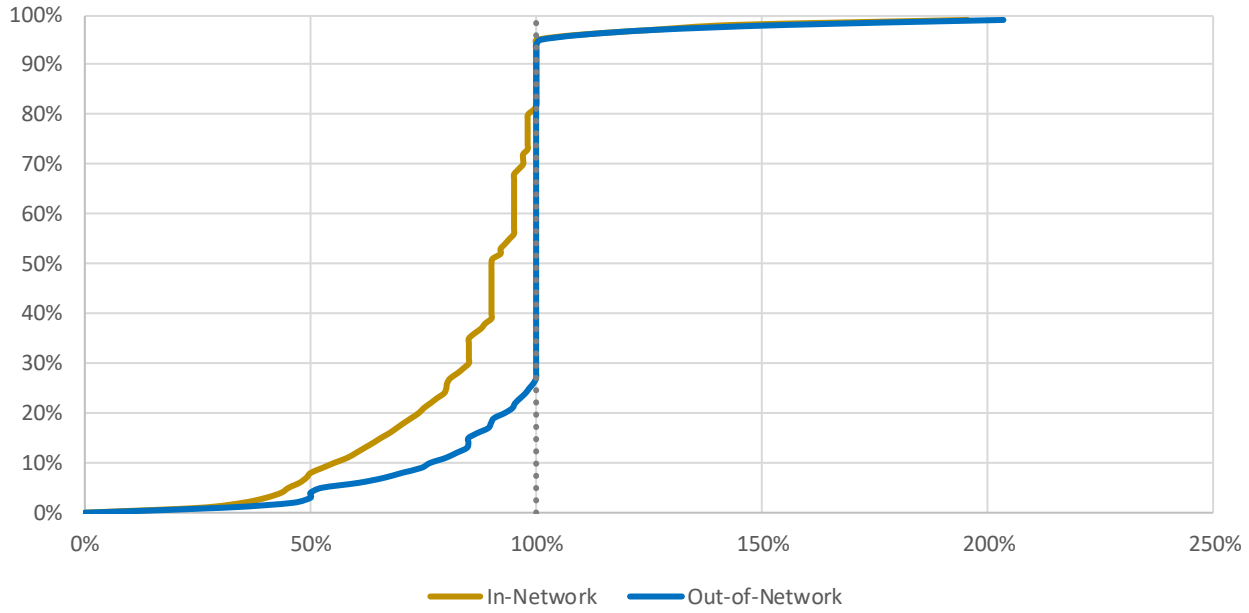


For the Other service category (Exhibit B.8):

- The pattern follows the general pattern of lower prices in-network
- The lengths of the two vertical segments over 100% show that over 60% of payments to out-of-network doctors were made at the MAR while less than 20% of the payments to in-network doctors were at the MAR
- About 80% of payments to in-network doctors were below the MAR, compared with about 25% of the payments to out-of-network physicians

Exhibit B.8: CDF of Paid as a Percentage of the Fee Schedule MAR

Service Years 2011–2016
Other, 33 States With Physician Fee Schedules



C: Controlling for Claim Mix

To account for claim mix, we construct a "market basket" of claims. Each claim in the market basket is assigned a frequency weight. Weights are assigned so that the in-network and out-of-network claim subsets have the same combined weight with respect to several main claim characteristics or controls.

To try and achieve a fair comparison of claim costs, we identify five main claim characteristics as controls:

- Claimant's Age Group at Injury (under 16, 16–25, 26–35, 36–45, 46–55, 56–65, 66–75, over 75)
- Claimant's Gender
- Accident Year
- State of Jurisdiction
- Diagnosis Group

The diagnosis group identifies medical conditions that have been found useful for comparing the utilization of medical services among states or state cohorts. An ideal comparison would also control for the actual medical severity of injuries. While we cannot achieve that ideal, simultaneously controlling for type of injury, jurisdiction, sex, and age via a weighted frequency market basket of claims makes for fairer and more meaningful comparisons of the average per claim for utilization, duration, and cost.

In constructing the market basket, we restrict to claims assigned as either in-network or out-of-network. For each combination of the controls, or "bucket," we count the number N_1 of in-network claims and the number N_2 of out-of-network claims. We require that N_1 and N_2 are both greater than one for the claims in that bucket to be included in the market basket. Within that bucket, claims are assigned frequency weights:

Each in-network claim is assigned the weight $= (N_1 + N_2)/ N_1$

Each out-of-network claim is assigned the weight $= (N_1 + N_2)/ N_2$

Both the in-network and out-of-network claims in that bucket have the same combined weighted frequency, namely $N_1 + N_2$. It follows that in-network and out-of-network claims have the same weighted claim mix for any subset of basket claims that is a union of such buckets, such as the claims from a group of states or the claims from an injury type. This construction assumes that the in-network and out-of-network empirical claims experience within each bucket is representative of the experience with that combination of the controls.

D: Table of Injury Types

Part of Body	Injury Description
Shoulder	Adhesive capsulitis Bicipital tendinitis Minor injury Rotator cuff tear SLAP lesion
Neck	Cervical spine degeneration Disc disorders Pain
Lumbar	Lumbar spine degeneration Lumbosacral disc Low back pain Sciatica
Knee	ACL or PCL tear Degenerative overuse Meniscus injury Minor injury
Hand-Wrist	Carpal tunnel syndrome Minor injury Acquired deformities Synovitis Crush injury Amputation
Elbow	Minor injury Tennis elbow
Ankle-Foot	Minor injury Plantar fasciitis Crush injury
Hip-Thigh	Minor injury

E: MPN Penetration and Utilization

This section looks at the utilization of services to treat an injury. For this, we combine all physician services on a claim. We compare utilization (determined by summing service intensities) between claims that are assigned as in-network and claims assigned as out-of-network. For that to be meaningful, the in-network and out-of-network sets of claims should share a common mix of injuries. This is achieved by using a market basket of claims in which claims are assigned frequency weights that balance in-network and out-of-network experience (Appendix D). Comparing frequency weighted means shows that in-network claims have a higher level of utilization, particularly for physician services.

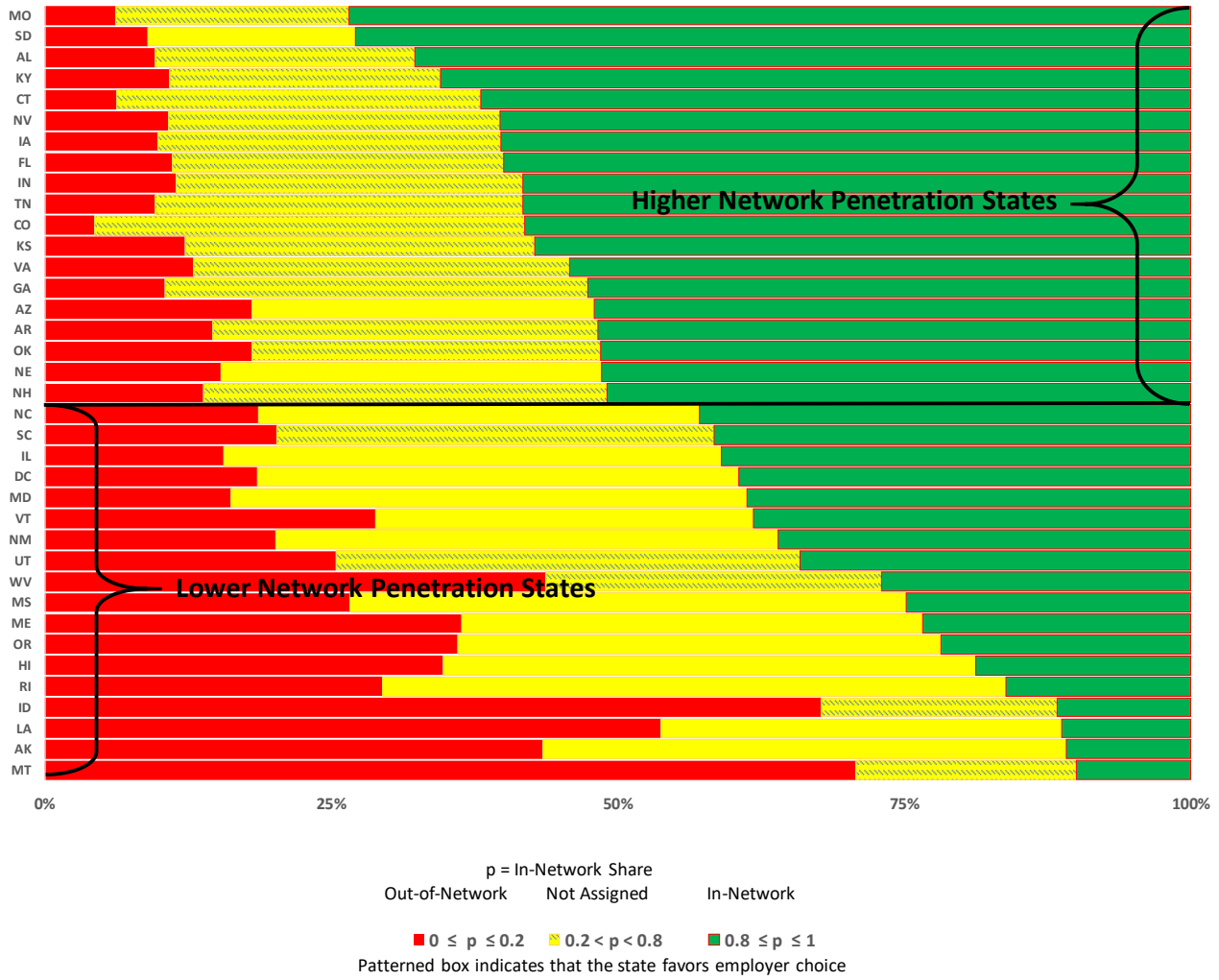
The medical providers treating a claimant need not all be in-network or all out-of-network. The proportion paid to in-network physicians provides our measure of network participation on the claim. To include a 90-day service window post-injury, we consider claims with dates of injury between January 1, 2011 and September 30, 2016. Texas experience is not reported through the MDC and is thus not included in this research.

In this study, a claim is *in-network* when 80% or more of the paid amount goes to in-network providers. A claim is *out-of-network* when 20% or less goes to in-network providers. Other claims are left unassigned. While admittedly arbitrary, we find this definition to be useful.

Organizing experience by state is key to our approach for relating utilization to MPN penetration. Exhibit E.1 shows, by state, the share of medical payments that go to in-network claims (green) and to out-of-network claims (red):

- Shares vary considerably among the states.
- States are ordered so that those with the higher in-network shares are above those with lower shares.
- That order identifies two cohorts of states, a lower network penetration group of states below a higher penetration group in Exhibit E.1.
- A pattern in the yellow unassigned box indicates that the state statute favors employer choice. While not always the case, Exhibit E.1 indicates that employer choice is associated with greater network penetration.

Exhibit E.1: Distribution of Paid Medical Costs by State
Sorted by Decreasing In-Network Share per Claim

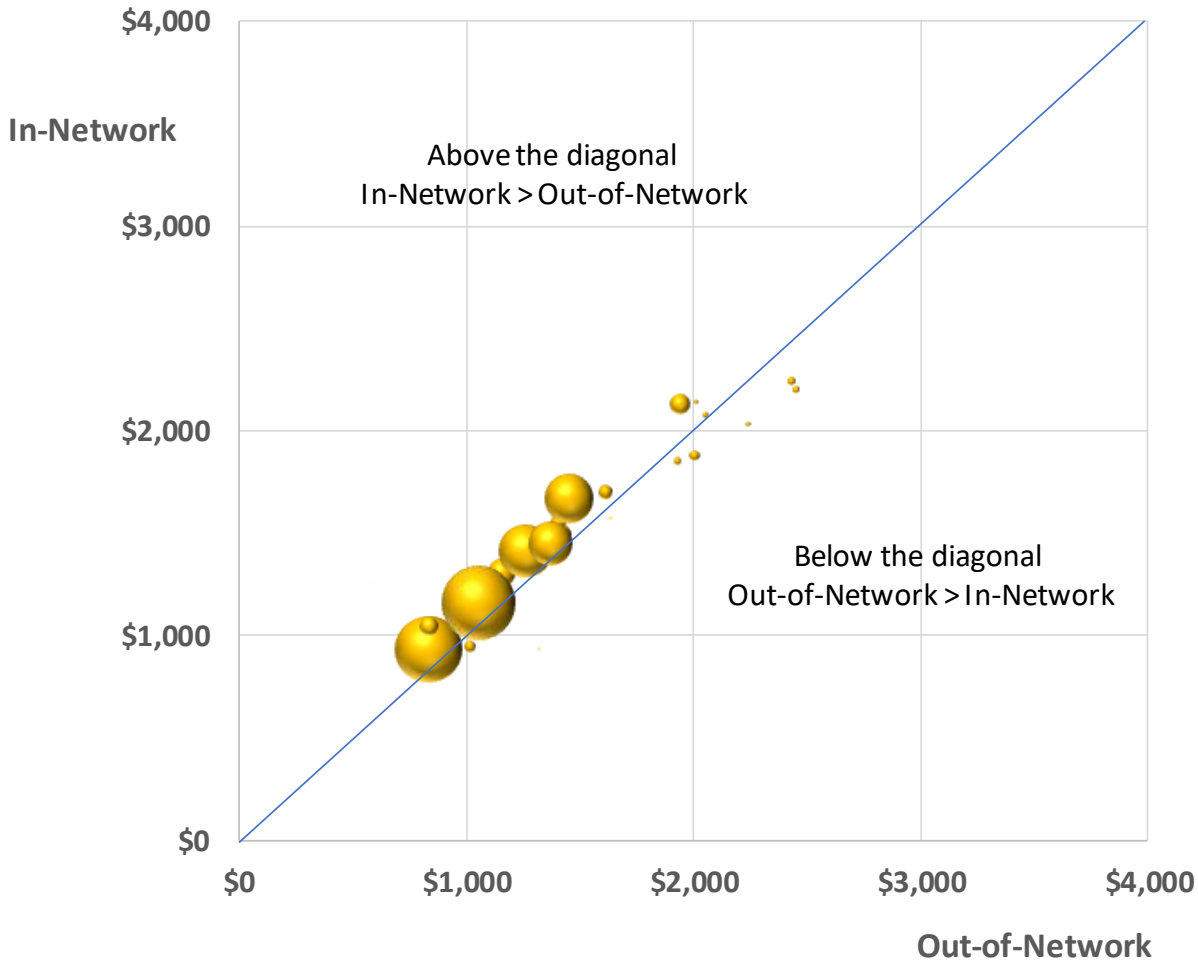


We exploit the variation by state in Exhibit E.1 to see if there is a relationship between the utilization of physician services and the level of network penetration. We use the experience of the higher (lower) level penetration states to proxy how utilization relates to a higher (lower) level of MPN penetration.

We find that higher penetration is associated with higher utilization. We illustrate this with two scatter plots. The first, Exhibit E.2, compares in-network and out-of-network mean utilization by injury type, after controlling for claim mix (other than injury type):

- Each ball reflects the experience of one injury type
- In-network mean utilization per claim is plotted along the vertical axis
- Out-of-network mean utilization is plotted along the horizontal axis
- The center of the ball is at the ordered pair of weighted means
- The size of the ball reflects the (unweighted) number of claims of that injury type
- Balls above the diagonal indicate a higher use of physician services in-network
- Larger balls above the diagonal in Exhibit E.2 shows a higher use of physician services in-network for the most common injuries (compare to Exhibit 11)

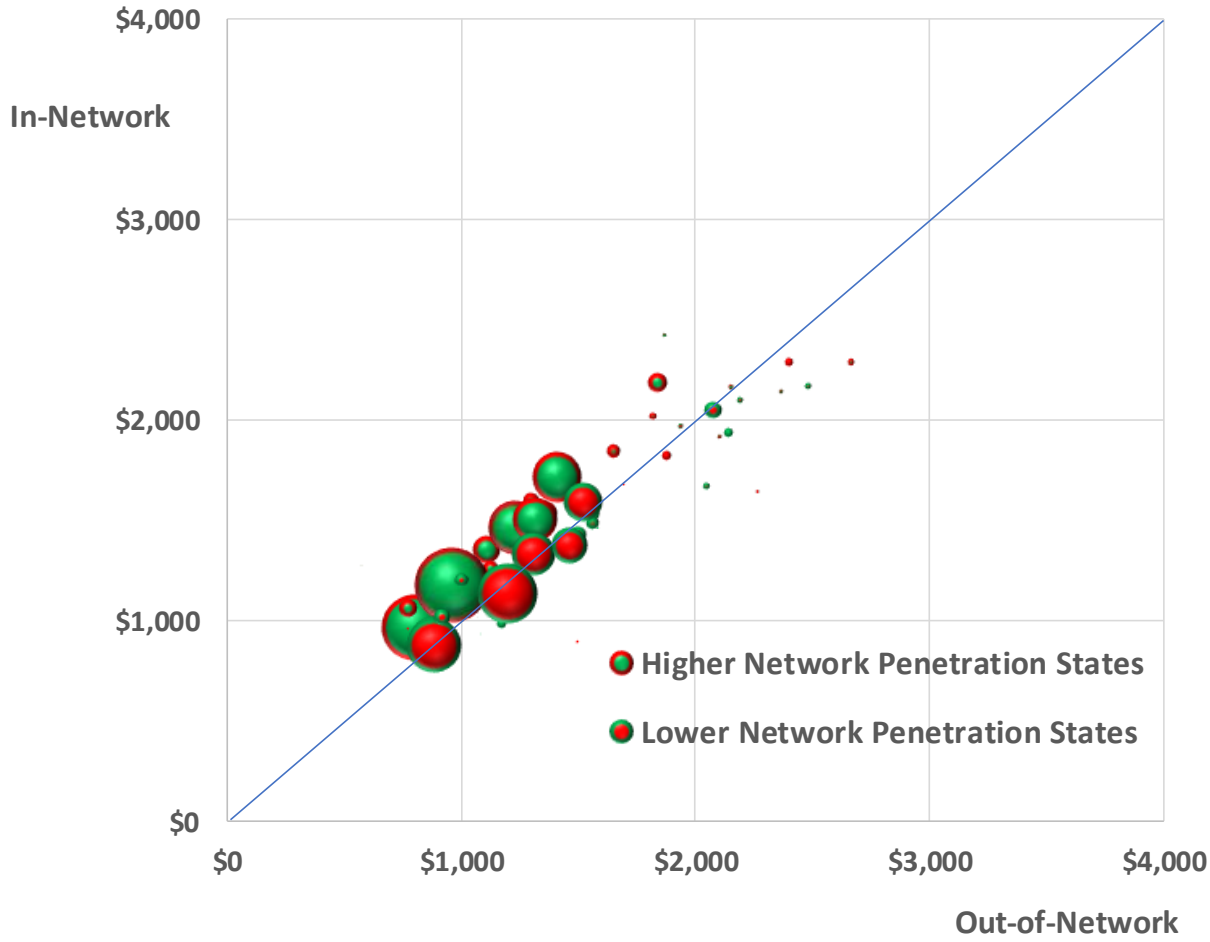
Exhibit E.2: Mean Utilization of Physician Services per Case
Each Ball Represents an Injury Type



The second scatter plot, Exhibit E.3, is similar but separates the experience according to the two state cohorts:

- As in Exhibit E.2:
  - Each ball reflects the experience of one injury type
  - In-network mean utilization per claim is plotted along the vertical axis
  - Out-of-network mean utilization is plotted along the horizontal axis
  - The center of the ball is at the ordered pair of weighted means
  - Balls above the diagonal indicate a higher use of physician services in-network
- In Exhibit E.3 there are two balls for each injury type:
  - A green ball for the higher MPN penetration states
  - A red ball for the lower MPN penetration states
  - The size of the ball reflects the (unweighted) number of claims of that injury type and state cohort
- The Higher Network Penetration state cohort has larger average utilizations for in-network claims than for out-of-network claims (green balls above the diagonal)
- By contrast, the Lower Network Penetration cohort has average utilizations for in-network claims that are like those for out-of-network claims (red balls near the diagonal)

Exhibit E.3: Mean Utilization of Physician Services per Case
Each Ball Represents an Injury and Network Penetration Cohort



The market basket of claims controls for mix within a state (and thus also within the two state cohorts) while also balancing in-network and out-of-network claim frequency. Therefore, the pattern of separation by cohort cannot be attributed to a difference in the relative frequency between in-network and out-of-network claims.

Comparing Exhibit E.3 with Exhibit E.2, the shift of the green balls up and away from the diagonal shows that a higher proportion of in-network claims in a state relates to comparatively greater utilization of services for in-network claims. In turn, this associates greater network penetration with greater utilization of services to treat in-network claims, compared with out-of-network claims.

Analogous plots associate greater network penetration with longer durations and a higher medical cost per case to treat in-network claims as compared with out-of-network claims.