The Effects of Provider Choice Policies on Workers' Compensation Costs

David Neumark and Bogdan Savych

Objective. To examine the effects of provider choice policies on workers' compensation medical and indemnity costs.

Data Sources/Study Setting. Pooled cross-sectional analysis of administrative claims records for workers with work-related injuries primarily in 2007–2010 across 25 states ($n = 4,489,729$).

Study Design. We used linear and quantile regression analyses to evaluate differences in claim costs (medical and indemnity) based on whether policies give employers or injured workers control over the choice of provider.

Principal Findings. We find no difference in average medical costs by provider choice policies, although a distributional analysis indicates higher developed medical costs for the costliest back injury cases in states where workers control provider choice. The evidence for indemnity costs is similar, although the point estimates also indicate (statistically insignificantly) higher average costs when policies give workers more control of the choice of provider.

Conclusions. Our nuanced evidence suggests that policymakers seeking to reduce workers' compensation costs may need to focus on the highest cost cases in states where policy gives workers more control over the choice of provider, rather than the simpler and broader issue of whether policy gives workers or employers more control.

Key Words. Workers' compensation, medical costs, indemnity costs, provider choice policies

Worker advocates have argued for considerable worker control over the choice of medical provider in workers' compensation cases. They argue that greater control helps ensure that workers are treated by providers who share workers' interests in full recovery after an injury and in medically appropriate return to work (Ellenberger 1992). In contrast, employer advocates argue that greater employer control of provider choice allows them to avoid doctors who provide "excessive services and treatment procedures," and to choose medical providers whose knowledge of the employer's operations can help workers achieve faster return to work (NFIB/NFUCWC n.d.).

Prior research on provider choice policies and medical costs is mixed. Some studies suggest that policies giving employers more control over provider choice are associated with lower medical payments (Victor and Fleischman 1990; Durbin and Appel 1991; WA DoL 1997), while some studies indicate the opposite (Boden and Fleischman 1989; Boden 1992; Pozzebon 1994). Using a different kind of evidence, based on a survey of workers, Neumark, Barth, and Victor (2007) studied the relationship of costs to who actually chose the provider, rather than to the provider choice policy “regime” (which influences but does not determine who chooses the provider). They found that costs were generally higher when workers selected the provider.

The jumping-off point for this study is the difference between who chose the provider (as in Neumark, Barth, and Victor 2007), and provider choice policy. The 2007 study covered only four states, making it impossible to draw any conclusions about the relationships between states’ provider choice policies and outcomes. In contrast, the data we use in the present study cover 25 states. We use claims data, which allow us to study both medical and indemnity costs.

Focusing on cost differences associated with provider choice policies, rather than who chose the provider, is critical for two reasons. First, what provider the worker chooses can be influenced by the nature of the injury, the prior relationship with the employer or a prior provider chosen by the employer, etc., which means that choice could be a marker for other factors that affect costs. As a consequence, the estimated relationships between workers’ compensation costs and who chose the provider can be uninformative about the impact of provider choice policies on costs. For example, workers with more expensive cases may end up choosing their providers because of contested issues or medical complications, in which case higher costs when workers choose the provider would not reflect cost differences attributable to policies giving workers more control of provider choice. Second, the statutes governing provider choice are most directly subject to influence by policymakers.

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Our focus on costs is potentially limiting. There are other goals of workers' compensation—such as return to preinjury employment, physical recovery, postinjury earnings, and income maintenance during work-related disability. Ideally, we need a fuller picture of how provider choice policies influence all of these outcomes. And this perspective would have to account for the possibility that higher costs can be associated with better outcomes for workers, as reflected, for example, in the fact that higher indemnity costs to employers (and the workers' compensation system more generally) are also higher indemnity benefit payments to workers.

PROVIDER CHOICE POLICY

After an injury, a worker may be treated by multiple medical providers in various settings, such as an occupational health clinic, an emergency room, or a doctor's office. Our focus is on the policies that define the choice of the treating provider. Provider choice policies vary across states in terms of who controls the initial choice of the treating provider, and the ability of workers and employers to change providers subsequently and hence, effectively, to choose their treating provider. We therefore characterize state provider choice policies using information on both dimensions of the degree to which employers or workers control the choice of the provider (Table 1), based on the following two-way classification:

- Employer choice of provider or control of a panel of providers, with very restricted options for workers to change provider.
- Worker choice or considerable ability of workers to change providers.

Although this classification combines elements of who controls the choice of the initial provider, and the ability to change provider, its parsimonious division of states captures the key policy difference. In addition, it affords more reliable estimation of the differences in costs associated with different provider choice policies than if we used more, and smaller, groups of states based on additional features of provider choice policies.¹

Provider choice policies did not change in our study states over the 2007–2010 time period covered by our data.² Many changes to provider choice laws occurred in the 1980s and 1990s—a period of rising workers' compensation costs (Victor et al. 2005)—when states implemented rules that required workers to select providers from within approved networks of providers that were established by employers.

Table 1: Study States by Provider Choice Policy Group, Two-Way Classification, 2007–2010

<i>Group of States</i>	<i>States</i>
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider	Alabama, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Missouri, Nevada, New Jersey, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia
States with worker choice or workers have considerable ability to change provider	Arizona, Delaware, Illinois, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, New York, Wisconsin

Notes: Two states made changes in provider choice regulations a short time prior to our analysis window and, thus, are not included in this classification. Texas introduced network regulations effective January 2006. California allowed creation of medical networks effective January 2005. Two states made changes in provider choice regulations after our analysis window. Michigan expanded employer control of provider choice from 10 to 28 days in 2011. Illinois introduced a preferred provider program for selecting treating physicians in 2011 (the final rules were adopted in March 2013).

DATA

Workers' Compensation Claims

Data on workers' compensation claims come from the Workers Compensation Research Institute Detailed Benchmark/Evaluation (DBE) database, which contains over 41 million claims with data from a majority of states. These data come from claims payors—insurers, state funds, and self-insured employers. We extracted information about the worker, employer, injury, and costs of each case. We use measures of indemnity benefits and medical payments per claim, which in the DBE database are standardized across payors and states. We focus on workers' compensation claims for injuries between October 2006 and September 2010 with an average of 36 months maturity—a sample of over 4,000,000 claims.³

We study incurred and developed medical and indemnity costs. Incurred costs include anything that was paid out plus reserves that are allocated to the claim, reflecting what was paid out within an average 36 months of maturity plus expert judgment from adjustors on each specific claim. Developed costs add additional actuarial modeling and are, in principle, the best estimate of ultimate costs. We believe that developed costs are the most meaningful from a policy perspective, but the potential inaccuracy relative to actual “final” costs also means that they are not definitive.

Other Workers' Compensation Policies

We control for other central features of state workers' compensation systems that might affect medical or indemnity costs. Because provider choice policies do not vary within states over the years covered in our analysis, we cannot include state fixed effects to control for other (fixed) dimensions of state workers' compensation policies. We capture generosity of benefits by controlling for individual replacement rates and whether states use a wage loss approach for compensating permanently disabling injuries, and account for waiting and retroactive periods. We also capture policies shaping medical prices and medical care utilization by controlling for fee schedules as a percent of Medicare rates, and indicator variables for whether the state regulates payments to medical providers using a fee schedule, and whether the state mandates the use of treatment guidelines or requires utilization review.⁴

These other workers' compensation policies do not cover all differences across states. Given the limited number of states, we chose a somewhat parsimonious set of controls for other policies—those that were most likely to be significant determinants of the medical and indemnity costs we study and hence most important to include in order to isolate the effects of provider choice policies on costs.

Other Controls

We also control for other characteristics of workers and employers that can affect workers' compensation costs. The worker controls we include—based on what is available in the DBE database—are age, gender, marital status, job tenure at the time of injury, and wages. Workplace characteristics include firm size and a breakdown of industries and occupations based on injury risk.⁵ Characteristics of the local labor market may also affect return to work and, hence, indemnity costs, so we control for the county unemployment rate and residence in a micropolitan or metropolitan area.

We also expect medical and indemnity costs to depend on the characteristics of the injury. We therefore include indicator variables for injury type, based on the ICD-9 diagnostic codes assigned by the providers, including: neurologic spine pain (e.g., disks, peripheral neuropathy); back and neck sprains, strains and nonspecific pain; fractures; lacerations and contusions; inflammations; other (nonback) sprains and strains; upper extremity neurologic pain (carpal tunnel); and a residual category of other injuries.

We exclude potential controls that may be informative about injury severity—whether there was an overnight hospitalization, and whether the treatment included major surgery. These are potentially problematic because they can also be affected by who chose the provider, which is in turn influenced by policy. The risk then is that these types of variables could “over-control” for injury severity, capturing not only remaining variation in severity but also outcomes of provider choice policies that are more appropriately thought of as effects of these policies.⁶

EMPIRICAL METHODS

For both medical and indemnity costs, we estimate linear models for cost outcome Y_{ist} where “ i ” indexes individuals, “ s ” states, and “ t ” injury year:

$$Y_{ist} = \alpha + \text{PCP}_{is}\beta + \text{POL}_{ist}\gamma + X_{ist}\delta + D_t\lambda + \varepsilon_{ist}. \quad (1)$$

States where policy gives employers control over provider choice are the reference category, and PCP is a dummy variable for states where policy gives workers control. POL is a vector of other workers’ compensation policies. X includes the worker, employer, and injury characteristics. D_t is a vector of injury year dummy variables, to control for changes over time in workers’ compensation costs that are common across states. Because there is no within-state variation in the provider choice policies (PCP), we do not include state dummy variables; hence, the equation does not include fixed state effects; the policy controls in POL, plus state composition differences in X , capture state differences. Because provider choice policies vary at the state level, standard errors are clustered at the state level.

We begin with ordinary least squares (OLS) linear regressions for medical and indemnity costs. We report results for the natural logarithm of costs to avoid sensitivity to outliers. With this specification, the regression coefficients measure *semielasticities*—that is, the percentage change in the outcome for a one-unit change in the independent variables (most importantly, differences in which provider choice policy prevails).

We also use quantile regressions, focusing in particular on whether provider choice policies matter more in the upper tails of the distributions (at the 90th, 95th, and 99th percentiles) where treatment might be more extensive, costs might be high because of responses to incentives under different provider choice policies, etc. Suppose, for example, that policies giving workers greater control of provider choice created opportunities for injured workers to

shop for a provider that would let them stay out of work longer. Alternatively, suppose that policies giving employers more control of provider choice enabled employers to shop for providers that do more to limit the amount of time workers stay out of work to recover from their injuries. If this is mainly an issue for costlier cases with considerable subjectivity in diagnosis, like back injuries (or other expensive cases that can arise from other injuries), the 95th percentile regression *without* conditioning on type of injury might be of most interest. If, instead, worker choice drives up costs for the costlier cases *relative to that injury*, then the 95th percentile regression *conditional on* injury type is most informative. Given these possibilities, we report two sets of estimates: estimates that do not condition on injury type and separate models on subsamples of injury types (which fully condition on injury type).

Caution is needed in interpreting our estimates as causal. The effects of provider choice policies are identified from cross-state policy variation, rather than, for example, quasi-experimental evidence from a longitudinal analysis in which some states change their policies. There are, however, reasons why a causal interpretation may be plausible.

First, we include detailed control variables, including key workers' compensation policies that should affect medical and indemnity costs, and which usually have the expected effects. Second, we verified that the results did not change when we included other potentially important state characteristics. For example, the more general political stance of a state may influence how generous policies are toward workers, and this may influence workers' compensation costs via channels other than our controls. But including a control for "red" versus "blue" states based on the 2008 Presidential election (which occurred during our sample period) did not affect the results materially. Third, the biggest threat to a causal interpretation is that provider choice policies are endogenously determined. However, in this case longitudinal data on states that change policies do not necessarily provide better causal evidence. For example, suppose policies granting employers more control of the choice of provider are adopted in high-cost states to help rein in costs. If policy implementation and hence impacts evolve slowly, then we might find spurious evidence that policies giving employers more control of provider choice raise workers' compensation costs because of where this policy was adopted. But our data cover a period of time during which provider choice policies have been in place for a long time, so if policies giving employers more control of provider choice are still associated with higher costs, a more plausible interpretation is that restricting worker choice does not in fact lower costs. For the same reason, we omit two states, California and Texas, which adopted policy changes—restricting choice to

networks—just prior to our sample period.⁷ Given that these recent reforms could generate biases from endogenous policy change, including these states in our analysis could generate variation between provider choice policies and costs that reflect the *drivers* of policies rather than the *effects* of those policies.⁸

EVIDENCE ON THE EFFECTS OF PROVIDER CHOICE POLICIES

Multivariate OLS Estimates

We begin with multivariate OLS estimates of models for medical costs and indemnity costs, which hold constant characteristics of workers, employers, injuries, and workers' compensation systems. Table 2, Panel A reports results for the differences in medical costs, both incurred and developed. These estimates tell a consistent story—there is essentially no difference in average costs between the states where provider choice policies give workers the most control over the choice of provider, relative to the reference category of states where employers have the most control. The estimate is 1.6 percent lower incurred medical costs and 0.5 percent lower developed medical costs in states where policies give workers more control of provider choice. These estimates are not statistically significant at the 10 percent level, which is not surprising given their very small magnitudes. Note that these estimates differ a bit from the simple comparisons of averages across states based on their provider choice policies, where costs were slightly higher in states where policies give workers more control of the choice of provider. The difference is not surprising, however, because we have added controls for other aspects of workers' compensation policies and for injury, worker, and firm characteristics.⁹

For indemnity costs, the point estimates in Panel B of Table 2 suggest higher costs in states where policies give workers more control over provider choice. For both incurred and developed indemnity costs, the estimates indicate that costs are higher by about 20 percent in these states compared with the most restrictive employer choice states.¹⁰ However, these estimated cost differentials are not statistically significant.

Quantile Regression Estimates

We now turn to evidence from quantile regressions that tell us whether provider choice policies shift costs in the upper tails of the distributions of costs,

Table 2: The Effects of Provider Choice Policies on Incurred and Developed Medical Costs and Indemnity Costs, Injury Years 2007–2010, Estimates from OLS, Semielasticities

<i>(A) Medical Costs</i>	<i>Incurred Medical Costs</i>	<i>Developed Medical Costs</i>
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	−1.6 (4.7)	−0.5 (4.8)
<i>(B) Indemnity Costs</i>	<i>Incurred Indemnity Costs</i>	<i>Developed Indemnity Costs</i>
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	19.2 (18.3)	20.6 (18.8)

Notes: Estimates are from OLS regressions relative to the base category of states with employer choice of provider or employer control of panel, with very restricted options for workers to change provider. Full set of estimates of regression coefficients is available from authors. Since indemnity costs are zero for cases with medical-only benefits, we increase indemnity measures by \$1 before taking the natural logarithm to avoid dropping medical-only cases from the analysis. (Results were nearly identical using the inverse hyperbolic sine (Andersson et al. 2016) instead of logs.) Standard errors are in parentheses. Standard errors are estimated allowing for intrastate cluster correlation. ***Statistically significant at 1% level, **statistically significant at 5% level, * statistically significant at 10% level. $N = 4,489,729$ for developed indemnity costs and 4,489,771 for developed medical costs.

without necessarily generating broader shifts in average costs (reflected in the conventional OLS regressions). Our estimates for the 90th, 95th, and 99th percentiles can be approximately interpreted as the differences in costs associated with different provider choice policies for the most expensive cases—those delineating the top 10 percent, top 5 percent, and top 1 percent costliest cases.

Table 3, Panel A presents results for medical costs for specifications that do not condition on type of injury, which are more informative about whether provider choice policies shift costs for higher-cost injuries or for lower-cost injuries. Later, we present results broken out by injury category, which tell us more about whether provider choice policies shift costs in the tails of the

distributions of costs and whether those injuries tend to be higher- or lower-cost injuries.

Recall from Table 2, Panel A that in the OLS regressions, the estimated differences in incurred and developed medical costs between the two sets of states classified by worker control over the choice of provider were close to zero (and statistically insignificant). The quantile regression estimates are more indicative of higher costs in states where policies give workers more control of provider choice. For incurred medical costs, the differences range from 4.7 to 8.0 percent, and for developed medical costs, they range from 10.9 to 14.7 percent. However, none of these estimated differentials are statistically significant.

The estimates for the same specifications and samples, but for indemnity instead of medical costs, are reported in Table 3, Panel B. Recall the evidence from Table 2, Panel B that showed higher costs in states where policies give workers more control of the choice of provider, although the differences were not statistically significant. The estimated differences in Panel B of Table 3 are actually smaller than those in Panel B of Table 2, with the exception of developed indemnity costs at the 99th percentile, although the point estimate is not a great deal larger than the average difference (27.9 versus 20.6). However, the point estimate for higher developed indemnity costs in the upper tail (the 99th percentile) is statistically significant at the 10 percent level, providing statistical evidence that the highest cost cases are more expensive in states where policies give workers more control over provider choice.

Overall, looking at the upper tails of the cost distributions, there is still little or no evidence that medical costs are higher in states where policies give workers more control of the choice of provider. But for indemnity costs, we find some evidence of higher costs among the most expensive cases in states where policies give workers more control over provider choice.¹¹

Costs vary considerably across different types of injuries, and there may be more scope for provider choice policies to matter more for the higher-cost injuries, perhaps because of the greater complexity of treatment and subjectivity about workers' readiness to return to work. Table 4 documents this variation in costs by injury group. For example, average developed medical costs per claim ranged from a low of \$1,787 for lacerations and contusions to a high of \$13,154 for fractures. These two types of injuries also had the lowest and highest averages for incurred medical costs. For indemnity costs, lacerations and contusions also had the lowest costs, while costs were highest for upper extremity neurologic pain (carpal tunnel), driven primarily by a higher percentage of claims with more than seven days of lost time.

Table 3: Coefficient Estimates from Quantile Regressions for Incurred and Developed Medical Costs and Indemnity Costs, Injury Years 2007–2010

<i>(A) Medical Costs</i>	<i>Incurred Medical Costs</i>	<i>Developed Medical Costs</i>
90th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	8.0 (10.6)	11.4 (11.9)
95th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	8.0 (11.2)	14.7 (12.9)
99th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	4.7 (10.5)	10.9 (12.4)
<i>(B) Indemnity Costs</i>	<i>Incurred Indemnity Costs</i>	<i>Developed Indemnity Costs</i>
90th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	8.0 (30.0)	13.4 (32.6)

continued

Table 3. *Continued*

<i>(B) Indemnity Costs</i>	<i>Incurred Indemnity Costs</i>	<i>Developed Indemnity Costs</i>
95th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	−3.4 (24.3)	5.8 (26.7)
99th percentile		
States with employer choice of provider or employer control of panel, with very restricted options for workers to change provider [base]		
States with worker choice or workers have considerable ability to change provider	12.4 (12.7)	27.9* (16.0)

Notes: See notes to Table 2. Estimates are from quantile regressions relative to the base category of states with employer choice of provider or employer control of panel, with very restricted options for workers to change provider. Full set of estimates is available from authors upon request. Standard errors are in parentheses. Standard errors are estimated allowing for intracluster correlation as in Parente and Santos Silva (2013), using *qreg2* estimation in Stata with state-level clustering (Machado, Parente, and Santos Silva 2013). *** Statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level. *N* = 4,489,729 for developed indemnity costs and 4,489,771 for developed medical costs.

We, therefore, next report estimates of specifications like those discussed in Table 3, but for subsamples grouped by the injury categories in Table 4. Beginning with medical costs in Table 5, Panel A, for each of the two cost measures and each injury type, we first report the OLS regression estimates that correspond to those reported in Table 2, Panel A, and we then report the quantile regression estimates that correspond to those in Table 3, Panel A.

Looking at the OLS estimates, for all injury types but one (back and neck sprains, etc.), the point estimates suggest slightly lower incurred or developed medical costs in states where provider choice policies give workers more control of the choice of provider. The estimated differentials are often close to zero, and none are statistically significant.

Looking at the upper tails of the cost distributions for each injury (the 90th, 95th, and 99th percentile regressions), the estimates for incurred medical costs are not very different. Most of the estimates are still negative, consistent with lower costs in states where policies give workers more control of

Table 4: Average Indemnity and Medical Payments at 36 Months of Maturity, Injury Years 2007–2010, by Injury Group

<i>Injury Group</i>	<i>Incurred Medical Costs</i>	<i>Developed Medical Costs</i>	<i>Incurred Indemnity Costs</i>	<i>Developed Indemnity Costs</i>	<i>% Open Claims</i>	<i>% of Claims with More Than 7 Days of Lost Time</i>
Fractures	\$10,716	\$13,154	\$8,495	\$9,782	7%	50%
Standard deviation of state means	2,227	3,179	2,943	3,663	0.0255	0.0575
<i>N</i>	199,336	199,331	199,336	199,331	199,331	199,336
Lacerations and contusions	\$1,534	\$1,787	\$771	\$886	1%	8%
Standard deviation of state means	365	614	357	456	0.0064	0.0251
<i>N</i>	1,371,205	1,371,172	1,371,197	1,371,164	1,371,172	1,371,205
Back and neck sprains, strains, nonspecific pain, or neurologic spine pain	\$7,989	\$10,966	\$9,170	\$11,247	9%	29%
Standard deviation of state means	3,397	6,485	4,481	6,359	0.0486	0.0784
<i>N</i>	819,785	819,730	819,774	819,719	819,730	819,785
Other (nonback) sprains and strains	\$4,219	\$5,074	\$4,343	\$5,044	5%	24%
Standard deviation of state means	1,248	1,700	2,063	2,583	0.0213	0.0508
<i>N</i>	959,551	959,526	959,541	959,516	959,526	959,551
Inflamations	\$10,190	\$13,017	\$11,163	\$13,325	12%	39%
Standard deviation of state means	2,868	4,461	5,524	7,055	0.0494	0.0736
<i>N</i>	210,881	210,875	210,881	210,875	210,875	210,881
Upper extremity neurologic (carpal tunnel)	\$8,795	\$10,840	\$11,934	\$13,920	15%	59%
Standard deviation of state means	2,382	4,179	6,127	7,673	0.0675	0.0987
<i>N</i>	45,001	45,001	45,000	45,000	45,001	45,001
Other injuries	\$6,867	\$9,058	\$4,742	\$5,699	5%	21%
Standard deviation of state means	1,639	2,619	2,046	2,727	0.0204	0.0455
<i>N</i>	999,418	999,388	999,403	999,373	999,388	999,418

Table 5: Coefficient Estimates from OLS and Quantile Regressions for Incurred and Developed Medical Costs at 36 Months of Maturity, Injury Years 2007–2010, All Claims, by Injury Group

<i>Injury Group</i>	<i>Incurred Medical Costs</i>				<i>Developed Medical Costs</i>			
	<i>Quantile Regression</i>				<i>Quantile Regression</i>			
	<i>OLS</i>	<i>90th Percentile</i>	<i>95th Percentile</i>	<i>99th Percentile</i>	<i>OLS</i>	<i>90th Percentile</i>	<i>95th Percentile</i>	<i>99th Percentile</i>
Fractures	−8.8 (5.1)	−9.8 (6.5)	−7.3 (6.3)	−12.6* (7.2)	−8.0 (4.9)	−8.1 (6.5)	−3.8 (7.6)	−7.1 (8.6)
Back and neck sprains, strains, and nonspecific pain, or neurologic spine pain	10.6 (7.9)	23.8 (14.6)	15.3 (13.3)	4.9 (10.5)	13.1 (8.6)	32.6* (17.2)	23.5 (15.4)	12.0 (11.5)
Lacerations and contusions	−8.8 (5.3)	−15.7** (6.2)	−10.6 (7.2)	−5.3 (10.7)	−8.8 (5.2)	−15.7** (6.1)	−10.3 (7.4)	−2.8 (12.2)
Other sprains and strains	−1.4 (4.8)	9.4 (7.7)	10.4 (8.4)	6.7 (9.1)	−0.5 (4.6)	12.6 (7.9)	15.8 (10.0)	14.8 (10.2)
Inflammations	−3.9 (6.0)	−4.7 (9.3)	−3.1 (10.3)	−0.9 (8.5)	−2.2 (6.0)	1.7 (11.2)	4.8 (11.5)	4.9 (9.7)
Upper extremity neurologic (carpal tunnel)	−7.6 (6.5)	−2.6 (7.1)	−0.1 (6.2)	−3.4 (9.2)	−4.4 (7.2)	4.0 (12.0)	5.7 (10.0)	1.3 (11.6)
Other injuries	−2.1 (5.3)	−3.7 (9.7)	−5.1 (10.5)	−7.5 (9.2)	−1.3 (5.3)	−1.0 (10.5)	−1.1 (11.6)	−2.6 (11.5)

continued

Table 5. Continued

Injury Group	Incurred Indemnity Costs				Developed Indemnity Costs			
	Quantile Regression				Quantile Regression			
	OLS	90th Percentile	95th Percentile	99th Percentile	OLS	90th Percentile	95th Percentile	99th Percentile
Fractures	11.3 (24.7)	-20.5 (15.3)	-13.2 (12.2)	1.0 (7.3)	12.7 (25.3)	-16.2 (16.7)	-5.3 (14.3)	14.8 (10.2)
Back and neck sprains, strains, and nonspecific pain, or neurologic spine pain	43.2 (26.6)	4.3 (29.4)	13.0 (19.0)	15.4 (9.4)	46.1 (27.5)	16.6 (32.8)	29.4 (22.6)	31.1** (13.0)
Lacerations and contusions	5.7 (9.9)	17.3 (27.3)	-2.4 (22.2)	-24.6 (22.3)	5.9 (10.1)	17.6 (27.5)	-1.7 (22.9)	-20.4 (23.3)
Other sprains and strains	29.8 (18.0)	9.3 (25.2)	0.3 (19.6)	10.1 (12.9)	30.9 (18.4)	13.9 (27.2)	6.9 (22.3)	24.7 (16.7)
Inflammations	2.5 (25.5)	-13.5 (20.1)	-2.6 (16.2)	6.0 (11.1)	5.2 (26.4)	-4.0 (22.8)	9.1 (18.9)	20.2 (14.8)
Upper extremity neurologic (carpal tunnel)	-24.9 (41.6)	-23.0 (26.9)	-8.7 (19.4)	7.3 (17.4)	-20.4 (42.5)	-9.7 (28.8)	8.8 (25.7)	30.1 (18.5)
Other injuries	11.8 (17.8)	-5.2 (29.9)	-14.1 (22.1)	-0.9 (11.6)	12.9 (18.3)	-0.8 (31.2)	-7.0 (25.8)	11.9 (16.7)

Notes: See notes to Table 2. Estimates are from quantile regressions relative to the base category of states with employer choice of provider or employer control of panel, with very restricted options for workers to change provider. Full set of estimates is available from authors upon request. Standard errors are in parentheses. Standard errors are estimated allowing for intraclass correlation as in Parente and Santos Silva (2013), using qreg2 estimation in Stata with state-level clustering (Machado, Parente, and Santos Silva 2013). *** Statistically significant at 1% level. ** statistically significant at 5% level, * statistically significant at 10% level. Sample size for the regressions was at least 195,850 cases with fractures, 803,618 cases with back and neck sprains, strains, and nonspecific pain, or neurologic spine pain, 1,329,304 cases with lacerations and contusions, 936,864 cases with other sprains and strains, 208,355 cases with inflammations, 44,777 cases with upper extremity neurologic (carpal tunnel), and 970,961 cases with other injuries.

provider choice, although the estimates become positive for other sprains and strains. There is one injury type—lacerations and contusions—for which there is evidence of significantly lower medical costs in states where policies give workers more control over the choice of provider (by 15.7 percent, for both incurred and developed costs, at the 90th percentile). For developed medical costs, in contrast, many more estimates are positive, consistent with higher medical costs. In particular, there are some rather large estimated cost differences for back and neck sprains, strains, and nonspecific pain, or neurologic spine pain, especially at the 90th percentile—where the positive estimate of about a 33 percent differential is statistically significant, although the estimates at the 95th and 99th percentiles are smaller and not statistically significant. For the most part, though, there is no strong evidence of higher medical costs in states where policies give workers more control over provider choice. For many of the injury types, the estimates of upper-tail cost differentials are relatively small and statistically insignificant.

Panel B of Table 5 turns to the evidence on incurred and developed indemnity costs. Here, too, we begin with OLS estimates (this time paralleling Panel B of Tables 2 and 3) for each injury group. Recall that in Table 2, Panel B, we found positive estimates around 20 percent for provider choice policies giving workers more control over the choice of provider, but these estimates were not statistically significant. The estimates in Panel B of Table 5 point to quite a bit of heterogeneity across injury types. For the OLS estimates, the estimated differentials point to higher costs in states where policies give workers more control of provider choice, in every case but one (upper extremity neurologic pain, for developed indemnity costs). For some injuries, the estimated cost differentials are small (lacerations and contusions, and inflammations), whereas for others, they are quite large (back and neck sprains, strains, and nonspecific pain, or neurologic spine pain, and other sprains and strains). But these estimated differences are never statistically significant.

When we look at the estimates at the upper percentiles of the cost distributions, there are isolated cases where some differences appear. This is most notable for the 99th percentile for back and neck sprains, strains, and nonspecific pain, or neurologic spine pain, where the estimate becomes positive and rather large for developed indemnity costs (31.1 percent)—the one estimate for upper-tail costs that is statistically significant. In general, though, this analysis also does not lead to strong evidence of cost differences between states based on the extent to which policies provide either employers or workers with the most control of provider choice. And for the most part—with one or two exceptions—there is not markedly different evidence at the upper tails of the cost distributions.

That said, across the various quantile regression estimates, there is one relatively consistent finding. For both medical and indemnity costs, for the injuries including back and neck sprains, strains, and nonspecific pain, or neurologic spine pain, the upper tails of the cost distributions are higher in states where policies give workers more control of the choice of provider.

CONCLUSIONS AND DISCUSSION

State workers' compensation policies differ in whether employers or workers have more control over the choice of provider in treating a workplace injury. Simple reasoning about incentives of providers and workers might predict that medical costs and indemnity costs would be higher when policies give workers more control of the choice of provider. For example, when employers cannot control the choice of provider, providers may provide excessive treatment and services. Or workers may be able to collaborate with their providers to stay out of work longer before the provider deems them fit to return to work.

Of course, this simple reasoning could be wrong. For example, more worker control of provider choice may lead to better medical decision-making, perhaps because of more trust between the patient and the treating provider, lower likelihood of disputes about care, and—when workers choose providers familiar with their medical history and conditions—better information about the worker that leads to better and more effective treatment decisions.

We study the relationship between these policy differences and the medical and indemnity payments resulting from such injuries. The answer, it turns out, is more nuanced than simple reasoning would suggest. On one hand, the evidence generally points to essentially no difference in medical costs between states where policies give employers or workers the most control over the choice of provider. This is true using either incurred or developed costs (the latter includes a projection of ultimate costs).

However, provider choice policy might matter more for higher-cost injuries, or cases where there is greater variation in treatment and recovery. We find no statistical evidence of overall differences in medical costs for the costliest cases overall. But when we disaggregate by injury type, there is some evidence that medical costs are higher, for particular types of injuries, in states where policies give workers more control over provider choice. Specifically, there are statistically significantly higher developed medical costs (as much as

33 percent) in the most expensive cases for the injury grouping that includes back and neck sprains, strains, and nonspecific pain, or neurologic spine pain. This does not provide an overwhelming case that medical costs are higher when policies give workers more control over provider choice. However, there is fairly strong evidence that medical costs are higher for a subset of injuries.

The evidence is somewhat clearer for indemnity costs. The evidence is in the direction of higher average costs in states where policies give workers the most control over provider choice, where incurred and developed costs are about 19–21 percent higher, although these differences are not statistically significantly different from zero. When we disaggregate by injury type, we find statistically significant evidence that indemnity costs are higher for the costliest cases in states where workers have the most control of choice of provider; at the 99th percentile of the distribution of developed indemnity costs, costs are higher by about 28 percent. This cost difference is driven by the injury group that includes back and neck sprains, strains, and nonspecific pain, or neurologic spine pain.

This evidence does not establish overall indemnity cost differences associated with provider choice policies. But the evidence of higher indemnity costs when policy gives workers more control of provider choice parallels the evidence on medical costs. We find both higher medical costs and higher indemnity costs, in states where policy gives workers more control of provider choice, for the costliest injuries involving back and neck sprains, strains, and nonspecific pain, or neurologic spine pain. Thus, perhaps the strongest and most robust conclusion is that very costly back-related injuries tend to have both higher medical and indemnity costs in states where policies give workers more control over provider choice. And these injuries, which are relatively expensive, also appear to at least partially account for differences in the overall distribution of indemnity costs.

What does this evidence imply for policy? First, given that *average* costs are *not* higher when policies give workers more control of the choice of provider, policy changes that restrict worker choice across the board may well fail to reduce costs on average. On the other hand, the higher costs, for some injuries, in the upper tails of the cost distributions, could reflect some of the common criticisms of policies giving workers more control of provider choice—that such policies remove the incentive to hold down costs, or that workers can collaborate with their providers to stay out of work longer. Thus, policy-makers might focus on how to reduce the incidence of high-cost cases when policies give workers control of the choice of provider.

Our research is limited to provider choice policies on the books. Implementation can also matter, and understanding how implementation of provider choice policies affects costs, and how policymakers can influence implementation, is a formidable challenge. Finally, it is important to extend the research beyond costs, which is not the only standard in judging the effectiveness of workers' compensation policies. Ultimately, we also need evidence on the effects of alternative provider choice policies on all the criteria for judging the success of workers' compensation—such as productive return to work, physical recovery, and income maintenance following a workplace injury.

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NOTES

1. Details and additional discussion are provided in the Appendix SA2.
2. These dates refer to "injury years," not calendar years. The injury year in the claims data runs from October 1 of the previous calendar year to September 30 of the current calendar year.
3. The number of observations in each state (which range from about 31,000 to 380,000), and the states covered, is reported in the Appendix SA2.
4. More details on the policy controls are provided in the Appendix SA2.
5. This includes high-risk services, low-risk services, clerical/professional occupations (regardless of industry), manufacturing, construction, trade, and other industries; see Yang (2013).
6. However, we verified that the results were insensitive to including these controls.
7. These states are also excluded since their policies limit the choice of provider to networks of providers.
8. We do not have similar concerns about other workers' compensation policies that are included as controls for key state system features, for which implementation is much quicker. The effect of fee schedules can be virtually instantaneous (see Yang

and Fomenko 2014; Fomenko and Yang 2015), and the adoption of utilization guides or treatment guides is also typically very fast.

9. Our results are dependent on the reliability of the medical cost data. The full model estimates indicate that the other findings for medical costs are as expected. For example, injuries expected to be less expensive (e.g., other sprains and strains, and inflammations) are in fact estimated to be less expensive, and injuries expected to be more expensive are estimated to be more expensive, such as injuries to older workers, injuries in states without fee schedules, and injuries in states with a larger (positive) gap between the fee schedule and the Medicare rate. Full regression results are provided in the Appendix SA2.
10. The corresponding full model estimates generally reveal expected differences—such as higher indemnity costs for older workers, for upper extremity neurologic pain, and in states with higher temporary disability replacement rates.
11. Our baseline results in Table 2 are qualitatively similar using levels rather than logs of costs (see Appendix SA2).

REFERENCES

- Andersson, F., J. C. Haltiwanger, M. J. Kutzbach, G. E. Palloni, H. O. Pollakowski, and D. H. Weinberg. 2016. *Childhood Housing and Adult Earnings: A Between-Sibling Analysis of Housing Vouchers and Public Housing*. NBER Working Paper No. 22721.
- Boden, L. 1992. "Workers Compensation Medical Costs: A Special Case." In *Workers Compensation Health Care Cost Containment*, edited by J. Greenwood, and A. Taricco, pp 27–54. Horsham, PA: LRP Publications.
- Boden, L., and C. Fleischman. 1989. *Medical Costs in Workers' Compensation: Trends and Interstate Comparisons*. Cambridge, MA: Workers Compensation Research Institute.
- Durbin, D., and D. Appel. 1991. "The Impact of Fee Schedules and Employer Choice of Physician." *NCCIDigest* 6 (3): 39–59.
- Ellenberger, J. 1992. "Labor's Perspective on Health Care Reform." In *Workers Compensation Health Care Cost Containment*, edited by J. Greenwood, and A. Taricco, pp 245–60. Horsham, PA: LRP Publications.
- Fomenko, O., and R. Yang. 2015. *Hospital Outpatient Costs Index for Workers' Compensation*, 4th Edition. Cambridge, MA: Workers Compensation Research Institute.
- Machado, J., P. Parente, and J. Santos Silva. 2013. QREG2: Stata Module to Perform Quantile Regression with Robust and Clustered Standard Errors, Statistical Software Components S457369. Boston College Department of Economics.
- Neumark, D., P. Barth, and R. Victor. 2007. "The Impact of Provider Choice on Workers' Compensation Costs and Outcomes." *Industrial and Labor Relations Review* 61 (1): 121–42.
- National Federation of Independent Business Research Foundation and National Foundation for Unemployment Compensation and Workers' Compensation (NFIB/NFUCWC). n.d. *Legislative Guide to Workers' Compensation Insurance Reform in the States*.

- Parente, P., and J. Santos Silva. 2013. *Quantile Regression with Clustered Data*. Discussion Paper No 728. Department of Economics, University of Essex.
- Pozzebon, S. 1994. "Medical Cost Containment under Workers' Compensation." *Industrial and Labor Relations Review* 48 (1): 153–67.
- Victor, R., and C. Fleischman. 1990. *How Choice of Provider and Recessions Affect Medical Costs in Workers' Compensation*. Cambridge, MA: Workers Compensation Research Institute.
- Victor, R., P. Barth, D. Neumark, and T. Liu. 2005. *The Impact of Provider Choice on Workers' Compensation Costs and Outcomes*. Cambridge, MA: Workers Compensation Research Institute.
- Washington Department of Labor and Industries and University of Washington Department of Health Services (WA DoL). 1997. *Workers' Compensation Managed Care Pilot Project: Final Report to the Legislature*.
- Yang, R. 2013. *CompScope™ Benchmarks for Florida*, 14th Edition. Cambridge, MA: Workers Compensation Research Institute.
- Yang, R., and O. Fomenko. 2014. *WCRI Medical Price Index for Workers' Compensation, Sixth Edition (MPI-WC)*. Cambridge, MA: Workers Compensation Research Institute.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix SA1: Author Matrix.

Appendix SA2: Online Appendix.