

Advanced Registered Nurse Practitioners as Attending Providers in the Washington State Workers' Compensation System (SHB 1691)

Report to the Washington State Legislature
As required by SHB 1691 (Chapter 65, Laws of 2004)

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Executive Summary

Advanced registered nurse practitioners (ARNPs) have been directly reimbursed for providing health care services to injured workers within the Washington State workers' compensation system for many years. However, prior to July 2004, ARNPs were restricted from independently performing those functions limited to attending physicians, such as signing accident report forms and certifying time loss. Substitute House Bill (SHB) 1691 (Chapter 65, Laws of 2004) took effect July 1, 2004, authorizing ARNPs to independently perform those functions of an attending physician within their scope of practice, except for rating permanent impairment. SHB 1691 is scheduled to sunset on June 30, 2007. SHB 1691 authorized this report to the legislature "on the implementation of this act, including but not limited to the effects of this act on injured worker outcomes, claim costs, and disputed claims."

In the first year after implementation, ARNPs were the first attending provider for 6.9 percent of the claims filed by primary care providers. Consistent with the charge of SHB 1691, this report examines the changed role for ARNPs for its effect on access to health care for injured workers, administrative process of care indicators (including claim disputes), worker outcomes, and claim costs.

A second bill was passed simultaneously, Senate Bill (SB) 6356 (Chapter 163, Laws of 2004), which authorized physician assistants (PAs) to have sole signature on the Report of Accident or Physician's Initial Report for simple industrial injury claims. (Simple industrial injury claims do not involve time loss, occupational disease, inpatient care on the date of the first medical visit, or complex injuries.) SB 6356 contained identical language regarding an evaluation (report provided under separate cover), and is scheduled to sunset on July 1, 2007.

Background

SHB 1691 was implemented amid concern regarding access to health care for injured workers in rural areas. Stakeholders had expressed concern that there were areas in the state with few providers willing to treat injured workers (potentially limiting access to health care) or aid injured workers in filing a workers' compensation claim. Other concerns were expressed during deliberations on the bill regarding whether adding another type of attending provider (ARNPs) would increase cost to the workers' compensation system.

Prior to the implementation of SHB 1691, ARNPs who treated injured workers were required to obtain physician signatures on key workers' compensation forms, such as the accident report (the initial claim form), and on forms certifying the initiation or continuance of time-loss benefits. This requirement may have caused delays in health care and claim filing, particularly for rural or underserved populations where physicians may have been less available.

ARNPs provide about 10 percent of the generalist outpatient visits in Washington State, and more in rural areas. In Washington, ARNPs are licensed as independent health care providers, although they often collaborate with physicians. Many studies have documented that ARNPs

provide safe and cost-effective care, however, no studies were found specific to workers' compensation-related care.

Evaluation methods

This report is based on an evaluation of existing administrative data, primarily from the Department of Labor & Industries (L&I) administrative databases. These databases provide detailed population-based claim, provider enrollment, and medical bill payment information for two-thirds of the nonfederal employees in the state, those covered by the State Fund. This evaluation did not consider workers' satisfaction with ARNP versus primary care physician (PCP) health care services, because such assessment would have required more resources than were available.

A number of analyses relied upon comparisons between ARNPs and PCPs. The definition of PCP included those allopathic and osteopathic physicians (MDs and DOs) with a recorded specialty of general practice, family practice, or internal medicine.

There were three hypothesized mechanisms by which SHB 1691 might have affected the process of care, disability outcomes, and/or costs:

1. The role expansion provided for in SHB 1691 may have encouraged greater numbers of ARNPs to enroll as L&I providers, thereby increasing the number of providers willing and able to treat injured workers. This could have decreased the distance an injured worker needed to travel to see a provider or the length of time required to obtain an appointment, particularly in rural or otherwise underserved areas.
2. Prior to July 1, 2004, ARNPs treating injured workers had been required to obtain a physician's signature on the accident report (claim form). Removing this requirement may have improved administrative efficiency, potentially decreasing the time between the first medical visit and L&I's receipt of the claim (referred to as "claim filing time" throughout this report).
3. The legislation authorized ARNPs to fill the role of attending provider, and there may have been practice differences between ARNPs and PCPs that affected outcomes. For example, one might hypothesize that costs, disputes, and outcomes would be no different between ARNPs and PCPs if these two provider types were equally competent in providing care for injured workers.

For this report, these potential effects of the legislation were evaluated using two basic approaches. First, system-level effects were assessed by measuring changes that took place from one year pre- to one year post-implementation of SHB 1691. Second, the performance of attending providers was assessed — evaluating potential differences in practice and outcome between ARNPs and PCPs — based on claims filed only after implementation, since ARNPs by regulation could not be attending providers prior to that date. The evaluation also included a number of other elements, identified through a review of the scientific literature and consultation with stakeholders.

Summary of findings

Findings are summarized here into three categories: those relating to system factors measured pre- and post-implementation of SHB 1691, those relating to rural vs. urban geographic location, and those relating to differences between ARNPs and PCPs in the role of attending provider.

System factors measured pre- and post-implementation

- Implementation appears to have encouraged ARNPs to enroll as L&I providers. For ARNPs, average monthly enrollment as new L&I providers increased by about 47% after implementation (compared with an increase of 22% for PCPs).
- The number of active ARNP providers in the L&I system rose 8.1% after implementation, compared with a decrease of 1.4% for PCPs (adjusted for change in the underlying employed population).
- The legislation did not produce any statewide effect on 1) the likelihood of being seen in an emergency department; 2) the length of time between the date of injury and the first medical visit; or 3) the likelihood of the first medical visit occurring within one day of injury.
- The number of claims filed by other providers decreased in rough proportion to the increase in claims filed by ARNPs and PAs.
- There was no meaningful change in the percent of disputed claims (protests and appeals) attributable to SHB 1691.
- The change in signature requirement for accident reports may have improved administrative efficiency. Among claimants who saw ARNPs, there was a 33% decrease after implementation in the average time from the first medical visit to filing of the accident report, and a significant increase in the likelihood of filing within 7 days.

Rural versus urban geographic location

- 22% of ARNPs were located in rural areas, compared with 17% of PCPs.
- After implementation, ARNPs filed 10.8% of the claims in rural areas filed by ARNPs, PAs or PCPs, compared with 6.3% in urban areas, and all counties where ARNPs filed more than 10% of those claims were rural counties.
- For those workers with injuries that occurred in rural counties, 13.3% had an ARNP as their first attending provider, compared with only 4.5% of those injured in urban counties.
- The proportion of Washington-licensed ARNPs enrolled as L&I providers appeared higher in rural areas compared with urban areas.
- Although claim filing times were 3.5 days longer for rural providers (averaged over the two year period of this study), implementation of SHB 1691 did not decrease claim filing times significantly more in rural compared with urban areas.

Differences between ARNPs and PCPs as attending providers

- Differences in claimant characteristics based on their attending provider type were generally small. The distribution of injury types was remarkably similar between ARNPs and PCPs.
- 22% of ARNPs were located in rural areas, compared with 17% of PCPs.
- PCPs were more than twice as likely as ARNPs to be the attending provider for more than 24 claims a year (29.7% compared with 13.4%).
- There were essentially no differences between ARNPs and PCPs in the percent of rejected or compensable claims. Claims filed by PCPs were more likely to receive a permanent partial disability payment (3.8% compared with 3.1%).
- There was no evidence of any meaningful difference between ARNPs and PCPs regarding the percent of claims with protests, appeals, or attorney representation.
- There were essentially no differences between ARNPs and PCPs regarding the time from injury to the first medical visit, the percent of claims reopened, transfers of attending provider, or claim duration.
- ARNPs were significantly more likely to file the claim within 7 days of the first medical visit, and filed claims on average 4.2 days faster than did PCPs.
- There were no statistically significant differences between ARNPs and PCPs regarding average time loss days, medical costs, or time loss costs per claim.

Conclusions

Implementation of SHB 1691 was not associated with any negative impact on costs, claim disputes, or time loss duration, and appeared to positively affect provider enrollment, availability of authorized attending providers in rural areas, and administrative efficiency.

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Introduction

Advanced registered nurse practitioners (ARNPs) have been directly reimbursed for providing health care services to injured workers within the Washington State workers' compensation system for many years. However, prior to July 2004, ARNPs were restricted from independently performing those functions limited to attending physicians, such as signing accident report forms and certifying time loss. Substitute House Bill (SHB) 1691 (Chapter 65, Laws of 2004) took effect July 1, 2004, authorizing ARNPs to independently perform those functions of an attending physician within their scope of practice, except for rating permanent impairment. SHB 1691 is scheduled to sunset on June 30, 2007. SHB 1691 authorized this report to the legislature "on the implementation of this act, including but not limited to the effects of this act on injured worker outcomes, claim costs, and disputed claims."

How SHB 1691 was implemented

SHB 1691 was implemented by the Department of Labor and Industries (L&I) as a pilot program with effective dates 7/1/04 through 6/30/07, via emergency rule-making procedures.^a The new rules authorized ARNPs to independently perform the functions of an attending physician, except for rating permanent impairment and performing independent medical examinations (IMEs). This is specifically outlined in the Washington Administrative Code (WAC) 296-23-241 to include the following functions:

- Completing and signing the Report of Accident or Physician's Initial Report, where applicable
- Certifying time loss compensation
- Completing and submitting all required or requested reports
- Referring workers for consultations
- Performing consultations
- Facilitating early return to work offered by and performed for the employer(s) of record
- Doing all that is possible to expedite the vocational process, including making an estimate of the worker's physical or mental capacities that affect the worker's employability
- Stating whether a worker has permanent impairment, such as on the department's Physician's Final Report (PFR)

A second bill was passed simultaneously, Senate Bill (SB) 6356 (Chapter 163, Laws of 2004), that authorized physician assistants (PAs) to have sole signature on the Report of Accident or Physician's Initial Report for simple industrial injury claims.^b SB 6356 contained

^a A provider bulletin (PB 04-09) was issued by L&I and sent to all relevant enrolled providers after the emergency rule was adopted, describing the rule changes related to both bills. The permanent rule was effective 12/15/04, and was posted on the L&I website. There were no changes to the emergency rule, so no additional provider bulletin was issued.

^b Simple industrial injury claims do not involve time loss, occupational disease, inpatient care on the date of the first medical visit, or complex injuries.

identical language regarding an evaluation (report provided under separate cover), and is scheduled to sunset one day later, on July 1, 2007.

Stakeholder involvement in the evaluation

Stakeholder contact regarding the evaluation of SHB 1691 began with introductory phone calls, followed by semi-structured interviews. The following stakeholder organizations were contacted:

- Workers' Compensation Advisory Committee (WCAC)
- Association of Washington Business (AWB)
- Washington Self-Insurers Association (WSIA)
- ARNPs United of Washington State (AU)
- Washington Academy of Physician Assistants (WAPA)
- Washington Osteopathic Medical Association (WOMA)
- Washington State Chiropractic Association (WSCA)
- Washington State Labor Council, AFL-CIO (WSLC)
- Washington State Medical Association (WSMA)
- Washington State Nurses Association (WSNA)

Interview topics included comments on the details of implementation, any noted early impact, and a request for input regarding the evaluation design. The preliminary evaluation design was refined based on information from these interviews, and a brief summary was provided to stakeholders in August of 2005 with a formal request for comments.

Following this process, a presentation of the evaluation plan was made to the L&I Workers' Compensation Advisory Committee (WCAC) on September 26, 2005. In general, stakeholders have been interested in maintaining communication about plans for the evaluation.

Background

SHB 1691 was implemented amid concern regarding access to health care for injured workers in rural areas. Provider surveys conducted by L&I contained evidence of provider dissatisfaction with the functioning of the workers' compensation system and resultant unwillingness to participate. In Washington State, providers must enroll with L&I prior to billing for workers' compensation-related services. Stakeholders had expressed concern that there were areas in the state with few providers willing to treat injured workers (potentially limiting access to health care) or aid injured workers in filing a workers' compensation claim.

Geographic access and the timeliness of care can be considered system-level quality factors, insofar as they are affected by other system factors such as provider enrollment levels and state policy regarding authorized provider roles and signature requirements. Barriers to access may interfere with the mission of facilitating timely health care and appropriate benefits for injured workers. Delays in diagnosis and treatment can lead to increased disability.^{1, 2} Although there has

been a fair amount of research on geographic health care access, none was found that specifically addressed workers' compensation systems. However, in general, rural areas are served by fewer health care providers per capita than are urban areas, and the distance involved in traveling to an appropriate provider may present a significant access barrier, disproportionately so in rural areas.³ A number of studies have documented difficulty in timely access to care for urgent conditions and related reliance on emergency departments.⁴ The L&I Attending Doctor's Return to Work Desk Reference⁵ lists same-day scheduling for work-related injuries or illnesses as a best practice.^c An increase in the number of available providers and/or appointments could decrease the length of time required to obtain an appointment, potentially leading to better outcomes.^{6, 7}

Prior to the implementation of SHB 1691, ARNPs who treated injured workers were not authorized to independently function as attending providers, and were required to obtain physician signatures on key workers' compensation forms, such as the accident report (the initial claim form), and on forms authorizing the initiation or maintenance of time loss. This requirement may have caused delays in health care and claim filing, particularly for rural or underserved populations where physicians may have been less available. Providers of workers' compensation-related care in Washington State are legally required to file the accident report within five days of identifying a work-related injury or illness, however compliance is inconsistent. The statewide average filing time is 13.2 business days, with 50% filed within 4.5 business days. At or after the first medical visit, the injured worker and provider each complete sections of the accident report, and it is then sent to L&I. Claim filing times thus depend on characteristics of both providers and claimants. The length of time from the first medical visit to claim filing was identified for the Washington State Centers of Occupational Health and Education (COHE) project as a useful administrative indicator.⁸ Removing the necessity for ARNPs to obtain physician signatures on claim forms may have improved system efficiency and timely access to care.

ARNPs provide about 10 percent of the generalist outpatient visits in Washington State, and more in rural areas.⁹ ARNPs as a profession developed in large part in response to limited access in rural and inner-city areas,^{10, 11} and are the only source of care in many rural communities.¹² Inclusion of ARNPs in the health care workforce has been found to mitigate both sociodemographic and geographic disparities in access to care.¹⁰ There are similarities in role and function between ARNPs and primary care physicians (PCPs), particularly in rural settings.¹³⁻¹⁵ ARNPs tend to have a greater scope of practice in states with more rural populations.¹⁶ In Washington, ARNPs are licensed as independent health care providers, although they often collaborate with physicians. Of the 74.4% who responded to a 2003 statewide survey of all Washington-licensed ARNPs, 12.5% of those in urban areas reported that there was no physician in their practice (this was slightly higher in rural areas, at 13.3%).^{17, 18}

In Washington State, injured workers can select the attending provider of their choice from among authorized attending provider types. SHB 1691 expanded the role of ARNPs in the workers' compensation system. Within their scope of practice, ARNPs have been found to

^c The time from the date of injury to the first medical visit was considered as a possible quality indicator for the Washington State Centers of Occupational Health and Education (COHE) project, but was not included as it was not considered to be completely under provider control.

provide care that is equivalent in quality to that of physicians.^{10, 19, 20} However, the existing literature is limited and methodologically problematic,^{10, 14, 21} and little information is available regarding care provided by ARNPs specifically to injured workers.²²

Injured workers in Washington State have the right to change attending providers, after notice to L&I. Transfers of attending provider may result from such underlying factors as patient dissatisfaction, a mismatch between the care required and scope or training of the provider (e.g., transfer to a pulmonologist for care of asbestosis or temporary transfer to a surgeon for a specific surgical procedure), or a change in the worker's residence. A higher percent of transfers from ARNPs to physicians might be expected due to referring out complex or "out-of-scope" cases. Business stakeholders have expressed concern that unnecessary transfers of care may introduce waste and extra expense.

Disputed claims (protests and appeals) stem from many causes and require increased levels of system resources. Both protests and appeals can be filed by the injured worker (or legal representative), the injured worker's health care provider, and/or the employer. A markedly lower rate of worker and/or employer protests for a given provider type could indicate closer adherence to worker and/or employer expectations, and may be a partial indicator of quality (to the limited extent that those expectations represent appropriate care). Higher levels of disputed claims and attorney representation may also be proxies for patient dissatisfaction.²³

Controlling system costs has been an ongoing priority,⁷ and some stakeholders have expressed concern that expanding the definition of attending provider may increase costs. There is specific interest in whether costs and outcomes attributable to ARNPs in this role are comparable to those of physicians. Many studies have documented that ARNPs provide safe and cost-effective care, however, none of these were specific to workers' compensation-related care.^{10, 11, 16, 24-26} ARNPs are new to the attending provider role, and if this legislation expanded the number of ARNPs who enrolled as workers' compensation providers, there may have been an added learning curve for those who were entirely new to the workers' compensation system.

Most studies have found no difference in clinical outcomes for patients of ARNPs as compared with those of physicians.^{14, 20, 27-29} In general, studies have found ARNPs to be comparable to physicians regarding technical processes of care within their scope of practice, such as ordering appropriate radiology, accuracy of physical exams, and treatment decisions.^{10, 30, 31} Research is mixed on whether utilization of tests and procedures is comparable between physicians and ARNPs,^{19, 20} but many studies have found no overall differences.^{13, 20, 27, 31} There is some evidence for fewer prescriptions written by ARNPs (among those with prescriptive authority).^{10, 32} ARNPs do tend to have longer visits.¹⁴ In some studies reporting higher utilization attributed to ARNPs, there were no benchmarks, so it was unclear whether the higher utilization reflected appropriate or inappropriate use of services.^{27, 33} (Utilization rates are best interpreted when there is a recognized standard of clinical care specifying the appropriate amounts and types of services.³⁴)

There is little information available related to the impact of health care provider type on disability or costs within the workers' compensation arena. No literature was found directly addressing care provided by ARNPs versus physicians as a correlate or predictor of time loss or costs in workers' compensation systems. It is important to note that practice differences between provider types may not be an important determinant of outcomes; for example, in studies of acute low back pain, outcomes were similar for patients of primary care physicians, chiropractors, and orthopedic surgeons.^{35, 36} The effect of health care may be small in comparison with that of sociodemographic, economic, psychosocial, employment, or administrative factors.^{37, 38}

The basis for this report

This section describes how the impacts of the legislation were evaluated, including describing the study sample and variables and discussing the evaluation's weaknesses and strengths.

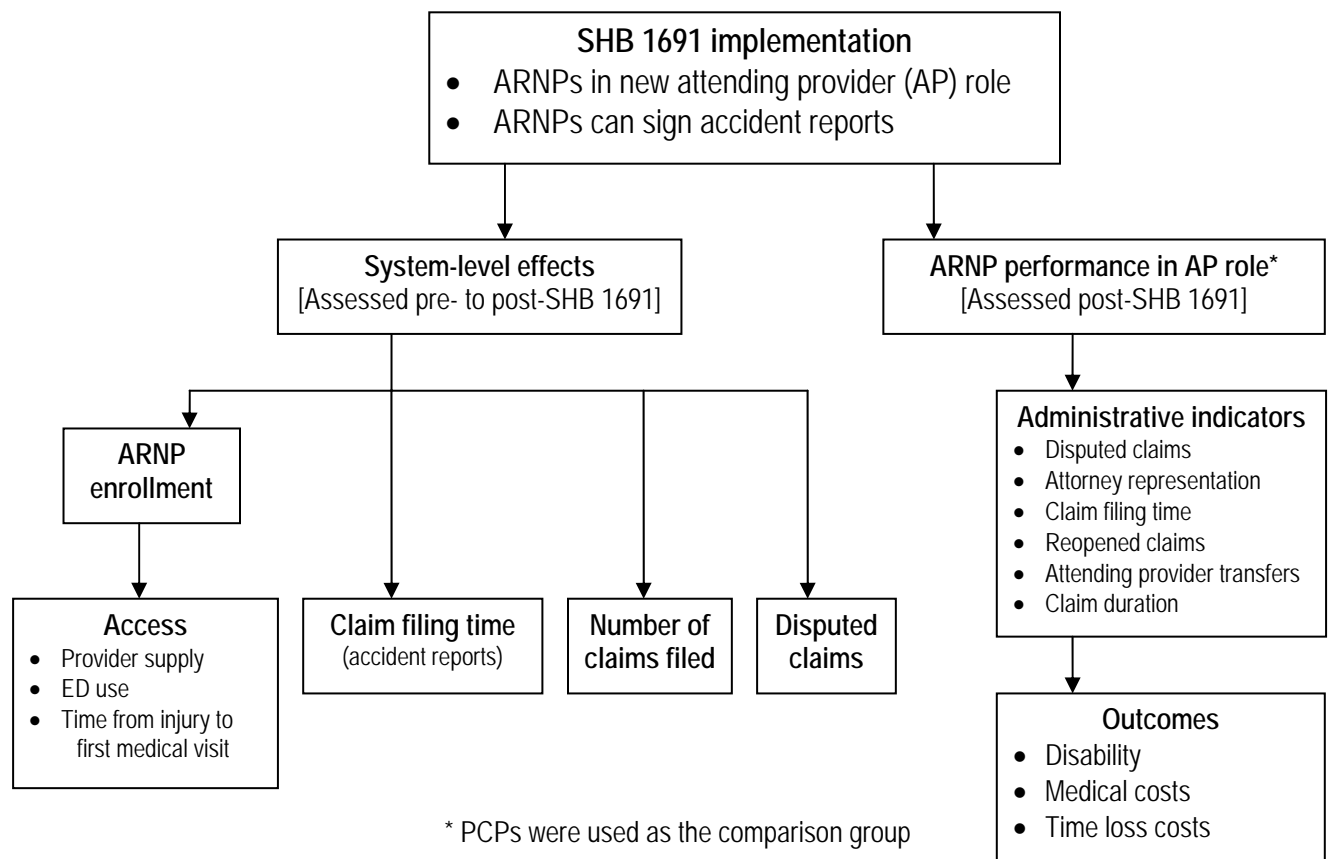
Evaluation approach

Figure 1 presents a diagram of the approach to this evaluation. There were three hypothesized mechanisms by which SHB 1691 might have affected the process of care, disability outcomes, and/or costs:

1. Prior to July 1, 2004, ARNPs treating injured workers had been required to obtain a physician's signature on the accident report (claim form). Removing this requirement may have improved administrative efficiency, potentially decreasing the time between the first medical visit and L&I's receipt of the claim (referred to as "claim filing time" throughout this report).
2. This legislation provided for ARNPs to fill the role of attending provider, and there may have been practice differences between ARNPs and PCPs that affected outcomes. For example, one might hypothesize that costs, disputes, and outcomes would be no different between ARNPs and PCPs if these two provider types were equally competent in providing care for injured workers. In addition, under L&I payment guidelines, ARNPs are paid at 90% of the physician fee schedule. Claim costs therefore might be somewhat lower for ARNPs based on this differential; however those services are likely to constitute a small portion of total claim costs, especially for the more costly claims.
3. The role expansion provided for in SHB 1691 may have encouraged greater numbers of ARNPs to enroll as L&I providers, thereby increasing the number of providers willing and able to treat injured workers. This could have decreased the distance an injured worker needed to travel to see a provider or the length of time required to obtain an appointment, particularly in rural or otherwise underserved areas.

There were two basic approaches taken in evaluating the potential pathways depicted in the diagram. System-level effects of the legislation were assessed via measuring changes that took place from one year pre- to one year post-implementation of SHB 1691. In contrast, the assessment of attending provider performance (evaluating potential practice and outcome differences between ARNPs and PCPs) included claims filed only after implementation, since ARNPs by regulation could not be attending providers prior to that date.

Figure 1. Diagram of evaluation approach



Evaluation questions

As specified in Substitute House Bill 1691, this report includes an evaluation of the effects of its implementation on injured worker outcomes, claim costs, and disputed claims. Based on a review of the scientific literature and consultation with stakeholders, a number of additional elements were also included in the evaluation. Several of these had been developed for use in the Washington State Centers of Occupational Health and Education (COHE) project via the convening of expert panels.³⁹ The following questions were identified and addressed in this report:

I. Access to health care for injured workers

- A. Who do ARNPs serve? Were the injured workers in their care different than those in the care of PCPs?
- B. Were there differences between the ARNPs and PCPs who served as attending providers?
- C. How much workers' compensation-related health care was provided by ARNPs?
- D. Did ARNP enrollment increase after implementation?

- E. Were there measurable effects of the legislation on the percentage of injured workers that went first to emergency departments vs. to providers in a clinic or office, or on the average time from the date of injury to the first medical visit?

II. Administrative indicators

- A. Did the number of claims filed change after implementation?
- B. Did the percent of claims with disputes change after implementation?
- C. Did implementation affect the average claim filing time for ARNPs?
- D. Did implementation have a differential effect on the average claim filing time for ARNPs in rural vs. urban areas?
- E. Did administrative indicators differ between ARNPs and PCPs in the role of attending provider?
 - Claim status
 - Disputed claims and attorney representation
 - Time to first medical visit
 - Claim filing time
 - Percent of claims reopened
 - Transfers of attending provider
 - Claim duration

III. Outcomes

- A. Did average medical costs per claim differ between ARNPs and PCPs in the role of attending provider?
- B. Did average cumulative time loss days per claim differ between ARNPs and PCPs in the role of attending provider?
- C. Did average time loss costs per claim differ between ARNPs and PCPs in the role of attending provider?

Study sample and variables

This evaluation relied on existing administrative data, primarily from the L&I administrative databases. These databases provide detailed population-based claim, provider enrollment, and medical bill payment information for two-thirds of the nonfederal employees in the state, those covered by the State Fund.⁴⁰ (The other third is covered by self-insured employers. This evaluation was restricted to State Fund claims, because the information available for self-insured claims is insufficient.) County-level data on licensed ARNPs in Washington State were obtained from the Washington State Department of Health, and county-level unemployment statistics were obtained from the Bureau of Labor Statistics (BLS).

Figure 2 presents the sample selection strategy for the analyses included in this report. Each box represents a subsample of claims used for a particular analysis or set of analyses. Each box contains the primary criteria used to create the subsample and the subsample size (broken down into pre- and post-implementation numbers where pre-implementation claims were included in

the analysis). Where appropriate, the subsample size is also broken out by first attending provider type (ARNP or PCP).

The complete claims sample included State Fund workers' compensation claims filed between July 1, 2003 and June 30, 2005 by claimants who were 18 to 70 years of age. Providers whose place of business was outside Washington State and workers with injuries occurring outside Washington State were excluded, due to the state-specific nature of the legislation. There were a total of 262,794 claims meeting these criteria. This provided a population-based set of claims for both the year prior to and the year following implementation of SHB 1691.

Data for specific variables were obtained based on existing evidence for their relationship to outcomes or costs in workers' compensation settings and based on their availability in L&I databases.^d There were three dimensions of predictor variables: geographic, provider, and worker. Definitions of these variables can be found in the technical appendix.

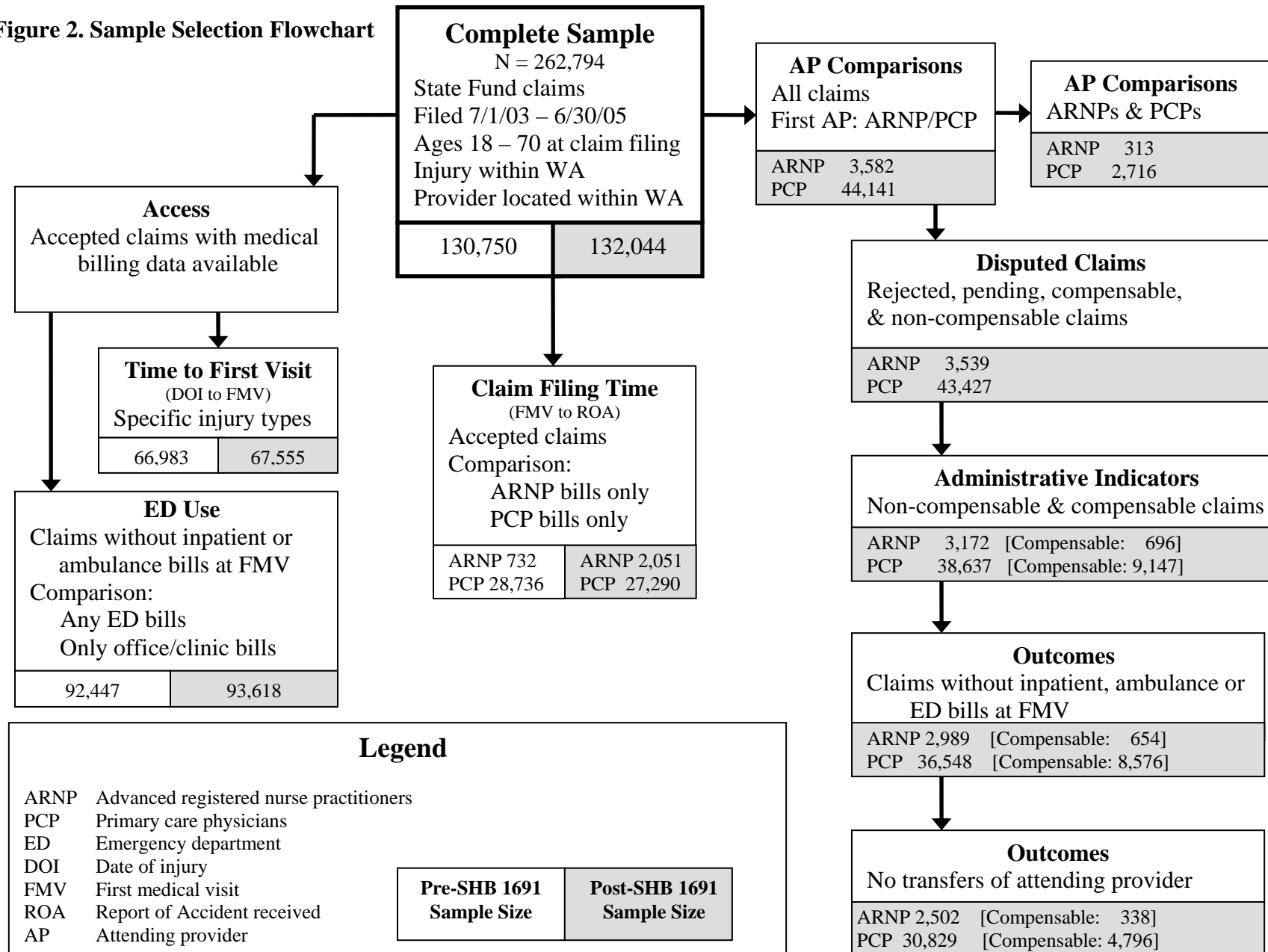
Geographic variables included rural/urban location (measured at the provider or worker level, depending on the analysis) and county unemployment level. Rural geographic location may directly affect costs, and may also function as a marker for unmeasured differences between rural and urban areas such as provider distribution and distance to care, varying standards of practice, or diffusion of best practices.⁴¹ Rural/urban location was expected to modify the relationship between SHB 1691 implementation and the measures of access and claim filing times. County unemployment rate may be associated with provider type (for example, if ARNPs are more likely to practice in state-designated "distressed counties"). Higher unemployment rates are associated with increased duration of time loss.⁴²

Provider-level variables included provider type, whether the provider was enrolled in the COHE project,^e and volume of L&I claimants (as a proxy for familiarity with the workers' compensation system). A number of analyses relied upon comparisons between ARNPs and primary care physicians (PCPs). The definition of PCP included those allopathic and osteopathic physicians (MDs and DOs) with a recorded specialty of general practice, family practice, or internal medicine.

Worker-level variables included sociodemographics (age, gender, marital status, dependents, pre-injury income), injury type, public vs. private sector employment, and whether the employer participated in a retrospective rating group. There is evidence that each of these characteristics can affect both disability and costs.^{2, 42-45}

^d This evaluation relied on computerized claim, provider enrollment, and medical billing data. It had been determined early on that neither the available resources nor the timeframe allowed for direct surveys of workers or providers to assess such factors as satisfaction or awareness of the rule change.

^e The Centers of Occupational Health and Education (COHE) project is a community-based approach to health care that provides health services coordinators to facilitate return to work efforts and provides financial incentives to enrolled providers for occupational health best practices, including submitting the accident report within 2 days. Elements of this project have been found to substantially reduce claim filing times and disability among injured workers, hence it was important to control for provider enrollment in this project.

Figure 2. Sample Selection Flowchart

Limitations and strengths of the evaluation

Limitations

All analyses for this evaluation relied on existing administrative data. In general, administrative databases are not designed nor maintained to maximize data quality for research purposes.⁴⁶ Data fields that are not reimbursement-related may tend to be less accurate or complete.⁴⁷ In addition, reliance on administrative data restricted the ability to evaluate factors such as the satisfaction of injured workers or providers.

The challenge of selection bias

Selection bias was a methodological challenge of particular concern, due to the fact that this evaluation was based on observational data. Selection bias refers to the extent to which the results might be affected by differences between those injured workers seeing ARNPs compared with PCPs as their first attending provider. Differences in measured characteristics (such as age, sex, injury type) were controlled, however, the injured workers seen by the two provider types might have been different in ways that were not measured. It is unclear to what extent selection bias due to choice of provider, severity of injury, comorbidities, or other factors may have played a role. Although it has been suggested that the practice patterns and patient profiles of ARNPs do not fully overlap those of primary care physicians, perhaps being of lower average acuity or complexity,⁴⁸ there is not convincing evidence of this in the literature.

Practice setting may have more influence than profession on practice patterns.⁴⁹ There is some evidence that ARNPs tend to care for a higher proportion of female and younger patients and tend to perform less invasive procedures than do physicians.^{13, 50, 51} (The higher proportion of female patients may be explained by provider demographics; in a survey of generalist health care providers in Washington, 92.7% of ARNPs were female, compared with 28.9% of physicians.⁹) On the other hand, there is evidence of general similarity in diagnoses^{32, 52} and complexity⁵³ for ARNPs as compared with physicians. Although there was no way to be certain that there were not important unmeasured differences between the injured workers in the care of ARNPs compared with PCPs, the available data did not provide evidence of substantial systematic differences in case mix. In addition, adding control for those variables that were available (such as geographic location and characteristics of the injured worker, the injury, and the employer) did not have much impact on the findings, suggesting that confounding was not a major problem in general.

Other limitations

Other limitations of the evaluation included:

- The impact of excluding self-insured companies from analyses (due to incomplete and unavailable data) is uncertain, but may have affected the estimates of provider volume.
- There was a short time frame available, so extended periods of disability couldn't be evaluated.
- For some ARNPs, billing may have occurred under a physician provider number.

- L&I provider identification numbers are not necessarily unique identifiers. Although technically not permitted, some providers may have used another provider's existing number, rather than applying for their own. Some providers have multiple identification numbers.
- Provider addresses may reflect mailing address rather than practice location.
- Providers may not have been aware of the new legislation in the first year after implementation, or may not have changed their practice in response. Although the L&I provider bulletin explaining the new rules was sent to all enrolled clinical providers, L&I has not conducted any systematic outreach or publicity to non-enrolled providers.
- The amount of compensated time loss does not necessarily reflect appropriate time loss, and the amount of time loss is only a rough measure of actual return to work.
- Successful outcomes are only partially influenced by the type of injury and the process of health care. Many important worker and employer characteristics were unmeasured.
- Because of the short timeframe available for evaluation, data extraction occurred at the end of the follow-up period, without any additional allowance for bill processing time. The average time loss and cost figures are likely to be underestimates.

Strengths

Despite the numerous limitations inherent in relying on administrative data, there are important advantages, particularly the ability to link enrolled provider data with claim and injury, medical billing, and time loss data, both at the individual and population-based levels.⁵⁴ All claims meeting the basic criteria were included, providing a very large set of population-based data. This allowed for the control of a large number of covariates in the regression analyses. And finally, stakeholders were involved in planning the evaluation design at an early stage.

Findings

This section presents the results of research designed to answer each of the evaluation questions. Research methods are described very briefly. Definitions of key variables and other methodological details can be found in the technical appendix.

I. Access to health care for injured workers

A. Who do ARNPs serve? Were the injured workers in their care different than those in the care of PCPs?

Table I compares the **characteristics of claimants** whose first recorded attending provider was an ARNP with those whose first recorded attending provider was a PCP. This comparison was based on claims filed within the year after implementation (between 7/1/04 and 6/30/05). The most notable difference was that a markedly higher proportion of claimants with ARNPs as their attending provider had their claim filed by a provider located in a rural area ($p < 0.001$). Although ARNPs were somewhat more likely to see claimants who were female, were younger, had any dependents, and had a lower pre-injury monthly income, the differences were fairly small in magnitude. ARNPs were also somewhat less likely to see workers in the public sector and more likely to see those whose employers were members of a retrospective rating group at the time of injury.

The distribution of injury types was remarkably similar between ARNPs and PCPs. In a closer look at this data, ARNPs were recorded as the initial attending provider for injured workers in every subcategory of injury type and affected body part that included at least 13 claims, in similar proportions to PCPs (subcategories not listed).

Table I. Claimant characteristics by attending provider type

Claimant Characteristics	ARNP n=3,582	PCP n=44,141
Median monthly income*	\$2,112	\$2,420
Mean age	37.1	38.4
<i>Percent of claims</i>		
Married*	50.4	51.0
1 or more dependents*	40.4	36.7
Male	64.4	66.3
Injury type:		
Back/neck sprains	15.4	17.2
UE/LE** sprains	17.5	16.7
UE/LE cuts/scratches/contusions***	21.7	21.3
UE/LE fractures	2.7	2.5
UE/LE bursitis	3.9	4.0
UE/LE heat burns	1.3	1.0
Carpal tunnel	2.4	2.7
Hearing loss	1.0	1.5
Eye scratches	4.1	3.0
Conjunctivitis	0.8	0.6
Other/unspecified	12.3	13.5
Occupational disease	6.1	7.0
Public sector employment	7.2	9.4
Retrospective rating group at time of injury	52.0	47.3
Rural attending provider	21.4	12.8

* Includes only compensable claims due to missing or unreliable data (n=9,843)

** UE/LE: upper extremity & lower extremity

***This category name is shortened to UE/LE cuts & scratches elsewhere

B. Were there differences between the ARNPs and PCPs who served as attending providers?

Table II compares the characteristics of ARNPs and PCPs who were recorded as the first attending provider for any claim filed within the year after implementation (between 7/1/04 and 6/30/05). A higher proportion of ARNPs were located in rural areas ($p=0.04$). There was little difference in COHE participation. PCPs were more than twice as likely as ARNPs to be the attending provider for more than 24 claims a year ($p<0.001$).

Table II. Provider characteristics by attending provider type

Attending Provider Characteristics	ARNP	PCP
	n=313	n=2,716
	<i>Percent of providers</i>	
Rural provider	21.7	17.1
COHE provider (by end of follow-up period)	8.6	6.8
High volume (> 24 claims/year)	13.4	29.7
Specialty	N/A*	
General Practice		13.7
Family Practice		60.9
Internal Medicine		25.4

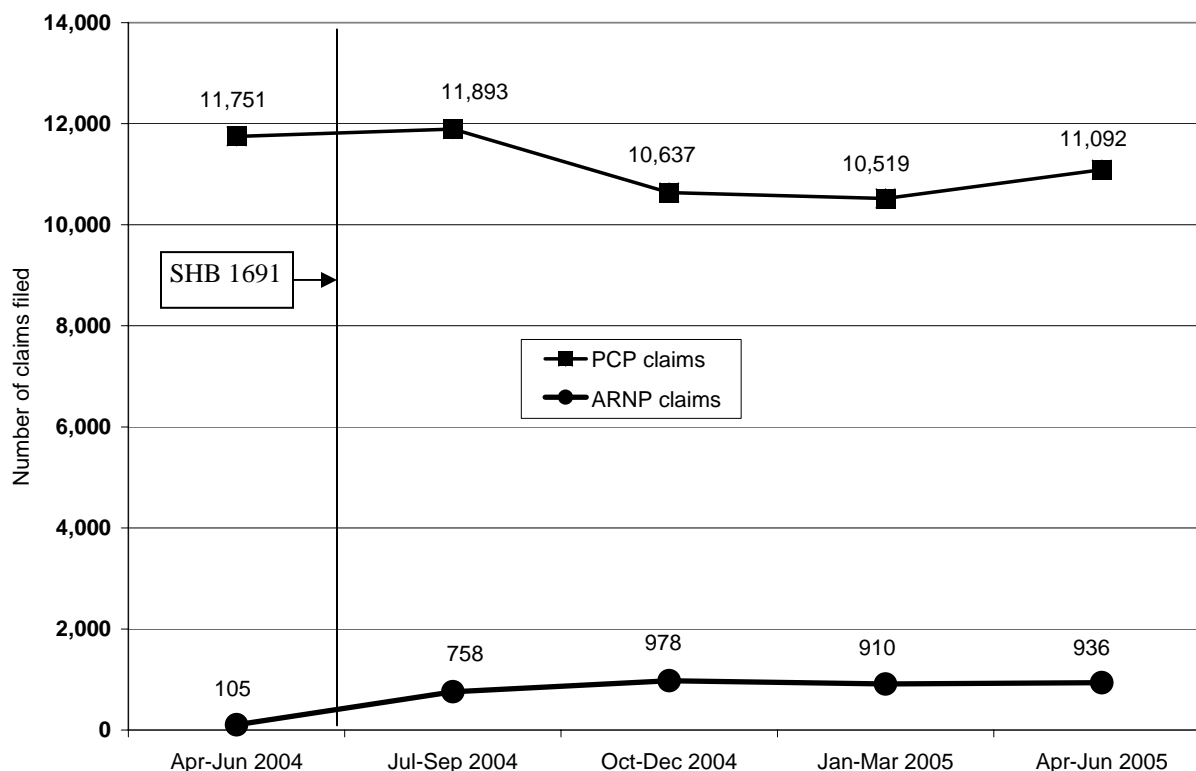
* L&I does not record specialty for ARNPs

C. How much workers' compensation-related health care was provided by ARNPs?

In the first year after implementation, ARNPs were the first attending provider for 6.9% of the claims filed by primary care providers (ARNPs, PCPs, and PAs). ARNPs filed a higher percentage of those claims in rural areas (defined by provider location); 10.8% in rural compared with 6.3% in urban areas ($p < 0.001$). For those workers with injuries that occurred in rural counties, 13.3% had an ARNP as their first attending provider, compared with only 4.5% of those injured in urban counties ($p < 0.001$).

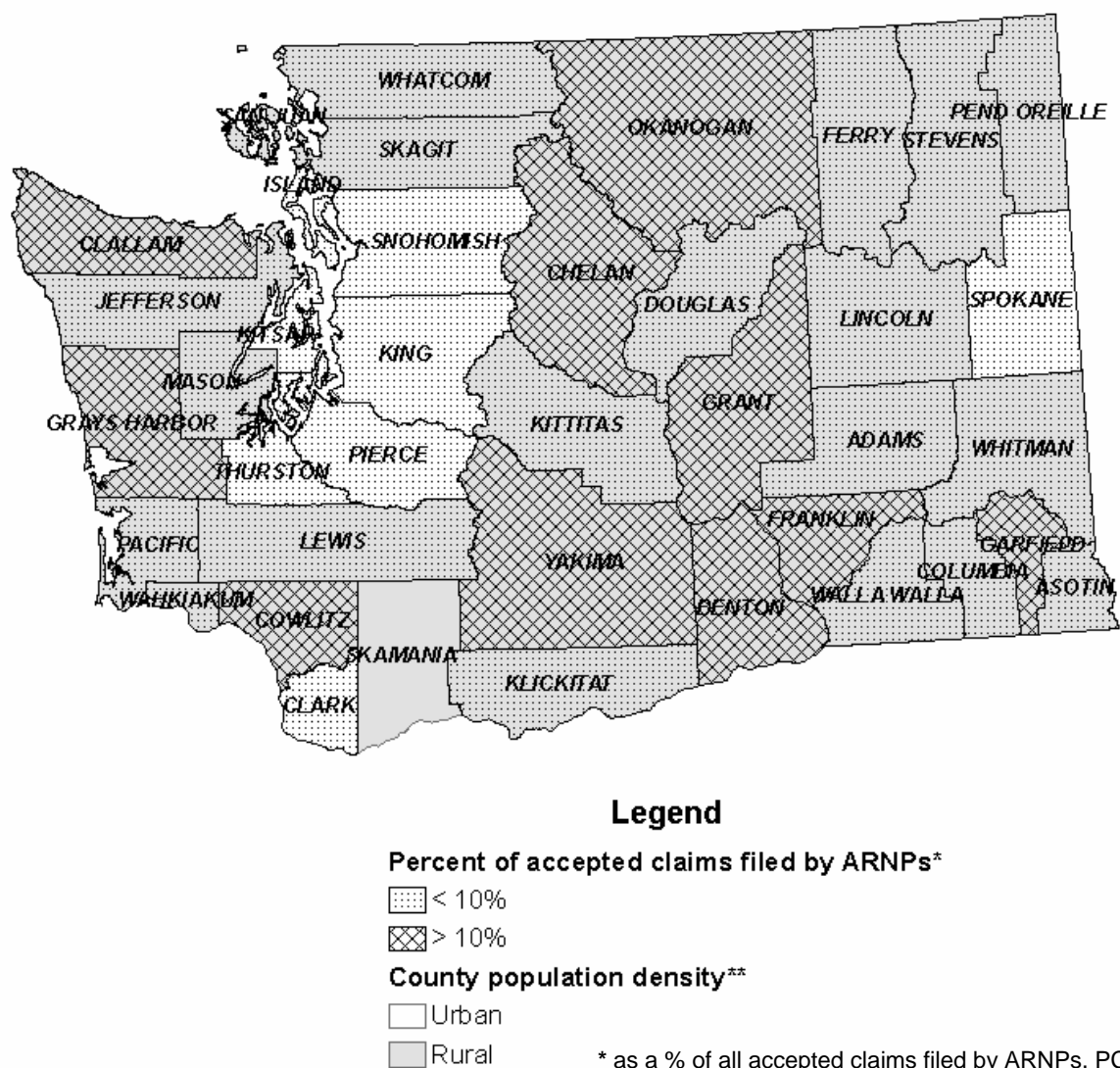
Figure 3 presents the number of initial claims filed each quarter by ARNPs and PCPs. The number of claims filed by PCPs (along with other providers, primarily occupational medicine physicians, chiropractors and clinics, as shown in Table III) decreased in rough proportion to the increase in the number of claims filed by ARNPs and PAs. (There was also an increase in claims filed by PAs related to SB 6356.) It was not possible to determine from the available administrative data whether this was due to injured workers seeing a different mix of provider types after the legislation, or solely to differences in which provider signed (and billed for) the accident report due to the rule changes.

Figure 3. Number of claims filed by ARNPs and PCPs, by calendar quarter



The map in Figure 4 displays the percent of accepted claims filed by ARNPs (of accepted claims filed by ARNPs, PCPs, and PAs) in the year after implementation for each Washington county. All counties where ARNPs filed more than 10% of claims were rural counties.^f

Figure 4. Percent of accepted claims filed by ARNPs, by county



* as a % of all accepted claims filed by ARNPs, PCPs, and PAs from 7/1/04 to 6/30/05

** Rural county: <100 persons/square mile (as defined by the WA State Office of Financial Management)

^f No providers were located in Skamania County, so it could not be classified. The mean for the other 38 counties was 9.4%. In Island County, which was classified as urban, ARNPs filed 9.6% of primary care claims.

D. Did ARNP enrollment increase after implementation?

The number of ARNPs enrolled with L&I was approximately 80% of the number of Washington-licensed ARNPs^g (as of August, 2005, about one year after implementation of SHB 1691). This was somewhat lower for urban and higher for rural areas.

The number of active ARNP providers in the L&I system rose 11.4% statewide after implementation. (For this purpose, active providers were defined as those with any allowed L&I bill during the year in question.) This figure decreased to 8.1% when the increase in the underlying employed population was taken into account.^h For reference, the number of active PCPs rose only 1.6% statewide, and decreased by 1.4% when the increase in underlying employed population was taken into account.

For ARNPs, average monthly enrollment as new L&I providers rose from about 17 per month in the year prior to implementation to about 25 per month in the year after implementation, a 47% increase. As a reference point, average monthly enrollment for PCPs rose from about 46 to 56, an increase of 22%.

E. Were there measurable effects of the legislation on the percentage of injured workers that went first to emergency departments (EDs) vs. to providers in a clinic or office, or on the elapsed time from the date of injury to the first medical visit?

Emergency department use

For the 2 years examined by this study, 35.4% of those claimants with medical bills on file had at least one bill for a service provided in an ED at the first medical visit.ⁱ This was higher for those claimants who were injured in rural counties (40.1% for rural compared with 33.4% for urban, $p<0.001$).

It was difficult to determine whether the legislation had an effect on emergency department use. Many factors may affect use, not just provider availability. However, it was hypothesized that if the legislation did have an effect, it should be most apparent in those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation. (PAs also needed to be considered because of the simultaneous implementation of SB 6356, authorizing PAs to sign some Reports of Accident).

There was a slight overall increase in emergency department use after implementation, from 36.5% to 38% ($p<0.001$). Logistic regression was used to control for whether the worker was injured in a rural county, injury type, and sociodemographics. There was no meaningful effect of

^g ARNPs with specialties very unlikely to file workers' compensation claims were excluded from the Washington-licensed numbers.

^h The figures for the employed population came from the BLS Current Population Survey, which included employed persons 16 and over in the civilian non-institutional population. This is not directly comparable to the numbers of workers covered by the State Fund, due to federal and self-insured employers.

ⁱ First medical visit was defined as the first date of service found in the medical and hospital billing data.

the legislation on the likelihood of being seen in an emergency department detected specifically for those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation.^j

Elapsed time from date of injury to the first medical visit

This analysis was concerned with whether provider availability might have affected the length of time between the date of injury and the first medical visit. The sample was restricted to claims with specific injury types,^k because the date of injury was often missing and was considered inaccurate for occupational disease. In addition, delays in the first appointment for occupational disease may have been more likely to reflect slow development of symptoms or slow recognition as opposed to access barriers.

In general, for this group of injuries, claimants were seen quickly. 72% were seen within 1 day of injury, and 90% were seen within 7 days. The mean time from injury to first medical appointment was 3.4 days in both rural and urban areas.

As for the analysis of emergency department use, it was hypothesized that if the legislation did have an effect, it should be most apparent in those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation. Linear regression was used to control for whether the worker was injured in a rural county, injury type and severity, whether any provider billing at the first medical visit was a COHE provider, and sociodemographics. There was no meaningful effect of the legislation on the duration of time between the date of injury and the first medical visit detected, either overall or specifically for those counties with higher proportions of claims filed by ARNPs and/or PAs after implementation. Using logistic regression, there was also no detected effect on the likelihood of the first medical visit occurring within one day of injury.^l

^j Further statistical detail can be found in the technical appendix.

^k Injury types included: upper and lower extremity cuts and scratches (n = 53,063), upper and lower extremity sprains (n = 27,338), back and neck sprains (n = 36,258), upper and lower extremity fractures (n = 8,054), and corneal abrasions (n = 9,825).

^l Further statistical detail can be found in the technical appendix.

II. Administrative indicators

A. Did the number of claims filed change after implementation?

As Table III shows, there was a 1% increase in the number of claims filed after implementation of SHB 1691, compared with the year before. However, there was a 3% increase in the employed population over the same time period, so some increase in claims would be expected.^m

Table III. Number of claims filed before and after implementation of SHB 1691

Provider Type Filing Claim	Pre-SHB 1691	Post-SHB 1691
ARNP	348	3,582
PA	601	3,998
PCP	46,746	44,141
Occupational Medicine Physician	8,500	7,901
Chiropractic	8,509	8,175
Clinic	10,547	9,128
Other	55,499	55,119
Total	130,750	132,044

B. Did the percent of claims with disputes change after implementation?

Table IV presents the percent of claims with disputes (protests and appeals) before and after implementation of SHB 1691. There was a longer follow-up time available for the claims filed prior to implementation, which if ignored would make for an unfair comparison (favoring the legislation). Therefore, the follow-up time was truncated to July 2005 for claims filed during the year prior to implementation, to equal the follow-up time available for those filed in the year after implementation (follow-up ended in July 2006).

There was no meaningful or statistically significant change in the percent of claims with employer protests at the time of claim filing or in the percent of claims with appeals. There was a statistically significant decrease in the percent of claims with protests (favoring the legislation; $p < 0.001$), but the magnitude of change was very small.

Table IV. Percent of claims with disputes before and after implementation of SHB 1691

Dispute Type	Pre-SHB 1691 (n=130,750)	Post-SHB 1691 (n=132,044)
Employer protest at claim filing	5.92	5.84
Any protest within 1 year	10.80	10.24
Any appeal within 1 year	1.76	1.84

^m The figures for the employed population came from the BLS Current Population Survey, which included employed persons 16 and over in the civilian non-institutional population. This is not directly comparable to the numbers of workers covered by the State Fund, due to federal and self-insured employers.

C. Did implementation affect the average claim filing time for ARNPs?

This analysis considers whether SHB 1691's removal of the requirement for a physician's signature for accident reports filed by ARNPs reduced the average time from the first medical visit to filing of the accident report for those injured workers seeing ARNPs.

The comparison of average claim filing time before and after implementation could not be based on the claim's attending provider because ARNPs were not authorized to be attending providers prior to implementation.ⁿ Therefore, medical billing data was used to determine the provider type that billed for the first medical visit. This was complicated by the fact that in a number of cases several providers billed for care on the day of the first medical visit and it was not possible to determine which provider gave care first, or was most responsible for the care provided. An algorithm was used to identify those claims that had bills only from ARNPs on the date of the first medical visit. A comparison group was constructed based on those claims that had bills only from PCPs on the date of the first medical visit. PCPs were used as a control group because SHB 1691 had no direct effect on their practice and they were otherwise comparable, in the sense that changes over time in average claim filing time due to other policy or environmental factors would likely affect PCPs similarly to ARNPs.

Claims were included in this analysis if the date of injury, first medical visit, and accident report filing date all occurred within one of the two study years (pre- or post-implementation). This allowed for unbiased comparison between the two study years, and avoided misclassification due to claim filing intervals that crossed the implementation date. Limiting the data in this way excluded the longest claim filing times. However, any bias toward shorter claim filing times should be equivalent for both time periods, and the ability to compare across time periods was considered more important than an accurate estimation of average claim filing time.

Table V presents the average time from the first medical visit to filing of the accident report for both ARNPs and PCPs. Average claim filing time decreased by over 4 days (33%) for ARNPs after implementation ($p < 0.001$). For PCPs, claim filing time decreased by only 3% ($p = 0.018$).

Table V. Claim filing time (in days) by provider type

Provider Type	n	Pre Mean (SD)	Post Mean (SD)	Difference
Only ARNP bills	2783	13.2 (22.1)	8.8 (13.1)	- 4.4
Only PCP bills	56026	8.8 (15.0)	8.5 (14.7)	- 0.3

Note: Due to the sample selection strategy, these are underestimates of actual claim filing times

ⁿ A sensitivity analysis was conducted based on the small subset of ARNPs that were recorded as attending providers prior to implementation ($n = 63$), with essentially the same results.

Linear regression was used to control for whether any provider that billed at the first medical visit was rurally-located or was a COHE provider by the time the claim was filed, injury type, occupational disease, and sociodemographics. Control was also included for change over time, by differencing out the change for PCPs. The average decrease in claim filing time associated with implementation of SHB 1691 for ARNP claims was 4.5 days (95% CI: -6.23, -2.83; $p < 0.001$).

Logistic regression was used to investigate whether implementation was associated with a change in the likelihood of claim filing within 7 days of the first medical visit, controlling for the same factors as before. Providers in Washington State are legally required to file the accident report within five days of identifying a work-related injury or illness, however compliance is inconsistent. Seven days was used as the cutpoint for this evaluation rather than five, to allow for weekends consistently across claims. The results were similar. After implementation, ARNP claims were more likely to be filed within 7 days of the first medical visit, after differencing out the decrease in claim filing time for PCPs ($p < 0.001$).^o

D. Did implementation have a differential effect on the average claim filing time for ARNPs in rural vs. urban areas?

This analysis was limited to the subset of claims that had only ARNP bills for the first medical visit ($N=2,783$). The analysis controlled for the same factors as the previous analysis.^p Those claims that had any bill from a rural provider at the first medical visit had an average claim filing time that was 3.5 days longer compared with those that did not. However, although implementation was associated with a 3 day decrease in claim filing times specifically for rural compared with urban claims, the decrease was not statistically significant (95% CI: -7.23, 1.12; $p=0.15$).

ARNPs are nearly as likely to practice independently of physicians in urban as in rural areas,^{17, 18} which could account for the inability to detect a significant differential impact of the legislation on claim filing times in rural areas. It is also possible that the definition of rural for this analysis was inadequate, since it was based by necessity only on there having been any bill from a rural provider at the first medical visit.

E. Did administrative indicators differ between ARNPs and PCPs in the role of attending provider?

Claim status

Table VI presents claim status information for all claims filed by ARNPs or PCPs during the year after implementation (between 7/1/04 and 6/30/05). Claims filed by PCPs were more likely to reflect a permanent partial disability payment ($p=0.03$), however the magnitude of the difference was very small. Claims filed by ARNPs were slightly less likely to be rejected or to be compensable, however the differences in claim status were not statistically significant overall.

^o Further statistical detail can be found in the technical appendix.

^p The provider type variables were dropped. Further statistical detail can be found in the technical appendix.

Table VI. Claim status

Claim Status*	ARNP <i>n</i> =3,582	PCP <i>n</i> =44,141	p-value
<i>Percent of claims</i>			
Claim status:			NS
Rejected	10.2	10.8	
Non-compensable	69.1	66.8	
Compensable	19.4	20.7	
Other**	1.3	1.7	
Permanent partial disability payment	3.1	3.8	0.03

* As of final data extraction on 7/2/06

** Pending, Provisional, Kept on Salary, Loss of Earning Power, Fatal, Total Permanent Disability

There were very few claims with a status of Kept on Salary, Loss of Earning Power, Fatal, or Total Permanent Disability. Those claims were excluded from all analyses that follow as there were too few in each category to make meaningful comparisons.

Disputed claims and attorney representation

There was no evidence of any systematic pattern of differences between ARNPs and PCPs regarding the percent of claims with protests, appeals, or attorney representation during the follow-up period (Table VII). The only comparison that reached statistical significance showed that among compensable claims, ARNPs had a very slightly lower percentage of appeals compared with PCPs. Within the 5,025 claims with a recorded protest and the 890 claims with a recorded appeal, there were no meaningful or significant differences between ARNPs and PCPs in terms of whether the employer, claimant, or provider filed the dispute.

Table VII. Disputed claims and attorney representation

Administrative Indicators	ARNP <i>n</i> =3,539	PCP <i>n</i> =43,427	p-value
<i>Percent of claims</i>			
Any protests			
Not accepted*	10.9	11.3	NS
Non-compensable	5.1	5.8	NS
Compensable	27.4	26.3	NS
Any appeals			
Not accepted	2.2	3.3	NS
Non-compensable	0.3	0.7	0.02
Compensable	5.9	5.1	NS
Attorney representation			
Not accepted	2.2	2.3	NS
Non-compensable	0.3	0.3	NS
Compensable	6.0	5.9	NS

*Represents claims with a status of Rejected, Pending, or Provisional. Claim status was recorded as of final data extraction on 7/2/06, and may have changed over time.

Other administrative indicators

The process of care indicators included here are intended to give a picture of possible differences in administrative efficiency and case mix between provider types; however, these indicators are at best only partially under the control of the attending provider. The process indicators in this table are all worded so that a lower percent is “better” (an indicator of less potential friction costs, dissatisfaction, etc.). Only accepted claims were included.

There were essentially no differences between ARNPs and PCPs for most of the indicators presented in Table VIII. ARNPs were slightly less likely to file the claim more than 7 days after the first medical visit ($p=0.003$), and mean claim filing time was 3.4 days shorter for ARNPs ($p=0.005$). A closer look was then taken at several of these indicators: claim filing time, transfers of attending provider, and claim duration.

Table VIII. Administrative process of care indicators

Administrative Indicators	ARNP	PCP	p-value
	<i>n=3,172</i>	<i>n=38,637</i>	
Mean claim filing time (in days)*	11.3	14.7	0.005
	<i>Percent of claims</i>		
First medical visit > 1 day after injury*	39.4	41.0	NS
Claim filing > 7 days after first medical visit*	34.7	37.4	0.003
> 1 attending provider on record	16.7	15.9	NS
Claim still open 6 months after claim filing**	19.9	21.1	NS
Claim still open 12 months after claim filing**	9.6	10.7	NS
Claim reopened at least once	0.5	0.6	NS

*For this table, first medical visit date was derived from the claims data

**Defined as the time from the date of claim filing to the last observed claim closure date or the end of the follow-up period, whichever was earlier

Claim filing time

This analysis considered whether there were differences after implementation between ARNPs and PCPs in the average length of time from the first medical visit to L&I’s receipt of the accident report, and in the proportion of claims filed within 7 days of the first medical visit.^q

Linear regression was used to control for rural provider location, whether the attending provider was a COHE provider by the date of claim filing, injury type, occupational disease, provider volume, and sociodemographics. Controlling for these factors, ARNPs filed claims on average 4.2 days faster than did PCPs (95% CI: -6.4, -2.0; $p<0.001$).

q First medical visit is defined here using the date in the claims file rather than the first date of service from the medical billing data. This is because the existence of multiple provider bills at the first medical visit did not allow for correcting standard errors by accounting for the correlation of claimant outcomes within a specific attending provider’s practice or for identifying variables specific to a single provider, such as rural location, claim volume, etc. The first medical visit date in the claims file matched the date derived from billing data 85% of the time. In other analyses, findings did not differ based on which source was used.

Logistic regression was used to investigate whether there was a difference between ARNPs and PCPs in the likelihood of claim filing within 7 days of the first medical visit, controlling for the same factors as before. Providers of workers' compensation-related care in Washington State are legally required to file the accident report within five days of identifying a work-related injury or illness, however compliance is inconsistent. Seven days was used as the cutpoint for this evaluation rather than five, to allow for weekends consistently across claims. The results were similar. ARNPs were more likely to file the claim within 7 days of the first medical visit than were PCPs ($p=0.04$).^r

Transfers of attending provider

In general, ARNPs and PCPs had a very similar pattern of attending provider transfers (Table IX). Neither the mean nor median number of days to the first transfer of attending provider significantly differed between ARNPs and PCPs. For both ARNPs and PCPs, over 65% of transfers of attending provider were to providers other than ARNPs, PCPs, PAs, or occupational medicine physicians.

Table IX. Percent of claims with 1, 2, or 3 or more attending providers

Provider Type	Number of attending providers		
	1	2	≥3
	<i>Percent of claims</i>		
ARNP	83.3	13.4	3.3
PCP	84.0	12.9	3.1

Claim duration

For this analysis, claim duration was defined as the length of time from the accident report filing date to the last observed claim closure date within the follow-up period. If the claim was open at the end of follow-up, claim duration was set equal to the duration of follow-up. All claims were followed for at least one year and up to two years after claim filing. 6% of claims remained open at the end of follow-up, for both ARNPs and PCPs.

In an unadjusted comparison, those claims having ARNPs as the first attending provider were closed on average 6 days sooner compared with PCP claims ($p=0.016$), and 5 days sooner for the subset of non-compensable claims ($p=0.004$). There was not a significant difference in claim duration between ARNPs and PCPs for compensable claims.^s

Linear regression was used to control for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type and severity, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, and sociodemographics. Although claims closed on average 3.8 days sooner for ARNPs, the difference was not statistically significant (95% CI: -10.7, 3.1; $p=0.28$).^t

^r Further statistical detail can be found in the technical appendix.

^s A table providing more elaborate descriptive statistics can be found in the technical appendix (Table A-1).

^t Further statistical detail can be found in the technical appendix.

III. Outcomes

For the three evaluation questions related to worker outcomes and claim costs, the sample was limited to accepted claims with either an ARNP or PCP recorded as first attending provider. Claims that had any bills for inpatient, ED, or ambulance services at the first medical visit were excluded (only 5% of claims were excluded on this basis). This was done in order to provide a sample that would be more homogeneous (to limit selection bias^u) and because the interest was primarily in outcomes for office and clinic based ARNPs, rather than those that might be working in EDs (and therefore likely directly with physicians).

For each of the three questions, a secondary analysis was performed using the subset of claims that had no attending provider transfers. The initial attending provider is not necessarily responsible for downstream events if the attending provider changes. However, limiting the primary analysis to this set of claims could exacerbate any selection bias in favor of ARNPs, since claims involving higher initial severity, deteriorating conditions, or those requiring surgery may be more likely to be transferred to a non-ARNP provider at some point (for example, it is standard practice to transfer attending provider status temporarily to a surgeon for any claim involving surgical intervention, to facilitate global billing). However, as noted earlier, there was essentially no difference in the observed pattern of attending provider transfers between provider types. As will be described in more detail below, there were no statistically significant differences between ARNPs and PCPs regarding time loss and costs, regardless of which sample was used. However, as expected, observed (but nonsignificant) differences were more likely to favor ARNPs when just those claims having no attending provider transfers were used.

A. Did average medical costs per claim differ between ARNPs and PCPs in the role of attending provider?

Average unadjusted medical costs per claim were slightly lower for ARNPs (Table X), although this varied by injury type. Figures 5 and 6 display mean and median costs by injury type.^v

(Mean refers to the average, or total medical costs divided by the number of claims, while median refers to the cost for a typical claim, where half of claims have higher costs than the median, and half have lower. For these comparisons, the median was always lower than the mean, because a few claims had very high medical costs.)

Table X. Medical costs per claim, by first attending provider type

Provider Type	N	Median	Mean	SD	90%	Max
ARNP	2989	\$363	\$2,140	\$5,114	\$5,781	\$66,401
PCP	36548	\$394	\$2,219	\$5,164	\$6,108	\$105,634

^u Selection bias refers to the extent to which the results might be affected by differences between those injured workers having ARNPs compared with PCPs as their first attending provider. Differences in measured characteristics (such as age, sex, injury type) were controlled, however, the injured workers seen by the two provider types might have been different in ways that were not measured.

^v A table providing complete descriptive statistics broken out by injury type, can be found in the technical appendix (Table A-2).

Figure 5. Mean medical costs by injury type

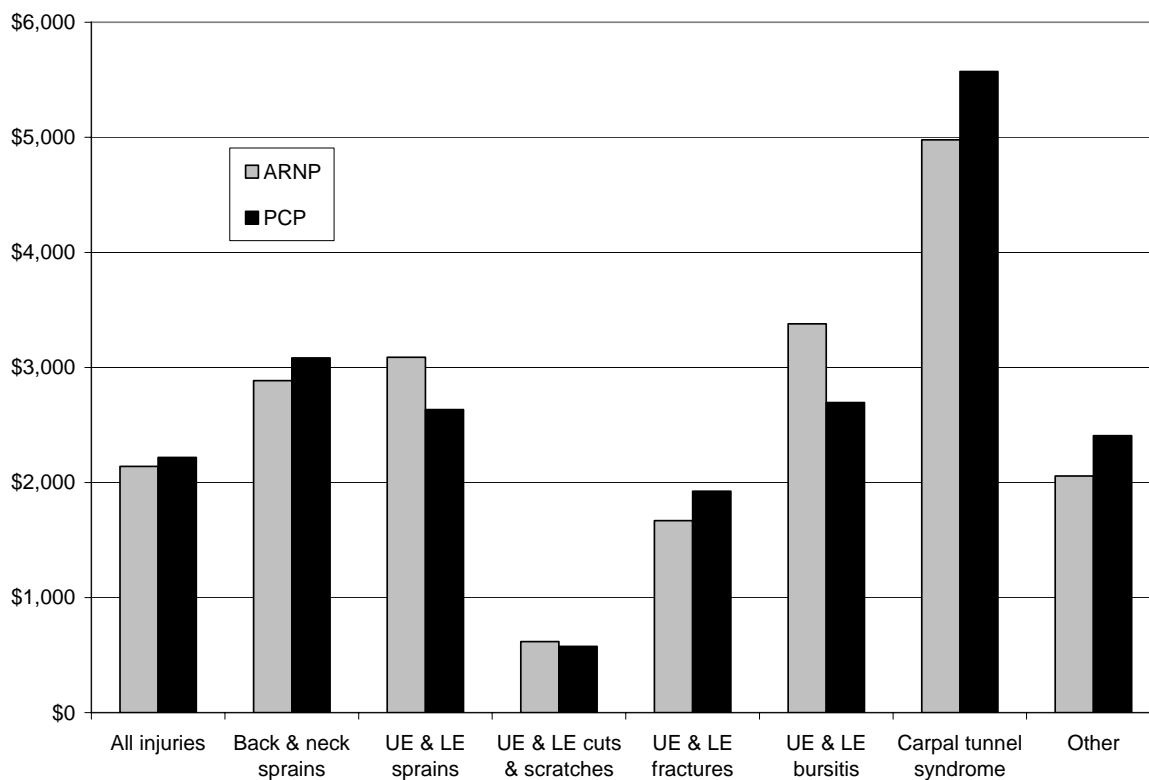
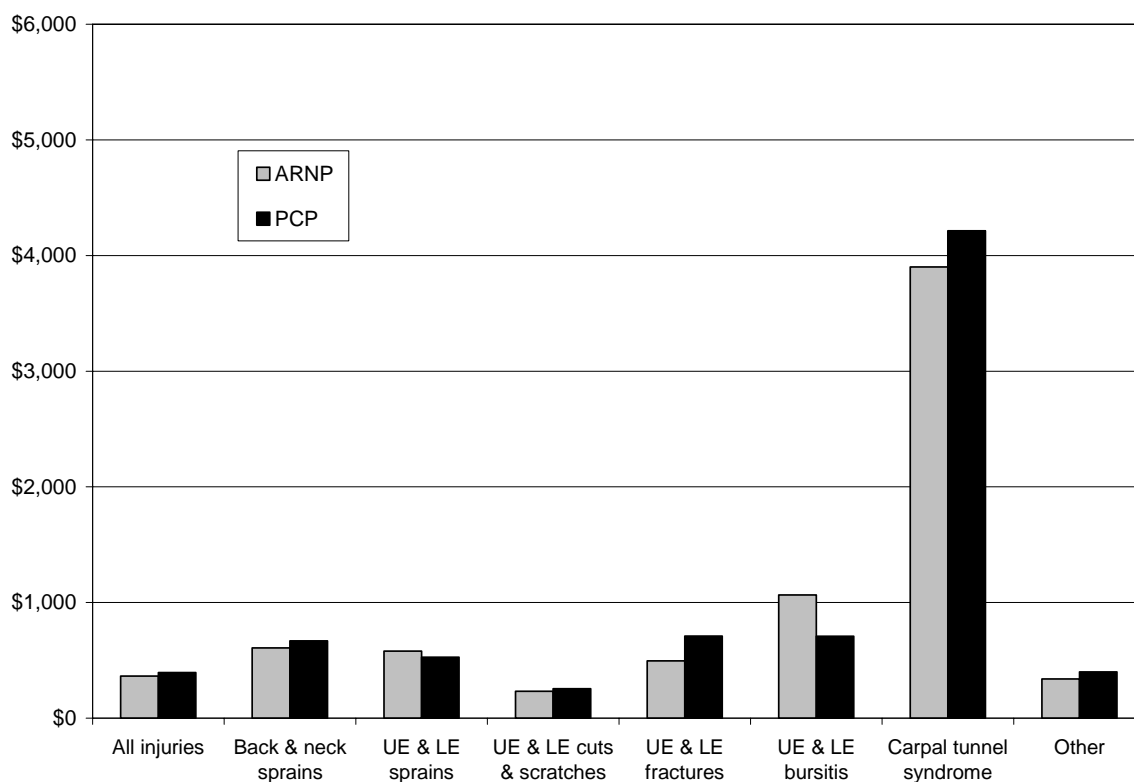


Figure 6. Median medical costs by injury type



Linear regression was used to control for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, and sociodemographics.

Although average medical costs per claim tended to be lower for ARNPs, there were no statistically significant differences in average medical costs between ARNPs and PCPs, either in the complete sample (\$4 lower for ARNPs, $p=0.98$, 95% CI: -\$272, \$262) or in the subset of claims that had no transfers of attending provider (\$93 lower for ARNPs, $p=0.28$, 95% CI: -\$262, \$76).^w Because of the apparent unadjusted differences in medical costs between ARNPs and PCPs across injury types, effect modification by injury type was also tested. There were no statistically significant medical cost differences between ARNPs and PCPs for any injury type (overall $p=0.50$).

B. Did average cumulative time loss days per claim differ between ARNPs and PCPs in the role of attending provider?

Within this sample of compensable and non-compensable claims, 21.9% of ARNP claims were compensable, compared with 23.5% of PCP claims ($p=0.049$). Although the difference was statistically significant, it was quite small. The following analyses of time loss days and time loss costs were limited to compensable claims.

Average unadjusted time loss days per compensable claim were exactly the same for ARNPs and PCPs (Table XI). Median time loss days were higher for ARNPs, but were lower at the 90th percentile. Figures 7 and 8 display mean and median time loss days by injury type.^x

Table XI. Time loss days per compensable claim, by first attending provider type

Provider Type	N	Median	Mean	SD	90%
ARNP	654	41	111	154	373
PCP	8576	32	111	162	383

^w Further statistical detail can be found in the technical appendix.

^x A table providing complete descriptive statistics broken out by injury type can be found in the technical appendix (Table A-3).

Figure 7. Mean time loss days by injury type

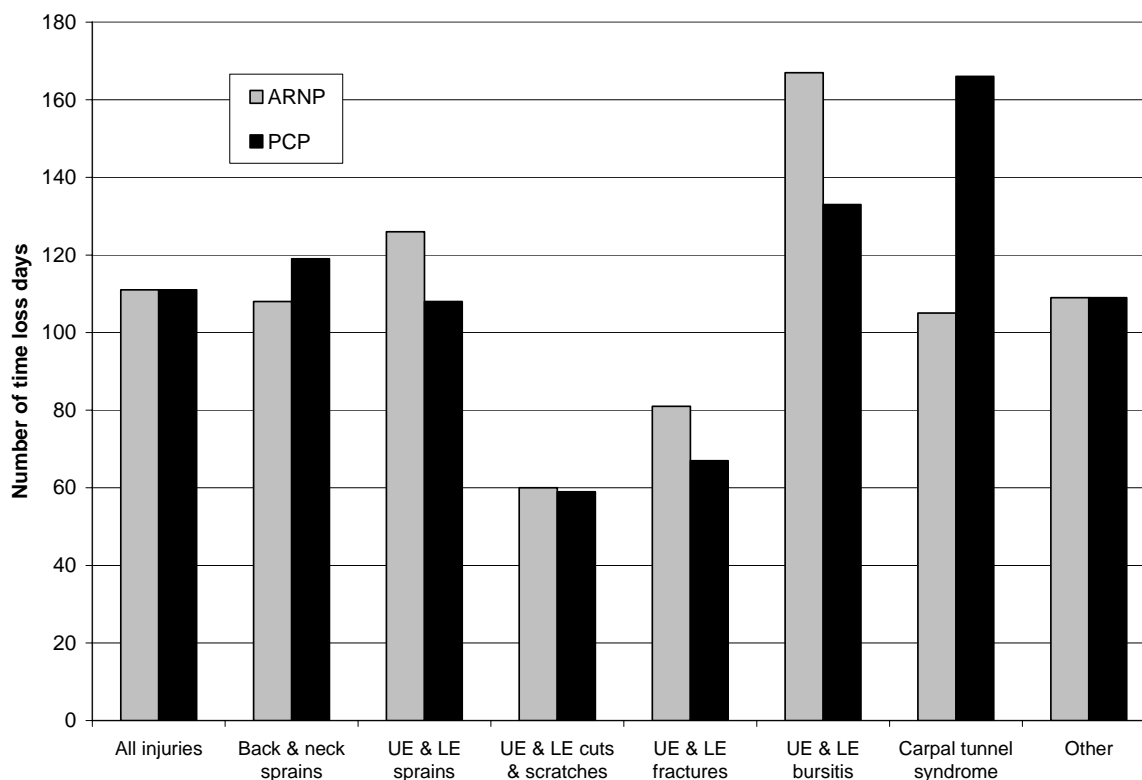
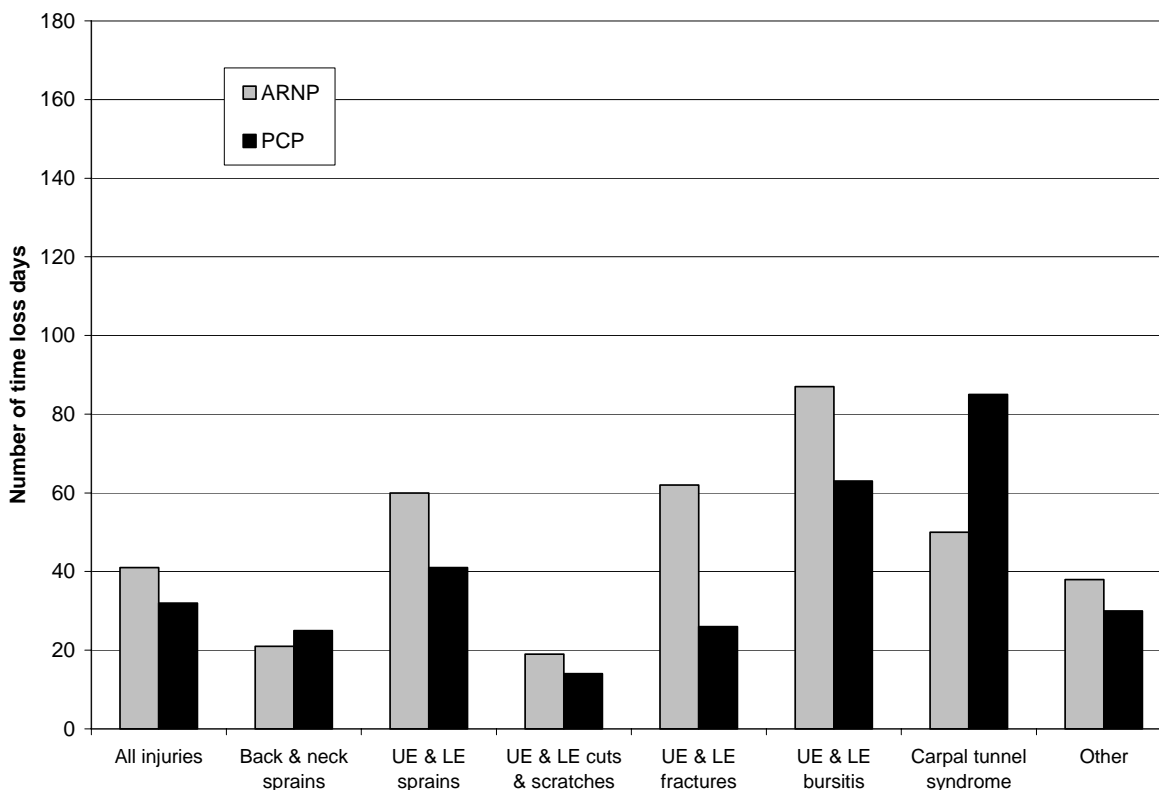


Figure 8. Median time loss days by injury type



Linear regression was used to control for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, unemployment rate and sociodemographics.

Although the average number of time loss days per claim tended to be lower for ARNPs, there were no statistically significant differences in average time loss days between ARNPs and PCPs, either in the complete sample (1 day less for ARNPs, $p=0.89$, 95% CI: -14, 12) or in the subset of claims that had no transfers of attending provider (10 days less for ARNPs, $p=0.11$, 95% CI: -23, 2).^y

To test the assumption that censoring did not introduce significant bias (due to the 6% of claims that were still open at the end of the follow-up period), Cox proportional hazards regression was used. The same covariates were controlled, with the exception of duration of follow-up, since survival analysis rendered such control unnecessary. The results confirmed the findings from linear regression that there was not a meaningful or statistically significant difference between ARNPs and PCPs.

Kaplan-Meier survival curves were used to provide a visual depiction of the relationship between the number of cumulative time loss days and the proportion of claimants still on time loss. (The interpretation of these curves is opposite that of the usual survival curves involving mortality. A “better” time loss curve would have a smaller gap between the curve and the lower left corner of the graph.) Figure 9 shows the unadjusted relationship for all injury types, separately for ARNPs and PCPs. As shown by the figure, over half of claimants were off time loss within 45 days for both ARNPs and PCPs. Figure 10 included adjustment for rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, unemployment rate and sociodemographics (as in the Cox proportional hazards regression). The pattern for ARNPs was again nearly identical to that for PCPs.

Figures 11 and 12 were adjusted for the same covariates as Figure 10, but provide a look specifically at the two injury types representing the largest number of compensable claims. Figure 11 suggests that time loss for workers with back and/or neck sprains (the largest injury category) ended sooner for those that had ARNPs as their first attending provider. For ARNPs, about 86% of workers with back and/or neck sprains were off time loss within 45 days, compared with about 69% for PCPs. For upper and lower extremity sprains (Figure 12), the pattern for ARNPs was very similar to that for PCPs.

^y Further statistical detail can be found in the technical appendix.

Figure 9

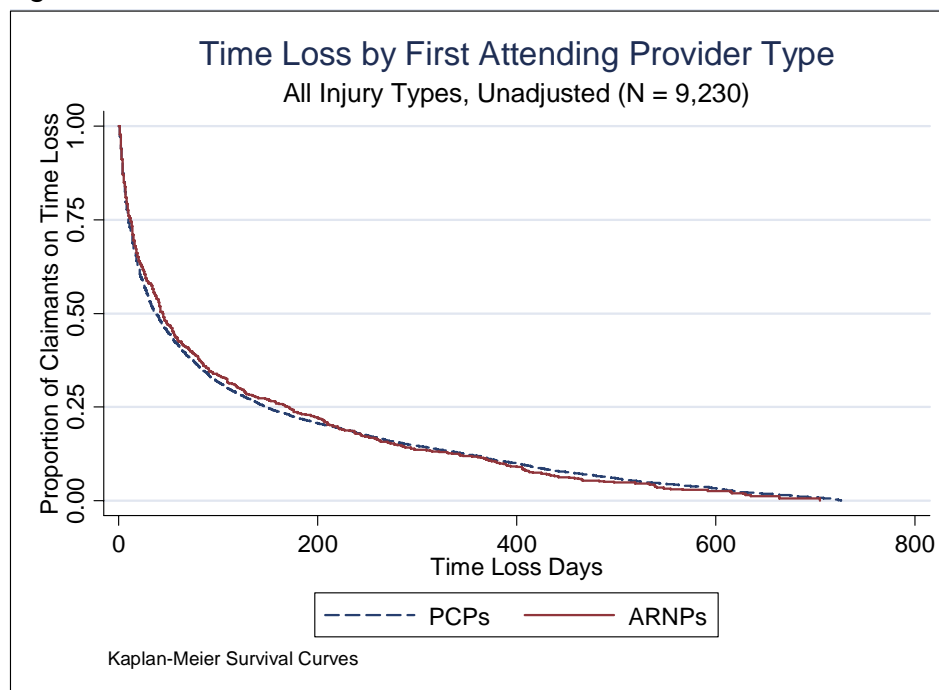


Figure 10

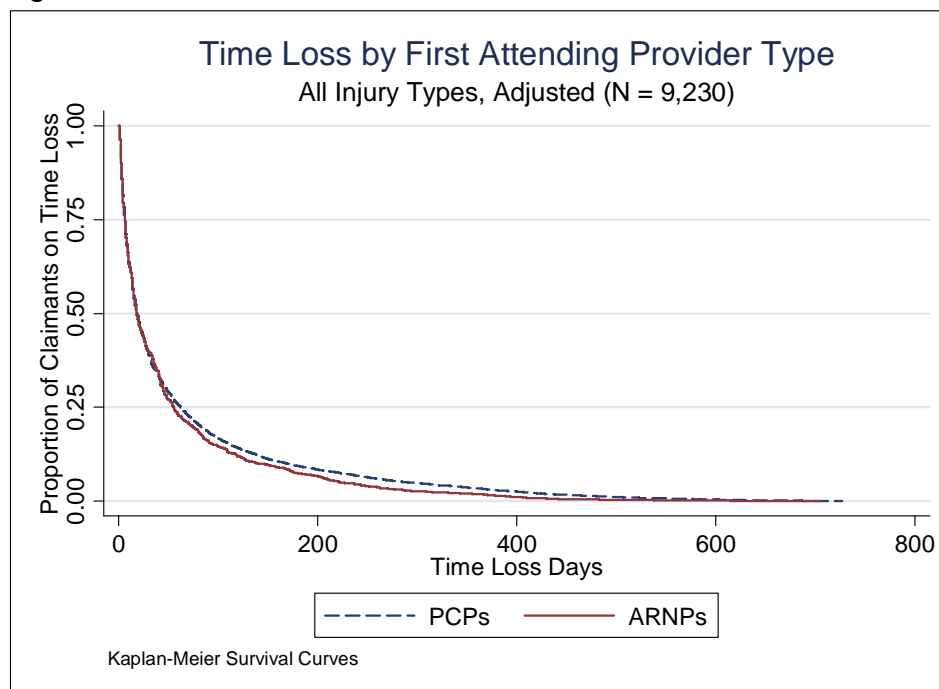


Figure 11

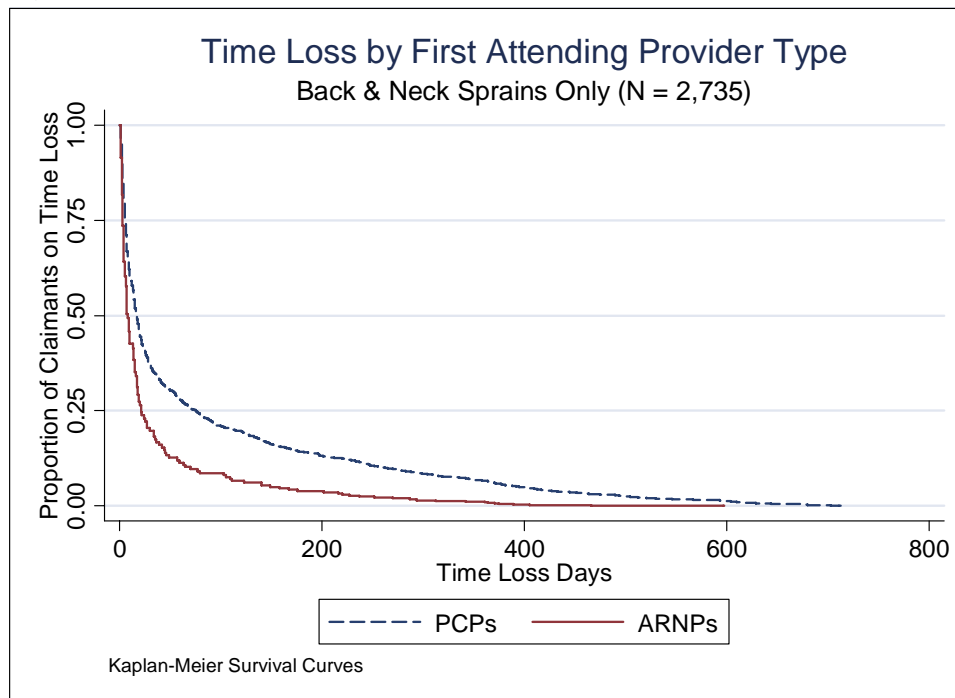
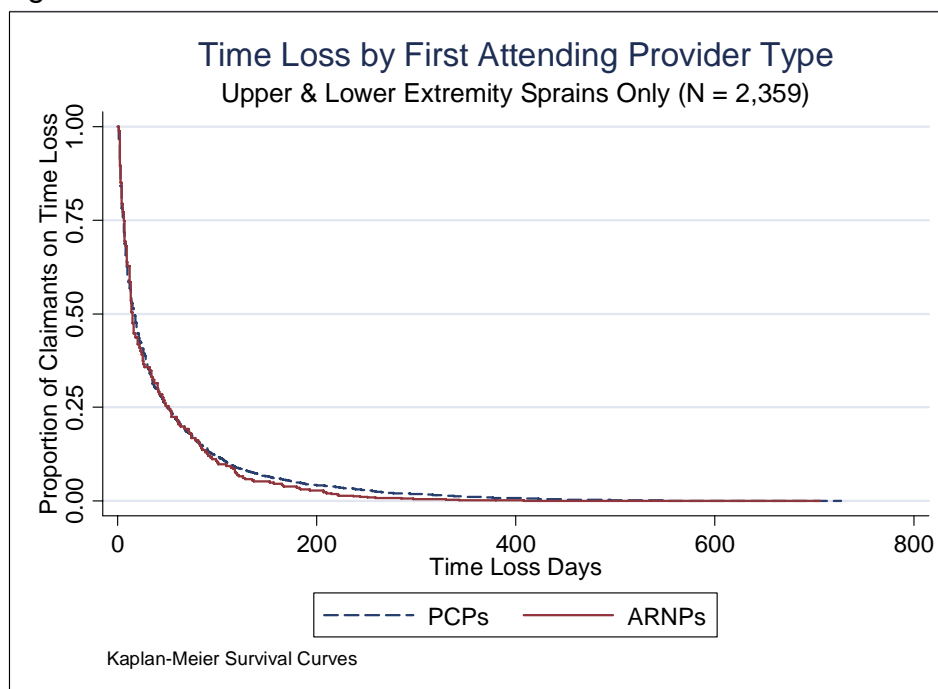


Figure 12



C. Did average time loss costs per claim differ between ARNPs and PCPs in the role of attending provider?

Average unadjusted time loss costs per claim were slightly lower for ARNPs (Table XII), although this varied by injury type. Figures 13 and 14 display mean and median time loss costs by injury type.^z

Table XII. Time loss costs per compensable claim, by first attending provider type

Provider Type	N	Median	Mean	SD	90%	Max
ARNP	654	\$1,290	\$5,585	\$9,724	\$18,037	\$58,544
PCP	8576	\$1,362	\$5,733	\$10,346	\$17,797	\$90,045

Linear regression was used to control for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, unemployment rate and sociodemographics.

There were no statistically significant differences in average time loss costs per compensable claim between ARNPs and PCPs, either in the complete sample (\$338 higher for ARNPs, $p=0.42$, 95% CI: -\$490, \$1165) or in the subset of claims that had no transfers of attending provider (\$428 lower for ARNPs, $p=0.23$, 95% CI: -\$1132, \$276).^{aa} It was unclear why average time loss costs tended to be higher for ARNPs, while the average number of time loss days tended to be lower (though neither observation was statistically significant). The difference is likely related to the high variability in observed costs (due either to random variation/chance or to variability explained by unmeasured variables), since the confidence intervals were very wide despite a large number of claims.

^z A table providing complete descriptive statistics broken out by injury type can be found in the technical appendix (Table A-4).

^{aa} Further statistical detail can be found in the technical appendix.

Figure 13. Mean time loss costs by injury type

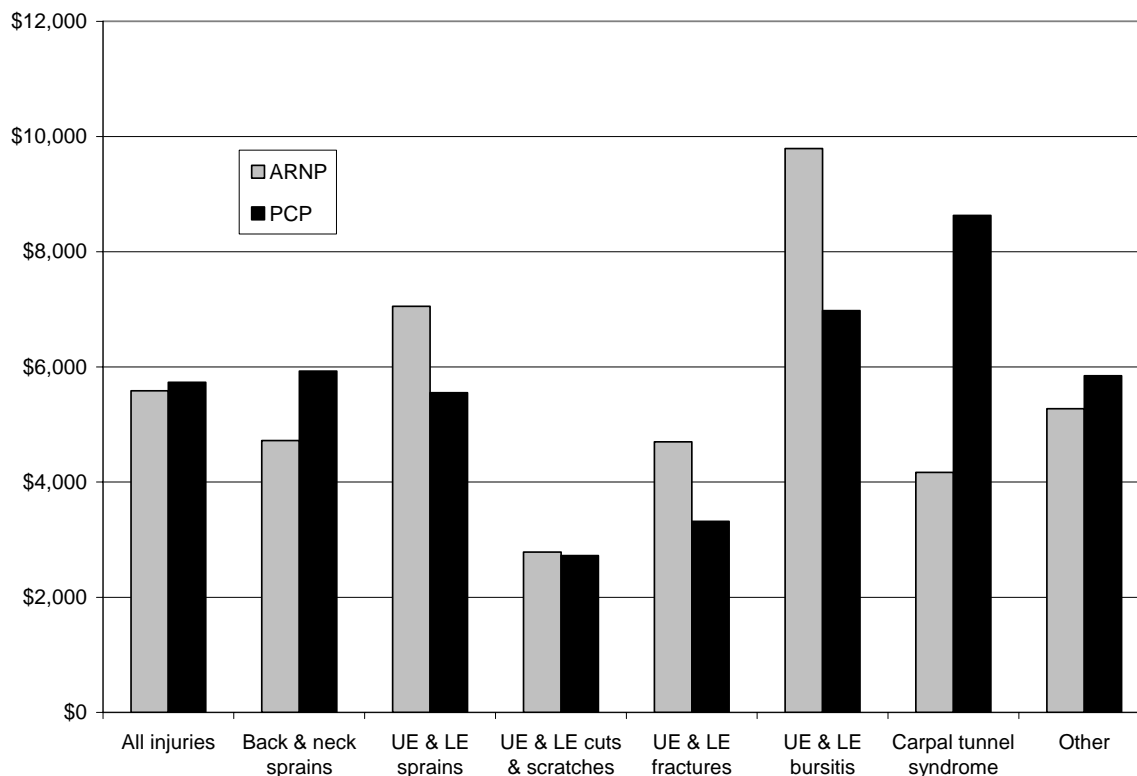
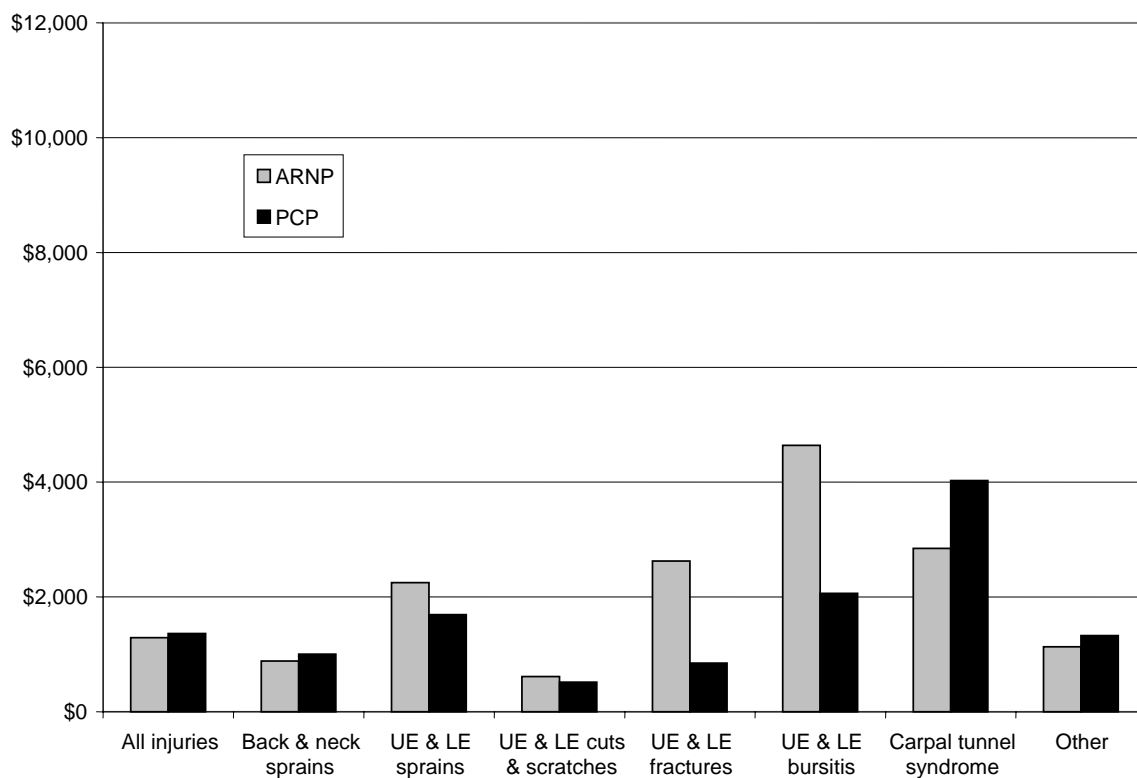


Figure 14. Median time loss costs by injury type



Summary of findings

SHB 1691 was implemented July 1, 2004, authorizing ARNPs to independently perform those functions of an attending physician within their scope of practice, including signing accident report forms and certifying time loss. In the first year after implementation, ARNPs were the first attending provider for 6.9% of the claims filed by primary care providers (ARNPs, PCPs, and PAs). This report examined a number of questions regarding potential effects on access to health care for injured workers, administrative process of care indicators, worker outcomes, and claim costs.

Findings are summarized here into three categories: those relating to system factors measured pre- and post-implementation of SHB 1691, those relating to rural versus urban geographic location, and those relating to differences between ARNPs and PCPs in the role of attending provider.

System factors measured pre- and post-implementation of SHB 1691

- Implementation appears to have encouraged ARNPs to enroll as L&I providers. For ARNPs, average monthly enrollment as new L&I providers increased by about 47% after implementation (compared with an increase of 22% for PCPs).
- The number of active ARNP providers in the L&I system rose 8.1% after implementation, compared with a decrease of 1.4% for PCPs (adjusted for change in the underlying employed population).
- The legislation did not produce any statewide effect on 1) the likelihood of being seen in an emergency department; 2) the length of time between the date of injury and the first medical visit; or 3) the likelihood of the first medical visit occurring within one day of injury.
- The number of claims filed by other providers decreased in rough proportion to the increase in claims filed by ARNPs and PAs.
- There was no meaningful change in the percent of disputed claims (protests and appeals) attributable to SHB 1691.
- The change in signature requirement for accident reports may have improved administrative efficiency. Among claimants who saw ARNPs, there was a 33% decrease after implementation in the average time from the first medical visit to filing of the accident report, and a significant increase in the likelihood of filing within 7 days.

Rural vs. urban geographic location

- 22% of ARNPs were located in rural areas, compared with 17% of PCPs.
- After implementation, ARNPs filed 10.8% of the claims in rural areas filed by ARNPs, PAs or PCPs, compared with 6.3% in urban areas, and all counties where ARNPs filed more than 10% of those claims were rural counties.
- For those workers with injuries that occurred in rural counties, 13.3% had an ARNP as their first attending provider, compared with only 4.5% of those injured in urban counties.

- The proportion of Washington-licensed ARNPs enrolled as L&I providers appeared higher in rural areas compared with urban areas.
- Although claim filing times were 3.5 days longer for rural providers (averaged over the two year period of this study), implementation of SHB 1691 did not decrease claim filing times significantly more in rural compared with urban areas.

Differences between ARNPs and PCPs in the role of attending provider

- Differences in claimant characteristics based on their attending provider type were generally small. The distribution of injury types was remarkably similar between ARNPs and PCPs.
- 22% of ARNPs were located in rural areas, compared with 17% of PCPs.
- PCPs were more than twice as likely as ARNPs to be the attending provider for more than 24 claims a year (29.7% compared with 13.4%).
- There were essentially no differences between ARNPs and PCPs in the percent of rejected or compensable claims. Claims filed by PCPs were more likely to receive a permanent partial disability payment (3.8% compared with 3.1%).
- There was no evidence of any meaningful difference between ARNPs and PCPs regarding the percent of claims with protests, appeals, or attorney representation.
- There were essentially no differences between ARNPs and PCPs regarding the time from injury to the first medical visit, the percent of claims reopened, transfers of attending provider, or claim duration.
- ARNPs were significantly more likely to file the claim within 7 days of the first medical visit, and filed claims on average 4.2 days faster than did PCPs.
- There were no statistically significant differences between ARNPs and PCPs regarding average time loss days, medical costs, or time loss costs per claim.

Conclusions

Implementation of SHB 1691 was not associated with any negative impact on costs, claim disputes, or time loss duration, and appeared to positively affect provider enrollment, availability of authorized attending providers in rural areas, and administrative efficiency.

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Technical Appendix

Software used for analyses

All statistical analyses were conducted using Stata 8.2 for Windows (StataCorp, College Station, TX). Graphs were produced using Stata 8.2 or Excel 2002 (Microsoft Corporation).

Data characteristics and data cleaning

Missing data

Aside from some sociodemographic variables (see variable definitions below), missing data was not a major problem. In general, binary indicators were set to default to the most likely case when data was missing. (For example, if there were no medical bills available for a particular claim, the indicators for ED and inpatient services were set to 0, meaning it was assumed there were no such services.) In many cases, the presence of a particular indicator was documented in the claims or billing data, but there was not a consistent method of documenting its absence. In these cases, the indicator was set to 0 as the default. (For example, if there was no evidence of attorney activity, it was assumed there was no attorney involved.) Although these strategies may have introduced some misclassification, it was considered more important to retain a complete population-based sample.

Outcome variables

In a small number of cases, the figures for medical costs, time loss days and time loss costs were negative. This may have been due to system calculation errors in processing repayments. Time loss days and costs were set to 0 for those claims with negative values. In a very small number of cases, the number of time loss days was greater than what would seem possible (date of injury to the last claim closure date or the end of follow-up). The source was unclear, and it was not possible to determine whether the fault lay with the date of injury or the number of time loss days. Those claims were retained in the analysis, and the number of recorded time loss days was not adjusted.

Non-unique provider identification numbers

As noted in the Limitations section, L&I provider identification numbers are not necessarily unique identifiers. Some providers may have used another provider's existing number, rather than applying for their own. This was impossible to detect in the data available. Some providers have multiple identification numbers. This issue was investigated and remedied to the limited extent possible. Where multiple identification numbers for the same provider could be identified with a reasonable level of certainty (based on exact matches for provider name, county, zip code, and provider type), one of the multiple provider identification numbers was selected as a master number for that provider and the others were replaced with the master number in all datasets (prior to the calculation of numbers of providers, etc.). This was a conservative strategy meant to minimize the introduction of new errors, and it is likely that this strategy did not capture many multiple identification numbers, due to potential typographical errors in names, etc. This strategy resulted in provider identification number changes for 4% of providers and 10% of claims.

Definitions of key variables

Sociodemographics

The sociodemographic variables available in the data included age, gender, marital status, dependents and pre-injury income. The variables for marital status, dependents, and pre-injury income are not considered reliable for non-compensable claims. In particular, pre-injury income was missing in a high percentage of cases for non-compensable claims. Therefore, most analyses included only age and gender. For those analyses restricted to compensable claims, all five sociodemographic variables were included. Age was categorized as 18-24, 25-34, 35-44, 45-54, and 55-70 (18-24 was the referent category). Gender, marital status (married vs. widowed/separated/divorced/single), and having dependents were binary. Pre-injury income was measured in hundreds of dollars per month.

Injury type

Injury categories were constructed using existing American National Standards Institute (ANSI) Z16.2 coding for nature of injury and part of body.⁵⁵

Occupational disease

The indicator for occupational disease identified claims that were recorded as probably or possibly being the result of an occupational disease. There were occupational disease claims identified in all injury type categories included in regression analyses that also included this indicator.

Severity

For some analyses, an indicator for severity was included, or those cases identified by this indicator were excluded. The severity indicator identified those cases with any first medical visit bill for emergency department, inpatient, or ambulance services. (See Place of Service definition for details.)

Claim status

All claim status variables were based on the claim status as noted at the time of final data extraction (July, 2006).

- ***Allowed claim:*** approved claim
- ***Rejected claim:*** a claim denied because it either did not meet the criteria for a valid claim or was a duplicate of a previously filed claim
- ***Non-compensable:*** any claim that results in payment for medical treatment only
- ***Compensable:*** any claim that is expected to result in compensation payments

- **Time loss:** compensated (partial and temporary) time away from work after a work-related injury or disease
- **Permanent partial disability:** a condition that results from the permanent loss of a body part or a lasting impairment (loss of function) that has been deemed unlikely to improve
- **Total permanent disability:** permanent and complete incapacitation, preventing gainful employment
- **Pending:** undetermined claim status
- **Provisional:** conditional authorization of medical treatment while a claim is pending
- **Kept on salary:** the worker continues to be paid by the employer during a period of disability
- **Loss of earning power:** a percentage of time loss compensation paid for wages lost due to situations such as modified work assignment or enrollment in a vocational program

Claim duration

Claim duration was defined as the length of time from filing of the accident report to either the last claim closure date observed within the follow-up period or the end of the follow-up period, whichever was earlier. The accident report filing date was used rather than the date of injury because the date of injury was not considered reliable for occupational disease claims. The following limitations are noted:

- This definition underestimates actual claim duration by the amount of any delay in medical care and/or claim filing. However, an accurate comparison between provider types was considered more important than an accurate estimate of actual claim duration.
- This definition overestimates claim duration by the amount of time a claim may have been closed between the two endpoints (if the claim were closed and reopened). However less than 1% of claims were reopened during the follow-up period.
- This definition underestimates claim duration for censored claims (those claim that were still open at the end of the follow-up period). However, less than 6% of claims were censored, and the level of censoring did not differ between ARNPs and PCPs.

Place of service

The variables for office or clinic, emergency department, inpatient, and/or ambulance services were derived from the medical and hospital billing data for the first date of service noted in the billing data. In order to reduce missing data issues, these indicators defaulted to 0 if there were no bills available for the claim. This may have introduced some misclassification, however only 2.3% of claims did not have billing data available.

- ***Emergency department:*** this indicator identified those claims for which any medical bill noted the place of service as a hospital emergency room or urgent care facility
- ***Office/clinic:*** this indicator identified those claims for which all medical bills noted the place of service as an office or clinic (including independent clinics, Federally Qualified Health Centers, state or local public health clinics, and rural health clinics)
- ***Ambulance:*** this indicator identified those claims for which any medical bill noted the place of service as a land, air, or water ambulance
- ***Inpatient:*** this indicator identified those claims for which any hospital bill noted the type of service as an inpatient service

Rural/urban

Rural/urban was defined two ways. Where zip codes were available, rural was defined using zip code-based Rural Urban Commuting Area (RUCA) codes (version 2.0). For this project, the definition of rural included large rural city/towns and small and isolated small rural towns (Categorization C: details available at: <http://depts.washington.edu/uwruca/>). In cases where zip codes were not available (particularly for injury location and for county-level provider data from the Department of Health) or for sensitivity analyses, rural/urban was defined at the county level using the Washington State Office of Financial Management's designation of rural as a population density of fewer than 100 persons per square mile. Of 39 counties in Washington, 31 were designated rural using this definition.⁵⁶

Provider type

The definition of primary care physician (PCP) included those allopathic and osteopathic physicians (MDs and DOs) with a designated specialty of general practice, family practice, or internal medicine.

COHE provider

The Centers of Occupational Health and Education (COHE) project is a community-based approach to health care that provides health services coordinators to facilitate return to work efforts and provides financial incentives to enrolled providers for occupational health best practices, including submitting the accident report within 2 days. Elements of this project have been found to substantially reduce claim filing times and disability among injured workers, hence it was important to control for provider enrollment in this project.

The COHE indicator was tailored to the particular analysis. For the analysis of time from injury to the first medical visit, the indicator was based on whether any of the providers who billed on the first date of service had enrolled with the COHE project by the first date of service. For those analyses concerned with time to claim filing, the indicator was based on whether any of the providers who billed on the first date of service had enrolled with the COHE project by the date of claim filing. For those analyses looking at administrative indicators or outcomes occurring

after claim filing, the indicator was based on whether the first attending provider enrolled in the COHE project by the end of the follow-up period.

Provider volume

For each provider, the number of claims for which that provider served as an attending provider at any point during the year following implementation was derived using the complete sample of claims. An indicator was then created to represent those providers who were attending provider on a higher volume of claims (over 24 claims in that year).

Unemployment rate

County-level seasonally-unadjusted unemployment rates by month were obtained from the Bureau of Labor Statistics (seasonally adjusted data was not available at the county level). The unemployment rate assigned to each claim was based on the date the accident report was filed.

Retrospective rating group

This indicator identified those claims for which the employer participated in a retrospective rating group at the time of the claimant's injury.

Public sector employment

This indicator was based on Standard Industrial Classification (SIC) codes. Claims were identified as being from the public sector if the industry was coded as governmental (federal, state, county, or city).

Methodological details

Additional methodological details are provided below for many of the evaluation questions. Basic statistical information is provided here for each linear and logistic regression model; the predictor, outcome, and control variables for each model are presented in the body of the report. (In general, information provided in the body of the report is not repeated here.)

I. Access to health care for injured workers

D. Did new ARNP enrollment increase after implementation?

To determine the ratio of the number of ARNPs enrolled with L&I to the number of Washington-licensed ARNPs, only those ARNPs with specialties that might be expected to file workers' compensation claims were included in the denominator. Those specialties excluded were: Nurse Anesthetist Practitioner, Nurse Midwife Practitioner, Pediatric Nurse Practitioner, Clinical Specialist in Psychiatric/Mental Health Nursing, School Nurse Practitioner, and Neonatal Nurse Practitioner. Because L&I does not document the specialty of enrolled ARNPs, it was not possible to verify the assumptions underlying this decision.

The following limitations are noted:

- The ratio was based on raw numbers, with no comparison of actual license numbers

- An active license doesn't necessarily indicate the ARNP was actively practicing
- County of licensure was determined by preferred mailing address, not necessarily practice location

To determine the number of active providers in the L&I system, active providers were defined as those with any allowed L&I bill during the year in question. This may have been an undercount of available providers, since those providers who submit very few bills would tend not to be captured using this definition (e.g., if there were few worker injuries occurring within their service area).

E. Were there measurable effects of the legislation on the percentage of patients that went first to emergency departments (EDs) vs. to providers in a clinic or office, or on the average time from the date of injury to the first medical visit?

For the purposes of this question, first medical visit was based on the first date of service in the medical billing data. (Sensitivity analyses using the date from the accident report in the claims data did not alter the findings.) Non-allowed bills were included in this determination because they were considered likely to represent actual visits, even if there were irregularities leading to their non-allowance. (Only accepted claims were included.) Because there were often multiple providers that billed on the first date of service, the rural/urban indicator was set to rural if any of those providers was rurally located. For the same reason, COHE provider status was based on whether any of the providers at the first medical visit were enrolled in COHE by that date.

At the county level, the proportion of claims filed by ARNPs and/or PAs in the year after implementation accounted for anywhere from 0 to 58% of all claims filed by ARNPs, PAs, and PCPs. The median was 6%, which was used as the cutoff for this indicator. (The mean was 10%; 25% of counties had a proportion over 10%, and using that cutoff did not alter the results.) This indicator was then combined with the indicator for SHB 1691 implementation to create an interaction term that would represent the effect of the legislation specifically in those counties having higher proportions of claims filed by ARNPs and/or PAs after implementation. This interaction term was the predictor variable of interest for both parts of this question. The coefficient for this term signified the effect of the legislation specifically for those counties where ARNPs and PAs filed a higher proportion of claims after implementation. The “control group” thus consisted of those counties where ARNPs and PAs did not file many of the claims, even after implementation. This was done to isolate the effect that the legislation may have had on access from effects due to secular trends, to the limited extent possible.

Because no providers were located in Skamania County, 119 claims from Skamania County were excluded. This left 38 counties. Standard errors were adjusted to account for within-county correlation based on the county where the injury occurred (since the predictor of interest was a county-level variable), and robust variance estimates were used to account for heteroskedasticity.

Emergency department use

This analysis compared claims having any bill reporting the site of service as an emergency department with those claims having all bills reporting the site of service as an office or clinic. (Those claims with a site of service reported as “outpatient hospital” were excluded, however including those claims either in the ED or office/clinic group did not alter the findings.) Site of service was determined by medical and hospital billing data for the first recorded date of service. Because this analysis was concerned with whether provider availability might affect the use of emergency departments (rather than severity), those claims with bills for inpatient or ambulance services at the first medical visit were excluded.

Logistic regression model

N: 186,065
Cluster N: 38
Pseudo R²: 0.064

Odds Ratio	95% Confidence Interval	p-value
0.94	(0.84, 1.05)	0.30

The odds ratio represents the change in likelihood of the first medical visit occurring in an ED (vs. office or clinic) associated with implementation, specifically for those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation, and controlling for whether the worker was injured in a rural county, injury type, and sociodemographics. (Note: because emergency department use was common, the odds ratio is an overestimate of the relative risk.)

Average time from date of injury to the first medical visit

In addition to restricting this sample to specific injury types as noted in the findings, claims with a notation of probable or possible occupational disease were excluded.

Linear regression model

N: 134,538
Cluster N: 38
R²: 0.050

Coefficient	95% Confidence Interval	p-value
- 0.02	(- 0.25, 0.22)	0.88

The coefficient represents the change in the number of days between the date of injury and the first medical visit associated with implementation, specifically for those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation, and controlling for whether the worker was injured in a rural county, injury type and severity, whether any provider billing at the first medical visit was a COHE provider, and sociodemographics.

Logistic regression model

N: 134,538
 Cluster N: 38
 Pseudo R²: 0.166

Odds Ratio	95% Confidence Interval	p-value
1.01	(0.94, 1.08)	0.78

The odds ratio represents the change in likelihood of the first medical visit occurring within one day of injury associated with implementation, specifically for those counties with a higher proportion of claims filed by ARNPs and/or PAs after implementation, and controlling for whether the worker was injured in a rural county, injury type and severity, whether any provider billing at the first medical visit was a COHE provider, and sociodemographics. (Note: because a high proportion of workers were seen within one day of injury, the odds ratio is an overestimate of the relative risk.)

II. Administrative indicators

C. Did implementation affect the average claim filing time for ARNPs?

This analysis incorporated a difference in difference approach to control for secular trends. The primary predictor variable was the interaction term created by interacting the indicator for SHB 1691 implementation with the indicator for whether only ARNPs or only PCPs billed at the first medical visit.

Because there were often multiple providers that billed on the first date of service, the rural/urban indicator was set to rural if any of those providers was rurally located. For the same reason, COHE provider status was based on whether any of the providers at the first medical visit was enrolled in COHE by the time the accident report was filed. The existence of multiple provider bills at the first medical visit did not allow for correcting standard errors by accounting for the correlation of claimant outcomes within a specific provider's practice. Robust variance estimates were used to account for heteroskedasticity.

Linear regression model

N: 58,809
 R²: 0.041

Coefficient	95% Confidence Interval	p-value
- 4.53	(- 6.23, -2.83)	< 0.001

The coefficient represents the change in claim filing time (in days) associated with implementation, specifically for injured workers seen by ARNPs, and controlling for secular trends, whether any provider that billed at the first medical visit was rurally-located or was a COHE provider by the time the claim was filed, injury type, occupational disease, and sociodemographics.

Logistic regression model

N: 58,809
Pseudo R²: 0.063

Odds Ratio	95% Confidence Interval	p-value
1.78	(1.49, 2.12)	< 0.001

The odds ratio represents the change in likelihood of the claim being filed within 7 days associated with implementation, specifically for injured workers seen by ARNPs, and controlling for secular trends, whether any provider that billed at the first medical visit was rurally-located or was a COHE provider by the time the claim was filed, injury type, occupational disease, and sociodemographics. (Note: because a high proportion of claims were filed within 7 days, the odds ratio is an overestimate of the relative risk.)

D. Did implementation have a differential effect on the average claim filing time for ARNPs in rural vs. urban areas?

Linear regression model

N: 2,783
R²: 0.048

Coefficient	95% Confidence Interval	p-value
- 3.06	(- 7.23, 1.12)	0.15

The primary predictor variable was the interaction term created by interacting the indicator for SHB 1691 implementation with the indicator for rural/urban. The coefficient represents the change in claim filing time (in days) associated with implementation for injured workers seen by rural (compared with urban) ARNPs, and controlling for whether any provider that billed at the first medical visit was a COHE provider by the time the claim was filed, injury type, occupational disease, and sociodemographics. Robust variance estimates were used to account for heteroskedasticity.

E. Did administrative indicators differ between ARNPs and PCPs in the role of attending provider?

Claim filing time

The date of the first medical visit was missing in 3.7% of cases. Those cases were excluded, leaving 40,259 claims. Standard errors were adjusted to account for the correlation of claim filing times within a specific provider's practice, and robust variance estimates were used to account for heteroskedasticity.

Linear regression model

N: 40,259
 Cluster N: 2,851
 R²: 0.002

Coefficient	95% Confidence Interval	p-value
- 4.20	(- 6.44, - 1.96)	< 0.001

The coefficient represents the difference between ARNPs and PCPs in average claim filing time (in days), controlling for rural provider location, whether the attending provider was a COHE provider by the date of claim filing, injury type, occupational disease, provider volume, and sociodemographics.

Logistic regression model

N: 40,259
 Cluster N: 2,851
 Pseudo R²: 0.074

Odds Ratio	95% Confidence Interval	p-value
1.34	(1.01, 1.79)	0.04

The odds ratio represents the likelihood of claim filing occurring within 7 days for ARNPs compared with PCPs, controlling for rural provider location, whether the attending provider was a COHE provider by the date of claim filing, injury type, occupational disease, provider volume, and sociodemographics. (Note: because a high proportion of claims were filed within 7 days, the odds ratio is an overestimate of the relative risk.)

Claim duration

Table A-1. Unadjusted claim duration (in days), by first attending provider type

Claim type	Provider Type	N	Mean	SD	Median	90%	p-value*
All claims							0.016
	ARNP	3172	132	138	81	352	
	PCP	38637	138	144	83	376	
Non-compensable							0.004
	ARNP	2476	90	83	66	167	
	PCP	29490	95	91	67	181	
Compensable							NS
	ARNP	696	282	182	246	554	
	PCP	9147	278	190	232	564	

* For the difference in mean claim duration

Linear regression model

N: 41,809
Cluster N: 2,899
R²: 0.197

Coefficient	95% Confidence Interval	<i>p</i> -value
- 3.84	(- 10.75, 3.08)	0.28

The coefficient represents the difference between ARNPs and PCPs in average claim duration (in days), controlling for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type and severity, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, and sociodemographics. Standard errors were adjusted to account for the correlation of claim duration within a specific provider's practice, and robust variance estimates were used to account for heteroskedasticity.

III. Outcomes

A. Did average medical costs per claim differ between ARNPs and PCPs in the role of attending provider?

Table A-2. Unadjusted medical costs per claim, by first attending provider type and injury type

Injury Type	Provider Type	N	Median	Mean	SD	90%	Max
All Injury Types							
	ARNP	2989	\$363	\$2,140	\$5,114	\$5,781	\$66,401
	PCP	36548	\$394	\$2,219	\$5,164	\$6,108	\$105,634
Back & neck sprains							
	ARNP	462	\$607	\$2,886	\$7,029	\$6,258	\$66,401
	PCP	6405	\$667	\$3,084	\$6,704	\$8,830	\$105,634
UE & LE* sprains							
	ARNP	550	\$581	\$3,090	\$6,335	\$9,497	\$51,470
	PCP	6303	\$527	\$2,633	\$5,364	\$8,226	\$80,488
UE & LE cuts & scratches							
	ARNP	692	\$233	\$618	\$2,179	\$769	\$44,840
	PCP	8403	\$255	\$575	\$1,810	\$703	\$46,961
UE & LE fractures							
	ARNP	80	\$496	\$1,668	\$3,700	\$3,762	\$28,503
	PCP	902	\$710	\$1,926	\$4,082	\$4,962	\$69,747
UE & LE bursitis							
	ARNP	111	\$1,066	\$3,379	\$5,424	\$10,795	\$24,004
	PCP	1396	\$708	\$2,696	\$4,789	\$8,349	\$40,752
Carpal tunnel syndrome							
	ARNP	61	\$3,901	\$4,978	\$5,194	\$11,520	\$25,295
	PCP	881	\$4,215	\$5,571	\$5,489	\$12,752	\$36,820
Other							
	ARNP	1033	\$339	\$2,057	\$4,521	\$5,889	\$40,201
	PCP	12258	\$400	\$2,408	\$5,457	\$6,402	\$99,328

*UE & LE: upper extremity and lower extremity

Linear regression model

N: 39,537
Cluster N: 2,832
R²: 0.068

Coefficient	95% Confidence Interval	p-value
- 3.84	(- 272.44, 264.74)	0.98

The coefficient represents the difference between ARNPs and PCPs in average medical costs per claim (in dollars), controlling for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, and sociodemographics. Standard errors were adjusted to account for the correlation of outcomes within a specific provider's practice, and robust variance estimates were used to account for heteroskedasticity.

For the model below, the coefficient represents the difference between ARNPs and PCPs in average medical costs per claim (in dollars), solely among those claims with no change in attending provider, controlling for the same factors as above.

Linear regression model

(for the subset with no change in attending provider)

N: 33,331
Cluster N: 2,674
R²: 0.067

Coefficient	95% Confidence Interval	<i>p</i> -value
- 93.02	(- 261.72, 75.68)	0.28

B. Did average cumulative time loss days per claim differ between ARNPs and PCPs in the role of attending provider?

Table A-3. Unadjusted time loss days per compensable claim, by first attending provider type and injury type

Injury Type	Provider Type	N	Median	Mean	SD	90%	Max
All Injury Types							
	ARNP	654	41	111	154	373	754
	PCP	8576	32	111	162	383	1016
Back & neck sprains							
	ARNP	131	21	108	157	387	598
	PCP	2048	25	119	175	411	1016
UE & LE* sprains							
	ARNP	163	60	126	158	380	705
	PCP	1686	41	108	149	351	726
UE & LE cuts & scratches							
	ARNP	49	19	60	103	204	453
	PCP	519	14	59	114	174	703
UE & LE fractures							
	ARNP	16	62	81	72	220	237
	PCP	327	26	67	111	179	634
UE & LE bursitis							
	ARNP	34	87	167	176	453	555
	PCP	374	63	133	165	397	721
Carpal tunnel syndrome							
	ARNP	32	50	105	133	232	628
	PCP	501	85	166	178	451	832
Other							
	ARNP	229	38	109	160	372	754
	PCP	3121	30	109	165	393	974

*UE & LE: upper extremity and lower extremity

Linear regression model

N: 9,230
Cluster N: 2,033
R²: 0.056

Coefficient	95% Confidence Interval	p-value
- 0.97	(- 14.44, 12.51)	0.89

The coefficient represents the difference between ARNPs and PCPs in average time loss days per claim, controlling for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational

disease, provider volume, public sector employment, employer participation in a retrospective rating group, unemployment rate and sociodemographics. Standard errors were adjusted to account for the correlation of outcomes within a specific provider's practice, and robust variance estimates were used to account for heteroskedasticity.

For the model below, the coefficient represents the difference between ARNPs and PCPs in average time loss days per claim, solely among those claims with no change in attending provider, controlling for the same factors as above.

Linear regression model

(for the subset with no change in attending provider)

N: 5,134
Cluster N: 1,563
R²: 0.058

Coefficient	95% Confidence Interval	p-value
- 10.20	(- 22.76, 2.36)	0.11

C. Did average time loss costs per claim differ between ARNPs and PCPs in the role of attending provider?

Table A-4. Unadjusted time loss costs per compensable claim, by first attending provider type and injury type

Injury Type	Provider Type	N	Median	Mean	SD	90%	Max
All Injury Types							
	ARNP	654	\$1,290	\$5,585	\$9,724	\$18,037	\$58,544
	PCP	8576	\$1,362	\$5,733	\$10,346	\$17,797	\$90,045
Back & neck sprains							
	ARNP	131	\$882	\$4,719	\$7,848	\$15,458	\$38,314
	PCP	2048	\$1,004	\$5,925	\$10,661	\$20,123	\$84,274
UE & LE* sprains							
	ARNP	163	\$2,249	\$7,049	\$11,274	\$21,465	\$58,544
	PCP	1686	\$1,690	\$5,551	\$9,622	\$15,300	\$70,292
UE & LE cuts & scratches							
	ARNP	49	\$612	\$2,785	\$8,146	\$7,920	\$51,024
	PCP	519	\$514	\$2,722	\$6,167	\$8,158	\$53,384
UE & LE fractures							
	ARNP	16	\$2,626	\$4,701	\$5,578	\$15,100	\$19,593
	PCP	327	\$846	\$3,315	\$7,795	\$8,592	\$73,896
UE & LE bursitis							
	ARNP	34	\$4,638	\$9,789	\$12,603	\$26,184	\$49,907
	PCP	374	\$2,062	\$6,978	\$10,518	\$22,659	\$58,703
Carpal tunnel syndrome							
	ARNP	32	\$2,845	\$4,168	\$5,020	\$8,128	\$24,681
	PCP	501	\$4,027	\$8,631	\$11,964	\$23,381	\$82,897
Other							
	ARNP	229	\$1,132	\$5,272	\$9,811	\$14,761	\$58,047
	PCP	3121	\$1,325	\$5,845	\$10,819	\$18,395	\$90,045

*UE & LE: upper extremity and lower extremity

Linear regression model

N: 9,230
Cluster N: 2,033
R²: 0.112

Coefficient	95% Confidence Interval	p-value
337.60	(- 489.95, 1165.14)	0.42

The coefficient represents the difference between ARNPs and PCPs in average time loss costs per claim (in dollars), controlling for duration of follow-up, rural provider location, whether the attending provider was a COHE provider by the end of the follow-up period, injury type, occupational disease, provider volume, public sector employment, employer participation in a retrospective rating group, unemployment rate and sociodemographics. Standard errors were

adjusted to account for the correlation of outcomes within a specific provider's practice, and robust variance estimates were used to account for heteroskedasticity.

For the model below, the coefficient represents the difference between ARNPs and PCPs in average time loss costs per claim (in dollars), solely among those claims with no change in attending provider, controlling for the same factors as above.

Linear regression model

(for the subset with no change in attending provider)

N: 5,134
Cluster N: 1,563
R²: 0.085

Coefficient	95% Confidence Interval	p-value
- 428.16	(- 1132.33, 276.02)	0.23