

Expanding the Role of Nurse Practitioners: Effects on Rural Access to Care for Injured Workers

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ABSTRACT: *Context:* A 3-year pilot program to expand the role of nurse practitioners (NPs) in the Washington State workers' compensation system was implemented in 2004 (SHB 1691), amid concern about disparities in access to health care for injured workers in rural areas. SHB 1691 authorized NPs to independently perform most functions of an attending physician. *Purpose:* The aims of this study were to (1) describe the contribution by NPs to Washington's workers' compensation provider workforce, (2) evaluate change in provider availability attributable to SHB 1691, and (3) evaluate the effect of SHB 1691 on timely accident report filing. *Methods:* Administrative data were used to evaluate this natural experiment, using a pre-post design with primary care physicians (PCPs) as a nonequivalent comparison group. *Findings:* NPs served injured workers with characteristics similar to those served by PCPs, but 22.0% of NPs were rural, compared with 17.3% of PCPs. Of claimants with NPs as their attending provider, 53.3% were injured in a rural county, compared with 24.7% for those with PCP attending providers. The number of NPs participating in the workers' compensation system rose after SHB 1691 implementation, more so in rural areas. SHB 1691 implementation was associated with a 16 percentage point improvement in timely accident report filing by NPs in both rural and urban areas. *Conclusions:* Authorizing NPs to function as attending providers for injured workers may improve provider availability (especially in rural areas) and timely accident report filing, which in turn may improve worker outcomes and system costs.

compensation insurance fund, and 30% of those injuries occurred in rural Washington counties. By July 2006, claims for those rural injuries had resulted in more than \$98.3 million in medical costs and \$52.3 million in compensation for time lost from work (Note 1).

Concern about access to health care for injured workers in rural areas and efforts by advanced registered nurse practitioners (NPs) to expand their scope in the Washington State workers' compensation system led to the passage of Substitute House Bill (SHB) 1691 (Chapter 65, Washington State Laws of 2004). The act was implemented on July 1, 2004, as a 3-year pilot program that authorized NPs to independently perform those functions of an attending physician within their scope of practice, with the exception of rating permanent impairment. NPs provide about 10% of Washington's generalist

Rural areas are served by fewer health care providers per capita, and travel distance may present a significant health care access barrier for injured workers.¹⁻³ At the same time, rural areas account for a large fraction of workplace injuries and workers' compensation costs. In 2004, 116,159 work-related accident reports were filed with Washington's state-administered workers'

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This study was supported by the NIOSH ERC Occupational Health Services Research Training Program (#T42 CCT010418, #1 T42 OH008433), and by the University of Washington Occupational Epidemiology and Health Outcomes Program. The authors thank Mary K. Salazar, Deborah Fulton-Kehoe, and Bonnie K. Lind for providing thoughtful feedback and inspiration over the course of this study, and Jerry Gluck for providing data management support. The authors also thank Cameron Craigie for providing extensive data documentation and Jamie Lifka for her policy insights. For further information, contact: Jeanne M. Sears, PhD, Department of Health Services, University of Washington, Box 357660, Seattle, WA 98195; e-mail jeannes@u.washington.edu.

outpatient visits.⁴ NPs are licensed as independent health care providers in Washington, though they often collaborate with physicians.^{5,6} NPs developed the profession in large part in response to limited health care access in rural and inner-city areas⁷ and are the only source of care in many rural communities.⁸ There are similarities in role and function between NPs and primary care physicians (PCPs), particularly in rural settings.⁹⁻¹¹ NPs tend to have a greater scope of practice in states with more rural populations.¹² Inclusion of NPs in the health care workforce has been found to mitigate both sociodemographic and geographic disparities in access to care.^{7,8}

Many barriers to health care access and compensation for injured workers have been documented,¹³ but there is little research available regarding injured worker access to health care providers. Although SHB 1691 was not expected to affect the number of licensed NPs in Washington, its provisions for role expansion may have increased NP participation in the workers' compensation system. Prior to SHB 1691, NPs treating injured workers were required to obtain physician signatures on key workers' compensation forms, including the initial accident report. This may have caused delays in health care and accident report filing, particularly for rural or underserved populations. Provider availability, timely access to care, and system efficiency have been linked to injured worker outcomes.¹⁴⁻¹⁸

The aims of this study were to (1) describe the contribution by NPs to Washington's workers' compensation provider workforce, (2) evaluate change in provider availability attributable to SHB 1691, and (3) evaluate the effect of SHB 1691 on timely accident report filing.

Methods

Study Setting. In Washington, approximately 70% of nonfederal employees are covered by the State Fund (the state-administered workers' compensation insurance fund). Self-insured employers account for the balance. Providers must enroll with the Department of Labor and Industries (L&I) before billing for workers' compensation-related services. Providers are legally required to file the accident report within 5 days of identifying a work-related injury or illness; however, compliance is inconsistent.

Of the 39 counties in Washington, 31 were designated rural by the Washington State Office of Financial Management (OFM), which defines rural counties as those having a population density of fewer than 100 persons per square mile.¹⁹ The 31 rural counties account for 86% of the state's total land area,²⁰

30.2% of all worker injuries (based on accepted claims), and 25.7% of the employed population.²¹

Study Population and Data Sources. The study population included workers 18-70 years of age who were injured in Washington and filed an accepted State Fund workers' compensation claim between July 1, 2003, and June 30, 2005 (1 year before and 1 year after SHB 1691 implementation). The study population also included Washington-based health care providers who were enrolled with L&I at any point during the same time period. Primary care physicians (PCPs) were defined as allopathic and osteopathic physicians in general practice, family practice, or internal medicine. The few physician assistants (PAs) with surgical specialties were excluded. L&I provided claim, provider enrollment, and medical billing data. County-level data on licensed NPs were obtained from the Washington State Department of Health, and county-level employed population statistics were obtained from the Bureau of Labor Statistics (BLS). The University of Washington Human Subjects Division reviewed and approved this study.

Study Design and Data Analysis. This natural experiment was evaluated using descriptive techniques and a pre-post design. Injury categories were constructed using American National Standards Institute (ANSI) Z16.2 coding for nature of injury and part of body.²² Rural areas were defined by linking ZIP codes to Rural Urban Commuting Area (RUCA) codes (version 2.0; Categorization C).²³ Where ZIP codes were not available (for injury location and for external county-level data), we followed the OFM definition.²⁰ Distressed counties are those with a 3-year average unemployment rate at least 120% of the statewide rate. There were little missing data and fewer than 1% of eligible claims did not have billing data available. All statistical analyses were conducted using Stata 8.2 for Windows (StataCorp LP, College Station, Tex).

NP Contribution to L&I Provider Workforce. Three general approaches can be taken to workforce estimation: (1) computation of provider-to-population ratios, (2) need-based approaches (medical morbidity), and (3) demand-based approaches (utilization).²⁴ In addition, geographic accessibility is increasingly recognized as an important descriptor.² Because each approach provides somewhat different information,²⁴ the number of active providers in rural and urban counties was calculated using 3 different denominators for this study: (1) land area in square miles (geographic accessibility), (2) number of accepted injury claims (combination of need and demand), and (3) employed population (provider-to-population).

Active providers were defined as those with any allowed L&I accident report or medical bill within each year of interest (exclusive of pharmacy bills). Although the employed population denominators were not directly comparable to the numbers of workers covered by the State Fund (BLS data include employed persons 16 and over and include federal and self-insured employers), they served as a reasonable approximation. Work injuries were counted based on the reported county of injury for all accepted claims within each study year.

Change in L&I Provider Enrollment Associated with SHB 1691. In addition to assessing provider availability and participation based on medical billing and attending provider status, the incidence of provider applications for L&I enrollment was also analyzed. New L&I enrollment applications for NPs and PCPs were tabulated by geographic region. An ARIMA-based time series analysis²⁵ was used to assess whether there was a significant increase in monthly enrollment applications associated specifically with SHB 1691 implementation over the 24 months of this study. Both a step function (using an indicator for SHB 1691 implementation) and a hinge function (the indicator for SHB 1691 implementation along with a term for the interaction of SHB 1691 implementation and time) were tested.

Change in Timely Accident Report Filing for NPs. This analysis incorporated a difference-in-difference approach, comparing change from pre- to post-SHB 1691 implementation for NP claims with change for PCP claims, and removing the difference from the estimated effect to account for secular trends.²⁶⁻²⁸ SHB 1691 had no direct effect on PCP practice, but changes over time in accident report filing due to other factors would likely affect PCPs similarly to NPs. The comparison groups were constructed based on the subset of claims that had first medical visit bills only from NPs or only from PCPs.

The primary predictor variable was the term created by interacting the binary indicator for SHB 1691 implementation with the binary indicator for provider type. The coefficient for this variable represents the change over time for NP claims, controlling for any secular trends captured by PCP claims. The outcome variable was whether or not the accident report was filed within 7 days of the first medical visit, reflecting the 5-day filing requirement and an allowance for weekends. Covariates included rural location, age, sex, injury type, and provider participation in an occupational health best practices program (Note 2). Linear regression was used in order to provide a directly interpretable coefficient; robust variance

estimates were used to account for heteroskedasticity.^{29,30} A separate regression model assessed change in timely accident report filing for NPs in rural versus urban areas by adding a third-order interaction term using the indicators for provider type, SHB 1691 implementation, and rural region.

Claims were included if the date of injury, first medical visit, and accident report filing date all occurred within either the pre- or the post-SHB 1691 implementation study year. Although this method resulted in underestimates of actual filing times, it allowed for unbiased comparison between the 2 study years, avoided calendar time-dependent truncation due to claims being unobserved until the accident report was filed, and avoided misclassification due to accident report filing intervals that crossed the implementation date.

Claims filed in the 3 months immediately after SHB 1691 implementation were excluded in a secondary analysis intended to explore the possible effect of delayed diffusion of information about the bill, comparing October 2003 to June 2004 with October 2004 to June 2005 (NPs accounted for a higher percentage of claims filed in the second quarter compared with the first quarter after implementation, but there was no rise in subsequent quarters).

Results

Provider Characteristics. There were a total of 286 NPs and 2,610 PCPs who were recorded as the first attending provider for any eligible claim filed during the year after implementation of SHB 1691. Of the PCPs, 24.6% were internists, 62.3% were family practitioners, and 13.1% were general practitioners (L&I does not record specialty for NPs).

A higher proportion of NPs were located in rural areas (22.0% compared with 17.3% for PCPs, $P = .05$) and distressed counties (20.6% compared with 15.9% for PCPs, $P = .04$). Median annual claim volume was nearly 3 times as high for PCPs (PCPs = 14, NPs = 5), and was higher for rural providers (PCPs = 19, NPs = 7), compared with urban providers (PCPs = 14, NPs = 5).

Claimant Characteristics. There were 42,533 eligible claims filed in the year after implementation of SHB 1691. Although the large number of claims resulted in statistically significant comparisons, most differences were small in magnitude. Mean age was 37.0 for claimants seeing NPs, compared with 38.2 for those seeing PCPs ($P < .001$). Median pre-injury monthly income was \$2,112 for claimants seeing NPs,

compared with \$2,418 for those seeing PCPs (computed using only claims involving time loss; $P < .001$). The most notable difference was that a markedly higher proportion of claimants having NPs (vs PCPs) as their attending provider were injured in a rural county (see Table 1). NPs were somewhat more likely to see claimants who were female and had dependents. The distribution of injury type was remarkably similar between NPs and PCPs.

NP Contribution to L&I Provider Workforce. There were 115,225 claims filed and accepted in the year prior to implementation of SHB 1691, compared with 116,566 claims for the year following implementation, a 1.2% increase (there was a 3% increase in the employed population over the same time period). The number of claims filed by PCPs (along with other providers, primarily occupational medicine physicians, chiropractors, and clinics) decreased in rough proportion to the increase in the number of claims filed by NPs and PAs (the increase in claims filed by PAs was related to concurrent legislation [Note 3]).

In the first year after implementation of SHB 1691, NPs were the first attending provider for 7.0% of the accepted claims filed by primary care providers (NPs, PCPs, and PAs). NPs filed 10.8% of those claims in rural

areas compared with 6.3% in urban areas ($P < .001$). For those workers with injuries that occurred in rural counties, 13.3% had an NP as their first attending provider, compared with only 4.5% of those injured in urban counties ($P < .001$). All counties where NPs filed more than 10% of the accepted claims filed by primary care providers were rural counties. A higher percentage of the claims filed by NPs (21.1%) were filed by rural providers, compared with PAs, PCPs, or occupational medicine physicians (see Table 2).

The number of active NPs in the L&I system rose 11.4% statewide after implementation of SHB 1691 (the number of active PCPs rose only 1.6%). Table 3 presents numbers of active NPs and PCPs by geographic region pre- and post-SHB 1691 implementation and shows that, regardless of choice of denominator (land area, injury claims, or employed population), there was an observed increase in NPs participating with L&I over the study period, and that the increase was larger in rural compared with urban counties (in contrast to PCPs). The percentage increase in active NPs after SHB 1691 implementation ranged from 7.4% to 14.0% (depending on the geographic region and denominator used) while for PCPs, the change ranged from a 2.6% decrease to a 1.7% increase.

Table 1. Claimant Characteristics by Attending Provider Type

Claimant Characteristics (Percentage of Claims)	NP (n = 3,211)	PCP (n = 39,322)	P
Injured in a rural county	53.3	24.7	<.001
Male	64.8	67.4	.003
Married*	50.4	51.0	.75
1 or more dependents*	40.4	36.6	.04
Injury type:			
Back/neck sprains	15.8	17.5	<.001
UE/LE† sprains	18.0	17.1	
UE/LE lacerations and contusions	23.7	23.0	
UE/LE fractures	2.9	2.6	
UE/LE bursitis	3.6	3.7	
UE/LE heat burns	1.3	1.0	
Carpal tunnel	1.9	2.3	
Hearing loss	0.8	1.3	
Eye scratches	4.4	3.2	
Conjunctivitis	0.8	0.7	
Other injury	14.3	15.2	
Other occupational disease	2.4	2.8	
Unspecified/multiple	13.6	13.2	

*Includes only compensable claims (n = 9,834).

†UE/LE: upper extremity and lower extremity.

Change in L&I Provider Enrollment Associated with SHB 1691.

The number of new L&I enrollment applications from NPs rose 40.0% statewide after SHB 1691 implementation (the number of PCP enrollment applications rose 18.7%). However, time series analysis did not provide evidence for a significant increase in monthly enrollment associated with SHB 1691 implementation, using either a step or a hinge function. For NPs, there was a larger observed enrollment increase in rural compared with urban areas, while for PCPs the opposite was observed (see Table 4).

Table 2. Rural–Urban Claims Filed by Selected Provider Types After SHB 1691

Provider Type Filing Claim	Number of Claims	Percentage Filed by Rural Providers	Percentage Filed by Urban Providers
Nurse practitioners	3,211	21.1	78.9
Physician assistants	3,607	17.7	82.3
Primary care physicians	39,322	12.8	87.2
Occupational medicine physicians	7,083	0.1	99.9
Total	53,223	11.9	88.1

Table 3. Active L&I Providers Pre- to Post-SHB 1691, by Rural–Urban County

Provider Type	Rural Counties			Urban Counties		
	Pre-SHB 1691	Post-SHB 1691	Percentage Change	Pre-SHB 1691	Post-SHB 1691	Percentage Change
NP counts						
Total number	172	196	+ 14.0	328	361	+ 10.1
Per 1,000 square miles	3.02	3.44	+ 14.0	34.11	37.54	+ 10.1
Per 1,000 injury claims	4.94	5.57	+ 12.8	4.08	4.44	+ 8.8
Per 10,000 workers	2.26	2.47	+ 9.3	1.48	1.59	+ 7.4
PCP counts						
Total number	1,107	1,123	+ 1.5	2,421	2,462	+ 1.7
Per 1,000 square miles	19.45	19.73	+ 1.5	251.74	256.00	+ 1.7
Per 1,000 injury claims	31.78	31.90	+ 0.3	30.12	30.26	+ 0.5
Per 10,000 workers	14.56	14.15	– 2.6	10.92	10.82	– 0.9

Change in Timely Accident Report Filing for NPs.

After SHB 1691 implementation, there was a significant increase in the percentage of claims filed within 7 days of the first medical visit for those workers seen only by NPs, but no change for those seen only by PCPs (see Table 5). The number of NP-only claims rose by 186% (from 742 to 2,125) pre- to post-implementation, compared with a 2% drop in PCP-only claims. Urban providers filed 69.7% of claims within 7 days, compared with 60.5% for rural providers.

The findings of multivariate analysis were consistent with the data presented in Table 5. Controlling for age, sex, injury type, rural location, provider participation in an occupational health best practices program (Note 2), and secular trends, SHB 1691 implementation was associated with a 15.7 percentage point improvement in timely (7-day) accident report filing (95% CI: 11.6, 19.7). The use of logistic regression resulted in similar findings (Note 4). Limiting the pre-post comparison to 9-month time periods (to allow for 3 months of delayed diffusion) did not have a material impact on the findings. There was no evidence that implementation of SHB 1691 was more important in improving timely accident report filing for NPs in rural compared with urban areas.

Discussion

We found that NPs filed 7% of the accepted workers’ compensation claims filed by primary care providers in the year after SHB 1691 was implemented.⁴ Regardless of choice of participation metric (attending provider status, provider billing activity, or new enrollment applications), or choice of denominator (land area, injury claims, or employed population), there was an observed increase in NPs participating with L&I after implementation of SHB 1691, particularly in rural areas (in contrast to findings for PCPs). SHB 1691 was associated with a 16 percentage point improvement in timely accident report filing for claimants seeing only NPs at the first medical visit, with a similar effect in rural and urban areas. An increase in the number of available providers and more timely filing of the accident report can reduce health care delays, potentially improving outcomes.^{14–18} L&I has prioritized efforts to improve the timeliness of accident report filing in order to reduce the burden of work disability.^{18,31} With the notable exception that NPs were more likely than PCPs to serve workers in rural and distressed areas, we did not find substantial case mix differences between NPs and PCPs.

Table 4. Change in New L&I Enrollment Applications, by Rural–Urban Region

Provider Type	Rural			Urban		
	Pre-SHB 1691	Post-SHB 1691	% Change	Pre-SHB 1691	Post-SHB 1691	% Change
NP enrollments	23	35	+ 52.2	177	245	+ 38.4
PCP enrollments	78	82	+ 5.1	474	573	+ 20.9

Table 5. Percentage of Accident Reports Filed Within 7 Days of the First Medical Visit, by Provider Type

Provider Type	N	Pre-SHB 1691	Post-SHB 1691	P
Only NP bills	2,867	52.2	65.1	<.001
Only PCP bills	57,103	67.9	67.8	.84

It was surprising that there was not a significant differential impact of the legislation on accident report filing in rural areas. We had expected that the physician signatures required before SHB 1691 would have been more time-consuming to obtain for rural NPs. However, NPs are nearly as likely to practice independently of physicians in urban as in rural areas of Washington.^{5,6}

As expected, we found a much higher density of L&I providers in urban compared with rural counties. In the year after implementation of SHB 1691, there were 11 times as many NPs per 1,000 square miles in urban versus rural counties (13 times as many for PCPs). However, finding more providers per 1,000 injury claims and per 10,000 employed workers in rural compared with urban counties was unexpected. The opposite is usually reported. For example, in the year 2000 in Washington, there were 210 generalist physicians per 100,000 people in metropolitan counties compared with 146 in rural counties.³² There are several possible explanations for our findings. County-based measures of rurality introduce misclassification, however, this would not explain why our findings for PCPs differ in direction from the county-based findings reported above. Provider head counts do not necessarily produce realistic estimates of the supply of health care available to injured workers, due to differences in training, specialty, experience, scope of practice, productivity, and/or full-time status.⁴ Head counts may be a differentially poorer measure in rural areas,³³ and perhaps even more so in the workers' compensation setting, where L&I claimants typically account for a very small portion of a provider's practice. Finally, it may be that there was more sharing of L&I provider identification numbers in urban areas (perhaps due to turnover and supervision issues at teaching hospitals and academic centers).

There was an observed increase in NP enrollment; however, the time series analysis did not provide evidence of an increase attributable solely to implementation of SHB 1691. Slow dissemination of information about the rule changes may have limited

the direct effects of SHB 1691. Although an L&I provider bulletin explaining the new rules was sent to all enrolled clinical providers, L&I did not conduct systematic outreach or publicity for non-enrolled providers. Other than SHB 1691, there are several possible explanations for the observed increase. Increased NP enrollment could result if injured workers were increasingly seeking out NPs, employers were increasingly hiring NPs to provide care to their workers, or medical facilities seeing injured workers were increasingly hiring NPs. However, accounting for the employed population and for the number of injury claims in the analysis of active provider availability had only a minor impact. The effect of the legislation on NP enrollment applications would likely also depend on the availability of licensed NPs who were not already enrolled. Unfortunately, baseline data on the number of NPs licensed by county were unavailable. However, there were 2,705 NPs licensed in the State of Washington in August 2005 (504 in rural counties and 2,201 in urban counties). The number of NPs enrolled with L&I was approximately 47% of the number of Washington-licensed NPs. This was somewhat lower for urban (43%) and higher for rural counties (64%), suggesting that NPs in rural counties were more likely to be enrolled with L&I than those in urban counties (it should be noted that active licensure does not necessarily indicate an active practice).

It was not possible to determine from the available data whether injured workers saw a different mix of provider types after implementation of SHB 1691, or whether there were differences only in which provider signed (and billed for) the accident report due to the rule changes. Nor could we determine which NPs were in solo practice, or in practice only with other NPs. Of those claims having medical bills submitted only by NPs at the first medical visit, 10.2% had an NP listed as the first attending provider prior to SHB 1691 implementation, while 78.0% had an NP listed as first attending provider after implementation. One likely explanation is that the legislation enabled those NPs who were already seeing injured workers independently to be identified as the attending provider of record. However, it is interesting that the number of claims with bills only from NPs at the first medical visit nearly tripled after SHB 1691 implementation. This may be due to NPs being more likely to see injured workers independently post-implementation, since NPs were already able to bill for their services.

Limitations. All analyses relied on existing administrative data subject to well-known limitations.^{34,35} L&I data exclude those with the poorest access, those who never enter the workers'

compensation system due to multiple systemic barriers.^{16,36} However, the use of administrative data also has important advantages, particularly the ability to link enrolled provider data with individual and population-based claim information.³⁷

A second set of limitations is related to the provider data. The use of multiple identification numbers by a single provider was corrected for an identified 4% of providers, but there may have been additional cases. Although technically not permitted, some providers may have used another provider's number rather than applying for their own. This was not possible to detect or correct. Provider mailing addresses may differ from practice location. The use of billing data to define active providers may have undercounted available providers. The exclusion of self-insured employer data may have resulted in underestimates of provider volume.³⁷

Finally, the underlying factors affecting the distribution and availability of physicians are quite different from those affecting the distribution and availability of NPs.^{38,39} However, no other group was felt to be as broadly comparable for the analyses of geographic distribution. Chiropractors are limited by L&I regulations to treating spine or extremity-related conditions. Occupational medicine physicians file very few rural claims (Table 2). PAs are not authorized to function as attending providers in Washington State.

Conclusions

Despite these limitations, the natural experiment presented by SHB 1691 offered a useful mechanism to assess the extent to which NPs contribute to workers' compensation-related care, and the extent to which regulation-based signature requirements can impact system efficiency. Although generalizability is limited by the variation between states in both NP scope of practice and workers' compensation regulations, there is little previous research regarding the role of NPs from a workers' compensation system perspective.⁴⁰ Our results suggest that authorizing NPs to function as attending providers for injured workers may improve provider availability (especially in rural areas), timely access to care, and system efficiency, which in turn may improve worker outcomes and system costs. Subsequent to the comprehensive evaluation of this pilot program,⁴¹⁻⁴³ legislation was passed that permanently authorized NPs to function as attending providers in the Washington State workers' compensation system.

Notes

1. These figures are underestimates, and do not include projected costs or public administrative costs. They

are based solely on accepted State Fund claims for reported injuries.

2. The Centers of Occupational Health and Education (COHE) project provides financial incentives to enrolled providers for occupational health best practices (including filing accident reports within 2 days).
3. Senate Bill (SB) 6356 (Chapter 163, Laws of 2004) authorized PAs to have sole signature on accident reports for simple industrial injury claims (those not involving time loss, occupational disease, or complex injuries).
4. Linear regression results are presented in order to provide directly interpretable coefficients (change in percentage points). Logistic regression produced an odds ratio of 2.01 (95% CI: 1.69, 2.40). This provides evidence for the same direction of effect but is an overestimate of the relative risk because accident report filing within 7 days was not a rare event. Barriers to using linear regression for a binary dependent variable include: (1) predicted values falling outside a 0-1 range, (2) heteroskedasticity, and (3) non-normality. Predicted values ranged from 0.29 to 0.97. The characteristics of this sample (large size and non-extreme outcome mean) mitigate concerns about non-normality and heteroskedasticity.^{29,30}

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