

The Extraregulatory Effect of Nurse Practitioner Scope-of-Practice Laws on Physician Malpractice Rates

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Abstract

Patients can hold physicians directly or vicariously liable for the malpractice of nurse practitioners under their supervision. Restrictive scope-of-practice laws governing nurse practitioners can ease patients' legal burdens in establishing physician liability. We analyze the effect of restrictive scope-of-practice laws on the number of malpractice payments made on behalf of physicians between 1999 and 2012. Enacting less restrictive scope-of-practice laws decreases the number of payments made by physicians by as much as 31%, suggesting that restrictive scope-of-practice laws have a salient extraregulatory effect on physician malpractice rates. The effect of enacting less restrictive laws varies depending on the medical malpractice reforms that are in place, with the largest decrease in physician malpractice rates occurring in states that have enacted fewer malpractice reforms. Relaxing scope-of-practice laws could mitigate the adverse extraregulatory effect on physicians identified in this study and could also lead to improvements in access to care.

Keywords

malpractice, legal/regulatory issues, physicians, nurse practitioners, scope of practice

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Introduction

Much of the ongoing debate over scope-of-practice (SoP) laws that govern the practice of nurse practitioners (NPs) across the country focuses on the cost of and access to health care and on whether these laws legitimately promote patient safety or are simply anticompetitive restrictions on NPs' ability to compete with physicians (Conover & Richards, 2015; Dower, Moore, & Langelier, 2013; Gilman & Koslov, 2014; Naylor & Kurtzman, 2010; Spetz, Parente, Town, & Bazarko, 2013). The debate is also fueled by concerns about current and future shortages of physicians and the opportunities of NPs to address these needs (see, e.g., Reagan & Salsberry, 2013). While significant factors to consider when formulating policy, this debate has occurred largely independently of another important discussion in legal and health care circles—how to reduce medical malpractice and how to reform medical liability (Lieber, 2015; Seabury, Helland, & Jena, 2014).

Patients may sue NPs just as they may sue physicians to recover monetary damages for injuries negligently caused by those providers. The American Medical Association (AMA) argues that fear of legal liability induces the practice of defensive medicine, which can lead to more tests, procedures, and prescriptions, and causes providers to reduce the scope of their services, retire early, and even relocate to states with more favorable medical malpractice environments (AMA, 2016).

While physicians are responsible for their own malpractice across all 50 states, the same is not true of NPs. NPs can be held directly liable for malpractice just like physicians, but depending on the SoP laws in place, NPs may pass a substantial portion of their liability to their supervising physicians. When a physician supervises an NP, patients injured by the NP's malpractice may be able to hold the physician liable (and collect money damages) under several different legal theories of liability. Because these theories generally require plaintiffs to show some level of supervision or control, plaintiffs will be more likely to succeed on a claim against a physician when state SoP laws require a greater degree of physician involvement in an NP's practice. Therefore, depending on a state's SoP laws, physicians may find themselves defending lawsuits and making damages payments for errors they did not commit.

The question driving this study is whether, and to what extent, there is a connection between SoP laws, malpractice reforms, and physician malpractice rates. To answer this question, we use national longitudinal data to examine the effect of physician supervision requirements on physician malpractice rates, that is, the number of payments made to patients by, or on behalf of, physicians as a result of malpractice. Between 1999 and 2012, several states changed their SoP laws to increase or decrease the degree of physician supervision required for NPs to practice, creating a natural experiment which we exploit in an empirical model to test the effect of physician supervision requirements for NPs on physician malpractice rates. This model allows us to examine the association of the amount of malpractice liability physicians bear with state SoP laws requiring them to supervise the practices of NPs. Findings can inform both the debates over the malpractice system and the influence

of state SoP laws and alert policy makers to other possible external benefits involving expanded access to health care. To our knowledge, this study represents the first empirical test of the premise that restrictions on NP service delivery have a corresponding effect on physician malpractice rates.

New Contributions

Prior research has explored the effect of various legal reforms on both physician malpractice rates and the average payment made to resolve malpractice claims against physicians (see, e.g., Avraham, 2007; Ho & Liu, 2011; Lieber, 2015; Seabury et al., 2014; Studdert, Bismark, Mello, Singh, & Spittal, 2016). This study extends the existing literature by making three new contributions. First, we highlight the connection between state SoP and malpractice laws by examining how SoP laws affect physician malpractice rates and how this effect differs depending on which malpractice reforms states have enacted. Second, this study alerts policy makers to an “extraregulatory” effect—higher physician malpractice rates—of maintaining restrictive SoP laws for NPs. Finally, we explore the implications of both malpractice and SoP reforms for physicians and NPs. The primary empirical finding of our study is that reforming SoP laws to require less physician supervision of NP practices results in a reduction of physician malpractice rates (31%) that is more than double the reduction associated with enacting a cap on noneconomic damages (11%), which is generally considered to be the most effective state reform in reducing malpractice liability risk (Mello, 2006).

Conceptual Framework

Malpractice Liability

When patients hold health care professionals liable for mistakes, they do so under a legal theory of malpractice, which is a type of tort. Malpractice is “an instance of negligence or incompetence on the part of a professional” (Garner, 2014). To prevail on a claim of malpractice, the plaintiff must prove that the health care professional failed to exercise the degree of care and skill that a reasonable professional would use under similar circumstances. The plaintiff must also prove that this failure caused injury. If successful, the plaintiff may obtain monetary damages as compensation for the injury (Buppert, 2014).

In theory, legal liability incentivizes providers to internalize the costs of their mistakes and take appropriate care to avoid them, which can promote the provision of safe and effective care (Arlen, 2013). For example, if a provider knows that she faces a 10% chance of causing a \$10,000 harm to a patient and being held liable for that harm, then she has a financial incentive to invest \$500 in learning a new technique that reduces the probability of harm (and liability) to only 5%. Without tort law, this financial incentive would not exist.

Malpractice Reforms

While malpractice liability can induce the provision of safer care, the threat of liability can deter providers from supplying appropriate care if the amount of damages providers must pay when they are held liable is not appropriately calibrated. The AMA asserts that the current system of tort law causes physicians to perform unnecessary tests and procedures as well as avoid certain high-risk patients (AMA, 2016). NPs who are held directly liable for their actions will likely be affected similarly to physicians. In response to perceived problems in their tort regimes, many states have enacted tort reforms, which are statutory reforms to the common law of torts, to decrease the risks associated with legal liability.

Although tort reforms come in many varieties, there are three major reforms (Avraham & Schanzenbach, 2010). First, noneconomic damages caps prohibit courts from imposing noneconomic damages awards in excess of the cap amount. Second, collateral source rule reform (CSR) alters the traditional rule so that the amount of damages a defendant must pay a plaintiff can be offset by the amount of compensation the plaintiff received from other sources (e.g., the plaintiff's health insurance). Third, joint and several liability reform (JSLR) prevents plaintiffs from recovering an entire damages award from a single defendant when multiple defendants were held liable—instead, the plaintiff can only recover an amount from each defendant commensurate with that defendant's liability. While each reform has a different legal effect, each can theoretically reduce the expected liability costs of health care providers (Mello, 2006; Mello, Kachalia, & Goodell, 2011).

The practical effects of tort reforms on physician malpractice liability have been debated for decades (Zuckerman, Koller, & Bovbjerg, 1986). Although the evidence is mixed, medical malpractice liability can affect physician supply, access to care, prevalence of defensive medicine, and health care expenditures (Mello, 2006; Mello et al., 2011). Recent work has found evidence that tort reforms, especially noneconomic damages caps, can reduce the liability physicians can expect to face (Avraham, 2007; Seabury et al., 2014). Based on this evidence, we expect to find similar effects and hypothesize that enacting tort reforms will reduce physician malpractice rates.

Scope-of-Practice Laws and Malpractice Liability

In general, a health care provider may be held directly liable for her own acts and omissions, and she may be held vicariously liable for the acts and omissions of others whom she employs or controls. Thus, while patients can sue an NP who commits malpractice, they may also sue that NP's supervising physician. Several legal theories allow a plaintiff to hold a physician liable for the malpractice of an NP. First, under the doctrine of *respondeat superior*, a physician "is subject to vicarious liability for a tort committed by [her] employee acting within the scope of employment" (American Law Institute, 2006). In this context, "employee" has a much broader meaning than its traditional definition, as an "employee is an agent whose principal controls or has the right to control the manner and means of the agent's performance of work" (American

Law Institute, 2006). Under this well-established theory of liability, a patient injured by the NP may hold the physician vicariously liable and obtain monetary damages from the physician even if the physician committed no error. While a state law requiring physician supervision of or collaboration with an NP is not necessary to establish a physician's "right to control" an NP, such a law could make it substantially easier for a plaintiff to hold a physician liable.

Second, courts may allow plaintiffs to use the legal theories of apparent agency and agency by estoppel to extend liability to the physician for the NP's acts (American Law Institute, 2006). Under these theories, if the plaintiff believed that the NP was the physician's agent because of some action taken (or not taken) by the physician, the physician may be vicariously liable for the NP's acts. A state law requiring physician supervision of NPs could ease a plaintiff's legal burden in succeeding under these theories.

Third, under the doctrine of negligent supervision,

a principal [i.e., a physician] who conducts an activity through an agent [i.e., an NP] is subject to liability for harm to a third party caused by the agent's conduct if the harm was caused by the principal's negligence in selecting, training, retaining, supervising, or otherwise controlling the agent. (American Law Institute, 2006)

Thus, if a physician fails to appropriately supervise an NP, the physician may be held liable by a patient injured by an NP. As with other legal theories, a state law requiring physician supervision of an NP's practice is not necessary to prove negligent supervision, but such a law will significantly ease a plaintiff's legal burden in establishing her case.

Because all of these legal theories require that the plaintiff establish that the physician supervised or exercised some control over the NP, we hypothesize that state SoP laws which reduce the degree of physician supervision required for NPs will reduce physician malpractice rates. We further hypothesize that a monotonic relationship exists between physician supervision laws and physician malpractice rates so that the greater the reduction in the degree of required supervision, the greater the reduction in physician malpractice rates.

Given that the growth in the number of NPs outstrips physicians (Auerbach, 2012; Stange, 2014) and the increasing number of roles NPs are assuming in the health care system, ignoring the effects on legal liability could lead to unintended but salient consequences. Hooker, Nicholson, and Le (2009) examine advanced practice nurse and physician assistant (PA) malpractice rates, analyzing an earlier version of the data set used in this study. They find that advanced practice nurses and PAs are, respectively, 24 and 12 times less likely to make a malpractice payment than physicians. Brock, Nicholson, and Hooker (2017) extend this analysis, finding that NPs and PAs are less likely to make a malpractice payment than physicians. However, neither study includes an analysis of either SoP laws or tort reforms.

Although the malpractice rates of NPs are important, we do not examine them in our analysis. Raw NP malpractice rates do not necessarily reveal true NP malpractice

rates because physicians may be held liable for the errors of NPs under their supervision. However, because physicians are at risk of liability for NPs in addition to their own risk of liability, examining the effect of NP SoP laws on physician malpractice rates can elucidate the relationship between NP autonomy and physicians' malpractice risk. In this study, we empirically analyze the association between the degree of physician supervision required for NPs by state law and physician malpractice rates.

Method

Data

We first construct a data set of physician supervision laws, as these laws have a significant impact on the daily practices of NPs across the country (Gadbois, Miller, Tyler, & Intrator, 2014). We focus on three broad categories of physician supervision laws that have been used by others (Kuo, Loresto, Rounds, & Goodwin, 2013; Traczynski & Udalova, 2014). We classify each state in each year as having one of the following types of physician supervision laws: (1) NPs are allowed to practice without any required physician supervision or collaboration, (2) NPs may practice without supervision or collaboration but must be supervised to prescribe medications, and (3) NPs may not practice without a supervising or collaborating physician. Although some states use the term "collaboration" instead of "supervision," the two terms are legally equivalent, as an NP cannot practice without a "collaborating" physician just as she cannot practice without a "supervising" physician. For the purposes of this study, we treat the District of Columbia as a state. Figure 1 provides an overview of the degree of physician involvement in the practices of NPs required by state law between 1999 and 2012, and Table 1 provides a comprehensive list of these laws and the dates on which new laws became effective. As Figure 1 and Table 1 demonstrate, there is significant state variation in physician supervision laws across the period of time we examine, which aids in the identification of our empirical model.

To classify each state's SoP laws, we rely directly on the actual statutory and regulatory language in place in each year of the study period. We obtained this language using Westlaw and its associated products. We classify each state in each year as allowing independent practice, requiring physician supervision of NPs when NPs prescribe medications, or requiring physician supervision of NPs at all times. Relying directly on the relevant statutes and regulations minimizes the risk of different secondary sources providing inconsistent legal interpretations. Based on these classifications, we create three indicator variables for use in our analysis.

Information on state tort reforms comes from the Database of State Tort Law Reforms compiled by Avraham (2014), which reports actual statutory language. Using this statutory language, we create three separate indicator variables for whether a state had enacted a noneconomic damages cap, CSR, and JSLR. Unlike the SoP indicator variables, the tort reform indicator variables are neither mutually exclusive nor collectively exhaustive.

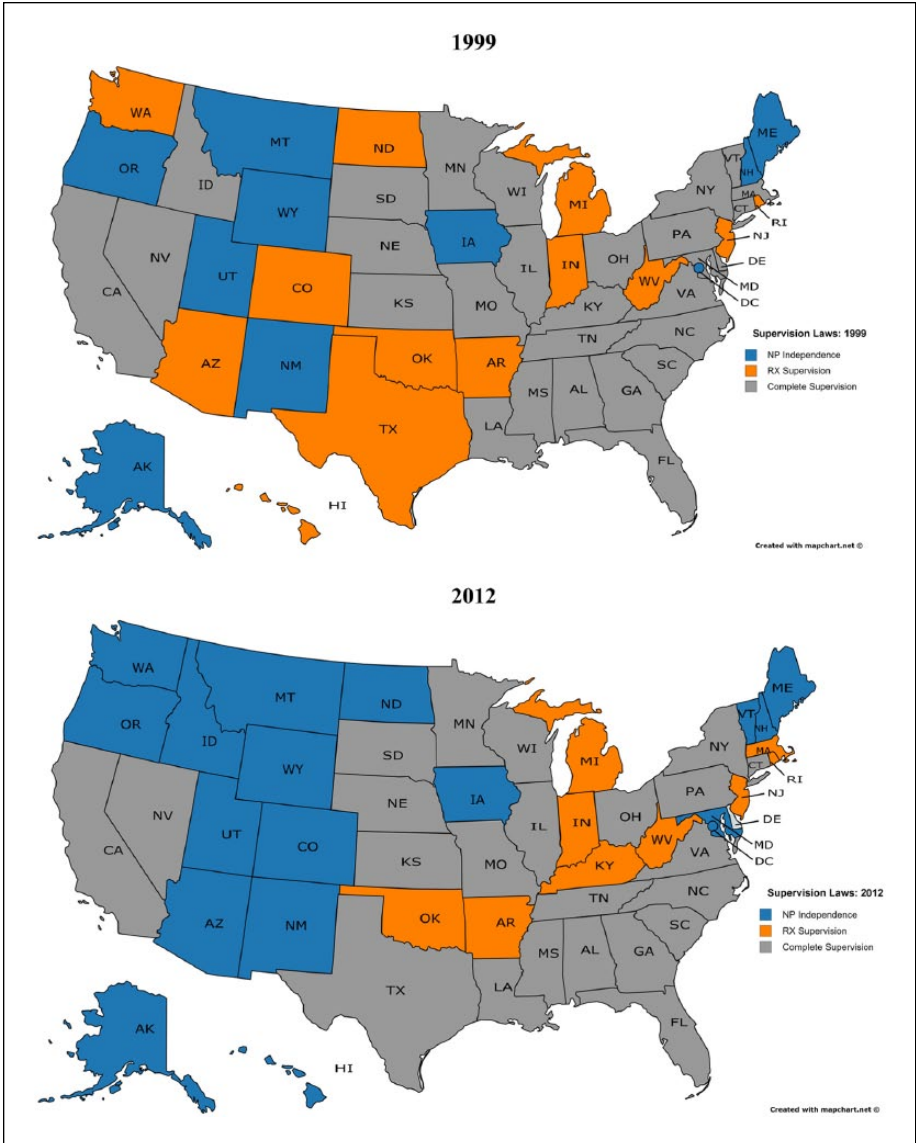


Figure I. Physician supervision laws for nurse practitioners, 1999 to 2012.

To construct the physician malpractice rate, we divide the total number of malpractice payments made by physicians in each state in each year by the total number of practicing physicians. Throughout this study, we define the malpractice rate as the number of payments per 1,000 physicians. The total number of malpractice payments

Table 1. Physician Supervision Laws for Nurse Practitioners by State, 1999 to 2012.

Always independent	Always prescription supervision	Always complete supervision
AK, DC, IA, ME, MT, NH, NM, OR, UT, WY	AR, IN, MI, NJ, OK, RI, WV	AL, CA, CT, DE, FL, GA, IL, KS, LA, MN, MS, MO, NE, NV, NY, NC, OH, PA, SC, SD, TN, VA, WI
Change from complete to prescription supervision	Change from complete supervision to independence	Change from prescription supervision to independence
KY (2001), MA (2012), MD (2011) TX (2002) ^a	ID (2005), VT (2011)	AZ (2000), CO (2010), HI (2010), MD (2012), ND (2011), WA (2001)

Note. All reported years reflect the first year a state is coded as having the new law.

^aTexas amended its law to move from prescription supervision to complete supervision in 2002.

comes from the National Practitioner Data Bank (NPDB), which is a database of all payments made as part of medical malpractice claims against individual providers, including physicians. Any time a payment is made as part of a malpractice dispute, federal law requires the payment be reported to the NPDB (see 42 U.S.C. § 11131). This includes all payments made as a result of settlements or verdicts. The NPDB provides the year in which the malpractice incident occurred as well as the year in which the payment was made. Because we examine the effect of legal changes, we focus on the year the malpractice occurred.

While the NPDB provides the numerator for the physician malpractice rate, for the denominator we use the Area Health Resource File (AHRF) to obtain the total number of physicians practicing in each state and year (except for 2009, which is excluded from the analysis because the AHRF does not include physician data for this year). The information on the number of physicians provided in the AHRF is derived from the AMA’s Physician Masterfile. We exclude all physicians who were not engaged in patient care. In addition to the number of physicians, the AHRF also includes information on socioeconomic, geographic, and environmental characteristics at the state level, which we use to construct control variables. In particular, we construct variables for population density, the percentage of the population identifying as Black, and the natural logarithm of median household income using information from the AHRF. The AHRF also includes information on health care infrastructure, and we construct the following control variables using this information: the percentage of the physician workforce composed of specialists, the percentage composed of surgeons, and the natural logarithm of the total number of surgeries performed in a state.

Our analysis is limited to 1999 forward. In 1997, Congress passed the Balanced Budget Act of 1997, which allowed Medicare to directly reimburse NPs for their services. Because NPs could not be directly reimbursed by Medicare (and most other insurance plans) prior to this Act, a state law allowing NP independence would likely

not have resulted in true NP independence from physicians before the Act was passed. Our analysis begins in 1999 to allow sufficient time for NPs and physicians to change their practices consistent with the Act, and it is limited to pre-2013 to allow for more complete reporting of malpractice payments to the NPDB, as many states have 2- to 3-year statutes of limitations for medical malpractice suits.

Analysis

We estimate a two-way fixed effects regression model, which isolates the change in physician malpractice rates attributable to changes in physician supervision laws for NPs. Because this model controls for characteristics of individual states that are fixed over time and nationwide characteristics that may vary year-to-year—even if those characteristics are unobserved—it provides plausible estimates of the effects associated with legal changes. Our empirical model is an ordinary least squares regression with the following specification:

$$\log(\text{malpractice rate})_{st} = SoPlaws'_{st} \beta_1 + tort\ reform'_{st} \beta_2 \\ + (SoPlaws) \times (tort\ reform)'_{st} \beta_3 + W'_{st} \theta + X'_{st} \lambda + \delta_s + \tau_t + \varepsilon_{st}$$

In this specification, s indexes states and t indexes time. The dependent variable is the natural logarithm of the physician malpractice rate. We use a logarithmic transformation of the physician malpractice rate because this variable exhibits a substantial right skew. Other studies of physician malpractice rates have employed a similar transformation (see, e.g., Ho & Liu, 2011). The vector *SoP laws* contains two indicator variables for whether a state allowed NPs to practice independently and for whether a state allowed NPs to practice without supervision except when prescribing medications. Complete supervision is the omitted category. The vector *tort reform* contains three indicator variables for whether a state had enacted a noneconomic damages cap, CSR, and JSLR. The coefficients of interest are β_1 , β_2 , and β_3 .

The vector W contains the following demographic control variables: population density, the percentage of the population identifying as Black, and the natural logarithm of median household income. These variables control for the population characteristics of states. These population characteristics may affect whether individuals in a state are willing and able to file a malpractice lawsuit, as well as influence individuals' trust in the legal system (Greene, 2016). The vector X contains the following health care infrastructure variables: the percentage of the physician workforce composed of specialists, the percentage composed of surgeons, and the natural logarithm of the total number of surgeries performed in a state. These variables control for variation in treatment and health care infrastructure across states. Finally, each model includes state and year indicator variables. The state indicator variables control for unobserved characteristics of states that are fixed over time. The year indicator variables control for unobserved nationwide trends and characteristics that may affect physician malpractice rates (Lieber, 2015; Wooldridge, 2010). In the interest of succinctness, only the

Table 2. The Effect of Nurse Practitioner SoP Laws on Physician Malpractice Rates (*N* = 661).

Variables	(1)	(2)	(3)
	Coefficient	SE	Marginal effect, %
Independence from MD	-0.364**	0.183	-30.5
MD Rx supervision only	-0.304***	0.103	-26.2
Noneconomic damages cap	-0.115**	0.049	-10.9
Collateral source rule reform	0.075	0.072	7.8
Joint and several reform	-0.142**	0.061	-13.2
(Independence) × (nonecon cap)	0.413**	0.173	51.1
(Independence) × (CSR)	0.044	0.217	4.5
(Independence) × (JSLR)	0.248	0.205	28.1
(Rx supervision) × (nonecon cap)	0.319**	0.133	37.6
(Rx supervision) × (CSR)	0.036	0.132	3.7
(Rx supervision) × (JSLR)	0.283***	0.102	32.7

Note. SoP = scope-of-practice; CSR = collateral source rule reform; JSLR = joint and several liability reform; SE = standard error; MD = medical doctor; Rx = prescription; nonecon = noneconomic. *R*² = .913. The dependent variable is the natural logarithm of the physician malpractice rate. The first column reports the coefficient estimate, the second column reports the robust standard error, and the third column reports the marginal effect. The marginal effect is calculated from a given coefficient, β, as exp(β) - 1. The regression model includes state and year fixed effects. Other covariates include the percentage of the state population that identifies as Black, the population density of the state, the median household income of the state, the percentage of the physician workforce composed of specialists, the percentage composed of surgeons, and the natural logarithm of the number of surgeries performed. We exclude two observations because of missing data.

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.

variables of interest are reported here, and the full regression results are reported in an online appendix.

Results

Table 2 reports results from the two-way fixed effects regression model. The physician malpractice rate in states allowing NPs to practice independently is 31% lower than the rate in states that require complete physician supervision. Similarly, the physician malpractice rate in states requiring only that physicians supervise NPs when they prescribe medications is 26% lower relative to states that require complete physician supervision. These results support our hypothesis that reducing physician supervision requirements for NPs is associated with a decrease in physician malpractice rates. Furthermore, the results are consistent with physicians bearing some of the liability NPs incur when NPs are legally required to have physicians supervise their practices.

Other results (Table 2) indicate that a noneconomic damages cap is associated with a reduction in physician malpractice rates of about 11%. Similarly, JSLR is associated with a reduction in physician malpractice rates of about 13%. Based on the magnitude of the changes in physician malpractice rates associated with amending SoP laws and

Table 3. Joint Effects of Nurse Practitioner SoP Laws on Physician Malpractice Rates.

	No reforms, %	Nonecon cap, %	CSR, %	JSLR, %	All reforms, %
Complete supervision	Baseline	-11**	8	-13**	-17**
MD Rx supervision only	-26***	-10	-18	-15*	16
Independence from MD	-31**	-6	-22	-23**	17

Note. SoP = scope-of-practice; MD = medical doctor; Rx = prescription; CSR = collateral source rule reform; JSLR = joint and several liability reform; nonecon = noneconomic. Each cell reports the joint effect of the SoP law on the left and the tort reform above. Each effect is calculated from the coefficients reported in Table 2 and is reported as a percentage change from the baseline physician malpractice rate. This baseline rate is the rate of physician malpractice in states that require complete physician supervision of nurse practitioners and that have enacted no tort reforms. The baseline rate is approximately 13 malpractice payments per 1,000 physicians. Statistical significance is calculated using *F* tests for joint significance of the SoP law listed to the left and the tort reform listed above.

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.

enacting tort reforms, allowing NPs to practice with greater independence is associated with more than twice the reduction in physician malpractice rates than is enacting a noneconomic damages cap or JSLR (31% or 26% vs. 11% and 13%).

Because our regression model includes indicator variables and interactions between these variables, we report the joint effects of different SoP laws and tort reforms in Table 3. All of the effects reported in this table are calculated from the coefficients reported in Table 2, and we assess whether the joint effects are statistically different from zero using *F* tests of joint significance. In Table 3, SoP laws are listed on the left and tort reforms are listed along the top. Each cell reports the joint effect of the SoP law on the left and the tort reform listed above. The baseline for comparison are those states that both required complete physician supervision and had enacted no tort reforms. In these states, approximately 13 malpractice payments were made per 1,000 physicians. Thus, in states that had enacted no tort reforms but allowed NPs to practice independently, approximately 9 malpractice payments were made per 1,000 physicians, that is, about 31% fewer payments. In states that allowed NPs to practice independently and had enacted JSLR, approximately 10 payments were made per 1,000 physicians, that is, the physician malpractice rate was 23% lower.

Across the range of tort reforms, allowing NPs to practice with more autonomy is generally associated with a decrease in the physician malpractice rate relative to the baseline, which is consistent with our hypotheses. The greatest decrease occurs in states that have enacted no tort reforms. This result is not surprising: If tort reforms reduce malpractice rates, then, this reduction may limit the negative impact on malpractice rates that allowing NPs to practice autonomously would be expected to exert. In other words, if there are fewer malpractice payments in general, changing physician supervision laws for NPs will have less of an effect on those malpractice payments that are still made.

Particularly supportive of the hypothesis that physicians bear increased liability risk when they are required to supervise NPs are the results for supervision laws when

JSLR has been enacted. JSLR essentially requires that each individual provider who is found to be at fault pay a part of the ultimate damages award commensurate with her proportion of liability (instead of allowing a plaintiff to collect the full amount from a single defendant). Moving from complete supervision to prescription supervision to independence, the decrease in physician malpractice rates attributable to JSLR becomes greater. This suggests that, as the legal ties between NPs and physicians are severed, physicians pass more and more liability to NPs.

When all three major tort reforms have been enacted, allowing NPs to practice with more autonomy is associated with an increase in physician malpractice rates relative to the baseline. Although the association is not statistically significant, future research should investigate this result further. This result may stem from a similar type of adverse selection as that identified by Lieber (2015), and future research with more specific data on the relationships of individual NPs and physicians should explore this potential explanation in more depth.

Discussion

Physicians have had a long-standing interest in lowering their risk of liability and decreasing their malpractice premiums by lowering malpractice rates. For physicians practicing in states that require supervision of NP practices, the results of our study indicate that their malpractice rates may decrease if those states were to remove these restrictions on NPs. This suggests an important extraregulatory effect of NP SoP laws on physician malpractice rates, as physicians may bear increased liability costs when NPs cannot practice autonomously. Thus, while physicians may benefit economically from restrictive SoP laws, our results indicate that, in states with restrictive SoP laws, physicians have higher malpractice rates. These higher malpractice rates could, consistent with the legal theories discussed above, stem from the malpractice of NPs under their supervision. By eliminating supervision requirements, the legal connection between the NP and the physician, which supports the physician's liability, would be severed, making it more difficult for plaintiffs to hold physicians liable for the mistakes of NPs. Thus, eliminating supervision requirements could reduce physician malpractice rates. While our results only establish a correlation between NP SoP laws and physician malpractice rates, the possibility that physicians bear increased malpractice costs when NPs cannot practice autonomously is an important consideration for policy makers.

Beyond these impacts which inure to physicians, lifting restrictions on NPs may have other effects on the delivery of health care, particularly in expanding access to care. First, prior research has shown that physicians provide more care when they face a lower risk of malpractice liability (Helland & Showalter, 2009). If physicians face increased malpractice risk when state SoP laws require physician supervision of NPs, relaxing those SoP laws could increase the care provided by physicians by reducing their malpractice risk. Second, if physicians fear liability as a result of their supervision of NPs, they may restrict the practices of NPs to a greater extent than state law does to reduce their liability risk. If physicians engage in this

behavior, relaxing SoP laws could eliminate their incentives to do so. While this could place increased malpractice pressure on NPs, allowing NPs to decide directly on how to provide care in the face of malpractice pressure (instead of involving physicians in this calculus) could better align the incentives to provide safe and appropriate care.

Of course, our study is not without limitations. First, while the NPDB represents the best publicly available data set of malpractice claims, it has limitations. It includes only positive payments, so if a provider was sued but paid nothing to a claimant, this claim does not appear in the NPDB. Additionally, previous research has estimated that the NPDB excludes about 20% of otherwise reportable malpractice payments because of reporting loopholes (Chandra, Nundy, & Seabury, 2005; Teninbaum, 2013). Second, we are unable to observe whether NPs are working below, at, or above their current legal SoP. Third, we lack information on physician specialty and other characteristics of physicians such as age, experience, practice setting, and so on. Two-way fixed effects regressions will provide reliable estimates of the effects of SoP laws as long as the mix of physician specialists and other physician characteristics within a state are not correlated with changes in SoP laws. Prior work has demonstrated that SoP laws generally do not affect the mix of specialists and primary care physicians (Traczynski & Udalova, 2014); however, to the extent that SoP laws affect the mix of specialists or other unobserved physician characteristics, our estimates may understate or overstate the effect of these laws on physician malpractice rates. Fourth, the same is true if SoP laws affect the mix, acuity, relative riskiness (in terms of malpractice liability), or number of patients treated by physicians versus NPs. Finally, we caution against interpreting any of the study results as indicating the quality of care provided by either physicians or NPs. Malpractice rates likely do not accurately reflect the quality of care provided for a variety of reasons, and we draw no conclusions about the quality of care from our malpractice rate results.

Conclusion

Overall, study results suggest that restrictive SoP laws have a salient, extraregulatory effect. An important implication of these results is that allowing NPs to practice with greater autonomy, and thus diminishing the ability of plaintiffs to hold physicians liable for the malpractice of NPs, could mitigate the distorting effects these laws have on the incentives created by malpractice law for both NPs and physicians. Removing these distorting effects may, in turn, increase access to care.

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