

MARKET WATCH

Changes In Physician Supply And Scope Of Practice During A Malpractice Crisis: Evidence From Pennsylvania

Physicians left medical practice during this time period, but not necessarily because of the malpractice crisis.

by **Michelle M. Mello, David M. Studdert, Jennifer Schumi, Troyen A. Brennan, and William M. Sage**

ABSTRACT: The extent to which liability costs cause physicians to restrict their scope of practice or cease practicing is controversial in policy debates over malpractice “crises.” We used insurance department administrative data to analyze specialist physician scope-of-practice changes and exits in Pennsylvania in 1993–2002. In most specialties the proportions of high-risk specialists restricting their scope of practice did not increase during the crisis; however, the supply of obstetrician-gynecologists decreased by 8 percent in the three years following premium increases in 1999. We discuss methodological issues that could explain the disparate findings regarding physician supply effects in studies using administrative data sets and survey data. [*Health Affairs* 26, no. 3 (2007): w425–w435 (published online 24 April 2007; 10.1377/hlthaff.26.3.w425)]

FEW ISSUES IN health policy have spurred as heated a public debate as the effects of rising malpractice insurance premiums on the supply of health care services. Over the past six years of “malpractice crisis,” interest groups and legislators have clashed over whether the upswing in insurance costs threatens access to care and therefore merits an aggressive policy response.¹

Pennsylvania is among the states affected most by hikes in insurance premiums.² It has also been the subject of two previous investi-

gations of claims that premium increases threaten access to care.³ Yet there are conflicts in the available evidence. A 2003 study by the U.S. Government Accountability Office concluded that overall, the effect of the malpractice crisis on access to care in Pennsylvania was more modest than physician groups had asserted.⁴ In contrast, in our 2003 survey of 824 Pennsylvania physicians in high-risk specialties, one-third or more reported their intention to retire or relocate their practices out of state within the next two years, and nearly

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half reported having reduced or eliminated high-risk aspects of their practices.⁵

In this paper we examine the impact of rising insurance costs on physician supply in Pennsylvania using a unique data source: the administrative database maintained by the Medical Care Availability and Reduction of Error Fund (MCARE), a division of the Pennsylvania Insurance Department. We analyzed changes in physicians' scope of practice before and during the current malpractice crisis, the number of physician departures from Pennsylvania practice, and trends in overall physician supply. We defined the crisis period as beginning in 1999, based on trends in insurance premiums (Exhibit 1) and information given previously by key informants in Pennsylvania.⁶

Study Data And Methods

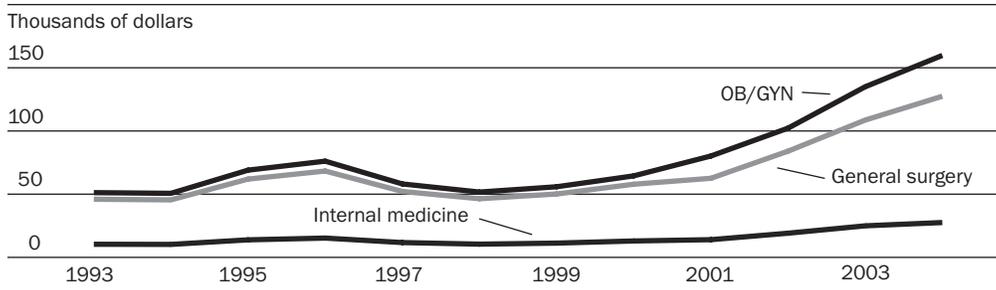
■ **Data.** MCARE, which prior to 2002 was known as the Medical Professional Liability Catastrophe Loss (CAT) Fund, is a state-run secondary-layer insurance fund.⁷ All health care facilities and practicing physicians who render 50 percent or more of their services in Pennsylvania—except for forensic pathologists; physicians practicing under a volunteer license; and federal, state, and military employees—must pay annual surcharges to the fund. In return, MCARE provides coverage for malpractice judgments and settlements that

fall between specified dollar amounts, which have varied over time. Surcharges are determined by physicians' specialty, scope of practice, and location, and they can be quite sensitive to changes in practice choices.

MCARE collects data on the nature of the services that covered physicians perform and all primary-layer insurance policies held. Information is gathered from primary insurance carriers, who are required to make periodic reports. We obtained a limited, deidentified data set from MCARE for 1993–2002. Institutional review boards (IRBs) at the Harvard School of Public Health and Columbia University approved the study.

Although it is limited to one state, the MCARE database has major advantages over the American Medical Association (AMA) Physician Masterfile, the source used in virtually all major studies of the U.S. physician workforce.⁸ Because providers are legally required to participate in MCARE, the database contains information on all actively practicing physicians. But because participation is costly, physicians who are not actively practicing generally are not represented. Additionally, the database is continually updated with carriers' reports of changes to insurance policies. The lag time for data entry is three to four months; in contrast, the Masterfile's triennial surveys create reporting lags of up to two years or

EXHIBIT 1 Liability Insurance Premiums For Pennsylvania Physicians In Selected Specialties, 1993–2004



SOURCE: Premium charged by the Pennsylvania Medical Society Liability Insurance Company for a standard primary-layer policy for physicians practicing in the Philadelphia area plus mandatory contribution to the state's patient compensation fund, calculated from data reported in the *Medical Liability Monitor* Annual Rate Survey.

NOTES: All dollar values were adjusted to 2003 dollars using the gross domestic product (GDP) deflator. OB/GYN is obstetrics-gynecology.

more.⁹ Finally, the MCARE database contains a risk code for each primary-layer policy a physician holds. These codes are linked to a detailed description of the physician's scope of practice (for example, procedures performed).

■ **Sample.** We obtained data on 436,329 insurance policies held by 64,803 unique physicians between 1 January 1993 and 31 December 2002 (each insurance policy was for one year; 96 percent of physicians held only one policy per year). This number excludes “tail” policies ($n = 34,841$), which provide coverage for claims that arise in connection with care rendered in a previous year. For physicians who had multiple policies in a given year, we retained the policy representing the highest-risk services the physician rendered and dropped the others ($n = 53,592$).

We restricted the data set to physicians practicing in eighteen specialties of interest. Based on previous work in Pennsylvania, we identified ten specialties with high liability risk (anesthesia, cardiology, emergency medicine, general internal medicine, neurosurgery, obstetrics/gynecology, orthopedics, radiology, surgery [including general surgeons and other surgeons who perform abdominal/gastrointestinal procedures], and urology) and, for comparative purposes, seven specialties with low risk (allergy, dermatology, geriatrics, infectious disease, neurology, pediatrics, and psychiatry).¹⁰ Because policy interest in the supply of physicians willing to deliver babies is especially intense, we also constructed a high-risk category, “deliveries,” which consisted of obstetrician-gynecologists (OB/GYNs) who delivered babies as well as any family or general practice physicians who did so. The final sample contained 47,366 physicians, including medical residents.

■ **Data analysis.** Our analyses addressed three questions relating to the malpractice “crisis period,” 1999–2002: (1) How frequently did high-risk specialists narrow their scope of practice to exclude high-risk procedures (“shifts analysis”)? (2) How frequently did high-risk specialists cease practice in Pennsylvania (“exits analysis”)? (3) Did the overall supply of high-risk specialists in Pennsylvania

decrease (“supply analysis”)? We used low-risk specialists during the crisis period and high-risk specialists in the years preceding the crisis period as comparisons.

In the supply analysis, we determined the number of physicians per 100,000 Pennsylvania residents, using U.S. census data.¹¹ In the exits analysis, we calculated the proportion of physicians in each specialty who left the MCARE database in each year transition and compared the average annual proportion leaving practice during 1993–1998 with the average proportion leaving during 1999–2002.¹² Data limitations precluded analyses of intrastate migration and forms of exit (relocation versus retirement).

In the shifts analysis, we classified physicians into one of three scope-of-practice groups for each year: major procedures/full range, minor procedures only, and no procedures. For OB/GYNs, the groups analyzed were full range, normal deliveries only, and no deliveries. For physicians who held insurance policies in more than one specialty, we investigated shifting behavior within each specialty. (Physicians who held multiple policies within a single specialty were counted only once, by examining the highest-risk policy.)

We calculated the proportions of high-risk specialists in each year who shifted from major to minor procedures, major to no procedures, or minor to no procedures. We compared the patterns of average annual shifting between pre-crisis and crisis periods. The denominator for the percentages was the number of physicians in the specialty providing services at each risk level during each year. The numerator was the number making each type of shift.¹³

Data were analyzed using the statistical software Stata 8.2, SAS 8.0, and R 2.0. Two-sample *t*-tests were used to assess differences between proportions, and Poisson regression was used to evaluate changes in rates.¹⁴

Study Results

In 1998, the study midpoint, the sample contained 22,767 physicians holding 23,796 primary-layer policies (Exhibit 2). Nine-tenths of physicians practiced full time.

EXHIBIT 2
Characteristics Of Pennsylvania Physicians In 1998

Characteristic	Number	Percent	Characteristic	Number	Percent
Specialty			FTE status		
"High-risk"			Full time	20,050	90
Internal medicine	4,865	21	Part time	2,717	10
Radiology	1,991	9	Age (years)		
"Surgeries" ^a	1,953	9	<35	4,685	21
Emergency medicine	1,909	8	35-44	7,915	35
Anesthesia	1,686	7	45-54	5,925	26
Cardiology	1,633	7	55-64	2,806	12
OB/GYN	1,528	7	65+	1,283	6
Physicians delivering babies ^b	1,354	6	Missing	153	<1
Orthopedics	1,071	5	Number of liability		
Urology	498	2	insurance policies held ^c		
Neurosurgery	242	1	1	21,792	96
"Low-risk"			2-4	974	4
Pediatrics	2,263	10	5+	1	<1
Psychiatry	2,172	10			
Neurology	616	3			
Dermatology	513	2			
Geriatrics	236	1			
Infectious disease	195	<1			
Allergy	159	<1			

SOURCE: Authors' own calculations.

NOTES: Percentages might not sum to 100 because of rounding. N = 22,767. FTE is full-time-equivalent.

^a General surgeons and other surgeons who perform abdominal/gastrointestinal procedures.

^b Obstetrician-gynecologists (OB/GYNs) and family/general practice physicians who deliver babies.

^c Counts exclude tail policies and policies that were completely identical to another policy on all data fields included in the set.

■ **Physicians restricting their scope of practice.** *Restrictions by high-risk specialists during the crisis period.* Overall, fewer than 3 percent (average annual percentage) of physicians performing major procedures shifted to minor procedures only (0.7 percent) or no procedures (1.8 percent) during the malpractice crisis period, and 8.2 percent of specialists performing only minor procedures shifted to no procedures (Exhibit 3). The most common practice restrictions observed were in internal medicine. In obstetrics, about 4 percent of obstetricians providing a full range of services shifted to normal deliveries only or no deliveries. Another 10.6 percent shifted from normal deliveries only to no deliveries. The obstetrics results should be interpreted with caution, because the pre-crisis period for this analysis consisted of a single year, as a result of changes to MCARE's coding system.

Crisis versus pre-crisis periods. None of the dif-

ferences between the proportions of high-risk specialists restricting their scope of practice in the two study periods was statistically significant at the 0.05 level ($t = -1.66, p = 0.15$ for major to minor; $t = -2.17, p = 0.078$ for major to none; $t = 0.66, p = 0.54$ for minor to none). The only significant increases in shifting between periods were in orthopedics ($t = -4.13$ for major to minor and $t = -2.94$ for major to none, $p < 0.05$ for both); obstetrics ($t = 3.71, p = 0.034$ for normal to no deliveries and $t = -15.3, p < 0.01$ for full range to normal only); and urology ($t = -2.75, p = 0.049$ for major to none). The absolute numbers of physicians making shifts in these categories, however, were small. There were no significant decreases in the amount of shifting.

To summarize, small proportions of high-risk specialists restricted their scope of practice during the crisis period, with the largest numbers of shifts occurring in internal medi-

EXHIBIT 3
Average Annual Percentage Of Physicians Restricting Their Scope Of Practice, 1993–1998 Versus 1999–2002

Specialty and type of shift	Pre-crisis (1993–1998)	During crisis (1999–2002)	Percentage-point change ^a	p value (t-test)
All high-risk				
Major to minor procedures	0.5%	0.7%	0.3	0.15
Major to no procedures	1.1	1.8	0.7	0.078
Minor to no procedures	9.4	8.2	-1.1	0.54
Surgery				
Major to minor procedures	<0.1	0.1	0.1	0.27
Major to no procedures	<0.1	0.0	-<0.1	0.39
Minor to no procedures	4.7	2.4	-2.3	0.10
Cardiology				
Major to minor procedures	2.9	4.4	1.5	0.33
Major to no procedures	4.0	2.2	-1.8	0.17
Minor to no procedures	6.0	8.1	2.1	0.50
Internal medicine				
Major to minor procedures	2.7	5.4	2.7	0.44
Major to no procedures	13.5	11.8	-1.7	0.69
Minor to no procedures	13.3	16.3	3.0	0.41
Orthopedic surgery				
Major to minor procedures	0.1	0.7	0.6	<0.01
Major to no procedures	0.2	1.3	1.0	0.026
Minor to no procedures	6.7	4.5	-2.1	0.81
Obstetrics^b				
Full range to normal deliveries only	1.4	0.1	-1.3	<0.01
Full range to no deliveries	2.6	4.1	1.4	0.17
Normal deliveries only to no deliveries	0.0	10.6	10.6	0.034
Urology				
Major to minor procedures	<0.1	0.4	0.3	0.13
Major to no procedures	0.1	0.8	0.7	0.049
Minor to no procedures	0.0	1.6	1.6	0.39

SOURCE: Authors' own calculations.

NOTE: All comparisons exclude the 1996–1997 transition as a result of a data coding change in 1997.

^a Positive sign means that restrictions on scope of practice were more prevalent during the crisis period than before.

Percentage-point change might not match post- minus pre-crisis period data from preceding columns because of rounding.

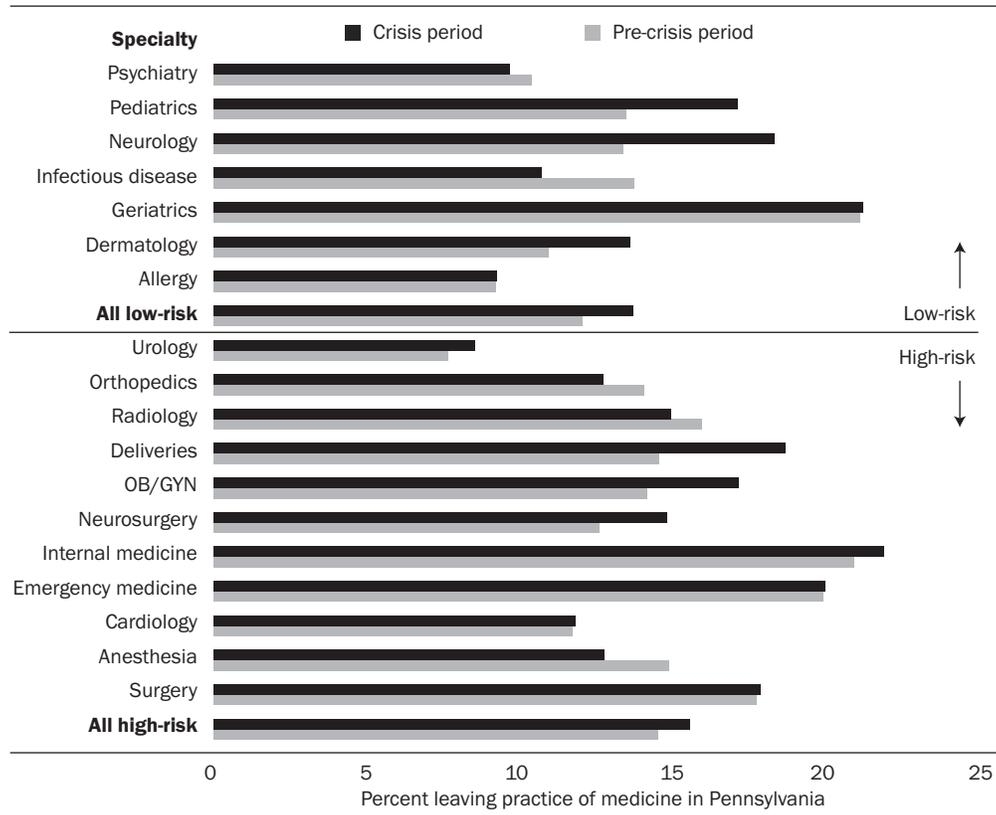
^b Obstetrics comparison is 1997–1998 versus 1999–2002 as a result of additional specialty-specific coding changes in 1997; comparison results should be interpreted with caution, given the single-year pre-crisis period. The “no deliveries” group includes both nondelivering obstetricians and former obstetricians now classified as gynecologists.

cine and obstetrics. The similarity of shifting behavior in the two study periods makes it improbable that these patterns can be attributed to changes in the malpractice environment. They may reflect physicians' efforts to reduce insurance costs even outside of crisis periods or other considerations, such as lifestyle choices or judgments that performing certain procedures is not financially worthwhile be-

cause of low payment or volume.

■ **Physicians leaving Pennsylvania practice.** We compared the average annual percentage of high- and low-risk specialists who left Pennsylvania practice during the pre-crisis and crisis periods (Exhibit 4).¹⁵ There was a substantial degree of exiting in both risk groups and both time periods. Most specialties saw 10–20 percent of their ranks exit prac-

EXHIBIT 4
Average Annual Percentage Of Physicians Leaving Practice In Pennsylvania, 1999–2002 (Crisis Period) Versus 1993–1998 (Pre-Crisis Period)



SOURCE: Authors' own calculations.
NOTES: OB/GYN is obstetrics/gynecology. Data for 1996–97 were excluded because of coding changes.

tice in Pennsylvania each year throughout the study period.

Crisis versus pre-crisis periods. On average, 15.5 percent of high-risk specialists left each year during the crisis period, compared to 14.5 percent in the pre-crisis period, a difference that was not statistically significant ($t = -1.04$, $p = 0.36$ in a two-sample test comparing the average annual proportion leaving in each period). None of the specialty-specific differences in proportions between the two time periods was significant.

High-risk versus low-risk specialties during the crisis period. Similar proportions of high- and low-risk specialists ceased practicing in Pennsylvania during the crisis period (15.5 percent versus 13.7 percent, $t = 1.35$, $p = 0.22$). Although

the proportions of specialists leaving practice in Pennsylvania each year were substantial, propensity to cease practice was not strongly associated with either the malpractice crisis period or specialty risk level.

■ **Physician supply.** To examine whether physician exits were offset by new entrants and changes in demand for medical care, we analyzed trends in the total number of practicing physicians in each specialty. The total across all specialties increased 5.8 percent between 1993 and 2002, from 181 per 100,000 Pennsylvania residents to 191. The increase was slightly but not significantly larger among low-risk than high-risk specialists (7.7 percent versus 5.2 percent, $p = 0.29$ for the interaction between risk group and year in a Poisson re-

gression model). During the crisis period, the overall supply of high-risk specialists increased by 3.3 percent (137.7 per 100,000 residents to 142.3), while the overall supply of low-risk specialists was flat (49.9 per 100,000 residents to 49.1).

Exhibits 5 and 6 show supply trends by specialty per 100,000 population. Eight specialties had changes of 5 percent or more between 1999 and 2002. Six of these were increases: infectious disease (24.2 percent), emergency medicine (15.5 percent), anesthesia (12.2 percent), cardiology (9.3 percent), geriatrics (9.2 percent), and radiology (5.3 percent). The two marked decreases were in neurology (-14.1 percent) and OB/GYN (-7.7 percent). In the case of OB/GYN (11.7 per 100,000 residents to 10.8; 1,404 obstetricians to 1,332), the decline continued a trend that began in 1998 with reductions of 2–8 percent per year, except for 1999–2000, when there was a 6 percent rise. Despite the decline in OB/GYN, the overall supply of physicians performing deliveries (including family/general practice physicians) increased slightly during 1999–2002 (12.6 per 100,000 residents to 12.9; 1,507 to 1,590 physicians).

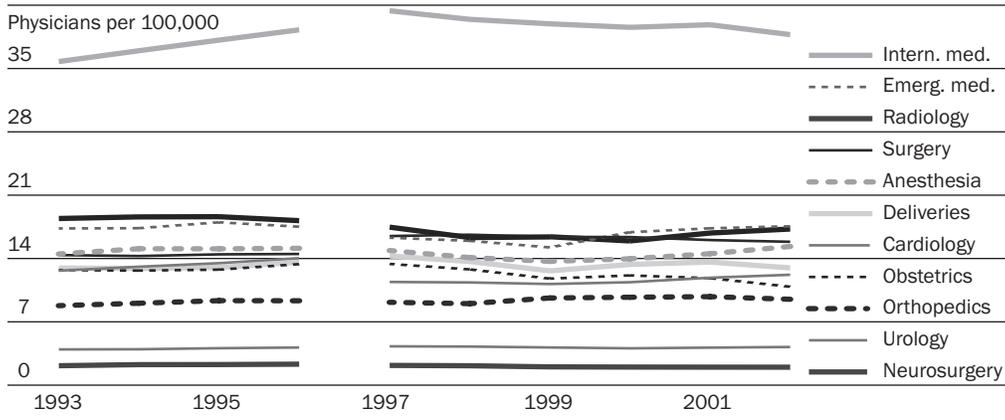
We also examined pairwise correlation coefficients between physician supply and insur-

ance premium data in three high-risk specialties for which the premium data were available. Correlations were -0.58 for OB/GYN, -0.33 for general surgery, and 0.12 for internal medicine.¹⁶ None of the correlations was statistically significant.

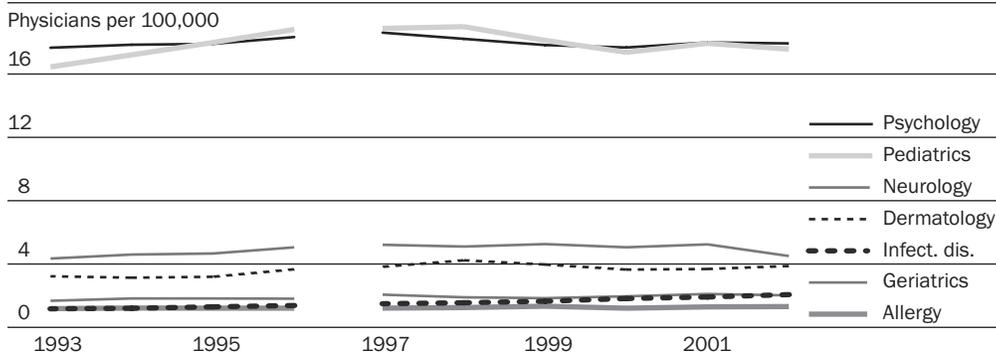
In summary, the overall supply of high-risk specialists did not drop in absolute or per capita terms during the malpractice crisis; rather, it increased slightly, with declines in surgery and OB/GYN offset by increases in other specialties. At the specialty level, the only notable decrease in supply of high-risk specialists during the crisis period was a nearly 8 percent reduction in the supply of OB/GYNs.

■ **Sensitivity analyses.** The inclusion of medical residents in our exits and shifts analyses might be controversial, because residents are less free than fully qualified physicians to cease practicing in the state in the early years of residency, are more free to move upon completion of their training, and generally cannot choose to narrow their scope of practice during training. Because we could not identify residents' stage of training, we could not conduct a sensitivity analysis excluding subgroups of residents. Any bias in propensity to cease practice cuts across all groups, however, and

EXHIBIT 5
Supply Of Physicians In High-Risk Specialties Per 100,000 Population In Pennsylvania, 1993–2002



SOURCE: Authors' own analysis.
NOTE: Data for the 1996–97 transition were excluded because of coding changes.

EXHIBIT 6**Supply Of Physicians In Low-Risk Specialties Per 100,000 Population In Pennsylvania, 1993–2002**

SOURCE: Authors' own analysis.

NOTE: Data for 1996–97 were excluded because of coding changes.

should not affect comparisons.

We could test the sensitivity of findings from the exits and shifts analyses to the inclusion of residents. We analyzed a subsample of 25,823 physicians who were not residents during 1999–2002 (MCARE did not flag residents before 1999). The proportions exiting and restricting their practices were not significantly different from the full sample.¹⁷

We also reran our analyses after changing the definition of the crisis period to start in 1998. Our core findings were unchanged.¹⁸ Comparing the pre- and post-crisis periods, there were statistically significant differences in the numbers of high-risk specialists who shifted from major to minor procedures, and from minor to no procedures, but the magnitude of the differences was very small (less than one percentage point).

Discussion

This study found that the proportions of physicians restricting their scope of practice and exiting practice in Pennsylvania were similar during and before the malpractice crisis for most high-risk specialties. The overall supply of high-risk specialists did not decrease during the crisis except in obstetrics-gynecology.

Previous survey work has elicited information about specialists' intentions to restrict their scope of practice, but this study is the

first to examine data on actual practice restrictions.¹⁹ Several previous studies have analyzed trends in physician supply, with inconsistent findings.

Our analysis found more modest effects of the liability crisis on physician supply than have been suggested by physician survey studies, including our own.²⁰ Forty-three percent of high-risk Pennsylvania specialists who responded to our previous survey said that they had restricted their scope of practice to reduce or eliminate high-risk services in the past two years (2001–2003).²¹ According to MCARE data, fewer than 3 percent of the high-risk specialists in Pennsylvania actually eliminated major or minor procedures during 2001–2002. We could not measure the proportion who reduced but did not eliminate procedures.

■ **Understanding variations in study findings.** A number of factors may explain why findings from survey studies might differ from those of analyses of administrative databases such as the MCARE database. First, examining physician practice changes only during periods of liability crisis, as surveys typically do, provides no basis for comparison to baseline rates of such changes. The supply of OB/GYNs, which has been at the forefront of policy discussions, illustrates the point. Although their ranks decreased by 8 percent, this trend had begun before liability premiums

soared, and it did not accelerate noticeably afterward. Further, the total number of physicians delivering babies, including family/general practitioners, did not fall significantly as a proportion of the population during the crisis. Overall, the results suggest that OB/GYN has been undergoing demographic shifts that are not clearly connected to the liability crisis.

Second, survey studies might suffer from response bias. Physicians who are especially affected by rising liability costs might be most likely to respond to surveys.²² Many surveys have garnered low response rates and likely reflect this dynamic.²³

Third, survey studies might have measurement error problems. Physicians might consciously or unconsciously overstate the effects of liability costs on their practice decisions, to build the case for the policy reforms they feel are needed.²⁴ Even truthful self-reports of intentions to leave or restrict practice might incorrectly predict future decisions. One study found that only 35 percent of surveyed physicians who reported an intention to cease clinical practice within three years actually did so.²⁵

Fourth, surveys have asked whether physicians reduced or eliminated certain procedures, whereas we measured only procedures eliminated. Finally, surveys might have picked up restrictions that we could not detect because they were not associated with a reclassification in insurance risk rating. For example, a surgeon might turn away certain high-risk patients.

Several longitudinal econometric studies have modeled the number of physicians in a state as a function of the liability environment. All but one study relied on the AMA Physician Masterfile. Four found a significant association, three had no significant findings, and two had mixed results.²⁶ The variation in study findings is not easily explained. Results did not vary systematically with the measure of malpractice risk used (premiums, claims payments, or tort reforms).

■ **Implications for access to care.** Studies of changes in the supply of physician services are frequently cited as evidence that liability costs are affecting access to care. Supply

data provide suggestive evidence that access could be compromised. However, access-to-care impacts depend on the adequacy of the baseline supply of providers as well as on changes in the demand for particular kinds of services over time. Along these lines, there was a decrease in the number of live births in Pennsylvania over our study period, which may help account for the decrease in the supply of OB/GYNs.²⁷

Studies analyzing the association between the liability environment and rates of high-risk procedures provide more direct evidence about access-to-care effects, if they control for changes in demand. The few studies available generally support our conclusion that liability costs do not appear to be greatly affecting the availability of high-risk services at the state level. Katherine Baicker and Amitabh Chandra found that changes in insurance premiums and claims payments were uncorrelated with rates of several procedures among Medicare patients, although they did find a positive association with mammography.²⁸ A descriptive study by David Dranove and Anne Gron found that the number of physicians performing craniotomies and high-risk deliveries in Florida fell from 2000 to 2003, but patient travel times did not increase for high-risk deliveries and increased by only five minutes for craniotomies.²⁹ Finally, a multivariate analysis by Badrinath Konety and colleagues determined that bladder cancer patients had a higher probability of undergoing radical cystectomy in states with caps on noneconomic damages, which suggests that this procedure might be less widely available in states with higher liability risk; however, the study did not control for clinical indications for surgery.³⁰

■ **Study limitations and research challenges.** One shortcoming of virtually all physician-supply studies, including ours, is that supply shifts below the state level are not analyzed. We could not examine changes in the distribution of physicians within Pennsylvania because MCARE could not furnish data on physicians' location, because of confidentiality concerns. This is an important avenue for future research: There exists suggestive evidence

that the liability environment may disproportionately affect physician supply in underserved areas.³¹

Although a major strength of the MCARE database is that it shows physicians' actual behavior as opposed to their desires or intentions, it does not tell a complete story about that behavior. We could not determine whether exits were attributable to retirement or relocation. In addition, there might be defensive changes in practice that we could not detect because they did not affect rating categories for MCARE coverage.

Our analysis has other limitations. Because the sample did not include data after 2002, we could not observe practice changes by physicians whose responses to rising liability costs are lagged by more than two years—that is, physicians who initially tried to “ride out the storm” but ultimately could not. Additionally, we counted physicians who were absent from the data set for one year as exits. This could have produced an overestimate of the annual proportion of exits because some physicians might exit transiently, for personal reasons, and reenter practice soon. We might also have overestimated exits if some physicians shifted from private practice to state or federal employment in Pennsylvania, as government employees are not represented in the MCARE data set. For both scenarios, any bias should be consistent across time and specialties and should not affect the validity of comparisons.

WHEN INSURANCE becomes difficult for physicians to find or afford, policymakers worry that patients' access to essential services will be compromised. These conditions and reactions prevailed in Pennsylvania in the late 1990s and early 2000s. However, our findings suggest that the supply of high-risk specialty care changed little and that where changes did occur, their connection to the crisis was weak or not apparent. Other evidence indicates that the impact of the crisis on physicians was considerable, in terms of costs, anxiety, and disillusionment with the practice of medicine.³² Statewide, however, physicians

appear to have held their ranks and weathered this distress.

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NOTES

1. M.M. Mello, “Understanding Medical Malpractice Insurance: A Primer,” January 2006, http://www.rwjf.org/publications/synthesis/reports_and_briefs/pdf/no8_primer.pdf (accessed 20 March 2007).
2. R.R. Bovbjerg and A. Bartow, “Understanding Pennsylvania’s Medical Malpractice Crisis: Facts about Liability Insurance, the Legal System, and Health Care in Pennsylvania” (Philadelphia: Project on Medical Liability in Pennsylvania, June 2003).
3. U.S. Government Accountability Office, *Medical Malpractice: Implications of Rising Premiums on Access to Health Care*, August 2003, <http://www.gao.gov/new.items/d03836.pdf> (accessed 21 March 2006); and M.M. Mello et al., “Effects of a Malpractice Crisis on Specialist Supply and Patient Access to Care,” *Annals of Surgery* 242, no. 5 (2005): 621–628.
4. GAO, *Medical Malpractice*.
5. Mello et al., “Effects of a Malpractice Crisis.”
6. M.M. Mello et al., “Hospitals’ Behavior in a Tort Crisis: Observations from Pennsylvania,” *Health Affairs* 22, no. 6 (2003): 225–233. We conducted forty-one interviews in Pennsylvania with officials at thirteen medical specialty societies, six county medical societies, a hospital association, nine hospitals, two health plans, and one state government agency; we asked informants to identify the year of onset of the malpractice crisis.
7. F.A. Sloan, “Public Medical Malpractice Insurance” (Philadelphia: Project on Medical Liability in Pennsylvania, March 2004).
8. K. Grumbach et al., “The Challenge of Defining and Counting Generalist Physicians: An Analysis of Physician Masterfile Data,” *American Journal of Public Health* 85, no. 10 (1995): 1402–1407; and P.R. Kletke, “Physician Workforce Data: When the Best Is Not Good Enough,” *Health Services Research* 39, no. 5 (2004): 1251–1255.
9. D.R. Rittenhouse et al., “No Exit: An Evaluation

- of Measures of Physician Attrition,” *Health Services Research* 39, no. 5 (2004): 1571–1588.
10. Mello et al., “Effects of a Malpractice Crisis”; and D.M. Studdert et al., “Defensive Medicine among High-Risk Specialist Physicians in a Volatile Malpractice Environment,” *Journal of the American Medical Association* 293, no. 21 (2005): 2609–2617.
 11. Population Division, U.S. Census Bureau, “Table 1: Annual Estimates of the Population for the United States and States, and for Puerto Rico: April 1, 2000 to July 1, 2004,” 22 December 2004, <http://www.census.gov/popest/states/tables/NST-EST2004-01.pdf> (accessed 20 March 2007); and Population Division, U.S. Census Bureau, “ST-99-3: State Population Estimates: Annual Time Series, July 1, 1990, to July 1, 1999,” 1999, <http://www.census.gov/population/estimates/state/st-99-3.txt> (accessed 20 March 2007).
 12. Changes to MCARE’s data coding practices in 1997 necessitated omission of the 1996–97 transition from all analyses.
 13. Three specialties (dermatology, psychology, and radiology) were excluded from the shifts analysis because of the coding change; three others were excluded because all policies in those specialties were classified as either major procedures (emergency medicine and neurosurgery) or minor procedures (anesthesia); and shifts in obstetrics-gynecology were analyzed beginning in 1997.
 14. J.M. Lachin, *Biostatistical Methods: The Assessment of Relative Risks* (New York: Wiley, 2000).
 15. For trend-line plot, see the online appendix at <http://content.healthaffairs.org/cgi/content/full/hlthaff.26.3.w425/DC2>.
 16. *Ibid.*, for premiums and specialist supply.
 17. *Ibid.*, for full results.
 18. *Ibid.*
 19. Mello et al., “Effects of a Malpractice Crisis.”
 20. *Ibid.*; J. Brehm et al., “Physician Supply in Key Medical Specialties in West Virginia Hospitals, 2001–2004,” *West Virginia Medical Journal* 100, no. 4 (2004): 132–135; R.G. Brooks et al., “Impact of the Medical Professional Liability Insurance Crisis on Access to Care in Florida,” *Archives of Internal Medicine* 164, no. 20 (2004): 2217–2222; and M.M. Mello and C.N. Kelly, “Effects of a Professional Liability Crisis on Residents’ Practice Decisions,” *Obstetrics and Gynecology* 105, no. 6 (2005): 1287–1295.
 21. Mello et al., “Effects of a Malpractice Crisis.”
 22. *Ibid.*
 23. GAO, *Medical Malpractice*.
 24. Mello et al., “Effects of a Malpractice Crisis.”
 25. Rittenhouse et al., “No Exit.”
 26. See the online appendix (Note 15) for summaries of findings in D.P. Kessler, W.M. Sage, and D.J. Becker, “Impact of Malpractice Reforms on the Supply of Physician Services,” *Journal of the American Medical Association* 293, no. 21 (2005): 2618–2625; F.J. Hellinger and W.E. Encinosa, “The Impact of State Laws Limiting Malpractice Awards on the Geographic Distribution of Physicians,” 2003, <http://www.ahrq.gov/research/tortcaps/tortcaps.htm> (accessed 11 April 2007); M.P. Gius, “An Examination of the Determinants of Physician Supply at the State Level,” *Journal of Business and Economic Studies* 6, no. 1 (2000): 73–79; K. Baicker and A. Chandra, “The Effect of Malpractice Liability on the Delivery of Health Care,” in *Frontiers in Health Policy Research*, vol. 8, ed. D.M. Cutler and A.M. Garber, abstract available online at <http://www.bepress.com/fhep/8/4> (accessed 19 April 2007); B.B. Erus, “Malpractice Liability Crisis and Physician Location Choice” (Working paper, Northwestern University, 2004); D. Matsa, “Does Liability Keep the Doctor Away? Evidence from Tort Reform Damage Caps” *Journal of Legal Studies* (forthcoming); W.E. Encinosa and F.J. Hellinger, “Have State Caps on Malpractice Awards Increased the Supply of Physicians?” *Health Affairs* 24 (2005): w250–w258 (published online 31 May 2005; 10.1377/hlthaff.w5.250); J. Klick and T. Stratmann, “Medical Malpractice Reform and Physicians in High Risk Specialties” (Working paper, Florida State University College of Law, 2006); and E. Helland and M.H. Showalter, “The Impact of Liability on the Physician Labor Market” (Working paper, RAND, 2006).
 27. Pennsylvania Department of Health, “Birth and Death Statistics, 1990–2005,” 2 February 2007, <http://www.dsf.health.state.pa.us/health/cwp/view.asp?a=175&Q=201652> (accessed 12 April 2007).
 28. Baicker and Chandra, “The Effect of Malpractice Liability.”
 29. D. Dranove and A. Gron, “Effects of the Malpractice Crisis on Access to and Incidence of High-Risk Procedures: Evidence from Florida,” *Health Affairs* 24, no. 3 (2005): 802–810.
 30. B.R. Konety et al., “Impact of Malpractice Caps on Use and Outcomes of Radical Cystectomy for Bladder Cancer: Data from the Surveillance, Epidemiology, and End Results Program,” *Journal of Urology* 173, no. 6 (2005): 2085–2089.
 31. Matsa, “Does Liability Keep the Doctor Away?”
 32. M.M. Mello et al., “Caring for Patients in a Malpractice Crisis: Physician Satisfaction and Quality of Care,” *Health Affairs* 23, no. 4 (2004): 42–53; and Common Good and Harris Interactive Inc., “Fear of Litigation Study: The Impact on Medicine,” 11 April 2002, <http://cgood.org/assets/attachments/57.pdf> (accessed 21 March 2006).