Defensive Medicine Among High-Risk Specialist Physicians in a Volatile Malpractice Environment

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Context How often physicians alter their clinical behavior because of the threat of malpractice liability, termed *defensive medicine*, and the consequences of those changes, are central questions in the ongoing medical malpractice reform debate.

Objective To study the prevalence and characteristics of defensive medicine among physicians practicing in high-liability specialties during a period of substantial instability in the malpractice environment.

Design, Setting, and Participants Mail survey of physicians in 6 specialties at high risk of litigation (emergency medicine, general surgery, orthopedic surgery, neurosurgery, obstetrics/gynecology, and radiology) in Pennsylvania in May 2003.

Main Outcome Measures Number of physicians in each specialty reporting defensive medicine or changes in scope of practice and characteristics of defensive medicine (assurance and avoidance behavior).

Results A total of 824 physicians (65%) completed the survey. Nearly all (93%) reported practicing defensive medicine. "Assurance behavior" such as ordering tests, performing diagnostic procedures, and referring patients for consultation, was very common (92%). Among practitioners of defensive medicine who detailed their most recent defensive act, 43% reported using imaging technology in clinically unnecessary circumstances. Avoidance of procedures and patients that were perceived to elevate the probability of litigation was also widespread. Forty-two percent of respondents reported that they had taken steps to restrict their practice in the previous 3 years, including eliminating procedures prone to complications, such as trauma surgery, and avoiding patients who had complex medical problems or were perceived as litigious. Defensive practice correlated strongly with respondents' lack of confidence in their liability insurance and perceived burden of insurance premiums.

Conclusion Defensive medicine is highly prevalent among physicians in Pennsylvania who pay the most for liability insurance, with potentially serious implications for cost, access, and both technical and interpersonal quality of care.

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DEFENSIVE MEDICINE IS A DEviation from sound medical practice that is induced primarily by a threat of liability.[1,2] Defensive medicine has been reported widely in the United States and abroad.[3-6] However, its prevalence and characteristics remain controversial.[7]

Defensive medicine may supplement care (eg, additional testing or treatment), replace care (eg, referral to another physician or health facility), or reduce care (eg, refusal to treat particular patients).[8,9] Some practices, herein termed *assurance behavior* (sometimes called "positive" defensive medicine), involve supplying additional services of marginal or no medical value with the aim of reducing adverse outcomes, deterring patients from filing malpractice claims, or persuading the legal system that the standard of care was met. Other practices, herein termed *avoidance behavior* (sometimes called "negative" defensive medicine), reflect physicians' efforts to distance themselves from sources of legal risk. Defensive medicine, particularly avoidance behavior, encompasses both day-to-day clinical decisions affecting individual patients and more systematic alterations of scope and style of practice.

See also pp 2618 and 2660.

Defensive medicine has mainly been invoked as an argument for tort reform in the years between malpractice crises when other pressures for legal change have ebbed.[10] Analysts have fo-

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cused on liability concerns as contributing incrementally to the overuse of health care services in the United States and the waste of scarce economic resources.[11] We hypothesized that during a more volatile period in liability insurance markets, physicians' uncertainty about the costs and availability of coverage may induce a wider array of defensive practices, affecting not only the cost of health care but also its accessibility and quality.[12]

We queried a group of physicians at high risk of malpractice claims about the frequency and nature of their defensive practices. These physicians' liability risk stemmed from location of their practice in Pennsylvania, a state that has been hit particularly hard by the latest malpractice "crisis."[13] At the time of the study, several liability insurers had recently left the Pennsylvania market and premiums charged by the remaining insurers had risen dramatically over the preceding 3 years.[13] For example, the cost of a standard primary-layer policy for Philadelphia general surgeons at the largest insurer rose from $33 684 in 2000 to $72 518 in 2003, excluding a mandatory contribution to the state's secondary-layer insurance fund (amounting to 43% of the primary premium in 2003).[14] The physicians we surveyed came from 6 specialties that have been acutely affected by high rates of litigation and steep premium increases. We requested specific details of defensive practices undertaken. We also tested whether the odds of physicians' practicing defensively were associated with objective and subjective measures of their liability burden.

METHODS

Study Design

Researchers at the Harvard School of Public Health (Boston, Mass) and Columbia Law School (New York, NY) collaborated with a professional survey organization, Harris Interactive Inc (Rochester, NY), to design and conduct the survey. Design of the sample and survey questionnaire was shaped by findings from 41 in-depth key informant interviews conducted with representatives from medical specialty societies, county medical societies, hospitals, insurers, and government agencies in Pennsylvania. Institutional review boards at the Harvard School of Public Health and Columbia Law School approved the research. The survey cover letter provided basic information about the study and return of the questionnaire constituted evidence of informed consent.

Sample

Key informants identified 6 specialties—emergency medicine, general surgery, neurosurgery, obstetrics/gynecology, orthopedic surgery, and radiology—as being especially affected by high and rising liability costs. A stratified random sample of 1333 physicians in these specialties was drawn from the American Medical Association Physician Masterfile; 1 primary stratum consisted of 5 counties in southeastern Pennsylvania, which informants identified as most affected, and the other consisted of all other counties in Pennsylvania. Within each stratum, specialists who were active in direct patient care at least 50% of the time according to the Physician Masterfile data were sampled. Sampling was proportionate by specialty except that neurosurgeons were oversampled to ensure adequate representation. The sample size was calculated to provide 80% power to detect differences of 10% or higher between specialty groups at the $P<.05$ level.

Survey Questionnaire

A 6-page questionnaire was developed and pretested on 10 Pennsylvania physicians in the targeted specialties. Cognitive posttest interviews led to revision of the questionnaire. The revised questionnaire contained questions about practice decisions, liability insurance, experience with malpractice claims, and demographic information. Respondents were asked to rate on a 4-point scale (never, rarely, sometimes, often) how frequently concerns about malpractice liability caused them to engage in each of 4 forms of assurance behavior: (1) order more tests than medically indicated; (2) prescribe more medications than medically indicated; (3) refer to specialists in unnecessary circumstances; and (4) suggest invasive procedures against professional judgment. Respondents used the same scale to rate the frequency with which they practiced 2 forms of avoidance behavior: (1) avoid conducting certain procedures/interventions; and (2) avoid caring for high-risk patients. Respondents who reported engaging in any of these defensive medicine practices were then asked in an open-ended question to describe their most recent act.

In addition, respondents were asked in consecutive questions whether they had reduced or eliminated high-risk aspects of their practice in the last 3 years because of the cost of professional liability insurance in Pennsylvania and the likelihood that they would (further) do so in the next 2 years. Respondents who answered affirmatively to either question were asked to specify the change as an open-ended response.

Survey Administration

Following institutional review board approval, the survey was mailed in May 2003 to 1333 physicians, along with a $75 honorarium. Multiple follow-up contacts were made with nonrespondents by mail and telephone during June and July. Physicians were also given the option of completing the survey online; 8% of respondents did so. Sixty-five physicians in the sample were deemed ineligible (52 no longer involved in direct patient care, 11 relocated out of state, and 2 deceased). After exclusion of these ineligible physicians, 824 physicians completed the survey—an adjusted response rate of 65% (824/1268). Specialty-specific response rates were: orthopedic surgeons, 72%; obstetrician/gynecologists, 67%; emergency physicians, 67%; general surgeons, 66%; radiologists, 59%; and neurosurgeons, 56%. The Physician MasterFile permitted comparison of respondents with nonrespondents across 5 variables (age, sex, specialty, years in practice, and hospital affiliation). There were statistically significant differences between the average age of respondents and nonrespondents (50 vs 51 years, respectively, $P=.008$) and their average

years in practice (21 vs 22 years, respectively, $P=.02$), but the absolute difference in both cases was only 1 year.

Statistical Analysis

Sampling weights were applied to ensure that survey responses reflected the distribution of Pennsylvania physicians in direct patient care in the selected specialties. Data were weighted within each geographic stratum by specialty, sex, and length of time in practice. Data were further weighted to make the sample representative of all Pennsylvania physicians in each of the specialties. All results except for the sample characteristics are presented in weighted form, although the effect of weighting was negligible. The margin of error for the study sample was ±4 percentage points and ranged up to ±17 percentage points in subsample analyses.

The data were analyzed using the SPSS 11.5 (SPSS Inc, Chicago, Ill) and STATA 7.0 (STATA Corp, College Station, Tex) statistical software packages with appropriate corrections for the complex survey design. Subgroup comparisons were made using adjusted Pearson χ^2 analysis.

We used conditional logistic regression to analyze predictors of frequent practice of each of the 6 forms of defensive medicine. The dependent variable in these analyses was respondents who reported undertaking the relevant practice "often" compared with all other responses. The paucity of responses in the "never" and "rarely" categories prompted this dichotomy. This specification of the dependent variables created relatively prevalent outcomes of interest, ranging from 32% to 61% across the 6 regression analyses (mean [SD] of 42% [12%]); therefore, the odds ratios (ORs) produced by the regression analyses should be interpreted as relative odds not relative risks.[15]

The independent variables were physician characteristics (years in practice, sex), practice type (solo, group, hospital clinic, other), form of liability insurance, and 3 *objective* measures of liability risk (physicians' practice location in a high-risk area, dropped by liability insurer within last 3 years, sued within last 3 years). In addition, 2 *subjective* measures of the impact of the liability environment on physician attitudes were constructed from the following questions: (1) "How much of a financial burden are your professional liability insurance premiums?" (not at all a burden, minor burden, major burden, extreme burden); (2) "How confident are you that your current liability insurance will cover all situations for which you may need coverage?" (not at all confident, not very confident, somewhat confident, very confident). Responses to these 2 questions were dichotomized (extreme burden vs other; not at all/not very confident vs somewhat/very confident), which split respondents into 2 groups of roughly equal size, and then added to the independent variables. We tested alternative specifications of both the dependent and independent variables.

The conditional regression design was based on specialty strata. We constructed the model this way to mitigate the potential for reported frequencies of each of the forms of defensive medicine behavior to be influenced by interspecialty differences in physicians' opportunities to perform those behaviors. For example, emergency physicians are relatively constrained in their ability to turn away high-risk patients. Thus, the model estimated predictors by specialty, with the final estimates representing an overall mean of the intraspecialty analyses.

RESULTS

Respondent Characteristics

Obstetrician/gynecologists comprised the largest specialty group among respondents (23%), followed by general surgeons and radiologists (both 19%), emergency physicians (18%), orthopedic surgeons (15%), and neurosurgeons (6%) (TABLE 1). Respondents were fairly seasoned clinicians (96% with >10 years in practice). They practiced in a mix of medical groups (39%), hospitals (28%), and solo practices (20%), and obtained their liability insurance coverage directly from a commercial carrier (63%) or through a hospital (37%).

Table 1. Characteristics of Physician Specialists

Characteristic	No. (%) of Physicians (N = 824)*
Specialty	
Emergency medicine	148 (18)
General surgery	155 (19)
Orthopedic surgery	127 (15)
Neurosurgery	52 (6)
Obstetrics/gynecology	187 (23)
Radiology	155 (19)
Sex	
Male	717 (87)
Female	107 (13)
Years in practice	
1-10	29 (4)
11-19	217 (26)
20-29	291 (35)
≥30	287 (35)
Practice type	
Solo	161 (20)
Group	322 (39)
Hospital clinic	227 (28)
Other	111 (13)
Primary hospital affiliation	
Not-for-profit	694 (84)
For-profit	93 (11)
Governmental	14 (2)
Source of liability insurance coverage	
Hospital	302 (37)
Commercial carrier	516 (63)
Practice location	
High-risk region	534 (65)
Low-risk region	290 (35)
Metropolitan statistical area	
Inside	718 (87)
Outside	106 (13)
Claims experience	
Sued	
≤3 y ago	399 (48)
>3 y ago	322 (39)
Never sued	100 (12)
Dropped by liability insurer	
Since 1995	421 (51)
1995-2000	228 (28)
2000-2003	328 (40)
Reason dropped by liability insurer†	
Insurer stopped writing policies in specialty and/or in Pennsylvania	393 (93)
Insurer terminated policy, but continued to write policies in specialty and in Pennsylvania	44 (10)
Burden of liability insurance premiums	
Is not	19 (2)
Minor	89 (11)
Major	369 (45)
Extreme	339 (41)
Confidence level regarding insurance policy providing adequate coverage	
Very	62 (8)
Somewhat	350 (42)
Not very	263 (32)
Not at all	146 (18)

*The data are not weighted. Subcategories may not sum to 824 because of missing data.
†Denominator is 421 physicians who were dropped since 1995. Reasons sum to more than 421 (100%) because of respondents with multiple changes and reasons.

Specialist physicians in the sample were not strangers to malpractice litigation and its consequences. Approximately two thirds practiced in high-risk regions of Pennsylvania, 88% had previously been sued and 48% had been sued in the previous 3 years. In addition, 51% had been dropped by an insurance carrier since 1995. A larger proportion of respondents were dropped after 2000 than between 1995 and 2000, but the primary reason for being dropped in both periods was that the insurer stopped writing policies for the respondent's specialty in Pennsylvania.

Most respondents perceived their insurance premiums to be financially burdensome, with 41% classifying the burden as extreme. Half of the respondents lacked confidence that their insurance would provide adequate coverage in the event they were sued; an additional 42% were somewhat confident and 8% were very confident.

General Findings

Virtually all respondents (93%) reported that they sometimes or often engaged in at least 1 of the 6 forms of defensive medicine outlined in the survey, and 82% of those who reported practicing defensively (626/768) detailed their most recent defensive act. Many of the respondents to the survey also reported that they had restricted the scope of their clinical practice because of liability concerns (42%) and/or were likely to do so further in the next 2 years (49%).

Assurance Behavior

Fifty-nine percent of respondents reported that they often ordered more diagnostic tests than were medically indicated; the proportion was significantly higher for emergency physicians (70%) compared with all other specialists (TABLE 2). Fifty-two percent of all respondents reported that they often referred patients to other specialists in unnecessary circumstances; this was a particularly common practice among obstetricians/gynecologists (59%). One third of all respondents reported often prescribing more medications than were medically indicated, and the same proportion reported often suggesting invasive procedures which, in their professional judgment, were unwarranted. General surgeons were especially likely to say that they often suggested unnecessary invasive procedures (44%).

TABLE 3 quantifies the specific practices reported by the 626 respondents who detailed their most recent defensive act. Forty-three percent of respondents who reported a defensive act, and more than half of the emergency physicians, orthopedic surgeons, and neurosurgeons who reported an act, described using imaging studies as their most recent act. More than half of the emergency physicians, orthopedic surgeons, and neurosurgeons who reported an act described using computed tomography, magnetic resonance imaging, or radiography that was not clinically necessary. Among obstetrician/gynecologists, ultrasonograms were the diagnostic study of choice (18%), but unnecessary referral (32%) was the most common practice. Eighteen percent of general surgeons and 9% of obstetrician/gynecologists declared ordering of an unnecessary biopsy as their most recent defensive act.

A few clinical scenarios arose repeatedly in physicians' verbatim descrip-

Table 2. Frequency of Assurance and Avoidance Behaviors by Physician Specialists*

	All Specialties, No. (%) (n = 669)†		Emergency (n = 148)		General Surgeons (n = 155)		Orthopedic Surgeons (n = 127)		Neurosurgeons (n = 52)		Obstetrician/ Gynecologists (n = 187)	
	Often	Never/ Rarely	Often	Never/ Rarely	Often	Never/ Rarely	Often	Never/ Rarely	Often	Never/ Rarely	Often	Never/ Rarely
Assurance behavior												
Order more tests than medically indicated	405 (59)	52 (8)	70‡	4	55	9	62	7	50	22	54	8
Prescribe more medications (eg, antibiotics) than medically indicated	223 (33)	207 (31)	30	29	35	30	43‡	30	19§	55	28	32
Refer patients to other specialists in unnecessary circumstances	349 (52)	78 (11)	52	11	50	13	48	13	29‡	32	59§	7
Suggest invasive procedures (eg, biopsies) to confirm diagnoses	221 (32)	199 (29)	19‡	32	44‡	22	28	35	21	61	38	25
Avoidance behavior												
Avoid certain procedures or interventions	216 (32)	189 (29)	21‡	43	25	28	42‡	19	39	33	38§	25
Avoid caring for high-risk patients‖	268 (39)	236 (35)	13‡	54	43	35	57‡	22	38	43	46	28

*The data are weighted. Adjusted Pearson χ^2 tests were used to test for significant differences between the proportion within each specialty who reported conducting the behavior often and the corresponding proportion for all other specialties combined.
†Radiologists were excluded because of the high proportion of responses indicating that the defensive practice was not applicable (eg, 54% regarding practice of overprescribing; 37% regarding referral to other specialists).
‡$P<.05$ compared with frequency of "often" responses for the other specialties combined.
§$P<.01$ compared with frequency of "often" responses for the other specialties combined.
‖The survey question asked whether respondents believed their practice or hospital would avoid caring for high-risk patients in the next 2 years. Response options ranged from "definitely will/already decided to" to "definitely will not." The "often" column reports the "definitely will/already decided to" responses; the "never/rarely" column reports "definitely will not" and "not likely" responses combined.

tions of their defensive practices. Detection of cancer is a major concern among physicians in all specialties surveyed (157; 24% of specified practices), which manifested in increased use of diagnostic imaging, specialist referral, and invasive procedures. Emergency physicians reported performing extensive workups, including hospitalization, for atypical chest pain in low-risk patients (22; 16% of practices specified by emergency physicians), ordering computed tomography for abdominal symptoms unlikely to be acute appendicitis (15; 11%), and ordering cranial imaging for minor trauma or other questionable indications (34; 25%). Obstetrician/gynecologists reported ordering ultrasonograms for both pregnant and nonpregnant patients (7; 4% of practices specified by obstetrician/gynecologists), and referring patients with palpable breast masses for surgical biopsy regardless of mammographic findings (9; 5%). General surgeons reported performing biopsies of breast masses (21; 14% of practices specified by general surgeons) and ordering confirmatory imaging of appendicitis before operating or declining to operate (17; 11%). Orthopedists and neurosurgeons reported ordering magnetic resonance imaging to exclude a tumor diagnosis for spine, bone, or joint symptoms (13; 7%). Radiologists reported referring patients with ambiguous mammograms for surgical biopsy (26; 17% of practices specified by radiologists) and ordering close follow-up with repeat imaging of low-risk abnormalities on chest radiographs (6; 4%).

Avoidance Behavior

Thirty-nine percent of specialist physicians reported that they "definitely will/already decided to" avoid caring for high-risk patients (Table 2). This response was significantly more likely among orthopedic surgeons (57%) and significantly less likely among emergency physicians (13%) compared with all other specialists. One third of specialist physicians reported often avoiding certain procedures or interventions; orthopedic surgeons were especially likely to report that they did so often (42%).

Among the 425 respondents who detailed their restrictions on practice, the most common reports were stopping practice altogether or eliminating specific high-risk procedures (TABLE 4); for example, emergency or trauma surgery by orthopedic surgeons, neurosurgeons, and general surgeons; complex obstetrics by obstetrician/gynecologists; and mammograms by radiologists. Many surgeons also reported avoidance of patients perceived to be risky propositions, either because of their clinical complexity or personal propensity for litigation, such as children and patients covered by workers' compensation and medical assistance.

Among respondents' reports of their most recent act of defensive medicine, avoidance behaviors were less prominent (Table 3). A substantial number of orthopedic surgeons (19%) and neurosurgeons (11%) reported referring a patient to another physician; several general surgeons reported referring a patient to another hospital (6%) or to another physician (7%). Although referral to another physician was the most common specific practice reported by obstetrician/gynecologists (32%), most of those referrals were made in their primary care capacity (eg, evaluation of breast masses) and therefore represent assurance rather than avoidance behavior.

Table 3. Specific Practices of Defensive Medicine Among Physician Specialists

Most Recent Act of Defensive Medicine	No. (%) of Physicians*
Emergency physicians (n = 126)	
Ordered CT, MRI, or x-ray	76 (63)
Admitted patient	19 (14)
Obtained cardiac workup	15 (12)
Ordered other tests	13 (11)
Referred patient to another physician	8 (5)
General surgeons (n = 119)	
Ordered CT, MRI, or x-ray	48 (41)
Obtained biopsy	23 (18)
Ordered other tests	9 (7)
Referred patient to another physician	9 (7)
Requested a second opinion	8 (7)
Referred patient to another ED or hospital	8 (6)
Recorded interaction with patient in more detail	6 (6)
Orthopedic surgeons (n = 97)	
Ordered CT, MRI, or x-ray	56 (55)
Referred patient to another physician	18 (19)
Ordered other tests	13 (14)
Prescribed additional drugs	5 (6)
Neurosurgeons (n = 33)	
Ordered CT, MRI, or x-ray	20 (58)
Ordered other tests	4 (12)
Ordered other imaging	4 (11)
Referred patient to another physician	4 (11)
Prescribed additional drugs	2 (7)
Obstetrician/gynecologists (n = 148)	
Referred patient to another physician	46 (32)
Ordered ultrasonography	28 (18)
Ordered other tests	20 (13)
Obtained biopsy	15 (9)
Ordered blood tests	11 (8)
Ordered CT, MRI, or x-ray	10 (7)
Referred patient to another ED or hospital	10 (6)
Performed cesarean delivery	9 (6)
Avoided seeing high-risk patient	7 (5)
Radiologists (n = 103)	
Ordered CT, MRI, or x-ray	38 (36)
Obtained breast biopsy	26 (25)
Ordered other tests (unspecified)	13 (14)
Obtained mammography	6 (7)

Abbreviations: CT, computed tomography; ED, emergency department; MRI, magnetic resonance imaging.
*The percentages are weighted.

Correlates of Defensive Medicine

TABLE 5 shows all statistically significant predictors of the defensive practices identified in the adjusted analyses. Two subjective measures of liability experience—specialist physicians' confidence in the adequacy of their liability coverage and their perceptions of premium burdens—were the strongest predictors across all types of defensive practice. Specialist physicians who lacked confidence in their coverage were more than twice as likely as other specialists to order unnecessary diagnostic tests (OR, 2.48; 95% confidence interval [CI], 1.75-3.51), refer patients to other physicians unnecessarily (OR, 2.25; 95% CI, 1.52-3.05), suggest invasive procedures that in their clinical judgment were not needed (OR, 2.12; 95% CI, 1.48-3.04), and avoid risky procedures (OR, 2.26; 95% CI, 1.57-3.26) and high-risk patients (OR, 2.47; 95% CI, 1.72-3.56). Specialist physicians who perceived their premium burden as extreme were more than 1½ times as likely as other specialists to overprescribe medication (OR, 1.88; 95% CI, 1.27-2.80), refer patients to other physicians unnecessarily (OR, 1.71; 95% CI, 1.53-2.88), and order un-

Table 4. Avoidance Behaviors Already Pursued or Likely to Be Pursued Within 2 Years

Avoidance Behavior	No. (%) of Physicians*
Emergency physicians (n = 37)	
Stops performing specific procedures	15 (40)
Spinal tap	3 (6)
Orthopedics	2 (5)
Obtains more consultations or refers more patients to another physician	12 (9)
Avoids treating high-risk patients	6 (5)
General surgeons (n = 85)	
Stops performing specific procedures	63 (73)
Vascular	15 (15)
Tumor excisions (unspecified)	7 (9)
Bariatric	7 (8)
Pancreatic	6 (9)
Thoracic	6 (7)
Stops performing emergency or trauma surgery	18 (21)
Avoids treating high-risk patients	13 (17)
Pediatric	6 (8)
Medical assistance	2 (4)
Stops practicing	11 (11)
Obtains more consultations or refers more patients to another physician	4 (6)
Orthopedic surgeons (n = 91)	
Stops performing specific procedures	52 (57)
Spine, neck, or back	32 (34)
Revisions	10 (11)
High-risk (unspecified)	9 (10)
Joint	4 (5)
Stops performing emergency or trauma surgery	26 (28)
Avoids treating high-risk patients	17 (19)
Workers' compensation	6 (7)
Pediatric	4 (5)
Litigious†	4 (5)
Stops practicing	16 (17)
Neurosurgeons (n = 29)	
Stops performing specific procedures	23 (80)
Cranial	9 (33)
Aneurysm	9 (30)
Emergency or trauma surgery	6 (20)
Spine, neck, or back	5 (17)
Avoids treating high-risk patients	4 (13)
Workers' compensation	2 (6)
Stops practicing	3 (11)

(continued)

necessary diagnostic tests (OR, 1.51; 95% CI, 1.02-2.22).

Only 1 of the 3 objective measures of physician liability risk was significant in any of the 6 regression models: the odds of overprescribing medication were greater for specialist physicians who had been dropped by their liability insurer in the previous 3 years (OR, 1.69; 95% CI, 1.18-2.41). Eliminating the subjective variables from the model did not affect this result.

Sensitivity Analyses

There was correlation among the outcome measures in the regression models as they captured different dimensions of defensive practice. Applying a Bonferroni correction for multiple comparisons dropped extreme premium burden from statistical significance as a predictor of overtesting; however, it did not affect the significance of the subjective measures in any other analyses.

Findings from the regression analyses were robust to alternative specifications of the dependent and independent variables. Respecifying the dependent variables as often/sometimes compared with rarely/never had only a minor impact on the size of coefficients; it also added extreme premium burden as a significant predictor of avoiding interventions (OR, 1.64; 95% CI, 1.08-2.50) and high-risk patients (OR, 1.58; 95% CI, 1.05-2.39). Altering the specification of the variable capturing lack of confidence in coverage (not at all vs the rest) had a trivial impact on size of coefficients and added the premium burden as a significant predictor of invasive procedures (OR, 1.50; 95% CI, 1.02-2.21). The distribution of responses within the premium burden variable did not permit stable alternatives for specification.

We also regressed a composite outcome variable on the original set of independent variables. This outcome variable compared respondents who reported often engaging in 3 or more of the 6 behaviors (n=301) with the rest of the sample. Three predictors were statistically significant: lack of confidence in coverage (OR, 2.28; 95% CI, 1.63-3.20), extreme premium burden (OR, 2.01; 95% CI, 1.38-2.93), and 30 or more years in practice (OR, 1.65; 95% CI, 1.08-2.52).

COMMENT

Previous efforts to measure defensive medicine have used either surveys of clinicians about their behavior[3] or linkage of variation observed in practice patterns to variation in liability exposure.[5,16-18] Each approach has methodological strengths and weaknesses.[2,3] We sought to advance survey work in this area in 3 ways. First, many previous surveys have centered on physicians subjected to relatively low levels of litigation, placid malpractice environments, or both.[5,19-24] Second, the research has often been limited to single specialties, such as obstetrics.[18,25-30] Third, most questionnaires have measured defensive medicine using fixed, generic categories or predetermined scenarios,[3]

lacking self-reported detail about specific behaviors.

We investigated defensive medical practice within a state that has been significantly affected by the latest escalation of liability costs and surveyed the 6 specialties that pay the most for liability insurance. We supplemented queries about classic forms of defensive practice with an open-ended format designed to distinguish general sentiment from actual conduct, and to elicit specific details of defensive acts.

We found that defensive medicine was widespread among high-risk specialists practicing in Pennsylvania, with 9 of 10 respondents reporting defensive practices. Overordering of diagnostic tests, unnecessary referrals, and avoidance of high-risk patients were the most common forms; three quarters of respondents said that they engaged in at least 1 of these defensive practices "often." Discrepant questionnaire wording frustrates neat comparisons across studies and our study does not correlate longitudinal changes in defensive practices with changes in the liability environment, but the frequencies reported in our study dramatically exceed those found in previous research. This suggests that physicians' practices may be sensitive to swings in the litigation and insurance climate.

In our study, as in previous ones, objective measures of physicians' liability experience and exposure were not associated with individual physicians' propensity to practice defensively.[24,28,31-33] In explaining this phenomenon, Glassman et al[31] have suggested that "the signal to practice defensively may have been broadcast so widely that individual experience is overshadowed by collective anxiety." Personal anxiety may also overshadow actual experience. We found that 2 subjective measures—confidence in liability coverage and burdensomeness of insurance premiums—were associated strongly with higher odds of individual physicians practicing virtually all forms of defensive medicine. Attention to the psychological effects of the liability environment seems particularly apt in the current liability environment. Tighter reimbursement rates, more assertive patients, greater administrative burdens, increased likelihood of being dropped by liability insurers, and other challenges to physi-

Table 4. Avoidance Behaviors Already Pursued or Likely to Be Pursued Within 2 Years (cont)

Avoidance Behavior	No. (%) of Physicians*
Obstetrician/gynecologists (n = 122)	
Stops practicing	
All obstetrics	51 (46)
Complex obstetrics	40 (32)
Stops performing specific procedures	47 (39)
Gynecologic surgery	12 (11)
High-risk surgery (unspecified)	12 (10)
Delivering infants	9 (6)
Vaginal birth after cesarean	6 (5)
Cancer-related surgery	6 (5)
Laparoscopic surgery	4 (4)
Obtains more consultations or refers more patients to another physician	12 (9)
Avoids treating high-risk patients	6 (5)
Radiologists (n = 61)	
Stops performing specific procedures or tests	
Mammography	30 (54)
Interventional procedures	24 (37)
Angiography	5 (7)
Contrasting agents	3 (5)
Obstetric ultrasonography	3 (4)
Avoids treating high-risk patients	3 (4)

*The percentages are weighted. Each physician could report more than 1 defensive medicine practice.
†Patients perceived to have a higher probability of bringing litigation.

Table 5. Multivariate Risk Factors for Physician Specialists Practicing Defensive Medicine*

Defensive Medicine Practice	OR (95% CI)	*P* Value
Often orders more tests than medically indicated		
Lack of confidence in coverage	2.48 (1.75-3.51)	<.001
Extreme premium burden	1.51 (1.02-2.22)	.04
Female physician	0.50 (0.30-0.86)	.01
Often prescribes more medications than medically indicated		
Lack of confidence in coverage	1.70 (1.19-2.42)	.003
Extreme premium burden	1.88 (1.27-2.80)	.002
Dropped by insurer in past 3 y	1.69 (1.18-2.41)	.004
Often refers patients to other specialists in unnecessary circumstances		
Lack of confidence in coverage	2.25 (1.52-3.05)	<.001
Extreme premium burden	1.71 (1.53-2.88)	<.001
Often suggests invasive procedures to confirm diagnoses		
Lack of confidence in coverage	2.12 (1.48-3.04)	<.001
Often avoids performing certain procedures or interventions		
Lack of confidence in coverage	2.26 (1.57-3.26)	<.001
≥30 y in practice†	1.61 (1.04-2.48)	.03
Already have/very likely to avoid caring for high-risk patients		
Lack of confidence in coverage	2.47 (1.72-3.56)	<.001
Solo practice‡	2.11 (1.02-4.35)	.04

Abbreviations: CI, confidence interval; OR, odds ratio.
*The independent variables in all 6 regression models are premium burden, confidence in coverage, high-risk county, years in practice, sex, dropped by insurer in last 3 years, commercial insurance, type of practice (solo, group, hospital, other), and having been sued in the last 3 years. Radiologists were excluded from the model because of the high proportion of their responses indicating that the specific defensive practice was not applicable to them.
†Reference category: 20-29 years in practice.
‡Reference category: hospital-based practice.

cians' equanimity tip physicians into a defensive posture that liability risk alone might not provoke.[34]

Cost and Access Effects

Many specialist physicians reported doing more for (or to) patients because of malpractice risk, the cost of which is mainly borne by health insurance. Resorting to unnecessary diagnostic tests, especially imaging, was extremely common and cut across specialties. More than 90% of all respondents reported ordering tests unnecessarily and more than 60% of physicians in all specialties except neurosurgery reported performing or requesting invasive diagnostic procedures. Within the group of physicians who practiced defensively, 70% reported ordering an unnecessary diagnostic test as their most recent act. The prevalence of assurance behavior, coupled with the unit of cost procedures typically ordered (eg, MRIs), lends weight to arguments that the total cost of defensive medicine is substantial.

Technology plays a key role in defensive medicine, and in malpractice liability generally.[34] Specialists reported using technology to pacify demanding patients, bolster their own self-confidence, or create a trail of evidence that they had confirmed or excluded particular disease entities. For example, assurance behavior in our study often involved cancer diagnoses in younger patients who had consulted obstetrician/gynecologists or orthopedists. Advances in diagnostic and therapeutic technologies make early detection of cancer both feasible and beneficial, and increase the likelihood that a missed diagnosis will be ruled negligent and assessed substantial damages.

Defensive use of technology is self-reinforcing. The more physicians order tests or perform diagnostic procedures with low predictive values or provide aggressive treatment for low-risk conditions, the more likely such practices are to become the legal standard of care. Reforms to address such "intensity creep" might include practice guidelines that empower physicians to withhold low-yield tests or force patients to shoulder some of the financial burden as well as dispute resolution and compensation systems that reduce hindsight bias following injury. Professional organizations are well positioned to lead the development and diffusion of such guidelines.

Effects of defensive medicine on patients' access to care are difficult to demonstrate because multiple factors influence access and few benchmarks exist for optimal supply (M.M.M., D.M.S., C.M.D., et al, unpublished data, 2004).[35] Nonetheless, large numbers of respondents reported engaging in avoidance behavior, many reporting across-the-board reductions in their scope of practice to qualify for less expensive malpractice insurance. For example, obstetrician/gynecologists reported halting obstetrics and radiologists reported not interpreting mammograms, both of which may affect essential health services for women. Some surgeons appear to be limiting their practices to "bread-and-butter" operations, no longer performing more difficult procedures. Several respondents described avoiding sicker patients, patients with prior complications, and patients perceived as dissatisfied (including those who had filed lawsuits in the past). When specialists in rural areas (13% of the sample) engage in avoidance behavior, a substantive effect on access is more likely because alternative sources of care are limited.

Technical and Interpersonal Quality Effects

Defensive medicine may reduce or improve quality, depending on the circumstances.[36] Most assurance behaviors described, such as additional diagnostic testing, were not harmful to patients and perhaps even offered marginal benefits. Referral of difficult cases to more specialized physicians or better equipped hospitals may be quality-enhancing.

On the other hand, unnecessary invasive procedures create significant risks of patient harm. Many specialist physicians in our study described performing biopsies or referring patients for a biopsy for defensive reasons. Because breast cancer was the most common clinical circumstance in which this occurred, female patients appear to bear a considerable portion of incremental risk from defensive medicine. False-positive results associated with low-yield diagnostic testing may also have detrimental effects on quality, particularly when ambiguous findings produce emotional distress and necessitate additional invasive or hazardous procedures.

Defensive medicine takes a toll on interpersonal quality of care and the patient-physician relationship. Some physicians may spend additional time with patients and provide more complete information about treatment risks and alternatives because of malpractice risk, but others may react with suspicion, confrontation, and abandonment. Our study suggests that certain types of patients commonly prompt specialist physicians to behave defensively, especially those who are seen as demanding, emotional, or unpredictable. Safety campaigns that urge patients to Speak Up[37] should take these effects into account.

Two contrasting behavioral responses were evident. Specialists who perceived or anticipated adversarial relationships with patients often indulged their demands for expensive but unnecessary diagnostic studies. However, specialists also reported refusing to care for patients with prior complications (especially if they had expressed dissatisfaction with a previous physician), noncompliant patients, workers' compensation cases, and obese persons. Both behavioral responses entail considerable time and energy spent predicting patients' possible litigiousness, especially for new patients, reflecting a level of suspicion that itself is arguably detrimental to quality.[38]

Study Limitations

Our study has several limitations. First, measurement and self-identification of defensive medicine are difficult because distinctions between inappropri-

ate and appropriate care are not clear in many clinical situations.[39] Moreover, it can be difficult to disentangle liability-related motivators from other factors that influence clinical decision making, such as physicians' general desire to meet patients' expectations, preserve trust, and avoid conflict.[2,4,40] To the extent that physicians unconsciously practice defensively, our results will underestimate defensive medicine; to the extent that physicians attribute liability motivations to decisions driven primarily by other considerations, our findings will be exaggerated.

Second, physician self-reports of defensive medicine may be biased toward giving a socially desirable response or achieving political goals. This may lead respondents to overstate the frequency of forms of defensive medicine that seem wasteful but not harmful, while causing them to understate the frequency of potentially dangerous practices. Third, our findings are derived from 6 physician specialties in a single state with a highly stressed liability insurance system, and may not be generalizable to other locations or malpractice climates.

Conclusions

Higher levels of defensive medicine are part of the social costs of instability in the malpractice system. The most frequent form of defensive medicine, ordering costly imaging studies, seems merely wasteful, but other defensive behaviors may reduce access to care and even pose risks of physical harm. Because both obstetrics and breast cancer detection are high-liability fields, women's health may be particularly affected. Efforts to reduce defensive medicine should concentrate on educating patients and physicians regarding appropriate care in the clinical situations that most commonly prompt defensive medicine, developing and disseminating clinical guidelines that target common defensive practices, and reducing the financial and psychological vulnerability of individual physicians in high-risk specialties to shocks to the liability system.

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Study concept and design: Studdert, Mello, Sage, DesRoches, Peugh, Zapert, Brennan.
Acquisition of data: Studdert, Mello, DesRoches, Peugh, Zapert.
Analysis and interpretation of data: Studdert, Mello, Sage, Brennan.
Drafting of the manuscript: Studdert, Sage.
Critical revision of the manuscript for important intellectual content: Studdert, Mello, Sage, DesRoches, Peugh, Zapert, Brennan.
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