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Physician spending and subsequent risk of malpractice claims: observational study

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ABSTRACT

STUDY QUESTION

Is a higher use of resources by physicians associated with a reduced risk of malpractice claims?

METHODS

Using data on nearly all admissions to acute care hospitals in Florida during 2000-09 linked to malpractice history of the attending physician, this study investigated whether physicians in seven specialties with higher average hospital charges in a year were less likely to face an allegation of malpractice in the following year, adjusting for patient characteristics, comorbidities, and diagnosis. To provide clinical context, the study focused on obstetrics, where the choice of caesarean deliveries are suggested to be influenced by defensive medicine, and whether obstetricians with higher adjusted caesarean rates in a year had fewer alleged malpractice incidents the following year.

STUDY ANSWER AND LIMITATIONS

The data included 24 637 physicians, 154 725 physician years, and 18 352 391 hospital admissions; 4342 malpractice claims were made against physicians (2.8% per physician year). Across specialties, greater average spending by physicians was associated with reduced risk of incurring a malpractice claim. For example, among internists, the probability of experiencing an alleged malpractice incident in the following year ranged from 1.5% (95% confidence interval 1.2% to 1.7%) in the bottom spending fifth ($19 725 (£12 800; €17 400) per hospital admission) to 0.3% (0.2% to 0.5%) in the top fifth ($39 379 per hospital admission). In six of the specialties, a greater use of resources was associated with statistically significantly lower subsequent rates of alleged malpractice incidents. A principal limitation of this study is that information on illness severity was lacking. It is also uncertain whether higher spending is defensively motivated.

WHAT THIS STUDY ADDS

Within specialty and after adjustment for patient characteristics, higher resource use by physicians is associated with fewer malpractice claims.

FUNDING, COMPETING INTERESTS, DATA SHARING

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WHAT IS ALREADY KNOWN ON THIS TOPIC

Defensive medicine is defined as medical care provided to patients solely to reduce the threat of malpractice liability rather than to further diagnosis or treatment

In the United States most physicians report practicing defensive medicine to reduce malpractice liability

However, no evidence exists on the overall question of whether higher levels of resource use are associated with a reduced risk of malpractice claims

WHAT THIS STUDY ADDS

A higher use of resources by US physicians in acute care hospitals in Florida during 2000-09 was associated with fewer malpractice claims

Also, focusing on a specific example of caesarean deliveries (argued to be influenced by defensive medicine), obstetricians with higher risk adjusted caesarean rates in a year had fewer alleged malpractice incidents the following year

Introduction

Critics of the US malpractice system often note that it promotes defensive medicine—defined as medical care provided to patients solely to reduce the threat of malpractice liability rather than to further diagnosis or treatment. Physicians report defensive medicine as a major contributor to healthcare costs, and commonly argue that they must practice defensively to reduce malpractice liability.[1-5] For instance, among physicians practicing in high risk specialties in Pennsylvania during a malpractice crisis, more than 90% reported sometimes or often practicing defensive medicine.[1] In Massachusetts, more than 80% of physicians report practicing defensive medicine, with a reported 20% to 30% of imaging studies and 13% of hospital admissions being defensively motivated.[6] In a national survey of US physicians, over 60% reported ordering diagnostic tests or consultations solely to reduce the threat of liability.[3] Several economic studies confirm the presence of defensive medicine among US physicians,[7-12] although estimates of its size are of considerable debate.[3 13 14] Concerns by physicians about malpractice liability and defensive medicine are not only limited to the United States. For example, in a survey of UK hospital doctors, 78% reported practicing defensive medicine, with the ordering of tests and unnecessary referral to other specialties cited as the most common examples.[15]

Despite widespread agreement that physicians practice defensive medicine to reduce malpractice liability, there are no studies of whether greater resource use by physicians, whether it is defensively motivated or not, is associated with reduced claims for malpractice. This lack of evidence is surprising, given that defensive medicine is premised on greater resource use reducing malpractice liability. The fact that most physicians practice at least some defensive medicine raises the question of whether a majority of physicians could be incorrect in believing that greater resource use can deter liability.

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There are reasons to believe that the level of resource use provided by physicians bears little relation to risk of liability. Studies suggest that a substantial fraction of malpractice claims stem from failures in physician-patient communication.[16-19] Furthermore, though diagnostic errors are the leading cause of malpractice claims in the US and several other countries,[20-22] these are usually attributed to cognitive or system errors rather than to the level of resource use.[23-25] The majority of adverse clinical events also do not result in malpractice claims, and a substantial proportion of claims involve no medical error, both of which suggest substantial idiosyncrasy in malpractice.[26-29] Finally, although few studies have specifically studied the association between resource use and medical errors, several studies have questioned whether greater resource use improves clinical outcomes more broadly.[30-34] Each of these considerations attenuate the relation between malpractice claims and the level of resource use.

We linked data on nearly all hospital admissions in Florida between 2000 and 2009 to the malpractice history of each attending physician of record to investigate whether physicians who provide more costly care are less likely to face malpractice claims. Adjusting for differences in patient characteristics across physicians and analyzing physician specialties separately, we examined the association between a physician's average hospital costs in a given year and the probability of a malpractice claim stemming from an incident occurring in the following year. To provide clinical context, we also studied whether the average risk adjusted rate of caesarean deliveries among obstetricians—a decision often argued to reflect defensive medicine—was associated with a lower risk of subsequent malpractice.[11 35-38] In both instances, our motivation was to explore whether greater resource use, defensively motivated or not, is associated with reduced malpractice claims.

Methods

Data sources

We obtained data from the Florida Agency for Health Care Administration on all hospital discharges from all non-state, non-federal Florida acute care hospitals during 2000-09. Data included patient age, sex, race, zip code of residence, year of hospital admission, ICD-9 (international classification of diseases, ninth revision) codes for principal and secondary diagnoses and procedures, discharge diagnosis related group, and total hospital charges. Each record also included the Florida license number of the attending physician of record for the hospital admission.

We also obtained data from the Florida Office of Insurance Regulation on all closed malpractice claims against Florida physicians with active medical licenses reported during the study period. By Florida law, all liability insurers and self insured healthcare providers are required to report claims for personal injury damages alleged to have occurred as a result of provider error, omission, or negligence, as well as indemnity payments. All claims are reported irrespective of whether they were settled or tried in court. Each closed claim record included the license number of the physician involved, whether an indemnity payment was made, and, if so, payment size, and dates of alleged injury, claim filing, and claim closure. Claims closed after December 2013 were unavailable. On average, however, malpractice claims are closed within four years of incident date,[39] allowing us to capture the majority of claims arising from clinical encounters that occurred in the last year of our study period, 2009.

Finally, we obtained data on physician specialty from publicly available practitioner profiles maintained by the Florida Agency for Health Care Administration.

Outcome measure

Our primary outcome was a binary variable for whether a physician was involved in an incident in a given year that resulted in a subsequent malpractice claim filed against the physician. For example, claims filed for incidents occurring in 2005 were attributed to the relevant physicians in 2005, rather than the year in which the claim was filed or it was closed, which could be several years after the event.[39] We attributed claims according to incident date rather than claim date because our primary interest was to examine whether the average intensity of care provided by a physician in a given year (for example, 2004) was associated with future malpractice liability stemming from clinical care provided in the subsequent year (that is, 2005). We did not compare spending in the current year with the probability of a claim in that same year because of concerns about reverse causality (the presence of an event resulting in a malpractice claim in a year could alter that physician's practice patterns). Note that our approach assumes that a physician's spending in a given year is a reliable predictor of a physician's overall spending pattern and not idiosyncratic from year to year—that is, that the relative intensity of physician practice styles persists over time. To confirm this, we demonstrated that physician spending in one year is highly positively correlated with spending in the next year (see supplementary eTable 1), suggesting that physician spending patterns are more systematic than idiosyncratic.

Physician resource use measures

We examined the association between the use of resources by physicians and subsequent malpractice claims by testing whether, within a specialty, physicians who tend to provide more costly care (after adjustment for clinical differences between patients) are more or less likely to face a future claim. We created two measures of intensity of care provided by physicians, one general and one clinically specific.

Our first measure was total hospital charges associated with patients treated by a given physician in a given year, averaged across all patients treated by that physician in that year and adjusted for patient personal and clinical characteristics. Although several physicians may be involved in the care of a hospital inpatient, we attributed all charges to the attending physician of record, intending to measure the overall approach of that physician toward hospital care.[40]

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Specifically, though multiple providers may be involved in the care of a single patient admitted to a hospital, the attending physician is classically responsible for the various day to day evaluation and management decisions for a given patient, which include diagnostic and laboratory testing, requesting assistance of specialist physicians and other providers, and determining date of discharge, all of which contribute to hospital costs.

We accounted for differences in patient characteristics and admission diagnoses between physicians by estimating a patient level multivariable linear model of total hospital charges during the hospital stay as a function of patient age, sex, race, diagnosis related group, indicator variables for Charlson-Deyo comorbid conditions, and year and physician indicators. We then used the results of the model to compute the average, adjusted cost of a hospital admission associated with each physician in a given year. Resource use and malpractice risk vary considerably by specialty, so we estimated separate models for internal medicine, internal medicine subspecialty, family medicine, pediatrics, general surgery, surgical subspecialty, and obstetrics and gynecology.

Given that the average hospital cost for a physician is a general measure of resource use, our second resource use measure was more clinically specific—namely, the risk adjusted rate of caesarean childbirths among obstetricians. Compared with our general measure of overall resource use, caesarean rates offer a well studied and clinically specific example of how physicians respond to malpractice liability. For instance, among 26 specialties in a large US study, obstetrics ranked fourth in the rate of paid malpractice claims and third in the average size of malpractice payments.[41] Geographic areas with greater pressure for malpractice have been associated with higher caesarean delivery rates, whereas state tort reforms that have a lower pressure for malpractice have been associated with decreased caesarean rates.[11 36-39] Moreover, US caesarean delivery rates grew by nearly 60% from 1996 to 2013 (20.7% of all deliveries in 1996 *v* 32.7% in 2013) coincident with several malpractice crises.[42]

We tested whether obstetricians with a greater propensity to perform caesarean deliveries in a given year had lower malpractice claims in the following year. Among 1 518 702 admissions for childbirth (identified by diagnosis related group codes 370-371 for caesarean delivery and 372-373 for vaginal delivery), we constructed adjusted physician year level caesarean rates by estimating a patient level logistic model of caesarean delivery as a function of mother's age, race, year indicators, and physician indicators. To isolate differences in the underlying propensity of obstetricians to perform caesarean sections in areas where they had more clinical discretion, we excluded women with clinical contraindications to vaginal delivery endorsed by the joint commission (for example, fetal distress, breech presentation, previous caesarean).[43]

For both the spending and the caesarean measures we applied bayesian shrinkage to adjust unreliable estimates (that is, observations for physicians who billed for few patients during a year) toward the specialty-year specific mean and to improve ranking of individual physicians in terms of their intensity of resource use.[44 45] This approach accounts for noise in the measured variables and provides a more accurate measure of the relation between physician spending levels and the outcome variables than do simple averages.

Statistical analysis

We used two approaches to analyze whether our measures of physician resource use in a year were associated with alleged malpractice incidents in the following year. Firstly, within specialty, we classified physician years into fifths of adjusted spending and then computed average alleged malpractice incident rates in the following year according to adjusted spending fifth. Similarly, for obstetricians we computed average malpractice incident rates according to fifth of adjusted caesarean rates. Observations in fifths were at the physician year level. We categorized physicians into fifths of resource use rather than using a continuous measure, to allow for a non-linear relation between resource use and probability of malpractice incident in the following year.

Additionally, we estimated linear regression models with physician fixed effects to eliminate unobservable, time invariant differences in physicians associated with both higher average intensity of care and malpractice risk of physicians. These could include differences in average patient population even after adjustment for comorbidities and diagnoses, or they could include plausibly fixed physician characteristics such as clinical knowledge or communication skills. This within physician analysis estimated the effect of use of healthcare resources by physicians on subsequent malpractice claims by studying changes in utilization and malpractice claims within the same physician over time. In all analyses, we weighted observations at the physician year level according to the number of patients in each physician year.

Sensitivity analyses

We conducted several sensitivity analyses to verify that model or specification choice did not drive our findings. Firstly, it is possible that average resource use by physicians and the probability of claims for malpractice will differ between non-teaching and teaching hospitals or between for profit and not for profit hospitals, which could confound our analysis. We addressed this problem for each specialty by estimating the association between adjusted physician level spending and subsequent malpractice incidents, including hospital specific fixed effects. For each specialty, this analysis therefore compared rates of subsequent malpractice incidents between high spending and low spending physicians within the same hospital. Secondly, our baseline analysis estimated the association between malpractice incidents and one year lagged physician spending (categorized into fifths). We assessed the sensitivity of our findings instead using a continuous measure of physician

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spending, which was separately included in the model in lags of one year, two years, and three years. Thirdly, we based our estimates of physician spending on hospital admission data from 2000 to 2009, and closed malpractice claims data were available until December 2013. We therefore assumed that four or five years after an alleged malpractice incident would be enough for most malpractice claims to be closed for physicians for whom we had spending data in 2009 (for example, physicians with a malpractice incident in January 2009 would have nearly five years for a claim to be closed to appear in our data). We assessed the sensitivity of our findings to this assumption by restricting our analysis to data on hospital admissions from 2000 to 2008, thereby allowing five or six years' follow-up for malpractice claims to be closed and therefore appear in our data. Moreover, we examined whether our findings were sensitive to defining malpractice incidents only among claims closed within a period of six years.

Patient involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in the design and implementation of the study. There are no plans to involve patients in dissemination of the results.

Results

Characteristics of study sample

Our data included 24 637 physicians and 154 725 physician years linked to nearly 19 million hospital discharges. The mean number of hospital admissions for each physician year varied by specialty and was largest in obstetrics and gynecology and in internal medicine (table 1). Overall, 4342 malpractice claims were filed against physicians (claim rate 2.8% per physician year). Malpractice rates varied across specialty consistently with previous studies,[41 46] ranging from 1.6% per physician year in pediatrics to 4.1% per physician year in general surgery and obstetrics and gynecology.

Hospital charges and malpractice claims

Across all specialties there was a negative association between the fifth of risk adjusted average spending for a given physician year and the probability of facing an alleged malpractice incident in the subsequent year (table 2). For example, in internal medicine, mean risk adjusted hospital spending per physician ranged from $19 725 (£12 800; €17 400) for each hospital admission in the bottom fifth of physician years to $39 379 for each hospital stay in the top fifth, whereas the probability of experiencing an alleged malpractice incident in the subsequent year ranged from 1.5% (95% confidence interval 1.2% to 1.7%) in the bottom fifth of spending to 0.3% (0.2% to 0.5%) in the top fifth. Similarly, in obstetrics and gynecology the probability of experiencing an alleged malpractice incident in the subsequent year ranged from 1.9% (1.3% to 2.4%) in the bottom fifth of adjusted physician year spending to 0.4% (0.1% to 0.8%) in the top fifth.

In analyses that relied on variation in risk adjusted spending within the same physician over time (that is, within physician analysis), greater physician spending in a given year continued to be negatively correlated with the probability of facing an alleged malpractice incident in the subsequent year, across specialties (table 3). The relation was statistically significant at the 5% level or better for all specialties except family medicine.

Caesarean deliveries and malpractice claims

Our data included 1 518 702 deliveries (224 850 were caesarean, 14.8%) performed by 1625 obstetricians across 10 358 physician years. In total, 496 malpractice claims were filed against these physicians (rate 4.8% for each physician year; table 4).

Increasing average risk adjusted caesarean rates for each obstetrician year was associated with decreases in the probability that an obstetrician experienced an alleged malpractice incident in the subsequent year (table 5). For example, the average adjusted caesarean rate for each obstetrician increased from 5.1% in the bottom fifth of obstetrician years to 31.6% in the top

Table 1 | Characteristics of study sample

Characteristics	Internal medicine	Internal medicine subspecialty	Family Medicine	Pediatrics	General surgery	Surgical subspecialty	Obstetrics and gynecology
No of physicians	8654	2745	2519	3649	3319	1812	1939
No of physician years	53 984	18 138	13 163	22 820	21 404	11 874	13 342
No of hospital admissions	7 682 304	1 505 529	1 412 864	2 740 541	1 863 745	998 797	2 148 611
No of hospital admissions per physician year	142	83	107	120	87	84	161
No of malpractice claims	1 442	501	246	359	869	385	540
No of malpractice claims per 100 physician years	2.7	2.8	1.9	1.6	4.1	3.2	4.0
Mean adjusted annual charges per hospital admission ($):*							
Physicians with a malpractice claim	25 775	30 972	18 653	11 034	31 474	33 561	10 601
Physicians without a malpractice claim	28 636	34 621	22 566	12 689	36 701	40 804	12 656
P value for difference†	<0.001	<0.001	0.02	<0.001	<0.001	<0.001	<0.001

$1.00 (£0.65; €0.88).
*Adjusted for patient age, sex, race, comorbid conditions, diagnosis related group, county fixed effects, and year. Charges for physicians with a malpractice claim reflect the mean hospital charges per physician in the year previous to an incident among physicians with a malpractice claim (that is, cases). Charges for physicians without a malpractice claim reflect the mean hospital charges per physician in all years among physicians with a malpractice claim (that is, controls). The purpose of this case-control comparison was to examine whether hospital charges in the year previous to an incident that led to malpractice (among physicians who faced a malpractice claim) differed from average annual hospital charges for physicians who were not sued.
†Difference in means between cases and controls.

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Table 2 | Rate of malpractice claims according to fifth of adjusted physician spending

Specialty	Fifth of adjusted hospital spending*				
	First (lowest)	Second	Third	Fourth	Fifth (highest)
Internal medicine:					
Adjusted hospital spending ($)	19 725	25 392	29 926	34 133	39 379
Malpractice claim rate (%, 95% CI)	1.5 (1.2 to 1.7)	1.1 (0.9 to 1.3)	0.8 (0.6 to 0.9)	0.6 (0.4 to 0.8)	0.3 (0.2 to 0.5)
Internal medicine subspecialty:					
Adjusted hospital spending ($)	23 626	32 573	36 165	41 651	46 654
Malpractice claim rate (%, 95% CI)	1.7 (1.3 to 2.2)	1.4 (1.0 to 1.8)	0.6 (0.4 to 0.9)	0.7 (0.4 to 1.0)	0.2 (0.0 to 0.5)
Family medicine:					
Adjusted hospital spending ($)	13 809	17 357	23 533	28 283	35 305
Malpractice claim rate (%, 95% CI)	0.5 (0.2 to 0.8)	0.5 (0.2 to 0.8)	0.3 (0.1 to 0.6)	0.0 (0.0 to 0.0)	0.2 (−0.1 to 0.4)
Pediatrics:					
Adjusted hospital spending ($)	9121	10 924	12 177	14 877	19 916
Malpractice claim rate (%, 95% CI)	0.7 (0.4 to 0.9)	0.2 (0.1 to 0.4)	0.3 (0.1 to 0.5)	0.1 (0.0 to 0.2)	0.1 (0.0 to 0.3)
General surgery:					
Adjusted hospital spending ($)	25 141	31 542	38 848	43 877	51 987
Malpractice claim rate (%, 95% CI)	2.3 (1.8 to 2.7)	0.9 (0.6 to 1.2)	0.8 (0.5 to 1.1)	0.6 (0.3 to 0.8)	0.4 (0.1 to 0.6)
Surgical subspecialty:					
Adjusted hospital spending ($)	26 979	34 316	40 571	51 959	61 907
Malpractice claim rate (%, 95% CI)	1.7 (1.1 to 2.2)	0.9 (0.5 to 1.3)	0.7 (0.3 to 1.0)	0.3 (0.1 to 0.5)	0.1 (−0.1 to 0.3)
Obstetrics and gynecology:					
Adjusted hospital spending ($)	8653	11 094	13 101	15 213	18 162
Malpractice claim rate (%, 95% CI)	1.9 (1.3 to 2.4)	1.1 (0.7 to 1.5)	0.5 (0.2 to 0.8)	0.2 (0.0 to 0.3)	0.4 (0.1 to 0.8)

$1.00 (£0.65; €0.88).
*Computed at physician year level, within specialty. Indicator variables were created for whether a physician experienced an adverse incident in the following year that ultimately resulted in a malpractice claim. The mean malpractice claim rate per spending fifth was computed by averaging this indicator variable across all physician years in a spending fifth.

fifth, whereas the probability an obstetrician experienced an alleged malpractice incident in the subsequent year decreased from 5.7% (95% confidence interval 4.6% to 6.8%) in the bottom fifth of caesarean delivery rates to 2.7% (1.9% to 3.6%) in the top fifth. In within physician analyses, which relied on variation in risk adjusted caesarean rates within the same obstetrician over time, greater caesarean rates continued to be negatively correlated with the probability of facing an alleged malpractice incident in the subsequent year (increased risk adjusted caesarean rate from the bottom fifth to the top fifth was associated with a −1.5 percentage point (95% confidence interval to −3.6 to −0.6) change in malpractice claims in the subsequent year).

Table 3 | Estimated effect of increased physician spending on subsequent malpractice risk, within physician analysis

Specialty	Absolute % change in malpractice claim rate* (95% CI)	P value†
Internal medicine	−2.1 (−3.4 to −0.8)	0.001
Internal medicine subspecialty	−2.4 (−4.7 to −0.1)	0.04
Family medicine	−1.2 (−3.0 to 0.6)	0.18
Pediatrics	−1.3 (−2.1 to −0.4)	0.003
General surgery	−3.4 (−4.6 to −2.1)	<0.001
Surgical subspecialty	−1.9 (−3.0 to −0.9)	<0.001
Obstetrics and gynecology	−1.3 (−2.3 to −0.4)	0.01

Table reports effect of increasing physician hospital spending from bottom fifth to top fifth on the probability a physician experiences an event that leads to a subsequent malpractice claim. The model was estimated with physician fixed effects (that is, a within physician analysis) and therefore accounted for the possibility that within a specialty and even after adjustment for patient case mix and diagnosis related group, unobserved patient characteristics may be associated with both higher use of healthcare resources by physicians and risk of malpractice claims. The model estimated the effect of physician spending on subsequent malpractice claims by studying changes in spending and malpractice claims within physicians over time.
*Associated with increase in physician spending from bottom to top fifth.
†Two sided *t* tests.

Sensitivity analyses

Our findings were robust across the different sensitivity analyses, including the estimation of models with hospital specific fixed effects to account for the possibility that average resource use and malpractice claims may vary systematically across different hospital types (see supplementary eTable 2); the estimation of models with continuous rather than categorical measures of physician spending as well as two year and three year lagged spending rather than one year lagged spending (see supplementary eTable 3); the estimation of models using data on hospital admissions from 2000 to 2008, thereby allowing five or six years of follow-up for malpractice claims to be closed and therefore appear in our data (see supplementary eTable 4); and relatedly, the estimation of models in which malpractice incidents were defined only among claims closed within a six year period (see supplementary eTable 5).

Discussion

Despite evidence that many physicians practice defensive medicine to reduce the risk of malpractice claims,[1-3] no evidence exists on the broader question of whether a greater use of resources by physicians is associated with a reduced risk of such claims. We investigated the association between average resource use by physicians and subsequent malpractice claims. In six of seven specialties, we found that greater resource use was associated with statistically significantly lower subsequent rates of alleged malpractice incidents. For example, internists in the highest fifth of patient risk adjusted resource use were less than half as likely to face a future malpractice claim compared with those in the lowest fifth. Among obstetricians, those with higher

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Table 4 | Characteristics of obstetrics sample

Characteristics	Obstetricians involved in deliveries
No of physicians	1625
No of physician years	10 358
No of deliveries (caesarean and vaginal)	1 518 702
No of deliveries per physician year	147
No of caesarean deliveries	224 850
Mean caesarean delivery rate (%)	14.8
No of malpractice claims	496
No of malpractice claims per obstetrician year (%)	4.8
Mean adjusted caesarean rate per obstetrician (%):*	
Physicians with a malpractice claim	13.7
Physicians without a malpractice claims	15.2
P value for difference†	<0.001

*Constructed by estimating a patient level logistic model of caesarean delivery as a function of mother's age, race, year, and county fixed effects, and obstetrician indicators. Deliveries that involved clinical contraindications to vaginal delivery (for example, fetal distress, breech presentation, previous caesarean) were excluded. Caesarean rates for obstetricians with a malpractice claim reflect the mean rate per obstetrician in the year previous to an incident among physicians with a malpractice claim (that is, cases). Caesarean rates for obstetricians without a malpractice claim reflect the mean rate per obstetricians in all years among obstetricians with a malpractice claim (that is, controls).
†Difference in means between cases and controls.

caesarean rates—a procedure sometimes considered to be defensively motivated—had lower subsequent rates of alleged malpractice. These relations held even when we adjusted for patient characteristics and accounted for time invariant physician characteristics such as patient mix, clinical skills, or communication skills. Within family medicine, higher spending physicians had statistically insignificant lower rates of subsequent malpractice claims, which may reflect a combination of relatively low malpractice claim rates overall and relatively fewer physicians compared with other specialties.

Policy implications

The implications of our findings for understanding the relation between resource use and subsequent malpractice liability depend on the mechanism through which higher resource use is associated with fewer claims. If higher spending is motivated by concerns about malpractice but is associated with fewer errors and therefore lower malpractice claims, then this spending would be considered defensively motivated but may not be wasteful because errors are lower. A comparison of the costs of additional resource use and the value of reduced errors would be needed to determine whether this defensively motivated care was socially wasteful (that is, classified as defensive medicine) or instead reflects socially beneficial deterrence (that is, the costs of additional resource use are outweighed by the value of reduced errors). If, in contrast, greater resource use is not associated with fewer errors and adds no other clinical benefit, then this additional spending could be considered wasteful, whether defensively motivated or not. In this latter case, the potential ability of physicians to reduce malpractice claims with increased spending would provide a strong incentive to practice defensively and therefore provide costly medical care with no clinical benefit. Moreover, physicians themselves do not generally bear the costs of additional healthcare spending (with the exception of capitated payment contracts) but do benefit from reduced liability associated with greater spending. The misalignment of benefits and costs to physicians may make greater healthcare spending attractive at the physician level although possibly inefficient at the societal level.

Without evidence on rates of errors associated with greater resource use, we cannot definitively conclude that defensive medicine—as it is traditionally defined—reduces the number of malpractice claims. However, our findings still suggest that greater resource use is associated with fewer claims, which is consistent with physician beliefs that higher resource use, more generally, is associated with reduced liability of malpractice.[1-5] There are multiple channels through which such a relation could operate. More frequent consultations and increased diagnostic testing could in theory reduce diagnostic errors, which are the leading cause of malpractice claims.[20] Similarly, greater spending may result in fewer adverse events and therefore fewer malpractice claims. For instance, in some studies greater hospital spending has been associated with improved survival in several acute medical and surgical conditions, although to our knowledge no evidence exists at the physician level.[47] Moreover, there is some evidence that improvements in process measures of quality are associated with reductions in malpractice claims[48]—our findings could be partly explained by the extent to which higher spending physicians are able to achieve better process measures of quality. Alternatively, more care could either foster a closer relationship between physician and patient or create the perception among patients that treatment was exhaustive, both of which may make patients less likely to file suit in cases where adverse events ultimately occurred. Finally, if judges or juries perceive more intensive care to imply more thorough care, this may reduce the ability of attorneys to successfully win litigation.

Despite our findings, the level of resource use provided by physicians is not the only factor that could influence malpractice claims and is perhaps not the most important. Several studies suggest that many

Table 5 | Rate of malpractice suits according to fifth of adjusted caesarean rate

	Fifth of adjusted caesarean rate*				
Variables	First (lowest)	Second	Third	Fourth	Fifth (highest)
Adjusted caesarean rate (% of all deliveries)	5.1	10.8	15.0	19.6	31.6
Malpractice suit rate (%, 95% CI)	5.7 (4.6 to 6.8)	5.1 (4.1 to 6.1)	4.7 (3.7 to 5.6)	3.3 (2.5 to 4.1)	2.7 (1.9 to 3.6)

*Computed at obstetrician year level. Placement into fifths was based on estimates of obstetrician year level caesarean rates from a patient level logistic model of caesarean delivery.. Deliveries that involved clinical contraindications to vaginal delivery were excluded. Indicator variables were created for whether an obstetrician experienced an adverse incident in the following year that ultimately resulted in a malpractice claim. The mean malpractice suit rate per caesarean fifth was computed by averaging this indicator variable across all physician years in a caesarean fifth.

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malpractice claims originate from failures in physician-patient relationships rather than in diagnostic or treatment failures alone.[16-19] Malpractice also often involves errors of both omission and commission (that is, many adverse events do not result in lawsuits and many lawsuits do not involve a medical error).[26-29] Malpractice liability may therefore also involve an idiosyncratic component that cannot be modified by decisions about broad levels of care chosen by physicians. However, it is possible that dealing with these issues could also alleviate incentives for defensive medicine simply by reducing the overall level of malpractice risk.

Comparisons with other studies

Although we studied healthcare spending and malpractice liability among US physicians, our findings have relevance internationally, with several non-US based studies demonstrating the importance of malpractice liability in shaping decisions made by physicians. For example, in a recent survey of UK hospital doctors, 78% reported practicing defensive medicine.[15] In a 1994 survey of UK general practitioners, 98% of those surveyed reported practicing some form of defensive medicine, including increased diagnostic testing (60%), increased follow-up (63%), greater referrals to specialists (64%), prescription of unnecessary drugs (29%), and more detailed clinical documentation (90%).[49] Similar estimates were noted in a follow-up study by the same author.[50] In Italy, 94% of gastroenterologists in one survey reported practicing defensive medicine, with 18% of endoscopies, 12% of consultations, and 9% of abdominal ultrasound examinations reported to be defensively motivated.[51] Also within Italy, one study found that 78% of general practitioners and 83% of surgeons and anesthesiologists reported practicing defensive medicine in the past month.[52] In a survey of orthopedic surgeons, trauma surgeons, and radiologists in Austria, the overall prevalence of defensive medicine was 98%, with the average surgeon surveyed requesting nearly 20 investigations each month for defensive reasons.[53] The time spent performing defensively motivated interventions or studies was reported to be approximately 18% of total work hours among surgeons. Finally, in a survey of Japanese gastroenterologists, 91% reported providing additional services of marginal or no medical value to reduce the risk of liability, and 96% reported avoiding certain procedures among high risk patients for the same reason.[54] Although these and other studies demonstrate similarities in defensive medicine between physicians in the US and other countries, less published evidence exists on the cause of malpractice claims across countries. For example, in a recent systematic review of the epidemiology of malpractice claims in primary care, published evidence on the cause of such claims was only available in the US, Australia, UK, and Canada.[21] Across these countries, diagnostic error was the leading cause of malpractice. Notably, however, an analysis of 18 907 complaints by patients in Australia alleged communication problems in a sizeable percentage of claims (23% *v* 41% related to diagnostic error).[22]

Strengths and limitations of this study

Our study has several limitations. Firstly, a principal limitation was that the association between resource use by physicians and malpractice claims may be confounded by unmeasured illness severity of patients. It is possible that physicians with higher adjusted hospital charges are those who treat patients with greater unmeasured illness severity and thus are at higher risk of adverse outcomes. However, we would expect that these unobserved factors would bias toward a positive association between average physician spending and malpractice claims, rather than the negative association that we found. Secondly, though we found that physicians with higher average spending face fewer malpractice claims, we do not know whether higher spending is defensively motivated—that is, is driven by a desire to reduce malpractice liability, or whether it reflects other idiosyncratic factors such as a physician's proclivity to order tests, procedures, and consultations, or varying risk aversion among physicians. None the less, the empirical association that we observed between physician level spending and risk of subsequent malpractice claims is consistent with physicians' beliefs about the impact of defensive medicine, and it further highlights one reason why efforts to curb physician spending have been challenging. Thirdly, our approach to classifying the intensity of care provided by physicians relied on hospital data rather than on outpatient data. A more accurate representation of physician practice patterns and the correlation of those patterns with malpractice claims would rely on both outpatient and inpatient data. However, physician hospital costs are still a useful measure of physician resource use because, in national data, nearly half of all paid malpractice claims are for incidents occurring in the inpatient setting,[55] with a larger proportion related to inpatient incidents among surgeons.[56 57] Also, further supporting our approach, it has been argued that hospital care may be more subject to defensive medicine than outpatient care since the latter more often entails longitudinal patient relationships.[58] A fourth limitation is that we attributed resource use patterns in a given hospital admission to the attending physician of record, which may be imperfectly recorded. This error biases our measured relation between resource use and malpractice claims toward zero. Fifthly, our sample was not nationally representative, but the rates of malpractice claims that we observed within specialty were similar to a national analysis of malpractice risk according to physician specialty.[41] Sixthly, we linked information between two administrative databases and this could have resulted in imperfect matches. However, as long as match failure is uncorrelated with physician spending this would not affect our findings. Seventhly, we focused our findings on resource use and did not consider the relation between avoidance medicine—that is, avoiding patients perceived to represent high liability risk, also called "negative defensive medicine"—with a lower risk of malpractice.[59] For example, in a survey of UK general practitioners, 80% cited growing liability insurance fees as a primary reason for reducing the

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number of off-hours shifts worked.[60] Moreover, in a survey of UK hospital doctors, 9% reported that they refused to treat high risk patients and 21% reported avoiding high risk procedures.[15] Also, because our data relied on hospital charges and not paid amounts, we could not directly estimate the association between a given increase in healthcare expenditures and risk of malpractice. Finally, to the extent that our findings indicate a causal relation—meaning that higher resource use directly lowers the risk of malpractice—we do not know whether that is because patients receiving more resource use experience better outcomes and have less cause to sue, or whether outcomes are the same and the additional care simply wards off lawsuits. Further work should seek to identify the mechanisms through which additional resource use lowers the risk of malpractice claims.

Conclusions

Despite evidence that the majority of US physicians report practicing defensive medicine, no evidence exists on the broader question of whether greater resource use by physicians is associated with fewer malpractice claims. Our findings suggest that greater resource use, whether it reflects defensive medicine or not, is associated with fewer malpractice claims.

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Ethical approval: The study was exempt from human subjects ethics review at Harvard Medical School.

Data sharing: No additional data available.

Transparency: The lead author (ABJ) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies are disclosed.

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Web appendix: supplementary information

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