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Malpractice Liability and Health Care Quality
A Review

Michelle M. Mello, JD, PhD; Michael D. Frakes, JD, PhD; Erik Blumenkranz, JD, MBA; David M. Studdert, LLB, ScD

IMPORTANCE The tort liability system is intended to serve 3 functions: compensate patients who sustain injury from negligence, provide corrective justice, and deter negligence. Deterrence, in theory, occurs because clinicians know that they may experience adverse consequences if they negligently injure patients.

OBJECTIVE To review empirical findings regarding the association between malpractice liability risk (ie, the extent to which clinicians face the threat of being sued and having to pay damages) and health care quality and safety.

DATA SOURCES AND STUDY SELECTION Systematic search of multiple databases for studies published between January 1, 1990, and November 25, 2019, examining the relationship between malpractice liability risk measures and health outcomes or structural and process indicators of health care quality.

DATA EXTRACTION AND SYNTHESIS Information on the exposure and outcome measures, results, and acknowledged limitations was extracted by 2 reviewers. Meta-analytic pooling was not possible due to variations in study designs; therefore, studies were summarized descriptively and assessed qualitatively.

MAIN OUTCOMES AND MEASURES Associations between malpractice risk measures and health care quality and safety outcomes. Exposure measures included physicians' malpractice insurance premiums, state tort reforms, frequency of paid claims, average claim payment, physicians' claims history, total malpractice payments, jury awards, the presence of an immunity from malpractice liability, the Centers for Medicare & Medicaid Services' Medicare malpractice geographic practice cost index, and composite measures combining these measures. Outcome measures included patient mortality; hospital readmissions, avoidable admissions, and prolonged length of stay; receipt of cancer screening; Agency for Healthcare Research and Quality patient safety indicators and other measures of adverse events; measures of hospital and nursing home quality; and patient satisfaction.

RESULTS Thirty-seven studies were included; 28 examined hospital care only and 16 focused on obstetrical care. Among obstetrical care studies, 9 found no significant association between liability risk and outcomes (such as Apgar score and birth injuries) and 7 found limited evidence for an association. Among 20 studies of patient mortality in nonobstetrical care settings, 15 found no evidence of an association with liability risk and 5 found limited evidence. Among 7 studies that examined hospital readmissions and avoidable initial hospitalizations, none found evidence of an association between liability risk and outcomes. Among 12 studies of other measures (eg, patient safety indicators, process-of-care quality measures, patient satisfaction), 7 found no association between liability risk and these outcomes and 5 identified significant associations in some analyses.

CONCLUSIONS AND RELEVANCE In this systematic review, most studies found no association between measures of malpractice liability risk and health care quality and outcomes. Although gaps in the evidence remain, the available findings suggested that greater tort liability, at least in its current form, was not associated with improved quality of care.

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Author Affiliations: Stanford Law School, Stanford, California (Mello, Blumenkranz, Studdert); Department of Medicine, Stanford University School of Medicine, Stanford, California (Mello, Studdert); Duke University School of Law, Durham, North Carolina (Frakes).

Corresponding Author: Michelle M. Mello, JD, PhD, Stanford Law School, 559 Nathan Abbott Way, Stanford, CA 94305 (mmello@law.stanford.edu).

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The medical liability system is intended to serve 3 functions: compensate patients injured by negligence, promote corrective justice by providing a mechanism to rectify wrongful losses caused by defendants, and deter negligence.[1] Deterrence is the notion that liability can make health care safer. Theoretically, clinicians will respond to the threat of being held liable for malpractice and will also change their behavior after they have been sued. Because evidence suggests that the tort system performs poorly as a means of providing patients with compensation for injuries related to negligence,[2] and rarely provides meaningful corrective justice,[2,3] a belief in deterrence motivates many defenders of the tort system.[4]

Whereas deterrence leads clinicians to calibrate safety responses so that the costs do not exceed the benefits, a related phenomenon, defensive medicine, reflects responses that are costly and provide little or no clinical benefit. Evidence of defensive medicine is common,[5] whereas evidence of deterrence is more elusive. The standard approach in deterrence studies is to compare levels of health care quality across environments with relatively high and low liability risk. This approach cannot evaluate what health care quality would be like in the absence of liability risk but can reveal whether the extent of liability risk is related to health care outcomes.

Does malpractice liability risk—that is, the extent to which clinicians face the threat of being sued and having to pay damages—contribute to improvements in the quality and safety of health care? This question is relevant to assessing the role of the liability system in the patient safety movement. Because malpractice litigation might inhibit error disclosure, clinicians may view tort litigation as counterproductive to quality improvement[6]; yet, legal practitioners view injury prevention as one of the fundamental functions of tort law. This question also matters for tort reform efforts because skepticism about the deterrent effect of malpractice litigation reinforces arguments that liability can be limited without risking the quality of care.

The objective of this systematic review was to evaluate the association between malpractice liability risk and health care quality and safety, and thereby assess the evidence for deterrence as it relates to clinicians.

Key Points

Question Is greater risk of malpractice liability associated with better quality of care?

Findings In this systematic review of 37 studies of obstetrical care outcomes, patient mortality, hospital readmissions, avoidable hospitalizations, and other measures, statistically significant associations between liability risk and quality-related outcome measures were rarely observed. Most studies focused on inpatient care.

Meaning Most studies in this review found no association between greater risk of malpractice liability and health care quality.

Methods

Search Strategy and Study Eligibility

We performed a systematic review in July 2018 of articles published or otherwise made public from January 1, 1990, to July 10, 2018; results were subsequently updated with an additional search through November 25, 2019. The search protocol was registered on PROSPERO (CRD42018103723) and is provided in eAppendix 1 and eAppendix 2 in the Supplement.

We searched 5 databases (Web of Science, MEDLINE/PubMed, Westlaw, SSRN, and EconLit) using combinations of keywords related to liability risk (eg, malpractice, liability, tort, deter, negligence, defensive, litigation) and measures of health-related outcomes (eg, outcome, quality, safety, care, deter, patient) (exact strings for each database are provided in eAppendix 3 in the Supplement). As an example, for Web of Science the search string used was *TI=(malpractice OR liab* OR tort OR deter OR deterren* OR negligen* OR defensive OR litigation) AND TS=(physician OR doctor OR hospital OR clinic OR provider OR practitioner) AND TS=(quality OR safety OR deter* OR outcome OR care OR patient) AND CU=(USA)*. We also examined the bibliographies of relevant articles for citations to additional papers, and included relevant working papers known to us through conference presentations and personal contacts with colleagues; together these methods added 5 studies to the sample.

After eliminating duplicate articles, we reviewed the articles retrieved and applied prespecified inclusion criteria. These criteria identified original empirical studies of the association between indicators of malpractice liability risk and indicators of health care quality and safety that used study approaches (eg, multivariable regression analysis) designed to address potential sources of confounding. To identify health care quality measures, we used the framework of Donabedian[7] and included measures of structure, process, and outcomes that unambiguously reflect quality of care (good or poor). Thus, services such as prenatal care and receiving β-blockers after myocardial infarction met our criteria (process), as did nurse staffing ratios (structure).

Studies that examined the relationship between liability risk and measures that are more reflective of costs than quality were excluded. For these reasons, studies focusing on cesarean deliveries and most types of diagnostic tests were excluded. Such services are considered overused due in part to defensive medicine. Unless studies accounted for clinical circumstances that distinguished appropriate from inappropriate use (for example, separating older patients from younger patients in examining screening mammography[8]), they were deemed unhelpful in assessing deterrence. If a study examined multiple outcome measures, we included only analyses of outcomes that met our criteria.

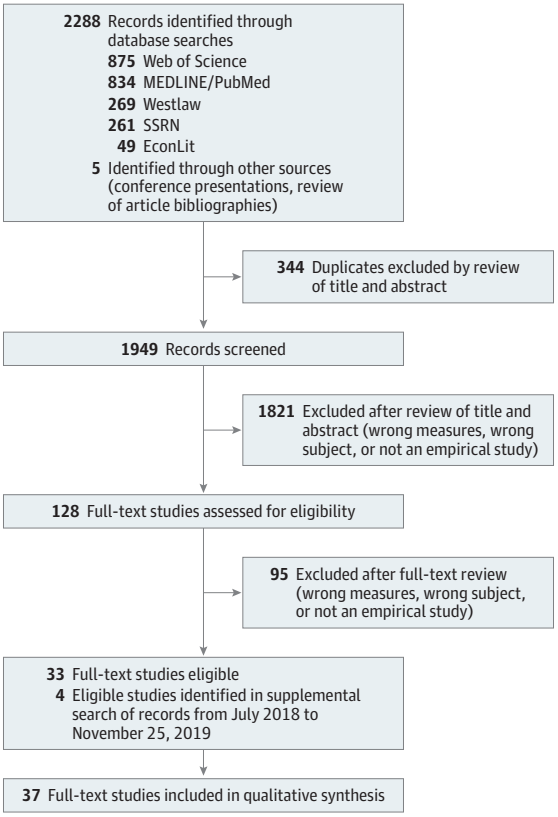
Each study was assessed for potential inclusion by 1 reviewer. When review of the title and abstract alone was insufficient to reach a decision about the eligibility of the study for inclusion, the full text was reviewed. If the reviewer remained uncertain as to whether a study met inclusion criteria, all 4 reviewers (M.M.M., M.D.F., E.B., and D.M.S.) assessed the full text of the study and resolved the issue through discussion.

To update the search results prior to publication of this review, supplemental searches using the same protocol with the date range of July 2018 to November 25, 2019, were performed.

Data Extraction and Synthesis

For each eligible study, we extracted into an Excel spreadsheet information on the authors, year published or released, exposure measures, outcome measures, data sources, sample size, level of

Figure. Study Identification and Selection



analysis (patient, facility, physician, or geographic unit), results (direction and magnitude of association with malpractice risk variables), authors' conclusions, and acknowledged limitations. The reported findings were in the direction of deterrence if greater liability risk was associated with better outcomes, whereas reported findings were in an antideterrence or reverse deterrence direction if greater liability risk was associated with worse outcomes. Study type is not reported because all but 1 study (a case-control analysis of emergency physicians)[9] took the same basic approach of using multivariable regression analysis to examine a retrospective sample of data from 1 year or longer.

Meta-analytic pooling was not possible due to variations in study features, especially the large number of different exposures and outcome measures modeled. Consequently, studies were summarized descriptively. We characterized as statistically significant those associations reported in the sampled studies that achieved the significance level of .05, except that we used significance levels corrected for multiple comparisons for studies that reported them. To avoid replicating possible bias in study authors' selective emphasis of particular study results, we examined tables of regression results rather than relying on summaries from the study authors.

Quality Assessment

Because of the nature of the study designs, it was not possible to use existing instruments to assess the risk of bias in research. Existing tools for assessing observational studies (for example, the Newcastle-Ottawa Scale and the Risk of Bias in Non-randomized Studies of Interventions [ROBINS-I] tool) were designed for clinical and epidemiological studies, and no comparable tool is used in the field of econometrics. For that reason, we performed an independent, qualitative risk of bias assessment, summarizing the strengths and weaknesses of each study. To ensure rigor, each article was reviewed by 2 reviewers with training in econometrics and who were not involved in the study being evaluated.

In addition to extracting limitations acknowledged by the study authors, reviewers noted the strengths and weaknesses pertaining to the data source (eg, sample size, population covered, range of covariates incorporated, usefulness of measures, whether the data could support individual-level models), model estimation methods (eg, identification strategy, control for confounders, potential endogeneity, robustness checks), and any concerns about the accuracy of the study authors' characterizations of the study findings.

Results

Study Characteristics

The original search identified 1949 unique studies as potentially eligible for inclusion; 1821 of these were excluded after review of the article title and abstract and another 95 were deemed ineligible after review of the full text (**Figure** and eAppendix 3 in the Supplement). Thirty-three studies met our inclusion criteria, 4 of which were unpublished. The supplemental update search added 4 eligible studies. Selected characteristics of the final sample of 37 studies are presented in **Table 1**. Additional details appear in eTable 1 and eTable 2 in the Supplement.

All studies used multivariable regression analysis to assess the association between the exposure and outcome variables in a longitudinal or cross-sectional sample. Because studies varied in their unit of analysis (from patient or physician to county, region, or state), the number of observations per study ranged from 50 to more than 132 million (Table 1). For example, Dhankhar and Khan[24] analyzed 100 state-year observations and Yang et al[28] analyzed 2 354 561 births.

Exposure Measures

The studies measured the extent of malpractice liability risk in each environment in several ways (Table 1). Physicians' malpractice insurance premiums and the presence of liability-limiting tort reforms in the state were the most common exposure measures (n = 21 studies). Other measures included the frequency of paid claims in the state or county (n = 13), insurance premiums (n = 7), average payment per paid claim (n = 8), physicians' claims history (n = 5), total malpractice payments in the state or county (n = 2), jury awards in the county (n = 1), immunity from malpractice liability (n = 1), the Centers for Medicare & Medicaid Services' Medicare malpractice geographic practice cost index (MGPCI) (a measure of premium costs to physicians in local liability insurance markets) (n = 1), and composite measures incorporating more than 1 of the foregoing (n = 3). Data sources for exposure measures included the National Practitioner Data Bank (a national repository of information on paid malpractice claims), insurance industry rate surveys, the Centers for Medicare & Medicaid Services, databases of jury awards, and summaries of state legal reforms in the 50 states.

Table 1. Selected Characteristics of the 37 Studies Included in the Qualitative Synthesis

Source[a]	Exposure Measures	Level of Model	Outcome Measures[b]	Sample Size[c]
Entman et al,[10] 1994	Physicians' claims histories were grouped into 4 categories	Patient, physician	Quality of obstetrical care assessed by quality of documentation, appropriateness of testing, frequency of adverse outcomes and errors, and expert reviewer's subjective assessment of quality of care	Interviews: 898 patients Records: 446 patients
Sloan et al,[11] 1995	Threat of litigation measure calculated as No. of claims against an obstetrician relating to care during 1977-1983 divided by No. of years in practice during 1977-1983	Physician, county	Birth outcomes included fetal death, low Apgar score, death within 5 d of birth, longer-term infant death, and death or permanent impairment at age 5 y	Interviews: 963 patients Birth records: 31 403 deliveries
	Malpractice claims payments measure calculated as indemnity plus defense costs divided by No. of years in practice during 1977-1983	County		
Kessler and McClellan,[12] 1996	Direct tort reforms: caps on damages, abolition of punitive damages, abolition of mandatory prejudgment interest, and collateral source rule reform	State	Mortality and readmission assessed separately for patients who had an MI or IHD and included mortality within 1 y, readmission for MI within 1 y, and readmission for heart failure within 1 y	Varied by model: 220 550-381 222 patients
	Indirect tort reforms: caps on contingency fees, mandatory periodic payments, joint and several liability reform, and patient compensation fund			
Sloan et al,[13] 1997	No. of claims per exposure year incurred by obstetrician and a set of binary variables classifying the obstetrician's claims experience	Physician	Prenatal care use assessed by No. of ultrasounds and whether amniocentesis, α-fetoprotein, and glucose tolerance testing were performed	Varied by model: 268-885 patients
	No. of claims per exposure year incurred by all obstetricians and total claim payments (indemnity plus defense costs) per exposure year	County	Patient satisfaction with care during labor and delivery reported as whether the "doctor is interested in you and your baby, doctor fully explained the reason for each test and procedure, doctor ignored what you told him/her, and you felt you could call doctor with questions"	
Dubay et al,[14] 1999	Malpractice premiums	Malpractice area (state or other)	Birth outcomes included 5-min Apgar score <7 and the average 5-min Apgar score	Not reported
	Tort reforms: caps on noneconomic damages, caps on total damages, discovery time limits, discretionary pretrial screening panels, and mandatory pretrial screening panels			
Dubay et al,[15] 2001	Malpractice premiums lagged by 1 y	State or other	Prenatal care use assessed by whether care was initiated after the first trimester and the No. of prenatal visits	Not reported
	Tort reforms: caps on noneconomic damages, caps on total damages, discovery time limits, discretionary pretrial screening panels, and mandatory pretrial screening panels		Birth outcomes included birth weight <2500 g and Apgar score <7	
Kessler and McClellan,[16] 2002	Tort reforms: direct and indirect reforms as in prior study[12] with measures indicating presence of reforms 2 y before and after the hospitalization	State	Mortality and readmission assessed separately for patients who had an MI or IHD and included mortality within 1 y, readmission for MI within 1 y, and readmission for heart failure within 1 y	Varied by model: 2 466 801-3 823 990 patients
Baicker and Chandra,[8] 2005	Average claim payment among paid claims	State	Preventive care use assessed by mammography rates among Medicare fee-for-service patients that were adjusted for age and race composition of the state and measured as the difference in logged values between 1992 and 2001	Not reported
	No. of claim payments per physician			
	Malpractice premiums per physician			
Konety et al,[17] 2005	Caps on noneconomic damages as a binary indicator	State	Patient mortality assessed by disease-specific survival rates over 155 mo for patients who had bladder cancer	Not reported
Baicker et al,[18] 2007	Average claim payments per physician	State	Patient mortality assessed by the No. of deaths among Medicare fee-for-service enrollees divided by the No. of Medicare fee-for-service enrollees	Not reported
	Malpractice premiums			
Dhankhar et al,[19] 2007	Claim frequency: average No. of paid claims over 3 y (2000-2002) per 100 000 population	State	Patient mortality included death before hospital discharge among patients who had an MI	Not reported
	Average claim payment: mean indemnity payment per paid claim in 2000-2002			

(continued)

Table 1. Selected Characteristics of the 37 Studies Included in the Qualitative Synthesis (continued)

Source[a]	Exposure Measures	Level of Model	Outcome Measures[b]	Sample Size[c]
Kim,[20] 2007	3-y Moving average for annual rate of obstetrics-related paid claims in the state (No. of claims/No. of births) and payments in those cases (dollars/No. of births)	State	Quality of obstetrical care assessed by cesarean deliveries for patients with breech presentation	Varied by model: 622 569-23 639 438 births
			Prenatal care use assessed by No. of prenatal visits and as ≥1 ultrasound	
Klick and Stratmann,[21] 2007	Tort reforms: caps on noneconomic damages, collateral source rule reform, joint and several liability reform, caps on contingency fees, mandatory periodic payment, caps on total damages, and patient compensation fund	State	Birth outcomes assessed by 6-d infant mortality rate (deaths per 100 000 infant births, analyzed separately for black and white infants)	Not reported
Currie and MacLeod,[22] 2008	Tort reforms: caps on punitive damages, caps on noneconomic damages, joint and several liability reform, and collateral source rule reform	State	Birth outcomes included preventable birth complications and 5-min Apgar score <8	2.3 Million births
Shepherd,[23] 2008	Tort reforms: caps on noneconomic damages, caps on punitive damages, caps on total damages, collateral source rule reform, joint and several liability reform, and mandatory periodic payment	State	Annual mortality rates for accidents (excluding motor vehicle crashes)	Not reported
Dhankhar and Khan,[24] 2009	Claim frequency: No. of paid claims per 100 obstetricians/gynecologists	State	Birth outcomes among Medicaid patients included maternal and fetal mortality, neonatal mortality, maternal morbidity (≥1 of 21 complications), birth trauma, respiratory distress syndrome, cerebral hemorrhage, and other complications due to asphyxia	100 State-years
	Average claim payment: mean indemnity payment per paid claim			
Sloan and Shadle,[25] 2009	Direct tort reforms: caps on damages, abolition of punitive damages, abolition of mandatory prejudgment interest, and collateral source rule reform	Patient	Patient mortality among Medicare patients included 1-y survival after hospitalization for MI, breast cancer, diabetes, or stroke	59 689 Patients
	Indirect tort reforms: caps on contingency fees, mandatory periodic payments, joint and several liability reform, and patient compensation fund			
Frakes,[26] 2012	Tort reforms: caps on punitive damages, caps on noneconomic damages, collateral source rule reform, and indirect reforms as defined in prior study[12]	Patient	Birth outcomes included 5-min Apgar score and 5-min Apgar score ≥7	7 450 600 Births
Lakdawalla and Seabury,[27] 2012	Jury awards: dollars in medical malpractice jury awards per capita	County	All-cause mortality	1473 Counties
Yang et al,[28] 2012	Tort reforms: contingency fee limits, collateral source rule reform, caps on punitive damages, caps on noneconomic damages (3 indicators for different cap levels), mandatory periodic payment, expert witness rule reform, joint and several liability reform, and pretrial screening panels	Patient	Birth outcomes included 5-min Apgar score <7, birth weight <2500 g, preterm birth (<37 wk), and any birth injury (defined as impairment of the infant's body function or structure due to adverse influences that occurred at birth)	2 354 561 Births
	Malpractice premiums: weighted average premiums across 3 specialties in the state			
Iizuka,[29] 2013	Tort reforms: caps on noneconomic damages, caps on punitive damages, joint and several liability reform, and collateral source rule reform	Facility, patient	PSIs included birth trauma (injury to neonate), obstetric trauma to mother during vaginal delivery (with or without instrument), and obstetric trauma to mother during cesarean delivery	10 551 Facility-years 8 293 541 Births
			In-hospital mortality among obstetrical patients	
Konetzka et al,[30] 2013	Claim frequency: claims per 1000 nursing home beds in the county over a 2-y moving window lagged by 1 y	Facility	Nursing home quality assessed by total nurse staffing hours per resident-day, ratio of RN to total nurse staffing hours per resident-day, and incidence of pressure sores	15 883 Facilities
Stevenson et al,[31] 2013	Each nursing home's claims experience during past 18 mo: whether a facility incurred ≥1 paid claims, total indemnity payments, and sum of indemnity and defense costs	Facility	Nursing home quality assessed by percentage of residents (1) with "low-risk" or "high-risk" pressure ulcers, (2) for whom physical restraints were used, (3) with late loss ADL decline, and (4) with UTIs. In addition, quality assessed by No. of nonserious and serious deficiencies identified during inspection and staffing hours for RNs and nurse aides per resident-day	1514 Facilities

(continued)

Table 1. Selected Characteristics of the 37 Studies Included in the Qualitative Synthesis (continued)

Source[a]	Exposure Measures	Level of Model	Outcome Measures[b]	Sample Size[c]
Avraham and Schanzenbach,[32] 2015	Tort reforms: caps on noneconomic damages	State	Deaths from CHD per 100 000 population analyzed separately by age group: 45-90 y, 45-65 y, and 65-90 y	1000 State-years
Bekelis et al,[33] 2015	Claim frequency: average No. of paid claims per 100 physicians in the state	Patient	In-hospital mortality among patients who underwent cranial neurosurgery	189 103 Patients
	Average claim payment: average indemnity payment per paid claim in the state		Surgical complications included unfavorable discharge (to short-term or long-term care facility) among patients who underwent cranial neurosurgery	
Missios and Bekelis,[34] 2015	Claim frequency: average No. of paid claims per 100 physicians in the state	Patient	In-hospital mortality among patients who underwent spine surgery	709 951 Patients
	Average claim payment: average indemnity payment per paid claim per physician in the state			
Bilimoria et al,[35] 2016	Malpractice premiums: state average for general surgeons	Patient	Postoperative 30-d mortality among Medicare patients undergoing colorectal surgery in the state	116 977 Patients
	Claim frequency: No. of paid claims per 100 surgeons in the state		30-d Readmission among Medicare patients undergoing colorectal surgery in the state	
	Composite measure consisting of paid claims per surgeon, average malpractice payment, lawyers per capita, malpractice premiums in 3 specialties, and composite index of tort reforms (caps on noneconomic damages, statutes of limitations, joint and several liability reform, contingency fee limits, mandatory periodic payment, patient compensation fund, apology laws, alternative dispute resolution mechanisms, certificate of merit laws, expert witness standards, and pretrial screening panels)		Any of the following 30-d postoperative surgical complications among Medicare patients undergoing colorectal surgery in the state: pneumonia, MI, VTE, acute renal failure, surgical site infection, sepsis, or other complication	
Frakes and Jena,[36] 2016	Tort reforms: caps on noneconomic damages, caps on punitive damages, collateral source rule reform, joint and several liability reform	State, patient	Patient mortality determined by inpatient mortality rate among nondiscretionary hospitalizations for stroke, MI, gastrointestinal bleeding, and hip fracture	1108 State-years for noncancer models Other models varied: 252 232-1 662 616 patients
			Avoidable hospitalizations determined by admissions in the state for ruptured appendix, pneumonia, and congestive heart failure	
			Birth outcomes included maternal trauma rate (third-degree and fourth-degree lacerations) and preventable delivery complications (fetal distress, excessive bleeding, precipitous labor, prolonged labor, or dysfunctional labor)	
			Cancer screening Women: Papanicolaou test within last year among those aged ≥21 y, physical breast examination within last year among those aged ≥40 y, and mammogram within last 2 y among those aged 40-75 y Men aged 50-75 y: sigmoidoscopy or colonoscopy screening within last 5 y, PSA test within last year, and digital rectal examination within last year	
Bartlett,[37] 2017	Claim frequency: No. of paid claims involving patient death	State	No. of deaths due to complications of medical care	612 State-years
	Tort reforms: caps on noneconomic damages			

(continued)

Table 1. Selected Characteristics of the 37 Studies Included in the Qualitative Synthesis (continued)

Source[a]	Exposure Measures	Level of Model	Outcome Measures[b]	Sample Size[c]
Bilimoria et al,[38] 2017	Malpractice premiums: CMS malpractice geographic practice cost index	Facility	Quality of care defined as percentage of hospitals with 95% or higher adherence to 17 Hospital Compare measures relating to surgery, MI, heart failure, and pneumonia	Varied by model: 1048-4046 facilities
	Claim frequency: No. of paid claims per 100 surgeons in the state		Patient mortality included 30-d risk-adjusted mortality rates for patients who had an MI, heart failure, or pneumonia	
	Tort reforms: caps on noneconomic damages, joint and several liability reform, contingency fee limits, mandatory periodic payment, patient compensation funds, apology laws, alternative dispute resolution mechanisms, certificate of merit laws, expert witness standards, and pretrial screening panels		Readmissions included 30-d risk-adjusted readmission rates for patients who had an MI, heart failure, or pneumonia	
			PSIs assessed as rates per 1000 discharges for deaths and treatable postoperative complications, iatrogenic pneumothorax, postoperative VTE, wound dehiscence, and accidental punctures or lacerations	
	Composite measure consisting of paid claims per surgeon, average malpractice payment, lawyers per capita, malpractice premiums in 3 specialties, and composite index of tort reforms (as in prior study[35])		Patient satisfaction determined by percentage of patients selecting "always" for 10 HCAHPS measures	
Minami et al,[39] 2017	Malpractice premiums: CMS malpractice geographic practice cost index	Patient	30-d Mortality among patients undergoing any of 11 surgeries	Varied by model: 448 500-890 232 patients
	Average payment: average indemnity payment per paid claim in the state		30-d Readmissions and prolonged length of stay among patients undergoing any of 11 surgeries	
	Claim frequency: No. of paid claims per 100 surgeons in the state		Any of the following postoperative conditions among patients undergoing any of 11 surgeries: sepsis, MI, pneumonia, surgical site infection, acute renal failure, respiratory failure, deep vein thrombosis or pulmonary embolism, gastrointestinal bleeding, and hematoma or hemorrhage	
	Tort reforms: caps on noneconomic damages, contingency fee limits, and pretrial screening panels			
	Composite measure consisting of paid claims per surgeon, average malpractice payment, lawyers per capita, malpractice premiums in 3 specialties, and composite index of tort reforms (as in prior study[35])			
Frakes and Gruber,[40] 2018	Immunity from liability[d]	Patient	90-d and 365-d Mortality after discharge	2 201 771 Hospitalizations 1 016 606 Deliveries
			30-d Readmissions	
			Occurrence of any PSI, 1 neonatal trauma PSI, or 2 maternal trauma PSIs	
			Other birth outcomes included preventable delivery complications (as in prior study[36]) and neonatal mortality	
Zabinski and Black,[41] 2018	Tort reforms: caps on noneconomic damages	Patient	12 Nondeath, nonobstetrical PSIs; 3 obstetrical PSIs; 2 PSIs involving nonobstetrical deaths; cases at risk for death among surgical inpatients with serious treatable complications (termed PSI-4); and several pooled measures combining PSIs	132 190 000 Hospitalizations
McMichael,[42] 2018	Tort reforms: apology laws (other reforms were included as controls, but the results were not reported)	Patient	Inpatient mortality among patients who had an acute MI	1.65 Million patients
Malak and Yang,[43] 2019	Tort reforms: caps on noneconomic damages, caps on punitive damages, collateral source rule reform, and joint and several liability reform	Patient	Birth outcomes included 1-y mortality and preventable birth complications (meconium or precipitous labor)	5.4 Million births
Moghtaderi et al,[44] 2019	Tort reforms: caps on noneconomic damages	Patient	Mortality among Medicare fee-for-service patients	Approximately 2 million patients
Carlson et al,[9] 2019	Physician's claims history: any claim or failure to diagnose during 5-y study period	Physician	Press Ganey patient experience scores for emergency department physicians	205 Physicians

Abbreviations: ADL, activities of daily living; CHD, coronary heart disease; CMS, Centers for Medicare & Medicaid Services; HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems; IHD, ischemic heart disease; MI, myocardial infarction; PSA, prostate-specific antigen; PSI, patient safety indicator; RN, registered nurse; UTI, urinary tract infection; VTE, venous thromboembolism.

[a] The studies are ordered chronologically and are multivariable regression analyses of 1 or more years of retrospective data. Additional information from each study appears in eTable 2 in the Supplement.

[b] Only those outcome measures meeting study inclusion criteria are presented.

[c] Studies varied in how sample sizes were reported. Some studies reported model-specific sample sizes and others only the overall sample size or none.

[d] Immunity arises from the *Feres* doctrine, which precludes liability for malpractice during medical encounters with active-duty service members.

Outcome Measures

Outcome measures included patient mortality; hospital readmissions, avoidable admissions, and prolonged length of stay; receipt of cancer screening services; Agency for Healthcare Research and Quality patient safety indicators (PSIs) and other measures of adverse events and postoperative complications; measures of hospital and nursing home quality; and patient satisfaction (the measures used in each study appear in Table 1). Three-quarters of the studies (28/37) focused on hospital care only, and nearly half (16/37) focused on obstetrical care. Studies outside the obstetrics context commonly measured associations between liability risk and patient mortality, although more recent studies examined associations with PSIs. Data sources for outcome measures included Medicare and other claims data, vital statistics records, physician practice group databases, cancer registries, and surveys.

Evidence Relating to Obstetrical Care

Of the 16 studies examining obstetrical care, 9 identified no significant associations between liability risk and quality in the direction of deterrence (**Table 2**). Seven studies found limited evidence of associations (ie, the statistical significance of the associations, the direction of the association [deterrence or antideterrence], or both were sensitive to the model specification used, the patient group studied, and the outcome measure examined).

Several studies found no significant association between liability measures and outcomes in the direction of deterrence. Entman et al[10] found that obstetricians' personal history of malpractice claims was not associated with quality of care or frequency of adverse events. Three studies using malpractice premiums as the exposure measure found no associations with Apgar scores, low birth weight, preterm birth, or birth injury.[14,15,28] In a study of military physicians, who are immune from malpractice litigation related to their care of active-duty servicemembers (but not care of other patients), Frakes and Gruber[40] found no association between immunity and several adverse birth outcomes (preventable delivery complications, neonatal mortality, neonatal trauma, and maternal trauma during vaginal deliveries). Two studies by Dubay et al[14,15] found that tort reforms were not associated with prenatal health care use, low birth weight, or Apgar scores. Frakes[26] also found no association between tort reforms and Apgar scores. Frakes and Jena[36] did not find tort reforms to be associated with any of several obstetrical PSIs. Kim[20] found neither claim frequency nor average claims payments were associated with prenatal care use or use of cesarean delivery in patients with breech presentation. Malak and Yang[43] found no association between tort reforms and infant mortality or preventable birth complications.

Several studies identified limited evidence of an association between liability measures and outcomes in the deterrence direction. Sloan et al[11] found a significant association between liability risk and birth outcomes in the direction of deterrence in 2 of 23 models tested. In county-level analyses using survey data, both claim frequency and total claims payments were associated with reduced risk of fetal mortality. However, these associations did not achieve statistical significance in physician-level models, and neither liability measure showed significant associations with any of the other 4 outcome variables (low Apgar score, 5-day neonatal mortality, infant mortality, and death or permanent impairment at the age of 5 years) in any model. In analyses using a larger sample of county birth records, no associations between liability risk measures and birth outcomes were significant at the $P < .05$ level.

A subsequent study by Sloan et al[13] found claim frequency to be significantly associated with prenatal care use in the direction of deterrence in 1 of 8 models tested. In physician-level models, claim frequency was significantly associated with greater use of α-fetoprotein tests, but not with greater use of ultrasonography or diabetes tests. The relationship between claim frequency and the use of amniocentesis was significant in the direction opposite of deterrence (ie, higher claim frequency was associated with less use of amniocentesis). In county-level models, no significant associations were observed between claim frequency and any of the 4 measures of patient satisfaction ("doctor is interested in you and your baby, doctor fully explained the reason for each test and procedure, doctor ignored what you told him/her, and you felt you could call doctor with questions").

Dhankhar and Khan[24] also examined claim frequency, along with mean payment amounts per paid claim. Among 56 models (in which patients with Medicaid coverage and those with private insurance, and births involving necessary and unnecessary cesarean deliveries, were analyzed separately), 53 models found no significant associations with the 7 birth outcomes examined. Two models found a significantly lower risk of neonatal respiratory distress among patients with private insurance and unnecessary cesarean deliveries. One model found a reverse deterrence association (ie, increased claim frequency was associated with an increased risk of neonatal respiratory distress) for Medicaid patients with necessary cesarean deliveries.

Three studies that examined tort reforms also found no evidence of an association between liability risk and health outcomes in the direction of deterrence in most models. Klick and Stratmann[21] studied 7 tort reforms in relation to mortality among black and white infants (modeled separately) and found no significant deterrence associations in 25 of 28 models. Only collateral source rule reform (which consists of deducting from plaintiffs' malpractice awards amounts already reimbursed by insurance and other sources) was consistently associated with mortality across model specifications in the direction of deterrence (ie, tort reform was associated with increased infant mortality); however, this association was observed only among black infants. Joint and several liability reform (which consists, in cases involving multiple defendants, of limiting the damages each defendant must pay to an amount proportional to that defendant's fault percentage for the injury) was associated with increased mortality for white infants in 1 of 2 model specifications, but was not significant in either model specification for black infants. Two models produced reverse deterrence findings (ie, greater liability was associated with worse outcomes).

Currie and MacLeod[22] studied 4 tort reforms in relation to preventable birth complications and low Apgar scores, and found that caps on noneconomic damages were associated with an increase in the rate of preventable complications but were not associated with low Apgar scores. Joint and several liability reform was associated with a decrease in preventable complications, which is a reverse deterrence finding because that reform limits defendants' liability. There was no significant association between joint and several liability reform and low Apgar score, or between the other tort reforms examined (caps on punitive damages and collateral source rule reform) and either of the outcomes. Iizuka[29] examined 4 tort

Table 2. Sixteen Studies Examining Associations Between Malpractice Liability Risk Measures and Obstetrical Care, 1990-2019

Source	Exposure Measures[a]	Outcome Measures[a]	Evidence for Deterrence?
Entman et al,[10] 1994	Physicians' claims histories	Quality of obstetrical care and frequency of obstetrical adverse events	No[b]
Sloan et al,[11] 1995	Claim frequency and total payments (at county and physician level)	Fetal mortality, low Apgar score, neonatal mortality, infant mortality, and mortality or impairment at aged 5 y	Limited; there were no significant associations in 21 of 23 models tested
Sloan et al,[13] 1997	Claim frequency	Prenatal care	Limited; there were no significant associations in 7 of 8 models tested
Dubay et al,[14] 1999	Premiums and tort reforms	Apgar scores	No[b]
Dubay et al,[15] 2001	Premiums and tort reforms	Prenatal care, low birth weight, and low Apgar score	No[b]
Klick and Stratmann,[21] 2007	Tort reforms	Infant mortality	Limited; there were no significant associations in 25 of 28 models tested
Kim,[20] 2007	Claim frequency and average payment	Prenatal care and cesarean deliveries for patients with breech presentation	No[b]
Currie and MacLeod,[22] 2008	Tort reforms	Preventable birth complications and Apgar score	Limited; the caps were associated with higher complication rates, but no deterrence associations were found for other reforms or Apgar scores
Dhankhar and Khan,[24] 2009	Claim frequency and average payment	Combined maternal/fetal mortality, neonatal mortality, maternal morbidity, birth trauma, and 3 other birth complications	Limited; there were no significant associations in 54 of 56 models tested, but significant associations were found for neonatal respiratory distress syndrome for privately insured patients
Yang et al,[28] 2012	Premiums and tort reforms	Birth injury, low Apgar score, low birth weight, and preterm birth	No[b]
Frakes,[26] 2012	Tort reforms	Low Apgar score	No[b]
Iizuka,[29] 2013	Tort reforms	Obstetrics patient safety indicators (birth injury, maternal trauma) and in-hospital mortality for obstetrical patients	Limited; collateral source rule reform was associated with increased complications but not mortality in hospital-level models, but the associations were not significant in patient-level models; and there were no deterrence associations for the other reforms
Frakes and Jena,[36] 2016	Tort reforms	Obstetrics patient safety indicators (preventable birth complications and maternal trauma)	No[b]
Zabinski and Black,[41] 2018	Tort reforms	Obstetrics patient safety indicators (birth injury and maternal trauma)	Limited; significant associations were found in 13 of 24 models tested and were driven by maternal trauma, but not infant injury
Frakes and Gruber,[40] 2018	Legal immunity (military)	Patient safety indicators, neonatal mortality, birth trauma, and preventable birth complications	No[b]
Malak and Yang,[43] 2019	Tort reforms	Birth outcomes (1-y mortality and preventable birth complications)	No[b]

[a] Additional details appear in Table 1.

[b] Indicates that (1) no model found statistically significant associations between the liability measure and any outcome measure or (2) the only statistically significant associations were in an antideterrence direction (ie, greater liability risk was associated with worse rather than better outcomes). Detailed quantitative results appear in eTable 2 in the Supplement.

Table 3. Twenty Studies Examining Associations Between Malpractice Liability Risk Measures and Patient Mortality in Nonobstetrical Care Settings, 1990-2019

Source	Exposure Measures[a]	Outcome Measures[a]	Evidence for Deterrence?
Kessler and McClellan,[12] 1996	Tort reforms	Mortality for patients who had an MI or IHD	No[b]
Kessler and McClellan,[16] 2002	Tort reforms	Mortality for patients who had an MI or IHD	No[b]
Konety et al,[17] 2005	Tort reforms	Mortality for patients who had bladder cancer	No[b]
Dhankhar et al,[19] 2007	Claim frequency and average payment	Mortality for patients who had an MI	Limited; yes for claim frequency and no for payments
Baicker et al,[18] 2007	Premiums and payments per physician	Total and disease-specific mortality for Medicare patients	No[b]
Shepherd,[23] 2008	Tort reforms	State-level, accidental death rates (excluding motor vehicle crashes)	Limited; there were no significant associations in 4 of 6 models tested
Sloan and Shadle,[25] 2009	Tort reforms	1-y survival posthospitalization for MI, breast cancer, diabetes, or stroke among Medicare patients	No[b]
Lakdawalla and Seabury,[27] 2012	Jury awards	County-level all-cause mortality	Yes
Avraham and Schanzenbach,[32] 2015	Tort reforms	Mortality among patients who had coronary heart disease or who had an MI	No[b]
Bekelis et al,[33] 2015	Claim frequency and average payment	Mortality or unfavorable discharge among patients who underwent cranial neurosurgery	No[b]
Missios and Bekelis,[34] 2015	Claim frequency and average payment	Mortality among patients who underwent spine surgery	No[b]
Bilimoria et al,[35] 2016	Premiums, paid claims, and a composite measure	30-d Postoperative mortality among patients who underwent colorectal surgery	No[b]
Frakes and Jena,[36] 2016	Tort reforms	Inpatient mortality	No[b]
Bartlett,[37] 2017	Claim frequency and tort reforms	Population mortality due to iatrogenic causes	No[b]
Bilimoria et al,[38] 2017	CMS malpractice cost index, claim frequency, tort reforms, and a composite measure	30-d Mortality among patients who had an MI, heart failure, or pneumonia	Yes except for claim frequency models
Minami et al,[39] 2017	Premiums, claim frequency, composite measure, average payment	30-d Postoperative mortality	No[b]
Frakes and Gruber,[40] 2018	Legal immunity (military)	90-d and 1-y Mortality	No[b]
Zabinski and Black,[41] 2018	Tort reforms	2 Fatal patient safety indicators and pooled measure	Limited; there were no significant associations in 14 of 18 models tested, including all models pooled across states
McMichael,[42] 2018	Tort reforms	Mortality among patients who had an acute MI	No[b]
Moghtaderi et al,[44] 2019	Tort reforms	Mortality among Medicare patients	No[b]

Abbreviations: CMS, Centers for Medicare & Medicaid Services; IHD, ischemic heart disease; MI, myocardial infarction.

[a] Additional details appear in Table 1.

[b] Indicates that (1) no model found statistically significant associations between the liability measure and any outcome measure or (2) the only statistically significant associations were in an antideterrence direction (ie, greater liability risk was associated with worse rather than better outcomes). Detailed quantitative results appear in eTable 2 in the Supplement.

reforms and 4 birth-related PSIs, modeling them at both the hospital and patient levels, and found that only collateral source rule reform was significant in a direction consistent with deterrence, and only in hospital-level models; there were no significant associations in the patient-level models.

In an analysis that examined the relationship between caps on noneconomic damages and 3 PSIs plus a pooled PSI, Zabinski and Black[41] found more consistent associations in the direction of deterrence across model specifications, but only for maternal outcomes. In a model examining all 50 states, the coefficient was significant and positive (ie, in the direction of deterrence) for the pooled measure and 1 PSI (maternal trauma with vaginal deliveries), but not for the other 2 PSIs (neonatal injury and maternal trauma during deliveries without instruments). In single-state models, the association between caps on noneconomic damages and outcomes was significant for the pooled measure and 1 PSI in 4 of 5 states, significant in 1 state for 1 PSI, and significant in 2 states for the other PSI.

Overall, studies found limited or no evidence of associations between liability risk and outcomes in obstetrical care in the direction of deterrence. The variations in findings were not clearly correlated with the choice of either the exposure measure or the outcome measure, although only 1 of the 6 studies that examined mortality as an outcome found any evidence of an association.

Evidence Concerning Patient Mortality

Twenty studies examined the relationship between liability risk and patient mortality (in settings other than obstetrical care) and 15 found no statistically significant associations in the direction of deterrence (**Table 3**). Three studies reached different conclusions about deterrence depending on the liability measure modeled and the individual states investigated,[19,23,41] and 2 studies yielded less equivocal evidence of deterrence.[27,38]

Of the 15 studies that reported no significant associations between liability measures and mortality in the deterrence direction, 9 used tort reforms as the measure of liability risk and 6 used claim frequency, average payment per paid claim, jury awards, or other measures (Table 3). These studies were also diverse in the patient populations studied, ranging from narrowly defined disease

Table 4. Seven Studies Examining Associations Between Malpractice Liability Risk Measures and Readmissions and Avoidable Hospitalizations, 1990-2019

Source	Exposure Measures[a]	Outcome Measures[a]	Evidence for Deterrence?
Kessler and McClellan,[12] 1996	Tort reforms	1-y Readmissions among patients who had an MI or IHD	No[b]
Kessler and McClellan,[16] 2002	Tort reforms	1-y Readmissions among patients who had an MI or IHD	No[b]
Frakes and Jena,[36] 2016	Tort reforms	Avoidable hospitalizations	No[b]
Bilimoria et al,[35] 2016	Premiums, claim frequency, and a composite measure	30-d Readmissions among patients who underwent colorectal surgery	No[b]
Bilimoria et al,[38] 2017	CMS malpractice cost index, claim frequency, tort reforms, and a composite measure	30-d Readmissions among patients who had an MI, heart failure, or pneumonia	No[b]
Minami et al,[39] 2017	Premiums, claim frequency, a composite measure, and average award	30-d Postoperative readmissions	No[b]
Frakes and Gruber,[40] 2018	Legal immunity (military)	30-d Readmissions	No[b]

Abbreviations: CMS, Centers for Medicare & Medicaid Services; IHD, ischemic heart disease; MI, myocardial infarction.

[a] Additional details appear in Table 1.

[b] Indicates that (1) no model found statistically significant associations between the liability measure and any outcome measure or (2) the only statistically significant associations were in an antideterrence direction (ie, greater liability risk was associated with worse rather than better outcomes). Detailed quantitative results appear in eTable 2 in the Supplement.

groups (eg, patients who had bladder cancer,[17] patients who underwent cranial neurosurgery[33]) to wide patient populations (eg, all Medicare patients[18,44]).

Two of the 3 studies that found limited evidence of deterrence used tort reforms as the measure of liability risk. Zabinski and Black[41] focused on caps on noneconomic damages and found no significant deterrence relationships in 14 of 18 models tested, including all the models that pooled data from more than 1 state. In 2 of 5 single-state models, caps on damages were significantly associated with higher mortality for 2 of the 3 mortality measures (1 individual PSI and a measure pooling 2 death PSIs). Shepherd[23] modeled 6 tort reforms and found that 2 (total caps on damages and collateral source rule reform) were significantly associated with state-level accidental deaths (excluding motor vehicle crashes) in the direction of deterrence (ie, deaths increased when liability was limited), whereas 2 (caps on noneconomic damages and punitive damages reform) were significantly associated with mortality in a reverse-deterrence direction (deaths decreased when liability was limited), and 2 (periodic payment and joint and several liability reform) had nonsignificant results. A study by Dhankhar et al[19] that used claim frequency and average payments per paid claim as the liability risk measures found that an increase in the number of paid claims was associated with a statistically significant reduction in the risk of in-hospital mortality among patients who had a myocardial infarction, but found no association between mean payment amounts and mortality.

Two studies found more consistent evidence of an association between liability risk and outcomes in the direction of deterrence. Lakdawalla and Seabury[27] estimated that a doubling of a county's jury award dollars per capita in malpractice cases was associated with a 2% decrease in the county's all-cause mortality rate; this is an unexpectedly large effect size considering that only a small fraction of deaths was due to medical injury. Bilimoria et al[38] examined 3 measures of liability risk in a model of 30-day mortality for hospitalized patients who had a myocardial infarction, heart failure, or pneumonia. The authors found that claim frequency was not significantly associated with mortality, although higher MGPCI was significantly associated with lower mortality for all 3 conditions, and a composite liability measure was significantly associated with lower mortality for patients with heart failure. However, most studies found no evidence of an association between higher liability risk and lower patient mortality.

Evidence Relating to Avoidable Hospitalizations and Readmissions

Six studies examined the relationship between liability risk and hospital readmissions and a seventh study examined associations with avoidable hospitalizations (**Table 4**). All 6 studies of readmissions found no significant association with liability risk despite testing diverse liability measures and patient populations ranging from narrow (eg, patients who underwent colorectal surgery[35]) to broad (eg, patients treated by military physicians[40]). In an analysis of avoidable hospitalizations, Frakes and Jena[36] found no significant association between 4 tort reforms (caps on noneconomic damages, caps on punitive damages, collateral source rule reform, and joint and several liability reform) and hospital readmissions.

Evidence Concerning PSIs and Postoperative Complications

Six studies examined the association between liability risk and rates of PSIs or other measures of postoperative complications outside the obstetrical care context (**Table 5**). Of these, 4 studies found no evidence of deterrence,[33,35,39,40] 1 found evidence in only a small number of the many models included in the study,[38] and 1 found evidence in most models tested.[41]

The variation in results across studies is not clearly attributable to the choice of exposure or outcome measures.[38] However, although the 4 studies that found no significant association between liability risk measures and health outcomes included a wide range of liability measures (claim frequency, average payments, premiums, legal immunity, and composite measures), none used tort reforms as the exposure measure. The study that reported limited evidence of deterrence, Bilimoria et al,[38] included tort reforms as an exposure measure and concluded there was no "consistent pattern of association" with 5 PSIs across the reforms (quantitative results were not reported). The same study found, in 15 other models testing the association of 3 other types of liability

Table 5. Twelve Studies Examining Associations Between Malpractice Liability Risk Measures and Other Outcomes, 1990-2019

Source	Exposure Measures[a]	Outcome Measures[a]	Evidence for Deterrence?
Patient Safety Indicators and Postoperative Complications			
Bekelis et al,[33] 2015	Claim frequency and average payment	Unfavorable discharge among patients who underwent cranial neurosurgery	No[b]
Bilimoria et al,[35] 2016	Premiums, claim frequency, and a composite measure	30-d postoperative complications among patients who underwent colorectal surgery	No[b]
Bilimoria et al,[38] 2017	CMS malpractice cost index, claim frequency, tort reforms, and a composite measure	5 Patient safety indicators	Limited; there were no significant associations in 11 of 15 models tested
Minami et al,[39] 2017	Premiums, claim frequency, a composite measure, and average award	10 Nonfatal postoperative complications	No[b]
Frakes and Gruber,[40] 2018	Legal immunity (military)	Had any patient safety indicator	No[b]
Zabinski and Black,[41] 2018	Tort reforms	13 Nonobstetrical, nonfatal patient safety indicators	Yes in 62 of 93 models tested, including 3 of 4 models pooled across patient safety indicators and states
Preventive Care Services			
Baicker and Chandra,[8] 2005	Premiums, average payment, and paid claim frequency	Mammography rates among Medicare patients	Limited; yes for average payment and no for premiums and claim frequency
Frakes and Jena,[36] 2016	Tort reforms	6 Cancer screening measures	No[b]
Facility Quality Measures			
Konetzka et al,[30] 2013	Claim frequency	3 Measures of nursing home quality	Limited; there were no significant associations in 2 of 3 models tested
Stevenson et al,[31] 2013	Each nursing home's claims experience within past 18 mo (whether ≥1 paid claims were incurred, total indemnity payments, and indemnity plus defense payments)	9 Measures of nursing home quality	No[b]
Bilimoria et al,[38] 2017	CMS malpractice cost index, claim frequency, tort reforms, and a composite measure	17 Hospital Compare process-of-care quality measures	No[b]
Patient Satisfaction			
Sloan et al,[13] 1997	Claim frequency	Obstetrical patient satisfaction ratings	No[b]
Bilimoria et al,[38] 2017	CMS malpractice cost index, claim frequency, tort reforms, and a composite measure	10 HCAHPS patient satisfaction ratings	No[b]
Carlson et al,[9] 2019	Physicians' claims histories	Press Ganey patient experience scores	Yes

Abbreviations: CMS, Centers for Medicare & Medicaid Services; HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems.

[a] Additional details appear in Table 1.

[b] Indicates that (1) no model found statistically significant associations between the liability measure and any outcome measure or (2) the only statistically significant associations were in an antideterrence direction (ie, greater liability risk was associated with worse rather than better outcomes). Detailed quantitative results appear in eTable 2 in the Supplement.

measures with each of the 5 PSIs, that findings were significant in the deterrence direction in 2 models (MGPCI and iatrogenic pneumothorax; and MGPCI and unintentional punctures or lacerations). Two models had significant results in the reverse deterrence direction, and 11 other models found no significant association between liability measures and outcomes.

The study by Zabinski and Black,[41] which tested caps on noneconomic damages only, was an outlier in terms of findings, and identified evidence of deterrence in most (62/93) models tested. The findings concerning deterrence were relatively consistent across pooled models but were mixed for models of individual PSIs and single states.

Overall, most studies found that higher liability risk was not associated with improved performance on PSIs or decreased rates of postoperative complications.

Evidence Relating to Other Quality Measures

Two studies investigated the relationship between liability risk and rates of clinically appropriate cancer screening (Table 5). Baicker and Chandra[8] identified significant associations between liability risk and mammography rates in models using mean malpractice claim payments as the exposure measure, but no significant associations in models using claim frequency or insurance premiums. Frakes and Jena[36] found no relationship between tort reforms and cancer screening rates.

Three studies examined process-of-care measures of quality (Table 5). The study by Bilimoria et al[38] of 17 Hospital Compare measures found no significant associations in the direction of deterrence between the state malpractice environment and the process-of-care quality measures. Stevenson et al[31] examined the relationship between each nursing home's claims experience and 9 process and outcome measures of quality and found no significant deterrence relationships. In an analysis of nursing home quality, Konetzka et al[30] found a significant association in a deterrence direction in 1 of 3 models. Claim frequency was significantly associated with a more favorable ratio of registered nurse to total staffing hours.

Two studies found no significant association between liability risk and patient satisfaction, although a third study found evidence of deterrence (Table 5). Sloan et al[13] found no relationship between claim frequency and obstetrical patients' satisfaction ratings, and Bilimoria et al[38] found that MGPCI, claim frequency, tort reforms, and a composite measure were not associated with Hospital

Consumer Assessment of Healthcare Providers and Systems ratings. However, Carlson et al[9] found that emergency physicians who experienced a claim had significantly higher patient experience scores after the claim was filed.

Qualitative Risk of Bias Assessment

Study-specific assessments of risk of bias are provided in eTable 2 in the Supplement. Although the quality of these studies could not be assessed using standard quality assessment tools, the methodological assessment we conducted revealed that, with few exceptions,[19,23,24] most studies included in this review used appropriate analytic methods, including good controls for confounding and exploration of the robustness of results to changes in model specification. The varied study results were not evidently attributable to the choice of measures, analytic approaches, or sample sizes. Although all the studies in this review have limitations, none can be dismissed as methodologically unsound. The study that had outlier findings, Zabinski and Black,[41] did not have obvious weaknesses other than its narrow focus on caps on noneconomic damages.

However, the quality assessment identified several methodological limitations that may affect the ability of some studies to accurately measure the extent and nature of associations between the exposure and outcome measures. First, a general limitation of the evidence base examined is that all studies but one[40] examined the extent of change in the outcome measures when liability risk was higher vs lower, rather than the absolute effect associated with tort liability risk.

Second, although studies that examined what happened during hospitalization may find no evidence of deterrence, it is possible that liability risk affects inpatient mix. In areas with high liability risk, physicians who are concerned about liability might be more inclined to admit patients whose need for hospitalization is less clear (ie, these patients may be healthier than other admitted patients on average). After tort reform is passed, there may be a lower tendency to admit such patients, in which case the average admitted patient would have higher severity of illness and be more prone to poor outcomes. The most likely consequence of such selection effects would be spurious positive findings of deterrence; they are less likely to invalidate null findings.

Third, in some studies that used tort reforms as the exposure measure, only a few states adopted reforms during the study period. For example, in the study by Zabinski and Black[41] only 5 states changed their laws on caps on noneconomic damages during the years studied. In such circumstances, regression estimates may have low precision and be subject to confounding by unobserved, time-varying effects.[45]

Fourth, some analyses may have unexplored problems of 2-way causation. For instance, adverse events are an established risk factor for malpractice claims.[30,46,47] A regression model that evaluates the relationship between adverse event rates and claim frequency without accounting for this cannot support the kind of causal inference a firm conclusion about deterrence requires.

Fifth, some studies relied on state- or county-level outcomes data. For instance, Klick and Stratmann[21] used state infant mortality rates, Baicker and Chandra[8] used state-level mammography rates for Medicare patients, Shepherd[23] used state mortality rates for accidents (excluding motor vehicle crashes), and Lakdawalla and Seabury[27] used county all-cause mortality rates. Drawing causal inferences with such measures can be problematic because group aggregation reduces information and may mask important differences between individuals in the group.[48]

Sixth, aggregation was also common in construction of exposure variables. Most studies measured liability risk indicators at the state or county level, rather than the level of the individual physician, and no studies measured physicians' perceived levels of liability risk. Physicians may have different awareness of and reactions to such environmental indicators, making physician-level analyses preferable. More studies should examine whether physicians change their clinical behavior after they have been sued and, ideally, parse sued physicians according to the subjective intensity of their liability experience.

Seventh, some studies were narrow in focus. Kessler and McClellan[12,16] examined only patients hospitalized with 2 cardiac conditions, Konety et al[17] focused solely on patients who had bladder cancer, Avraham and Schanzenbach[32] only studied deaths due to coronary heart disease, Missios and Bekelis[34] only included patients who underwent spine surgery, Bekelis et al[33] focused on patients who underwent cranial neurosurgery, and Bilimoria et al[35] only included patients who underwent colorectal surgery. Findings from these distinct analyses may or may not replicable in broader samples.

Discussion

This review of 37 studies of malpractice deterrence conducted since 1990 found that most studies suggest that higher risk of malpractice liability is not significantly associated with improved health care quality. Studies that examined obstetrical care were most likely to have identified some significant associations, but even in that domain there was inconsistency across analyses, including analyses within the same study, and most analyses did not identify evidence of deterrence. Notwithstanding some methodological shortcomings, collectively this body of evidence is enough to support a conclusion that higher tort liability risk is not systematically associated with safer or higher-quality care in the hospital setting. Because only a limited number of studies addressed care delivered in other settings, it is not possible to draw conclusions about deterrence in those clinical contexts.

In theory, the deterrence effect of malpractice liability risk could proceed through 3 mechanisms. The first is economic: malpractice claim payments impose a direct financial sanction. Most physicians are well insured for malpractice[49] and awards rarely exceed coverage limits[50]; however, physicians may experience economic effects if their insurance premiums increase or their medicolegal track record adversely affects their clinical income.[51] Health care facilities may be affected by economic sanctions more readily than physicians because their insurance generally involves greater experience rating, meaning that premiums are determined in part based on how costly the facility's claims were during a prior period. The second mechanism (which is less applicable to health care facilities) is that the psychological stress and trauma of litigation can be severe, and physicians will endeavor to avoid experiencing them.[52,53] The third mechanism is informational. Not all malpractice claims are meritorious, but some convey information about deviations from standards of care. Individual clinicians, health care facilities, health

insurers, and regulators may then respond to those signals in ways that may prevent harm.

Our systematic review suggests that notwithstanding these theoretical mechanisms, malpractice liability risk may not be effective in preventing substandard care. One possible explanation relates to the etiology of medical error. Some errors involve momentary or inadvertent lapses at the individual clinician level.[54,55] Although hospitals might be able to implement systems to identify such errors before they cause harm, other errors are not amenable to the kind of conscious precaution taking (at either the hospital or the physician level) on which the deterrence model relies.

Previous reports have identified 3 other problems, which have continuing relevance.[49] The first (and perhaps largest problem) is that most instances of medical negligence that cause harm never become malpractice claims, whereas many claims of uncertain or no merit are filed. The poor fit between claims and negligence introduces noise into the deterrent signal, reinforcing physicians' perceptions that claims do not convey valid information about their quality of care.

Insurance is a second contributing factor. Unlike causing a motor vehicle crash, causing a malpractice injury does not ordinarily result in higher insurance premiums for the involved individual. It is actuarially difficult for insurers to apply an experience rating at the physician level, so paid claims do not tend to manifest as direct economic sanctions for the physician. This is less of a problem at the facility level, where self-insurance and experience rating are common.

A third issue is uncertainty about the legal standard of care. Physicians complain that they do not know what "negligence" is—ie, precisely what the law requires in each clinical situation. Such uncertainty may contribute to undercutting the desired behavioral change.

Policy levers exist that could address these problems. For example, adopting enterprise liability, a reform that shifts the primary focus of liability from individual practitioners to larger organizations such as hospitals or accountable care organizations, would be helpful.[49] Organizations experience the economic aspect of deterrence more strongly than physicians because they are sued more often and have experience-rated insurance.[49] Organizations are also better positioned to effectuate changes in care that transcend individual practitioners.

Another pertinent lever would be widespread implementation of communication and resolution programs, through which health care facilities disclose adverse events to patients, rapidly investigate them, and offer proactive compensation when deviations from the standard of care have caused harm.[56] These programs could result in a higher proportion of negligent events receiving compensation, thereby reinforcing the economic and psychological mechanisms of deterrence. Furthermore, under communication and resolution programs, injuries that are not due to negligence are less likely to become claims because facilities explain to patients what happened; preventing such claims strengthens the informational function of litigation because claims more reliably point to actual quality problems.

Limitations

This systematic review has several limitations. First, because studies of deterrence in the malpractice context are published in journals in a wide range of disciplines, there is a risk that some studies were missed. To minimize this risk, we searched multiple databases spanning the medical, public health, economics, business, and legal literatures.

Second, some studies reported incomplete or vague information. Articles varied in the amount of detail provided about the data sources, data years analyzed, and model estimation methods used. In addition, some did not report full quantitative results for some models, and articles varied in how quantitative results were reported (eg, with β coefficients or odds ratios).

Third, some articles reported the results of a very large number of different models and model specifications (for example, 1 article reported using 84 models[39]). These circumstances complicated our effort to summarize studies and provide quantitative results that are interpretable and comparable across studies.

Fourth, no validated instrument was available for assessing quality or risk of bias in studies of the type included in this review; consequently, this assessment has greater subjectivity than is optimal.

Conclusions

In this systematic review, most studies found no association between measures of malpractice liability risk and health care quality and outcomes. Although gaps in the evidence remain, the available findings suggested that greater tort liability, at least in its current form, was not associated with improved quality of care.

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Submissions: We encourage authors to submit papers for consideration as a Review. Please contact Edward Livingston, MD, at Edward.livingston@jamanetwork.org or Mary McGrae McDermott, MD, at mdm608@northwestern.edu.

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