

SPECIAL ARTICLE

Relationship between Quality of Care and Negligence Litigation in Nursing Homes

David M. Studdert, L.L.B., Sc.D., Matthew J. Spittal, Ph.D.,
Michelle M. Mello, J.D., Ph.D., A. James O'Malley, Ph.D.,
and David G. Stevenson, Ph.D.

ABSTRACT

BACKGROUND

It is unclear whether high-quality health care institutions are less likely to be sued for negligence than their low-performing counterparts.

METHODS

We linked information on tort claims brought against 1465 nursing homes between 1998 and 2006 to 10 indicators of nursing home quality drawn from two U.S. national data sets: the Online Survey, Certification, and Reporting system and the Minimum Data Set Quality Measure/Indicator Report. We tested for associations between the incidence of claims and the quality measures at the facility calendar-quarter level, correcting for facility clustering and adjusting for case mix, ownership, occupancy, year, and state. Odds ratios were calculated for the effect of a change of 1 SD in each quality measure on the odds of one or more claims in each facility calendar-quarter.

RESULTS

Nursing homes with more deficiencies (odds ratio, 1.09; 95% confidence interval [CI], 1.05 to 1.13) and those with more serious deficiencies (odds ratio, 1.04; 95% CI, 1.00 to 1.08) had higher odds of being sued; this was also true for nursing homes that had more residents with weight loss (odds ratio, 1.05; 95% CI, 1.01 to 1.10) and with pressure ulcers (odds ratio, 1.09; 95% CI, 1.05 to 1.14). The odds of being sued were lower in nursing homes with more nurse's aide-hours per resident-day (odds ratio, 0.95; 95% CI, 0.91 to 0.99). However, all these effects were relatively small. For example, nursing homes with the best deficiency records (10th percentile) had a 40% annual risk of being sued, as compared with a 47% risk among nursing homes with the worst deficiency records (90th percentile).

CONCLUSIONS

The best-performing nursing homes are sued only marginally less than the worst-performing ones. Such weak discrimination may subvert the capacity of litigation to provide incentives to deliver safer care.

From the Melbourne School of Population Health (D.M.S., M.J.S.) and Melbourne Law School (D.M.S.), University of Melbourne, Melbourne, VIC, Australia; and the Department of Health Policy and Management, Harvard School of Public Health (M.M.M.), and the Department of Health Care Policy, Harvard Medical School (A.J.O., D.G.S.) — both in Boston. Address reprint requests to Dr. Studdert at the Melbourne School of Population Health, 207 Bouverie St., Carlton, VIC 3053, Australia, or at d.studdert@unimelb.edu.au.

N Engl J Med 2011;364:1243-50.
Copyright © 2011 Massachusetts Medical Society.

UNTANGLING THE RELATIONSHIP BETWEEN the quality of health care and the risk of negligence litigation is a crucial challenge in medicolegal research. Although previous studies have probed this relationship,¹⁻¹¹ an important question for clinicians and health care institutions remains unanswered: does the delivery of high-quality care reduce the risk of being sued?

Methodologic and data problems have frustrated attempts to answer this question empirically. Malpractice claims are typically too rare among individual physicians to allow meaningful assessments of risk.¹² Physician-level quality measures also have substantial limitations.¹³⁻¹⁵ Measures of litigation risk and quality at the hospital level are more robust, but physicians, not hospitals, are the chief defendants in most medical malpractice claims. The absence of a comprehensive national repository of data on all filed malpractice claims adds to the difficulties; it generally forces a choice between limiting investigations to a few institutions¹⁻⁴ and pulling back to ecologic analyses at the area level.⁵⁻⁹

These methodologic constraints are less problematic in the long-term care setting. The vast majority of claims alleging negligence in the delivery of nursing home care target the facility, not the individual clinicians who work in the facility.¹⁶ Quality measures for nearly all nursing homes in the United States are collected routinely, are detailed, and are widely used in research. In addition, the predominance of large nursing home chains provides natural points of convergence for information on many claims from many facilities.

Historically, rates of litigation against nursing homes were low. That changed in the middle-to-late 1990s, with sharp spikes in rates noted in several regions.¹⁶ We linked indicators of the quality of care in nearly 1500 nursing homes in 48 states to data on the incidence of negligence claims against them. Our goal was to compare the litigation experiences of high-performing and of low-performing facilities.

METHODS

CLAIMS DATA

Five of the largest nursing home chains in the United States provided us with data on tort claims brought against their facilities. The facilities operated in 48 states, and the claim periods varied by chain: 2000–2006 for chain 1, 1998–2005 for

chain 2, 1998–2005 for chain 3, 1998–2005 for chain 4, and 2000–2005 for chain 5. Every claim in each period was included, regardless of whether it was resolved in or out of court and whether it resulted in a payment to the plaintiff. We defined a claim as a written demand for compensation for injury.^{3,4,17}

QUALITY DATA

Measures of nursing home quality came from two sources: the Online Survey, Certification, and Reporting (OSCAR) system and the Minimum Data Set (MDS) Quality Measure/Indicator Report. The OSCAR database contains survey and certification data for all Medicaid-certified and Medicare-certified facilities (96% of all facilities). State regulators must survey each facility at least once every 15 months, and the average time between inspections is approximately 1 year. Nursing homes report facility, resident, and staffing information. When government inspections reveal noncompliance with federal standards, each deficiency is recorded in the OSCAR database, and its severity is rated on a scale from A to L (with L being the most severe). The MDS database was designed to track nursing home residents in terms of their functional, cognitive, and affective levels. Since June 1998, the federal government has required nursing homes to submit information on a monthly basis regarding care processes and resident outcomes. The facility-level indicators have been shown to be reliable and valid in measuring quality¹⁸ and identifying potential problems related to quality.¹⁹⁻²¹

Although the OSCAR and MDS databases are the most comprehensive sources of facility-level information about nursing home quality, they each have recognized limitations (see the Supplementary Appendix, available with the full text of this article at NEJM.org).

STUDY DATA SET AND VARIABLES

We constructed the study data set at the level of the facility calendar-quarter (hereafter referred to as facility-quarter). From the MDS database, we selected six quality indicators (fractures, falls, weight loss, dehydration, pressure ulcers among residents at high risk, and use of restraints) that have been used in previous studies of nursing home quality^{22,23} and that correspond well to the prevalent types of harm alleged in nursing home litigation.¹⁶ Values for these variables indicated

the percentage of residents in each facility-quarter to which the indicator applied.

From the OSCAR database, we extracted information on deficiencies and staffing for the facilities in our sample. We calculated a relative deficiency score by subtracting the facility's deficiency count from the average deficiency count for all facilities in the same state and year. Using the same approach, we calculated a score for serious deficiencies, defined as those rated at level G (actual physical or emotional harm) or higher. All models that included the relative-deficiency score also included a variable indicating the average number of deficiencies in the same state and year; we adopted the same approach for serious deficiencies. The models also included variables for the number of registered-nurse-hours and the number of nurse's aide-hours per resident-day. In addition, we extracted from the OSCAR database several other facility-level variables (resident census, payer mix, and resident acuity index) that were used to adjust our analysis.

In merging the litigation and quality variables, claims were assigned to the calendar quarter in which the plaintiff alleged that the negligent episode of care had occurred. MDS data, available by month, were aggregated into quarters. Values for the OSCAR variables in each facility-quarter reflected the results of the nursing home's most recent survey.

STATISTICAL ANALYSIS

The outcome of interest was a binary variable distinguishing facility-quarters in which at least one negligence claim was made from facility-quarters in which no such claim was made. We analyzed the claims variable on each of the 10 quality measures (2 deficiency measures, 2 staffing-level measures, and 6 MDS indicators) in separate regression models. The quality measures were scored so that the odds ratios represented the effect of a change of 1 SD on the incidence of claims. The models used generalized estimating equations for binary outcomes; adjusted for case mix, chain, number of residents, year, and state; and corrected standard errors for clustering at the facility level to account for repeated measures of the same facilities across quarters.

We hypothesized that if an association existed between quality and litigation risk, it would be relatively strong where claim rates were low and weaker or nonexistent where rates were high. Two

secondary analyses were used to test this hypothesis. First, we stratified the samples into high-litigation and low-litigation environments, based on claim rates in the state and year in which each facility was operating. (For details about these strata, see the Supplementary Appendix.) Second, we constructed a continuous variable indicating the frequency of litigation in each state and year and reran each of the main multivariate models, including an interaction between this variable and the quality measure.

Two of the MDS quality indicators (falls and pressure ulcers) matched allegation categories in our typology of claims, and two other indicators combined (weight loss and dehydration) matched an allegation category. This permitted three stratified analyses in which we regressed the probability of a specific type of claim in each facility-quarter on the corresponding quality measure.

Finally, we tested the sensitivity of our results in two ways. First, we modified the outcome variable to indicate facility-quarters that had paid claims (as opposed to all claims). Second, we reanalyzed the data using a Poisson regression model, specifying the outcome variable as a count of claims in each facility-quarter.

RESULTS

CHARACTERISTICS OF CLAIMS AND NURSING HOMES

Plaintiffs filed a total of 4716 claims against the 1465 nursing homes in our sample during the study period. The overall claim rate declined between 1998 and 2006 from an average of 1.5 claims per 1000 residents per year in 1998 to 0.3 in 2006. (Plots of trends in claim rates for the full sample and for selected states can be found in the Supplementary Appendix.)

On average, each nursing home received one claim every 2 years (Table 1). The most prevalent types of harm alleged in claims were injuries from falls (26.6% of claims) and pressure ulcers or bed sores (15.9%). Sixty-one percent of the claims resulted in a payment, with payments averaging \$199,794 per claim, for a total of \$578 million in compensation (in 2006 dollars).

The nursing homes averaged 0.3 nurse-hours per resident-day and 2.0 nurse's aide-hours per resident-day (Table 2). The OSCAR surveys identified an average of 7.0 deficiencies and 0.6 serious

Table 1. Characteristics of Negligence Claims against Nursing Homes.*

Characteristic	Value
No. of claims per nursing home per yr	0.47±1.06
Claims paid — %	61
Compensation per paid claim — \$†	199,794±423,130
Most prevalent negligent harms alleged — no. (%)‡	
Falls	1256 (26.6)
Pressure ulcers, bed sores	750 (15.9)
Dehydration, malnutrition, weight loss	385 (8.2)
Physical or verbal abuse	214 (4.5)
Medication errors	192 (4.1)

* Plus–minus values are means ±SD.

† Values shown are in 2006 dollars.

‡ Some claims involved multiple allegations (5791 allegations among 4716 claims).

deficiencies. Mean quarterly rates for the MDS indicators ranged from 0.7 instances of dehydration per 100 residents to 15.6 pressure ulcers per 100 residents at high risk.

MULTIVARIATE ANALYSIS

All the regression results reported below have been adjusted for case mix, nursing home chain, number of residents, year, and state. However, the introduction of these covariates had only a minor effect on the association of interest (<10% change in the coefficients of the quality measures).

Main Models

The odds of being sued were significantly higher among nursing homes with more deficiencies (odds ratio, 1.09; 95% confidence interval [CI], 1.05 to 1.13; $P<0.001$) and those with more serious deficiencies (odds ratio, 1.04; 95% CI, 1.00 to 1.08; $P=0.04$) relative to the state average. The odds were also positively associated with the incidence of weight loss (odds ratio, 1.05; 95% CI, 1.01 to 1.10; $P=0.01$) and pressure ulcers (odds ratio, 1.09; 95% CI, 1.05 to 1.14; $P<0.001$). The odds of incurring claims were significantly lower among nursing homes with more nurse's aide–hours per resident–day (odds ratio, 0.95; 95% CI, 0.91 to 0.99; $P=0.02$) (Table 3). However, the effects were small: each of these odds ratios indicates the effect on claims incidence of a change of 1 SD in the quality measure. There was no significant relationship between litigation risk and the other five quality measures examined.

Stratification According to Litigation Environment

The size and significance of the association between the quality indicators and the odds of being sued did not change appreciably when the relationship was reestimated within low-litigation environments only (Table 3), with a few exceptions: fractures became positively associated with the odds of being sued (odds ratio, 1.06; 95% CI, 1.01 to 1.12; $P=0.01$), and the associations with nurse's aide–hours ($P=0.04$) and weight loss ($P=0.06$) were of only borderline significance. In analyses confined to high-litigation environments, none of the quality measures retained a significant association with litigation risk.

The alternative method used to test whether the association between quality and litigation risk varied according to the litigation environment — namely, the addition to the main multivariate models of a continuous variable consisting of an interaction between each quality indicator and the claims incidence in the relevant state and year — showed no effect; the interaction term was not significant in any of the 10 models.

Stratification According to Claim Type

Subgroup analyses linking particular MDS quality indicators to corresponding claim types showed stronger relationships than did the analyses linking the indicators to all claims. Specifically, an increase of 1 SD in a facility's rate of pressure ulcers was positively associated with the odds of incurring a claim pertaining to pressure ulcers (odds ratio, 1.27; 95% CI, 1.17 to 1.39; $P<0.001$). Associations between the quality indicators and claim risk for falls (odds ratio, 1.08; 95% CI, 1.01 to 1.16; $P=0.03$) and weight loss or dehydration (odds ratio, 1.18; 95% CI, 1.05 to 1.32; $P=0.005$) were smaller but significant.

ANALYSIS OF MARGINAL EFFECTS

Using the estimates obtained from the main models, we predicted the litigation risk faced by nursing homes in the 10th, 50th, and 90th percentiles of deficiency records (best, median, and worst, respectively) for each of the five significant indicators. We then totaled the risks across four quarters to obtain an annualized estimate.

Nursing homes with the best deficiency records faced about a 40% annual risk of one or more claims, as compared with 47% among homes with the worst deficiency records (Fig. 1A). The best-quality nursing homes — in terms of rates of

serious deficiencies, weight loss, pressure ulcers, and nurse's aide-hours per resident — had litigation risks that were 2 to 7 percentage points lower than their low-quality counterparts in absolute terms and 5 to 20% lower in relative terms. Limiting the analyses to low-litigation environments reduced litigation risk across the board, but the comparative risks were virtually identical.

In the analysis that linked the MDS quality indicator for falls with the subgroup of claims alleging fall-related negligence, the annual risk of claims was 12% for high-quality facilities and 15% for low-quality facilities (Fig. 1B). In the other linked analyses, the risk ranged from 6 to 11% for litigation over pressure ulcers and from 5 to 7% for litigation over weight loss or dehydration.

SENSITIVITY ANALYSES

Altering the models to predict paid claims, as opposed to all claims, had a negligible effect on estimates from the primary and secondary analyses. Reconstructing the outcome variable as a count of claims per facility-quarter and using Poisson regression analysis also did not change the main results.

DISCUSSION

This study showed an inverse relationship between nursing home performance and litigation risk for half the 10 quality measures examined. But the associations were weak in our primary analyses: the levels of litigation were only fractionally lower for the best-performing nursing homes than for their worst-performing counterparts. The capacity of litigation to discriminate between nursing homes with excellent performance and those with poor performance did not improve when the analysis was restricted to environments with relatively low claim levels. However, the associations were stronger in secondary analyses linking particular MDS quality indicators to corresponding claim types.

Previous investigations of the quality-litigation relationship have taken two main approaches. Ecologic analyses⁵⁻¹⁰ conducted at state and regional levels have correlated certain markers of the litigation “pressures” that providers face on the basis of where they work (most commonly, claims prevalence, tort reforms, and costs of liability insurance) with population-level measures of patient outcomes and service delivery in those areas.

Table 2. Characteristics of Nursing Homes.*

Characteristic	Mean Value†
Deficiencies (no.)	
All deficiencies	7.0±6.1
Serious deficiencies‡	0.6±1.5
Staffing (hr/resident-day)	
Registered nurses	0.3±0.2
Nurse's aides	2.0±0.5
MDS quality indicator (% of residents)	
Fractures	1.7±1.5
Falls	14.1±5.5
Weight loss	11.9±5.2
Dehydration	0.7±1.4
Pressure ulcers in residents at high risk	15.6±7.6
Use of restraints	7.5±7.2
Residents (no.)	103.8±44.6
Case mix	
Medicare as primary payer (% of residents)	13.7±10.0
Medicaid as primary payer (% of residents)	63.1±17.2
ADL score§	3.9±0.4
Acuity index¶	10.2±1.2

* Study sample consists of data from 1465 nursing homes and 34,754 quarters. All values were calculated at the facility-quarter level. MDS denotes minimum data set.

† Plus-minus values are means ±SD.

‡ Serious deficiencies are those rated G (actual physical or emotional harm) or higher on a severity scale of A to L, where L is the most severe.

§ The activities of daily living (ADL) score ranges from 0 to 5 and indicates the number of ADL limitations per resident, averaged at the facility level.

¶ The acuity index is based on the proportion of residents with various limitations with regard to ADL and the proportion receiving respiratory care, suctioning, intravenous therapy, tracheostomy care, and parenteral feeding (range, 0 to 38, with higher numbers representing greater activity).

In general, these studies have shown that the litigation environment is associated with patterns of care, particularly obstetrical care, but not with the quality or outcomes of care. The methodologic limitations intrinsic to ecologic analyses have been well described.²⁴

An alternative approach, closer to the design of our analysis, links quality of care with litigation at the provider level.¹⁻⁴ Previous studies of this kind in the context of medical care have focused on retrospective reviews of closed malpractice-claim files to determine how frequently claims target substandard care, and the results have revealed a troubling degree of imprecision. Examining claim files in this way offers one perspective on the

Table 3. Multivariate Odds Ratios for One or More Negligence Claims per Quarter.*

Quality Measure	Nursing Homes in All States		Nursing Homes in Low-Litigation Environments		Nursing Homes in High-Litigation Environments	
	Odds of Claim (95% CI)	P Value	Odds of Claim (95% CI)	P Value	Odds of Claim (95% CI)	P Value
Deficiencies†						
All deficiencies	1.09 (1.05–1.13)	<0.001	1.09 (1.04–1.14)	<0.001	1.08 (0.99–1.18)	0.10
Serious deficiencies only	1.04 (1.00–1.08)	0.04	1.05 (1.01–1.10)	0.01	1.02 (0.93–1.11)	0.70
MDS quality indicators						
Fractures	1.02 (0.99–1.06)	0.20	1.06 (1.01–1.12)	0.01	0.97 (0.91–1.05)	0.50
Falls	1.02 (0.97–1.06)	0.42	1.05 (0.99–1.11)	0.12	0.94 (0.85–1.03)	0.16
Weight loss	1.05 (1.01–1.10)	0.01	1.05 (1.00–1.10)	0.06	1.04 (0.95–1.13)	0.39
Dehydration	1.00 (0.96–1.04)	0.99	1.01 (0.97–1.06)	0.60	0.97 (0.87–1.08)	0.58
Pressure ulcers	1.09 (1.05–1.14)	<0.001	1.09 (1.03–1.15)	0.002	1.07 (0.98–1.17)	0.13
Use of restraints	0.96 (0.92–1.00)	0.08	0.99 (0.93–1.05)	0.71	1.00 (0.91–1.10)	0.98
Staffing hr per resident-day						
Nurse	1.02 (0.97–1.07)	0.44	1.01 (0.95–1.07)	0.80	1.03 (0.93–1.14)	0.58
Nurse's aide	0.95 (0.91–0.99)	0.02	0.94 (0.89–1.00)	0.04	1.07 (0.98–1.16)	0.13

* Odds ratios in all models indicate the effect of an increase of 1 SD in the quality measure on the odds of receiving one or more claims per quarter. Odds ratios were adjusted for case mix, nursing home chain, number of residents, year, and state. CI denotes confidence interval.

† Odds ratios in the deficiency models are relative to the average deficiency score in the relevant state and year; these models were also adjusted for the average deficiency score in the relevant state and year. MDS denotes minimum data set.

performance of litigation in tracking substandard quality. However, it does not directly illuminate the quality–litigation risk equation that confronts health care providers — namely, the extent to which delivering exemplary care protects against lawsuits, at least relative to one's subpar counterparts. (Analogizing to epidemiology, the first perspective resembles a measure of positive predictive value, whereas the second is closer to the concepts of sensitivity and specificity.)

To the best of our knowledge, the only previous attempts to measure the relationship between quality and litigation risk from this care-delivery perspective have been in the nursing home sector. Johnson and colleagues found significant associations between claims and both deficiencies and staffing levels in analyses of state²⁵ and national²⁶ samples, but an exploratory study of 49 jury verdicts in Florida detected no clear relationship.²⁷ Our study extends this approach.

To the extent that the weak relationship we detected between nursing home quality and litigation risk exists more widely across the health care delivery system, our results have several implications. Over the past decade, patient-safety experts have sought to eliminate the traditional separation

between risk-management activities and quality-improvement activities, recasting them as a unified enterprise. If higher quality does not translate into a lower risk of being sued, however, this alignment is questionable.

More important, the social value of personal-injury litigation rests in large part on its capacity to discourage risky behavior. Tort theory suggests that litigation induces defendants to be more careful and warns others to take precautions.²⁸ But to be effective, this deterrent function logically requires a degree of precision. If, as we found in the context of nursing homes, providers who deliver low-quality care face only marginally higher exposure to litigation than do providers who deliver high-quality care, deterrence may be disrupted at the outset.

An alternative explanation for our findings is that the quality measures we used are the wrong ones. Technically, this critique is correct. Tort litigation is supposed to target instances of negligent care that harm residents, not quality of care in a broader sense. If the prevalence of harmful negligence was similar across nursing homes with high performance and those with low performance according to the OSCAR and MDS indica-

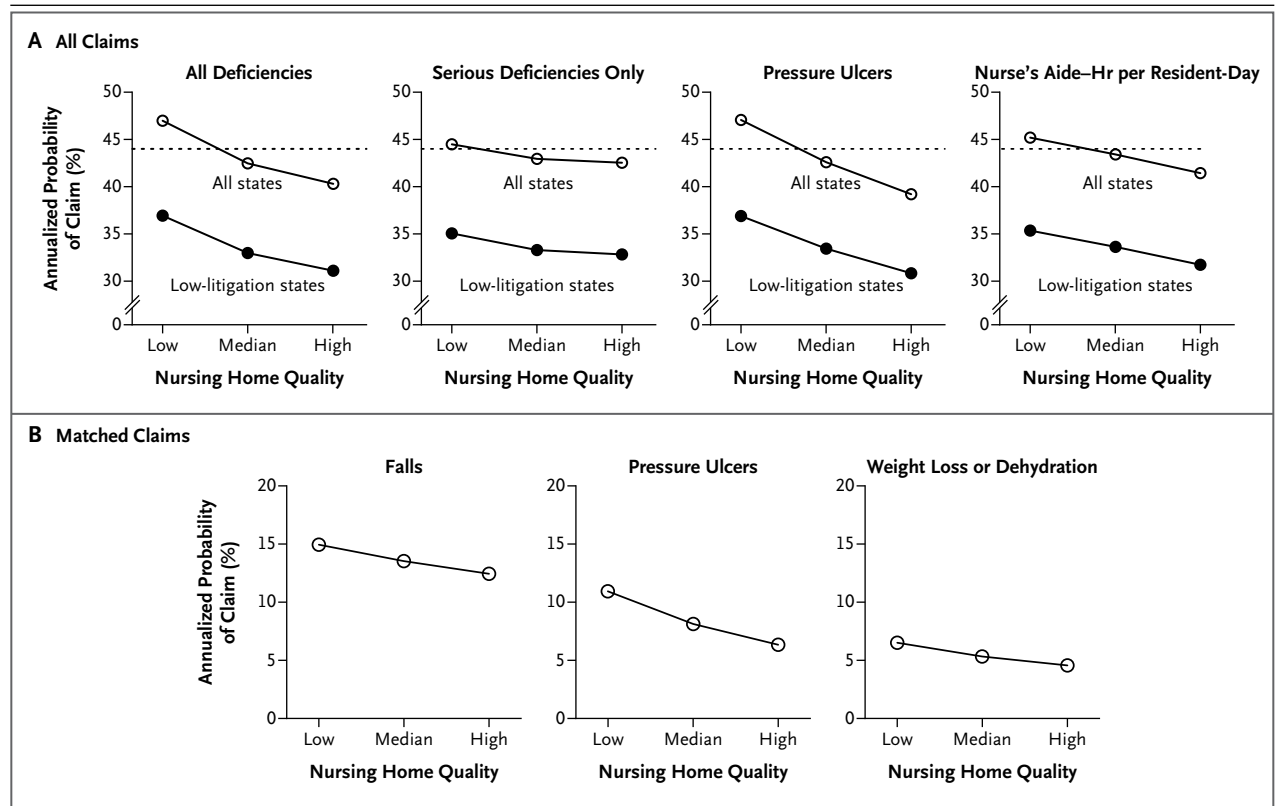


Figure 1. Adjusted Annualized Probability of Negligence Claims for Nursing Homes of High, Median, and Low Quality.

High, median, and low are defined as the 10th, 50th, and 90th percentiles, respectively, of quality on each of the measures examined. The graphs in Panel A show data for all claims. The dotted lines denote the mean probability of one or more claims per year across the entire study sample. The graphs in Panel B show data for matched claims, with the outcome variable tailored to the quality measure (e.g., claims alleging injury from falls as a function of the facility's record on falls).

tors that we examined, our analyses may falsely suggest that the litigation lacks discriminatory power.

Although theoretically possible, this explanation is implausible in two respects. First, unsafe care processes are likely to elevate risks of adverse events across the spectrum, ranging from near misses to catastrophic errors.^{29,30} Furthermore, most of the MDS quality indicators we used indicate direct harm to patients.^{31,32} Thus, a facility's performance on the quality measures we examined should be correlated with the incidence of negligent adverse events at that facility. Second, this rival explanation for our findings relies on an account of the relationship between negligence and institutional quality that raises profound (albeit different) questions about the value of litigation in improving the quality and safety of care. Discouraging isolated episodes of negligent care without lifting institutional performance more

broadly would surely be a Pyrrhic victory for tort law's deterrent effect.

This study has several limitations. First, the experience among facilities owned by the five national nursing home chains we studied may not represent that of other nursing homes, nor may these findings from the long-term care sector apply in other health care sectors. Second, one possible influence on the association between quality and claims, unmeasured in our analyses, is that plaintiffs' attorneys may incorporate facilities' publicly reported quality records into their strategies for screening or identifying prospective plaintiffs. Such behavior would tend to boost the strength of any associations detected. Third, the strongest effects observed were in the analyses matching pressure-ulcer rates with claims related to pressure ulcers. Our inability to match a wider range of specific quality indicators with corresponding types of claims may have resulted in

an underestimate of the strength of the association between quality and litigation risk

The results of this study raise questions about the capacity of tort litigation to provide incentives for improving the quality and safety of nursing home care. It is far from clear that superior performance will be rewarded with substantially lower risks of being sued. Policy moves that are afoot in the long-term care sector, such as public reporting

of performance indicators and provider payments that are based on performance, may have brighter prospects for making nursing homes safer.

Supported by a Federation Fellowship from the Australian Research Council (to Dr. Studdert) and the Harvard Interfaculty Program for Health Systems Improvement.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

We thank David Grabowski for helpful comments on an earlier draft of the manuscript.

REFERENCES

- Localio AR, Lawthers AG, Brennan TA, et al. Relation between malpractice claims and adverse events due to negligence: results of the Harvard Medical Practice Study III. *N Engl J Med* 1991; 325:245-51.
- Brennan TA, Sox CM, Burstin HR. Relation between negligent adverse events and the outcomes of medical-malpractice litigation. *N Engl J Med* 1996;335:1963-7.
- Studdert DM, Thomas EJ, Burstin HR, Zbar BI, Orav EJ, Brennan TA. Negligent care and malpractice claiming behavior in Utah and Colorado. *Med Care* 2000;38:250-60.
- Studdert DM, Mello MM, Gawande AA, et al. Claims, errors, and compensation payments in medical malpractice litigation. *N Engl J Med* 2006;354:2024-33.
- Sloan FA, Whetten-Goldstein K, Githens PB, Entman SS. Effects of the threat of medical malpractice litigation and other factors on birth outcomes. *Med Care* 1995;33:700-14.
- Kessler D, McClellan M. Do doctors practice defensive medicine? *Q J Econ* 1996;111:353-90.
- Dubay L, Kaestne R, Waidmann T. Medical malpractice liability and its effect on prenatal care utilization and infant health. *J Health Econ* 2001;20:591-611.
- Currie J, Macleod WB. First do no harm? Tort reform and birth outcomes. *Q J Econ* 2008;123:795-830.
- Yang YT, Mello MM, Subramanian SV, Studdert DM. Relationship between malpractice litigation pressure and rates of cesarean section and vaginal birth after cesarean section. *Med Care* 2009;47:234-42.
- Greenberg MD, Haviland AM, Ashwood JS, Main R. Is better patient safety associated with less malpractice activity? Evidence from California. Technical report TR-824-ICJ. Santa Monica, CA: RAND, 2010.
- Mello MM, Hemenway D. Medical malpractice as an epidemiological problem. *Soc Sci Med* 2004;59:39-46.
- Sloan FA. Experience rating: does it make sense for medical malpractice insurance? *Am Econ Rev* 1990;80:128-33.
- Landon BE, Normand SL, Blumenthal D, Daley J. Physician clinical performance assessment: prospects and barriers. *JAMA* 2003;290:1183-9.
- Jha AK, Epstein AM. The predictive accuracy of the New York State coronary artery bypass surgery report-card system. *Health Aff (Millwood)* 2006;25:844-55.
- Kaplan SH, Griffith JL, Price LL, Pawlson LG, Greenfield S. Improving the reliability of physician performance assessment: identifying the "physician effect" on quality and creating composite measures. *Med Care* 2009;47:378-87.
- Stevenson DG, Studdert DM. The rise of nursing home litigation: findings from a national survey of attorneys. *Health Aff (Millwood)* 2003;22(2):219-29.
- Weiler PC, Hiatt HH, Newhouse JP, Johnson WG, Brennan T, Leape LL. A measure of malpractice: medical injury, malpractice litigation, and patient compensation. Cambridge, MA: Harvard University Press, 1993.
- Morris JN, Nonemaker S, Murphy K, et al. A commitment to change: revision of HCEA's RAI. *J Am Geriatr Soc* 1997; 45:1011-6.
- Mor V, Berg K, Angelelli J, Gifford D, Morris J, Moore T. The quality of quality measurement in U.S. nursing homes. *Gerontologist* 2003;43:37-46.
- Karon SL, Sainfort F, Zimmerman DR. Stability of nursing home quality indicators over time. *Med Care* 1999;37:570-9.
- Zimmerman DR, Karon SL, Arling G, et al. Development and testing of nursing home quality indicators. *Health Care Financ Rev* 1995;16:107-27.
- Stevenson DG. Nursing home consumer complaints and their potential role in assessing quality of care. *Med Care* 2005;43:102-11.
- Stevenson DG, Grabowski DC. Private equity investment and nursing home care: is it a big deal? *Health Aff (Millwood)* 2008;27:1399-408.
- Wakefield J. Ecologic studies revisited. *Annu Rev Public Health* 2008;29:75-90.
- Johnson CE, Dobalian A, Burkhard J, Hedgecock DK, Harman J. Factors predicting lawsuits against nursing homes in Florida, 1997-2001. *Gerontologist* 2004; 44:339-47.
- Johnson CE, Dobalian A, Burkhard J, Hedgecock DK, Harman J. Predicting lawsuits against nursing homes in the United States, 1997-2001. *Health Serv Res* 2004; 39:1713-31.
- Troyer JL, Thompson HG Jr. The impact of litigation on nursing home quality. *J Health Polit Policy Law* 2004;29:11-42.
- Mello MM, Brennan TA. Deterrence of medical errors: theory and evidence for malpractice reform. *Texas Law Rev* 2002; 80:1595-637.
- Committee on Quality of Health Care in America, Institute of Medicine. Crossing the quality chasm: a new health system for the 21st century. Washington, DC: National Academy Press, 2001.
- Perrow C. Normal accidents: living with high-risk technologies. New York: Basic Books, 1984.
- Bostick JE, Rantz MJ, Flesner MK, Riggs CJ. Systematic review of studies of staffing and quality in nursing homes. *J Am Med Dir Assoc* 2006;7:366-76.
- Castle NG. Nursing home caregiver staffing levels and quality of care: a literature review. *J Appl Gerontol* 2008;27:375-405.

Copyright © 2011 Massachusetts Medical Society.