

A RAND NOTE

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Improvement Tool: I. Epidemiology of
Error in Four Specialities**

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Malpractice Claims Data as a Quality Improvement Tool

I. Epidemiology of Error in Four Specialties

Richard L. Kravitz, MD, MSPH; John E. Rolph, PhD; Kimberly McGuigan, MS

Objective.—To identify potentially preventable sources of medical injury in obstetrics and gynecology, general surgery, anesthesiology, and radiology.

Design.—Retrospective review of physician malpractice claim records.

Setting.—Large New Jersey physician malpractice insurer.

Participants.—Physicians practicing obstetrics and gynecology, general surgery, anesthesiology, and radiology and covered by the insurance carrier during any portion of 1977 through 1989.

Main Outcome Measures.—Proportion of claims due to negligence associated with errors in (1) patient management, (2) technical performance, and (3) medical and nursing staff coordination and the clinical and financial consequences of such errors.

Results.—Among 1371 claims ascribed to negligence, patient management errors were cited most frequently in all four specialties (48% to 75%) and, compared with performance and coordination problems, were generally associated with a higher frequency of serious injury and higher median payments. Coordination problems accounted for about 9% of claims. In obstetrics and gynecology, newborn delivery claims usually arose from management errors (57% to 68%), whereas gynecologic procedure claims were most often associated with performance errors (55% to 73%). Underperformance of cesarean section was cited more frequently than overperformance (31% vs 3%). General surgery claims were about equally divided between management and performance types regardless of procedure. Failure to perform appropriate diagnostic testing or monitoring was the main problem in 3% to 8% of claims.

Conclusion.—Malpractice data can be used to identify problem-prone clinical processes and suggest interventions that may reduce negligence.

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INCREASING demands for accountability in health care have prompted numerous efforts to measure, monitor, and improve the quality of medical practice (*Am Med News*, January 1, 1988).^{1,2} Rigorous review of past experience is the cornerstone of such efforts. Because they undergo intense scrutiny by physicians, lawyers, and insurance compa-

nies, medical malpractice claims records contain information about a particularly valuable subset of patient care experience: those cases in which poor processes of care have led to bad

See also p 2093.

outcomes. In this study we use physician malpractice claims data to identify potentially preventable sources of medical injury in four specialties.

MALPRACTICE CLAIMS DATA AS A QUALITY IMPROVEMENT TOOL: PITFALLS AND PROMISE

There are at least two problems with using malpractice claims as a source of data for medical quality improvement. First, most cases of physician negligence never result in malpractice claims.^{3,4} Second, many malpractice claims are filed in the absence of physician negligence.^{5,6} While the first problem can be obviated only by avoiding reliance on malpractice data as the sole window into negligence, the second can be addressed by focusing on those claims most likely to have arisen from negligence. However, no matter how carefully screened, malpractice claims data can be considered neither sensitive nor entirely specific for the occurrence of poor quality care.

Nevertheless, malpractice claims data are accessible, contain clinically detailed information, and may hold lessons the medical profession ought to

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learn. To assess the usefulness of a malpractice database for identifying important problems in medical practice and for suggesting solutions, we analyzed data arising from claims against physicians in four specialties covered by a large New Jersey insurance carrier over a 13-year period. In so doing, we hoped to alert peer review organizations, medical specialty societies, and hospital managers to areas deserving further attention and study.

RESEARCH QUESTIONS

In examining the New Jersey data, we posed the following specific research questions. First, what were the most common types of clinical errors leading to malpractice claims against physicians practicing obstetrics and gynecology, general surgery, anesthesiology, and radiology in New Jersey during the period studied? Second, did the distribution of error types vary across specialties, and if so, how? Third, what was the prevalence of claims associated with the failure to order indicated diagnostic tests or the failure to perform necessary physiologic monitoring?

Although numerous studies have examined the relative proportion of malpractice claims associated with different medical conditions, procedures, and errors,³⁻¹⁵ many used data from the early and mid 1970s, and few compared the incidence of different error types across specialties or described clinical error types in sufficient detail to target specific problems for attention. Analyses of claims by specialty are regularly performed by hospital risk management programs, malpractice insurance companies, and risk management and insurance consortiums, but the results are rarely published.^{16,17}

METHODS

Definitions

For the purposes of this study we defined medical injuries as injuries incurred by patients as a direct result of medical care; medical negligence as failure to provide such care as a reasonable, careful, and competent practitioner would in the year in which the injury occurred; and negligent injuries as injuries due to medical negligence.^{3,4} As discussed below, "negligence claims" were physician malpractice claims that, in the judgment of the involved physician, the carrier, or the courts were associated with negligent injury.

Data

Detailed information on malpractice claims and on the physicians named in them was obtained from the database of

Table 1.—Weighted Frequency Distribution of Error Types by Specialty

Error Type	Obstetrics and Gynecology, No. (%)	General Surgery, No. (%)	Anesthesiology, No. (%)	Radiology, No. (%)
Patient management problems				
Diagnosis error	123 (21)	74 (19)	5 (3)	163 (72)
Decision error	117 (20)	62 (16)	34 (19)	6 (2.6)
Improper management	37 (6.3)	25 (6.5)	21 (12)	0 (0)
Medication error	18 (3.1)	14 (3.6)	22 (12)	0 (0)
Unnecessary treatment	14 (2.4)	10 (2.6)	0 (0)	2 (0.9)
Problem in communicating with patient	24 (4.1)	13 (3.5)	2 (1.1)	2 (0.9)
Subtotal	333 (57)	198 (52)	84 (48)	173 (76)
Technical performance problems (improper performance or unintentional iatrogenic injury)				
	204 (35)	143 (37)	79 (45)	41 (18)
Medical and nursing staff coordination problems				
Equipment error, surgical foreign body, or misidentification of patient	25 (4.3)	32 (8.3)	6 (3.4)	3 (1.3)
Consultation or referral problem	9 (1.5)	7 (1.8)	0 (0)	0 (0)
Problem in communication between providers	11 (1.9)	2 (0.5)	6 (3.4)	6 (2.6)
Patient falls	2 (0.3)	2 (0.5)	1 (0.6)	4 (1.8)
Subtotal	47 (8)	43 (11)	13 (7)	13 (6)
Total	584 (100)	384 (100)	176 (100)	227 (100)

the Medical Inter-Insurance Exchange of New Jersey ("the Exchange"), a physician-owned, medical society-sponsored physician malpractice insurer with about a 70% market share statewide. We screened all claims filed between 1977 and 1989 in four relatively high-risk specialties chosen to represent a broad spectrum of practice. Claims against family practitioners incurred while they were practicing obstetrics were included with other obstetrical claims. Because this was a physician database, claims against hospitals that did not involve an Exchange-insured physician were not available for analysis.

As a matter of policy, the Exchange does not voluntarily settle cases in which it believes the standard of care has been met, with the exception of chipped teeth claims against anesthesiologists. We selected for analysis only those claims on which payment had been made, or for which peer review had made a determination of negligence even though no payment was made, referring to this subset as "negligence claims."

Claims Processing and Coding

On notification that an Exchange-insured physician has been sued, one of 30 medical liability representatives gathers pertinent medical records, summarizes relevant information, and enters data into a computer-based record (case summary). If the case is clearly indefen-

sible (eg, removal of the wrong organ), efforts are made to settle. In clearly defensible cases, counsel is immediately retained. In the remaining cases (60% to 70%), the claim is reviewed by the defending physician, the medical liability representative, defense counsel, and at least one volunteer physician-expert. Peer-review findings, summaries of depositions, and other plaintiff information are added to the case summary as they are generated.

When the claim is 1 year old and again at closing, a trained risk prevention analyst reviews the case summary and enters codes into a computerized risk prevention file. Both objective data (ICD-9-CM [*International Classification of Diseases, Ninth Revision, Clinical Modification*] diagnoses and procedures, patient injuries, and payments on claims) and subjective data (assessments by the risk analysts of the types of clinical errors leading to injury) are coded. Up to three "behavioral error" codes, chosen from a list of 99 descriptors, characterize the behaviors thought to have caused the injury. Examples include "error in identification of anatomy," "delay in treating," and "misinterpretation of fetal monitor strip." A summary "misadventure" code (eg, "diagnosis error," "decision error," etc) is entered to indicate the primary error type. Although basic coding rules are now standard among most physician-owned insurers,¹⁸ the Exchange's four risk prevention analysts

and their two supervisors rely largely on an oral tradition supported by more than 50 person-years of experience.

Clinical Error Taxonomy

To enhance comprehensibility while retaining sufficient detail for clinically meaningful analysis, we combined the 25 Exchange misadventure codes into 11 aggregated misadventure categories (Table 1). We further combined these 11 categories into three broad problem types: (1) patient management problems, (2) technical performance problems, and (3) medical and nursing staff coordination problems (Table 1).

Patient management problems involved cognitive errors such as failing to notice a key physical finding or laboratory value, ordering the wrong medication, proceeding with a surgical procedure when a nonoperative strategy was indicated, or miscommunicating with patients (including failure to provide informed consent). Technical performance problems included both "slips of the knife" (eg, severing the ureter during gynecologic surgery) and intraoperative misperceptions or misjudgments (eg, clamping the wrong artery during abdominal surgery). Medical and nursing staff coordination problems resulted from breakdowns in hospital procedures (eg, a surgeon failing to conduct a sponge count before closing a surgical wound), miscommunication between providers (eg, the attending surgeon not telling an infectious disease consultant about a penicillin allergy or an intern not awakening the attending obstetrician when late decelerations were observed on the electronic fetal monitor), or a series of omissions or commissions so complicated that it would be difficult to assign responsibility to any one individual (eg, x-ray report of new lung nodule lost in the mail, not called in by the radiologist, and not followed up by the primary physician).

This taxonomy was related conceptually to systems developed for more comprehensive studies,^{3,4} but was designed to take advantage of the information available from the Exchange and was purged of categories that had no obvious clinical meaning (such as the distinction between misdiagnosis and nondiagnosis).³ To determine the face validity and interrater reliability of the Exchange's classification system, a board-certified internist classified 393 paid claims in obstetrics and gynecology as (1) failure to recognize a clinical condition, (2) failure to act in a timely and appropriate manner, or (3) failure to accomplish the planned treatment properly. Clinical judgment was required to integrate the information available in the risk preven-

Table 2.—Relative Frequency of Three Major Problem Types: MIENJ (1977 through 1989) vs PIAA (1985 through 1989)*

	Obstetrics and Gynecology		General Surgery		Anesthesiology		Radiology	
	MIENJ, No. (%) (n=584)	PIAA, No. (%) (n=2520)	MIENJ, No. (%) (n=384)	PIAA, No. (%) (n=2211)	MIENJ, No. (%) (n=176)	PIAA, No. (%) (n=583)	MIENJ, No. (%) (n=227)	PIAA, No. (%) (n=692)
Patient management	333 (57)	1361 (54)	200 (52)	1172 (53)	84 (48)	257 (44)	173 (76)	491 (71)
Technical performance	204 (35)	1033 (41)	142 (37)	862 (39)	79 (45)	292 (50)	41 (18)	187 (27)
Coordination	47 (8)	126 (5)	42 (11)	177 (8)	12 (7)	35 (6)	14 (6)	14 (2)

*MIENJ indicates Medical Inter-insurance Exchange of New Jersey and includes all negligence claims. PIAA indicates Physician Insurance Association of America and includes all paid claims.

tion file. A second board-certified internist reviewed a random 10% sample and, following written classification rules established by the first clinician, agreed with the initial determination in 37 (97%) of 38 cases, suggesting that at least in the sole specialty evaluated, the Exchange's risk prevention codes are reasonably detailed and comprehensible.

Information on the clinical and financial consequences of negligence claims was obtained from the Exchange's records on severity of injury (1 to 9 scale),¹⁸ and, for negligence claims resulting in payment, the amount of indemnity paid, adjusted to 1990 dollars.

Statistical Analysis

Weighting.—To avoid giving undue weight to cases in which multiple physicians were sued and assigned partial responsibility for the same error, the frequency of the 25 misadventure types was adjusted to reflect the actual frequency of different kinds of errors. (The term "misadventure" is used to reflect the nomenclature applied by the Exchange to the 25 clinical groupings.) When more than one policyholder was named in a suit and the misadventure for these physicians was the same, the weights were calculated in proportion to the size of indemnity payments for each physician's claim. The sum of the weights over all physicians with the same misadventure for a single claim was one. If more than one physician was named, each with a different recorded misadventure, then each record was given a weight of one. Finally, claims involving only one physician were weighted as one error. Because our taxonomy was structured so that each misadventure type was uniquely associated with one of 11 aggregated misadventure categories and thereon with one of three broad problem types, the assigned weights applied across all levels of the taxonomy.

Censoring.—The analyses used claims reported as of December 31, 1989, that had either been resolved

(closed claims) or had received a peer review (open claims). There was an unknown number of claims from incidents that had occurred during the period covered by our database but had not yet been reported to the Exchange. About 3.5% of the files in our database had been reported but had not yet received a peer review to determine error type. We adjusted for the effects of both of these types of censoring, using standard methods.¹⁹ Details are available from the authors.

Statistical Significance Testing.—The statistical significance of differences in the percentages of death and serious injury by problem type was assessed with χ^2 testing; differences in the payout distribution by problem type were assessed using the nonparametric Kruskal-Wallis test.²⁰

RESULTS

Error Type by Specialty

Of 1371 claims made between 1977 and 1989 and judged likely to represent negligence, 584 were in obstetrics and gynecology, 384 in general surgery, 176 in anesthesiology, and 227 in radiology (Table 1). In all four specialties, most negligence claims were associated with patient management errors (making the wrong diagnosis, making the right diagnosis but selecting the wrong treatment, or improperly communicating treatment decisions to the patient) (Table 1). Despite recent concerns about the extent of inappropriate surgery,²¹ unnecessary treatment accounted for less than 3% of negligence claims in the two surgical specialties (Table 1). Except in radiology, between one third and one half of errors were related to improper technical performance of procedures. Medical and nursing staff coordination problems accounted for only 6% to 11% of negligence claims (Table 1).

To assess the generalizability of the findings, we compared the New Jersey data with published material from the Physicians' Insurers Association of America for claims paid between 1985 and 1989.⁵ The distribution of negli-

Table 3.—Death, Serious Injury, and Indemnity Payments for the Three Major Problem Types by Specialty*

Problem Type	Obstetrics and Gynecology (n = 584)			General Surgery (n = 384)			Anesthesiology (n = 176)			Radiology (n = 227)		
	Death, No. (%)	Serious Injury, No. (%)	Median Payment, Thousands \$ (90th Percentile)	Death, No. (%)	Serious Injury, No. (%)	Median Payment, Thousands \$ (90th Percentile)	Death, No. (%)	Serious Injury, No. (%)	Median Payment, Thousands \$ (90th Percentile)	Death, No. (%)	Serious Injury, No. (%)	Median Payment, Thousands \$ (90th Percentile)
Management (n = 788)	36 (11)	127 (38)	42 (550)	54 (27)	66 (33)	48 (294)	46 (55)	23 (27)	85 (630)	21 (12)	48 (28)	21 (138)
Performance (n = 467)	2 (1)	53 (26)	31 (185)	11 (8)	45 (32)	48 (294)	16 (20)	14 (18)	25 (224)	0 (0)	12 (29)	33 (402)
Coordination (n = 116)	4 (8)	11 (23)	9 (133)	4 (9)	1 (2)	16 (95)	3 (23)	3 (23)	14 (1039)	2 (15)	4 (31)	30 (147)
Total	41 (7)	193 (33)	34 (368)	69 (18)	111 (29)	39 (270)	65 (37)	40 (23)	48 (444)	23 (10)	64 (28)	23 (185)
P†	<.001	.006	.001	<.001	<.001	.007	<.001	.339 (NS)	.003	.056	.959 (NS)	.0398

*Serious injury was defined as significant permanent injury, major permanent injury, or brain damage or quadriplegia (Physician Insurers Association of America severity categories 6 through 8).¹⁹ Median payment is used for paid claims only and is presented in 1990 dollars. NS indicates not significant. The denominators for calculation of the percentage of claims associated with death and serious injury were based on the number of claims related to each type of error within each specialty as shown in Table 2. Because weighted percentages were used to calculate weighted numbers, not all columns add exactly due to rounding error.

†Significance probabilities for differences in death and serious injury proportions across error categories were determined using Pearson's χ^2 test. Significance probabilities for the indemnity payment distributions test for any difference in the distribution used the nonparametric Kruskal-Wallis test.²¹

gence claims across the three problem types in New Jersey comported well with the national paid claims frequencies, except that in the more recent national data a higher percentage of claims in radiology were due to technical performance errors (Table 2).

Consequences of Presumed Medical Negligence

The proportion of negligence claims associated with serious injury¹⁸ or death ranged from 38% (10% death and 28% serious injury in radiology) to 60% (37% death and 23% serious injury in anesthesiology) ("Total" row, Table 3). Among claims resulting in payment of indemnity, median payout was highest in anesthesiology (\$48 000) and lowest in radiology (\$23 000) (Table 3). Except in radiology, patient management errors were generally associated with higher rates of death and serious injury, as well as higher median indemnity payments (Table 3). Although median payments for management errors in obstetrics and gynecology vs surgery were comparable, payments at the 90th percentile were nearly twice as high in obstetrics and gynecology, reflecting the high cost of outlier cases. Coordination problems as identified in this physician-centered database were generally associated with low median indemnities, but several cases in anesthesiology generated extraordinarily high payments (\$1 039 000 at the 90th percentile) (Table 3).

Distribution of Broad Problem Types by Major Procedure

Previous studies indicate that most malpractice claims in surgical specialties are associated with the performance of major therapeutic procedures.^{3,4} To determine the relative frequency of clinical errors arising from

Table 4.—Weighted Frequency of Problems Associated With Various Procedures in Obstetrics, Gynecology, and General Surgery

Procedure	No. of Cases	Problem Type		
		Patient Management, No. (%)	Technical Performance, No. (%)	Coordination, No. (%)
Obstetrics				
Induced or assisted delivery	114	65 (57)	34 (30)	15 (13)
Cesarean section	71	48 (68)	18 (25)	5 (7)
Gynecology				
Hysterectomy (not including operations for cancer)	72	26 (36)	40 (56)	6 (8)
Tubal ligation or placement of intrauterine device	57	14 (25)	40 (70)	3 (5)
Therapeutic abortion	44	11 (25)	32 (73)	1 (2)
Dilation and curettage	26	10 (37)	14 (55)	2 (8)
Other operative procedures	48	23 (48)	20 (42)	5 (10)
General surgery				
Gastrointestinal operations	104	47 (45)	45 (43)	12 (12)
Skin, subcutaneous tissues, and lymph node operations	37	22 (59)	11 (30)	4 (11)
Biliary operations	28	10 (36)	12 (43)	6 (21)
Breast operations	26	7 (27)	16 (62)	3 (12)
Vascular surgery	25	14 (56)	9 (36)	2 (8)
Genitourinary operations	20	9 (45)	8 (40)	3 (15)
Hernia repair	16	6 (38)	8 (50)	2 (12)
Other operations*	48	14 (29)	28 (58)	6 (13)

*Including thyroid, parathyroid, cardiothoracic, and orthopedic procedures.

major procedures in obstetrics and gynecology and in general surgery, we examined the occurrence of the three broad problem types by procedure in these specialties. Patients undergoing obstetric procedures (vaginal and cesarean deliveries) generated 185 negligence claims, and most of these (57% to 68%) were associated with management errors (Table 4). Many more obstetrical claims were associated with nonperformance or delay in performing cesarean section than with unnecessary or inappropriate cesarean section (31% vs 3%; data not shown in tabular form). In contrast to obstetrics, negligence claims in gynecologic surgery (hysterectomy, di-

lation and curettage, tubal ligation, and therapeutic abortion) were most often related to technical performance problems (Table 4).

In general surgery, management and performance errors were about equally responsible for the negligence claims associated with the seven most frequently cited operations (Table 4). Coordination problems were relatively rare in both specialties.

Insufficient Testing or Monitoring

Physicians' perceptions that negligent injury commonly results from insufficient testing or monitoring may be related to the practice of "defensive

Table 5.—Negligence Claims Resulting From Failure to Perform Appropriate Diagnostic Testing or Monitoring

	Obstetrics and Gynecology, No. (%) (n = 584)	General Surgery, No. (%) (n = 384)	Anesthesiology, No. (%) (n = 176)
Omission is partial basis for claim	53 (9.1)	50 (13)	8 (4.5)
Omission is primary basis for claim	25 (5.5)	32 (8.3)	6 (3.4)

medicine." To investigate this issue, we tabulated negligence claims in obstetrics and gynecology, general surgery, and anesthesiology for which the Exchange had assigned the following behavioral error codes: improper workup, failure to order, failure to perform, or failure to monitor (Table 5). (Radiology was not included because radiologists do not commonly order tests or procedures themselves.) After eliminating cases in which the procedure "not performed" was clearly therapeutic (eg, failure to perform a laparotomy), we found the proportion of all negligence claims associated with diagnostic or monitoring omissions ranged from 4.5% (anesthesiology) to 13% (general surgery); the Exchange considered such omission to represent the primary basis for the claim in 3% to 8% of the cases.

COMMENT

In this analysis of selected malpractice claims in four specialties, patient management (cognitive) errors were the most frequent type in all specialties; compared with technical performance and coordination problems, they were generally associated with greater mortality and higher median indemnity payments. Also, the distribution of error types varied across specialties, emphasizing the perils of combining specialties when looking at physician error profiles. Finally, omission of diagnostic tests and physiologic monitoring was associated with a relatively small fraction of negligence claims.

Patterns of Physician Error

Malpractice claims included in the analytic file as negligence claims were those in which negligence was admitted by the physician or determined by peer review or the legal system. This represents a methodologic improvement over previous claims-based studies, because the number of "false-positive" claims in which no negligence occurred should be minimized. While these data lack the denominators that would permit calculation of error rates, they are useful nonetheless because they highlight the types of problems that result in negligent injury and demonstrate the relative importance of different error types among cases consequential enough to prompt legal action.

In comparing the specialties, performance errors were relatively rare in radiology, possibly because radiologists performed few invasive procedures during the period of study.²² Error patterns for obstetrician-gynecologists and general surgeons were roughly similar. However, problems in communication between providers, while relatively rare, were more commonly represented among claims in obstetrics and gynecology; surgical foreign bodies (eg, abandoned sponges) were overrepresented in general surgery.

Obstetrics and Gynecology.—Negligence claims associated with newborn deliveries most commonly involved errors in perception or judgment, whereas those associated with gynecologic operative procedures were more often related to improper performance. Attention to these prevailing patterns could help shape strategies aimed at reducing negligence. For example, errors in obstetrical judgment might be addressed by promulgation of clear practice guidelines for the management of childbirth, whereas errors in gynecologic surgical performance might be addressed by surgical outcomes monitoring in connection with periodic technical recertification. While the data do not support specific solutions, they do suggest certain broad approaches that could be subjected to rigorous prospective evaluation.

General Surgery.—In general surgery, negligence claims were fairly evenly divided between the patient management and performance types, supporting the view that the safe practice of surgery requires good decision making, as well as technical skill. Although recent work has underscored the importance of individual surgical competence (as measured by complication rates) in determining the appropriateness of performing particular procedures,²³ further understanding is needed of factors related to surgical outcomes, including the role of fail-safe systems designed to avert the most common kinds of errors.

Anesthesiology.—The relatively high proportion of performance errors and low frequency of improper monitoring may reflect recent trends in the practice of anesthesia. Anesthesia monitoring standards introduced in the ear-

ly 1980s have diminished the relative likelihood of being sued for failure to detect hypoxia, hypotension, or arrhythmias.²⁴⁻²⁶

Radiology.—The disproportionate number of negligence claims in radiology stemming from diagnostic errors comports with the diagnostic forces of this specialty. However, performance errors were costly when they occurred. Although diagnostic inaccuracy is surprisingly high even among academic radiologists,²⁷ what constitutes negligence is controversial.²⁸ Since radiologists' diagnostic accuracy may improve when they are informed of patients' clinical conditions,^{28,29} improved systems for the sharing of clinical information may reduce rates of diagnostic error.³⁰

Failure to Test or Monitor

Although it has not yet been satisfactorily defined, the problem of defensive medicine has received considerable recent attention.³¹⁻³⁵ One aspect of defensive medicine is the use of marginally indicated tests to reduce the risk of negligent injury. In this study less than 15% of negligence claims were associated with failure to order diagnostic tests or employ monitoring techniques. Although we examined only those claims believed to have involved true negligence, the data suggest that performing still more tests would probably not avert a large proportion of negligence claims, at least in procedurally oriented specialties like those we studied.

The Importance of Systems

In this physician database, coordination problems as strictly defined were relatively uncommon. However, in many cases where inappropriate patient management or poor technical performance was deemed responsible for the negligent injury, impaired coordination between multiple health care personnel appeared to play a strong supporting role. For example, in one case of misdiagnosed ectopic pregnancy (Exchange case 1363), the physician failed to read relevant laboratory reports. While cataloged as a diagnostic error (and thus a "patient management problem"), this claim might have been averted by systems designed to make sure that positive pregnancy test results got promptly into the hands of the responsible physician. System failures may be more important in facilitating medical malpractice than is generally recognized.^{36,37}

Systemic problems need systemic solutions. Evaluating the effects of computerized clinical information systems on rates of patient injury and malpractice claims is an important research goal for the future.

CONCLUSIONS

By identifying clinical circumstances that generate sizable numbers of errors, our analysis points to areas that deserve more attention from the quality assurance community. In a companion study presented in this issue of *JAMA*,³⁸ we examine the ability of malpractice data to target specific providers for remedial education or sanctions.

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