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LIABILITY AND LIABILITY INSURANCE FOR MEDICAL MALPRACTICE

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Physicians typically carry virtually complete malpractice insurance coverage. This contradicts standard theoretical predictions that (1) under a negligence rule of liability there should be no demand for insurance, and (2) insurance policies under moral hazard will contain co-payment provisions. It is argued that judicial 'errors' in defining negligence generate a demand for liability and legal defense insurance. Physician co-payment undermines the insurer's incentives for legal defense and thus induces a trade-off between loss reduction by injury prevention and by legal defense. Fee-for-service reimbursement further distorts the physician's choice between injury prevention and insurance. Implications for the deterrent function of the tort system are discussed.

1. Introduction

Medical providers are currently subject to a negligence rule of liability for adverse outcomes of medical care. Under a negligence rule, a physician is liable only if the patient is injured as a result of the physician's failure to practice with 'due care'. Producer liability in this market may be justified on grounds of asymmetry of information of two types. First, if patients misperceive the risks of alternative treatments, first party liability (caveat emptor) will result in a non-optimal number of risky procedures and non-optimal quality of care per procedure [Spence (1977)]. Second, if patients cannot monitor the quality of care delivered, there is a potential for fraud. In principle, a rule of liability for negligence can be designed which corrects these potential distortions and creates incentives for physicians to deliver the quantity and quality of care that would be chosen by informed patients.[1]

Many commentators question the deterrent value of tort liability in general and medical malpractice liability in particular, because tortfeasors are typically protected by liability insurance. This presumption, that liability insurance undermines any potential deterrent effect of the malpractice system,

[1]Following Shavell (1980), appendix A (available from the author) shows the optimality of a two-pronged negligence rule, with liability for substandard care per procedure and for performing unnecessary procedures. Such a rule creates optimal incentives provided that patients do not misperceive the benefits as well as the risks of treatment.

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is the basis for several recent proposals for tort reform.[2] But in a rigorous analysis of the effect of liability insurance on incentives for prevention, Shavell (1982a) concludes that 'liability insurance does not have an undesirable effect on the working of liability rules ... the terms of insurance policies sold in a competitive setting would be such as to provide an appropriate substitute (but not necessarily equivalent) set of incentives to reduce accident risks. In other words, it is not socially beneficial for the government to intervene'.

Under an ideal negligence rule with perfect information, the issue is moot: the optimal due care standard is defined to require the level of prevention which minimizes the sum of the costs of injuries plus injury prevention. Given such a rule, there is no demand for liability insurance because by the definition of the standard, it is cheaper to prevent than to insure injuries that would be deemed negligent.[3] In fact, the legal definition of negligence as defined by Judge Learned Hand approximates such an efficient standard. Negligence is said to occur if the loss caused by the accident, multiplied by the probability of the accident's occurring, exceeds the burden of the precautions the defendant might have taken to avert it.[4]

But the evidence clearly contradicts the conclusion that there is no demand for insurance under a negligence rule of liability. Physicians carry virtually complete insurance, with high limits of coverage. Moreover malpractice insurance policies typically lack features designed to preserve the insured's incentives for loss prevention. There are no deductibles or coinsurance. Merit rating (rating on the basis of prior claims) is used less frequently than is statistically feasible.[5] This apparent absence of policy provisions designed to deter moral hazard is inconsistent with theoretical predictions [e.g., Arrow (1970), Zeckhauser (1970)] and empirical evidence from first party insurance and other lines of liability insurance, where copayment and merit rating are common. The purpose of this paper is to attempt to explain this discrepancy between theory and evidence with respect to the demand for medical malpractice liability insurance; to examine the optimal form of liability insurance contract; and to reconsider the case for government intervention in malpractice insurance markets.

Section 2 shows how in principle a rule of liability for negligence can be designed to provide physicians with incentives to practice with the level of

[2]For example, 'The extent to which the defendant must respond in damages is better measured by the plaintiff's harm than by the degree of the defendant's fault ... the notion of a wrongdoing defendant is increasingly anachronistic in this age of widespread malpractice insurance...' [American Bar Association (1977)].

[3]The objection that people would still insure against their own 'carelessness' ignores the purpose of the liability rule to influence the propensity to be careless. If the due care standard is defined taking into account all relevant social costs, including the costs of avoiding 'carelessness', this objection is meaningless.

[4]U.S. v. Carroll Towing, 159 2d 169 (2d. Cir. 1947).

[5]Rolph (1981).

care that would be preferred by fully-informed patients. Section 3 examines optimal liability insurance contracts under a negligence rule, under conditions of imperfect information, court error and costly legal defense, which are excluded by assumption from the model in section 2 and in Shavell (1982a). It is shown that, in contrast to first party insurance, the optimal liability insurance policy under moral hazard is unlikely to include an automatic deductible or coinsurance provision. Optimal co-payment in liability insurance is less than for first party coverage with equivalent moral hazard on the part of the policyholder. Because liability insurance typically covers damages and legal defense in a single policy, there is a trade off between providing incentives to the policyholder to reduce injuries and providing incentives to the insurer to defend claims. These theoretical predictions are related to characteristics of medical malpractice insurance markets in section 4. Section 5 shows that the physician's choice between injury prevention and liability insurance may be further distorted by the tax treatment of health insurance and by reimbursement practices of health insurers. Section 6 evaluates policy implications.

2. Optimal liability rules

The model is formulated in terms of medical injuries but could apply equally in any market context where consumers may be injured by product failure which depends only on the care taken by producers. State-dependent utility of patients and physicians is assumed, because personal injury plausibly affects the patient's utility of income and liability claims impose uninsurable time and reputation costs on physicians.

Assume that expenditure on prevention affects the probability but not the size of loss, and each patient buys just one unit of medical care.[6] Insurance for first party or liability losses is available, with perfect experience rating and a proportionate loading charge. The following notation is used:

$V(B)$ = patient's utility of initial wealth, $V'>0$, $V''<0$,
$p(r)$ = probability of injury, $p'<0$, $p''>0$,
r = quality (prevention) per unit of service,
s = price of service,
$c(r)$ = production cost per unit, $c'>0$, $c''<0$,
L = monetary loss to patient if injury occurs,
M = first party insurance coverage bought by patient,
γp = premium rate per dollar of first party coverage, where $\gamma \geqq 1$ is the loading charge,

[6]This abstracts from the effects of liability rules on quantity of services (see footnote 1). The model also assumes that physicians pay any judgment in excess of policy limits, ignoring the possibility of bankruptcy or judgment proofing.

$h(p)$ = patient's perception of p, $h'>0$, $h''<0$,
$U(A)$ = physician's utility of initial wealth, $U'>0$, $U''<0$,
D = damages paid by physician if a loss occurs,
Q = liability insurance coverage bought by physician, $Q \leqq D$,
λp = premium rate per dollar of liability coverage, where $\lambda \geqq 1$ is the loading charge,
μ = Lagrange multiplier.

Subscript 0 denotes the state in which an injury occurs. Subscript 1 denotes the state in which no injury occurs. Subscripts f, s and n denote first party, strict and negligence liability, respectively.

Initially, patients are assumed to be fully informed.

First party liability. If patients are fully informed and markets are competitive, the physician chooses the level of safety (r) and product price (s) to maximize expected utility of patients, $E(V)$, subject to maintaining an opportunity level of utility, U^c, determined by the physician's alternative use of time.[7] Patients select first party insurance coverage (M), given the supply price per dollar of coverage γp. Informed markets thus solve the following optimization problem:

$$\max_{M,s,r} \phi = (1-p)V_1[B-s-\gamma pM] + pV_0[B-s-\gamma pM-L+M]$$

$$+\mu\{U[A+s-c(r)]-U^c\}. \tag{1}$$

Maximization with respect to M, s and r yields

$$\gamma \bar{V}' = V_0', \tag{2}$$

$$\bar{V}' = \mu \bar{U}', \tag{3}$$

$$c' = -p'\left[\frac{V_1-V_0}{\bar{V}'}+\gamma M\right], \tag{4}$$

where $\bar{V}' = (1-p)V_1' + pV_0'$.

Eq. (2) may be rewritten

[7] If the physician has monopoly power, U^c includes some rent but the structure of the problem is not affected. The model ignores other possible arguments in a physician's utility function, such as prestige and ethics.

$$\frac{V_1'}{V_0'}=\frac{1-\gamma p}{\gamma-\gamma p}\lesseqgtr 1 \quad \text{as} \quad \gamma\lesseqgtr 1. \tag{2'}$$

This is the familiar result, that optimal coverage does not fully equate the marginal utility of income if the insurance premium contains a proportionate loading charge ($\gamma>1$). Eq. (4) shows that if injury entails irreplaceable loss ($V_1>V_0$), optimal prevention (r_f^*) may exceed the optimal level with risk neutrality ($c'=-p'L$), even with full insurance of any monetary loss.

Strict third party liability. Under a rule of strict third party liability the physician pays for all iatrogenic injury. An omniscient benevolent dictator would choose the damage award (D), physician's liability insurance coverage (Q), prevention (r) and product price (s) to maximize the patient's expected utility, subject to maintaining the opportunity level of utility for physicians, U^c,

$$\begin{aligned}\max_{D,Q,s,r}\ \phi=&(1-p)V_1[B-s]+pV_0[B-s-L+D]\\&+\mu\{(1-p)U_1[A+S-c(r)-\lambda pQ]\\&+pU_0[A+s-c(r)-\lambda pQ-(D-Q)]-U^c\}.\end{aligned} \tag{5}$$

Maximization with respect to D, Q, s and r yields

$$V_0'=U_0', \tag{6}$$

$$\lambda\bar{U}'=U_0', \tag{7}$$

$$\bar{V}'=\mu\bar{U}', \tag{8}$$

$$c'=-p'\left[\frac{V_1-V_0}{\bar{V}'}+\frac{U_1-U_0}{\bar{U}'}+\lambda Q\right], \tag{9}$$

where $\bar{U}'=(1-p)U_1'+pU_0'$.

Eqs. (6) and (8) together imply

$$\frac{V_1'}{V_0'}=\frac{U_1'}{U_0'}=\frac{1-\lambda p}{\lambda-\lambda p}\lesseqgtr 1 \quad \text{as} \quad \lambda\lesseqgtr 1.$$

The optimal tort damage award, D^*, provides the level of insurance patients would choose to buy voluntarily, but with the loading factor of the

physician's liability insurance. Thus $D^* \gtreqless M$, as $\lambda \gtreqless \gamma$. The optimal safety level (r_s^*) implicitly defined by eq. (9) may exceed or fall short of r_f^* under first party liability as $(U_1 - U_0)/\bar{U}' + \lambda Q \gtreqless \gamma M$.

If $\lambda = \gamma = 1$ and the physician incurs no uninsurable liability loss, then $r_s^* = r_f^*$. Under the more reliastic case of $\lambda > \gamma$ and $U_1 > U_0$ because of time and reputation costs of suit, the optimal level of prevention is higher under strict liability.

Negligence. Under a negligence rule, the physician is liable only if he fails to meet the due care standard, r_n^*, and the patient is injured. The social welfare function is given by eq. (1) for $r < r_n^*$ and by eq. (5) for $r > r_n^*$. If either U is state-dependent or $\lambda > 1$, the physician is not fully insured against the loss. The social welfare function is discontinuous at r_n^* because of the costs of suit to physicians.

A first best solution can be achieved by setting D at D^*, the optimal compensatory award under strict liability, and $r_n^* = r_f^*$. The physician's decision problem is then to choose Q, s and r to maximize $E(V)$, subject to $E(U) > U^c$ and subject to the penalty $D = D^*$ if $r < r_n^*$. But this private objective function is identical to the social welfare function, i.e., it is a discontinuous function equal to eq. (1) for $r > r_n^*$ and equal to eq. (5) for $r < r_n^*$. If either $\lambda > \gamma$ or $U_0 < U_1$, the physician's incentive is to choose $r = r_n^*$, i.e., to be non-negligent and hence have no demand for liability insurance. On the other hand, if $1 = \lambda < \gamma$ and U is not state-dependent, then physicians would choose $r < r_n^*$, i.e., would choose to be negligent and to insure the resulting losses. As a practical matter, this case can be ignored.[8]

Imperfect information. The analysis so far has shown that if consumers are fully aware of risks, first party liability and negligence are equally efficient and superior to strict liability, when shifting liability imposes uninsurable losses on defendants.[9] But if consumers underestimate risks, under first party liability they buy too little insurance and non-optimal safety. Spence (1977) shows that under strict liability, a first best solution with respect to compensation and prevention can be achieved by means of a two-part penalty. A compensatory award equal to D^* is paid to victims. A fine, paid to the state initially but refunded as a subsidy to the hazardous activity, is set equal to $(1 - h')((V_1 - V_0)/\bar{V}')$, where $h(p)$ is the consumer's perception of p and $(V_1 - V_0)/\bar{V}'$ is the dollar measure of loss due to injury, or the willingness to pay for injury reduction.

[8]If $\lambda > \gamma \geq 1$, it might be optimal to provide compensation through first party coverage and impose a liability fine on physicians to achieve optimal deterrence. Enforcement would depend on subrogation actions by the patient's first party insurer against the physician or his liability insurer.

[9]This analysis ignores costs of adjudicating claims, which would probably be highest for strict liability, lowest for first party liability.

With a risk averse defendant and incomplete insurance, provided the standard of care is correctly set at r_f^*, the fine necessary to achieve compliance is less under negligence than under strict liability because of the discontinuity of the pay-off function.[10] The physician will choose to meet the standard provided

$$\frac{U_1-U_0}{\bar{U}'}+\lambda Q \geqq \frac{V_1-V_0}{\bar{V}'}\left(1-\frac{h'}{p'}\right)+\gamma M.$$

Thus if the load on liability insurance is at least as great as the load on first party insurance ($\lambda \geqq \gamma$), a fine over and above the compensatory award paid to victims is not necessary to induce compliance with a negligence standard, if the uncompensated cost of suit to physicians $(U_1-U_0)/\bar{U}'$ exceeds the distortion in market incentives due to consumer misperceptions $((V_1-V_0)/\bar{V}')(1-h'/p')$. Since the fine-subsidy mechanism is presumably costly to administer, this is an added attraction of a negligence rule over strict liability.[11]

The demand for liability insurance

It has been shown that, under a negligence rule with the standard of care and rule of damages optimally defined, physicians have incentives to be non-negligent. Hence there should be no demand for liability insurance.

This argument presupposes that courts enforce an efficient due care standard with perfect accuracy, and that this is known to physicians and patients. The demand for liability insurance can arise out of either Type 1 or Type 2 errors by the courts, or penalties insufficient to offset consumer misperception of risk.[12] If courts set the standard too high, holding physicians liable for some injuries where the cost of prevention exceeds the expected benefits (Type 2 errors), it is cheaper for the physician to insure than to prevent these injuries, and this is socially optimal. But if victims or courts also commit Type 1 errors, failing to file or to find liability in all true instances of negligence, or if liability payments are too low, then it is cheaper for the physician to insure than to avoid some instances of negligence, and this is not socially optimal.

These two cases are illustrated in fig. 1. The curves labelled FF and SS show the marginal social benefits of care per patient encounter, under first party and strict liability respectively, with fully informed consumers and

[10]This is analogous to the result in Diamond (1974), that there is a non-trivial range within which the due care standard can fall and still induce compliance.

[11]Reform of tort awards along the lines implied by this analysis is discussed in Danzon (1984).

[12]The Type 1 and Type 2 errors here are errors in the court's perception of the physician's level of care. Simon (1982) analyzes Type 1 and Type 2 diagnostic errors by the physician, but assumes that courts are perfectly informed about both the true condition of the patient and the physician's level of care.

courts. Under first party liability, the marginal benefit of additional care (FF) is simply the reduction in probability of injury to the patient, which is assumed to be subject to diminishing returns. Under strict liability, there is an additional benefit from care if the physician incurs some uninsurable loss of time, reputation or inconvenience in responding to claims, so SS > FF. The

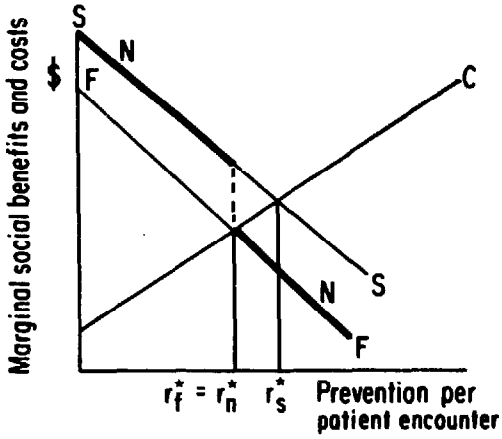

Fig. 1. Optimal prevention under first party, negligence and strict liability.

curve labelled CC shows the marginal cost of care. The discontinuous heavy line NN shows the marginal social benefits of care under a negligence rule with the due care standard, r_n^*, optimally set equal to r_f^*, the level that would be chosen by fully informed patients. NN is discontinuous at r_n^* because for levels of care that equal or exceed that level, the physician meets the due care standard; hence he bears no liability.

Type 1 errors (failure to file or find liability in all instances of negligence) or a suboptimal penalty if negligent imply a downward shifting of NN. Provided the vertical segment of NN intersects CC at r_n^*, physicians will still choose to be non-negligent. But if the Type 1 errors are sufficiently large, the intersection occurs to the left of r_n^*. It is then cheaper for physicians to practice with less than due care and to purchase liability insurance than to be non-negligent.

Type 2 errors consist of setting the standard to the right of r_n^*. As long as $r_f^* < r_n < r_s^*$, physicians will meet the standard. But if $r_n > r_s^*$, it is cheaper for physicians to choose r_s^*, i.e., to practice below the excessively high standard set by the courts and to insure against the resulting claims. Patients are thereby better off than if physicians adhered to the excessively high standard, but are worse off than if the standard were set at r_n^*, because medical fees rise to cover the additional prevention costs $(r_s - r_n^*)$ and physicians' uninsured disutility of suit.[13]

[13]In principle, the additional cost of liability insurance is offset by a reduction in first party insurance costs.

Casual evidence suggests that Type 1 errors dominate the demand for liability insurance. In medical and other lines of professional liability, the courts defer to the customary practice of professionals 'in good standing' as the standard of due care, rather than apply the Hand cost–benefit calculus in each case. This creates a bulwark against Type 2 errors for above-average physicians but a presumption of Type 2 errors and consequent incentive to insure for those of below-average competence. Thus the Type 2 errors hypothesis would predict that a substantial fraction of physicians would not buy insurance, which is not the case. On the other hand, Type 1 errors, which give all physicians an incentive to buy insurance, are very common. Rough estimates suggest that at most 1 in 5 incidents of medical malpractice give rise to a claim, and of these less than 50% are compensated.[14]

3. Optimal liability insurance

Perfectly informed insurers. Given errors by the courts in applying the negligence rule, the optimal liability insurance policy (with zero load) would provide full coverage of invalid claims (Type 2 errors) and zero coverage of valid claims, assuming insurers could costlessly distinguish between valid and invalid claims. The purpose of insurance would be protection against the risk of judicial error – a risk that is beyond the control of the physician. Such a policy would preserve optimal deterrence while providing full coverage of claims for injuries not worth preventing. But obviously if the information necessary to operate such a policy were available to insurers, it would be optimal for the courts to use the information and eliminate the errors which generated the demand for insurance in the first place.

Imperfectly informed insurers. In analyzing the optimal liability policy when the insurer cannot costlessly monitor the physician's care ex ante or discriminate valid from invalid claims ex post, let us consider first the contract that would be a private optimum, from the standpoint of the physician.

Damages coverage. Assume initially that courts adjudicate all claims costlessly, with some random error that cannot be influenced by legal defense

[14]Danzon (1985). Based on a review of a random sample of hospital records, CMA (1977) found a rate of iatrogenic injury of 4.65 per 100 admissions. Of these, 17.07% (or 1 per 126 admissions) were determined by the reviewers to be instances where liability probably would be found (p. 97). Based on these injury rates, the estimated number of negligent injuries in California hospitals in 1974 was 23,800. Averaging over 1976–1978, the number of malpractice claims filed arising out of hospital-based injuries was roughly 2,376 [NAIC (1980)]. This implies at most 1 in 10 malpractice victims filed a claim. Since 1978, the frequency of claims has roughly doubled; there are no current data on iatrogenic injury rates. Assuming no change in the number of negligent injuries (which is plausible if the rate of admissions has increased but the rate of injury per admission has decreased), the current frequency of claims per negligent injury would be 1 in 5.

effort, such that the demand for liability insurance is only to cover damage payments to plaintiffs. For damages insurance alone, many of the results from analyses of optimal first party insurance contracts apply.[15] Assuming that both the probability and size of loss depend to some degree on the physician's care, optimal co-payment would include a deductible and co-insurance. Since the risk being insured against is invalid claims, it may be optimal for the insurer to invest in information beyond the simple fact that a claim was filed, in order to determine the probable validity of the claim. In particular, if courts are better informed than are claimants, such that valid claims have a higher probability of a plaintiff verdict, then optimal co-payment would be higher on claims the plaintiff wins than on claims the plaintiff loses. But if court error is significant, it may pay for the insurer to undertake an independent review of claims and require co-payment only on those which the reviewers deem negligent, rather than rely on the judicial process and require co-payment on all paid claims.

The optimal co-payment rate on paid claims is lower (optimal level of coverage is higher), the higher the ratio of invalid to valid claims and the higher the cost to the insurer of discriminating between valid and invalid claims ex post. This is because co-payment can only affect the physician's level of care. But by assumption of a high ratio of invalid to valid claims, increased effort at injury prevention has little impact on liability losses.[16] One important implication is that if it is very costly for patients, courts and insurers to distinguish between valid and invalid claims, optimal coverage is highest for those specialties where the normal risk of adverse outcome, given non-negligent care, is relatively high.

These conclusions are derived from the principles of first party insurance, where the policyholder insures against loss to himself and the policy which maximizes policyholder utility is also socially optimal. This presumption may not apply to insurance against liability to third parties, particularly in the case of personal injury involving irreplaceable loss. Thus there may be divergence between the private optimum (for the physician policyholder) and the socially optimal liability insurance contract.

However the analysis above implies that physicians' choices of liability insurance will also be socially optimal provided either (1) patients perceive risks accurately, such that the value they place on safety is reflected in fees they are willing to pay for medical care, or (2) tort damage awards are set to correct for patient misperceptions or other social costs that are not inter-

[15]For example, Mossin (1968), Arrow (1970), Zeckhauser (1970), Harris and Raviv (1978).

[16]This is analogous to Shavell's result in the first party context, that optimal coverage approaches complete coverage if the cost of care is very high [Shavell (1979)]. I ignore here the possibility that invalid claims may be non-random across physicians, being determined partly by a physician's practice characteristics (type of patient, case complexity, bedside manner). This is considered in part 4.

nalized through medical care markets. Thus competitive liability insurance markets will tend to devise monitoring and contract terms which distinguish Type 2 errors from valid claims. Provided damage awards are optimally set, such contracts will also be socially optimal, because by definition Type 2 errors are claims for injuries not worth preventing.

Legal defense insurance. The analysis so far has assumed that the outcome of a claim, once filed, depends only on an exogenously determined decision of the courts. In fact, the outcome can be greatly influenced by the legal effort of plaintiff and defendant.[17] The need to provide for legal defense alters the form of the optimal liability insurance contract considered so far.

If the defendant physician were risk neutral, knew the production function of legal defense and could costlessly monitor the defense effort, he could hire defense attorneys by the hour. To the extent physicians are risk averse, they may seek insurance against such expenditures. In considering the optimal form of insurance for both legal defense and damage payments to plaintiffs, note that the physician's effort at injury prevention now affects the loss of both the legal defense insurer and the damages insurer; and the liability loss of the damages insurer also depends on the legal defense effort of the physician or his legal defense insurer.

For several reasons, it is likely to be efficient to provide legal defense insurance together with damage insurance in a single policy. First, since both the legal defense insurer and the damage insurer face a risk of moral hazard with respect to the physician's incentives to prevent injuries, economies of scale argue for a single monitor. Second, if the physician has full damage insurance which is imperfectly experience rated, his incentive for loss reduction by legal defense effort is reduced. Thus if the damage insurer were not also the legal defense insurer, he would have to monitor the physician's legal defense effort. But with incomplete damage coverage, both the physician and the damages insurer would have a stake in monitoring the legal defense effort. If the damages insurer has greater expertise in monitoring legal defense because of more frequent usage, this is a further reason for combining legal defense with damages insurance.

Summarizing, liability losses create a demand for both legal defense and damage insurance. It is likely to be optimal to provide both in a single policy, to prevent duplicative monitoring of the policyholder's effort at injury prevention and duplicative monitoring of defense attorneys.

However, combining legal defense and damage coverage in a single liability insurance policy creates a reverse moral hazard risk. The physician is exposed to moral hazard with respect to the insurer's legal defense effort,

[17]Plaintiff and defense legal expenditures each average about one half of net compensation received by plaintiffs.

unless the insurer bears the full cost of damages. But damages coverage with zero co-payment would undermine the physician's incentives for injury prevention. Moreover if the coverage for damages does include a co-payment but related to valid claims only, as was argued would be optimal, physicians would want to monitor the drawing of the distinction between valid and invalid claims. Absent such monitoring, the insurer has an incentive to declare all claims valid and hence subject to co-payment. Thus where both the insurer and the policyholder can affect the probability or size of loss, no simple loss sharing contract can simultaneously provide both with correct marginal incentives. In general, if it is costly for physicians to monitor the liability insurer's legal defense effort, the optimal level of co-payment is likely to be lower than on a first party coverage with comparable policyholder moral hazard in injury prevention.

To see the effects of insurer moral hazard on the physician's optimal co-payment, assume that the size of loss, D, can be reduced by the insurer's defense effort, f, with $D_f<0$, $D_{ff}>0$. The insurer's potential liability is simply the physician's level of coverage Q, which may be defined as some fraction (t) of the potential loss $Q=tD$. If it is prohibitively costly for physicians to monitor the defense effort, the insurer's incentive is to select f to minimize the sum of liability and defense costs

$$\min_f tD+f.$$

The insurer's optimum is implicitly defined by $tD_f=-1$, whereas the physician's optimum is defined by $D_f=-1$. This familiar distortion of share contracts decreases with t ($\partial f/\partial t>0$), and $D_t[=D_f(\partial f/\partial t)<0]$. The (absolute) value of D_t is lower, the better informed are physicians, so deviations from the strategy which minimzes total cost are reflected in decreased demand for the insurer's product.

Assume that physicians perceive the general relationship $D(t)$, although they cannot detect lapses on individual cases. The physician's objective function is then (substituting $Q=tD$)

$$\begin{aligned}\max_{t,r,s}\phi=&(1-p)V_1[B-s]+pV_0[B-s-L+D(t)]\\&+\mu\{(1-p)U_1[A+s-c(r)-\lambda ptD(t)]\\&+pU_0[A+s-c(r)-\lambda ptD(t)-D(1-t)]-U^c\}.\end{aligned}\tag{10}$$

The first order term for optimal coverage is

$$V'_0 D_t + \mu\{-\lambda D\bar{U}' + DU'_0 - D_t[t\lambda\bar{U}' + (1-t)U'_0]\} = 0, \tag{11}$$

which may be compared with eq. (7). When D is endogenous, an increase in coverage which increases legal defense effort reduces the physician's liability and insurance premium costs (the term in square brackets) but reduces patient utility ($V'_0 D_t$). In the likely event that patients are unaware of the effect of t on D, eq. (11) reduces to

$$\lambda\bar{U}' = U'_0[t/(t+E_{D,t})], \tag{12}$$

where $E_{D,t}$ is the elasticity of D with respect to t. Since $E_{D,t}<0$, the term in square brackets exceeds unity. Thus from the physician's standpoint, optimal coverage is inversely related to $E_{D,t}$ (in absolute value).[18]

Optimal co-payment is even lower if defense effort also influences plaintiffs' incentives to file claims. In particular, a deductible undermines the insurer's incentive to fight claims which can be settled for less than the deductible. In the case of medical malpractice claims closed 1975–1978, 51% of claims closed without payment but with an average defense cost of $3,075, and for the 64% of claims that closed for under $3,000, legal expense exceeded damages paid.[19] Incurring defense costs in excess of damage payments is likely to be an optimal strategy only if it deters other potential claims. If a policy with a deductible did induce significant insurer moral hazard, the number of claims filed and closed with payment might rise sufficiently to offset any savings in injury prevention resulting from the physician's increased financial exposure.

How does legal defense affect the possible conflict between private and social optima? In principle, the contract which maximizes the physician's utility may also be socially optimal provided patients know the physician's choice of coverage, perceive its effects on incentives for prevention and legal defense, and this is reflected in their willingness to pay for the physician's services. In this case, physicians internalize all consequences of choosing a higher level of coverage. Each individual patient may anticipate a lower award if injured, but also benefits to the extent legal effort deters invalid claims and excessive awards, thereby controlling the cost of liability insur-

[18]In the first party context, there are two analogs of insurer moral hazard. First, the insurer has an incentive to try to deny valid claims, but this incentive is mitigated rather than exacerbated by the insured's retention of risk. Second, Doherty (1976) has shown that a monopolistic insurer may have suboptimal incentives to encourage loss prevention, if the demand for insurance falls by more than the cost when losses are reduced. In the liability insurance context, a monopolistic insurer may have suboptimal incentives to encourage loss reduction through both legal defense and injury prevention.

[19]NAIC (1980, p. 34).

ance which is passed on in medical fees. More plausibly, if patients lack this information, the contract which is preferable to the physician is not necessarily socially optimal. In particular, the physician's co-payment may be too low and defense effort may be too high: from a social standpoint, too many resources may be devoted to fighting claims, and too few to injury prevention. However this conclusion of excessive effort at legal defense ignores the social value of litigation in setting precedents and enforcing standards. Once these factors are recognized, unconditional conclusions about the efficiency of insurance contracts evolved in competitive markets are approximate at best.[20]

4. Evidence from malpractice insurance markets

The theoretical analysis has suggested that the problem of distinguishing valid from invalid claims and monitoring legal defense are important factors distinguishing liability from first party insurance. This section identifies features of malpractice insurance markets which provide rough evidence to support this theory.

Sources of coverage. Prior to 1975, malpractice insurance was underwritten by major commercial insurers. The market was dominated by group programs sponsored by local medical societies, which enlarged their market share from under 30% in the early sixties to over 70% by the early seventies. Typically, such programs guaranteed coverage to all members of the medical society. Physician representatives participated actively in underwriting, and claim handling and determining the premium rate structure, subject to the carrier's estimate of the total required premium volume. Following the malpractice insurance 'crisis' in 1975, physician-owned mutual insurance companies were formed in several states.[21] By 1985, these 'bedpan mutuals' had grown to over 40% of premium volume nationwide. Thus in contrast to most lines of insurances, policyholders have played an active role on the supply side of the market. This is consistent with the need for policyholder monitoring of the insurer's legal defense effort.

Rating. Premiums are typically based on limits of coverage, medical speciality and geographic location. Larger states have a finer classification of specialties and territories, suggesting that the relatively small pool of

[20]The enforcement value of private litigation is discussed in Ordover (1978) and Shavell (1982b).

[21]The crisis resulted from premium increases of up to 500% in some states and/or withdrawal of commercial carriers in states where requested rate increases or changes in policy forms were denied by insurance regulators. Danzon (1985) discusses other reasons for the growth of mutuals.

policyholders may be an actuarial constraint on more refined rating, including more use of merit rating. Individual rating on the basis of exposure is limited to surcharges or explicit exclusions for specific procedures, such as X-ray or shock therapy, and surcharges for partnerships and employees. There is no rating on the basis of volume of business, except for a crude adjustment for part-time practice.

To the extent rating on the basis of individual claim record exists, it is in the form of a surcharge for multiple claims, rather than an automatic deductible or co-payment. These merit rating programs are consistent with the hypothesis that the risk being insured against is Type 2 claimant and court error, so information to distinguish valid from invalid claims would be used. For example, one mutual company levies a surcharge of $2,500 per claim for more than one claim *paid* over $10,000 (or considered indefensible) in a three year period. Another mutual imposes a two year surcharge of 10% of premium for one 'transgression', 20% of premium for two transgressions and would probably terminate the policy after more than two. A transgression is defined by physicians on the board, on the basis of a review of claims and characteristics of the policyholder's practice. A similar subjective review process is used in screening applicants rather than a mechanical rule based on claim history.[22]

A review of the rating structure tends to understate the degree of individual rating for several reasons. First, if some companies use claim history in selective underwriting and are able to offer lower rates, this creates an incentive for risk reduction to potential applicants. Second, although policies do not contain an explicit deductible, there is an implicit deductible in the uninsured costs a physician incurs if he is sued. These time and reputation costs are hard to quantify but the fact that policies typically preserve the physician's right to refuse to settle indicates some degree of exposure.[23] A rough measure of these costs may be obtained from amounts awarded in countersuits by physicians against unsuccessful claimants for malicious prosecution. As of 1981 compensatory awards ranged from $2,000 to $35,000 – a non-trivial implicit deductible.[24] In addition, non-linear pricing for high levels of coverage may act as a crude substitute for individual rating [Rothschild and Stiglitz (1976)].

[22]Personal communication with underwriters. A policyholder might be penalized for non-cooperation in settlement, but he would not be penalized for a claim where, in the opinion of the reviewers, an award or settlement was made simply to compensate a severely injured plaintiff, without evidence of medical negligence, i.e., a Type 2 error.

[23]Some policies cover the policyholder's out-of-pocket expenses and a per diem for trial appearances.

[24]Taube (1981). Additional amounts for punitive damages, ranging from $6,000 to $50,000, have also been awarded. To the extent uninsured costs vary with the severity of the injury, because severe injuries take longer to settle and are more likely to go to court [Danzon and Lillard (1983)] there is a hidden coinsurance rate.

Nevertheless, the empirical evidence suggests that the typical medical malpractice policy includes fewer explicit forms of risk retention to control moral hazard – deductibles, coinsurance or surcharges – than the typical liability policy for other professionals or for product liability,[25] which also cover legal defense. Moreover the very limited evidence suggests that the distribution of claims among physicians is not random and more individual rating is actuarially feasible than in fact occurs.[26] The following section therefore examines institutional features of medical markets that may reduce the demand for risk retention in medical malpractice insurance and distort the physician's choice of insurance and prevention.

5. Institutional factors affecting the demand for risk retention

Heterogeneous patients. A non-random distribution of claims among physicians could arise for reasons other than differential levels of care, for example, if courts set a uniform standard but patients are heterogeneous and some physicians systematically treat higher risk patients. Competitive insurance markets would still be expected to develop a merit rated policy, since competition generates pressures for actuarially correct pricing. The welfare gains would be limited to market as opposed to individual deterrence, affecting the frequency of treatment rather than care per treatment. However, if medical fees cannot be raised to high risk patients,[27] but physicians feel an obligation to treat such patients, they might as a group resist malpractice rating on the basis of claim experience. This may be a factor which distinguishes the medical profession from other professions. Just how important it is empirically cannot be determined without data on the claim histories and practice characteristics of individual physicians.

The incidence of costs. Health insurance permits the shifting of some costs from the individual patient and physician to patients and taxpayers in general. Roughly 88% of inpatient hospital care and 63% of physicians' services are covered by health insurance [Gibson, Waldo and Levit (1983)],

[25]Deductibles are common in professional liability policies of attorneys, architects and engineers, corporate officers and directors, and accountants [Munch and Smallwood (1979)]. Machine tool manufacturers reported average deductibles of $80,000 on product liability coverage in 1978 [U.S. House of Representatives (1979)].

[26]Data on claims against 8,000 physicians in California over a four year period show that 46 physicians (0.6%) accounted for 10% of all claims and 30% of all payments. Rolph (1981) shows that this is inconsistent with a purely random distribution of claims and awards, after controlling for specialty. Four years of data on past claim experience provide as much information for predicting a physician's claims rate as knowing his specialty.

[27]The problem is lack of an objective, measureable indicator of a high risk patient. To rely on subjective reporting by the physician would expose the health insurer to moral hazard. This may explain why malpractice premiums are rated on the basis of high risk procedures, but not high risk patients.

and over 80% of persons with private insurance are covered through employment [U.S. Bureau of the Census (1985)]. Because employment-based group health insurance premiums are not individually experience rated and are tax-exempt, whereas out-of-pocket health expenditures are not, medical costs which are covered by health insurance appear to be subsidized to the individual patient and physician.

Reimbursement practices of health insurers tend to distort the relative price of prevention and insurance, as perceived by the physician, in two ways. First, malpractice premium costs are reimbursed by health insurers more readily than are the physician's out-of-pocket (retention) liability costs, at least under the usual, customary and reasonable (UCR) fee-for-service system of reimbursement. Health insurers typically set an upper limit on the maximum allowable charge per procedure, and pay the lesser of the physician's actual fee or the maximum allowable charge, minus the patient's coinsurance percentage. Maximum allowable charges for Medicare patients include an explicit allowance for average malpractice insurance premium costs, but not for an individual physician's out-of-pocket malpractice costs such as a deductible or premium surcharge.[28] Private insurers typically set the maximum allowable charge for each physician by reference to charges of other physicians in the locality. Thus liability premium costs which are common to all physicians can be reimbursed more readily than can deductibles or premium surcharges specific to a few individual physicians.[29]

Second, the fee-for-service reimbursement system tends to raise the relative cost of the physician's time as an input in care. Whereas additional procedures, such as X-rays or lab tests, can be reimbursed in full, the cost of additional physician time per procedure, beyond that implicitly reimbursed by the allowable charge, is borne by the patient or the physician. Effectively, this places a tax on the physician's time, raising the opportunity cost of time relative to tests and raising the opportunity cost of injury prevention, relative to liability insurance. This distortion in relative prices creates an incentive to substitute tests for time in prevention, and to substitute liability insurance for prevention of injuries.[30]

To demonstrate the effect of the pass-through of costs on the physician's choice of insurance and prevention, let

a = physician's share of malpractice premium costs,

[28]The maximum allowed increase in Medicare fees each year is based on a cost index, of which average malpractice premiums are one component.

[29]This argument presupposes collusion by physicians in choosing their malpractice insurance coverage. Such collusion is not implausible in view of the role of the medical societies in running malpractice insurance programs.

[30]For the most common procedures, such as office visits, fee schedules do recognize multiple levels of complexity. A formal model of how the fee-for-service system may distort the physician's choice of own time and tests is developed in Danzon (1980b).

b = physician's share of retention $(D-Q)$,
g = physician's share of prevention costs.

The physician's objective function (ignoring consumer misperceptions) is now

$$\max_{Q,r,s} \phi = (1-p)V_1[B-s] + pV_0[B-s-L+D]$$
$$+\mu\{(1-p)U_1[A+s-gc-a\lambda pQ]$$
$$+pU_0[A+s-gc-a\lambda pQ-b(D-Q)]-U^c\}. \tag{13}$$

First order conditions are

$$a\lambda \bar{U}' = bU_0', \tag{14}$$

$$\mu = \bar{V}'/\bar{U}',$$

$$gc' = -p'[(V_1-V_0)/\bar{V}' + (U_1-U_0)/\bar{U}' + a\lambda Q]. \tag{15}$$

$a=b=g=1$. The physician bears all costs and the results derived above apply. The physician buys less than full coverage, on account of the positive load [eq. (14)]. Optimal prevention exceeds the cost-minimizing level, on account of the uninsured costs of patients and physicians [eq. (15)].

$a=b=g=0$. If all costs are passed through, Q is indeterminate. Since r^* is determined by

$$(V_1-V_0)/\bar{V}' = (U_0-U_1)/\bar{U}'$$

a finite value of r^* may require negative prices.

$0<a=b=g<1$. If the physician bears a uniform fraction of insurance, prevention and retention costs, choices are undistorted only if insurance is actuarial ($\lambda=1$), the patient is fully compensated ($V_1=V_0$) and the physician is fully insured ($U_1=U_0$). If these conditions are not met, effects on level of coverage and prevention effort are ambiguous.

$0<a<b<g<1$. The assumption $a<b$ applies if liability insurance premium costs are passed on more readily than retention costs. The case $a<b<g$ applies if prevention requires additional physician time costs, which are less readily passed on. Both conditions are plausible under fee-for-service reimbursement. From the first order conditions for coverage

$$\frac{U_1'}{U_0'} = \frac{b/a\lambda - p}{1-p} \gtrless 1 \quad \text{as} \quad b \gtrless a\lambda.$$

If $b > \lambda a$, i.e., the physician's share of retention costs exceeds his share of premium costs times the load, more than full coverage is desired. From eq. (15), with no load and full compensation, prevention is less than the cost-minimizing level

$$c' = -p' \frac{a}{g} Q. \tag{15'}$$

For a given $\lambda > 1$, prevention is lower than in the case of a uniform pass-through ($a = b = g$), due to both the higher relative price of prevention and the increased level of coverage, which narrows the pay-off to prevention in terms of the physician's utility ($U_1 - U_0$).

Summarizing:

(1) Cost pass-through at a uniform rate does not distort the choice of insurance and prevention if insurance is actuarial and losses are fully compensated. When insurance contains a load, the insurance/prevention mix is affected, but the direction is ambiguous a priori.
(2) If the physician bears a lower fraction of insurance costs than retention costs, coverage is higher than with no pass-through. Full coverage may be chosen, even if premiums contain a load, if the physician's share of retention exceeds his share of premium costs times the load.
(3) If the physician bears a higher fraction of the cost of own time than of insurance or other prevention inputs, he will substitute away from the relatively unsubsidized input. This 'tax' on own time may explain the common perception that the malpractice system does not deter negligence but simply results in high malpractice premiums and excessive tests (defensive medicine).[31]

This conclusion, that private health insurance contracts induce suboptimal physician effort at injury prevention, appears to conflict with the presumption that competitive first party insurance markets generate optimal contracts. This apparent paradox derives in part from the tax subsidy to health insurance, in part from the fee-for-service form of payment for health services, which offers some advantages as a solution to the agency problem

[31]Another factor encouraging substitution of tests for time in prevention is that performance of tests and other procedures may be more easily verifiable by the courts than the amount of time or effort, and therefore will be used as a proxy for the (unobservable) true standard of care. Spence and Zeckhauser (1971) show that the use of some proxy as a signal for the true level of care creates incentives for overinvestment in that proxy.

of health care, although it may induce some resource misallocation, including distortion of the insurance/prevention trade-off noted here. To the extent prospectively-determined capitation reimbursement replaces fee-for-service, distortions in the physician's choices of prevention and liability insurance should be reduced.

Professional politics. A striking feature of the malpractice insurance market is the active role of physicians on the supply side, through physician-owned mutuals and group programs sponsored by medical societies, in which physicians participate in setting rates, including specialty differentials and individual surcharges. Collective influence may contribute in two ways to the high observed levels of coverage and lack of retention. First, as argued above, if average premium costs can be passed on as higher allowable charges but out-of-pocket malpractice expenses cannot be, physicians as a group have an incentive to collusively opt for higher levels of coverage than they would do individually. Second, if high risk individuals dominate in physician-sponsored programs or companies, policies offered may reflect the preferences of a relatively high risk group within the profession, who prefer a policy with more complete coverage and less individual rating than would the majority of physicians.

The reasoning in section 3 implies that if surgical specialties have a higher ratio of invalid to valid claims, because of higher risk of adverse outcome despite due care, then surgeons would prefer a lower rate of co-payment than non-surgeons. There is some evidence to support the hypothesis that the preferences of surgeons dominate sponsored programs. An analysis of malpractice premiums paid in 1974–1976 showed that in states dominated by a sponsored program, surgeons paid 3–8% lower premiums and non-surgical specialties paid roughly 10% higher premiums than in states where the leading insurer did not write through a program.[32] However an alternative explanation of this finding is that the influence of the medical profession generates a pricing structure that is actuarially more correct, whereas the commercial companies may attempt to price-discriminate against surgeons, whose demand for coverage is likely to be less elastic. Unfortunately data are not available to discriminate between these hypotheses.

The extent to which physician-dominated companies or programs can effect a subsidy from low to high risk physicians is limited by the availability of alternative sources of coverage for the low risks. Firms writing in the individual market may not be effective competition to group programs because individual writers face higher marketing costs, higher costs of

[32]Danzon (1980a). These effects cancel out, so premiums averaged over all specialties are no different in dominant program states. One mutual explicitly prices to subsidize surgical specialties, on grounds that the non-surgeons benefit from referring surgical cases.

accurate actuarial information and of meeting regulatory requirements, and risk of adverse selection.[33] The declining share of the market written as individual policies confirms their comparative disadvantage. But in the absence of barriers to entry by mutuals catering to low risks, one must infer that the typical policies with complete coverage and little individual rating are preferred by the majority of physicians.[34]

6. Policy implications

There are no simple policy implications of this analysis. The negligence rule of liability is potentially superior to a rule of first party liability for adverse outcomes of health care, because of information and monitoring costs facing patients. In principle a standard of due care, compensatory and punitive damage rules can be devised that represents a first best solution to the problems of optimal prevention of injuries and compensation for those injuries that occur despite optimal care. If courts were perfectly informed, liability insurance would not interfere with physicians' incentives for injury prevention because there would be no demand for insurance: it would be cheaper to prevent than to insure those injuries that would be deemed negligent.

In practice, imperfect information leads to Type 1 and Type 2 errors by courts in applying the negligence standard, and hence to a demand by physicians for liability insurance. Because insurers, like courts, lack the information to distinguish valid from invalid claims, liability insurance cannot be perfectly experience rated.

Co-payment, which is the standard solution to the moral hazard problem created by insurance in first party coverages, is an even less ideal solution in the case of liability coverage, because it tends to encourage moral hazard on the part of the legal defense insurer. In liability insurance, co-payment induces a trade-off between loss reduction by injury prevention and by legal defense. Typical malpractice insurance policies provide virtually complete coverage of monetary losses. This may be optimal for the average physician because of uninsured time and reputation costs of suit, the need to control moral hazard on the part of the legal defense insurer, and the effective subsidy to liability insurance that results from health insurance reimbursement policies.

[33]In sponsored programs, the medical society owns their claim experience and makes it available to potential bidders for the program. If the society approves the rates, regulatory approval is virtually guaranteed (private communication with underwriters).

[34]This conclusion applies to the extent that risk of suit depends on readily observable characteristics, such as medical specialty. To the extent that there are unobservable differences in the propensity for suit among physicians within a given specialty, the absence of a low coverage policy for low risk physicians may result from adverse selection risk [Rothschild and Stiglitz (1976)].

But in the case of liability insurance against losses to third parties, there is no presumption that the policy which maximizes policyholder utility is also socially optimal. Private and social optima coincide only if injurers and victims are in a contractual relation and both correctly perceive risks – but in such markets there is no need for third party liability – or if tort awards are designed to correct for misperceptions. However given the susceptibility of court decisions to legal effort, all conclusions on optimal liability rules and optimal insurance contracts become tentative.

If it were known that the net effect of all these factors were inadequate incentives for prevention, would that establish a case for an uninsurable fine or punitive damage award, or a mandatory deductible or limit on coverage?[35] In general there is no guarantee that either policy would necessarily raise prevention. The ambiguity arises because an increase in the physician's expected loss raises the marginal utility cost of prevention as well as the expected pay-off. It is shown in appendix B (available from the author) that an uninsurable fine will increase prevention only if

$$|E_{p,c}| > \frac{\rho g c}{A},$$

where $E_{p,c}$ is the elasticity of the loss probability with respect to the cost of prevention, ρ is the relative risk aversion parameter, g is the physician's share of prevention costs, and A is his initial wealth. Thus the impact would be greatest on prevention inputs whose cost can be shifted – which may already be utilized excessively.

The case for limiting the intervention of the medical profession on the supply side of the insurance market is even weaker. It is possible that this intervention distorts the choice of policy towards one with less risk retention – and hence less incentive for prevention – than might be socially optimal or preferred by the average physician, but the evidence is ambiguous. On the other hand, physician input performs a useful function in screening applicants, discriminating between valid and invalid claims, and monitoring the insurer's defense effort on behalf of policyholders. The more insurer moral hazard can be controlled by monitoring, the more policyholder moral hazard can be controlled by co-payment.

The unambiguously useful reform would be one which improves the accuracy of court decisions by means other than expenditure by the litigants. In that case, the system would work in practice as it should in theory, and there would be no demand for liability insurance. It is easier to point to the need for such a reform than to devise it.

[35]These two options differ in that, with a deductible or limit on insurance coverage, the cost of insurance should fall so there is an additional income effect on incentives for prevention.

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