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Torts, Expertise and Authority:
Liability of Physicians and Managed Care Organizations

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Torts, Expertise and Authority: Liability of Physicians and Managed Care Organizations

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Abstract

The goal of this paper is to examine optimal individual and entity-level liability for negligence when expected accident costs depend both on the agent's level of expertise and the principal's level of authority. We consider these issues in the context of physician and managed care organization (MCO) liability for medical malpractice. It is shown that the standard rules for the determination of negligence and damages do not result in an efficient outcome when only physicians are held liable for their torts, but is restored if MCOs are held solely liable for the torts committed by their physicians. There is a damage rule that induces the efficient outcome when physicians are held liable for their torts, however these damages are a complex function of the details of the MCO contract.

1 Introduction

The purpose of this paper is to explore the proper scope of physician and managed care organization (MCO) negligence liability for medical malpractice. Specifically, we determine how the exertion of control by the MCO over physician decision making affects the optimal damage award when a tort is the result of either physician negligence or the recommendation of suboptimal treatment by an MCO. It is shown that when the MCO is liable for all torts, including those committed by its physicians, then the standard rule for damages results in the second-best efficient outcome. However, current law considers physicians covered by a managed care plan to be private contractors, and hence they are personally liable for their torts. It is shown that the optimal damage award is a function of the details of the MCO contract with the physician. In particular the optimal damage award is, under reasonable parameter values, *higher* then the award determined by current law.

The reason is that in contrast with traditional fee-for-service insurers, MCOs are not simply passive insurers whose role is limited to paying for any treatment provided, but seek to affect care directly through the use of a "utilization review". Under a "utilization review", MCO review proposed treatments, denying coverage for any treatment the MCO deems to be either "experimental" or not "medically necessary." An MCO denying coverage for one treatment often does so with the understanding that it will pay for another treatment. This decision as to what treatment to cover often determines the treatment the patient receives – particularly in the case of serious illnesses with expensive treatments.

Although MCOs influence medical treatment, generally they are not liable for damages to patients resulting from an MCO's provision of negligent medical care. This is in contrast with physicians and other medical providers who are liable in tort for medical negligence. Moreover, although corporations generally are vicariously liable for employees' torts, MCOs generally avoid liability for negligence of their affiliated physicians because they are considered to be independent contractors, and not employees of the MCO. However, if the MCO contract affects the behavior of physicians, the first question is does this exercise of control affect the optimal damage award. Secondly, what would be the consequence of making MCOs liable for the torts committed by their physicians.

To examine optimal negligence liability for malpractice in a market dominated by MCOs, one must model the impact of utilization review on the expected quality and costs of the treatment provided by both MCOs and physicians. We introduce a model of malpractice that explicitly incorporates the role of MCO utilization

review that extends the model of authority in organizations developed by Aghion and Tirole (1997) to the liability context. Aghion and Tirole observe that principals do not limit themselves to regulating agents through incentive contracts in those circumstances where providing agents' optimal incentives does not eliminate the risk of bad decisions. In such situations – as occur when agents are not fully informed about the costs and benefits of their own decisions – the principal may attempt to improve the quality of the outcome by making the decision itself. The principal may assert "authority" over certain decisions, though only when the principal itself has the knowledge necessary to make a better decision (from its perspective).

Authority alters the principal-agent relationship beyond simply injecting the additional cost to the principal of acquiring the information. In those situations where the principal cannot obtain sufficient information to assert authority, the agent can reduce her risk of error by becoming more informed – by developing "expertise." This expertise affects the expected quality of agent decision-making in those circumstances where the principal does not assert authority. The key insight of the Aghion and Tirole model is that the agent's incentives to invest in expertise is affected by the degree of control exerted - when there is less control, the agent is more autonomous, and hence has more incentive to become informed. The greater the likelihood that the principal over-rules a decision, less influence the agent is likely to have over the decision, and thus the lower the agent's incentives to invest in making an informed decision.

This captures many of the essential elements of the MCO-physician relationship. The MCO-physician relationship is characterized by moral hazard: physicians may select overly expensive treatments when patients are fully insured. Were this the only problem, incentive contracts might suffice as a solution. In addition, physicians may select inappropriate treatments – either too costly or too low quality – unknowingly, for example because they incorrectly diagnose the patient or are incorrectly informed about the costs and benefits of the available treatments. Even though physicians can reduce this risk of error by investing in expertise, some risk remains. In response, MCOs employ "utilization review" to give them the right to determine treatment choice in some circumstances. When the MCO does not assert authority, the physician determines the patient's treatment. The expected quality of physician-selected treatment depends on the probability of physician error, and thus on physician expertise. Yet physician expertise depends on MCO authority: physician incentives to invest in expertise are lower the greater the likelihood that treatment choice is dictated by the MCO.[1]

Thus, this framework shows that ensuring optimal patient care requires more than simply ensuring that

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[1] The conclusion that MCO authority affects physician quality is consistent with evidence that MCO's affect physician's treatment quality even for patients who are not MCO subscribers. See Glied and Zivin (2000) (treatment quality depends not only on whether a patient is an MCO-subscriber, but also on the portion of a physician's patients who are managed care subscribers).

informed physicians *want* to provide non-negligent care. The expected quality and cost of patient care is instead the result of a complex interplay between the MCO's decision as to how frequently to overrule the physician and what treatment to provide when it does, and the physician's decision to acquire expertise needed to make informed treatment decisions. The questions are, what, if any, is the appropriate role of physician and MCO liability for negligence in regulating this complex relationship, and what are optimal damages?

These questions cannot be answered using the traditional analyses of liability within a principal-agent relationship as they do not permit explicit consideration of either physician learning or MCO authority. The traditional analyses, beginning with Kornhauser (1982) and Sykes (1984), are based upon the standard principal agent model, in which the goal is to modify the amount of care taken by an agent who is fully informed about the expected benefits and costs of her decisions.[2] Principals, in these models, do not affect outcomes directly. They influence care solely through incentives they provide to agents. Moreover, in these models, principals need not even intervene at all if agents are subject to optimal tort liability. In turn, tort liability is unnecessary if principals subject agents to socially optimal incentive contracts. By contrast, here, both the principal and the agent directly affect both treatment outcomes and each other's payoffs. Thus, the goal must be to ensure optimal decision-making by both principals and agents, under situations where each is potentially uncertain about the merits of his or her own actions. This case is particularly relevant for medical malpractice where much of the effect of liability is upon diagnosis, as shown recently by Kessler and McClellan (2002).

The analysis first considers the second-best optimal allocation of authority and expertise. The paper shows that the exertion of authority over the physician by the MCO can be socially optimal, even when informed physicians make better decisions than informed MCOs, if the risk of physician error is great enough. We then consider the potential role of the tort system by examining the outcome under private contracting when patients have accurate rational expectations, expertise and authority are noncontractable, and no sanctions are imposed for negligence.[3] We show that in this case physician expertise and MCO authority are not optimal, and hence even though the patient has rational expectations regarding MCO and

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[2] See also Chu and Qian (1995) who ue a principal-agent model to explore the effect of vicarious liability upon the incentives to reveal information.

[3] The level of MCO authority is likely to be non-contractible since it is based on the notion of "medically necessary" treatment, which is not defined in most MCO contracts. Physician expertise also is likely to be non-contractible. Licensing boards can ensure physicians meet certain bare minimum standards, but neither licensing boards nor patient contracts regulate exactly how much effort and attention the physician puts into keeping abreast of the latest developments and improving her skills throughout her career. See Gawande (2002) (providing an insightful discussion of the importance of, and difficultly in regulating, on-going physician investment in expertise).

physician behavior, the outcome is inefficient.(compare with Shavell (1980))

The article then examines the effect of individual negligence liability imposed for both physician negligence and negligent treatment decisions by MCOs. We find that physician expertise and MCO authority can be returned to their first best levels with the introduction of tort law that allows patients to seek damages for injuries resulting from negligent treatments. In contrast with existing law, however, liability must be imposed for both physician and MCO negligence. Failure to hold MCO's liable for treatment decisions results in both inefficient authority and inefficient physician expertise.

In contrast with the traditional model, where damages over the minimum optimal award do not affect behavior (see Cooter (1984)), here the efficiency of negligence liability is very sensitive to excessive damages because each medical provider faces an omnipresent risk of inadvertent error, medical providers inevitably face a risk of liability. Thus, excessive damages can distort behavior.

If the MCO and the physician cannot contract between themselves to impose reciprocal sanctions – for example, because of legal restrictions on such contracts – then tort damages must incorporate the cost to both the patient and the other medical care provider of inefficient authority or expertise.[4] In this case, the optimal damage rule is rather complex. For example, the optimal damage rule when the physician makes an error is equal to the harm caused *plus* the additional cost to the MCO of the patient receiving erroneous rather than informed treatment and super-compensatory damages are required. By contrast, damages are considerably simpler if the MCO and physician can contract to impose reciprocal sanctions on each other in the event of the other's negligence. In this situation, damages need only include the cost of negligence to the patient. Patient's losses, moreover, must be based on the expected cost to the patient of an uninformed decision, and not the patient's ex post injury. Thus, in the case of physician negligence, optimal damages equal expected benefit to the patient of informed rather than erroneous physician-selected treatment. This differential often will be less than the ex post harm suffered by the patient.

Finally, we consider whether liability for physician negligence is best imposed on the physician or the MCO. Although in some cases entity-level liability for MCOs achieves the identical result as individual physician liability for physician negligence, this result depends upon the physician not being judgement-proof (or risk averse), and providing services in a competitive market. If either of these conditions are not met, then the rule of MCO liability is strictly preferred to individual liability. Hence, we conclude that while individual liability can be made to work under some rather stringent conditions, it is never the case that entity-level liability makes things worst. By contrast, in some situations, particularly when physician

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[4]Although Epstein and Sykes (2001) suggest informally that making the MCO and physician personally liable for their own errors can result in the first best, they do not explore the impact of MCO authority on optimal damages.

assets are less than optimal, individual liability, (or the MCO has superior information regarding physician performance relative to the courts), entity-level liability with optimal damages can result in the first best.

2 Institutional and Legal Background

The health care industry provides two basic services: medical care and insurance. Under the traditional fee-for-service insurance, insurers pay for all treatment costs (minus a deductible); physicians select and provide treatment without interference from insurers. This system appears to result in excessively costly medical care because physicians and patients have little reason to consider treatment costs in selecting between treatments.[5]

Treatment quality also is a concern. Many patients are injured by negligent medical care.[6] Reducing medical negligence is difficult because physicians rarely provide substandard care knowingly. More often than not, physicians err accidentally, as a result of inadequate knowledge, training, or skill of medical personnel.[7] The traditional system vests physicians with primary authority over treatment decisions. Thus, the quality of care depends on each individual doctor (or practice group) obtaining sufficient expertise and skill to diagnose patients and assess all the available treatment.

Managed Care Organizations (MCOs) arose to address the problem of excess health care costs, while also offering the potential to improve care quality. They now dominate the medical insurer market.[8] Most MCOs control costs, at least in part, by requiring physicians to obtain prior approval for treatments through a process "utilization review."[9] Utilization review provisions generally give MCOs the right to deny coverage

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[5] E.g., Kessler and McClellan (1996).

[6] Medical error results in countless injuries and approximately 98,000 deaths per year: Kohn, Corrigan, and Donaldson (2000).

[7] Evidence suggests that 20% of all medical errors and 15% of serious adverse events result directly from medical personnel having inadequate knowledge or failing to employ knowledge they have. In addition, inadequate expertise also accounts for a significant portion of the medical error attributable to "systemic errors" (which comprises 60% of total errors). "Expertise"-related systemic errors include those attributable to medical residents performing tasks unsupervised that they are not qualified to perform; surgeons failing to update their practice protocols over times; and a general failure of physicians to adapt up-to-date guidelines and protocols. See Krizek (2000).

[8] As of 1997, only 2% of health plans conformed to traditional fee-for-service, while 98% of health plans are either managed care or fee-for-service with utilization review (Glied and Zivin (2000)). We use Managed Care Organization (MCO) to refer to any insurer which seeks to influence treatment choice, for example through utilization review. The term MCOs thus covers Health Maintenance Organizations (HMOs) as well as ostensible fee-for-service insurers which employ utilization review. Our results also may apply to physician groups in California, which perform many of the same functions as MCOs.

[9] Additionally, many MCOs use capitation agreements to regulate physician behavior. Capitation agreements are beyond the scope of this article.

for medical treatments that are either "experimental" or not "medically necessary and appropriate." The MCO discharges its utilization review responsibilities by employing trained medical personnel to compare a physician's recommended treatment against data the MCO has collected on prevailing appropriate diagnoses and medical practices. If properly implemented, this process can improve health quality by providing a centralized decision-maker who collects and analyses complex, national data on best medical practices.

At present, utilization review gives MCOs substantial authority to determine what treatments they will pay for. Patients face difficulties in challenging MCO decisions because the terms "experimental" and "medically necessary" are not always clearly defined in the contract. Moreover, MCOs generally assert the unilateral right to determine which treatments satisfy its standard. Patients often have no right to any external review of coverage denials. Indeed, MCOs have gag clauses that preclude physicians from effectively objecting to MCO treatment denials.[10]

The evidence suggests that utilization review has been effective at reducing treatment costs; its effects on expected treatment quality have been more variable. For some patients and types of diseases, utilization review appears to reduce costs without reducing expected treatment quality. For others, in particular the seriously ill or the poor, evidence suggests that utilization review reduces costs at the expense of lower expected treatment quality.[11]

Even when quality improves on average, some patients are injured by MCO coverage decisions that deny them appropriate treatment in favor of substandard care. This can occur intentionally or unintentionally. MCO contracts place sufficiently weak constraints on MCOs that an MCO can, if it chooses, reduce costs by providing substandard care at least in some cases.[12] Yet an MCO also can injure patients unintentionally, even when it is trying to improve expected quality. MCO must make initial treatment coverage decisions based on summary information that is less nuanced and patient-specific than the information available to a physician. This may result in an MCO denying a patient necessary and appropriate treatment. Moreover, these initial errors cannot always be remedied by permitting the patient to appeal and supply more detailed information. The initial denial can permanently injure the patient even when an appeal is success if the review process introduces sufficient delay that the patient can no longer benefit from the recommended treatment (or any other treatment).[13]

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[10] See, e.g., Havighurst (2001). Some states are seeking to mandate independent external review of treatment denials.

[11] Sullivan (1999)(controlling for coverage, a review of exsting studies suggests that MCOs provide either inferior or equal health quality).

[12] Market forces (reputation) may limit this, but imperfectly.

[13] Many suits by patients against MCOs arise in situations where the MCO eventually approves the treatment on appeal, but the treatment is no longer effective. E.g., Cicio v. Vytra Healthcare, 208 F. Supp. 2d 288 (2001)(after initial denial, Vytra approves cancer treatment after sufficient delay that the window of opportunity for the treatment to be effective had passed);

The present system regulates treatment quality in part through tort liability imposed for medical negligence. A physician who provides negligent medical treatment – as measured by the customary medical care – faces liability in tort should that treatment injure a patient. Many patients injured by medical negligence also are seeking to impose liability on MCOs. Patients face enormous hurdles in obtaining recovery from MCOs.

Generally, patients are pursuing two different types of claims against MCOs. Patients are filing direct actions against MCOs for negligent coverage determinations that result in the patient being injured by the denial of medically necessary and appropriate medical care. Yet, in contrast to physician negligence, both state and federal laws impose impediments to these suits. Many states do not permit recovery for negligent refusal to provide insurance coverage, even when it results in the patient receiving negligent treatment. Moreover in those states permitting such actions, patients' right to recover from MCOs under state law may be precluded by the federal Employee Retirement Income Security Act of 1974 (ERISA).[14]

Patients also are filing indirect claims against MCOs arguing that MCOs should be held liable for negligence by their affiliate physicians. ERISA is less likely to present a problem for these actions. The critical impediment appears to be state law governing entity-level liability. Under state law governing entity-level liability, MCOs are not liable for physician negligence provided the physician is an independent contractor – not an "employee" of the MCO – and the MCO ensured that its subscribers knew the physician was not an employee.[15] Most MCOs thus should be able to avoid liability for physician negligence because most MCOs do not actually employ physicians, but instead offer health care services through a network of independent contractors.

Congress currently is considering legislation that would significantly change the legal landscape for MCOs. Several proposals would amend federal law to permit state law tort actions against MCOs for personal injury or death against any person resulting from the denial of treatment coverage. Legislatures also are considering MCO liability for injuries resulting from physician negligence.

Pappas v. Asbel, D.O., 564 Pa. 407 (Penn. 2001) (patient rendered quadriplegic from failure to immediately treat abscess on spine as a result of health care plan's insistence on limiting transfer to a facility that could not treat him promptly); see also Davila v. Aetna, 307 F.3d 298 (2002) (Aetna initially denied physician recommendation that patient receive Vioxx, an arthritis drug with a low ulcer risk in favor of alternatives; patient developed sufficiently severe bleeding ulcers on alternatives that he can no longer take any pain medication, such as Vioxx, that is absorbed through the stomach).

[14] Employee Retirement Income Security Act of 1974, 29 USC § 1001-1461 (1974). See Langbein and Wolk (2000) (discussing ERISA preemption).

[15] An MCO is not vicariously liable for physician negligence unless the physician is the MCO's employee. Alternatively, the MCO may be liable under ostensible agency if the MCO holds the physician out as an employee and the patient relies on this. MCOs can avoid liability under ostensible agency by making sure that patients are informed that physicians are independent contractors and not employees.

3   The Model and Preliminary Analysis

Consider a three agent model consisting of a patient, insurer and physician. The patient delegates authority over treatment choice to a medical professional, either the physician or MCO. The MCO determines which medical professional selects treatment by deciding whether it will assert "authority" over treatment choice; if the MCO does not assert authority the physician selects the treatment. Physician-selected treatment has higher expected costs than MCO-selected treatment. In some cases it is higher quality, in other cases it is not. Physicians select higher cost treatment because the MCO – not the physician or patient – bears all treatment costs. Physicians select higher quality treatments than MCOs when physicians are "informed" because physicians benefit more directly from better ex post patient outcomes than MCOs, have superior more patient-specific information about optimal treatment (when informed), and are unconcerned about costs. Physicians can err inadvertently, providing suboptimal treatment that can injure the patient. The probability of physician error depends on her post-contractual investment in expertise.

The MCO potentially can lower treatment costs by asserting authority over treatment choice in favor of a lower cost treatment, when one is available. To assert authority, the MCO must invest in information and review systems. The probability the MCO over-rules the physician depends on the MCO's investment in such systems. The MCO only asserts authority when it can suggest a lower cost treatment which arguably is acceptable. In some cases, this treatment indeed provides the patient with the same benefits as informed physician treatment at lower cost. In other cases, the MCO's substitute low cost treatment is of suboptimal quality, and injures the patient. This could occur, for example, because it turns out that the physician was correct that this patient needed the more expensive treatment, but utilization review produced sufficient delays that this treatment is no longer effective.

Thus, we have the following decision sequence:

1. The patient contracts with an insurance company that is assumed to be in a perfectly competitive industry, and thus earns zero profits.

2. The insurance company then contracts with the physician, who is also assumed to be in a perfectly competitive market with a default utility of U^0.

3. The MCO and physician make non-contractible investment decisions: the level of authority in the case of the MCO and the level of expertise in the case of the physician.

4. If the patient falls ill, she contacts a physician for treatment. For simplicity this occurs with probability 1.

5. The physician recommends treatment, which may be over-ruled by the MCO in favor of an alternative treatment.

6. The patient is treated, and faces a chance of inadequate care.

7. The patient files suit if care is inadequate, and damages are positive.

The risk neutral and liquidity constrained patient seeks two types of medical services: medical treatment and insurance.[16] The patient seeks medical treatment from a physician who is the exclusive provider of medical services, while insurance is provided by a specialized managed care company (MCO) who reimburses the physician for treatment costs. MCOs are assumed to operate in competitive markets making zero profits. Thus, the patient's premium, P, equals the MCO's expected costs of providing insurance.

For any given illness there are a variety of possible treatments, $t \in T = \{1, ..., n\}$, with different consequences for the patient. The expected benefit of any given treatment is b_t, which is net of any expected adverse consequences, l_t. As b_t is an expectation taken over a distribution of potential outcomes resulting from treatment t, ex ante expectations can differ from ex post outcomes. The cost of providing the treatment is c_t, which is assumed to be borne by the insurer. The concept of a "treatment" is very general. It includes differences in treatment type (for example, medication or surgery), as well as differences in how and when a *given* procedure is performed. For example, a procedure performed immediately is a different treatment than the same procedure performed a week later if the delay affects the expected benefit (or costs) of the treatment.[17]

Notice, the provision of insurance does introduce a moral hazard problem, as first discussed by Pauly (1968). Ex ante – at the moment of contracting – the patient would like to contract to receive the treatment that maximizes the total expected benefit of treatment minus treatment costs. Yet once ill, the prospect of full cost reimbursement by the insurance company implies that the patient would like to receive the treatment with the maximum expected benefit, regardless of cost: this being treatment t^*, where $t^* = \arg\max_{t \in T}\{b_t\}$. The expected benefit of this patient/physician preferred treatment is given by b^*, with cost c^*.

The patient cannot select his own treatment because he has insufficient information to evaluate treatments and cannot control the care with which treatment is provided. Thus, the patient delegates authority over treatment decisions to medical professionals. The treatment decision may be made by the physician or MCO.

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[16] The patient and physician are assumed to be liquidity constrained to generate a market for insurance provided by someone other than the physician.

[17] Thus utilization review can affect treatment choice even if an MCO approves the physician-recommended treatment. The physician-recommended treatment (e.g., $\tilde{t}$) differs from the same treatment provided post-utilization review, $\hat{t}$, if the delay associated with utilization review materially alters expected patient outcomes or treatment costs.

Under an MCO insurance contract, the MCO determines the probability that the treatment decision is made by the MCO instead of the physician.

3.0.1 Physician Treatment Choice

The physician is assumed to care directly about the welfare of her patients, in addition to caring about any pecuniary rewards. In other words the physician prefers that the patient gets well.[18] To capture this, it is assumed that the physician's direct benefit from providing treatment t is given by αb_t, where α reflects either physician compassion, the impact of norms (e.g., the Hippocratic oath), or the effect of patient outcomes on physician reputation. Since b_t represents the full monetary benefit to the patient of a good outcome, it is assumed that $1 > \alpha \geq 0$.[19] Whenever $\alpha > 0$ then, in the absence of any pecuniary considerations, the physician chooses treatment t to maximize b_t, $t^* = \arg\max_{t \in T}\{b_t\}$. The absolute value of α is referred to as the physician's level of "compassion."

Although an informed physician would select treatment t^*, in practice the physician does not necessarily do so because she is not always correctly informed about the patient's condition and the relative merits of available treatments. When "uninformed" the physician inadvertently provides erroneous medical treatment, $\widehat{t}$. The assumption that physicians err accidentally as a result of being "uninformed" is consistent with evidence that many medical errors arise from a inadequate information or expertise.[20] Expected treatment $\widehat{t}$ is on average both lower quality and higher cost than expected treatment t^*, in that $\hat{b} < b^*$ and $\hat{c} > c^* > 0$, where $\hat{c}$ is the cost of erroneous treatment and $\hat{b}$ is given by the *expected* benefit of erroneous treatment.[21]

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[18] While such an assumption seems quite reasonable, it is not typically made explicit in most analysis of tort law, which focuses upon the level of care. However, when dealing with information issues it is important to be more explicit regarding the physician attitudes towards treatment decisions. The reason is that one job of the physician is to provide a diagnosis regarding the preferred treatment. The fact that a critical difference between the physician and the patient is expertise over treatments makes it difficult for the patient to verify treatment choice. The question then is how does one provide explicit incentives to invest in expertise. The standard solution to this problem is to make the physician face flat incentives, which combined with the compassion for the patient results in the best decision for the patient.

[19] As a practical matter it would never be reasonable to suppose that $\alpha = 1$. At an efficient allocation, it would be optimal to treat the patient and thus b_t would exceed total treatment costs, including physician salary. Hence if $\alpha = 1$ the physician could increase her welfare by fore-going her salary – and indeed subsidizing patient's treatment costs – in order to treat patients who would not otherwise be treated. The physician would, for example, offer to pay for treatment herself whenever the MCO denied coverage for optimal treatments.

The fact that $\alpha < 1$ also explains why one cannot solve the moral hazard problem in treatment choice by making physicians liable for all treatment costs. Thus, the fact that one cannot make the physicians residual claimants with respect to costs then provides an efficiency reason for the existence of MCO authority of physician decisions.

[20] See supra note .

[21] We assume that erroneous treatment is more costly in order to consider the role of physician expertise and MCO authority

The physician can reduce her risk of error by investing in "expertise" – by investing in her capacity to diagnosis illnesses and assess and provide treatments. We focus on one particular type of expertise: post-contractual investments that affect whether the physician is correctly informed regarding the best treatment for any and all of her patients.[22]   This expertise includes a physician's post-contractual efforts to improve her diagnostic skills, her understanding of the expected benefits of all available treatments, and her ability to provide treatments by doing rounds in a hospital, reading the latest medical journals, participating in continuing medical education, and attending conferences.[23]

Expertise reduces the probability of accidental medical error. To model this, we employ the approach of Aghion and Tirole (1997) , and assume that investment in expertise increases the probability e that the physician is "informed" – that is the physician can accurately assess the costs and benefits of the available treatments. The probability that the physician is uninformed is given by $(1 - e)$. The cost to the physician of acquiring expertise is given by $V_D(e)/\theta_D$, where θ_D represents the physician's innate ability and $V_D(0) = V_D'(0) = 0$, $V_D''(e) > 0$, and $\lim_{e \to 1} V_D(e) = \infty$. Expertise is assumed to be non-contractible, as it is either non-observable or non-verifiable. Though a physician knows her level of expertise – and thus her probability of err – she does not know when she is informed or uninformed.[24]   The expected benefit of the treatment provided by the physician is therefore $eb^* + (1 - e)\hat{b}$.

Although erroneous treatment is of lower expected quality than the patient's preferred treatment ($b^* > \hat{b}$), treatment $\hat{t}$ does not necessarily produce worse ex post outcomes. In other words, in some cases negligence does not produce a legally cognizable ex post injury. An actual example is an individual with meningitis who is sent home untreated, due to physician failure to diagnose her condition. A physician engages in medical negligence if she fails to diagnosis a patient with classic symptoms of meningitis because untreated bacterial meningitis generally is fatal in a matter of days. Yet a physician who engages in such negligence often causes no ex post harm to the patient: should it arise that the patient had viral meningitis, he will recover on his own without any treatment. To model the possibility of error that does not cause ex post injury, it is

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in correcting for potential physician error in situations where physician error not only reduces social welfare, but also is costly to both the patient and the MCO. The converse assumption would imply that, absent tort liability, a cost-minimizing MCO should endeavour to reduce physician investment in expertise, which is not something we observe in practice.

  This assumption also is plausible in that physician error often requires expensive corrective measures and longer hospital stays.

[22] For an interesting discussion of the importance of on-going physician training to physician skill and patient welfare see Gawande (2002).

[23] Our model of expertise also captures other post-contractual physician-investments in improving care quality that are not easily observable by patients or verifiable by court physicians – such as certain improvements in administrative systems.

[24] This permits us to examine accidental medical negligence, in addition to considering the possibility that a physician will knowingly provides substandard care.

assumed that, when a physician errs and provides treatment $\widehat{t}$, there is a probability $\pi^D < 1$ that the error injures the patient and a probability $1 - \pi^D$ that the error does not injure the patient. The expected benefit of "injurious" error is given by b^e, where $b^e < b^*$. The expected benefit of non-injurious errors is assumed to be b^*. Thus the expected benefit of erroneous treatment is given by $\hat{b} = \pi^D b^e + (1 - \pi^D)b^*$. We assume that all erroneous treatment entail expected treatment costs of $\hat{c}$.[25]

3.0.2   MCO Treatment Choice

The MCO agrees to provide the patient with necessary medical services in exchange for a fixed fee. The insurance motive is not explicitly modelled, rather it is assumed that the MCO reimburses the patient for all out of pocket *approved* medical expenses for a fixed fee, given by P.

The MCO-physician relationship is subject to a moral hazard problem because the physician would like to select the treatment that maximizes patient outcomes without regard to cost.[26] The MCO bears the full treatment costs. The MCO regulates treatment choice through utilization review: the MCO reviews some portion of the physician's treatment recommendations and overrules them when it believes that a substitute treatment would provide the patient with adequate care at lower cost. Although an MCO is entitled to overrule a physician when it so chooses, we assume it does not always do so because asserting authority is expensive. As in Aghion and Tirole (1997), to assert authority the MCO must invest in an information system at a cost $V_I(a)$, where $V_I(0) = V_I'(0) = 0$, $V_I''(a) > 0$, and $\lim_{a \to 1} V_I(a) = \infty$. The investment a represents the probability that the MCO will overturn a decision by the physician.[27]

The MCO only over-rules the physician when its information indicates that a lower cost alternative treatment is available, t^0, that arguably satisfies the contractual requirement that the treatment be medically appropriate. The MCO makes this treatment determination *ex post*, after the premium is paid. Absent intervening forces, the MCO thus would have an incentive to select the cost-minimizing treatment, even if it

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[25] Varying the costs of treatment would not fundamentally change the implications of our analysis. Indeed, our conclusions regarding the advantages of entity-level liability when physicians are insolvent would be strengthened if remedied error entailed higher treatment costs as higher costs would signal the MCO that the physician erred.

[26] The moral hazard problem explored here is different from the traditional moral hazard problem, as in for example Holmstrom (1979) or Shavell (1979). In the standard problem, the principal has an external measure of performance, and then makes compensation an increasing function of this performance measure to provide appropriate incentives. Here, the nature of medical treatment is such that critical information regarding the patient's illness and the evaluation of acceptable treatments much come from the physician herself. With the physician in substantial control of the signal, the MCO cannot rely on this mechanism to control moral hazard.

[27] For example, the number of physicians and other support staff the MCO hires for its utilization review panels will determine how frequently it can subject claims to full utilization review.

is unacceptable, because the MCO bears treatment costs but, post-contract, does not benefit directly from improved patient outcomes.[28] The MCO is constrained (imperfectly) from pure pursuit of cost-minimization its treatment choice by the MCO-patient contract (as by reputation). To model this, it is assumed that the MCO-patient contractual requirement that the MCO only overrule treatments that are not medically necessary or appropriate places sufficient constraint on the MCO that the MCO directs its utilization review board to treatments that provide equal benefits as informed physician-selected treatments at lower cost. Yet this contractual constraint is not fully binding. In some cases the MCO does intervene to lower costs by providing substandard treatment. MCO provision of erroneous treatment could be intentional or unintentional. The MCO may provide substandard care unintentionally because if, based on the information available to it, errs in concluding that the physician recommended treatment was not appropriate and later cannot correct its error because sufficient time has elapsed that the physician's recommended treatment is no longer effective.[29] To model this, it is assumed that if the MCO asserts authority to recommend treatment t^0, with probability $1 - \pi^I$, the substitute treatment provides the patient with the same expected benefits as informed physician treatment, b^*, at lower cost, $c^0 < c^*$.[30] But, with probability, π^I, treatment t^0 lowers expected costs to c^0, but injures the patient, providing suboptimal benefits, b^e, equivalent to injurious uninformed physician treatment. Thus, the expected benefit from the MCO decision is $b^0 = \pi^I b^e + \left(1 - \pi^I\right) b^*$, and satisfies: $b^* > b^0 > \hat{b} > b^e$.[31]

To analyze the general case, it is assumed that the expected benefit of MCO-selected treatment, $b^0 = \pi^I b^e + \left(1 - \pi^I\right) b^*$, may be greater than or less than the expected benefit of physician-selected treatment, $eb^* + (1-e)\hat{b}$, depending in part on physician expertise. Where the MCO asserts authority, we assume that the patient receives the MCO selected treatment even if $b^0 < eb^* + (1-e)\hat{b}$. Adhering to the MCO choice is both *ex ante* and *ex post* rational, provided that b^0 exceeds the *net* benefit to the patient of the recommended treatment given that the patient must pay the entire treatment cost himself (not just the additional cost):

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[28] In fact, market forces (e.g., reputation) may ensure that the MCO obtains some post-contractual benefit from patient outcomes. Our results do not turn on the assumption of zero benefit. They depend only on the milder assumption that the MCO obtains less post-contractual benefit from good patient outcomes than does either the patient herself, see supra note (on why $\alpha < 1$) or the physician.

[29] See supra note .

[30] The MCO makes this treatment determination *ex post*, after the premium is paid. This creates an incentive for the MCO to select low cost treatment at the expense of patient welfare. Yet both the MCO-patient contract and market force limit the MCOs ability to cut costs at the expense of patient welfare. To model this, it is assumed that the MCO-patient contract constrains the MCO's ability to cost minimize at the expense of patient welfare, but only imperfectly.

[31] Should the MCO and physician face identical incentives to provide optimal treatment, then the fact that MCO treatment is the result of an explicit screening based upon verifiable information would suggest that the expected benefit from the MCO's decision would be better decision than the uninformed physician, and therefore $\pi^I < \pi^D$.

$$b^0 > eb^* + (1-e)\hat{b} - \{ec^* + (1-e)\hat{c}\}.$$

3.1   The Social Optimum

In summary, the main choice variables in this model are the level of expertise by the physician, where e represents the probability of being informed, and the level of authority exerted by the MCO, where a is the probability that the MCO is informed regarding a preferred treatment choice. With probability a the MCO exerts authority resulting in expected benefit b^0, and with probability $(1-a)$ the physician is given authority, with expected benefit $e \cdot b^* + (1-e)\hat{b}$. The expected payoffs of the MCO, physician and patient can now be defined.

The direct expected benefit to the patient of treatment as a function of the control variables is $B(a, e)$ which is given by:

$$B(a,e) = a \cdot b^0 + \ (1-a)[e \cdot b^* + (1-e)\hat{b}].$$

The corresponding expected cost of treatment is denoted by $C(a, e)$ and defined by:

$$C(a,e) = a \cdot c^0 + (1-a)[e \cdot c^* + (1-e)\hat{c}].$$

The patient has an income I, and pays a premium P to the MCO, and hence has utility:

$$U_P(P,a,e) = I - P + B(a,e). \tag{1}$$

The MCO receives the payment P as income, pays compensation W to the physician, investment cost $V_I(a)$ and $C(a, e)$ for any additional medical services ordered by either the physician or the MCO. The MCO's payoff is:

$$U_I(P,W,a,e) = P - W - C(a,e) - V_I(a). \tag{2}$$

Finally, the physician earns non-pecuniary benefits $\alpha B(a, e)$ from treating the patient, and pecuniary benefits W, less training costs $V_D(e)/\theta$ to maintain a level of expertise e. The physician's utility is given by:

$$U_D(W,a,e) = W + \alpha B(a,e) - V_D(e)/\theta. \tag{3}$$

Both the MCO and physician are assumed to be in competitive markets, with the profits of the MCO normalized to zero, while the alternative utility of the physician is U^0. The optimal allocation under the hypothesis that expertise and authority are contractible maximizes the patient's utility subject to the constraints that both the MCO and physician receive at least their alternative payoffs:

$$\max_{P,W,a,e} U_P\left(P,a,e\right) = I - P + B\left(a,e\right),$$

subject to:

$$
\begin{aligned}
U_I\left(P,W,a,e\right) &= P - W - C\left(a,e\right) - V_I\left(a\right) \geq 0, \\
U_D\left(W,a,e\right) &= W + \alpha B\left(a,e\right) - V_D\left(e\right)/\theta \geq U^0.
\end{aligned}
\tag{4}
$$

At the optimum the individual rationality constraints are binding. Thus, one can solve for W and P, and substitute these into the objective function, which yields a total welfare function. The individual rationality constraint for the physician implies $W = V_D\left(e\right)/\theta - \alpha B\left(a,e\right) + U^0$, while for the MCO one has $P = W + C\left(a,e\right) + V_I\left(a\right)$. Substituting these into the payoff for the patient, one obtains the following expression for net social welfare as a function of authority and expertise:

$$SW\left(a,e\right) = I + \left(1+\alpha\right)B\left(a,e\right) - C\left(a,e\right) - V_I\left(a\right) - V_D\left(e\right)/\theta - U^0.$$

Differentiating, we can solve this problem using reaction functions. Given the level of expertise, the optimal level of authority, $A\left(e\right)$, solves:[32]

$$(1+\alpha)B_a - C_a = V_I'(A(e))$$

where

$$
\begin{aligned}
B_a(a,e) &= b^0 - \{eb^* + (1-e)\widehat{b}\}, \\
C_a(a,e) &= c^0 - \{ec^* + (1-e)\widehat{c}\}.
\end{aligned}
$$

Given a level of authority a, the optimal level of expertise, $E\left(a\right)$ solves:

$$(1+\alpha)B_e - C_e = V_D'(E(a))/\theta$$

where

$$
\begin{aligned}
B_e(a,e) &= (1-a)\left(b^* - \widehat{b}\right), \\
C_e(a,e) &= (1-a)\left(c^* - \widehat{c}\right).
\end{aligned}
$$

---

[32] Notice that the level of ability does not affect the reaction curve for authority, while b^0 and c^0 do not affect the reaction curves for expertise, and hence we can view these parameters as primitives describing the behavior of the physician and insurer respectively. In particular, notice that increasing physician ability shifts reaction curve $E\left(a\right)$ up, and hence for sufficiently high θ it is the case that it is efficient to have no insurer control, while the converse is true when θ is low.

Insurer authority potentially involves a trade-off between cost and quality, whereas physician expertise does not. Equations $B_e(a, e)$ and $C_e(a, e)$ imply that, all else equal, increasing expertise increases treatment quality and decreases treatment costs.[33] By contrast, increasing authority (given expertise) always decreases costs, but the effect on benefits is ambiguous. If the level of expertise is sufficiently high, then $b^* > b^0$ implies that $B_a < 0$. By contrast, if expertise is sufficiently low that $b^0 > \{eb^* + (1 - e)\widehat{b}\}$, then an increase in authority increases the gross benefit of treatment to the patient.
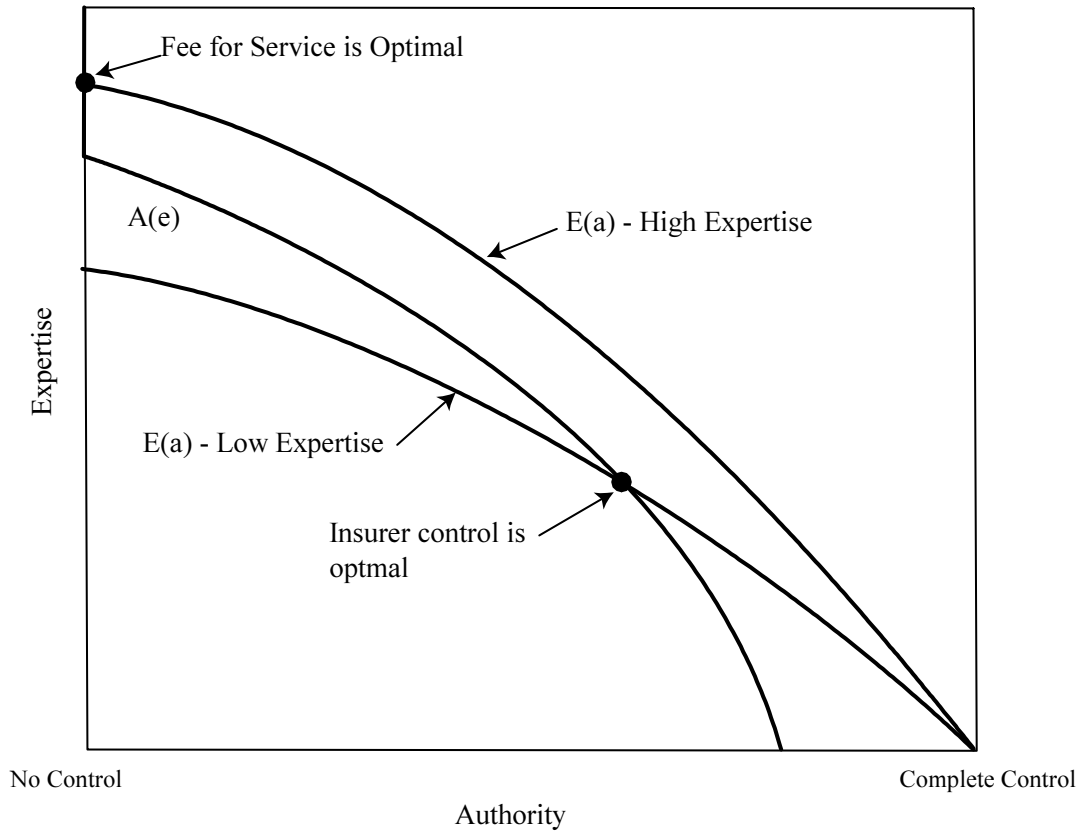
Figure 1: Socially Optimal Authority and Expertise

The solution to the social optimum is illustrated graphically in figure 1. Notice the effect of physician ability on the optimal solution. When physician ability is low, the expected quality of physician treatment is lower, and then the optimal solution entails some positive level of authority by the MCO. When physician ability increases, with all other parameters held fixed, then optimal physician expertise (and expected treat-

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[33] Expertise would increase treatment costs if informed treatment t^* were lower cost than the uninformed treatment, $\widehat{t}$.

ment quality) increases and the optimal level of authority falls. When expertise is sufficiently high then, as shown in the figure, exerting no authority is optimal.

The term "ability" needs to be interpreted broadly as measuring the relative cost to the MCO and physician of making informed treatment decisions. The modern rise of MCO authority is, in part, a response to technological improvement, particularly in information technology, that allows health care providers to compile information, and respond in a timely fashion to treatment requests – something that would not have been possible before the advent of modern computer technology. For frequent illness where the MCO has extensive data, and where the optimal treatment varies little across patients, it is more likely to be efficient for the MCO to exert authority. By contrast, it often will not be optimal for the MCO to assert authority with respect to illnesses where the physician can more accurately assess optimal treatment at lower cost – as is likely for relatively rare conditions or conditions where the determination of optimal treatment depends heavily on patient-specific characteristics that the MCO cannot easily assess from afar. In this case, no authority may be optimal.

Caution should be exercised when interpreting the results concerning the effect of physician "ability" on optimal MCO authority. Optimal authority depends not only on the relative cost to the MCO and physician of becoming informed, but also the expected net social benefits of the treatment selected by each. Thus, even if it were relatively more expensive for the MCO to make informed decisions, MCO authority still might be optimal if the expected quality of MCO selected treatment, b^0, exceeded the expected quality of physician selected treatment (at zero authority), or if the cost savings associated with MCO authority exceeded any expected reduction in treatment outcomes. Alternatively, even if MCOs can make treatment decisions at low cost, MCO authority might not be optimal if MCOs consistently select suboptimal treatments.

3.2   Equilibrium with Incomplete Contracts

Consider now the solution under incomplete contracts. The medical malpractice context involves the imposition by physicians and MCOs of risk on people (patients) with whom they are in a market relationship. It has suggested that in such a situation, market forces will induce optimal care-taking provided potential victims optimally anticipate the risks imposed on them. Tort liability and private sanctions for negligence are both unnecessary (see Shavell (1980)). However, this is no longer the case it is impossible to specify *ex ante* the level of authority or expertise.

In practice is it not possible for the MCO and patient to contract over how much authority the MCO will assert post-contract. Indeed the MCO's desired level of intervention will change over the life of the contract as the MCO acquires new information and more experience. Changes in optimal treatments also

will influence MCO authority. A similar argument applies to the level of expertise chosen the by physician.[34] It also is assumed that the parties cannot contract ex ante over what treatments the MCO or physician will select for any given illness the patient might have.

This is modelled by supposing that at stage 3 in the decision sequence the MCO and physician simultaneously choose the level of authority and expertise respectively. They cannot observe the choice of the other agent, but have rational expectations regarding these choices. Therefore the optimal incomplete contract is given by the solution to the following problem:

$$\max_{P,W,a,e} I - P + B(a,e). \tag{5}$$

subject to:

$$P - W - C(a,e) - V_I(a) \geq 0, \tag{6}$$

$$W + \alpha B(a,e) - V_D(e)/\theta \geq U_D^0, \tag{7}$$

$$a \in \arg\max_{a' \in [0,1]} P - W - C(a',e) - V_I(a'), \tag{8}$$

$$e \in \arg\max_{e' \in [0,1]} W + \alpha B(a,e') - V_D(e')/\theta. \tag{9}$$

In the case of the MCO, the optimal level of authority given the physician's expertise is given by the reaction function, $A^c(e)$, that satisfies:

$$-C_a(e) = V_I'(A^c(e)).$$

Similarly, the physician's optimal choice of expertise given the level of authority is denoted by $E^c(a)$, and solves:

$$\alpha B_e(a) = V_D'(E^c(a))/\theta.$$

Formally the solution to the incomplete contract problem forms a Nash equilibrium:

Definition 1 *A Nash equilibrium for the medical services problem is a pair* $\{a(\omega), e(\omega)\}$ *solving:*

$$a(\omega) = A^c(e(\omega)),$$

$$e(\omega) = E^c(a(\omega)),$$

where ω *is the vector of exogenous parameters.*

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[34] See Gawande (2002) discussing the importance to patient's health of physician investment in expertise through-out the physician's career, and certainly post-residency.

This solution is illustrated in figure two. Observe that at the incomplete contracts equilibrium with no sanctions, the MCO invariably asserts authority, *regardless* of the level of expertise, even if fee-for-service system would be first best, as shown in figure one.
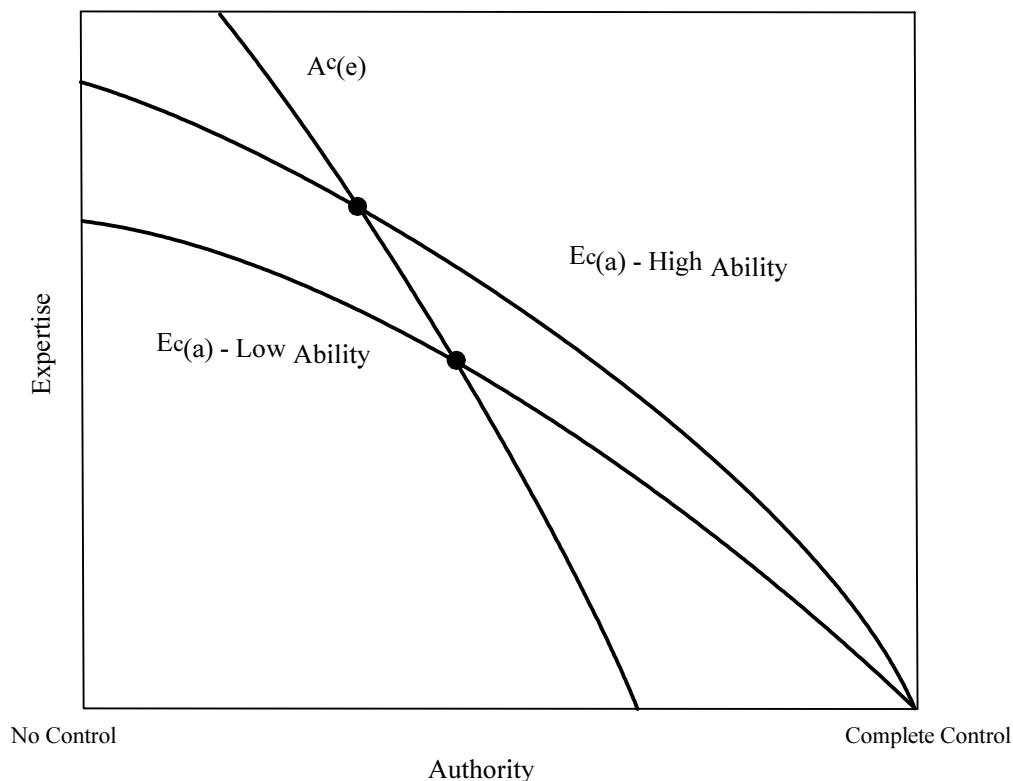

Figure 2: Equilibrium Actions with Incomplete Contracts

These properties of the equilibrium with incomplete contract are summarized in the next proposition.

Proposition 2 *There is a solution to 5 such that every equilibrium (a^c, e^c) has the properties:*

1. *Both authority and expertise are strictly positive, but there is less than perfect control, $a^c, e^c \in (0, 1)$.*

2. *At an equilibrium $SW_e(a^c, e^c) > 0$, and hence increasing expertise at an equilibrium always increases social welfare. Welfare is also increasing with physician ability θ.*

3. *$SW_a(a^c, e^c) < 0$ if and only if $b^0 < \{eb^* + (1 - e)\widehat{b}\}$ decreasing authority at an equilibrium increases social welfare whenever the benefit from MCO treatment is less than the expected benefit of physician-selected treatment.*

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Proof. in the Appendix. ∎

If authority and expertise are non-contractible, then the equilibrium absent liability is suboptimal notwithstanding the assumption that all parties know each other's pay off functions and accurately predict each other's behavior in equilibrium. This contrasts with the result of the classic model of accidents. In that model, when injurers and victims are in a market relationships the market alone can induce optimal care-taking when victims accurately predict the risks imposed on them.[35] This result illustrates that accurate expectations are not sufficient to induce optimal care-taking if expected accident costs depend on noncontractable, post-contractual, actions by the injurer. In such situations, victims ex ante ability to accurately "price" expected accident costs is not sufficient to ensure that, after the contract price is paid, the injurer faces optimal incentives to take victim costs into account. In this case, the injurer will take too little "care", even though the parties jointly would be better off if the injurer could commit to take due care.[36] Thus private contracting and accurate expectations are not sufficient to ensure that injurers take efficient care when care is taken ex post and is noncontractable.

4   Optimal Damages with Individual Liability

Consider now whether social welfare could be improved through the use of sanctions for medical malpractice. Only negligence liability is considered because this rule currently governs medical malpractice cases. The leading proposals in Congress for MCO liability are predicated upon negligence liability.[37]

This section considers a regime of individual liability for negligence, under which the physician and MCO each governed by a negligence liability rule as to their own treatment decisions, but neither is liable for negligent treatment provided by the other. Thus the physician is potentially liable for treatments she selects and provides. In contrast with existing law, the MCO also is potentially liable for treatments that it selects

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[35] Compare with Spence (1977) (risk-taking is efficient when injurers and victims are in a market relationship and victims correctly estimate the risk of harm); see Polinsky (1980); Schwartz (1988) (discussing products liability and arguing that consumers do not systematically underestimate the risk of products failure).

[36] Medical care is one of many products and services where customer welfare depends on non-contractable producer actions taken ex post. Obvious examples include contracts for the services of other professionals such as lawyers, engineers, and accountants, where quality depends on post-contractual actions that the consumer cannot monitor. In addition, more traditional products also will share this feature if, for example, the consumer purchases a composite product composed of the actual physician good purchased and a promise by the producer to provide certain services after the product is purchased with noncontractable quality. For example, many drugs can be seen as composite products, being the joint product of the actual drug and an obligation to notify consumers about any material problems the company becomes aware of.

[37] In addition, previous analysis suggests that negligence liability for medical malpractice is superior to strict liability. See, e.g., Simon (1982).

and provides, but is not liable for treatments selected by the physician.

Under negligence liability, a medical care professional is liable if she selected "negligent" treatment and this treatment injured the patient.[38] Consistent with existing law, it is assumed that negligence liability depends on the quality of treatment provided, and not the quality (or expertise) of the medical provider. We also assume that treatment adequacy is determined with respect to medical custom. A treatment is negligent if it provided the patient lower expected benefits than the "customary" treatment provided by an informed physician (t^*). It is assumed that courts can assess whether the medical professional was negligent – provided lower quality treatment than would be selected by an informed physician – but cannot determine optimal expertise or authority.

The present analysis extends the traditional model of medical malpractice by permitting formal consideration of accidental, or inadvertent, negligence. The traditional model of accidents assumes that injurers (here medical professionals) know the expected costs and benefits of their actions. Thus, injurers also know when they are being negligent. Thus, they will not be negligent if damages are set sufficiently high to induce due care (see Shavell (1980)). This framework does not appear to capture an essential feature of medical malpractice because physicians rarely knowingly decide to provide substandard care. The present model permits consideration of such errors through the assumption that even compassionate physicians can err with probability $1 - e$.

Moreover, it is also the case that physician negligence does not necessarily result in harm, which is important because negligence is actionable only if the patient is injured.[39] Thus it is assumed that an uninformed physician faces liability for selecting negligent treatment $\hat{t}$ only if it injures the patient (which occurs with probability π^D). The MCO faces potential liability only when it selects negligent treatment that injures the patient, which occurs with probability π^I.[40]

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[38] Equivalently, this section considers a regime in which the MCO and physician commit contractually to provide non-negligent treatment (with negligence determined by informed physician custom) and agree to pay damages to any patient injured by medical negligence. Such contractual provisions might well not survive existing limitations on liquidated damages provisions.

[39] For example, a physician may be negligent in failing to diagnose an infection that may be fatal for some individuals. Yet this negligence is not actionable if the patient nevertheless recovers.

[40] In order to focus on the authority decision, we assume that the probability that the MCO is negligent if it asserts authority is exogenously given. In other words, we focus on patient injuries that result because the MCO, in subjecting the physician's treatment decision to utilization review effectively altered treatment choice, for example by introducing sufficient delay to preclude the patient from receiving the correct treatment (even though post-review the MCO would happily have agreed to the treatment). The assumption that the MCO does not also intentionally select negligent treatments is consistent with an assumption that the MCO contract (or reputation) is sufficiently binding that the MCO always attempts to select the treatment that provides benefit b^*, even absent sanctions for negligence. Assuming that MCOs intentionally select negligent treatments absent tort liability would strengthen our arugment for imposing liability on MCOs.

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The present analysis examines negligence liability relative to a system where there is no intervention at all. The relative merits of negligence and quality regulation are not formally considered. Nevertheless, while quality regulation has an important role to play, there may be still be benefits from providing additional incentives via the tort system because regulations must be set in advance, and cannot dynamically adjust to new and changing conditions. Thus the level of expertise considered here should be interpreted as the amount of expertise *above* the minimum level set by regulatory agencies.

4.1 Optimal Damages for Individual Negligence

The first question to be addressed is the optimal level of damages that induce the MCO and physician to select the socially optimal levels of authority and expertise respectively. Let the expected damage award for physician negligence be L^D, and the damage award for MCO negligence be L^I.[41] It is assumed that the patient, MCO and physician all know the current liability rule before entering into a contract. Accordingly, the optimal incomplete contract under individual liability solves the following program:

$$\max_{P,W,a,e} I - P + \left\{ B\left(a,e\right) + (1-a)(1-e)\pi^D L^D + a\pi^I L^I \right\}$$

subject to:

$$P - W - C\left(a,e\right) - a\pi^I L^I - V_I\left(a\right) \geq 0$$

$$W + \left\{ \alpha B\left(a,e\right) - (1-a)(1-e')\pi^D L^D \right\} - V_D\left(e\right)/\theta \geq U_D^0$$

$$a \in \arg \max_{a' \in [0,1]} P - W - C\left(a',e\right) - a\pi^I L^I - V_I\left(a'\right)$$

$$e \in \arg \max_{e' \in [0,1]} \left\{ \alpha B\left(a,e'\right) - (1-a)(1-e')\pi^D L^D \right\} - V_D\left(e'\right)/\theta.$$

This problem is the same as the incomplete contract problem in the previous section, with the MCO facing an additional cost $\pi^I L^I$ whenever it exerts authority, while the physician faces an expected liability $(1-a)\pi^D L^D$ when she is not informed. In the case of the MCO, increasing its liability decreases the authority it exerts, while increasing the liability of the physician results in an increase in expertise. However, notice that the marginal impact of expertise decreases with authority.

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[41] Our analysis can be extended to incorporate the special issues that arise in the case of serious permanent injury and death. Serious permanent injury and death affect the patient's utility function – in particular, on the valuation a patient places on money. See generally Arlen (1993). Our analysis can accomodate this issue of "state-dependent utility functions" by treating L as the expected damage award in the event a suit is brought (e.g., ex post).

Proposition 3 *The following expected damage rules result in the optimal level of authority and expertise:*

$$\pi^D \bar{L}^D = \left(b^* - \hat{b}\right) + (\hat{c} - c^*), \tag{10}$$

$$\pi^I \bar{L}^I = (1 + \alpha)\left\{(eb^* + (1-e)\hat{b}) - b^0\right\}, \tag{11}$$

where e^* is the optimal level of expertise.

Proof. in the Appendix. ∎

Hence imposing liability for both MCO and physician negligence increases the parties' joint welfare relative to the no sanction equilibrium. Moreover, liability can be welfare increasing even when all physicians are "compassionate," and invariably try to provide treatment t^*. Physician compassion is not sufficient to induce optimal treatment quality because expected treatment quality depends not only on the choices made by informed physicians, but also on physician's incentives to invest in becoming "informed." Absent sanctions for negligence, compassionate physicians will not invest optimally in expertise because they bear the full cost of expertise but do not obtain the full benefits of informed decisions ($\alpha < 1$).

In addition the standard rule of damages equal to harm is not necessarily efficient. To induce optimal expertise, expected damages for physician error, $\pi^D L^D$, must equal the expected net cost to society of the physician providing uninformed rather than informed treatment (over and above that borne by the physician). Thus, damages for physician negligence must equal the marginal cost to the patient of receiving uninformed (rather than informed) treatment $\left(b^* - \hat{b}\right)$ plus the marginal cost to the MCO of physician error $(\hat{c} - c^*)$, divided by the probability of negligence producing a legally cognizable injury.

This rule differs from the standard rule in several respects. First, optimal damages are based on the expected benefit to the patient of informed versus uninformed treatment, and not the actual physical injury suffered by the patient. For example, in a case where the patient died as a result of physician negligence, the damage award would discount the patient's recovery by the probability that she would have died if provided proper treatment. Second, damages for medical negligence often must exceed the victim's costs (as defined by $\left(b^* - \hat{b}\right)$) because the optimal award must take into account the cost of service.

Where physician error increases the expected treatment costs, then damages should exceed the patient's losses. Where physician error reduces expected treatment costs, then optimal recovery would be less than patient's losses by $(\hat{c} - c^*)$. Similarly, optimal damages for MCO negligence must include the cost to the physician of MCO authority, $\alpha\{(eb^* + (1-e)\hat{b}) - b^0\}$, in addition to the cost to the patient$\{(eb^* + (1-e)\hat{b}) - b^0\}$.[42] Also, damages may exceed losses when negligence does not always cause injury. In this case,

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[42] Notice that when physician expertise is sufficiently low – when the patient is better off at the no liability equilibrium if the

damages are increased by dividing the costs of negligence by the probability that negligence produces a legally cognizable injury.

This results shows that optimal damages for medical negligence place more exacting requirements on courts than the standard analysis of accidents would suggest. In the standard model, the liability rule typically forms a lower bound on damages because any potential injurer can completely avoid liability by taking due care (see Cooter (1984)). In contrast, this model predicts that damages must be set precisely at the optimal level; they cannot exceed it. Excessive damages distort behavior because, to use Professor Robert Cooter's terminology, negligence liability operates as a "sanction" in its regulation of treatment choice, but operates to "price" physician expertise. A physician can avoid liability for intentional negligence by selecting treatment t^* whenever she is informed. She cannot avoid all liability in this way because she is not always informed: she does not always know the correct treatment. Thus the physician faces the omnipresent risk of liability for errors made when uninformed, and provides an incentive to invest in expertise.[43] Thus, negligence liability effectively operates as a kind of "strict liability" regime for expertise, in that a physician who errs is liable even if she invested optimally in expertise.[44]

These results illustrate that generic rule of making agents directly responsible for the harms that they directly cause upon others does not necessarily result in the first best. This is because the decisions of the MCO can affect the quality of a physician's decision making, and hence the optimal damage rule needs to incorporate this effect. One of the more interesting implications is that the damages from physician negligence should be reduced to reflect the cost savings of any decisions it might make. In practice the MCO

insurer asserts more authority – then the optimal damage entails a *payment* to the MCO whenever it is liable to increase the incentives to take control. Given that in practice the MCO also affects treatment choice as a function of liability one would not wish to use such a rule. This result illustrates the extent to which the exercise of authority over the physician leads to a much more complex set of rules for the determination of damages when doctors and MCOs are assumed to be at an arm's length relationship.

[43] Physician liability for unintentional error not only enables the tort system to regulate expertise in addition to treatment choice by uncompassionate physicians, it also may improve the dynamic stability of the tort system. In the conventional model, injurers can avoid liability by taking due care. This does not necessarily produce an efficient long run pure strategy equilibrium if litigation is costly and victims incur litigation costs before becoming fully informed about whether the injurer was negligent. This is because victims will have little reason to sue if they expect defendants to take due care. Yet if plaintiffs never sue, injurers essentially face no liabilty and so may be negligent. Thus the pure strategy equilibrium is unstable. By contrast, our framework yields a stable pure strategy equilibrium because the physician risks liability for accidental medical errors even when she invests optimally in expertise and selects optimal treatment whenever she is informed. This provides plaintiffs with an incentive to sue even when patients expect informed physicians to be nonnegligent.

[44] Mark Grady also argued that negligence liability in effect imposes strict liability for inadvertent negligence. In his analysis this strict liability serves no purpose because injurers cannot affect their likelihood of being inadvertent. Our analysis liability affects injurer behavior because the injurer can affect the probability of error. See Grady (1988).

not only uses authority to affect physician decision making, but could also make physician reimbursement reflect the cost and quality of her treatment decisions. The next two subsections address these cases in turn.

4.2 Cost Sharing Contracts

One of the ways that MCOs affect the decisions of physicians is to make compensation a function of the cost of treatment. For example, the physician may be paid a lump sum for each patient, and is responsible for additional costs. Our interest is not to determine the optimal degree of cost sharing between the MCO and physician, a problem that is complicated by the addition of the tort system. Rather, given an existing cost sharing arrangement, how does this affect the optimal damage rule?

Initially, suppose that the *treatment decision* does not depend upon the cost sharing rule. That is the informed physician is assumed to choose the treatment that is in the best *ex post* interests of the patient. Let the amount of cost sharing be represented by the parameter $\beta \in [0, 1]$, where the MCO reimburses $(1 - \beta)$ fraction of the costs, and the physician pays the rest. A straightforward extension of proposition 3 implies the following corollary:

Corollary 4 *When the physician pays a fraction β of the costs of treatment, then, assuming the negligence rule constrains an informed physician to select treatment t^*, the optimal damage rules are:*

$$\pi^D \bar{L}^D = \pi^D L^D + (1 - \beta)(\hat{c} - c^*) \tag{12}$$

$$= \left(b^* - \hat{b}\right) + (1 - \beta)(\hat{c} - c^*), \tag{13}$$

$$\pi^I \bar{L}^I = \pi^I L^I + \beta \left\{c^0 - (ec^* + (1 - e)\hat{c})\right\} \tag{14}$$

$$= (1 + \alpha)\left((eb^* + (1 - e)\hat{b}) - b^0\right) + \beta \left(c^0 - (ec^* + (1 - e)\hat{c})\right), \tag{15}$$

where e^* is the optimal level of expertise.

Observe that the amount of costs borne by the physician *increases* optimal physician liability relative to the case with no cost sharing (given $\hat{c} - c^* > 0$). Cost sharing *decreases* optimal MCO liability relative to no cost sharing (given $c^0 - (ec^* + (1 - e)\hat{c}) < 0$). This shows that when assessing damages for malpractice suits, the nature of the reimbursement rules should be taken into account since the socially optimal level of authority and expertise is a function of both the costs and benefits from treatment decisions.

4.2.1 The Effect upon Treatment Decision

Cost-sharing is generally lauded as a method for improving physician treatment decisions, yet it may or may not improve physician treatment decisions. When the MCO fully insures the patient and physician against

costs, informed physicians select overly expensive treatments, because they only consider the *ex post* benefit from treatment, and ignore treatment costs. When there is cost sharing, then *ex post* the physician's benefit from a treatment decision is $\alpha b_t - \beta c_t$.

Absent liability, cost sharing will induce an informed physician to select the treatment:

$$t(\beta) = \arg\max \alpha b_t - \beta c_t. \tag{16}$$

Cost-sharing thus can induce the physician to select the optimal treatment, $t^{**} = \arg\max b_t - c_t$ but only if, $\alpha = \beta$. Since this treatment results in lower gross benefits to the patient, this reduces the incentives to acquire expertise, all other parameters held fixed. Absent liability, cost-sharing will result in suboptimal treatment quality – and thus also suboptimal expertise – if $\beta > \alpha$. In other words, informed physicians subject to cost-sharing will select suboptimal treatments if they bear proportionately more in treatment costs than they obtain in treatment benefit through the effect of compassion. The parameter α is likely to be physician specific, and vary greatly from physician to physician, and hence it is very difficult, if not impossible for the the MCO to choose $\beta = \alpha$.

This implies that when physicians are subject to cost-sharing, negligence may play a dual role, regulating not only expertise but also treatment choice. If β is moderately large, then the effect of costs dominate the physician's decision, and, under optimal negligence liability, informed physicians may provide the lowest quality consistent with the negligence standard, and hence the negligence standard is more likely to place a binding constraint on the physician.

In conclusion, the use of cost sharing can in principle result in the physician making a more efficient decision. However, since the trade-off is between well defined costs, and benefits that depend upon a physician's subjective preferences towards good outcomes, it is not clear that cost sharing by itself can lead to an efficient outcome. Moreover, the use of cost sharing further increases the importance of the tort system to ensure quality treatment. For those physicians that place a lower weight α upon good outcomes, the negligence standard in effect defines the standard of care provided by these physicians when they are informed.

5   Optimal Damages with Performance Pay and Entity Liability

The present section expands the previous analysis of individual liability to consider optimal negligence liability where the MCO and physician can contractually agree that negligence by either will require the negligent medical provider to make payments to the other. The section compares optimal damages awards

under such a regime with optimal damages where such contracts are not possible, and discusses the benefits of permitting such contracts.

We also ask if welfare would be improved by holding the MCO, rather than the physician, liable for physician negligence. Under the rule of vicarious liability, if the physician is held to be an employee of the MCO, then the MCO would be jointly liable for all torts committed by the physician. Most MCO contracts are structured so that affiliated-physician are independent contractors, and hence MCOs often avoid liability for physician negligence. Physician liability for physician negligence is essential for efficiency in the prior section, where the MCO and physician do not condition payments to each other as a function of negligent behavior. This conclusion no longer holds if performance pay is possible.

5.1 Performance Pay

Suppose then that the MCO can sanction the physician who would be found negligent in court. [45] For example, her contract with the MCO may be terminated, or there may be explicit monetary penalties. Thus penalties depend upon whether the physician or the MCO is responsible. Assume further that the MCO is liable for its own treatment decisions, and either the MCO or physician may be liable for physician negligence: with the physician liable under "individual" liability and the MCO liable under "entity-level" liability. To explore this effect suppose that the MCO bears $\gamma \in [0,1]$ of the physician's liability, with $\gamma = 1$ corresponding to the case of entity-level liability (EL for short) and $\gamma = 0$ corresponding to individual liability (IL for short). In this case the liability of the MCO and physician are:

$$\mathcal{L}_I = a\pi_I L^I + \gamma (1-a)(1-e)\pi_D L^D, \tag{17}$$

$$\mathcal{L}_D = (1-\gamma)(1-a)(1-e)\pi_D L^D \tag{18}$$

where L^I are damages awarded for harms caused by MCO negligence and L^D are damages for harm caused by physician negligence. For simplicity, the explicit dependence of $\mathcal{L}_t$ on a, e, L^I, L^D and γ is suppressed.

The sequence of decisions in the relationship is as follows:

1. The patient offers a contract to the MCO that entails a payment P, and damage rules, L^I and L^D, who can either accept or reject and obtain 0. The MCO reimburses γ of the physician's liability.

2. The MCO then offers a contract to the physician, given the damage rules, the contract terms for a wage, W, and penalties k_I and k_D, depending upon who selected the treatment. The penalties k_I and

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[45] This does not necessarily entail a court decision. Some cases may be so clear cut that they do not arrive in court, with damages set by an arbitrator. In that case the MCO may still penalize the physician as a result of an arbitrator ruling.

k_D depend on the same conditions that trigger a court case, and hence they are substitutes for L_I and L_D, with the difference that the payments go to the MCO and not the patient.

3. The MCO and physician simultaneously set authority and expertise.

4. Patient falls ill, and receives treatment from physician.

As before, it is assumed that the contract terms between the physician and MCO are agreed upon after the patient has purchased insurance. This is consistent with the observation that the MCO has no obligation to inform the patient of any changes in the terms of the contract with the physician. The purpose of the sanction k_D is to provide the MCO control over the actions of the physician. The optimal contract is therefore the solution to the following constrained optimization problem:

$$\max_{P,W,L^D,L^I,a,e} I - P + \{B(a,e) + \mathcal{L}_I + \mathcal{L}_D\} \tag{19}$$

subject to:

$$P - W + a\pi^I k_I - \mathcal{L}_I + (1-a)(1-e)\pi^D k_D - C(a,e) - V_I(a) \geq 0, \tag{20}$$

and

$$W,a,e,k_I,k_D \in \arg\max_{W,a,e,k_I,k_D} P - W + a\pi^I k_I - \mathcal{L}_I + (1-a)(1-e)\pi^D k_D - C(a,e) - V_I(a), \tag{21}$$

subject to:

$$W + \{\alpha B(a,e) - a\pi^I k_I - (1-a)(1-e)\pi^D k_D - \mathcal{L}_D\} - V_D(e)/\theta \geq U_D^0 \tag{22}$$

$$a \in \arg\max_{a'\in[0,1]} P - W + a'\pi^I k_I - \mathcal{L}_I + (1-a')(1-e)\pi^D k_D - C(a',e) - V_I(a') \tag{23}$$

$$e \in \arg\max_{e'\in[0,1]} \{\alpha B(a,e') - a\pi^I k_I - (1-a)(1-e')\pi^D k_D - \mathcal{L}_D\} - V_D(e')/\theta. \tag{24}$$

The MCO's ability to employ performance pay fundamentally changes the role of the tort system. In the previous section, where performance pay was not available, tort damages lay where they fell. Thus tort liability has to ensure that, post-contract, the MCO and physician each had optimal incentives. By contrast, when the MCO employs performance pay, it is the MCO that determines post contractual incentives to invest in expertise and assert authority. Accordingly, the role of the tort system shifts from providing optimal ex post incentives to ensuring that, ex ante, MCO profits are maximized when expertise and authority is efficient. These ex ante incentives will induce the MCO to design performance contracts that induce both the physician and itself to behave efficiently post contract.

Ex ante, the MCO bears the full cost of both its own liability and any liability imposed directly on the physician, through its obligation to pay the physician a sufficient wage to ensure that being affiliated with the MCO always is as good as her next best market alternative. Thus, the MCO bears the same expected liability for physician negligence, whether it is imposed directly – in the form of entity-level liability – or indirectly, through the effect of individual liability on physician wages. Thus, we get the following neutrality result:[46]

Proposition 5 *(Neutrality)When performance pay is possible, then the distribution of liability between the physician and MCO does not affect authority or expertise, regardless of the damage award.*

This result follows from proposition 6 below, and so the proof is omitted. With more complete contracting, the MCO internalizes all the costs and benefits of medical care to both itself and the physician. Thus, tort liability need only ensure that the MCO internalizes the benefit of treatment to the patient; liability no longer need ensure that each provider bears the cost of her negligence to the other. Once the MCO has incentives to induce e^* and a^*, the MCO will ensure that each provider has the appropriate ex post incentives through private sanctions, k_I and k_D. Thus one obtains the following optimal damage rules and private sanctions.

Proposition 6 *When $a^* > 0$ then, under either EL or IL, optimal expected damage rules are:*

$$\pi^D L^{D*} = b^* - \hat{b},$$
$$\pi^I L^{I*} = b^* - b^0,$$

The optimal contract offered by the MCO entails penalties:

$$\pi^I k_I^* = \alpha \left(b^0 - \left(e b^* + (1-e) \hat{b} \right) \right) + (1-e) \left\{ (b^* - c^*) - \left(\hat{b} - \hat{c} \right) \right\},$$
$$\pi^D k_D^* = \gamma \left(b^* - \hat{b} \right) + \hat{c} - c^*.$$

The proof of this result is in the appendix. It demonstrates again the dependence of optimal damage rules for medical negligence on the nature of MCO-physician contracting. With performance contracts, optimal liability for physician negligence simply equals the expected costs she imposes on the patient, $b^* - \hat{b}$. The MCO employs a private sanction k^D to ensure that the physician also considers the cost of her negligence to

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[46]Observe that the neutrality result turns on nothing more than the potential availability of performance contracts. There is no requirement that the MCO be able to exert any more direct control over physician behavior. Zeiler (2002) demonstrates this result in the context of a game with information disclosure, while Kornhauser (1982) shows this result in a standard principal-agent setting.

the MCO. Thus, the total expected sanction faced by a negligent physician is: $(b^* - c^*) - \left(\hat{b} - \hat{c}\right)$, regardless of whether one has individual or enterprise level liability.

Optimal damages for MCO negligence also are considerably simpler when the parties can employ performance contracts. With performance contracts, liability for MCO negligence need no longer include the cost to the physician of MCO authority. This is because the MCO bears the cost ex ante through physician wages, and can provide optimal ex post incentives to take physician welfare into account through k_I. With performance pay, optimal expected damages for MCO negligence equal the cost to the patient of receiving MCO-selected treatment, instead of that selected by an informed physician, $b^* - b^0$. By contrast, absent incentive contracts, the expected harm to the patient requires optimal damages to include the term, $(eb^* + (1 - e)\hat{b}) - b^0$. Thus, incentive contracts obviate the need for courts to calculate expected physician expertise.

The present analysis suggests that courts and legislatures should not interfere with the MCO and physician performance pay contracts.[47] Moreover, performance pay simplifies the task of computing court imposed damages, while the task of estimating *expected* physician expertise is left to the MCO, which has better information on each physician's expected expertise.

5.2 Judgement Proof Physicians

The purpose of this section is to explore the extent to which enterprise liability is optimal when agents are judgment proof, in that their assets are not sufficient to cover their liabilities. For simplicity suppose that the wealth constraint is given by W, the physician's income. This assumption is made for notational simplicity only, the more general case yields the same results. Accordingly, the payoff to the physician is given by:

$$U^\alpha (a, e, \mathcal{C}) = W - a\pi^I k_I - (1 - a)(1 - e)\pi^D \min\left\{k_D + (1 - \gamma) L^D, W\right\} - V_D(e)/\theta,$$

with the sanctions subject to the constraints:

$$k_I \leq W,$$
$$k_D \leq \max\left\{W - (1 - \gamma) L^D\right\}.$$

The previous analysis reveals that optimality depends, in part, on the MCO facing sufficient expected damages to ensure that it maximizes profits when authority and expertise are optimal. For this it follows that when agents are judgment proof entity level liability is strictly preferred to individual liability.

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[47] Efforts abound to limit the ability to MCO's to obtain indemnification from negligent physicians and to shift liability for MCO negligence. The present analysis demonstrates the value of permitting such contracts.

Proposition 7 *If the courts and the MCO base penalties upon the same information, then the rule of entity liability is strictly preferred to individual liability when the physician's wealth constraint with optimal damage rules:*

$$\pi^D L^{D*} = b^* - \hat{b},$$
$$\pi^I L^{I*} = b^* - b^0.$$

Proof. Under optimal damages rules, entity liability results in $\mathcal{L}(a, e, L^{I*}, L^{D*}) = B(a, e) +$ constant. Hence $\Pi^{EL} = (1 + \alpha)B(a, e) - C(a, e) - V_I(a) + /-$ constant. Therefore the MCO has exactly the same objects as the patient, and will choose a contract that maximizes patient welfare, subject to physician's IR constraint and the IC constraints for the MCO and physician, as given by the appropriately modified equations 21 to 24.

In the case of individual liability, one has $\partial \Pi^{IL}/\partial e = \alpha B_e(a, e) + (1 - a)W - C_e < \partial \Pi^{EL}/\partial e = (1 + \alpha)B_e(a, e) - C_e$, given $W < b^* - \hat{b}$ and yet faces the same IC and IR constraints. Since the constraints are continuous and differentiable in expertise, it follows that one does not obtain the second best optimum under individual liability. ∎

Under entity level liability, the MCO initially bears any liability imposed for physician negligence. Thus physician insolvency does not affect the liability imposed on the MCO. Accordingly, the optimal damage rules described above will ensure that the MCO bears the full expected cost of both MCO negligence and physician negligence to the victim. Accordingly, the MCO will have optimal incentives to employ the tools available to it – here performance pay – to induce optimal behavior, subject to the additional constraint arising from physician insolvency.

The prior results concerning individual liability turn on the assumption that courts employ the same optimal damages as in the case of solvent physicians. Courts could provide the MCO with second best optimal ex ante incentives to assert authority by adjusting liability for MCO negligence to take physician wealth into account:

$$-\pi^I L^I + (1 - e)W = B_a(a, e) \tag{25}$$
$$\pi^I L^I = (eb^* + (1 - e)\hat{b}) - b^0 + (1 - e)W \tag{26}$$

These rules place considerably greater informational burdens on courts than does the optimal rule under entity level liability, L^{I*}. The rules require the court to know both physician wealth and the probability of physician error. In contrast, under entity-level liability optimal MCO liability for its negligence is based only on $b^* - b^0$.

5.2.1 MCO has Superior Information

Physician insolvency is a particular problem under individual liability because courts only impose liability when a negligent physician injured the patient, and so these physicians avoid liability with probability $(1 - \pi^D)$. To create the right incentives, optimal damages must exceed plaintiff's losses by the multiple $1/\pi^D$, $L^{D*} = (b^* - \hat{b})/\pi^D$. Thus, even when the physician has wealth $W > b^* - \hat{b}$ she may be insolvent with respect to the optimal award, L^{D*}. Individual liability does not provide the MCO with an incentive to solve this problem, because reducing physician insolvency only increases its own expected costs. Entity level liability does provide the MCO with the optimal incentive to reduce the problem of physician insolvency. Under entity level liability physician wealth does not affect the MCO's expected liability. Moreover, when damages are optimal, the MCO maximizes its profits by inducing optimal expertise and authority.

An MCO governed by entity level liability may be able to reduce the problem of physician insolvency by increasing the probability that negligent physicians are subject to sanction. This in turn would reduce the magnitude of the optimal sanctions. While a court only learns about physician negligence through the victim's law suit, the MCO may be able to detect physician negligence even when physician negligence does not result in a suit, or indeed ever when the patient suffers no lasting damages. This is because it has detailed information regarding patient treatments, and hence can use criteria for intervention that are less extreme than waiting until an obviously negligent treatment has occurred.

To explore this suppose that the courts impose a penalty only when physician negligence injures the patient – which occurs with probability $(1 - a)(1 - e)\pi^D$– but that the MCO can sanction the physician whenever the physician is negligent, which occurs with probability $(1 - a)(1 - e)$. Hence if the courts impose a sanction L^D upon the physician, then the MCO can achieve the same deterrence with a sanction of $k_D = \pi^D L^D < L^D$, and hence the MCO faces less binding wealth constraint. Therefore we may conclude:

Proposition 8 *Suppose that the MCO can observe whenever the physician makes an uninformed decision, then if α is sufficiently small and physician expertise is sufficiently large, entity level liability is preferred to individual liability. When $\left(b^* - \hat{b}\right)/\pi^D + (\hat{c} - c^*) > W^* > \left(b^* - \hat{b}\right) + (\hat{c} - c^*)$, where W^* is the optimal wage, then entity level liability results in the first best, while individual liability is inefficient.*

This result, whose proofs is similar to the previous proposition, and hence is omitted, captures the basic reason why vicarious liability is the preferred rule when the principal continuously monitors the performance of the agent. It is in a position to modify dangerous or inefficient behavior on the part of the agent, even though such behavior does not result in a tort. The point here is that the MCO is in a position to gather information regarding physician performance in cases where no tort is committed, and hence can use

sanctions and rewards that are smaller in magnitude than those that would be necessary if one waited until a tort is committed to sanction an individual.

6   Discussion

One of the fundamental principles for tort is that individuals should face the consequences of their actions, with damages equal to the harm they have suffered. In the context of medical services, this implies that physician should be made liable whenever they are found negligent. The main result of this paper is to highlight how this principle should be modified in the context of managed care organizations. MCOs alter optimal damages for physician negligence because, when MCOs can assert authority, the MCO and physician each affect the other's payoffs, altering the formula for optimal damages under a negligence regime.

Moreover, in such relationships, optimal damages depend upon details of the contract between the MCO and the physician, information that is difficult for courts to obtain and interpret. When performance contracts are not available, damages for physician negligence must equal the cost of negligence to both the patient and the insurer. When the MCO and physician can employ incentive contracts, optimal damages need equal the expected cost to the patient of uninformed physician treatment. Even here, the measure of damages differs from the traditional model. To induce optimal physician expertise, damages should be based on the expected cost to the patient of receiving "uninformed" rather than informed treatment, which is generally less than the ex post harm suffered by the patient.

The present analysis also bears on the debate over whether MCOs should be liable for either their own negligence or physician negligence. MCO liability for negligent treatment decisions is needed to induce both efficient MCO authority, and, as a result, efficient physician expertise. MCO liability for physician negligence is also shown to be equal to, or superior to, individual liability for physician negligence when MCOs can regulate physician behavior through incentive contracts. In this context, MCO liability for physician negligence ensures that the MCO bears optimal incentives to regulate physician behavior, even when physicians are insolvent. Providing such incentives can be particularly important when MCOs are better informed about physician negligence than are courts.

Finally, and more generally, this article reveals that optimal tort law often must take into account the nature of principal-agent relationships. Economic analysis of tort law has relied primarily on models of individual liability, notwithstanding the fact that most important torts involve injurers involved in a principal-agent relationship. The present analysis reveals that when principals regulate agents using authority the individual liability no longer cannot be analyzed independently of the principal-agent relationship. The

principal-agent relationship affects the structure of optimal damages for negligence. Moreover, individual liability cannot induce optimal behavior of agents unless principals also face optimal liability. Thus, greater attention can profitably be paid to how organizational structure affects the ability of the tort system to provide optimal incentives.

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Proof of Proposition 2. Given that the payoff function for each agent is continuous, and quasi-concave in the agents' own strategy, and the strategy space is compact and convex implies the existence of a Nash equilibrium. The compactness of the constraints ensures the existence of a solution. Assumption B implies that $a, e < 1$. The fact that $-C_a(e)$, $\alpha B_e(a) > 0$ for $a, e \in [0, 1)$, combined with assumption B ensures that both strategies are positive.

Inequality 2 follows from the fact that at the equilibrium one has:

$$
\begin{aligned}
SW_e(a^e, e^e) &= (1 + \alpha) B_e(a^e, e^e) - C_e(a^e, e^e) - V_D'(e^e)/\theta^D \\
&= B_e(a^e, e^e) - C_e(a^e, e^e) \\
&= (1 - a)\left[\left(b^* - \hat{b}\right) + c^* - \hat{c}\right] > 0.
\end{aligned}
$$

In the case of authority one has:

$$
\begin{aligned}
SW_a(a^e, e^e) &= (1 + \alpha) B_a(a^e, e^e) - C_a(a^e, e^e) - V_I'(a^e) \\
&= (1 + \alpha) B_a(a^e, e^e) \\
&= (1 + \alpha)[b^0 - \{eb^* + (1 - e)\widehat{b}\}]
\end{aligned}
$$

from which final inequality follows. ∎

Proof of Proposition 3. Under the negligence rule, the physician's behavior given authority, $E^N(a)$, solves:

$$
\begin{aligned}
V_D'\left(E^N(a)\right)/\theta &= \alpha B_e(a, e) + (1 - a)\pi^D L^D, \\
&= \alpha(1 - a)\left(b^* - \hat{b}\right) + (1 - a)\pi^D L^D.
\end{aligned}
$$

The first order condition for optimal expertise for the physician is given by:

$$
(1 - a)\left\{(1 + \alpha)\left(b^* - \hat{b}\right) + \hat{c} - c^*\right\} = V_D'(e)/\theta
$$

Since V_D is convex, physician expertise is uniquely identified from this expression, and therefore at the optimum:

$$
\alpha(1 - a)\left(b^* - \hat{b}\right) + (1 - a)\pi^D L^D = (1 - a)\left\{(1 + \alpha)\left(b^* - \hat{b}\right) + \hat{c} - c^*\right\}
$$

and hence:

$$
\pi^D L^D = (b^* - \hat{b}) + (\hat{c} - c^*).
$$

and, therefore, given $\widehat{b} = \pi^D b^e + (1 - \pi^D)b^*$:

$$L^D = (b^* - b^e) + \frac{(\hat{c} - c^*)}{\pi^D}$$

In the case of the MCO the first order conditions the damages must satisfy are given by:

$$SW_a(a,e) = -C_a(a,e) - \pi^I L^I - V_I'(a),$$

$$(1+\alpha)B_a(a,e) - C_a(a,e) - V_I'(a) = -C_a(a,e) - \pi^I L^I - V_I'(a),$$

$$(1+\alpha)B_a(a,e) = -\pi^I L^I.$$

This expression implies expression 11. ∎

Proof of Proposition 6. Notice that the incentive constraints for the MCO and the physician are concave programs, and hence described by their first order conditions. Hence the Lagrangian for the MCO's problem, given the damage rules, is given by:

$$
\begin{aligned}
L = {} & P - W - C(a,e) + a\pi^I k_I + (1-a)(1-e)k_D - \mathcal{L}_I - V_I(a) \\
& + \lambda\left\{W + \{\alpha B(a,e) - \mathcal{L}_D - a\pi^I k_I - (1-a)(1-e)\pi^D k_D\} - V_D(e)/\theta - U_D^0\right\} \\
& + \mu_I\left\{\pi^I k_I - (1-e)\pi^D k_D - \partial\mathcal{L}_I/\partial a - C_a(a,e) - V_I'(a)\right\} \\
& + \mu_D\left\{\alpha B_e(a,e) + \partial\mathcal{L}_D/\partial e + (1-a)\pi^D k_D - V_D'(e)/\theta\right\},
\end{aligned}
$$

where λ is the multiplier for the physician's IR constraint, μ_I is the multiplier for the MCO's IC constraint, and μ_D is the corresponding multiplier for the physician's IC constraint.

The first order condition $\partial L/\partial W = 0$, implies that $\lambda = 1$ hence the Lagrangian is now:

$$
\begin{aligned}
L = {} & P + \alpha B(a,e) - C(a,e) - (\mathcal{L}_D + \mathcal{L}_I) - V_I(a) - V_D(e)/\theta - U_D^0 \\
& + \mu_I\left\{\pi^I k_I - (1-e)\pi^D k_D - \partial\mathcal{L}_I/\partial a - C_a(a,e) - V_I'(a)\right\} \\
& + \mu_D\left\{\alpha B_e(a,e) + \partial\mathcal{L}_D/\partial e + (1-a)\pi^D k_D - V_D'(e)/\theta\right\},
\end{aligned}
$$

Now notice that $0 = \partial L/\partial k_D = \mu_I(1-a)\pi^D$, and since $a < 1$, then this implies that $\mu_I = 0$. Similarly, $\mu_D = 0$. Therefore, the incentives constraints are not binding. That is the MCO can select at no cost, the level of k_I and k_D to control the desired level of authority and expertise *ex ante*. Consequently, the MCO chooses a and e to satisfy:

$$\alpha B_a(a,e) - C_a(a,e) - \partial(\mathcal{L}_D + \mathcal{L}_I)/\partial a - V_I'(a) = 0, \qquad (27)$$

$$\alpha B_e(a,e) - C_e(a,e) - \partial(\mathcal{L}_D + \mathcal{L}_I)/\partial e - V_D'(e)/\theta = 0. \qquad (28)$$

Observe that $\mathcal{L}_D + \mathcal{L}_I = a\pi^I L^I + (1-a)(1-e)\pi^D L^D$, hence demonstrating the first claim, namely that the MCO's decision is independent of γ.

Now the patients problem is to solve:

$$\max_{P,W,L_I,L_D,a,e} I - P + \left\{ B\left(a,e\right) + (1-a)(1-e)\pi^D L^D + a\pi^I L^I \right\}$$

subject to the individual rationality and incentive constraints. Substituting in for W and P using the individual rationality constraints one arrives at the problem:

$$\max_{P,W,L_I,L_D,a,e} I + (1+\alpha) B\left(a,e\right) - C\left(a,e\right)$$

subject to 27 and 28. Since L^D and L^I no longer enter the objective function, then they are selected such that:

$$-\partial\left(\mathcal{L}_D + \mathcal{L}_I\right)/\partial a = -\pi^I L^I + (1-e)\pi^D L^D = B_a\left(a^*,e^*\right),$$
$$-\partial\left(\mathcal{L}_D + \mathcal{L}_I\right)/\partial e = (1-a)\pi^D L^D = B_e\left(a^*,e^*\right),$$

which implies the optimal damage rules.

The IC constraints can be used to derive k_I and k_D, which must solve:

$$\pi^I k_I - (1-e)\pi^D k_D - \partial\mathcal{L}_I/\partial a - C_a\left(a,e\right) - V_I'\left(a\right) = (1+\alpha) B_a - C_a - V_I'\left(a\right)$$
$$\alpha B_e + (1-a)\pi^D k_D - \partial\mathcal{L}_D/\partial e - V_D'\left(e\right)/\theta = (1+\alpha) B_e - C_e - V_D'\left(e\right)/\theta,$$

from which one obtains the expressions in the proposition. ∎