

# Patient welfare under the legal standard of care

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## Abstract

Presuming that the health insurers' standard of care harms patients, courts try to reinforce their traditional legal standard of care in malpractice lawsuits. This paper reviews the literature and translates the courts' standard into microeconomic terms. Compared to the society's first best the legal standard proves to be inefficiently high. When insurers align their reimbursement with the first-best standard, physicians are likely to break the legal standard under higher cost shares. Patient welfare is therefore maximized when purchasers use a certain reimbursement scheme that induces a negligent but first-best level of care. If this is not feasible, a second-best reimbursement scheme is suggested.

**JEL-classification:** I11, K13

**Keywords:** Medical malpractice, Negligence rule, Supply-side cost sharing, Hand-Rule

## 1 Introduction

This paper approaches the current legal discussion about the appropriate standard of care in medicine. Here a standard prescribes the diagnostic procedure and therapy, the level of medical expertise or the organization of treatment to be chosen by physicians under defined circumstances. Courts determine negligent behavior in malpractice lawsuits upon the legal standard and health insurers base their reimbursement on their own standard. If physicians comply with both standards, they ensure an acquittal in possible malpractice lawsuits as well as an adequate payment for provided services.

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German and US-American courts, however, presume that compliance with both standards does not go together very well since the insurers' standard is too low. They fear that physicians maximize their profits at the expense of patient welfare, and as a countermeasure they try to reinforce their traditional legal standard of care. Three questions arise from this observation: (i) How far does the legal standard deviate from the insurers' standard, (ii) do courts work in the interest of patients and furthermore (iii) what are the implications for the reimbursement scheme set by health insurers?

To answer these questions I review the literature about three alternative standards of care in the first part of the paper: the insurers', the courts' and the Hand-Rule standard. Verbal descriptions found in the literature are translated into microeconomic terms so that the standards can be compared.

The establishment of the statutory health insurance in Germany and managed care organizations in the USA reflects the society's desire to provide people with high-quality but affordable medical care (for Germany see § 135, 137 SGB V, Steffen, 2000; for the USA see Danzon, 1985 and 1997). For this reason insurers are forced by law or statute to evaluate the expected social benefits and costs of their services and, by explicitly trading off benefits and costs, to offer a standard of care that maximizes the society's welfare.

From German and US-American legal literature<sup>1</sup> it follows that the legal standard of care is mainly determined by the minimum of risk of damage to patients which in turn maximizes the occurrence probability of a treatment success. US-American authors still appreciate an evaluation of outcomes, meaning risks and treatment success. However, the costs of the physicians' activities play a secondary role in both jurisdictions. Courts refrain from cost-benefit trade-offs since they fear an uncontrolled decrease of the level of care in medicine (see for Germany Kern, 2002; Hart, 1996 and for the USA Rich, 2005; Danzon, 1997).

As German and US-American courts use the Hand-Rule standard to define negligence in other areas than in medicine (Kerkmeester and Visscher, 2003) and several authors regard it as the appropriate standard of care in medicine (Danzon, 2000 and 1985; Phelps, 1997; Weiler, 1991), the Hand-Rule standard serves as a benchmark in this paper. By minimizing the expected costs of a dangerous activity, it also incorporates an evaluation and explicit trade-off of expected costs and benefits of care. However, with respect to benefits it only considers prevented damages (see for example Cooter and Ulen, 2000) neglecting benefits derived from the treatment

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<sup>1</sup>For medical malpractice Germany has case law and the negligence rule in common with the USA (Faure and Koziol, 2001).

success.

In the second part of the paper I examine the physicians' behavior and implied patient welfare when courts apply their traditional legal standard. Health insurers are assumed to try to enforce the first-best standard by a certain reimbursement scheme.

It turns out that physicians comply with the legal standard under low supply-side cost shares but the higher the cost share is the more likely the legal standard is to be broken. Under conditions derived in this paper insurers successfully implement their standard by inducing physicians to break the legal standard and to provide a first-best level of care. In this case the courts' concerns about patient welfare are unjustified because patient welfare increases. Based on this insight, a first-best and a second-best reimbursement scheme are derived that maximize patient welfare by inducing a certain negligent level of care.

If courts waive their traditional legal standard and adopt the insurers' standard instead, matters change. On the one hand courts determine the physicians' choice of care under higher cost shares than before. On the other hand, if physicians comply with this new standard, patient welfare is always maximized. By contrast, adopting the Hand-Rule standard will cause a loss of welfare independent of the reimbursement scheme.

The remainder of the paper is organized as follows: In **section 2** three different regimes of standards of care are presented: the first-best, the legal and the Hand-Rule standard. **Sections 3** and **4** analyse the physicians' choice of care and appraise the patient welfare when courts use the legal standard of care. From this I infer the reimbursement schemes maximizing patient welfare. In **section 5** courts adopt the first-best or the Hand-Rule standard. It is examined how the patient welfare changes and the optimal reimbursement schemes under these alternative standards are derived. Conclusions and a discussion can be found in **section 6**.

## 2 Three different standards of care

The physicians' level of care  $y$  is a continuous variable. It may be observed by insurers but cannot be contracted between physicians and insurers.

The central term in the definition of the different standards of care, the risk or the probability of a damage  $r(y)$ , is determined by the physicians' level of care. A higher level decreases the risk but to a decreasing extent  $r' < 0$ ,  $r'' > 0$ . Starting from some level of care a minimum of risk is achieved  $r' = 0$  at  $\tilde{y}$ , and going beyond this level is without any additional benefit.

In medicine also the probability of a treatment success  $h$  is of interest. Here one could think of the probability of healing, preventing the worsening of a disease and alleviating pain (Steffen, 2000). In the following this term is assumed to be constant. The treatment success only arises when no damage occurs, which is expressed by the joint probability  $[1 - r(y)] h$ .

Any damage leads to a reduction of the patients' utility, translating into a constant loss of income  $L$ . A treatment success increases the patients' capability of producing income, amounting to a constant gain in utility  $H$ .

The physicians' actual costs of care  $K(y)$  can be observed but they are uncertain so that they do not reveal the actual level of care. This implies that a contract with the physicians about the level of care cannot be based on observed costs. The structure of expected costs  $E[K(y)] \equiv C(y)$ , however, is known. They increase disproportionately with care  $C' > 0$ ,  $C'' > 0$ .

## 2.1 The first-best standard of care

Social welfare  $EW$  equals the expected benefits from treatment success minus expected costs of care and expected damages. The first-best standard of care  $s^{FB}$  corresponds to the level of care solving the problem:<sup>2</sup>

$$\max_y EW(y) = [1 - r(y)] hH - C(y) - r(y)L. \quad (1)$$

The necessary and sufficient condition for the first-best standard:

$$-r'(s^{FB})(hH + L) = C'(s^{FB}) \quad (2)$$

requires that the marginal probability of no damage weighted by the total benefit of care  $hH + L$  equals the expected total marginal costs. A comparative static analysis of (2) shows that the first-best standard increases with the total benefit of care  $\frac{ds^{FB}}{d(hH+L)} > 0$ , which is due to an increase of the expected marginal benefits of care.

## 2.2 The legal standard of care

In a medical malpractice lawsuit in Germany and in the USA an expert witness usually determines the legal standard of care  $s^L$  (Jones et al., 2004; Faure and Koziol, 2001). It is defined by the level of care of a reasonable physician so that

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<sup>2</sup>It is assumed that the first-best standard is feasible, meaning that it does not burden the society or  $EW(s^{FB}) \geq 0$ .

physicians are held liable when they fail to correctly handle *a priori* risks defined by an unbiased spectator (Giesen, 1988).

Following the legal literature, German courts favor a level of care that minimizes the risk of damage minus the probability of treatment success (Hart, 2000; Laufs and Uhlenbruck, 2002). This objective gives rise to the analytical expression:

$$s_G^L = \arg \min r(y) - [1 - r(y)] h. \quad (3)$$

US-American courts basically agree with their German colleagues about the optimal level of care but they use a positive formulation of objective function (3) (compare Rich, 2005; Graskemper, 2004; Morrheim, 1998). They also explicitly emphasize that the standard of care should reflect the patients' interests (Jones et al., 2004). Due to a long tradition of evidence-based medicine US-American physicians as well as courts will use  $H$  and  $L$  to evaluate expected benefits and risks for the patients. A level of care, thus, becomes standard if it maximizes the patients' expected net benefits:

$$s_{US}^L = \arg \max [1 - r(y)] hH - r(y)L. \quad (4)$$

Current German and US-American literature shows that the expected costs of care  $C(y)$  play a secondary role in the courts' definition of the optimal standard of care. Since the liability law is seen as an instrument to protect patients courts refrain from trading-off expected benefits and costs of care that could decrease the legal standard (see for Germany Hart, 2002; Dressler, 2000; Steffen, 2000 and for the USA Morrheim, 1998; Danzon, 1997).

From solving the target functions (3) and (4) it becomes obvious that German and US-American courts adopt a standard that fulfills the necessary condition of the minimum of risk  $r'(s_i^L) = 0$ , so that  $s_G^L = s_{US}^L = s^L$ .<sup>3</sup>

**Corollary 1** *The legal standard of care is always higher than the first-best standard of care  $s^L > s^{FB}$ .*

Proof: From (2) it follows that  $-r'(s^{FB}) > 0$ . Since  $r'(s^L) = 0$  and  $r'' > 0$  welfare increases when the standard decreases starting from the legal standard of care.

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<sup>3</sup>It is assumed that  $s^L$  is feasible, meaning that the net probability of a treatment success and the patients' net benefits at this standard are non-negative.

### 2.3 The Hand-Rule standard of care

The Hand-Rule defines a particular level of care minimizing the expected costs of a dangerous activity. It requires to minimize the expected costs of care plus the expected damages:

$$\min_y C(y) + r(y)L. \quad (5)$$

The Hand-Rule standard  $s^{HR}$  thus fulfills the necessary and sufficient condition:<sup>4</sup>

$$-r'(s^{HR})L = C'(s^{HR}). \quad (6)$$

This is equivalent to the first-best optimum except that the expected marginal benefits from treatment success is neglected.

**Corollary 2** *As medical treatment provides utility from healing, preventing the worsening of a disease or alleviating pain, the Hand-Rule standard of care is lower than the first-best standard of care  $s^{HR} < s^{FB}$ . It is also lower than the legal standard of care  $s^{HR} < s^L$ .*

Obviously the Hand-Rule does not consider the expected marginal benefits of care beyond the avoidance of a damage  $-r'hH > 0$ . For this reason the Hand-Rule standard is inefficiently low.

## 3 The physicians' choice of care under the legal standard of care

Physicians are assumed to be risk-neutral. Their reimbursement depend on the observed costs of care. The expected reimbursement assumes  $f + (1 - \tau)C(y)$  where  $f > 0$  denotes a fixed payment and  $\tau$  is the supply-side cost share. Then,  $\tau = 0$  represents full cost reimbursement,  $\tau \in (0, 1)$  cost sharing and  $\tau = 1$  a pure prospective payment. A fee-for-services reimbursement is denoted by a positive but very low cost share.

In Germany as well as in the USA the negligence rule is the relevant liability rule for medical malpractice. The physicians' expected payment of compensation

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<sup>4</sup>By assuming that the expected costs of the Hand-Rule standard do not overcompensate social benefits of medical treatment,  $s^{HR}$  is feasible.

$EL$  depends on the level of care and the standard of care given by the courts  $s > 0$ :<sup>5</sup>

$$EL(y|s) = \begin{cases} r(y)L & \text{if } y < s \\ 0 & \text{if } y \geq s \end{cases}. \quad (7)$$

It shows that breaking the standard or acting negligently  $y < s$  leads to a judgement of liability. Physicians then have to compensate the patient for the damage and  $EL(y|s) = r(y)L$ . By contrast, complying with or exceeding the standard  $y \geq s$  leads to an acquittal and  $EL(y|s) = 0$ .

The physicians' aim is to maximize expected profits  $E\pi$ . Given the courts' standard of care and the insurers' reimbursement scheme they choose a level of care that maximizes the expected net income:

$$y^* = \arg \max f - \tau C(y) - EL(y|s). \quad (8)$$

**Figure 1** illustrates expected profits under reimbursement schemes with a positive cost-share. To the left hand side of the courts' standard physicians are held liable and expected costs increase with care while the expected payment of compensation decreases. This gives rise to expected profits under liability which are depicted in bold line. As soon as care approaches the courts' standard of care physicians are acquitted and their expected profits assume the dotted bold line.

Hence, expected profits are discontinuous at the courts' standard and physicians face a choice between the standard  $s$  and a negligent level of care  $y < s$ . If, as in **figure 1**, expected profits at the standard of care are not lower than at any negligent level of care or  $E\pi(s) - E\pi(y) \geq 0$  and the fixed payment is high enough  $f \geq \tau C(s)$ , physicians comply with the courts' standard of care  $y^* = s$ .

Breaking the courts' standard can only be the optimal decision  $y^* = y < s$  when the physicians' expected profits are higher under liability than under compliance with the courts' standard or  $E\pi(s) - E\pi(y) < 0$  and the fixed payment is high enough  $f \geq \tau C(y) + r(y)L$ . In this case physicians choose the level of care that minimizes the expected costs under liability. Formally, it follows from the necessary and sufficient condition:

$$-r'(y^M)L = \tau C'(y^M). \quad (9)$$

Physicians will thus extend care until the expected marginal benefits from a reduced payment of compensation are equal to the expected marginal costs. Apparently, the

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<sup>5</sup>I implicitly assume that courts ignore the hypothetical level of expected damages at the standard of care  $r(s)L$  so that physicians expect to be held liable for all damages. This assumption simplifies matters and approximates reality since courts are assumed to imperfectly account for  $r(s)L$ .

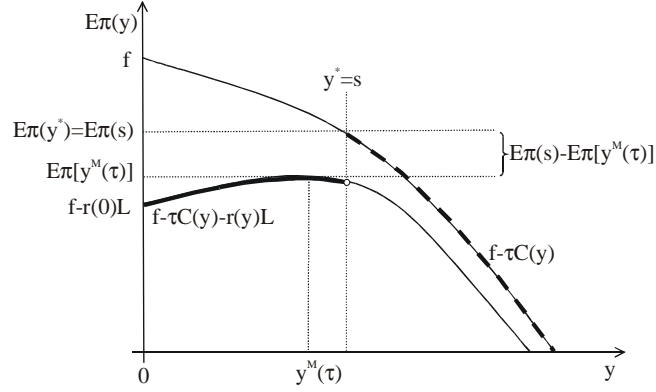


Figure 1: Expected profits and the physicians' optimal level of care  $y^*$  when  $E\pi(s) > E\pi[y^M(\tau)]$

physicians' cost share determines the optimum  $y^M(\tau)$  and the comparative static analysis of the necessary condition reveals that an increasing cost share decreases the optimum  $\frac{\partial y^M(\tau)}{\partial \tau} < 0$ .

If courts insist on the legal standard of care  $s = s^L$ , insurers will regard compliance with courts' standard as inefficient. By contrast they prefer physicians to break the legal standard. In order to enforce the first-best level of care they apply the first-best cost share  $\tau^{FB} = \frac{L}{hH+L} < 1$  and pay a fixed payment  $f \geq \tau^{FB}C(s^{FB}) + r(s^{FB})L$ . The optimum of physicians under liability therefore assumes the first-best level of care  $y^M(\tau^{FB}) = y^{FB}$ .

**Proposition 1** *Insurers are not able to enforce the first-best standard of care and physicians comply with the traditional legal standard  $y^* = s^L$  if the first-best cost share is too low:  $\tau^{FB} < \tau^e(s^L)$ .*

**Figure 2a** illustrates the physicians' choice of care for reimbursement schemes of the form  $[\tau, f \geq \tau C[y^M(\tau)] + r[y^M(\tau)]L]$ . Let  $\Delta\pi(\tau, s^L) = E\pi(s^L) - E\pi[y^M(\tau)]$  denote the minimum expected profit advantage of compliance with the legal standard over liability. Under low cost shares, as under full cost reimbursement and fee-for services,  $\Delta\pi(\tau, s^L)$  is always positive and physicians comply with the legal standard. However, as shown in the **Appendix**, an increasing cost share decreases the expected advantage at an increasing rate ( $\Delta\pi_\tau < 0$ ,  $\Delta\pi_{\tau\tau} < 0$ ) and thus increases the probability of negligent behavior.

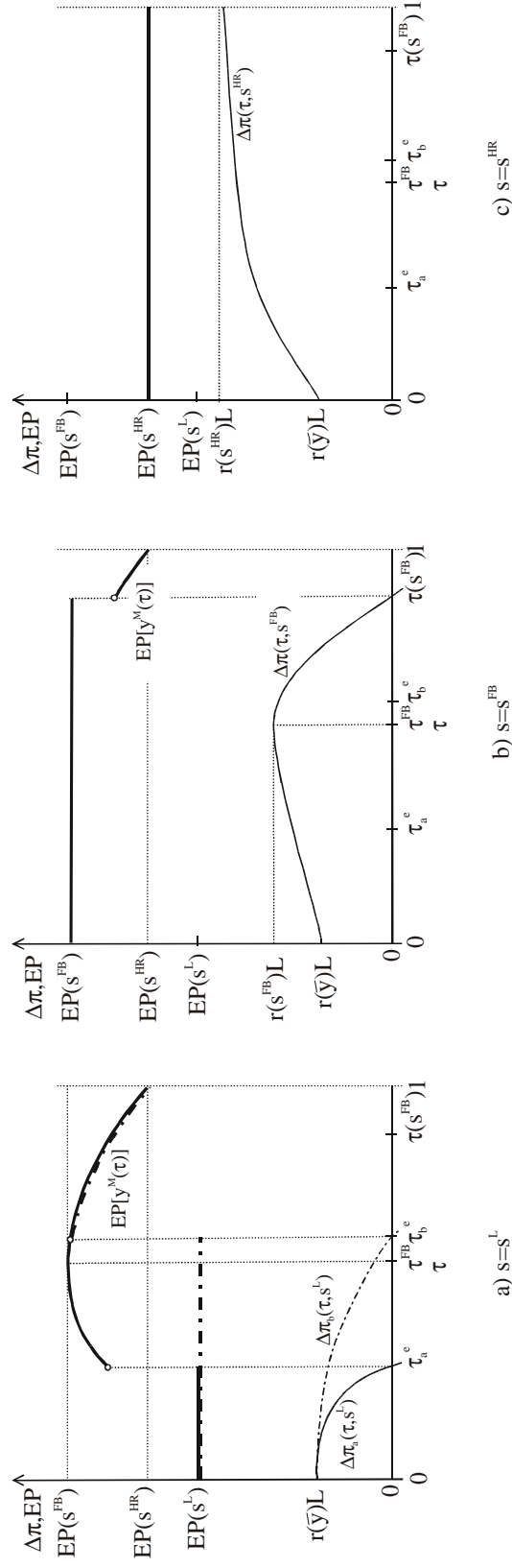


Figure 2: Expected profit advantage and patient welfare at different courts' standards

Intuitively, this is due to the fact that the physicians' expected costs of the legal standard are relatively large and accordingly increase with the cost share. At  $\tau^e(s^L) = \frac{r[y^M(\tau^e)]L}{C(s^L) - C[y^M(\tau^e)]}$   $\Delta\pi(\tau^e, s^L) = 0$  and physicians are indifferent between complying with the legal standard or acting negligently.<sup>6</sup> As a result physicians will only break the legal standard if the cost share exceeds  $\tau^e(s^L)$ .

So, if the expected advantage decreases fast enough, as in  $\Delta\pi_a(\tau, s^L)$ , it drops to zero at  $\tau_a^e(s^L) < \tau^{FB}$  and physicians act as intended: Under the first-best cost share they choose the negligent but first-best level of care  $y^* = y^{FB} < s^L$ , while expecting non-negative profits. However, if the advantage decreases more slowly and  $\tau_b^e(s^L) \geq \tau^{FB}$ , compliance still pays off at the first-best cost share. Physicians will therefore comply with the legal standard  $y^* = s^L$  and expect positive profits. The property of the solution depends on the slope of  $\Delta\pi(\tau, s^L)$ ; the more sensitive the optimal level of care under liability is on the cost share, the faster the expected advantage of compliance with the legal standard decreases.

## 4 Patient welfare under the legal standard of care

Risk-neutral patients expect positive benefits from the treatment success  $[1 - r(y)]hH$ . Being the final payer of all health care services, patients incur the expected reimbursement  $f + (1 - \tau)C(y)$  and they expect a loss in form of uncompensated damages if courts acquit physicians  $r(y)L - EL(y|s)$ . Patient welfare thus assumes:

$$\begin{aligned} EP(y) &= [1 - r(y)]hH - f - (1 - \tau)C(y) - r(y)L + EL(y|s) \\ &= [1 - r(y)]hH - C(y) - r(y)L - E\pi(y). \end{aligned} \quad (10)$$

Obviously, patient welfare achieves its maximum when physicians exert the first-best level of care (compare condition (2)) and the physicians' participation is ensured by zero expected profits.

**Proposition 2** *Under the traditional legal standard patient welfare is maximized when insurers can choose the reimbursement scheme*

$(\tau, f) = [\tau^{FB}, \tau^{FB}C(s^{FB}) + r(s^{FB})L]$  with  $\tau^{FB} > \tau^e(s^L)$ . If this is not possible a second-best reimbursement scheme is  $[\tau^e(s^L) + \zeta, f^{SB}]$  with  $\zeta > 0$ .

The level of welfare expected by the patients under  $E\pi = 0$  is depicted in **figure 2a** in bold line. If courts use their traditional legal standard of care, a chance to

<sup>6</sup>The trivial solution of permanent compliance with the courts' standard is precluded by assuming  $\tau^e < 1$ .

maximize patient welfare is to apply cost share  $\tau^{FB}$  and fixed payment  $\tau^{FB}C(s^{FB}) + r(s^{FB})L$ . If  $\tau^{FB} > \tau^e(s^L)$ , physicians break the legal standard and choose the negligent but first-best level of care  $y^* = y^{FB} < s^L$ .

However, if  $\tau^{FB} \leq \tau^e(s^L)$ , physicians are indifferent or better off under compliance with the legal standard  $y^* = s^L$  and only a second-best solution can be achieved. Under conditions detailed in the **Appendix** a cost share slightly higher than  $\tau^e(s^L)$  and a fixed payment  $f^{SB} > \tau^{FB}C(s^{FB}) + r(s^{FB})L$  make the best out of the situation for the patients. Physicians, therefore, break the legal standard by choosing the negligent level of care  $y^M(\tau^{SB}) < y^{FB}$  and expect zero profits. Patient welfare amounts to  $EP(s^{FB}) > EP[y^M(\tau^{SB})] > EP(s^L)$ .

## 5 The physicians' choice of care and patient welfare under alternative courts' standards

If courts adopted the alternative standards  $s \in \{s^{FB}, s^{HR}\}$ , the expected profit advantage  $\Delta\pi(\tau, s)$  would change and with it the physicians' behavior. As derived in the **Appendix** and depicted in **figure 2b**, under the first-best standard the expected profit advantage  $\Delta\pi(\tau, s^{FB})$  is positive when cost shares are low so that  $y^M(\tau) > s^{FB}$  and it assumes its maximum at  $\tau^{FB}$  where  $y^M(\tau) = s^{FB}$ . If cost shares exceed the first-best cost share,  $y^M(\tau)$  further decreases. As a result  $\Delta\pi(\tau, s^{FB})$  decreases and drops to zero at  $\tau^e(s^{FB})$ .

**Proposition 3** *If courts adopt the first-best standard, patient welfare is maximized under reimbursement schemes  $[\tau \leq \tau^e(s^{FB}), \tau C(s^{FB})]$  with  $\tau^e(s^{FB}) > \tau^e(s^L)$ ,  $\tau^{FB}$ .*

Under reimbursement schemes with  $\tau \leq \tau^e(s^{FB}) = \frac{r[y^M(\tau^e)]L}{C(s^{FB}) - C[y^M(\tau^e)]}$  and  $f \geq \tau C(s^{FB})$  physicians maximize their expected profits by complying with the courts' standard. Insurers can therefore always enforce the first-best standard of care but are not bounded to a single reimbursement scheme as under the traditional legal standard.

The maximum of patient welfare is achieved with  $\tau \leq \tau^e(s^{FB})$  and  $f = \tau C(s^{FB})$ . Under this reimbursement scheme physicians comply with the standard of care  $y^* = s^{FB}$  and expect zero profits.

Furthermore, it can be shown that  $\tau^e(s^{FB})$  exceeds  $\tau^e(s^L)$ . The reason for that follows from the definition of  $\tau^e$ . At this cost share the expected profits at the courts' standard of care or the optimum under liability are equal, translating into condition  $C(s) = \frac{r[y^M(\tau^e)]L}{\tau^e} + C[y^M(\tau^e)]$ . If courts substitute the first-best standard

for the traditional legal standard, the left hand side of this equation decreases. The right hand side, however, is independent of the courts' standard and can only adjust through  $\tau^e$ . Its derivation amounts to:

$$\frac{d \left[ \frac{r[y^M(\tau^e)]L}{\tau^e} + C [y^M(\tau^e)] \right]}{d\tau^e} = -\frac{rL}{(\tau^e)^2} + \left[ \frac{r'L}{\tau^e} + C' \right] \frac{\partial y^M}{\partial \tau}. \quad (11)$$

By inserting the necessary condition (9) this derivation reduces to  $-\frac{rL}{(\tau^e)^2} < 0$ , indicating that the physicians' cost share has to increase or  $\tau^e(s^{FB}) > \tau^e(s^L)$  to fulfill the condition stated above. Hence, by adopting the first-best standard, courts will expand their sphere of influence because they can determine the physicians' decisions under higher cost shares than before.

**Figure 2c** illustrates the situation when courts apply the Hand-Rule standard. Under this condition  $y^M(\tau) \geq s^{HR}$  and therefore  $\Delta\pi(\tau, s^{HR})$  is always positive. The expected advantage increases at a decreasing rate and achieves its maximum under a pure prospective payment.

**Corollary 3** *If courts adopt the Hand-Rule standard, patient welfare is never maximized. Physicians who expect non-negative profits comply with the Hand-Rule standard  $y^* = s^{HR}$  independent of the cost share  $\tau \in (0, 1]$ .*

Since  $\Delta\pi(\tau, s^{HR}) > 0$  complying with the courts' standard is the dominant strategy independent of the cost share and the physicians cannot be induced to choose the first-best level of care by the reimbursement scheme. As long as insurers apply a fixed payment  $f \geq \tau C(s^{HR})$ , physicians will participate and exert the Hand-Rule level of care.

If courts use the Hand-Rule standard of care, patient welfare is never maximized. Physicians, however, expect zero profits with  $f^* = \tau C(s^{HR})$ .

## 6 Conclusions and Discussion

This paper approaches a legal discussion in Germany and the USA concerning the appropriate standard of care in medicine. Since courts presume that the insurers' standard is too low they fear that physicians maximize their profits at the expense of patient welfare. As a countermeasure they try to reinforce the traditional legal standard of care.

In order to evaluate this discussion I review the literature about the legal standard and alternative standards of care in medicine. It turns out that courts minimize

the risk of damage and neglect the costs of care, which leads to an inefficiently high legal standard. This finding complements previous work. Danzon (2000), for example, notices that the positive deviation of the courts' standard from the welfare optimum collides with the basic tenets of managed care organizations. According to Danzon (1997), this deviation is due to the generous reimbursement schemes in the past that induced physicians to extend the level of care without considering costs. Moral hazard by uniformed patients fuelled by generous insurance contracts supported this development.

In the second part of the paper I examine the physicians' behavior and patient welfare when courts apply the legal standard but insurers align their reimbursement with the first-best standard. Based on the finding that physicians are likely to break the legal standard under higher cost shares, a technical condition is derived for maximal patient welfare. Insurers should therefore induce negligent behavior by applying a specific supply-side cost share. From this it follows a first-best reimbursement scheme and, if this does not work, a second-best scheme.

It has to be admitted that these optimal reimbursement schemes may be at odds with real-world conditions. Maximizing patient welfare when courts use the legal standard requires insurers to exactly apply the optimal cost share derived in this paper. If then insurers also wanted to induce positive efforts at cost-containment, their supply-side cost share would certainly be higher than the one derived in this paper and the level of care too low.

However, matters change completely when courts decrease their standard of care. Contrary to the legal experts' intuition, I show that courts extend their influence on the physicians' behavior by substituting the lower standard of insurers for the legal standard. Physicians, therefore, comply with the courts' standard under higher cost shares than before and patient welfare is maximized. Moreover, the number of lawsuits as well as the level of payment to physicians decrease.

At first glance, also some legal experts argue for an adoption of the insurers' standard by courts (Hart, 2002; Sandbill, 2002). However, on closer inspection it becomes clear that they would accept a lower, less costly standard of care only if the treatment success can be held constant. This still precludes a lower standard that incorporates a trade-off between benefits and costs as it would be accepted by insurers.

Following the results with respect to the Hand-Rule standard, I disagree with other authors. As the expected benefits of care in medicine go beyond the prevention of damages, I show that the Hand-Rule standard of care is inefficiently low. Since physicians would always comply with the Hand-Rule standard, there exists

no reimbursement scheme that maximizes patient welfare. The Hand-Rule standard should therefore not be applied in malpractice lawsuits.

Technical assumptions in this paper can be relaxed without changing the basic results. One could, for example, introduce different productivity types of physicians by assuming different marginal costs of care. The first-best standard of care then increases with the physicians' productivity but the first-best cost share remains the same for all types. If courts apply their traditional legal standard,  $\tau^e$  increases with productivity and leads to the result that only less productive physicians can be induced to exert the first-best level of care. Consequently, the optimal reimbursement scheme differs with the productivity type. Patient welfare achieves its maximum by applying the first-best reimbursement scheme derived in this paper to less productive physicians but the second-best scheme to more productive ones.

# Appendix

## Appendix Section 3

Deriving  $\Delta\pi(\tau, s) = E\pi(s) - E\pi[y^M(\tau)] = \tau \{C[y^M(\tau)] - C(s)\} + r[y^M(\tau)]L$  with respect to the cost share gives due to the envelope theorem:

$$\begin{aligned}\frac{d\Delta\pi(\tau, s)}{d\tau} &= C[y^M(\tau)] - C(s) + (\tau C' + r'L) \frac{\partial y^M}{\partial \tau} \\ &= C[y^M(\tau)] - C(s) \geq 0.\end{aligned}$$

Accordingly, the slope of the expected profit advantage is determined by the difference between expected costs at the optimum under liability and the expected costs at the courts' standard. The advantage increase (decreases) with the cost share, if  $y^M(\tau) > (<)s$ . The second derivative assumes  $\frac{d^2\Delta\pi(\tau, s)}{(d\tau)^2} = C'' \frac{\partial y^M}{\partial \tau} < 0$ .

## Appendix Section 4

In case of  $\tau^{FB} \leq \tau^e(s^L)$ , a second-best solution can be achieved. If patients appreciate the reduction of costs more than that of risks, patient welfare is higher at the Hand-Rule standard than at the legal standard of care  $EP(s^{HR}) > EP(s^L)$  and welfare is maximized with a cost share slightly higher than  $\tau^e$ :  $\tau^{SB} = \tau^e + \zeta$  with  $\zeta > 0$ . The optimal fixed payment then is  $f^{SB} = \tau^{SB}C[y^M(\tau^{SB})] + r[y^M(\tau^{SB})]L$ , which is higher than the first-best payment:  $f^{SB} > \tau^{FB}C(s^{FB}) + r(s^{FB})L$ .

However, if  $EP(s^{HR}) < EP[y^M(\tau^{SB})] < EP(s^L)$ , the second-best cost share is drawn from  $\tau \in [0, \tau^e]$  and the fixed payment assumes  $f = \tau C(s^L)$ . Physicians will therefore comply the legal standard, which maximizes patient welfare under given conditions.

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