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Kickbacks in Medical Expert Markets*

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“It is not obvious that referral behavior is more appropriate when kickbacks are prohibited.”

Mark Pauly (1979, p. 352)

Abstract

This paper examines patient and overall welfare effects of kickbacks paid by a monopolistic hospital to competitive physicians in return for patient referrals. This practice is regarded as unethical and illegal in most cases. On the other hand, kickbacks can also enhance the distribution of labor in the production of medical services. In the context of medical services modelled as credence goods where patients need one of two possible treatments (minor or major), it is shown that patient welfare is always lower with kickbacks than without. When the use of kickbacks is allowed, an equilibrium with overcharging (the patient requires the minor treatment but is charged for the expensive one) and one with overtreatment (the patient receives but does not require the major treatment) are possible. The latter results if patients can verify the treatment but not the diagnosis, the former arises when no verifiability applies. Overall welfare is lowest in the equilibrium with overtreatment. Overcharging does not necessarily reduce overall welfare, as it depends on the degree of altruism among referring physicians. If they are solely extrinsically motivated, allowing kickbacks increases overall welfare. If physicians behave altruistically, a tradeoff arises between resource savings and guilt disutility from referrals. Additional equilibria emerge if the hospital can differentiate prices and post its own price for inexpensive treatments. Kickbacks continue to be predicted if physicians are not overly altruistic and no or only partial verifiability applies. In these cases, a prohibition of kickbacks improves the allocation. Kickbacks disappear, however, if treatment and diagnosis are verifiable, or if the hospital market is competitive.

Keywords: Health care, credence goods, provider behavior, kickbacks, overcharging, overtreatment, welfare

JEL index: D47, D82, I11, I18, L50

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1. Introduction

Professional ethical codes and the laws of most countries prohibit kickbacks to physicians who refer patients. Kickback payments, however, exist despite prohibition, even in countries where moral standards are high. In Germany, for instance, in a 2012 survey of 1,141 medical providers, 49 percent of physicians agreed or partly agreed with the statement that kickbacks are quite common, and 20 percent indicated that they are very common. Among non-medical professionals, the agreement rate was even higher (*Bussmann, 2012*). The sheer existence of kickbacks, of course, reveals scope for exchange to the mutual benefits of providers of health care. For this reason, *Pauly (1979)* argued in favor of kickbacks as they improve the allocation of health services. In particular, when administered prices are above the marginal costs of provision or monopoly power prevails, kickbacks offer incentives which might even improve patient welfare.

Pauly's argument is well taken in a world of well-informed patients. However, health care markets are prone to information asymmetry. Physicians generally know more about the type of medical services that patients need than patients themselves. They can diagnose patients' illnesses, provide the right quality of care and charge for it, or they can exploit the informational asymmetry by defrauding patients. Expert markets for diagnosis and treatment give rise to two specific types of problems (*Dulleck and Kerschbamer, 2006*). The first are treatment inefficiencies, where patients receive undertreatment – patients require a sophisticated, typically expensive treatment, but receive a simple, inexpensive one and forgo the benefits of the sophisticated treatment – or the reverse, i.e., overtreatment where the additional benefits are less than the additional costs of the sophisticated treatment. The second problem involves not necessarily an inefficiency, but a pure transfer from patients to providers when patients require an inexpensive treatment but are charged for an expensive one.

Existing institutions address the informational problems with markets for diagnosis and treatment. The Hippocratic Oath is intended to prevent undertreatment, while the institutionalized separation of outpatient and inpatient care addresses potential overtreatment by the hospital. The prohibition of kickbacks works in the same direction by preventing agreements between hospitals and referring physicians, which might potentially disadvantage patients. Similarly, the separation of physicians' and pharmacies' functional activities seeks to avoid overtreatment by disentangling the incentives to prescribe drugs from the profit to be gained from selling them.

In this paper, we address kickbacks by modelling health care services as credence goods. We assume the ethical commitment and liability of providers of health care, which ensures that patients receive the prescribed treatment and excludes inappropriate treatment. We distinguish between a monopolistic hospital, competitive general practitioners (GPs) and patients who need medical treatment. Patients have an expectation about the probability of being severely ill and in need of inpatient care. If they have only a minor medical problem, it is sufficient to turn to a GP and receive an inexpensive treatment. Based on the existing prices for out- and inpatient care, patients decide which provider to visit first. If they consult the GP, they will be diagnosed and possibly referred

to the hospital. If they seek treatment in the hospital, they will receive inpatient care and will be charged the monopoly price. In line with *Pauly (1979)*, we assume that the hospital also has a comparative advantage in treating patients with a minor problem.¹ Therefore, from the point of view of resource use, it would be best if all patients underwent inpatient treatment. GPs cannot treat the severely ill, but only patients with a minor problem. Hospitals may use kickbacks in order to incentivize GPs to refer patients with a minor problem to them. We assume that GPs internalize part of these patients' disutility from paying the monopoly price. This gives rise to a tradeoff between resource savings and disutility from referrals.

Dulleck and Kerschbamer (2006) present a framework for determining the equilibrium behavior of providers and consumers in the credence goods market. If experts can provide both the minor and the major treatment and either consumers can verify the treatment or experts are held liable for undertreatment, the price mechanism alone is sufficient to solve the fraudulent expert problem. With monopoly power present, overcharging or overtreatment are possible equilibrium outcomes. We differ from the *Dulleck and Kerschbamer* model in three aspects. First, we assume that GPs can provide the minor treatment only. Second, our model excludes the possibility that the hospital can compete in the market for outpatient care by posting its own price for inexpensive treatments. Third, we introduce the optional use of kickbacks by the hospital combined with the altruistic preferences of GPs to capture the existing ethical reservations against kickbacks.

Inderst and Ottaviani (2012) report a dearth of literature on kickbacks. Beside *Pauly (1979)*, they also mention the contribution by *Owen (1977)*, who discusses the role of kickbacks that providers of title-insurance services pay to real estate brokers to steer homebuyers. *Inderst and Ottaviani (2012)* analyze Hotelling competition between two sellers through kickbacks to intermediaries that advise consumers. An example in the medical context are the kickbacks that pharmaceutical firms and other health-care suppliers pay to physicians, who then issue a recommendation to their patients regarding which treatment matches their need best. Our framework differs as we have a monopolistic hospital which provides both treatments, competing with the GPs who can provide only the minor treatment. GPs can be interpreted as an advisor, but they are not confronted with several specialists and hospitals that try to steer them with kickbacks. When we introduce competition in the hospital market, we assume price (Bertrand) competition.

The remainder of the paper is organized as follows. In Section 2, we present the model in more detail. In Section 3, we derive the market equilibrium and compare it with the equilibrium that arises when the use of kickbacks is not feasible. Moreover, we analyze a third equilibrium that results if patients can verify the sort of treatment they receive. We compare the profit, patient welfare and overall welfare between the three equilibria. In Section 4, we investigate other possible allocations if the hospital can differentiate its price in order to attract patients to seek inpatient care

¹ This assumption must be taken literally. Quite naturally, GPs will have an advantage in treating some patients. However, there will also be patients who would benefit if treated by a hospital. The prohibition of kickbacks combined with price regulation or market power might prevent an efficient provision of health care.

directly. We differentiate between equilibria with partial verifiability (patients can verify the treatment), general verifiability (patients can additionally verify the diagnosis), monopoly power and competition in the hospital market. In Section 5, we summarize the findings and draw conclusions.

2. The Model

We consider a monopolistic hospital H , a competitive market for the services of general practitioners GPs and risk-neutral patients who seek treatment for their illness. The hospital can treat patients with major and minor medical problems, whereas GPs can only cure minor cases. We assume that a patient of type s has the major medical problem with probability s and the minor problem with probability $1 - s$. Patients' types are drawn independently from the cumulative distribution function $F(s)$, with density $f(s)$ on $[0,1]$. $F_G(s)$ is the cumulative distribution functions for the patients with a minor medical problem and $F_H(s)$ are the corresponding function for the patients with a major problem. If μ is the share of patients with a minor medical problem in the population, it holds that $F(s) = \mu F_G(s) + (1 - \mu) F_H(s)$.

Patients are assumed to have a uniform reservation price for medical treatment equal to r . They do not know the severity of their illness; only the medical expert will know this after the diagnosis. Verifiability is also not satisfied, i.e., patients cannot verify either the diagnosis or the treatment they receive. However, we shall assume liability of the providers in the sense that legal rules hold an expert liable for the provision of inappropriate, poor-quality care.

Patients know that a GP cannot treat them if they are severely ill and will have to refer them to the hospital where the price of treatment is p_H . In this case, the GP will charge a fee d for the diagnosis cost. If the GP decides to treat them instead, the price is p_G . A patient's expected utility from turning to a GP as a function of his type s is, thus, $EU_G(s) = r - (1 - s)p_G - s(d + p_H)$. Alternatively, the patient can seek treatment in the hospital without seeing the GP and will pay the price p_H . In the absence of verifiability, the hospital will charge p_H , even if it has provided the inexpensive treatment. The patient's expected utility from inpatient treatment is then independent of his type s , equal to $EU_H = r - p_H$.

Combining the alternatives for the patient's choice and assuming that $p_H > p_G$, we define the patient of type \tilde{s} who is indifferent between turning to the GP and seeking direct treatment in the hospital:

$$\tilde{s} = 1 - \frac{d}{p_H - p_G + d}. \quad (1)$$

A patient's first choice as a function of his type s is illustrated in Fig. 1. Patients of types $s > \tilde{s}$ will seek inpatient treatment, while patients with expectations $s < \tilde{s}$ will see the GP first. The reason why not all patients visit the GP is that even if they are not treated by the GP but are referred to inpatient care, they have to pay the diagnosis cost d .

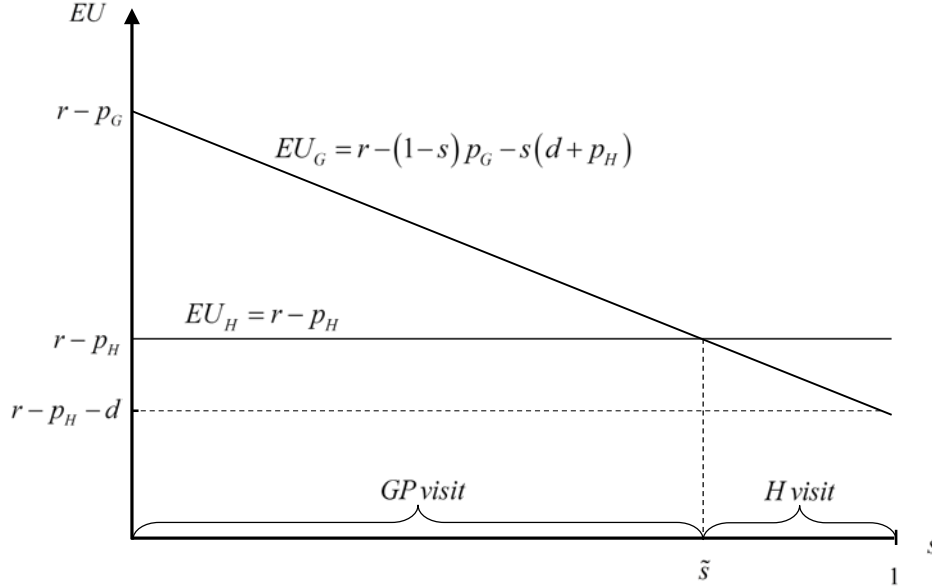


Fig. 1 The patient's first provider choice

The hospital is assumed to be a profit-maximizing monopoly. It receives all severely ill patients for treatment either through direct contact or through referral by a GP. To induce referrals of patients with a minor problem, the hospital has the option to pay a kickback κ per patient to referring GPs.² Given the definitions of $F_G(s)$ and $F_H(s)$, the monopolistic hospital's decision problem can be written as follows:

$$\begin{aligned} \max_{p_H, \kappa} \pi_H = & (1 - \mu) \left[p_H - c_H - (1 - F_H(\tilde{s}))d \right] \\ & + \mu \left[(1 - F_G(\tilde{s})) (p_H - d - c_H^G) + x(p_H, p_L, \kappa) F_G(\tilde{s}) (p_H - \kappa - c_H^G) \right], \end{aligned} \quad (2)$$

where c_H and c_H^G are the respective costs for the inpatient treatment of severe and non-severe cases, with $c_H > c_H^G$.³ For those patients who directly visit, the hospital has diagnosis cost in addition. x is the share of patients with a minor medical problem visiting a GP who is referred to the hospital. Based on the prevailing prices, GPs decide whether to treat patients with a minor problem

² We could instead assume that hospitals pay a kickback for every referral, including the severe cases, but this would only complicate the model without providing further insights.

³ Note, we assume that referred patients need no second diagnosis in the hospital.

(i.e., $x(p_H, p_L, \kappa) = 0$) or to refer them to the hospital (i.e., $x(p_H, p_L, \kappa) = 1$).

GPs practice in a competitive environment where they are price-takers. As they cannot treat patients with a major medical problem, they refer them to the hospital and charge the fee d to cover the diagnosis cost. The profit from treating a patient with a minor problem in the outpatient setting is $p_G - d - c_G$, where $d + c_G$ is the total cost for the diagnosis and the treatment. We assume that GPs internalize a share α of the patient's utility from the treatment (see *McGuire*, 2000, for the standard model of physician agency). The additional disutility from referring a minor case to inpatient care is $\alpha(p_H + d - p_G)$. The GP's net utility in monetary terms for such a referral is, thus, $\kappa - \alpha(p_H + d - p_G)$.

These assumptions give rise to the following GP profit maximization problem:⁴

$$\max_x \pi_G = \mu F_G(\tilde{s}) \left[(1 - x(p_H, p_L, \kappa))(p_G - c_G - d) + x(p_H, p_L, \kappa)(\kappa - \alpha(p_H + d - p_G)) \right]. \quad (3)$$

The final assumption regards the comparative advantage of the hospital in treating patients with a minor medical problem: $c_H^G < c_G$.

3. The Equilibrium with and without Kickbacks

The timing of the game is as follows. The posted outpatient price is p_G . The hospital announces its price p_H publicly, and the kickback payment κ for non-severe cases privately to GPs. The hospital is not allowed to post its own price for treating patients with a minor medical problem. Patients decide whether to seek inpatient care directly or to see a GP first. If they are indifferent between these two alternatives, we assume that they seek treatment in the hospital. The GP examines the patient, learns the severity of the illness and, based on this information and the observed prices, decides to treat or to refer him. If the GP is indifferent, we assume that he will refer the patient to the hospital.

Profit maximization of GPs in the competitive markets means that marginal cost equals price and zero profit: $p_G = c_G + d$ and $\kappa = \alpha(p_H - c_G)$. The monopolistic hospital's price is bounded from below by marginal cost and above by the patients' maximal willingness to pay for treatment: $c_H + d \leq p_H \leq r$.

The following two propositions characterize the respective equilibrium when hospitals have the option to pay kickbacks to referring GPs (i.e., $\kappa \geq 0$) and when they are not allowed to take this

⁴ The profit function contains total profits over all GPs. This is not critical as we assume an identical technology for all GPs and perfect competition.

option (i.e., $\kappa = 0$).

Proposition 1: In the equilibrium 1 with kickbacks, $x^* = 1$; i.e., all patients end up being treated in the hospital. The profit-maximizing monopoly price of inpatient care is equal to $p_H^* = r - d$. The competitive outpatient price is $p_G = c_G + d$ and the equilibrium kickback payment equals $\kappa^* = \alpha(r - d - c_G)$.

Proof: The maximal price that the monopolist can charge is r . At this price, the level of kickbacks needed to induce GPs to refer patients with a minor problem is $\kappa = \alpha(r - c_G)$. The hospital's profit from treating a referred minor case is then $r - c_H^G - \alpha(r - c_G)$. This profit is positive, because $c_H^G < c_G$ and $\alpha < 1$. A reduction in the inpatient price would obviously reduce the hospital's profit. An increase in kickbacks would also reduce the profit. It follows, then, that $p_H^* = r$ is the profit-maximizing price and $\kappa^* = \alpha(r - c_G)$ is the equilibrium kickback. With $p_H = p_H^*$ and $\kappa = \kappa^*$, GPs will refer all patients to the hospital. Hence, $x^* = 1$. ■

Proposition 2: In equilibrium 2 where kickbacks are prohibited ($\kappa = 0$), $x^* = 0$; i.e., GPs treat all visiting patients with a minor medical problem. The hospital's profit maximizing price is $p_H^* = r$ and the GPs' price is at marginal treatment cost: $p_G = c_G + d$.

The proof is obvious. If kickbacks are not allowed and, in fact, not paid, GPs have no incentive to refer patients with a minor medical problem. Hence, they treat all minor cases, while referring the severe ones to inpatient care. ■

We want to compare the hospital profit, patient welfare and overall welfare in the two equilibria. First, we note that, as prices are identical, the patients' first choice of providers is the same in the two equilibria: $\tilde{s}^* = 1 - d/(r - c_G)$.

For the profits and their difference, we calculate:

$$\begin{aligned} \pi_H^1 = & (1 - \mu)(r - c_H - (1 - F_H(\tilde{s}))d) + \mu(1 - F_G(\tilde{s}))(r - d - c_H^G) \\ & + \mu F_G(\tilde{s})(r - c_H^G - \alpha(r - c_G)), \end{aligned} \quad (4)$$

$$\pi_H^2 = (1 - \mu)(r - c_H - (1 - F_H(\tilde{s}))d) + \mu(1 - F_G(\tilde{s}))(r - d - c_H^G), \quad (5)$$

$$\pi_H^1 - \pi_H^2 = \mu F_G(\tilde{s})((1 - \alpha)(r - c_G) + c_G - c_H^G) \quad (6)$$

Clearly $\pi_H^1 > \pi_H^2$, because $r > c_G$ and $c_G > c_H^G$; the monopolistic hospital earns a higher profit in equilibrium 1 where it additionally treats the also profitable non-severe cases.

In equilibrium 1, patients who see a GP first incur negative welfare equal to the diagnosis cost d as they pay the monopoly price plus d , while patients who visit the hospital directly achieve zero net welfare. In equilibrium 2, patients with a minor medical problem treated by a GP achieve a rent that amounts to $(r - (c_G + d))$, as they pay the marginal cost of treatment. Therefore, patient welfare V in the two equilibria becomes:

$$V^1 = -F(\tilde{s}^*)d, \quad (7)$$

$$V^2 = -(1 - \mu)F_H(\tilde{s}^*)d + \mu F_G(\tilde{s}^*)(r - c_G - d), \quad (8)$$

$$V^1 - V^2 = -\mu F_G(\tilde{s}^*)(r - c_G). \quad (9)$$

As expected $V^2 > V^1$: patients benefit when kickbacks are prohibited.

Finally, for the difference in overall welfare W we find:

$$\begin{aligned} W^2 - W^1 &= V^2 + \pi_H^2 - V^1 - \pi_H^1 \\ &= \mu F_G(\tilde{s}) \left[\alpha(r - c_G) - (c_G - c_H^G) \right]. \end{aligned} \quad (10)$$

This difference cannot be signed, as it involves two elements that affect welfare in opposite directions. The first corresponds to the kickback payments for the referral of patients with a minor problem, reflecting the GPs' guilt disutility in equilibrium 1. The second reflects the increase in resource use in equilibrium 2, where minor cases are treated by the GPs and not by the hospital. Thus, a tradeoff between resource savings and disutility of referrals exists.

When GPs are solely extrinsically motivated (i.e., $\alpha = 0$), equilibrium 1 dominates equilibrium 2 in welfare terms. Although patients are worse off, the market participants as a whole benefit from the cost reduction due to efficient production if kickbacks are feasible. By comparison, perfect agency of GPs (i.e., $\alpha = 1$) is not sufficient to render the equilibrium under a prohibition of kickbacks welfare-improving. This will be the case only if the consumer rent for the patients with a minor problem compared to the inpatient cost savings is sufficiently high. Finally, if the hospital has no comparative advantage in the treatment of patients with a minor medical problem, overall welfare is lower with kickbacks, due to the guilt disutility of referring GPs.

For further possible equilibria, let us assume that patients can verify the kind of treatment they receive, but not their diagnosed health status before treatment. This excludes the possibility of overcharging, i.e., that a patient with a minor medical problem receives the appropriate inexpensive treatment, while paying the high price. Partial verifiability, however, gives rise to overtreatment, since the hospital might have an incentive to employ the expensive treatment, which still allows it to charge the monopoly price. With kickbacks $\kappa^* = \alpha(r - c_G)$, the hospital's profit and patient welfare become:

$$\begin{aligned} \pi_H^3 = & (1-\mu)(r-c_H-(1-F_H(\tilde{s}))d) + \mu(1-F_G(\tilde{s}))(r-d-c_H) \\ & + \mu F_G(\tilde{s})(r-c_H-\alpha(r-c_G)), \end{aligned} \quad (11)$$

$$V^3 = -F(\tilde{s}^*)d. \quad (12)$$

Setting $\kappa = 0$ is not profit-maximizing since $c_H > c_G$ and $\alpha \leq 1$. Furthermore, the profit is lower than under equilibrium 1 where patient cannot differentiate between a sophisticated treatment and a non-sophisticated one: $\pi_H^3 - \pi_H^1 = -\mu(c_H - c_H^G)$. By comparison, the difference to equilibrium 2 cannot be signed: $\pi_H^3 - \pi_H^2 = \mu[F_G(\tilde{s})(r-c_H-\alpha(r-c_G)) - (1-F_G(\tilde{s}))(c_H - c_H^G)]$. If patients can verify the treatment, their welfare corresponds to the one under equilibrium 1. Overall welfare under equilibrium 3 is lower than under the two alternative equilibria:

$$W^3 - W^1 = -\mu(c_H - c_H^G) < 0, \quad (13)$$

$$W^3 - W^2 = -\mu[(1-F_G(\tilde{s}))(c_H - c_H^G) + F_G(\tilde{s})(c_H - c_G) + F_G(\tilde{s})\alpha(r-c_G)] < 0. \quad (14)$$

Compared to equilibrium 1, the welfare loss corresponds to the increase in average cost due to overtreatment of the patients with a minor problem. Compared to equilibrium 2, the increase in average cost is less but additionally the guilt disutility of the referring GPs applies.

If kickbacks are not allowed and treatment verifiability applies, overtreatment also occurs as the profit from an expensive treatment of a patient with a minor medical problem is positive, whereas the profit would be zero with an inexpensive treatment. This provides us with equilibrium 4:

$$\pi_H^4 = (1-\mu)(r-c_H-(1-F_H(\tilde{s}))d) + \mu(1-F_G(\tilde{s}))(r-d-c_H), \quad (15)$$

$$V^4 = -(1-\mu)F_H(\tilde{s}^*)d + \mu F_G(\tilde{s}^*)(r-c_G-d). \quad (16)$$

Compared to equilibrium 3, the change in overall welfare is positive:

$$W^4 - W^3 = \mu F_G(\tilde{s})[\alpha(r-c_G) + c_H - c_G]. \quad (17)$$

Forbidding kickbacks when partial verifiability applies saves the patients with a minor problem visiting the GP the overtreatment they would face if they were referred to the hospital, and their GPs the corresponding guilt disutility.

We have assumed the liability of providers for inappropriate care, which excludes the possibility of undertreatment. If both liability and verifiability do not apply, the hospital will use the kickback channel, employ inexpensive treatment for every patient and always charge the monopoly price. Patients in need of a major treatment will then be undertreated. Note that a prohibition of kickbacks

would not prevent undertreatment. Such an inefficient outcome is not feasible if the patient can verify treatment. In this case, we are back in the situation dealt with above, and either equilibrium 2 or equilibrium 3 emerges, depending on the degree of altruism among GPs.

4. Differentiated Hospital Pricing, Verifiability and Competition

So far, we have not considered the option that the monopolistic hospital posts its own price for treating patients which have a minor medical problem. Let us assume that the hospital has menu prices p_H^G for inexpensive and p_H^H for expensive treatments, respectively. The expected utility of a patient visiting the hospital, is then $EU_H(s) = r - (1-s)p_H^G - s \cdot p_H^H$. Combining this with the expected utility of turning to the GP, $EU_G(s) = r - (1-s)p_G - s(d + p_H^H)$, the indifferent patient is now characterized by

$$\tilde{s} = 1 - \frac{d}{p_H^G - p_G + d}. \quad (18)$$

This equation reveals that the hospital price for patients with a major problem, p_H^H , is not relevant for the patients' provider choice, but only the price difference between in- and outpatient care for minor cases. The hospital can attract additional patients if it lowers the price for inexpensive treatment to the outpatient level. In fact, if $p_H^G = p_G$, seeking inpatient care becomes the dominant strategy for all patients, as outpatient care involves the additional fee for diagnosis d (i.e., $\tilde{s} = 0$ according to (18)).

In the base case of no verifiability, the hospital has no incentive to charge a lower price for inexpensive treatments, despite the posted differentiated price menu. Instead, it will communicate to all patients that they suffer a major illness, treat every patient according to his needs and always charge the higher price. The profit-maximizing price is $p_H^H = r$, with the profit equal to $\pi_H^5 = r - d - (1-\mu)c_H - \mu c_H^G$. This does not necessarily represent an equilibrium, because the hospital could alternatively use the kickback channel to receive the patients with a minor illness. The difference in the profit to equilibrium 1 is $\pi_H^5 - \pi_H^1 = \mu F_G(\tilde{s})\alpha(r - c_G) - F(\tilde{s})d$. This gives rise to a tradeoff between the additional diagnosis cost $F(\tilde{s})d$ in equilibrium 5 and the kickbacks $\mu F_G(\tilde{s})\kappa$ which the hospital pays under equilibrium 1. Clearly, if GPs are solely extrinsically motivated, we expect equilibrium 1 to exist. If the altruistic parameter increases above the threshold $\hat{\alpha} = \left[F(\tilde{s}) / (\mu F_G(\tilde{s})) \right] \left[d / (r - c_G) \right]$, the equilibrium switches to one without kickbacks. Equilibrium 5 also emerges if kickbacks are forbidden.

Next, consider that patients can verify the treatment and that the hospital sets its price for inexpensive treatments at the competitive level. The hospital has two options in the treatment of a patient

with a minor problem. It can either treat him inexpensively, which will lead to a profit equal to $c_G - c_H^G$, or it can overtreat him and will achieve a profit equal to $r - d - c_H$. Let us assume for a while that the second option results in a higher profit. Compared to equilibrium 3, a tradeoff exists between additional diagnostic cost and kickbacks to referring GPs: $\pi_H^6 - \pi_H^3 = \mu F_G(\tilde{s})\alpha(r - c_G) - F(\tilde{s})d$. Then, again, the equilibrium which emerges will depend on the degree of GPs' altruism. If $\alpha < \hat{\alpha}$, paying kickbacks is more profitable so that equilibrium 3 is relevant and the hospital will not post a price for inexpensive treatments. If $\alpha > \hat{\alpha}$, equilibrium 6 emerges. This equilibrium also applies when kickbacks are forbidden. If overtreatment is not profitable, the hospital will truthfully reveal the diagnosis. In this case, equilibrium 6 will not differ from equilibrium 7 which arises under general verifiability. The profit maximum is $\pi_H^7 = (1 - \mu)(r - d - c_H) + \mu(c_G - c_H^G)$, and we find $\pi_H^7 - \pi_H^6 = \mu(c_G - c_H^G - r + d + c_H)$. This difference is only positive if it is more profitable to employ the inexpensive treatment for patients with a minor problem.

Finally, assume that the hospital no longer has monopoly power. At least one other hospital may contest the market and Bertrand competition applies. *Dulleck und Kerschbamer (2006)* analyzed this environment. Firstly, the profit is zero in the equilibrium. Secondly, the price $p_H^G = p_G = c_G + d$ will ensure that all patients seek inpatient care, so that there is no need for kickbacks. Again, we differentiate between situations where verifiability applies partly, where it applies generally, and where it does not apply. If patients can verify the kind of treatment they receive, overcharging is excluded. But also cheating with the diagnosis will not occur in the equilibrium (*Dulleck und Kerschbamer, 2006, Lemma 1*). Equilibrium 8 is identical to the one that results if verifiability holds in general. All patients receive inpatient treatment at marginal cost: $p_H^G = c_H^G + d$ for a minor treatment and $p_H^H = c_H + d$ for a major treatment. Equilibrium 9 reflects the competitive outcome if no verifiability applies. Here, a posted price of hospitals for inexpensive treatment equal to $p_H^G = c_H^G + d$ again ensures that all patients seek inpatient care. The inpatient price covers average treatment cost: $p_H = d + (1 - \mu)c_H + \mu c_G$ (*Dulleck und Kerschbamer, 2006, Lemma 2*).

If the hospital market is contestable, patient welfare is maximized. With monopolistic pricing, general verifiability guarantees the competitive price for patients with a minor medical problem, while patients with a major problem pay the monopoly price. Patient welfare is then even larger than in equilibrium 2 with forbidden kickbacks, where some patients with a major problem see the GP and have to pay the outpatient diagnosis. If partial or no verifiability applies and GPs are tend to be extrinsically motivated, the hospital prefers referrals by the GPs as in equilibrium 3. Patient welfare is low, because all patients pay the monopoly price. If kickbacks are forbidden or in case GPs have a high degree of altruism, overcharging and overtreatment occurs in both equilibrium 4 and equilibrium 6. This is advantageous to all patients who no longer visit the GP and, thus, are

not charged the outpatient diagnosis. Forbidding kickbacks prevents equilibrium 3 to the benefit of patient welfare. However, patients with a minor medical problem who visit the hospital first remain subject to overtreatment. If general verifiability applies, kickbacks are zero, irrespective of whether GPs are altruistic or not. Patients benefit, since overtreatment and overcharging disappear.

Efficiency arises if all patients are treated in the hospital, no overtreatment takes place, and hospital do not use kickbacks. Positive kickbacks will not emerge when markets are contestable, as they are dispensable when the price mechanism works. Monopoly power in combination with general verifiability also ensures efficiency, as this proposition is well established in the literature on price discrimination. A monopolistic hospital may overtreat patients with a minor medical problem or use kickbacks and, thus, produce an inefficient allocation. Forbidding kickbacks in these situations increases welfare. If no variability applies, it would prevent overtreatment and achieve an efficient equilibrium. If treatment is verifiable, a prohibition of kickbacks will not prevent overtreatment and, hence, not establish an efficient outcome, which is achieved with competition.

5. Summary and Conclusion

This paper investigates the patient and overall welfare effects of kickbacks paid by a monopolistic hospital to competitive GPs in return for patient referrals. Kickbacks can incentivize defrauding behavior on the part of physicians who refer their patients to the providers. On the other hand, kickbacks can enhance overall welfare, because they incentivize GPs to refer patients to the more cost-efficient hospital. In this paper, we model medical services as credence goods where patients need one of two possible treatments (minor or major). We differentiate between equilibria where the hospital can only post one price and equilibria where the hospital can differentiate its price for major and minor treatments. GPs can only treat patients with a minor medical problem. If they refer a minor case to the hospital, they suffer a disutility, since they internalize part of the patient's expected utility of treatment. Expert markets can exhibit deficiencies, including overcharging (the patient requires the inexpensive minor treatment, but is billed the expensive one) and overtreatment (the patient receives but does not require the major treatment).

Table 1 summarizes the hospital's optimal price policy, including kickbacks in the different equilibria. The first four cases concern a monopolistic hospital which cannot post a price for inexpensive treatment. In this case, the hospital always charges the uniform monopoly price. When kickbacks are forbidden and no verifiability applies (equilibrium 2), patients visiting the GP first receive treatment at a marginal cost price if they have a minor problem or they are referred to the hospital if they are severely ill. In equilibrium 1 with kickbacks, overcharging occurs as patients with a minor problem receive inexpensive inpatient care while paying the uniform monopoly price. In equilibrium 3 with kickbacks and treatment verifiability, patients with the minor problem are overtreated. As the hospital no longer can mask its treatment procedure, it also employs the expensive treatment for minor cases. Forbidding kickbacks (equilibrium 4) does not prevent overtreatment of patients with a minor medical problem who visit the hospital first.

Table 1: Kickbacks, posted and billed hospital prices in the different equilibria

Case	Characteristics	Kickbacks κ	Hospital price list	Hospital's billing
Monopolistic hospital posts one price				
1	Kickbacks allowed, no verifiability	$\alpha(r - c_G)$	} $p_H = r$	uniform price and overcharging
2	Kickbacks forbidden, no verifiability	0		uniform price and overcharging
3	Kickbacks allowed, treatment verifiable	$\alpha(r - c_G)$		uniform price and overtreatment
4	Kickbacks forbidden, treatment verifiable	0		uniform price and overtreatment
Monopolistic hospital posts two prices				
5	Kickbacks allowed, no verifiability and $\alpha > \hat{\alpha}^a$ or kickbacks forbidden	} 0	} $p_H^H = r$ $p_H^G = c_G + d$	uniform high price and overcharging
6	Kickbacks allowed, treatment verifiable and $\alpha > \hat{\alpha}^a$ or kickbacks forbidden			uniform high price and overtreatment
7	Kickbacks allowed, general verifiability			price differentiation
Competitive hospital market, kickbacks allowed				
8	Treatment verifiable or general verifiability	} 0	$p_H^H = c_H + d, p_H^G = c_H^G + d$	marginal cost pricing
9	No verifiability		$p_H = (1 - \mu)c_H + \mu c_H^G + d$	uniform competitive price

$$^a \hat{\alpha} = [F(\bar{s}) / (\mu F_G(\bar{s}))][d / (r - c_G)]$$

A monopolistic hospital, which is allowed to differentiate its price and to post a price for inexpensive treatments, will not always take this option, but use kickbacks instead to acquire referrals of patients from GPs. This is the case if GPs tend to be extrinsically motivated. It can also happen when no verifiability applies, as this opens an opportunity to overcharge patients when they have a minor medical problem; alternatively, it can happen when patients can verify the sort of treatment they receive and the hospital has the option to overtreat patients. These two equilibria will not emerge if kickbacks are forbidden. Interestingly enough, the prohibition of kickbacks then does not prevent overcharging and overtreatment, as is the case when the hospital has no access to price differentiation.

With a sufficiently high degree of altruism among GPs, kickbacks disappear, since it is cheaper for the hospital to attract patients with differentiated pricing. If patients cannot verify either treatment or diagnosis, they are charged the uniform monopoly price, implying that patients with a minor problem will be overcharged. If patients can verify treatment, they will receive overtreatment.

Competition results in lower prices and the disappearance of kickbacks. Given that treatment is verifiable, which is necessarily the case with full verifiability, marginal cost pricing benefits both

patients' welfare and overall welfare. Finally, competition with no verifiability comes with a uniform competitive price. In this case, patients with a minor problem cross-subsidize patients with a major medical problem.

In the absence of liability of providers regarding malpractice, the undertreatment of patients with a major medical problem occurs under both a monopolistic and a competitive hospital market. Whether kickbacks are used will depend on the degree of altruism of the referring GPs and on whether the patient can verify treatment or not. A prohibition of kickbacks, however, does not solve the problem of undertreatment.

Given liability, patients benefit from the prohibition of kickbacks, while overall welfare might be reduced, even taking into account the guilt disutility of referring physicians. This will be the case for the monopolistic hospital which cannot differentiate its price if sufficiently large resource economies are not realized because of prohibited kickbacks. However, if the hospital is allowed to differentiate its price, a prohibition of kickbacks in case the hospitals would use this channel increases both patient welfare and overall welfare. The reason for this difference is that patients do not visit the GP if differentiated inpatient prices apply, as they thus save the payment for diagnosis, and thereby achieve a consumer rent. The prohibition of kickbacks can still not prevent the over-treatment that may occur if the patient can verify the treatment.

Regional monopolies in inpatient care exist, not in urban but in thinly populated rural areas. According to our analysis, a prohibition of kickbacks in a monopolized inpatient setting will increase patient welfare, but overall welfare might be negatively affected even if the ethical concerns of kickbacks are taken into account. A prohibition of kickbacks in a competitive environment is dispensable, since the price mechanism will prevent positive kickbacks.

The reimbursement of inpatient care is often regulated in the Western world. Diagnosis-related Group (DRG) payments is a commonly used reimbursement scheme, which is based on diagnostic information at the time of hospital admission. This classification is employed to guarantee a fair compensation according to the expected treatment costs and to set incentives for the hospital to minimize cost. The classification to a certain extent contributes to the verification of diagnosis. But it also extends the discretionary room that hospitals have in delivering diagnoses which lead to the so-called 'DRG creep'. Now, it is interesting to see that buyers of health care heavily invest in the verification of diagnosis and treatment in order to fight moral hazard by providers. To the extent that they are successful in this endeavor, a prohibition of kickbacks seems dispensable.

In European health care systems, we observe a trend towards integrating the provision of services. Hospitals extend their services to include ambulatory care. This form of service allows them to have the benefits of kickbacks without engaging in specifically unethical behavior. The real source of kickbacks – as pointed out by *Pauly* (1979) long ago – is the divergence of price from marginal cost. DRGs, for instance, are calculated on a full-cost base. Today, especially in indications where technology is capital-intensive, marginal cost might be substantially below average cost, which

provides incentives to increase the number of treatments, which in turn incentivizes the use of kickbacks. The prohibition of kickbacks is fighting the symptom. The direct cure for kickbacks would be a deregulation of prices so that price would equal marginal cost.

6. References

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