



Does performance disclosure influence physicians' medical decisions? An experimental study*

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Abstract

Quality improvements in markets for medical care are key objectives in any health reform. An important question is whether disclosing physicians' performance can contribute to achieving these goals. Due to the asymmetric information inherent in medical markets, one may argue that changes in the information structure are likely to influence the environment in which health care providers operate. In a laboratory experiment with medical students that mimics a physician decision-making environment we analyze the effect of disclosing performance information to peers. Our results suggest that the information structure does influence the individual physician's supply of medical services. Under performance disclosure, choices that are in accordance with the medical norm or maximize the joint benefit become more frequent.

Keywords:

Physician payment system; laboratory experiment; incentives; performance disclosure; fee-for-service; information and product quality.

JEL-Classification: C91, I11, H40, J33, L15,

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1. Introduction

As proclaimed by [Arrow \(1963\)](#), asymmetric information between physicians on the one hand, and their patients and third party payers on the other hand, is a fundamental characteristic of the market for medical care. The doctor-patient relationship is often described as one of imperfect agency where the physician's objectives, to some extent, differ from the objectives of the patient or insurer and, further, the physician has superior information. Appropriately calibrating financial incentives addresses core aspects of asymmetric information as physicians may be encouraged to make decisions in accordance with the patient's and the payer's objectives. Hence, the information gap becomes less of a problem.

In this paper, we propose that information disclosure is a potential policy measure which, in itself, may influence medical decisions due to, for instance, physicians' concerns for social reputation and/or social and personal norms (see [Bénabou and Tirole, 2006](#)). A frequently used term in this context is *audit*, defined as "any summary of clinical performance of health care over a specified period of time, given in a written, electronic or verbal format" ([Jamtvedt et al., 2006](#), p.1). For audit purposes, processed aggregates of collected information are made available via internet and other information channels. Examples of this type of information disclosure include, for instance, the English National Health Service which publishes quality information on general practitioners that is collected through the so-called *Quality and Outcomes Framework* and the Office of the Patient Advocate in the state of California which publishes ratings of health care providers and health insurance plans.

We focus on disclosing performance information among peers. Physician reputation is not influenced by performance under a regime of private information. Performance disclosure among peers may encourage improvement of medical practice. Knowing that information is made public may encourage more patient-regarding treatment decisions that correspond to the reputation a physician would like to attain. Effort is now more rewarding as it can influence one's reputation and social standing among colleagues and may also enhance one's self-image or self-respect as a good physician who adheres to the medical code of the Hippocratic oath (see e.g. [Kesternich et al., 2015](#)).³

³Other aspects include, for instance, patients' responses to disclosing performance information or how performance information influences which providers insurers prefer to contract with. Our

An undesired effect of performance revelation occurs, however, if physicians' reputation concerns personal standing in terms of income (see [Bénabou and Tirole \(2006\)](#)). Then performance disclosure may invoke some kind of competition for the highest income and more self-regarding behavior would be expected.

One may argue that introducing full or partial disclosure of provider performance implies a more transparent information structure, and hence, contributes to reducing the problems of asymmetric information in the market. Often, however, disclosure of performance information is introduced together with other health policy measures. For instance, both collecting and disclosing performance information are a necessary part of pay-for-performance schemes, and simultaneously are an important factor that influences the functioning of a market. Therefore, disentangling the effect of a change in the information regime from a change in financial incentives is difficult from observational data. Nevertheless, from the perspective of a social planner it might be valuable to distinguish between policies that target the information structure in the market and policies that are related to calibrating payment systems such as fee-for-service or pay-for-performance-type financial incentives. Understanding the causal impact of different information structures sufficiently well and identifying and quantifying their influence on market outcomes will provide the regulator with an additional policy instrument.

The research question addressed in this paper is whether disclosing physicians' performance information to their peers has an effect on their medical decisions and if so, in which direction. We are interested in choice dynamics and behavioral patterns that provide insights into physicians' motivations underlying their quantity/treatment choices. This is an important research topic because the optimal calibration of economic incentives in a physician payment scheme will depend partly on the impact the information regime itself has on performance. If, for example, introducing performance disclosure among physicians and their peers is already sufficient for inducing providers to deliver optimal quality of care, then, introducing a regime combining both – a new payment scheme and disclosure of performance measures – might be inefficient.

Different methodological approaches are used in the small but growing literature

paper will not deal with these aspects, though.

on information disclosure. In health economics, researchers have so far relied on field studies and surveys. An experimental economics literature exists on the general topic of information disclosure. Experimental economics studies on information disclosure in a physician decision-making context are rare, however, and to the best of our knowledge, our paper is currently one of the two only studies on this topic.⁴

Closing this gap is particularly important because the experimental method allows us to implement *ceteris-paribus* changes of the decision environment in a controlled way. Our experimental study will, therefore, enable us to draw inferences on the direction and strength of the effect of information disclosure on physicians' performance. As argued above, this might be difficult in a field setting, as the *ceteris-paribus* condition will rarely be fulfilled.

In our experiment, 51 medical students in the role of physicians choose quantities of medical services they want to provide for their patients under a fee-for-service payment system (FFS). Under FFS, physicians are paid for each medical procedure or service dispensed to a patient, i.e., the physician's remuneration increases in the quantity provided. The experimental subjects are exposed to two distinct information regimes: a regime of *private information* and a regime of *public information*. The number of patients and the patients' benefit functions are given and kept constant under both information regimes. The quantity a subject (she) chooses for a patient (he) determines her own profit and the patient's benefit. When making the quantity decision for a given patient, the subject knows about her own profits and the patient benefits for all choice alternatives.

The patient benefit is measured in monetary terms that represents a monetary equivalent for the benefit from the provision of medical services. For each patient, a unique quantity exists that indicates the best treatment for the patient; this provides his highest benefit. The quantity that maximizes patient benefit varies across patient types. The subject faces a tradeoff between her own profit and the patient benefit. No patients are present in the lab in our experiment. Yet, subjects' choices have consequences for real patients outside the lab, as the money corresponding to the aggregated patient benefits is transferred to a charity that uses the money to finance cataract surgery for real patients. The parameters in our experiment

⁴The second study is [Kairies and Krieger \(2013\)](#).

are identical to the fee-for-service condition of [Hennig-Schmidt et al. \(2011\)](#) and [Godager and Wiesen \(2013\)](#).

The experiment is framed in a medical context in that the subjects, who are medical students expected to become physicians in the future, make their decisions in the role of physicians. The rationale is to avoid that subjects themselves impose a context on the abstract experimental task which the experimenter cannot control ([Harrison and List, 2004](#)).

Performance disclosure is implemented by revealing to everyone present each subject's performance in terms of total profit and generated total patient benefit at the end of the experiment.

We apply a within-subject design where each subject is exposed to both scenarios of information structure. In the first part of the experiment, subjects are confronted with a regime of private information about their own performance. In the second part, we introduce public information about all subjects' performance. Information about altering the regime is made known to the subjects only after having completed the private information regime, and prior to proceeding with the performance disclosure part of the session. All experimental parameters are kept constant; only the information regime varies.

We identify behavioral patterns that are consistent with theoretical models of strict patient benefit maximizing, strict profit maximizing and efficiency concerns in that the sum of patient benefit and physician profit is maximized. Many of the subjects are rather patient-oriented as the majority (56%) of patients receive the maximum benefit even in the private information regime. Our results suggest that the information structure does influence the individual physician's supply of medical services. For one thing, we find that the probability of patients receiving their best treatment in terms of maximum patient benefit is significantly higher in the performance disclosure regime than under private information. The majority of subjects provide more patient benefit under performance disclosure, and the change in behavior towards higher patient benefit is statistically significant. Assessing the impact of performance disclosure on the probability of choosing patient benefit maximum, profit maximum or an alternative where joint benefit is maximized, we find that the probability of maximizing patient benefit and the probability of maximizing joint

benefit is substantially increased by performance disclosure. The results provide an indication that caring optimally for the patient is a social norm in our experiment.

The paper proceeds as follows: Section 2 gives a brief overview of related medical literature on survey and field research as well as on experimental economics papers dealing with information disclosure. Section 3 states our hypotheses, describes the experimental design and procedure. Results are presented in Section 4. In Section 5 we conclude and discuss policy implications of our findings.

2. Related literature

A literature review of field studies on the effect of public information on performance shows that revealing comparative information about the clinical practice of physicians may slightly improve health care quality. [Tu et al. \(2009\)](#) find some positive effects of report cards on the quality of care for patients with acute myocardial infarction and congestive heart failure in 86 hospitals. [Paulsen and Munck \(2010\)](#) report on an audit project at the University of Southern Denmark (<http://www.apo-danmark.dk>) showing that even though the level of hypertension in the study period decreases for the control group and the intervention groups of GPs, there was no difference between them. [Foy et al. \(2005\)](#), doing a meta-study on results of audits and feedback for treatment of the disease diabetes mellitus, conclude that these measures can be effective in changing health care professional practice. [Jamtvedt et al. \(2006\)](#) survey 118 studies on randomized trials of audit and feedback. They too find that audit and feedback can be effective in improving professional practice. Yet, the effects are generally small to moderate. [Ketelaar et al. \(2011\)](#) review the literature on the effect of publishing performance information on the behavior of health care consumers, professionals or organizations. They find no consistent evidence that suggests that the public release of performance data improves care.

There are several possible explanations for the mixed evidence found in the literature. For one thing, difficulties of distinguishing the effect of audits and feedback from the effect of other factors at work may account for the contradictory findings. Field studies are also vulnerable to other methodological difficulties. Not only are unobservable factors likely to affect physician behavior, but also country-specific

institutional arrangements as well as subtle contextual factors challenge the generalizability of the results (Gosden et al., 2001).⁵ Further, performance measures may not be reliable, in particular how the impact on patient benefit is to be measured.

We conduct a laboratory experiment to study the potential effect of performance disclosure. The experimental method has several advantages (see Davis and Holt, 1993; Falk and Heckman, 2009) allowing us to control the decision environment such that only *ceteris-paribus* changes are implemented. In our case, it is only the information regime that is varied: in the first part of the experiment subjects take their decisions in complete anonymity. In part two, they *ex ante* know that the outcome of their decisions will be revealed to their fellow participants *ex post*, all other things being equal. Another feature of economic experiments, in contrast to survey studies, is that decisions are incentivized. Depending on their choices, subjects get higher or lower financial rewards. Such situations correspond to those that real physicians face in medical practice. A further advantage of laboratory experiments is that they allow us to test institutional changes before they are implemented in the real world.

The only experimental economics paper we know of, in addition to ours, that compares behavior in regimes of private and public information in a physician decision-making context is Kairies and Krieger (2013). These authors analyze how public quality reporting affects physician performance in a fee-for-service payment system. Their experimental design is based on Brosig-Koch et al. (2015b) and Brosig-Koch et al. (2015a) which differs in some features from the one we use. The research focus of Kairies and Krieger (2013) also differs from ours. While we are interested in whether information revelation and ranking as such have an impact on provision behavior, Kairies and Krieger (2013) study whether service provision is influenced by information on one's own rank only (private information) against information on the full ranking of all participants in a session (public information). The authors find that public feedback has a significant and positive effect on the quality of care.

There is a general experimental economics literature on information disclosure. The literature includes studies that differ from ours in that they involve one or more of the following features: interactive decision-making like in public good

⁵See Hennig-Schmidt et al. (2011) for a discussion of further methodological problems.

games/fund-raising (e.g. [Harbaugh, 1998](#); [Andreoni and Petrie, 2004](#); [Soetevent, 2005](#)) or trust experiments ([Castillo and Leo, 2010](#)); making social distance between and/or approval of experimental participants salient (e.g. [Bohnet and Frey, 1999](#); [Gächter and Fehr, 1999](#); [Rege and Telle, 2004](#)); reducing anonymity by allowing peer observation (e.g. [Falk and Ichino, 2006](#)); and providing (much) more information than we do (e.g. [Mohnen et al., 2008](#)). These papers reveal a tendency that more information on other participants' choices, less social distance and less anonymity lead to less selfish behavior or more effort. Sometimes, however, a combination of measures is needed to achieve a significant effect; see, for instance, [Gächter and Fehr \(1999\)](#), who in a public good experiment jointly apply handshaking of group members at the beginning of the experiment and joint discussions of revealed choices afterwards. None of the above studies provides a comparably low degree of information revelation as in our disclosure regime where we disclose individual performance only at the end of a session.

Other laboratory studies investigating information disclosure effects concern dictator games, which are related to our design.⁶ In a study on social and moral norms in the laboratory, [Schram and Charness \(2015\)](#) examine dictator choices, where a shared understanding is created by providing allocation advice from peers with no financial payoff at stake. The authors find that decisions are affected when observability and the shared understanding are combined; advice leads to more generous offers but only when choices are revealed. [Andreoni and Bernheim \(2009\)](#) design their study on observation (audience) effects in such a way that dictators distribute the monetary endowment but also nature may make the allocation decision. At the conclusion of the experiment, dictators, recipients, and outcomes are publicly identified but it is not revealed whether nature or the dictator has chosen. Dictators are much less selfish when the information revelation will show that nature has no say in dividing the money. [Andreoni and Bernheim \(2009\)](#) emphasize that studying audience effects is important as they potentially affect a wide range of real economic choices.

⁶In such a game, the dictator has to divide, between herself and a recipient, a monetary endowment given to the dictator by the experimenter. The recipient has no say in the division and has to accept any allocation offered by the dictator. In contrast, in our experiment, the decision-maker only can decide on her own profit – and only thereby affects the benefit generated for the patient. She does not “own” the total endowment.

3. Hypotheses, experimental design and procedure

3.1. Hypotheses

The research question addressed in this paper is whether performance disclosure influences medical decisions. If so, what are the characteristics of the choice alternatives that becomes more or less common under performance disclosure? Moreover, we are interested in choice dynamics and behavioral patterns that provide insights into physicians' motivations underlying their quantity/treatment choices.

We relate our hypotheses on the impact of performance disclosure to three categories of behavior Behavior that complies with the medical norm where the physician's objective is to maximize the patient benefit (choice of B^*), behavior where the physician behaves selfishly and maximizes her own profit (choice of $\hat{\pi}$), and behavior where the physician seeks to maximize the sum of profit and patient benefit (choice of $\max(\pi + B)$).

Own profit as well as the patient's health benefit are seen as major determinants of physician behavior. In economic modeling of physician behavior it has become common to specify a physician's objective function as a weighted sum of the physician's own profit and the patient's health benefit (see, e.g., [Ellis and McGuire, 1986](#); [Newhouse, 2002](#); [Léger, 2008](#); [Godager et al., 2015](#)). These two categories of behavior can be represented by different specifications of the weights assigned to patient benefit and profit. Behavior consistent with maximizing patient benefit can be specified by letting profit be weighted by zero, while selfish (profit-maximizing) behavior results if patient benefit is weighted by zero. Maximizing joint outcomes – like maximizing the sum of physician profit and patient benefit as in our experiment – has been referred to as concern for efficiency (see e.g. [Engelmann and Strobel, 2004](#), [Engelmann and Strobel, 2007](#) see also [Kesternich et al., 2015](#)) in the sense that nothing of the joint payoff is wasted. Efficiency is then merely understood as the sum of payoffs, not in the sense of Pareto efficiency.⁷

When physicians are primarily motivated by patient benefit and believe this to be the social norm – in the sense of jointly-recognized agreements regarding appropriate or inappropriate behavior which is met with disapproval if not adhered

⁷Note that if equal weights are assigned to profit and patient benefit, the objective function represents behavior where the sum of profit and patient benefit is maximized.

to (see [Elster, 1989](#), [Elster, 2009](#), [Fehr and Falk, 2002](#), [Krupka and Weber, 2009](#), [Schram and Charness, 2015](#)) – with performance disclosure, patient-regarding behavior is more rewarding, as the recognition from colleagues can then be enjoyed. Hence, if patient health has to be balanced against own profit, patient health is likely to get a higher and profit a lower weight compared to private information. Thus, information disclosure will strengthen the professional norm of providing the best treatment for the patient and more pro-social behavior is observed.

When physicians are motivated by efficiency concerns they seek to provide treatment that maximizes joint profit and patient benefit. If they assume that the prevailing social norm captures caring for the patient but also caring in some way for oneself and not wasting any money, performance disclosure will induce physicians to provide more of efficiency-enhancing behavior.

We hypothesize that performance disclosure will influence individual behavior in that those choice alternatives the individual believes will induce appreciation and approval from the group will be chosen more frequently. The implication is a convergence to the social norm a physician identifies himself with.

We expect that the medical norm of caring for the patient is appealing to medical students, and hence that the individual subject believes the group of peers to appreciate adherence to this norm. Based on this expectation performance disclosure will cause an increase in the frequency of those choice alternatives consistent with pro-social behavior while those choices consistent with selfish behavior will become less frequent. This leads us to state our hypotheses.

Hypothesis 1. Patients benefit from a performance disclosure regime (*PD*) compared to a private information regime (*PI*) in that physicians are more likely to choose patient-benefit maximizing quantities under *PD* compared to *PI*.

Hypothesis 2. Physicians are less likely to choose profit-maximizing quantities under regime *PD* compared to *PI*.

Hypothesis 3. Physicians are more likely to provide treatment that maximizes the sum of profit and patient benefit under *PD* than under *PI*.

3.2. Experimental design

We apply a within-subject design, where the subjects are confronted two times with the same 15 decisions/patients in the same sequence but under different information regimes. Each subject in our experiment is assigned to a physician’s role and joins the experiment only once. All subjects are medical students. The design of our experiment is based on the fee-for-service condition of the experiment by [Hennig-Schmidt et al. \(2011\)](#).

A physician’s decision task is to choose a quantity of medical services for a given patient whose health benefit is determined by that choice. Physician i decides on the quantity of medical services $q \in \{0, 1, \dots, 10\}$ for three patient types ($j = 1, 2, 3$) with five abstract illnesses ($k = A, B, C, D, E$) each. She thus makes 15 decisions in both the private information (PI) and the performance disclosure (PD) part of the experiment. The three types of patients account for a heterogeneous patient population. Patient types reflect the patients’ different states of health. The combination of patient type and illness characterizes a specific patient 1A, 1B, 1C, ..., 3D, 3E. Patient types differ in the benefit they gain from the medical services ($B_{1k}(q)$, $B_{2k}(q)$, $B_{3k}(q)$). The patient health benefit is measured in monetary terms. A physician’s choice of medical services simultaneously determines the patient benefit and her own profit ($\pi_{jk}(q)$). The patient is assumed to be passive and fully insured, accepting each level of medical service provided by the physician.

In our experiment no real patients are present. However, physicians’ quantity choices have consequences for real patients outside the lab. The money corresponding to the aggregated patient benefits is transferred to *The Norwegian Association of the Blind and Partially Sighted*. This organization funds hospitals in Africa where real patients are taken care of, in particular by surgical treatment of cataracts.⁸ Thus, physicians have an incentive to take the patient benefit into account when making their choices.

To illustrate the physicians’ task, Figure 1 provides the decision screen for patient 1C. The physician gets information on her remuneration, costs and profit, as well as

⁸We did not inform the subjects about the money being transferred to developing countries because we wanted to avoid motives like compassion for people independent of being in need of ophthalmic surgery. This issue was raised when debriefing subjects in a pre-experiment pilot session in [Hennig-Schmidt et al. \(2011\)](#).

Figure 1: Decision screen for patient 1C

Patient type 1/Illness C					
Medical services	Quantity	Your Remuneration (in Taler)	Your Cost (in Taler)	Your Profit (in Taler)	Patient benefit (in Taler)
none	0	0.00	0.00	0.00	0.00
Service C1	1	1.80	0.10	1.70	0.75
Service C1, Service C2	2	3.60	0.40	3.20	1.50
Service C1, Service C2, Service C3	3	5.40	0.90	4.50	2.00
Service C1, Service C2, Service C3, Service C4	4	7.20	1.60	5.60	7.00
Service C1, Service C2, Service C3, Service C4, Service C5	5	9.00	2.50	6.50	10.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6	6	10.80	3.60	7.20	9.50
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7	7	12.60	4.90	7.70	9.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8	8	14.40	6.40	8.00	8.50
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8, Service C9	9	16.20	8.10	8.10	8.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8, Service C9, Service C10	10	18.30	10.0	8.30	7.50

Your Decision

Please indicate the quantity of medical services you want to provide

OK

This figure illustrates the decision screen for patient 1C.

on the patient's benefit for each quantity from 0 to 10. All monetary amounts are in Taler, our experimental currency, the exchange rate being 1 Taler = NOK 0.75 (approximately 0.10 EURO at the time of the experiment). The first two columns of the screen state the medical services and the corresponding quantities. The third column indicates the physician's remuneration that increases in the quantity of medical services. Column 4 shows the costs of medical services that are assumed to be constant across patient types in both parts of the experiment. Physician's profit (remuneration minus costs) is given in the fifth column, and the final column comprises the patient benefit.

Parameters

Physicians receive a fee for each unit of medical services provided; i.e., the remuneration increases in q . Remuneration differs with illnesses $R_{jA}(q), R_{jB}(q), \dots, R_{jE}(q)$. See panel I of Table A.1 for an overview of all remuneration parameters.

The patient benefit $B_{jk}(q)$ varies across patient types. A concave benefit function is applied, and a common characteristic is a global optimum on the quantity interval

$[0, 10]$. There is a unique quantity q_{jk}^* that yields the highest benefit to patients of type j for illnesses k . The quantities that maximize patient benefit are $q_{1k}^* = 5$, $q_{2k}^* = 3$ and $q_{3k}^* = 7$ for patient types 1, 2, 3, respectively—and are also known to the physicians.⁹ Patient benefit $B_{jk}(q)$ is shown in panel IV of Table A.1.

Further parameters relevant for physicians' decisions are costs $c_{jk}(q)$ and, particularly, profit $\pi_{jk}(q)$; see panels II and III of Table A.1. Physicians have to bear costs $c_{jk}(q) = \frac{1}{10} \cdot q^2$ under both information regimes. Profits vary across illnesses because remuneration differs, and costs are kept constant. The profit-maximizing quantity \hat{q}_{jk} is 10 for all patients, except for those with illness A, i.e., patients 1A, 2A and 3A, as $\hat{q}_{jA} = 5$. For patient 1A, $\hat{q}_{1A} = q_{1A}^* = 5$.

Experimental protocol

Our experiment was conducted at the Institute of Health and Society at the University of Oslo and was programmed with z-Tree (Fischbacher, 2007). A total of 51 medical students participated after being recruited via email invitation¹⁰. The experimental procedure was as follows. Before the experiment started subjects were randomly allocated to their workstations. The workstations were numbered and separated from each other by wooden panels, which guaranteed that subjects took their decisions in both parts of the experiment in complete anonymity. Then, the experimenter read out the instruction for the first part of the experiment where physicians' performance was kept private. Subjects were given time for clarifying questions which were asked and answered individually. To check for subjects' understanding of the decision task, they had to answer three test questions. Each subject then went through a sequence of 15 choices on the quantity of medical services to be provided. The order of patients to be treated was predetermined and kept constant across information regimes.

After each decision, each subject in both parts of the experiment was privately informed about his/her profit and the patient benefit generated by the previous choice. At the end of the first part of the experiment, he/she privately got to know his/her total profit achieved and the total patient benefit generated during

⁹From a medical point of view, there might be many acceptable treatment variations. We do not address this in our experimental setup. We assume a specific amount of medical services to provide the patient with the maximum benefit.

¹⁰When the students signed up, they were not informed about decision tasks.

all 15 quantity decisions. Then, the experimenter read out the instruction for the second, public information part. After having made all 15 decisions in the second part, each subject's performance in Part 2 was made public. This was done by displaying on each subject's computer screen an identical table showing the total profit achieved by each of the subjects present in the session, the total patient benefit generated per subject, and the corresponding workstation numbers. To make performance disclosure salient, the table was ordered according to profit, with the highest profit in a session on top of the table. Moreover, subjects had to stand up showing their workstation numbers one by one starting with the highest-profit subject and continuing to the bottom of the table. After both parts of the experiment had been completed, subjects were asked to answer questions including some about the background for their decisions. Finally they were paid in private according to their choices.

To validate the actual transfer of the money, a monitor randomly selected from the participants verified that an invoice benefitting *The Norwegian Association of the Blind and Partially Sighted* with the amount equating the aggregate patient benefits generated during the session was forwarded electronically to the appropriate e-mail address for billing the University of Oslo. All subjects in a session were included as recipients of the same e-mail. The monitor signed a statement that the appropriate monetary amount was included in the invoice, and a scanned copy of the statement was forwarded to all subjects' e-mail addresses. In addition, a signed letter from *The Norwegian Association of the Blind and Partially Sighted* confirming the amount of funds received, was also forwarded to all subjects. The monitor was paid an additional €13.00 (see also the instructions in [Appendix B](#)).

Sessions lasted for about 45 minutes. Based on decisions in the two information regimes, each of the 51 subjects earned €24.50 on average.¹¹

In total, €1,408.26 were transferred to *The Norwegian Association of the Blind and Partially Sighted*. In Malawai, one of the countries where this organization has ongoing projects, the average cost for surgical treatment of cataract patients amounts to about €41 ([Dean et al., 2012](#)). Hence the money from our experiment allowed the treatment of 33 real patients.

¹¹Average payoffs correspond approximately to the hourly wage of a student helper at the University of Oslo (€21). A lunch at the student cafeteria is around €6.50.

4. Results

4.1. Descriptive analysis of choices

We start our analysis by a descriptive investigation of how individual patients are treated under both information regimes. We are interested in choice dynamics and behavioral patterns that provide insights into physicians' motivations underlying their quantity/treatment choices. We will be led by the hypotheses stated in Section 3.1. An important element of our analysis is taking into account that some of the choice alternatives are consistent with more than one of the categories described in 3.1: B^* , $\hat{\pi}$ and $\max(\pi + B)$.

Our procedure is as follows. By means of 15 transition matrices we analyze for each physician and each patient which quantities are chosen in PI and PD . We then check whether people keep their choice of PI also in PD or whether they change their decision. If they choose differently, we analyze which quantity they move to. We observe whether or not chosen quantities are consistent with B^* , $\hat{\pi}$ and $\max(\pi + B)$.

A first important finding is that 69.8% of physicians' treatment decisions are not influenced by performance disclosure, i.e. nearly 70% of the patients are treated equally under both PI and PD . As a consequence, the change in information regimes only affects 30.2% of the patients. This inertia suggests to first investigate at which quantities high decision frequencies are found under PI because this may shed light on the underlying motives for "sticky behavior". It turns out that those quantity choices made under PI which were consistent with one of B^* , $\hat{\pi}$ and $\max(\pi + B)$ were less likely to be changed when going from PI to PD . 26.8% of all patients (i.e. 205 out of all 765 decisions) are treated in a way that is not consistent with either of the three behavioral categories, and among these 205 patients 61% receive a different treatment under PD . Yet, among those 73.2% of all patients (i.e. 560 out of all 765 decisions) that are treated in consistency with one of B^* , $\hat{\pi}$ and $\max(\pi + B)$, only 19% are provided with a different treatment under PD .

Our analysis shows an interesting behavioral pattern. Subjects keep those choices that are characterized by B^* , \hat{q} or by $\max(\pi + B)$, the latter being kept in particular when $B = B^*$. The inertia we found appears to be due to the decision characteristics that seem to provide justifiable arguments to choose a decision under private information and to keep it under performance disclosure.

Private information regime PI

First we look at treatment decisions that coincides with the medical norm (B^*) We find that 56.1% of all 765 patients receive their best treatment in the private information condition already. Thus, in more than half of their decisions subjects are motivated by delivering optimal care to the patient from the outset. Six subjects chose the patient–optimal quantity for each patient, which amounts to 11.7% of all decisions. ¹²

A second characteristic of treatment decisions that coincides with purely selfish behavior ($\hat{\pi}$) is quantity \hat{q} that maximizes the physician’s profit $\pi_{jk}(q)$. 12.9% of the patients receive a treatment that does not care for the patients’ well-being. One subject chose the profit-maximizing quantity for each patient, i.e. in 1.9% of all decisions.

Third we look at choices that coincides with ($\max(\pi + B)$) and find that. 39.7% of all patients are treated accordingly in *PI*.

Performance disclosure regime PD

When performance information is disclosed , the choice alternatives consistent with B^* , $\hat{\pi}$ and $\max(\pi + B)$ described in Section 3.1 increase in frequency. As said before, many physicians, however, keep their decisions which results in the great majority of patients being treated equally under both information regimes.

Patient-optimal quantity q^ .*

Under *PD*, in 59.5% of all decisions subjects chose to provide the maximum patient benefit B^* , an increase of 3.4 percentage points. This increase might seem rather low. But included are those 48.6% of patients who are provided with patient-benefit maximum under both information regimes. Moreover, the number of subjects who choose the patient–optimal quantity for each patient is doubled from six to 12 under performance disclosure, i.e. to 23.5% of all decision. However, 7.5% of patients suffer the loss of optimal treatment.

¹²Recall that for patient 1A q^* and \hat{q} coincide. We will analyze the impact of overlapping motivations on treatment behavior in the regression part of our analysis below.

Profit-maximizing quantity \hat{q} .

In *PD*, subjects choose to go for their maximum profit $\hat{\pi}$ in 13.5% of all their decisions, an increase of 0.6 percentage points. This number comprises 10.8% of patients who are provided with profit-maximizing treatment in both information conditions. The same subject as in *PI* always chooses \hat{q} also in *PD*.

Quantity maximizing the sum of physician's profit and patient benefit $q^{\max(\pi+B)}$.

In *PD*, subjects' treatment behavior is also characterized by $\max(\pi + B)$ as 44.1% of all their decision are accordingly, an increase of 4.4 percentage points. This number comprises 33.9% of patients who are provided with quantities that maximize the sum of physician's profit and patient benefit under both information regimes..

We test for each of the three behavioral categories separately whether the choices are different between *PI* and *PD*. We find that the frequency of choices consistent with patient benefit maximum is significantly higher under *PD* (exact McNemar significance probability= 0.0342), while for profit maximizing choices, we cannot reject the zero hypothesis that the frequency is not influenced (exact McNemar significance probability=0.6177). We find that the frequency of choices consistent with maximizing the sum of profit and patient benefit is significantly higher under *PD* (exact McNemar significance probability = 0.0037). Our descriptive analysis presents some indication that B^* and $\max(\pi + B)$ might have been considered as social norms by our subjects.

We note that the parameter values of our experimental design are such that for some of the patients, available quantity alternatives are consistent with two or three of B^* , $\hat{\pi}$ and $\max(\pi + B)$. Since the available choices are not mutually exclusive, this needs to be handled in the specification of our empirical model where we assess the impact of performance disclosure on the probability of making choices consistent with B^* , $\hat{\pi}$ and $\max(\pi + B)$.

4.2. Results from regression analysis

Our data are characterized by repeated decisions of the same subject within an information regime. Further, each decision situation occurs under each of the two information regimes. Appropriate empirical methods should acknowledge the fact that the different choices of the same subject do not constitute independent observations. We take this fact into account when specifying our empirical model. We

Table 1: The effect of performance disclosure on probability of maximizing patient benefit, profit, or the sum of patient benefit and profit. Results are from multinomial logit regression where the base alternative comprises the quantity choices other than B^* , $\hat{\pi}$ and $max(\pi + B)$

	B^*	$\hat{\pi}$	$max(\pi + B)$
	Relative risk ratio [95% CI]	Relative risk ratio [95% CI]	Relative risk ratio [95% CI]
<i>PD</i>	1.315* [1.041,1.662]	1.283 [0.965,1.705]	1.470** [1.127,1.918]
Patient type (Reference: Patient type 1)			
2	0.954 [0.715,1.272]	0.568* [0.342,0.943]	0.585*** [0.426,0.803]
3	2.993*** [1.646,5.441]	0.202 [0.0407,1.005]	5.082*** [2.758,9.364]
Illness (Reference: Illness A)			
<i>B</i>	0.220*** [0.140,0.344]	0.0283*** [0.00975,0.0821]	0.230*** [0.138,0.386]
<i>C</i>	0.309*** [0.190,0.502]	0.0137*** [0.00210,0.0891]	0.136*** [0.0761,0.244]
<i>D</i>	0.0995*** [0.0636,0.156]	0.0103*** [0.00278,0.0383]	0.0348*** [0.0196,0.0616]
<i>E</i>	0.137*** [0.0871,0.215]	0.0123*** [0.00366,0.0412]	0.0250*** [0.0146,0.0430]
# of subjects	51		
# of choice occasions	30		
# alternatives per choice occasions	4		

p-values and confidence intervals are based on standard errors that are clustered at the level of the individual subject

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

analyze the subjects' quantity choices with reference to B^* , $\hat{\pi}$ and $max(\pi + B)$. We specify a multinomial logit model to analyze the decision to maximize the patient benefit, to maximize ones' profit or to choose a quantity where the sum of patient benefit and profit is maximized. The experimental design is such that some choice alternatives are consistent with more than one category. For instance, for patient 1A, the quantity that maximizes patient benefit also maximizes the profit, and thereby the sum of profit and patient benefit. In our specification of a multinomial logit model we may allow for choices that are not mutually exclusive. We estimate our multinomial logit model after expanding the data to allow for subjects making choices consistent with more than one of the three alternatives. The estimated model is formally a special case of McFadden's (1974) choice model¹³. This model is a (conditional) case fixed effect model, which is suitable in our situation

¹³We use the module for the McFadden model in STATA 14 to estimate our model

with repeated choice occasions.

We show our estimation results in Table 1. The quantitative effects are presented in terms of relative risk ratios.¹⁴ We include dummy variables in our model specification that capture the variation in experimental parameters across patients. The estimated effect of PD on the probability of choosing the patient-benefit maximizing quantity q^* is statistically significant. The interpretation of the quantitative effect is that performance disclosure increases the relative risk of choosing q^* with 31.5%. The estimated effect of PD on the probability of choosing the profit maximizing quantity \hat{q} is not statistically significant, while PD has a statistically significant effect on the probability of choosing a quantity of medical services such that the sum of patient benefit and profit is maximized. The interpretation of the quantitative effect of PD on the probability of choosing $q^{max(\pi+B)}$ is that performance disclosure increases the relative risk of choosing $q^{max(\pi+B)}$ by 47%.

Finally, it is important to note, that the strongest among the quantitative effects in our model are the effects of the dummies that capture the variation in experimental parameters. We see, for example, that the odds that q^* is chosen is almost 3 times higher for patient type 3 who achieves patient benefit maximum at a high quantity, relative to patient type 1 who achieves patient benefit maximum at an intermediate quantity. We see further that the choice of the profit maximizing quantity \hat{q} has 43% lower odds for patient type 2 than what is the case for patient type 1. Also the probability of choosing quantities such that the sum of patient benefit and profit is maximized depends largely on the parameters of the experiment. In particular, we see that this alternative is chosen most frequently for patient type 3.¹⁵

In summary, our analysis suggests that the probabilities of making decisions in accordance with the medical norm (B^*), and in accordance with maximizing the joint benefit, ($max(\pi + B)$) are significantly higher under PD . We cannot reject the hypothesis that purely selfish behavior ($\hat{\pi}$) is unaffected by PD . Our findings, thus, are supporting Hypotheses 1 and 3. Hypothesis 2 stating that physicians are

¹⁴A relative risk ratio is a statistical effect measure which conceptually is closely related to an odds ratio and coincides with an odds ratio when there are only two outcomes. See, for example, Cameron and Trivedi (2005, p. 503).

¹⁵As a robustness check, we also estimate three separate logistic regression models where letting correspondingly choosing/not choosing $q = q^*$, $q = \hat{q}$ and $q = q^{max(\pi+B)}$ enter as dependent variables. The results as presented in Table A.2 are conceptually very similar to our previous results.

less likely to choose profit-maximizing quantities under regime *PD* compared to *PI* cannot be confirmed as we found no significant behavioral effect.

5. Discussion and policy implications

In this paper, we examine the impact of two different information regimes on the behavior of individual physicians. We introduced a fully incentivized laboratory experiment and implemented a controlled *ceteris-paribus* change of the information regime, exposing all subjects to two regimes. During the first part of the experiment all information was private. At the beginning of the second part, subjects were told that profit and patient benefit of their treatment decisions during the second part of the experiment would be disclosed to their colleagues at the end of the experiment. Since information was made public after subjects had made their treatment decisions, there is no mutual influence of the actual decisions made. Hence, we manage to isolate the impact of information disclosure irrespective of the actual content of information about profit and treatment outcomes. Our approach is more distinct than in audits, where the effect of information *per se* cannot be distinguished from the effect of the actual treatment decisions physician colleagues make.

We find that the information regime influences the individual subject's behavior. The probability of choosing quantities that are consistent with subjects being concerned for patients rises under performance disclosure. The results suggest that performance disclosure does not affect the frequency of choices consistent with purely selfish behavior. Our findings on the effects of performance disclosure on patient benefit correspond to the tendencies reported in field studies (see, e.g. [Tu et al., 2009](#); [Foy et al., 2005](#); [Jamtvedt et al., 2006](#)). They also are in line with [Kairies and Krieger \(2013\)](#) who find that public feedback has a significant and positive effect on the quality of care in that deviations from the maximal patient benefit decrease. Our experimental design allows some deeper analyses, however. In particular, in contrast to [Kairies and Krieger \(2013\)](#) where profit parameters are the same *vis-a-vis* all patients, our experiment includes variation in the profit functions.

Our study has interesting policy implications. Our results suggest that the information structure in markets for medical care can be considered a policy instrument. By thoughtfully influencing the available performance information among providers, the regulator can influence outcomes. This is an important result, as past experience

has revealed that implementing financial incentives to encourage quality improvements can be quite expensive ([National Audit Office, 2008](#)).

Although performance disclosure increases the probability of choices that are in accordance with the medical norm or with maximizing joint profit and patient benefit, we find that 69.8% of treatment decisions are identical across information regimes. Choice alternatives where patients already achieve patient-benefit-maximum dominates this picture, as 56.1% of patients receive their best treatment already under private information and 48.6% of patients achieve B^* under both information regimes. We interpret this observations as a clear indication that caring optimally for the patient is a social norm in our experiment.

There is need for more research on the topic of performance disclosure. An important question is how subjects' behave in repeated choice scenarios *after* having learned about the performance of their peers. In addition to knowing that performance information will be disclosed, one could think of experimental designs where the behavior after disclosing performance information is the subject of analysis, as described in Section 2. Learning from, and comparing others' decisions to one's own choices, is more comprehensive (and more costly) than just knowing that others will be informed about one's own decisions at the end of a session/time period.

A further policy measure that could be tested in the laboratory is sharing information with a wider audience, as described in the Introduction. Information disclosure might then impact on patient demand for a particular physician and, accordingly, also act as an indirect economic incentive. Although the payment system in our experiment is restricted to fee-for-service, payment parameters vary over patients and significantly influence the probability of choosing quantities that maximize patient benefit, own profit or the sum of profit and patient benefit. Hence, payment parameters are of key importance and offer an additional instrument for steering decisions towards desired outcomes.

6. References

- Andreoni, J., Bernheim, B., 2009. Social image and the 50–50 norm: A theoretical and experimental analysis of audience effects. *Econometrica* 77 (5), 1607–1636.
- Andreoni, J., Petrie, R., 2004. Public goods experiments without confidentiality: a glimpse into fund-raising. *Journal of Public Economics* 88 (7), 1605–1623.
- Arrow, K. J., 1963. Uncertainty and the Welfare Economics of Medical Care. *American Economic Review* 53, 941–969.
- Bénabou, R., Tirole, J., 2006. Incentives and prosocial behavior. *American Economic Review* 96 (5), 1652–1678.
URL <http://www.aeaweb.org/articles.php?doi=10.1257/aer.96.5.1652>
- Bohnet, I., Frey, B., 1999. Social distance and other-regarding behavior in dictator games: Comment. *American Economic Review* 89 (1), 335–339.
- Brosig-Koch, J., Hennig-Schmidt, H., Kairies, N., Wiesen, D., 2015a. The effects of introducing mixed payment systems for physicians - experimental evidence, working Paper, Ruhr Economic Papers, No. 543.
- Brosig-Koch, J., Hennig-Schmidt, H., Kairies-Schwarz, N., Wiesen, D., 2015b. Using artefactual field and lab experiments to investigate how fee-for-service and capitation affect medical service provision. *Journal of Economic Behavior & Organization*, –.
URL <http://www.sciencedirect.com/science/article/pii/S0167268115001158>
- Cameron, A. C., Trivedi, P. K., 2005. *Microeconometrics: Methods and Applications*. Cambridge University Press, Cambridge (UK).
- Castillo, M., Leo, G., 2010. Moral hazard and reciprocity. *Southern Economic Journal* 77 (2), 271–281.
- Davis, D., Holt, C., 1993. *Experimental Economics*. Princeton University Press, Princeton (NJ).
- Dean, W., Sherwin, J., Kumwenda, S., Angeletti, M., Wiehler, U., 2012. Willingness to pay for cataract surgery in post-operative cataract patients in rural malawi. *Ophthalmic Epidemiology* 19 (5), 265–271.
- Ellis, R. P., McGuire, T. G., 1986. Provider Behavior under Prospective Reimbursement: Cost Sharing and Supply. *Journal of Health Economics* 5, 129–151.
- Elster, J., 1989. Social norms and economic theory. *The Journal of Economic Perspectives*, 99–117.
- Elster, J., 2009. Social norms and the explanation of behavior. *Oxford Handbook of Analytical Sociology*, 195–217.

- Engelmann, D., Strobel, M., 2004. Inequality aversion, efficiency, and maximin preferences in simple distribution experiments. *American Economic Review*, 857–869.
- Engelmann, D., Strobel, M., 2007. Preferences over income distributions experimental evidence. *Public Finance Review* 35 (2), 285–310.
- Falk, A., Heckman, J. J., 2009. Lab Experiments Are a Major Source of Knowledge in Social Sciences. *Science* 326, 535–538.
- Falk, A., Ichino, A., 2006. Clean evidence on peer effects. *Journal of Labor Economics* 24 (1), 39–57.
- Fehr, E., Falk, A., 2002. Psychological foundations of incentives. *European Economic Review* 46 (4), 687–724.
- Fischbacher, U., 2007. Z-tree: Zurich Toolbox for Readymade Economic Experiments – Experimenter’s Manual. *Experimental Economics* 10, 171–178.
- Foy, R., Eccles, M., Jamtvedt, G., Young, J., Grimshaw, M., Baker, R., 2005. What do we know about how to do audit and feedback? pitfalls in applying evidence from a systematic review. *BMC Health Services Research* 5 (50).
- Gächter, S., Fehr, E., 1999. Collective action as a social exchange. *Journal of Economic Behavior & Organization* 39 (4), 341–369.
- Godager, G., Hennig-Schmidt, H., Iversen, T., 2013. Does performance disclosure influence physicians’ medical decisions? an experimental analysis, health Economics Research Network Working Paper Series, No. 2013:1.
- Godager, G., Hennig-Schmidt, H., Iversen, T., 2014. Does performance disclosure influence physicians’ medical decisions? an experimental study, health Economics Research Network Working Paper Series, No. 2014:4.
- Godager, G., Iversen, T., to Albert Ma, C., 2015. Competition, gatekeeping, and health care access. *Journal of Health Economics* 39, 159 – 170.
URL <http://www.sciencedirect.com/science/article/pii/S0167629614001428>
- Godager, G., Wiesen, D., 2013. Profit or patients’ health benefit? exploring the heterogeneity in physician altruism. *Journal of Health Economics* 32, 1105–116.
- Gosden, T., Forland, F., Kristiansen, I., Sutton, M., Leese, B., Guiffrida, A., Sergison, M., Pedersen, L., 2001. Impact of Payment Method on Behavior of Primary Care Physicians: A Systematic Review. *Journal of Health Services Research and Policy* 6, 44–54.
- Harbaugh, W., 1998. The prestige motive for making charitable transfers. *American Economic Review* 88 (2), 277–282.
- Harrison, G. W., List, J. A., 2004. Field experiments. *Journal of Economic Literature* 42, 1009–1055.

- Hennig-Schmidt, H., Selten, R., Wiesen, D., 2011. How Payment Systems Affect Physicians' Provision Behavior – An Experimental Investigation. *Journal of Health Economics* 30, 637–646.
- Jamtvedt, G., Young, J., Kristoffersen, D., O'Brien, M., Oxman, A., 2006. Audit and feedback: effects on professional practice and health care outcomes. *cochrane database of systematic reviews* 2006, issue 2. *Cochrane Database of Systematic Reviews* (2).
- Kairies, N., Krieger, M., 2013. How do non-monetary performance incentives for physicians affect the quality of medical care? A laboratory experiment, working Paper, *Ruhr Economic Papers*, No. 414.
- Kesternich, I., Schumacher, H., Winter, J., 2015. Professional norms and physician behavior: Homo oeconomicus or homo hippocraticus? *Journal of Public Economics* 131, 1 – 11.
URL <http://www.sciencedirect.com/science/article/pii/S0047272715001449>
- Ketelaar, N., Faber, M., Flottorp, S., Rygh, L., Deane, K., Eccles, M., 2011. Public release of performance data in changing the behaviour of healthcare consumers, professionals or organisations. *Cochrane Database of Systematic Reviews*.
- Krupka, E., Weber, R. A., 2009. The focusing and informational effects of norms on pro-social behavior. *Journal of Economic Psychology* 30 (3), 307–320.
- Léger, P. T., 2008. Physician Payment Mechanisms. In: Lu, M., Jonsson, E. (Eds.), *Financing Health Care: New Ideas for a Changing Society*. Wiley-VCH Press, Weinheim (Germany), pp. 149–176.
- McFadden, D., 1974. Conditional logit analysis of qualitative choice behavior. In: Zarembka, P. E. (Ed.), *Frontiers in Econometrics*. Academic Press, New York, pp. 105–142.
- Mohnen, A., Pokorny, K., Sliwka, D., 2008. Transparency, inequity aversion, and the dynamics of peer pressure in teams: Theory and evidence. *Journal of Labor Economics* 26 (4), 693–720.
- National Audit Office, 2008. *NHS Pay Modernisation: New Contracts for General Practice Services in England*. The Stationery Office, London.
- Newhouse, J. P., 2002. *Pricing the Priceless – A Health Care Conundrum*. MIT Press, Cambridge (MA).
- Paulsen, M., Munck, A., 2010. *Audit om hypertension i almen praksis 2. registrering. Report, Audit Projekt Odense*.
URL <http://www.apo-danmark.dk/files/pub/3697.pdf>
- Rege, M., Telle, K., 2004. The impact of social approval and framing on cooperation in public good situations. *Journal of Public Economics* 88 (7), 1625–1644.

- Schram, A., Charness, G., 2015. Inducing social norms in laboratory allocation choices. *Management Science* 61 (7).
- Soetevent, A., 2005. Anonymity in giving in a natural context- a field experiment in 30 churches. *Journal of Public Economics* 89 (11), 2301–2323.
- Tu, J., Donovan, L., Lee, D., Wang, J., Austin, P., Alter, D., Ko, D., 2009. Effectiveness of public report cards for improving the quality of cardiac care. *JAMA: the journal of the American Medical Association* 302 (21), 2330–2337.

Appendix

Appendix A. Experimental parameters

Table A.1: Experimental parameters

Panel	Variable	Quantity (q)										
		0	1	2	3	4	5	6	7	8	9	10
I	$R_{jA}(q)$	0.00	1.70	3.40	5.10	5.80	10.50	11.00	12.10	13.50	14.90	16.60
	$R_{jB}(q)$	0.00	1.00	2.40	3.50	8.00	8.40	9.40	16.00	18.00	20.00	22.50
	$R_{jC}(q)$	0.00	1.80	3.60	5.40	7.20	9.00	10.80	12.60	14.40	16.20	18.30
	$R_{jD}(q)$	0.00	2.00	4.00	6.00	8.00	8.00	15.00	16.90	18.90	21.30	23.60
	$R_{jE}(q)$	0.00	1.00	2.00	6.00	6.70	7.60	11.00	12.30	18.00	20.50	23.00
II	$c_{jk}(q)$	0.00	0.10	0.40	0.90	1.60	2.50	3.60	4.90	6.40	8.10	10.00
III	$\pi_{jA}(q)$	0.00	1.60	3.00	4.20	4.20	8.00	7.40	7.20	7.10	6.80	6.60
	$\pi_{jB}(q)$	0.00	0.90	2.00	2.60	6.40	5.90	5.80	11.10	11.60	11.90	12.50
	$\pi_{jC}(q)$	0.00	1.70	3.20	4.50	5.60	6.50	7.20	7.70	8.00	8.10	8.30
	$\pi_{jD}(q)$	0.00	1.90	3.60	5.10	6.40	5.50	11.40	12.00	12.50	13.20	13.60
	$\pi_{jE}(q)$	0.00	0.90	1.60	5.10	5.10	5.10	7.40	7.40	11.60	12.40	13.00
IV	$B_{1k}(q)$	0.00	0.75	1.50	2.00	7.00	10.00	9.50	9.00	8.50	8.00	7.50
	$B_{2k}(q)$	0.00	1.00	1.50	10.00	9.50	9.00	8.50	8.00	7.50	7.00	6.50
	$B_{3k}(q)$	0.00	0.75	2.20	4.05	6.00	7.75	9.00	9.45	8.80	6.75	3.00

This table shows all experimental parameters. $R_{jk}(q)$ denotes physicians' payment for patient type j and illness k . Note that $R_{jk}(q)$ varies with illnesses k and increases in q . The costs for providing medical services $c_{jk}(q)$ increase in q . Physicians' profit $\pi_{jk}(q)$ is equal to $R_{jk}(q) - c_{jk}(q)$. $B_{jk}(q)$ denotes the patient benefit for the three patient types $j = 1, 2, 3$ held constant across information regimes.

Appendix B. Instructions

[Translated from Norwegian]

INSTRUCTIONS FOR PART 1

General information

In the following experiment you will make a series of decisions. How much money you will earn will depend on the decisions you make and that you follow these instructions. It is therefore very important to read the instructions carefully.

Your choices will be made anonymously at the computer without collaborating with others. During the experiment, it is not allowed to talk to any other participants, and we ask participants to turn off mobile phones and put them away. If you have questions, please raise your hand, and one of the experimenters will come to your place and help you there. Violation of these rules may result in exclusion from the experiment without receiving any payment. All monetary amounts in the experiment are given in the artificial currency Taler. When the experiment is completed, your earnings will be converted to Norwegian Kroner at an exchange rate of 1 Taler = 0.75 Kroner. The payment will be transferred to your bank account.

This experiment consists of two parts. We will now inform you about the decision situation in part 1. We will give you further information on Part 2, when Part 1 is completed. The choices you make in Part 1, will have no impact on Part 2 of the experiment, and vice versa.

Your decisions in Part 1 of the experiment

You are in the role of a physician. All other participants of this experiment are also taking their decisions in the role of a physician. You have to decide on the treatment of 15 patients. You decide on the QUANTITY of medical services you want to provide for a given illness of a patient. You decide on your computer screen where five different illnesses—A, B, C, D and E—of three different patient types—1, 2 and 3—will be shown one after another. For each patient, you can provide 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 medical services.

Your PAYMENT is as follows: A different PAYMENT is assigned to each QUANTITY of medical services. The PAYMENT increases in the QUANTITY of medical services. While deciding on the QUANTITY of medical services, in addition to YOUR PAYMENT you determine the COSTS you incur when providing these services.

COSTS increase with increasing QUANTITY provided. Your PROFIT in Taler is calculated by subtracting your COSTS from your PAYMENT.

A certain benefit for the patient is assigned to each quantity of medical services, the PATIENT BENEFIT the patient gains from your provision of services. Therefore, your decision on the QUANTITY of medical services not only determines YOUR OWN PROFIT, but also the PATIENT BENEFIT.

An example of a decision situation is given on the following screen:

Patient type 1/Illness A

Medical services	Quantity	Your Remuneration (in Taler)	Your Cost (in Taler)	Your Profit (in Taler)	Patient benefit (in Taler)
none	0	0.00	0.00	0.00	0.00
Service C1	1	1.70	0.10	1.60	0.75
Service C1, Service C2	2	3.40	0.40	3.00	1.50
Service C1, Service C2, Service C3	3	5.10	0.90	4.20	2.00
Service C1, Service C2, Service C3, Service C4	4	5.80	1.60	4.20	7.00
Service C1, Service C2, Service C3, Service C4, Service C5	5	10.50	2.50	8.00	10.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6	6	11.00	3.60	7.40	9.50
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7	7	12.10	4.90	7.20	9.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8	8	13.50	6.40	7.10	8.50
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8, Service C9	9	14.90	8.10	6.80	8.00
Service C1, Service C2, Service C3, Service C4, Service C5 Service C6, Service C7, Service C8, Service C9, Service C10	10	16.60	10.0	6.60	7.50

Please indicate the quantity of medical services you want to provide

Your Decision

You decide on the QUANTITY of medical services on your computer screen by typing an integer between 0 and 10 into the box named "Your Decision".

There are no real patients taking part in this experiment, but abstract ones. Yet, the PATIENT BENEFIT an abstract patient receives as a result of your decision on medical services will be beneficial for real patients. The total amount corresponding to the sum over all patient benefits of your 15 patients will be transferred to Norges Blindeforbund [Norwegian Association of the Blind and Partially Sighted](www.blindeforbundet.no, blindeforbund Postbox 5900 Majorstuen, 0308 OSLO) **to support eye clinics engaged in work on prevention of blindness through treatment of patients with cataract.**

After each decision, you will be informed about your PROFIT and PATIENT BENEFIT. After having made your 15 decisions in Part 1 of the experiment, you will receive information about your total profit, and the total PATIENT BENEFIT.

Your earnings in Part 1 of the experiment

After having made your 15 decisions in Part 1, your overall earnings will be calculated by summing up the PROFITS from all your decisions. This amount will be converted from Taler into Kroner at the end of the experiment. The overall PATIENT BENEFIT resulting from your 15 quantity decisions will be converted into Kroner as well and the amount will be transferred to Norges Blindeforbund Postbox 5900 Majorstuen, 0308 OSLO). The transfer is done by sending an invoice to "Felles fakturamottak ved Universitet i Oslo" [the office where the University of Oslo handles invoices]. On this invoice, Norges Blindeforbund is stated as the recipient and the correct amount equal to the sum of total PATIENT BENEFIT of all the abstract patients in the experiment. A representative (trustee) of the participants will check the calculations and invoice. The invoice is converted to a pdf file and sent to the designated email address of "Felles fakturamottak ved Universitet i Oslo" (address@domain). To document that the money has actually been

transferred, we will forward a receipt to all participants' e-mail, as soon as the transfer to Blindeforbund will have been made.

After Part 2 of the experiment, one of the participants will randomly be assigned the role of the trustee and the trustee will receive 100 Kroner for compensation in addition to the payment from the experiment. The trustee will sign a written statement declaring that the invoice was correctly written so that Blindeforbund Postbox 5900 Majorstuen, 0308 OSLO will receive the correct amount from the University of Oslo.

Please answer now a few questions to become familiar with the decision situation.

In the examples, when you are asked to fill in fractions, please use a dot (.) as a decimal, not a comma (,).

Finally, after you have made your 15 decisions, we will ask you to answer a few more questions on your screen.

INSTRUCTIONS FOR PART 2. TO BE HANDED OUT AFTER PART 1 OF THE EXPERIMENT

The decision situation in Part 2 of the experiment is the same as in Part 1. You and the other participants in the experiment are in the role of physicians. You choose the treatment for 15 different patients. On your computer, you select the number of medical services you want to provide for a given illness of a patient. It is still the case that the PATIENT BENEFIT the abstract patients receive as a result of the medical services you provide will help to improve the health of real patients. The total amount your 15 patients receive will be transferred to Norges Blindeforbund to support eye clinics engaged in work on prevention of blindness through treatment of patients with cataracts. After each decision, you will be informed about your PROFIT and the PATIENT BENEFIT. After having made your 15 decisions in Part 2 of the experiment, you will receive information about your total profit, and the total PATIENT BENEFIT.

At the end of Part 2, each participant will be informed about their own profit, and the PROFIT of each of the other participants. Likewise, each participant will be informed about the PATIENT BENEFIT that resulted from his/her own decisions, and the PATIENT BENEFIT that resulted from the decisions of each of the other participants. NOTE: PROFIT and PATIENT BENEFIT from Part 1 are not publicly announced. The list will be sorted by PROFITS with the highest profit on top. This information screen will look something like this: **Example:**

WORKSTATION NUMBER	PROFIT	PATIENT BENEFIT
11	300	40
2	290	41
13	260	80
1	144	130
:		
:		
5	139	170

When the table is displayed on your screen, all participants in the experiment will be asked to stand up, and one by one hold up the sheet displaying the participant's workstation number, while at the same time, one of the experimenters communicates the respective individual's profit by reading it out aloud.

Your earnings in Part 2 of the experiment

Having made your 15 choices in Part 2, your total earnings are calculated by summing up the PROFITS from all your

choices. At the end of the experiment, this amount will be converted from Taler to Kroner, and the money will be transferred to your bank account together with your earnings from Part 1. The total PATIENT BENEFIT that patients receive from your 15 decisions, will also be converted to Kroner and transferred to Norges Blindforbund by the same procedure as described in the instructions for Part 1.

After Part 2 of the experiment is completed, one of the participants is randomly assigned the role of the trustee, and the trustee will receive 100 Kroner in compensation in addition to the payment from the experiment. As described in the instructions for Part 1, the trustee will sign a written statement declaring that the invoice was correctly written and sent to the University of Oslo.

After you have made your 15 decisions, we will ask you to answer some additional questions on your screen. When the experiment is over, please stay seated at your computer. We will call participants one by one and arrange payment of your earnings in private. Finally, please do not talk to others about the content of the experiment. This is to ensure that future participants are not influenced. Thank you for your cooperation.

Appendix C. Results from conducting robustness checks

Table A.2: The effect of performance disclosure on probability of maximizing patient benefit, profit, or the sum of patient benefit and profit. Results from logistic regression models estimated separate for the three dependent variables.

	B^*	$\hat{\pi}$	$max(\pi + B)$
	Odds Ratio	Odds Ratio	Odds Ratio
<i>PD</i>	1.458*	1.222	1.727*
Patient type 2	0.653	0.0649	0.139***
Patient type 3	9.164***	0.000316	24.66***
Illness B	0.121***	0.0000988	0.176***
Illness C	0.500*	0.0000181	0.0466***
Illness D	0.119***	0.0000573	0.0105***
Illness E	0.165***	0.0000763	0.00105***
# of subjects	51	51	51
# of choice occasions	30	30	30

p-values and confidence intervals are based on standard errors that are clustered at the level of the individual subject

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$