Reimbursement systems, organisational forms and patient selection: Evidence from day surgery

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Abstract

Background: Cream skimming can be defined as the selective treatment of patients that demand little resources while providing high economic refunds. We test whether cream skimming occurs after the introduction of DRG-based activity-based financing (ABF) in Norway in 1997 and if the problem further increases after the 2002 organizational reform where hospitals were turned into trusts. The DRG-system offers the same economic reimbursement for patients classified within day-surgical DRGs irrespective of whether the patient receives same-day treatment or in-patient care over several days. This both gives a potential for cream skimming and allow us to investigate cream skimming within the actual diagnoses. *Method:* Patient data from the period 1999-2005 is analyzed. Waiting time, as an indicator of patient selection, is analyzed as a function of severity within each diagnosis, controlling for age and gender of the patient, as well as institutional and time-dependent variables. *Results:* The analysis gives some evidence of cream skimming in the period of ABF, in particular within the lighter orthopaedic diagnosis. However, cream skimming does not increase after the 2002 organizational reform but is stable, or for some DRGs even reduced. *Conclusion:* The study indicates that cream skimming may occur if the reimbursement system is not particularly sophisticated, but also that political signalling can reduce the problem.

1. Introduction

Cream skimming can be defined as the selective treatment of patients that demand little resources while providing high economic refunds. An assumption for cream skimming to occur is that health insurers or health providers are able to distinguish subgroups of individuals with different expected costs within a risk group for which the risk-adjusted payment is identical (de Ven & van Vliet, 1992). Cream skimming may take on different forms, such as insurers avoiding high-risk individuals or hospitals choosing low risk patients from their waiting lists, and is usually assumed to prove a more significant problem in market-oriented than in non-market oriented systems (Le Grand, 1991). Given that recent health reforms in many Western countries have led to introduction of market-oriented hospital financing schemes (e.g. Newhouse, 1994), there is consequently a growing interest in exploring the potential for protection against cream skimming, while at the same time preserving incentives to efficiency. Adapting to the increasing market-orientation in Western welfare systems, Norway put into operation an activity-based financing (ABF) scheme for the hospitals from 1 July 1997 (Biørn et al, 2003). A second major reform was implemented in 2002 as the central government took over responsibility and ownership of all public hospitals from the counties, and turned them into trusts (Hagen & Kaarbøe, 2006).

The study of cream-skimming is mainly rooted in the economic literature, and builds on a theoretical rather than an empirical approach, with the main ambition being the development of financing systems that reduces the scope for such behaviour (e.g. Matsaganis & Glennerster, 1993; Jones & Cullis, 1996; Ellis, 1999; Barros, 2003). The approach of the present paper is somewhat different, as our ambition is to explore the actual patient prioritisation of Norwegian hospitals in the wake of the 1997 reform of the financing system and the 2002 hospital reform. We concentrate on day surgery. Day surgery has gained increasing significance during the last decade. Norwegian public health policy objectives explicitly state an aim to move towards outpatient and same-day surgical services, and this mode of treatment now constitutes more than 60 per cent of all elective surgery (Martinussen, 2005). The main arguments for substituting inpatient care with day surgery are well known: it is assumed to be less traumatising for the patient, involves lighter narcosis than in the case of traditional surgery, and implies shorter treatment time and faster convalescence. The underlying assumption is therefore that this mode of delivering surgery will ultimately increase the efficiency of hospitals as well as the quality of the patient treatment. Whereas studies of day surgery have addressed aspects such as patient satisfaction (Roberts et al., 1995; Kangas-Saarela et al., 1998; Mitchell, 1999; Lau et al., 2000), clinical outcomes (Pineault et al., 1985), cost efficiency (Russel et al., 1977; Pineault et al., 1985; Ancona-Berk & Chalmers, 1986; Keithley et al., 1989; Heath et al., 1990; Hollmann et al., 1994; Janeke, 1994; Clarke, 1996; Weale, 2002; Martinussen & Midttun, 2004), and waiting time (Midttun & Martinussen, 2005), little attention has been paid to the actual patient priorities within these kind of procedures.

Using patient data from 1999-2005, the main focus of our study is on the relationship between patient severity and waiting time for day surgery *within* the actual diagnosis related groups (DRGs). Do hospitals give priority to patients that can be treated and discharged at the same day over patients that need in-patient care over several days? Simply put, if a hospital can choose between patients that provide the same economic reimbursement, is it then more likely that low severity patients will be chosen for treatment before high severity patients? Given that length of stay (LOS) can be considered a proxy on the severity of the patient's medical condition and thereby on the resource use associated with the hospital stay, the central question to be addressed is whether the waiting time for treatment within the same day-surgical DRGs is shorter for patients with short length of stays than for patients with long length of stays.

The day-surgical DRGs are of particular interest in our setting, since the ABF system offers the same economic reimbursement for patients classified within day-surgical DRGs irrespective of whether the patient is actually treated the same day or as in-patients. The potential for cream skimming should consequently be especially high within these DRGs, since the hospitals will have an economic incentive for prioritising patients that imply the shortest length of stay. Naturally, the waiting time for treatment is dependent upon other factors than patient severity alone, and our empirical analysis controls for the age and gender of the patient, the year of treatment as well as hospital-specific effects.

The paper is organised as follows. The next section gives a brief introduction to the theoretical concept in question; the problem of patient selection. Section 3 discusses the operationalization of our main variables and describes the development of day surgery in Norwegian health care. In section 4 we develop the empirical model. The empirical results are reported in section 6, while section 7 contains the concluding remarks.

2. The problem of patient selection

Selection problems like cream skimming is usually related to health care systems where competing insurers receive a risk-adjusted premium per insured patient *or* providers receive risk-adjusted payments for treated patients. The essence of the problem on the provider side, as Newhouse (1989) puts it, is that a physician treating a patient will have more information about the patient's likely future spending than any risk-adjustment formula can incorporate. In such a context cream skimming can be viewed as a form of preferred risk-selection, as the insurer or provider select patients with expected payments to be above the expected cost level. In a theoretical investigation of the implications of different payment incentives, Ellis (1999) compares cost-based reimbursement, prospective payment, and a mixed payment system. His conclusion that prospective payment may result in undesirable creaming, skimping, and dumping is not merely a theoretical possibility; it is also one that has been found empirically to occur: real world examples of such behaviour includes Newhouse and Byrne (1988), Newhouse (1989) and Frank and Lave (1989).

The two major reforms in Norwegian secondary care during the last 10 years, the introduction of activity based financing (ABF) in 1997 and the hospital reform of 2002, may both have affected the way patients are prioritized. The Norwegian reimbursement system prior to 1997 – which implied that hospitals received a global budget by the beginning of each year – could be characterised as a prospective payment system, and thus gave incentives to cream skimming. However, the reimbursement system was combined with strong prioritising signals, both from central government and from county politicians, which were compatible with basic medical ethics: patient severity should be the main prioritising rule. It is generally believed that this rule was followed. Yet, as a result of relatively low growth in hospital budgets during the first part of the 1990s waiting lists and waiting time for elective treatment was high. The implementation of ABF from 1 July 1997 implied that a proportion of the block grant from central government was replaced by a matching grant depending upon the number and composition of hospital treatments measured by the DRG system. Initially, 30 per cent of the grant was related to the number of DRG equivalents. The ABF share was gradually increased to 60 per cent of the total budget in 2003, reduced to 40 per cent in 2004 and yet again increased to 60 per cent in 2005. The introduction of ABF increased production and efficiency (Biørn et al., 2003) and reduced waiting lists and waiting time. But has it also lead to cream skimming? Will a shift from a low-powered to a higher-powered prospective payment system influence priorities? A survey conducted in 1999 on the consequences of the ABF system indicates that this may be the case. The results show that 10 per cent of the chief surgeons in somatic hospitals had experienced pressure or instructions from the hospital management to give preference to profitable patients (Halvorsen, 1999). Also, in 10 per cent of the outpatient departments the respondents held the opinion that the choice as to whether patient treatment were to take place via hospitalisation, day treatment or in outpatient departments was guided by revenue generation rather than medical evaluations. Moreover, 25 per cent of the chief surgeons considered operations and treatment to be de-prioritised due to dependency of outpatient income.

The second major reform implied that the central state from 1 January 2002 took over ownership and responsibility of hospitals from the county governments, organized the hospitals as trusts within five regional health authorities and implemented private sector accounting systems (Hagen & Kaarbøe 2006). Again, one can hypothesize increased cream skimming, as trusts are believed to be more revenue-oriented than governmental bodies. Even if central government has emphasised that prioritisations should be grounded in medical ethics rather than on the basis of economic evaluations, there has been a growing concern – indicated for instance in several articles in the Journal of the Norwegian Medical Association (e.g. Haug, 2001; Pettersen, 2001; Øgar, 2001) – that the contrary would be the case. A survey conducted in 2006 furthermore demonstrates that 60 percent of hospital physicians view the new organizational model as giving incentives for prioritizing profitable patients. One in three physicians reports that a businesslike way of making priorities – meaning that patients are prioritized according to the net revenues they generate – is emphasized in their department (Aasland et al., 2006).

Thus, we can state our two main hypotheses as such:

1) Hospitals partly reimbursed by DRG-based activity based financing will with a probability select low severity patients *over* high severity patients (low risk over high risk patients) within the actual DRG.

2) Turning the hospitals into trusts will *increase* the probability with which the hospitals select low severity patients over high severity patients within the actual DRG.

3. Operationalization of main variables

We test our hypothesis by investigating the relationship between waiting time for treatment and severity for elective patients. Our dependent variable, *waiting time for treatment (WT)*, is defined as the number of calendar days from the patient is referred from the primary physician or private specialist to the hospital treatment starts. If our hypotheses are confirmed, waiting time should be lower for low severity than for high severity patients.

The essential explanatory variable, *patient severity*, is operationalized as the patient's *length of stay (LOS)* in the hospital. As already indicated, severity is hypothesised to affect waiting time positively. There are two underlying assumptions here. First, we assume that LOS within each DRG is a proxy for severity. This is documented in several studies for inpatients (e.g. van den Pool et al 2006) and now also for procedures that can be performed both in inpatient and outpatient departments (e.g. Latham et al 2006). Second, we assume that that hospitals in most cases hold relatively detailed information about a patient's condition before the surgery takes place, obtained either through medical deliberations from the patient's primary physician, through outpatient consultations at the hospital, or both. Norway makes for a particular case here, since the waiting time regulations guarantee that a hospital specialist within a maximum of thirty days after referral and before surgery will formally assess all patients. When organising the waiting list, the hospital will therefore have a pretty good ex ante estimate on most patients' LOS, and thereby on the resources that can be expected to be related to each case. Consequently, and although there will be exceptions, LOS registered ex post can be used as proxy for ex ante evaluations of severity. Exceptions will be related to for instance post operational infections and other complications during the hospital stay. Given the ABF-reform described above, we hypothesize that the hospitals will have an incentive to select the patients that can be assumed to have the shortest LOS; i.e. the patients demanding the least resources for a given economic refund.

We test our propositions on data from day surgery since the ABF system offers the same economic reimbursement for day surgical patients irrespective of their length of stay in the hospital. The data set consists of more than 1.2 millions patients receiving day surgery during the period 1999-2005. Figure 1 shows the increase in day surgical activity during the period.

- Figure 1 -

A first impression of the relationship between patient severity and waiting time for elective day surgery can be obtained by comparing the waiting time for short stays (LOS = 0.5 day) and long stays (LOS ≥ 1 day), respectively (figure 2). The figure obviously lends little support to a hypothesis that more severe patients waited longer than less severe patients. Even though waiting time for short stays dropped during the period, the waiting time decreased more than the double for long stays, with 38 days for the former type of patients and 87 days for the latter. Notice in particular the significant drop in short-stay waiting time from 2002 – the year of the hospital reform – to 2005, during which waiting time was reduced by 29 days.

- Figure 2 -

Treating all day-surgical activity as one naturally implies a vast over-simplification. Given that day surgery in 2005 comprised 151 different DRGs, involving a large number of various procedures, a more suitable approach is instead to focus on the specific day-surgical DRGs. Figure 3 therefore presents the actual share of same-day treatments performed within the day-surgical DRGs that had a patient volume of at least 2 per cent of all day surgery during the 1999-2005-period. The table serves as a good illustration of why day surgery deserves special attention in the context of patient selection: within several of the day-surgical DRGs there is a surprisingly low share of patients that are actually treated by same-day treatment, while other DRGs have an almost 100 per cent same-day treatment share. In fact, the percentage same-day treatment is below 70 per cent for one third of the DRGs presented in figure 3, and for DRGs 60, 112 and 359 the share of same-day treatment is even below 50 per cent. At the other end of the scale we find DRGs 6, 39, 40 and 381, with more than 90 per cent same-day treatments (for a description of the DRGs, see table 2). The large variation between the DRGs in terms of the actual use of same-day treatment is naturally related to the procedures' level of complexity and patients' convalescence period.

- Figure 3 -

The potential for patient selection is naturally higher the larger and more heterogeneous the patient group. Hence, for the DRGs with near 100 per cent same-day treatment, there exits little room for making this kind of prioritisations between patients based on assumed LOS, given that almost all patients are treated the same day. However, since it is difficult to decide exactly where to set the limit for which DRGs should be investigated, and in order to obtain as complete a picture as possible, we choose to include all DRGs in our analysis.

4. Empirical model

Although patient severity described by LOS is the variable of main interest in our study, a number of additional variables can naturally be expected to influence waiting time (WT_i) for patient i, and consequently need to be controlled for in the analysis. Our basic empirical model captures effects of patient-specific, hospital-specific and time-specific variables within each DRG, and can be written:

$$\mathrm{Ln}(\mathrm{WT_i}) = \beta_0 + \beta_1 \mathrm{Ln}(\mathrm{LOS_i}) + \beta_2 \mathrm{Ln}(\mathrm{Age_i}) + \beta_3 \mathrm{Gender_i} + \beta_4 \mathrm{D} + v_i \qquad (1)$$

Age is patient i's age measured in intervals of five years, and gender is a dummy-variable for which the value of 1 is assigned to male patients, otherwise 0. *D* is a vector of dummies representing institutional and time-specific variables specified in alternative ways, while v is the error term. The structure of the error term is affected by the specifications of *D*, which we now turn to. First, and common to all empirical specifications, we estimate the impact of the 2002 hospital reform by a dummy variable, *REFORM*, that takes the value of 0 in the period from 1999 to 2001 and the value of 1 in the period from 2002 to 2005, and an interaction term between *REFORM* and LOS (*LOS x REFORM*). In one of our estimated models we additionally include hospital-specific (*H*) and year-specific dummy variables (*Y*). Equation (2a) expresses this alternative specification for the dummy variables in (1):

$$D = \beta_5 REFORM + \beta_6(LOS \times REFORM_i) + \beta_7 H + \beta_8 Y \quad (2a)$$

β_1 gives us the effect of patient severity on waiting time under the financial regime of ABF (before the 2002 hospital reform), while ($\beta_1+\beta_6$) gives us the estimated effects of patient severity on waiting time after the hospital reform. If turning hospitals into trusts increases cream skimming, the interaction term should take positive estimates ($\beta_6 >1$). The time trend in waiting time will be captured by *REFORM* and the time-specific variables, *Y*. As figure 2 indicates, there has been a strong reduction in waiting time during the 7-year-period studied. The reduction in waiting time for elective treatments started in 2000 mainly as the result of the introduction of ABF in 1997 and a general increase in expenses to hospital care from the same moment in time. After the responsibility for providing specialized health services was transferred to central government in 2002, there has been a further reduction in average waiting time of more than 20 per cent. The hospital-specific variables (*H*), included for both public and private hospitals, will work as 'fixed effects'. The fixed effects will capture both observed and unobserved time-constant variables. In addition, by controlling for fixed effects we are able to study the *within* effects of the time varying variables, for example LOS. The estimates of LOS in the fixed effects-models tell us how much *WT* changes as LOS changes, within the specific hospitals (and for the specific DRG).

Not all institutional variables are time constant variables. Some variables that may affect *WT* change both between institutions and over time. The hospitals' budget is one such variable. Another is a non-observed variable that describes the introduction of separate day-surgical units during the period analysed. Obviously, an increase in day surgical units may stimulate treatments of less severe cases. To account for unobserved variables that change within hospitals and across time we include an interaction term between *Y* and *H*. Equation (2b) represents and alternative specification of the dummy variables in (1) that capture the challenges from observed and unobserved variables that are both varying between and within institutions:

$$D = \beta_5 Reform + \beta 6 LOS_i \times Reform + \beta_7 Y + \beta_9 Y \times H \quad (2b)$$

We report results from equation 1, specification 2a, in the tables, and comment upon the results from specification 2b in the text. Descriptive statistics for the variables are presented in table 1.

5. Empirical results

The analysis employs patient-data for the period from 1999 to 2005, and includes only day-surgical DRGs that represent a patient volume of at least 2 per cent of all day-surgical stays during the period, and by this criterion we are left with 16 DRGs available for analysis, each DRG including between 22 785 and 154 293 patients. The basic model (equation 2a) is estimated via OLS regression, and the results are reported in table 2.

- Table 2 -

Starting with the variables of main interest, the empirical results lend support to our first hypothesis, as we observe a positive relationship between severity – described by LOS – and waiting time for 10 of the 16 DRGs analysed. In particular, for the light orthopaedic procedures (DRG 222: operations on knee, DRG 224: operations on shoulder, elbow and forearm, DRG 225: foot procedures, DRG 229: hand and wrist procedures and DRG 232: arthroscopy) there is a marked difference in waiting time. We also find the same pattern for lens procedures (DRG 39), extra ocular procedures (DRG 40), tonsillectomy (DRG 60), percutaneous cardiovascular procedures (DRG 112), and vein ligation and stripping (DRG 119). The estimates for the LOS-variable is expressed as elasticises and should be interpreted as the percentage increase in waiting time for one percentage increase in LOS. The tendency of patient selection due to severity is most pronounced for percutaneous cardiovascular procedures and knee operations, for which a 1 per cent increase in LOS increases waiting time with 0.81 for the former and 0.24 per cent for the latter. In practical terms, the effects amount to average increases in waiting time of 72 and 33 days, respectively.

Note however that the estimates of LOS on waiting time vary considerably between the DRGs; from 0.81 to 0.06 per cent. In the cases of the weakest effects associated with LOS one may therefore question the practical impact in terms of actual waiting time, but that would be jumping to conclusions. Consider for instance the LOS-estimate of .06 per cent obtained for DRG 225 (foot procedures): given that the average waiting time is over 212 days for such treatment, a 1 per cent increase in LOS would still imply that a patient on average stand to wait almost two weeks longer for treatment (when the other independent variables are held constant) – which could be quite much in cases of painful illnesses.

However, the picture is not quite clear-cut, as the results also indicate the opposite relationship for LOS and waiting time – i.e. prioritisation according to severity – for 3 of the 16 DRGs analysed: DRGs 36 (retinal procedures), 270 (other skin, subcut tissue and breast procedures), and 359 (uterine and adnexa procedures).

While we consider our first hypothesis – that hospitals reimbursed by DRG-based ABF-systems will select low severity patients *over* high severity patients within the actual DRG – as partly confirmed, our second hypothesis receives little support at all. The interaction variable (*LOS x REFORM*) indicates whether the hospitals after the trust reform select patients on different criteria than before the reform within the actual DRG. It takes negative values for 5 and non-significant estimates for 9 of the 16 DRGs. This indicates that the problem of cream skimming is reduced after the reform. Only for 2 of the DRGs (DRG 162: inguinal and femoral hernia procedures and DRG 359: uterine and adnexa procedures) do we observe a positive relationship for the interaction variable, indicating increased cream skimming in this period.

Age does not seem to be systematically related to waiting time. It is however worth bringing up that the waiting time for DRG 112 (percutaneous cardiovascular procedures) is significantly lower for persons with high age than for those who are younger. The empirical results furthermore uncover relatively strong gender differences in waiting time, and, with a few exceptions, in favour of male patients: men waited shorter than women for treatment in as many as 9 of the DRGs analysed. The differences are most pronounced for extra ocular procedures (DRG 40) and foot procedures (DRG 225). The advantages enjoyed by male patients are above 0.10 per cent only in 3 of the 9 DRGs. The opposite relationship only appears in 2 cases: male patients waited *longer* than female patients for DRG 224 (shoulder, elbow or forearm procedures) and DRG 229 (hand or wrist procedures).

The effects of the variable that describes the 2002 hospital reform and the year-specific dummy-variables reflect the strong reductions in waiting time during the period of analysis. As can be observed, in particular lighter orthopaedic procedures have had a strong decrease in waiting time from 1999 to 2005.

Finally, the alternative specification of the dummy variables – the inclusion of a year-specific and hospital-specific interaction term in addition to the year-wise dummy-variables (equation 2b) – only marginally alters the results reported in table 2 (the results are not reported here). This model increases the explanatory power of the model for all DRGs analysed, which is naturally to be expected. The estimates for the variable of main interest, LOS, appear robust, as we generally obtain estimates very close to those returned from the basic model (equation 2a). In the cases for which LOS exerts the strongest positive effect on waiting time – DRGs 112 and 222 – the estimated effect are reduced somewhat for the former procedure, from 0.78 to 0.61 per cent, and increased marginally, from 0.22 to 0.24 per cent, for the latter. As regards the interaction term (*LOS x REFORM*), it is worth noticing that the alternative specification returns a significant positive estimate for DRG 39, a significant negative estimate for DRG 60, while the significant positive estimate obtained for DRG 162 in the basic model becomes insignificant. Otherwise, the results basically remain the same.

6. Conclusions

In the setting of this paper, cream skimming is the kind of patient selection that occurs when patients that demand little resources for a given economic refund (low risks) are prioritized over patients that demand more resources for the same refund (high risks). We have investigated whether cream skimming takes place within day surgery after the introduction of ABF in Norway in 1997, and if the problem has increased after the public hospitals was turned into trusts from 2002.

Our first hypothesis, that hospitals reimbursed by DRG-based ABF-systems select low severity patients over high severity patients within the actual DRG, is confirmed. Our empirical investigation signifies that some form of patient selection occurs within several of the largest DRGs. Yet, our results should be interpreted with some caution. First of all, the practical impact of patient severity on waiting time is marginal for some of the DRGs studied. It must therefore be emphasised that the tendency of patient selection applies first and foremost to the light orthopaedic procedures: it is for these procedures that the positive LOS-effects are most pronounced, with the waiting time disadvantages exceeding a week for each extra day

LOS. Secondly, it is also important to bear in mind that our analyses concentrate on the 'easiest' of the 'easy' patients. In other words, these are patients that are better suited to wait than patients with more severe illnesses.

Our second hypothesis was that the problem of cream skimming would increase after turning the Norwegian hospitals into trusts in 2002. This hypothesis failed to receive any support. Although there has been a huge increase in the treatment of patients with lighter diagnosis in the period after the 2002 reform (Martinussen, 2005), the problem of cream skimming within the actual diagnosis is stable or even reduced for many of the DRGs in this period. A possible explanation of this is stronger prioritizing signals from the Ministry of Health (MOH). It can be argued that the fear of cream skimming has led the MOH to be more active than before, and that strong prioritizing signals have been formulated and included both in political speeches and in the annual planning documents from the MOH to the regional health authorities.

An important point related to cream skimming noted by Pauly (1984), is that cream skimming is the result of *regulation* and not of *competition*. If insurers, or in our setting the providers, were free to set their premiums in a competitive market, the result would be premium differentiation rather than cream skimming. The problem is that premium differentiation in a free market is bound to imply that for instance an 80-year old person would have to pay a much higher premium than a 20-year old, and that a chronically sick person would have to pay many times the premium of a chronically well person of the same age. Risk-adjusted per capita payments (or vouchers) can therefore be seen as "a form of regulation that attempts to simulate the premium structure in a competitive health insurance market without having the adverse effect of (extreme) premium differentiation" (Pauly, 1984: 24). Hence, cream skimming is likely to occur when the system of risk-adjusted payments is not sufficiently sophisticated. In this analysis the risk-adjusted payment is not very sophisticated since hospitals receive the same price irrespective of the patient is treated same day or as an inpatient. The study indicate that this can lead to cream skimming, but also that the problem of cream skimming can be reduced not only by premium differentiation but also by political signalling.

References:

Aasland, O., T. P. Hagen & P. E. Martinussen (2006). Sykehuslegenes syn på sykehusreformen. Unpublished manuscript. Oslo: Institute of Health Management and Health Economics, University of Oslo.

Ancona-Berk, A. V. & T. C. Chalmers (1986). An analysis of the costs of ambulatory and inpatient care, *American Journal of Public Health* 76: 1102-1104.

Barros, P. B. (2003). Cream-skimming, incentives for efficiency and payment system, *Journal of Health Economics* 22: 419-443.

Biørn, E., T. P. Hagen, T. Iversen & J. Magnussen (2003). The effect of activity-based financing on hospital efficiency: A panel data analysis of DEA efficiency scores 1992-2000, *Health Care Management Science,* 6: 271-283.

Clarke, A. (1996). Why are we trying to reduce length of stay? Evaluation of the costs and benefits of reducing time in hospital must start from the objects that govern the change, *Quality Health Care* 5: 172-179.

de Ven, W. P. M. M & R. C. J. A. van Vliet (1992). How can we prevent cream skimming in a competitive health insurance market? The great challenge for the 90's, in P. Zweifel & H. E. Frech III (eds.), *Health economics worldwide*. Dordrecht: Kluwer Academic Publishers.

Ellis, R. P. (1999). Creaming, skimping and dumping: provider competition on the intensive and extensive margins, *Journal of Health Economics* 17: 537-555.

Frank, R. & J. Lave (1989). A comparison of hospital responses to reimbursement policies for Medicaid psychiatric patients, *Rand J Econ* 24: 588-600.

Hagen, T. P. & O. Kaarbøe. 2006. The Norwegian Hospital Reform of 2002: Central Government Takes Over Ownership of Public Hospitals, *Health Policy*, 76: 320-333.

Halvorsen, P. (1999). Presses til å prioritere inntekt fremfor medisin, *Tidsskrift for Den norske lægeforening* 199: 3480-3481.

Haug, C. (2001). Makten flyttes, *Journal of the Norwegian Medical Association* 18: 2139.

Heath, P., T. Ogg, C. Hall & G. Brownlie (1990). The cost of day surgery, *Health Trends* 22: 109-111.

Hollmann, R., A. Rotzer & J. Lange (1994). Ambulatory surgery – a sensible future perspective, *Helvetica Chirurgica Acta* 60: 803-806.

Janeke, J. B. (1994). Same-day surgery is cost-effective and safe, *South African Medical Journal* 84: 454.

Jones, P. R. & J. G. Cullis (1996). Decision making in quasi-markets: a pedagogic analysis, *Journal of Health Economics* 15: 187-208.

Kangas-Saarela, T., J. Ohukainen, M. Koivuranta (1998). Patients' experiences of day surgery – an apporach to quality control, *Ambulatory Surgery* 7: 31-4.

Keithley, J., G. L. Glandon, J. Llewellyn, B. Berger & D. Levin (1989). The cost-effectiveness of same-day surgery, *Nursing Economics* 7: 90-93.

Latham, N. K., D. U. Jette, R. L. Warren & C. Wirtalla (2006). Patterns of functional change during rehabilitation of patients with hip fracture, *Archives of Physical Medicine and Rehabilitation* 87: 111-116.

Lau, H., J. Poon & F. Lee (2000). Patient satisfaction after ambulatory inguinal hernia repair in Hong Kong, *Ambulatory Surgery* 8: 115-8.

Le Grand, J. (1991). Quasi-markets and social policy, *The Economic Journal* 101: 1256-1267.

Martinussen, P. E. (2005). Dagkirurgi, in R. Jørgenvåg (ed.), SAMDATA Hospital Report 1/05. Trondheim: SINTEF Health Research.

Martinussen, P. E. & L. Midttun (2004). Day surgery and hospital efficiency: empirical analysis of Norwegian hospitals, 1999-2001, *Health Policy* 68: 183-96.

Matsaganis, M. & H. Glennerster (1994). The threat of 'cream skimming' in the post-reform NHS, *Journal of Health Economics* 13: 31-60.

Midttun, L. & P. E. Martinussen (2005). Hospital waiting time in Norway: what is the role of organizational change?, *Scandinavian Journal of Public Health* 33: 439-446.

Mitchell, M. (1999). Patients' perceptions of day surgery: a literature review, *Ambulatory Surgery* 7: 65-73.

Newhouse, J. (1994). Patients at risk: health reform and risk adjustment, *Health Affairs* 1: 132-146.

Newhouse, J. (1989). Do unprofitable patients face access problems?, *Health Care Financing Review* 11: 32-42.

Newhouse, J. & D. J. Byrne (1988). Did Medicare's prospective payment cause lengths of stay to fall?, *Journal of Health Economy* 7: 413-416.

Pauly, M. V. (1984). Is cream-skimming a problem for the competitive medical market?, *Journal of Health Economics* 3: 87-95.

Pettersen, I. J. (2001). Fra plan til marked – noen perspektiver på sykehusreformen, *Journal of the Norwegian Medical Association* 121: 2186-8.

Pineault, R., A.-P. Contandriopoulos, M. Valois, M.-L. Bastian & J.-M. Lance (1985). Randomized clinical trial of one-day surgery: patient satisfaction, clinical outcomes and costs, *Medical Care* 23: 171-182.

Roberts, B. L., G. M. Peterson, W. T. Friesen & W. G. Beckett (1995). An investigation of pain and management following gynaecological day surgery: differences between open and closed surgery, *Journal of Pain and Symptom Management* 5: 370-7.

Russel, I. T., H. B. Devlin, M. Fell, N. J. Glass & D. J. Newell (1977). Daycase surgery for hernias and haemorrhoids, *Lancet* 1: 844-847.

Van den Pool, M. A., M. van Houdenhoven, E. W. Hans, E. Boersma, J. J. Bax, H. H. H. Feringa, O. Schouten, M. R. H. M. van Sambeek & D. Poldermans (2006). Influence of cardiac risk factors and medication on length of hospitalization in patients undergoing major vascular surgery, *The American Journal of Cardiology*, 97: 1423-1426.

Weale, A. R. (2002). Randomized clinical trial of the effectiveness of emergency day surgery against standard inpatient treatment, *British Journal of Surgery* 89: 423-427.

Øgar, P. (2001). Statlige sykehus – hva så?, *Journal of the Norwegian Medical Association* 18: 2189-2191.

Figures

Figure 1. Per cent day surgery of all elective surgery and all surgery, Norway, 1999-2005.

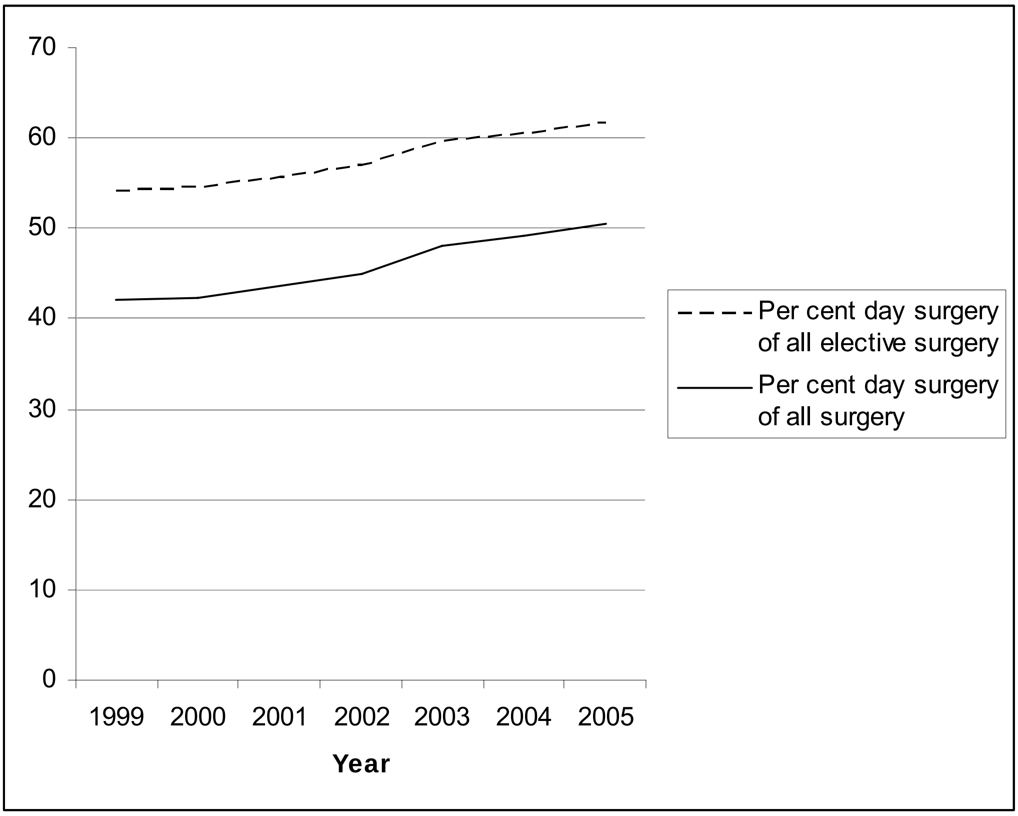


Figure 2. Average waiting time and length of stay for day-surgical DRGs (elective stays), Norway, 1999-2005.

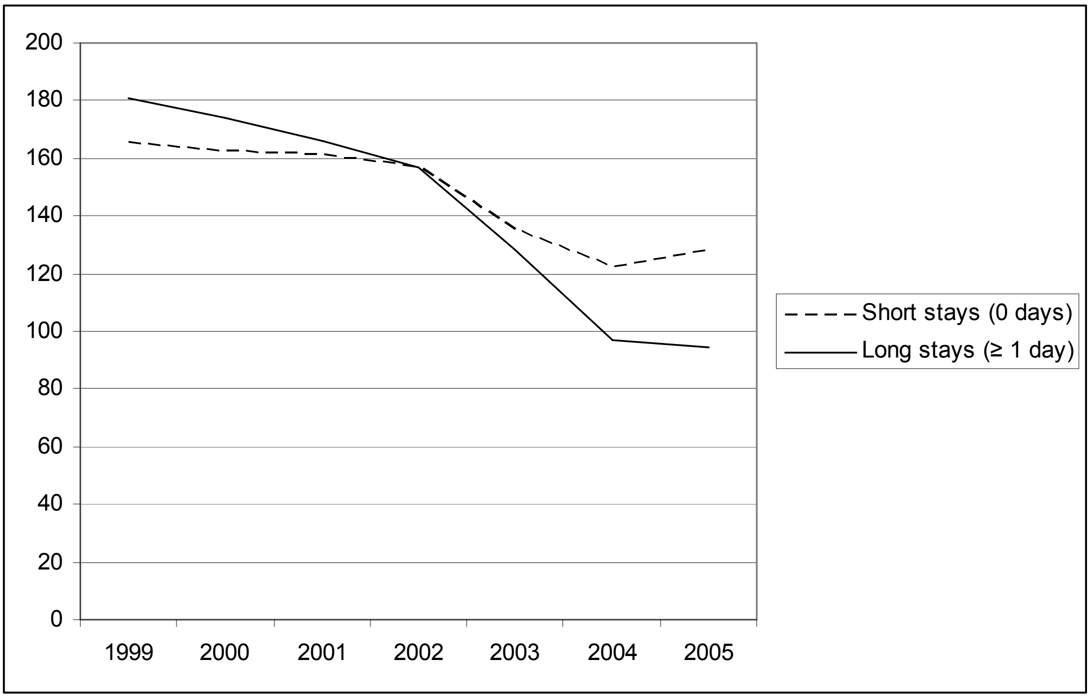
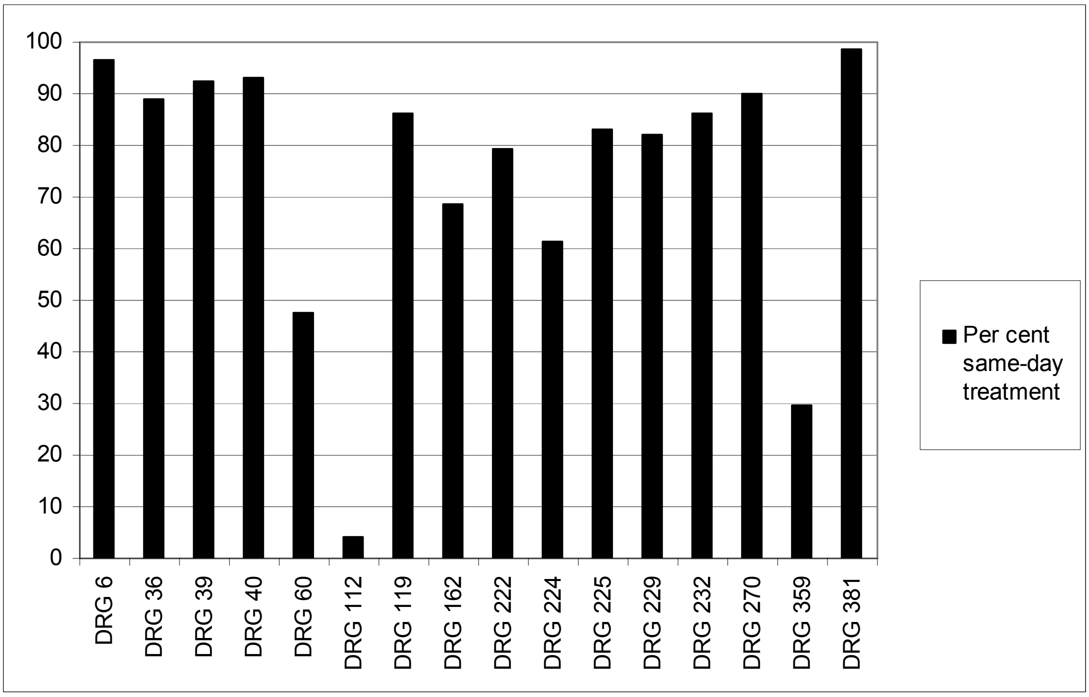


Figure 3. Per cent same-day treatment within specific day-surgical DRGs, Norway, 1999-2005.



Tables

Table 1. Descriptive statistics for the variables in the analysis. Minimum and maximum values, mean and standard deviation.

	Min. value	*Max. value*	*Mean*	Std. deviation
1999 (Valid N=124 872):				
LOS	.50	208.00	1.88	3.05
Age	1.00	18.00	10.16	4.89
Male	.00	1.00	.41	.49
Reform	.00	.00	.00	.00
LOS*Reform	.00	.00	.00	.00
Waiting time	1.00	999.00	175.75	187.58
2000 (Valid N = 171 387):				
LOS	.50	202.00	1.65	2.66
Age	1.00	18.00	10.12	4.84
Male	.00	1.00	.40	.49
Reform	.00	.00	.00	.00
LOS*Reform	.00	.00	.00	.00
Waiting time	1.00	999.00	171.66	187.95
2001 (Valid N = 194 212):				
LOS	.50	196.00	1.70	2.86
Age	1.00	18.00	10.20	4.70
Male	.00	1.00	.40	.49
Reform	.00	.00	.00	.00
LOS*Reform	.00	.00	.00	.00
Waiting time	1.00	999.00	167.76	190.21
2002 (Valid N = 196 192):				
LOS	.50	109.00	1.62	2.69
Age	1.00	18.00	10.27	4.63
Male	.00	1.00	.41	.49
Reform	1.00	1.00	1.00	.00
LOS*Reform	.00	109.00	1.29	2.83
Waiting time	1.00	999.00	161.91	181.60
2003 (Valid N = 225 910):				
LOS	.50	213.00	1.75	3.19
Age	1.00	18.00	10.51	4.58
Male	.00	1.00	.42	.49
Reform	1.00	1.00	1.00	.00
LOS*Reform	.00	213.00	1.42	3.32
Waiting time	1.00	999.00	146.88	169.00
2004 (Valid N = 167 015):				
LOS	.50	192.00	1.73	3.27
Age	1.00	18.00	10.55	4.62
Male	.00	1.00	.42	.49
Reform	1.00	1.00	1.00	.00
LOS*Reform	.00	192.00	1.40	3.40
Waiting time	1.00	999.00	137.56	160.71
2005 (Valid N = 189 234):				
LOS	.50	178.00	1.70	3.23
Age	1.00	18.00	10.53	4.61
Male	.00	1.00	.43	.49
Reform	1.00	1.00	1.00	.00
LOS*Reform	.00	178.00	1.37	3.36
Waiting time	1.00	999.00	138.91	162.04

Table 2. Determinants of waiting time for elective day surgery, Norway, 1999-2005. Estimates obtained from OLS regression. Unstandardised estimates with standardised t-values in parenthesis.

	DRG 6	DRG 36	DRG 39	DRG 40	DRG 60	DRG 112	DRG 119	DRG 162	DRG 222	DRG 224	DRG 225	DRG 229	DRG 232	DRG 270	DRG 359	DRG 381
LOS	.033	-.208**	.080**	.079**	.065**	.782**	.069**	-.016	.243**	.129**	.058**	.117**	.166**	-.136**	-.036**	-.009
(log)	(1.07)	(14.06)	(9.48)	(4.55)	(7.18)	(31.70)	(5.34)	(1.41)	(26.71)	(10.58)	(5.47)	(9.33)	(14.72)	(9.77)	(4.79)	(.17)
Age	-.097**	-.096**	.119**	.012	.072**	-.593**	-.032	.099**	.056**	-.040	-.085**	.201**	.135**	-.384**	-.107**	-.075**
(log)	(4.41)	(3.89)	(9.25)	(.73)	(6.78)	(20.98)	(1.66)	(5.10)	(4.55)	(1.77)	(5.44)	(15.66)	(8.88)	(36.38)	(4.69)	(5.27)
Gender	.017	.008	-.027**	-.178**	.010	-.069**	-.081**	-.126**	-.053**	.032*	-.148**	.097**	-.056**	-.074**	-	-
	(1.30)	(.47)	(5.63)	(16.10)	(1.07)	(3.46)	(7.07)	(6.17)	(5.83)	(2.22)	(9.86)	(7.44)	(4.86)	(5.54)		
Reform	-.116**	-.056	-.235**	.073**	-.028	-.250**	.036	-.227**	-.108**	-.083*	-.054*	-.103**	.041	-.009	-.131**	-.096**
	(4.07)	(1.50)	(21.64)	(2.94)	(1.32)	(5.14)	(1.70)	(9.06)	(3.08)	(2.41)	(2.24)	(3.76)	(1.53)	(.27)	(4.90)	(6.77)
Year	-.108**	.064	.030**	.053*	-.043*	-.353**	-.003	-.016	.011	-.136**	-.072**	-.069**	-.103**	-.034	.002	-.017
2000	(4.06)	(1.71)	(3.345	(2.22)	(2.55)	(7.81)	(.13)	(.69)	(.33)	(4.15)	(3.04)	(2.63)	(6.17)	(.99)	(.08)	(1.22)
Year	-.158**	-.086*	-.178**	.071**	.018	-.306**	.001	-.077**	.025	-.144**	-.060**	-.078**	-.083**	.062	-.016	-.046**
2001	(6.13)	(2.32)	(19.48)	(3.04)	(1.06)	(7.23)	(.065)	(3.51)	(.75)	(4.53)	(2.62)	(3.03)	(5.02)	(1.86)	(.75)	(3.27)
Year	-.155**	.118**	-.116**	-.232**	-.103**	.067*	-.249**	-.171**	-.179**	-.079**	-.138**	-.148**	-.196**	-.001	-.062**	.012
2003	(7.53)	(4.21)	(13.99)	(12.45)	(5.94)	(2.26)	(15.50)	(8.51)	(13.84)	(3.22)	(7.00)	(6.54)	(6.73)	(.03)	(3.29)	(1.04)
Year	-.125**	.021	-.219**	-.327**	-.215**	-.137**	-.351**	-.364**	-.231**	-.176**	-.218**	-.236**	-.215**	.063	-.114**	-.064**
2004	(5.45)	(.66)	(24.13)	(16.06)	(10.95)	(4.09)	(18.49)	(16.00)	(16.13)	(6.59)	(9.64)	(9.41)	(6.56)	(2.67)	(5.46)	(4.94)
Year	-.276**	.113**	-.572**	-.176**	-.089**	-.340**	-.346**	-.375**	-.274**	-.140**	-.277**	-.283**	-.319**	.085	-.117**	-.078**
2005	(12.96)	(3.78)	(64.27)	(9.41)	(4.77)	(10.53)	(19.39)	(16.94)	(19.63)	(5.47)	(13.28)	(11.87)	(9.60)	(3.68)	(5.64)	(5.81)
LOS*	.033	.006	.013	-.069**	-.014	-.104**	-.063**	.024*	.002	-.029**	-.016**	.010	-.012	.001	.011**	.022
Reform	(1.44)	(1.01)	(1.45)	(5.57)	(1.78)	(9.29)	(5.39)	(2.48)	(.37)	(4.17)	(2.50)	(1.27)	(.83)	(.22)	(2.81)	(.86)
Intercept	4.290**	5.023**	4.220**	5.281	3.768**	5.851**	5.046**	4.377**	4.275**	4.748**	5.125**	4.036**	4.109**	5.133**	4.371**	2.397**
	(65.96)	(67.35)	(111.80)	(102.26)	(180.48)	(69.05)	(96.33)	(75.74)	(100.57)	(77.50)	(117.46)	(95.42)	(103.74)	(112.38)	(77.25)	(51.72)
Adj. R^2	.12	.06	.13	.05	.14	.21	.14	.15	.17	.11	.09	.11	.09	.12	.06	.07
N	29 178	26 840	154 293	44 622	35 758	24 784	34 096	27 885	57 480	22 785	28 406	31 468	37 076	36 133	39 887	71 728

** = p < .01, * = p < .05

DRG 6: carpal tunnel release
DRG 36: retinal procedures y
DRG 39: lens procedures with or without vitrectomy
DRG 40: extra ocular proc except orbit age > 17
DRG 60: tonsillectomy &/or adenoidectomy only, age 0-17
DRG 112: percutaneous cardiovascular procedures
DRG 119: vein ligation & stripping
DRG 162: inguinal & femoral hernia procedures age > 17 w/o cc

DRG 222: operation on knee excl prosthesis op w/o cc
DRG 224: shoulder, elbow or forearm proc, exc major joint proc
DRG 225: foot procedures
DRG 229: hand or wrist proc, exc major jointporc, w/o cc
DRG 232: arthroscopy
DRG 270: other skin, sub cut tiss & breast proc w/o cc
DRG 359: uterine & adnexa proc for non-malignancy w/o cc
DRG 381: abortion w d&c, aspiration curettage or hysterectomy

Appendix: Variable definitions

Data have been provided by the Norwegian Patient Register (NPR). NPR is not in any way responsible for how the data are used in this article.

Waiting time (Ln): The number of days from the patient is referred to hospital treatment until admission to a hospital takes place, logarithmic form.

Length of stay (Ln): The patient's discharge date minus hospitalisation date, logarithmic form.

Age (Ln): The patient's age on logarithmic form, based on the following age cuts:
1: 0-4 years
2: 5-9 years
3: 10-14 years
4: 15-19 years
5: 20-20 years
6: 25-29 years
7: 30-34 years
8: 35-39 years
9: 40-44 years
10: 45-49 years
11: 50-54 years
12: 55-59 years
13: 60-64 years
14: 65-69 years
15: 70-74 years
16: 75-80 years
17: 80-84 years
18: 80+ years

Gender: Dummy-variable for which the value of 1 is assigned to male patients.

Year 2000: Dummy-variable for which the value of 1 is assigned to hospital stays in 2000.

Year 2001: Dummy-variable for which the value of 1 is assigned to hospital stays in 2001.

Year 2002: Dummy-variable for which the value of 1 is assigned to hospital stays in 2002.

Year 2003: Dummy-variable for which the value of 1 is assigned to hospital stays in 2003.

Year 2004: Dummy-variable for which the value of 1 is assigned to hospital stays in 2004.

Year 2005: Dummy-variable for which the value of 1 is assigned to patients that were treated in 2004.

Reform: Dummy-variable for which the value f 1 is assigned to hospital stays during the years after the hospital reform, i.e. 2002-2005.

LOS x Reform: Interaction term for length of stay and reform.

Hospital-specific dummies: Dummy-variables for which the value of 1 is assigned to hospital stays in the respective health enterprise (the estimates for these dummy-variables are not reported in the tables).