Dijk, C.E. van, Berg, B. van den, Verheij, R.A., Spreeuwenberg, P., Groenewegen, P.P., Bakker, D.H. de. Moral Hazard and supplier-induced demand: empirical evidence in general practice. Health Economics: 2013, (22(3), 340-352

Postprint Version	1.0
Journal website	http://onlinelibrary.wiley.com/doi/10.1002/hec.2801/abstract
Pubmed link	http://www.ncbi.nlm.nih.gov/pubmed/22344712
DOI	10.1002/hec.2801

This is a NIVEL certified Post Print, more info at http://www.nivel.eu

MORAL HAZARD AND SUPPLIER-INDUCED DEMAND: EMPIRICAL EVIDENCE IN GENERAL PRACTICE†

CHRISTEL E. VAN DIJK[1,*], BERNARD VAN DEN BERG[2], ROBERT A. VERHEIJ[1], PETER SPREEUWENBERG[1], PETER P. GROENEWEGEN[1,3], DINNY H. DE BAKKER[1,4]

[a]NIVEL, Netherlands Institute for Health Services Research, Utrecht, the Netherlands
[b]Centre for Health Economics, University of York, York, UK
[c]Utrecht University, Department of Sociology, Department of Human Geography, Utrecht, the Netherlands
[d]Tilburg University, Scientific Centre for Transformation in Care and Welfare (TRANZO), Tilburg, the Netherlands

ABSTRACT

Changes in cost sharing and remuneration system in the Netherlands in 2006 led to clear changes in financial incentives faced by both consumers and general practitioner (GPs). For privately insured consumers, cost sharing was abolished, whereas those socially insured never faced cost sharing. The separate remuneration systems for socially insured consumers (capitation) and privately insured consumers (fee-for-service) changed to a combined system of capitation and fee-for-service for both groups. Our first hypothesis was that privately insured consumers had a higher increase in patient-initiated GP contact rates compared with socially insured consumers. Our second hypothesis was that socially insured consumers had a higher increase in physician-initiated contact rates. Data were used from electronic medical records from 32 GP-practices and 35 336 consumers in 2005–2007. A difference-in-differences approach was applied to study the effect of changes in cost sharing and remuneration system on contact rates. Abolition of cost sharing led to a higher increase in patient-initiated utilisation for privately insured consumers in persons aged 65 and older. Introduction of fee-for-service for socially insured consumers led to a higher increase in physician-initiated utilisation. This was most apparent in persons aged 25 to 54. Differences in the trend in physician-initiated utilisation point to an effect of supplier-induced demand. Differences in patient-initiated utilisation indicate limited evidence for moral hazard.

INTRODUCTION

Ex post moral hazard and supplier-induced demand (SID) are central issues in the health economics literature. Theoretical contributions include the work of Nyman (2004, 2008), Pauly and Blavin (2008) and Zweifel and Manning (2000) for moral hazard and Labelle *et al.* (1994) and De Jaegher and Jegers (2000) for SID. Ex post moral hazard results from the fact that insured people, ceteris paribus, demand more health care compared with uninsured (Nyman, 2004). Arrow (1963) pointed out that SID arises from information asymmetry between consumers and physicians. Because of this information asymmetry, physicians can shift the demand curve of consumers, that is, SID. Richardson (1981) defined SID as 'physician's ability, for better or worse, to shift a patient's demand curve to the right'. We believe that shifting the demand curve to the left also can be considered as SID. Empirical evidence of ex post moral hazard and SID is hard to obtain but is crucial for developing health policy. Getting the incentives right might prevent an unnecessary rise of healthcare expenditure and might even increase population health.

Empirical evidence regarding ex post moral hazard comes from the Rand Health Insurance Experiment (HIE) and natural experiments or makes use of comparing people with and without supplementary insurance. The HIE showed that outpatient visit rates to physicians and other healthcare providers was 66%

higher in the free plan compared with the 95% co-insurance plan (Manning *et al.*, 1988). Natural experiments generally show that consumers respond to an increase in cost sharing with a reduction in healthcare utilisation (e.g. van de Voorde *et al.*, 2001; Kim *et al.*, 2005; Nolan 2007) or increase in healthcare utilisation with supplemental insurance (e.g. Buchmueller *et al.*, 2004). Fewer studies have used panel data to analyse ex post moral hazard using a treatment and control group. Cherkin *et al.* (1989) found a 8.2% higher decrease in total primary care visits compared with a control group after the introduction of a $5 co-payment fee for surgery visits in a health maintenance organisation in the USA. However, analyses were not controlled for health status. Chiappori *et al.* (1998) investigated the effects of the introduction of a 10% co-payment for physician visits in France compared with a control group and found that the number of consumers with general practitioner (GP) home visits was significantly affected by the introduction of the co-payment, but not GP surgery consultations. Although the separation in contact types was an interesting contribution to the moral hazard literature, it should be mentioned that the sample was not representative of the French population nor was the analysis controlled for health status. Finally, Winkelmann (2004) analysed the effect of an increase in co-payment of DM 6 for prescription drugs in Germany (co-payment after reform: DM9-13) on GP consultation rate. Controlling for several factors, including health status, Winkelman found a reduction in the consultation rate of 10%.

Empirical literature on SID has mainly focused on the physician's response to changes in physician density or to changes in remuneration systems (McGuire, 2000). According to McGuire's overview, studying SID in the context of changes in regulated fees has advantages over studying changes in physician density because the first directly influences incentives to induce demand. Even more important, changes in remuneration system are exogenous to physician's supply and consumer's demand. Here, we only discuss literature on changes in regulated fees of studies using a treatment and control group. The majority of evidence about physicians' responses to changes in remuneration systems comes from natural experiments. One exception is the randomised study of Hickson *et al.* (1987) in the USA. They assigned paediatric residents (students) to either a salary or fee-for-service (FFS) and blinded patients to the manner of remuneration of their physician. Hickson *et al.* showed that physicians with FFS reimbursement missed fewer recommended visits and made more visits in excess of recommendations. This study was performed in students with different career objectives. Unfortunately, randomisation was not balanced in terms of students' career goals. Natural experiments show ambiguous results. Krasnik *et al.* (1990) investigated the 6- and 12-month effect of a change in remuneration from capitation to a combined system of FFS and capitation compared with a control group on GPs' activities in Copenhagen, Denmark. Increase in contact rates was higher after the change in remuneration compared with the control group 6 months after the change but not after a one-year period. The authors ascribed these results to a learning period for GPs about their own preferences regarding income and leisure. Because data for the control group were not available on the individual doctor level, aggregated data were used and not adjusted for other factors potentially influencing healthcare utilisation. Madden *et al.* (2005) investigated the effects on GP visiting rates of a change in remuneration system in Ireland in 1989 for medical card consumers from FFS to capitation, whereas private consumers continued to pay on an FFS basis. The authors used self-reported data and expected the differential in visiting rates between medical card consumers and private consumers to narrow between 1987 and 1995/2000 if SID played a major role prior to the change in remuneration system. However, no difference in trend between privately and medical card-insured consumers was found. A potential drawback of Madden *et al.* (2005) was that they could not distinguish between patient-initiated and physician-initiated utilisation.

Although Arrow (1963) stressed that SID relates to information asymmetry, one also could argue that SID is just the standard neoclassical response to prices (Labelle *et al.*, 1994; De Jaegher and Jegers, 2000). Acknowledging the difficulties in disentangling both effects from an empirical point of view, there seems potential to do so as the crucial difference between the neoclassical and the SID models is that within an inducement model, changes in utilisation will be greater in consumers with a higher level of information asymmetry. We believe that this effect would not be expected in the neoclassical model. Consumers with chronic conditions could, for example, be classified as consumers with a lower level of information asymmetry compared with consumers without chronic conditions because they generally have more knowledge about their disease and treatment options, resulting in less opportunities for physicians to induce demand.

Another point of concern with SID is that that changes in utilisation after alterations in remuneration could result from rationing, as was stressed by Carlsen and Grytten (1998). Rationing takes place when medical services are withheld from individuals who would probably benefit from utilisation. Certainty in a capitation system, without payment per service, physicians could lower demand by making use of the information asymmetry and influencing demand of consumers, that is, SID.

This paper attempts to contribute to the health economics literature using balanced panel data from electronic medical records (EMRs) of GPs and a policy change that enable us to evaluate the effect of changes in cost sharing and GPs' remuneration system on utilisation of GP care. The diagnosis-coded contact data from EMRs enable us to distinguish between patient-initiated and physician-initiated services and, thereby, to analyse simultaneously the effect of changes in cost sharing (moral hazard) and remuneration system (SID). To differentiate between SID and a standard neoclassic response to a change in healthcare prices, we examined whether SID effects varied according to the level of information asymmetry as proxied by comparing the effects of chronically ill versus non-chronically ill consumers.

INSTITUTIONAL BACKGROUND AND HYPOTHESES

Institutional background

In January 2006, the Dutch government introduced a new health insurance act based on the principles of managed competition (Enthoven and Van de Ven, 2007). Before 2006, inhabitants had either compulsory social (sickness fund, 62%) or voluntarily private (36%) health insurance depending, among others, on income (below a gross annual income of €33 000 people were socially insured). This combined system of social and private health insurance was replaced by a compulsory single universal basic health insurance covering a legally defined package of basic benefits including GP care. GPs act as gatekeepers for secondary care, being the first point of contact in health care. The new health insurance system gives insurers flexibility to design their products to better appeal to consumers and the ability to selectively contract with healthcare providers as this is thought to improve the efficiency of the healthcare system (Van den Berg *et al.*, 2008).

With the introduction of the new insurance system, consumers' cost-sharing arrangements and GP's remuneration system changed. Socially insured consumers did not face cost sharing for consulting their GP before 2006, but some privately insured consumers did (Table 1). Privately insured cost sharing depended on the particular insurance policy. Six percent of privately insured consumers had no insurance for GP care, and 31% had cost sharing of over €500 per year. Cost sharing for GP care was abandoned in 2006. It is worth mentioning that all Dutch insured faced cost sharing (called no-claim) in 2006 and 2007, but GP care was excluded from cost sharing.

[TABLE 1]

Before the insurance reform of 2006, an FFS remuneration was in operation for privately insured consumers and a capitation system for socially insured consumers (Table 1). Three important actors, namely, the National GP Association, the Ministry of Health and Health Insurers Netherlands, negotiated about a new remuneration system. Health Insurers Netherlands suggested an FFS remuneration with negotiable fees for part of GP services, whereas the National GP Association suggested a capitation system without negotiable fees. The negotiations resulted in a combined system of capitation and FFS based on negotiable fees for only a very small part of GP services.

Hypotheses

The EMR data enable us to separately compare changes in patient-initiated and physician-initiated utilisation. Our key assumption is that consumers initiate the first GP contact per care episode, that is, patient-initiated utilisation (estimating moral hazard—effect of abolishment cost sharing) and that GPs might influence subsequent contacts, that is, physician-initiated utilisation (estimating SID—effect of changes in remuneration).

Based on the moral hazard literature, we expected abolition of cost sharing for privately insured consumers to result in a higher increase in patient-initiated utilisation compared with socially insured consumers (Hypothesis 1a). With respect to moral hazard, most healthcare costs are spent on persons with a lower remaining expected lifetime (Zweifel, 1990), of which, age is an important factor. For this reason, we expected the effect of moral hazard to be stronger in younger consumers (Hypothesis 1b).

Although the empirical evidence of effects on changes in remuneration on the number of contacts physicians provide is mixed, we assume that GPs can shift consumers' demand curve. Literature suggests that an FFS system encourages GPs to provide services, whereas a capitation is thought to encourage providers to curtail services (Chaix-Couturier *et al.*, 2000; Greß *et al.*, 2006). Because the fee for privately insured consumers is much lower compared with the payment for privately insured consumers before the change in remuneration, our second hypothesis assumes that the change from a capitation system for socially insured consumers and an FFS system for privately insured consumers to a combined system of capitation and FFS involves a higher increase in physician-initiated contacts for socially insured consumers compared with privately insured consumers (Hypothesis 2a). We expected this effect to be stronger in older consumers and in consumers without a chronic disease (Hypothesis 2b) because we assume the GP's potential to exploit advantages in information asymmetry are larger in these groups. When offering more services, GPs are expected to provide these services to the most needy patients. Because healthcare utilisation and needs are generally higher in older age groups (Busato and Künzi, 2008), we expected the difference in trend of contacts to be greater for the older age groups. To differentiate between SID and a neoclassic response to a change in price for health care, we compared the difference in trend between chronically ill and non-chronically ill consumers.

METHODS

Data

Our sample consisted of GP practices participating in the Netherlands Information Network of General Practice (LINH) from 2005 to 2007 (Verheij *et al.*, 2009). LINH holds panel data on morbidity, drugs prescriptions and referrals of around 90 GP practices derived from EMRs. The network is a dynamic pool of practices with an annual change in composition of practices, with an average of 13 mutations per year between 2005 and 2007.

Inclusion criteria *for practices* were availability of data on morbidity of clients for all 3 years and type of contact (known or new complaint) in more than 65% of the morbidity record. Type of contact is necessary to construct care episodes, which enable to distinguish between physician-initiated and patient-initiated utilisation (see explanation below). Fifty-one GP practices had data for the total period 2005–2007, of which, 32 (63%) had a type of contact registered in the morbidity records of above 65%.

Inclusion criteria for *consumers* were registration within GP practices for the full period of 2005–2007 (all Dutch inhabitants are supposed to be registered with a GP practice), age over 18 in 2005, and no missing value on any of the variables: a balanced panel. Consumers who died within this period were excluded. We lost a large number of respondents because of our selection criteria of availability of information on the variables because income and nationality were not directly available in LINH. They were derived from the Statistics Netherlands database (CBS) (Statistics Netherlands, 2009). These variables were linked according to postal code, gender and date of birth: 94.9% or 74 142 could be linked. For 35 336 (45.2%) people of the matched consumers, income data were available. This resulted in a net sample of 32 practices with 35 336 registered consumers.

Included GP practices and registered clients are representative of Dutch GP practices with regard to practice type (single handed, duo, group or health centre), degree of urbanisation and region, and consumers' age and gender.

Variables

The effect of changes in cost sharing and remuneration was assessed with patient-initiated and physician-initiated contacts on the basis of care episodes. A care episode includes ‘all encounters for the management of a specific health problem’ (WONCA Classification Committee, 1995). An episode could be one contact or a sequence of contacts that reflects the course of a disease over time. Care episodes were constructed on the basis of EPICON, which is an algorithm to group ICPC-coded contact records from EMRs in GP practice into episodes of care. This algorithm calculates care episodes for each year separately. Thus, a care episode that persists over 2 years is counted as two care episodes: one in each year (Biermans *et al.*, 2008). The effect of changes in cost sharing was assessed with patient-initiated utilisation defined as the first GP contact ((telephone) consultations and home visits) for a specific health problem, that is, the first contact in a care episode. The effect of changes in remuneration was assessed with physician-initiated utilisation

defined as all other contacts for a specific health problem[1]; Table 2 gives variable definitions and descriptive statistics.

[TABLE 2]

Control variables potentially influencing healthcare utilisation included the following: age, gender, presence of chronic condition, comorbidity, level of urbanisation, nationality and income (consumer level) and practice size, primary care nurse and GP information system (GP practice level).

The presence of one of four chronic conditions (cardiovascular diseases, asthma or COPD, diabetes mellitus and depression or anxiety disorder) is a proxy for health status. The presence of each condition was separately determined on the basis of ICPC codes. Comorbidity was defined as the presence of two or more of the four mentioned conditions. Level of urbanisation was assessed in five categories and was included because research has shown that healthcare utilisation increases with higher urbanisation (Farmer *et al.*, 2006). Nationality and income were derived from the Statistics Netherlands database (CBS). Healthcare utilisation has been shown to differ between ethnic groups (Bago d'Uva, 2005; Uiters *et al.*, 2009). Nationality was divided into Dutch, foreign western nationality and foreign non-western nationality. Income was based on the standardised household incomes in 2006, which is the after-tax household income adjusted for household size and composition, age of children, and one-earner or two-earner households.[2] Income was added to the model as a categorical variable and divided into six separate categories based on the distribution of income in the Dutch population. The presence of a primary care nurse was taken into account because research shows that contact rate within a GP practice increases with the presence of a primary care nurse (Laurant *et al.*, 2004). Changes in the GP information system were taken into account as sub-analyses showed that changing to an episode-based GP information system changed the registration utilisation pattern (not shown). The covariates were centred on the basis of variables in 2005, with the exception of the GP information system.[3]

Econometric methodology

We separately compare changes in patient-initiated (moral hazard) and physician-initiated utilisation (SID). For changes in patient-initiated utilisation, we are clearly able to identify a treatment (privately insured) and a control (socially insured) group, as well as a treatment (post-2006) and a control (pre-2006) period and therefore apply a difference-in-difference approach/estimation. For physician-initiated utilisation, only a control period can be defined but no treatment and control group. We believe that comparing changes in contacts between socially and privately insured consumers can still be informative as it gives an indication about the effect that changes in remuneration have on physician-initiated utilisation. Equations for patient-initiated and physician-initiated utilisation are similar. The basic equation for analysing the impact of changes in cost sharing and remuneration is as follows:

[FIGURE 1]

Data were analysed using iterative generalised least squares estimation. We used Poisson multilevel repeated measurement regression analyses with extra Poisson variation to account for over-dispersion (MLWin 2.02 software). The Poisson models were fitted with the second-order PQL estimation, with estimated co-variances and variances (per year) on consumer and practice level. Multilevel analyses were used to correct for the hierarchical structure of the data with level 1 being time, level 2 consumers and level 3 general practice (Rice and Jones, 1997—here estimating random intercept). Co-variances and variances on consumer and practice level were estimated because variances and co-variances of the outcome variable varied over time (Snijders and Bosker, 1999).[4] Consumer and practice covariates (X and Z) are centred on the sample averages of covariates in the first year (2005), and thereby, β^0 represents the average socially insured consumer in 2005. The scores per individual could differ between years (for instance, age (+1 per year) and presence of chronic diseases) or be constant (for instance, gender). The consumer level covariates (X) and practice level covariates (Z) were estimated across years, assuming that the effect is constant over time, that is, having diabetes mellitus in 2005 had the same effect on utilisation as having diabetes in 2007. This assumption is necessary because consumers' health status can vary over time, affecting utilisation.

Differences in the number of contacts are denoted by the relative risk (RR), with the equation for RR being $RR = e\beta x$. The RR shows the chance of the outcome (contacts) in one group compared with another group or, in case of a continuous variable, the change of the outcome with one step.

We included two dummy variables for waves, with $Time^{dum1}$ indicating the difference between 2005 and 2006 and $Time^{dum2}$ the difference between 2005 and 2007. Because the effects of changes in remuneration system and cost sharing might take time, we estimated one- and two-year differences. We were mainly interested in the differences in trends between socially and privately insured consumers in time, which is included in the variable *timedum*1 · *insurance* for the difference in trend between 2005 and 2006 and *timedum*2 · *insurance* for the difference in trend between 2005 and 2007. For our variable of interest, *timedum*1 · *insurance*, an RR of 0.80 indicates a 25% (1/0.80) higher increase in GP contacts in 2006 compared with 2005 for socially insured consumers compared with privately insured consumers. To test for SID in physician-initiated utilisation (Hypothesis 2), we examined whether estimates varied according to the level of information asymmetry employing the information on the four chronic conditions as described earlier and for non-chronically ill consumers.

EMPIRICAL RESULTS

Poisson multilevel regression analyses were first performed without any covariates (model 1). In the second model, all covariates were added (model 2). In addition, interaction between the interaction term (time*insurance) and age or presence of chronic disease were estimated (model 2) to check for differences in effects between age groups and presence of chronic disease.[5] To test whether results differed if a larger dataset was used (sensitivity analyses), model 1 also was estimated for the same dataset before linking to the Statistics Netherlands database.

Patient-initiated healthcare utilisation

Our first hypothesis was that abolition of cost sharing for privately insured consumers led to a higher increase in patient-initiated utilisation compared with socially insured consumers. There seems no statistically significant evidence for difference-in-differences effects in any of the models (Table 3). However, Table 4 showed a statistically significant difference-in-differences effect in the majority of age categories. We found a higher increase in patient-initiated utilisation for privately insured consumers within the age groups of 65 and older. In the age category 65–74, privately insured consumers had a 5% higher increase in patient-initiated contacts than socially insured consumers between 2005 and 2006 and a 10% higher increase between 2005 and 2007. In younger age categories, there seemed to be a decrease in contacts of privately insured consumers compared with socially insured ones. Please note that the finding that utilisation of older age categories goes up and younger age categories goes down is not something that is, by definition, determined in the regression analysis because covariates were centred on the basis of variables in 2005, with the exception of the GP information system. However, analyses for age groups could be affected by the fact that consumers aged 75 and older could not move to other age groups and, therefore, provided an underestimation. It is worth noting that analysing model 1 with a larger dataset (n = 78 127) showed similar results ($Time^{dum1}$*insurance: 1.00 (ns); $Time^{dum2}$*insurance: 1.01 (ns)).

[TABLE 3][TABLE 4]

Patient-initiated utilisation increased between 2005 and 2006 and between 2005 and 2007 by 7% for both socially and privately insured consumers. After controlling for characteristics like healthcare needs, age ranges and nationality, privately insured consumers had statistically significantly fewer patient-initiated contacts compared with socially insured consumers over the 3-year period. Many of the other results are comparable with the literature (Cardol *et al.*, 2004; Van Lindert *et al.*, 2004): patient-initiated utilisation of GP care was higher for older consumers, the presence of a chronic condition, foreign western or non-western nationality and female subjects.

Physician-initiated healthcare utilisation

Our second hypothesis was that the change from a capitation system for socially insured consumers and an FFS system for privately insured consumers to a combined system of capitation and FFS involved a higher increase in physician-initiated utilisation for socially insured consumers. In line with our expectations, the

statistically significant interaction term suggests an effect of changes in GPs' remuneration on physician-initiated healthcare utilisation (Table 5). Differences in trend between privately and socially insured consumers between 2005–2006 and 2005–2007 were both 0.95. This means that socially insured consumers had a 5.3% (1/1.05) higher increase in physician-initiated contacts than privately insured consumers as a consequence of exogenous changes in the remuneration system. Physician-initiated contacts rose by approximately 19% between 2005 and 2006 and 21% between 2005 and 2007 for socially insured consumers and by 13% and 15% respectively for privately insured consumers. This increase occurred predominantly between 2005 and 2006. Privately insured consumers again had significantly lower physician-initiated contacts over the 3-year period. Many of the other results are in line with the literature (Cardol et al., 2004; Van Lindert et al., 2004): physician-initiated utilisation was higher for female subjects, persons with a chronic condition, increased age, and foreign non-western nationality and lower income. Analysing model 1 with a larger dataset (n2005 = 58 085; n2006 = 58 874; n2007 = 59 623) showed similar results, but between 2005 and 2007 significant results (Timedum1*insurance: 0.99 (ns); Timedum2*insurance: 0.96 ($p < 0.05$)).

[TABLE 5][TABLE 6]

To differentiate between SID and the neoclassic response to changes in price for health care, we examined whether effects varied according to the level of information asymmetry: chronically ill versus non-chronically ill consumers. Table 7 suggests that the statistically significant differences in trend in physician-initiated contacts were only apparent in consumers without chronic disease, indicating an SID response rather than a neoclassic response. Differences in trend between privately and socially insured consumers with no chronic disease between 2005–2006 and 2005–2007 were 0.88 and 0.89, respectively. This means that socially insured consumers had a 13.6% (2005–2006) and 12.4% (2005–2007) higher increase in physician-initiated contacts than privately insured consumers as a consequence of exogenous changes in the remuneration system. Note that the category asthma/COPD also shows similar non-significant differences in trend in physician-initiated contacts. Other research showed that only 17% of healthcare utilisation in COPD patients is specifically for COPD (van Dijk *et al.*, 2009). Therefore, in the main part of all encounters, COPD patients do not have a lower information asymmetry.

[TABLE 7]

DISCUSSION AND CONCLUSION

The purpose of this study was to test empirically whether GPs' and consumers' behaviour changed following a change in financial incentives as a result of a policy change. We investigated whether a change in cost sharing and GP reimbursement resulted in changes in patient-initiated and physician-initiated utilisation. Our hypothesis was that abolition of cost sharing for privately insured consumers would result in a higher increase in patient-initiated utilisation for privately insured consumers compared with socially insured consumers, indicating at ex-post moral hazard. This hypothesis was rejected, although we did find an ex-post moral hazard effect in consumers aged 65 and older.

We hypothesised that the change from a capitation system for socially insured consumers and an FFS system for privately insured consumers to a combined system of capitation and FFS involved a higher increase in physician-initiated utilisation for socially insured consumers compared with privately insured consumers. Empirical results seems to support our hypotheses as socially insured consumers had a 5.3% higher increase in physician-initiated contacts than privately insured consumers. Further analyses suggested that the higher increase in physician-initiated utilisation for socially insured consumers was only apparent in non-chronically ill consumers. This indicates at SID.

A number of points should be noted. First, included GPs could represent a highly motivated part of Dutch GPs. This could have affected their medical ethics. Effects of changes in physician-initiated healthcare utilisation could therefore be larger in the Dutch GP population compared with our sample, although other Dutch GPs show similar contact rates (Karssen *et al.*, 2009). We also were unable to distinguish between necessary and unnecessary healthcare utilisation. An increase in utilisation could imply better quality and accessibility of GP care. For instance, GPs could have rationed healthcare services for socially insured

consumers before the insurance reform. As Labelle *et al.* (1994) pointed out, SID includes care that might contribute positively to consumer health, and therefore, SID can be positive. Third, our main assumption was that the first contact was patient initiated, and follow-up contacts were physician initiated. However, this distinction might be less straightforward than appeared at first. Previous experiences with GP practice could influence patient-initiated utilisation, and consumers could demand extra contacts. In addition, there could be registration bias. Since 2006, GPs have been reimbursed for every service, which motivates them to record correctly every service provided. In LINH, we prevented this by recording instructions for participating GP practices. Furthermore, first and follow-up contacts were based on care episodes. Care episodes do not take into account that consumers might visit the general practice with more than one health problem during one contact. Alternatively, without the construction of care episodes, we would not have been able to distinguish between patient-initiated and physician-initiated contacts, which we believe was a valuable contribution to the literature.

Patient-initiated utilisation increased between 2005 and 2007. The increase was similar for socially and privately insured consumers, suggesting the absence of ex post moral hazard. This is contrary to our hypothesis and to some other studies (see e.g. Manning *et al*, 1988; Cherkin *et al*, 1989). The absence of ex post moral hazard may be because of the low costs of GP care for privately insured consumers. In 2005, the price of a GP consultation was €24.80, which may be too low to avoid ex post moral hazard for the average privately insured patient. The overall increase in patient-initiated utilisation might be the result of realisation of unmet needs and better accessibility of GP care in the general population.

The increase in physician-initiated utilisation was higher in socially insured consumers between 2005 and 2007 as expected. GPs seem to react to a change in remuneration from capitation to a combined system of FFS and capitation. The number of physician-initiated contacts increased for both socially and privately insured consumers, which might partly be explained by the increased attention to chronically ill patients in primary care. Between 2005 and 2007, several measures and campaigns have encouraged diabetes mellitus patients to be treated in primary care in the Netherlands. The care for diabetes involves numerous follow-up contacts, which could explain the overall increase in physician-initiated utilisation, although we corrected for chronic conditions.

The 2006, insurance reform in the Netherlands involved changes in remuneration and cost-sharing systems. These changes seem not to have resulted in changes in patient-initiated healthcare utilisation but in a limited change in physician-initiated utilisation, which could be ascribed to SID. Our main contribution was to disentangle the changes in healthcare utilisation because of demand and supply side financial incentives. In this respect, we have provided empirical evidence on the part of the health policy reform puzzle, which was outlined by Maynard (2005). Although our results seem to suggest that policy makers better focus on supply side incentives instead of demand side if they wish to influence utilisation. Our empirical contribution should ideally be complemented with evidence on the impact of changes in healthcare utilisation on patients' health and other outcomes to get a glance of the total picture.

REFERENCES

Arrow KJ. 1963. Uncertainty and the Welfare Economics of Medical Care. The American Economic Review 53(5): 941–973.

Bago d'Uva T. 2005. Latent class models for use of primary care: evidence from a British panel. Health Economics 14: 873–892.

Biermans MCJ, de Bakker DH, Verheij RA, Gravestein JV, van der Linden MW, de Vries Robbé PF. 2008. Development of a case-based system for grouping diagnoses in general practice. International Journal of Medical Informatics 77(7): 431–439.

Buchmueller TC, Couffinhal A, Grignon M, Perronnin M. 2004. Access to physician services: does supplemental insurance matter? evidence from France. Health Economics 13(7): 669–687.

Busato A, Künzi B. 2008. Primary care physician supply and other key determinants of healthcare utilisation: the case of Switzerland. BMC Health Services Research 8: 8.

Cardol M, Van Dijk L, De Jong J, De Bakker DH, Westert GP. 2004. Huisartsenzorg: Wat doet de poortwachter [General practitioner care: What does the gatekeeper?]. NIVEL/RIVM: Utrecht.

Carlsen F, Grytten J. 1998. More physicians: improved availability or induced demand? Health Economics 7: 495–508.

Chaix-Couturier C, Durand-Zaleski I, Jolly D, Durieux P. 2000. Effects of financial incentives on medical practice: results from a systematic review of the literature and methodological issues. International Journal for Quality in Health Care 12(2): 133–142.

Cherkin DC, Grothaus L, Wagner EH. 1989. The effect of office visit copayments on utilization in a health maintenance organization. Medical Care 27(11): 1036–1045.

Chiappori P, Durand F, Geoffard P. 1998. Moral hazard and the demand for physician services: first lessons from a French natural experiment. European Economic Review 42: 499–511.

De Jaegher K, Jegers M. 2000. A model of physician behaviour with demand inducement. Journal of Health Economics 19: 231–258.

Van Dijk C, Schellevis F, Rijken M, De Bakker D, Verheij R, Groenewegen P. 2009. Kanttekeningen bij functionele bekostiging: Anders is niet per se beter [Remarks on disease oriented funding: different is not per se better]. Medisch Contact 64: 973–976

Enthoven AC, Van de Ven WPMM. 2007. Going Dutch - managed-competition health insurance in the Netherlands. The New England Journal of Medicine 357(24): 2421–2423.

Farmer J, Iversen L, Campbell NC, Guest C, Chesson R, Deans G, MacDonald J. 2006. Rural/urban differences in accounts of patients' initial decisions to consult primary care. Health and Place 12(2): 210–221.

Greß S, Delnoij DMJ, Groenewegen PP. 2006, Managing primary care behaviour through payment systems and financial incentives. In Primary care in the driver's seat?: organizational reform in European primary care, Saltman RB, Rico A, Boerma W (eds.). Open University Press/ Maidenhead: New York; 184–200.

Hickson GB, Altemeier WA, Perrin JM. 1987. Physician reimbursement by salary or fee-for-service: effect on physician practice behavior in a randomized prospective study. Pediatrics 80(3): 344–350.

Karssen B, Schipper M, Jurling BRA. 2009. Praktijkkosten en opbrengsten van huisartsenpraktijken: Eindrapportage van een onderzoek naar de praktijkkosten en opbrengsten van huisartsenpraktijken in Nederland in 2006 [GP-practice costs and benefits: final report of research on GP-practice costs and benefits in the Netherlands in 2006]. Significant: Barneveld.

Kim J, Ko S, Yang B. 2005. The effects of patient cost sharing on ambulatory utilization in South Korea. Health Policy 72: 293–300.

Krasnik A, Groenewegen PP, Pedersen PA, Von Scholten P, Mooney G, Gottschau A, Flierman HA, Damsgaard MT. 1990. Changing remuneration systems: effects on activity in general practice. British Medical Journal 300(6741): 1698–1701.

Labelle R, Stoddart G, Rice T. 1994. A re-examination of the meaning and importance of supplier-induced demand. Journal of Health Economics 13: 347–368.

Laurant M, Reeves D, Hermens R, Braspenning J, Grol R, Sibbald B. 2004. Substitution of doctors by nurses in primary care. Cochrane Database of Systematic Reviews 4, Art. No.: CD001271. DOI: 10.1002/14651858.CD001271.pub2.

Madden D, Nolan A, Nolan B. 2005. GP reimbursement and visiting behaviour in Ireland. Health Economics 14: 1047–1060.

Manning WG, Newhouse JP, Duan N, Keeler E, Benjamin B, Leibowitz A, Marquis MS, Zwanziger J. 1988. Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. RAND Corporation: Santa Monica.

Maynard A. 2005. European health policy challenges. Health Economics 14: S255–S263.

McGuire TG. 2000. Physician agency. In Handbook of Health Economics, Culyer AJ, Newhouse JP (eds.). Elsevier: Amsterdam; 461–536.

Nolan A. 2007. A dynamic analysis of GP visiting in Ireland: 1995–2001. Health Economics 16: 129–143.

Nyman JA. 2004. Is 'Moral Hazard' inefficient? The policy implications of a new theory. Health Affairs 23(5): 194–199.

Nyman JA. 2008. Health insurance theory: the case of the missing welfare gain. European Journal of Health Economics 9: 369–380.

Pauly MV, Blavin FE. 2008. Moral hazard in insurance, value-based cost sharing and the benefits of blissful ignorance. Journal of Health Economics 27: 1407–1417.

Rice N, Jones A. 1997. Multilevel models and health economics. Health Economics 6(6): 561–575.

Richardson J. 1981. The inducement hypothesis: That doctors generate demand for their own services. In Health, economics and health economics, Van der Gaag J, Perlmand M (eds.). North-Holland Publishing Company: Amsterdam; 189–214.

Snijders TAB, Bosker RJ. 1999. Multilevel analysis: an introduction to basic and advanced multilevel modeling. Sage Publications: London.

Statistics Netherlands. http://www.cbs.nl/. [20 April 2009].

Uiters E, Devillé W, Foets M, Spreeuwenberg P, Groenewegen PP. 2009. Difference between immigrant and non-immigrant groups in the use of primary medical care; a systematic review. BMC Health Services Research 9: 76.
Van de Voorde C, Van Doorslaer E, Schokkaert E. 2001. Effects of cost sharing on physician utilization under favourable conditions for supplier-induced demand. Health Economics 10: 457–471.
Van den Berg B, Van Dommelen P, Stam PJA, Laske-Aldershof T, Buchmueller T, Schut FT. 2008. Preferences and choices for care and health insurance. Social Science and Medicine 66: 2448–2459.
Van Lindert H, Droomers M, Westert GP. 2004. Een kwestie van verschil: verschillen in zelf-gerapporteerde leefstijl, gezondheid en zorggebruik [A matter of difference: differences in self reported lifestyle, health and health care utilisation]. NIVEL/RIVM: Utrecht.
Vektis. 2005. Zorgthermometer: juli 2005 [Care thermometer: July 2005]. Vektis: Zeist.
Verheij RA, van Dijk CE, Abrahamse H, Davids R, Van den Hoogen H, Braspenning J, Van Althuis T. 2009. Landelijk Informatienetwerk Huisartsenzorg. Feiten en cijfers over huisartsenzorg in Nederland [Netherlands Information Network of General Practice: facts and figures of general practice in the Netherlands]. http://www.linh.nl/. NIVEL/WOK: Utrecht/Nijmegen.
Winkelmann R. 2004. Co-payments for prescription drugs and the demand for doctor visits - Evidence from a natural experiment. Health Economics 13: 1081–1089.
WONCA Classification Committee. 1995. An international glossary for general/family practice. Family Practice 12: 341–369.
Zweifel P. 1990. Ageing: The great challenge to health care reform. European Economics Review 34: 646–658
Zweifel P, Manning WG. 2000. Moral hazard and consumer incentives in health care. In Handbook of Health Economics, Culyer AJ, Newhouse JP (eds.). Elsevier: Amsterdam; 461–536.

TABLES AND FIGURE

Table I. Consumers' cost sharing arrangement and GPs' remuneration system before and since 2006 in the Netherlands

	Before 2006		Since 2006
	Socially insured	Privately insured	All insured
Co-sharing arrangement			
Existence of cost sharing	No	31.2% of consumers faced cost sharing > €500 per year. 6% faced no insurance for GP care. Mean GP cost-sharing care expenditure €86 in 2003 (Vektis, 2005).	No
Remuneration system			
Capitation fee			
Basic capitation fee	€ 77.00[a]	—	€ 52.00[a]
Fee-for-service			
Per consultation unit	—	€ 24.80	€ 9.00[a]

[a]The capitation fee and the fee of €9.00 for every consultation unit is paid by the consumer's health insurer.

Table II. Variable definitions and descriptives[a]

Variable	Definition	2005	2006	2007
Consumer level (n = 35 336)				
Patient-initiated utilisation[b]	Continuous variable indicating all first contacts of a consumer for health problem; percentage of consumers with patient-initiated contacts	2.38; 74.5%	2.59; 76.0%	3.02; 76.8%
Socially insured		2.58	2.81	3.28
Privately insured		2.03	2.22	2.58
Physician-initiated utilisation[b]	Continuous variable indicating all repeat visits for health problems; percentage of consumers with physician-initiated contacts	1.75; 51,9%	2.09; 55,5%	2.54; 59,0%
Socially insured		1.90	2.27	2.79
Privately insured		1.46	1.75	2.06
$Time_{dum1}$[c]	1 data from 2006, 0 otherwise	0%	100%	0%
$Time_{dum2}$[c]	1 data from 2007, 0 otherwise	0%	0%	100%
Insurance[c]	1 if privately insured, 0 if socially insured	36.8%	36.8%	36.8%
$Time_{dum1}$*insurance[c]	1 if data from 2006 and privately insured	0%	36.8%	0%
$Time_{dum2}$*insurance[c]	1 if data from 2007 and privately insured	0%	0%	36.8%

[a]For full information on variable definitions and descriptives of control variables, we refer to the full table on the website of the journal.
[b]Mean.
[c]Percentage.

Figure 1

$$\log(E(y_{tij}|\beta_{0-i})) = \beta_0 + \beta_1 \cdot timedum1_{tij} + \beta_2 \cdot timedum2_{tij} + \beta_3 \cdot insurance_{ij} + \beta_4 \cdot timedum1 \cdot insurance_{tij} + \beta_5 \cdot timedum2 \cdot insurance_{tij} + \beta_{0x0} X_{tij} + \beta_{00z} Z_{tj} + \mu_{t0j} + \varepsilon_{t0ij} (1)$$

y_{tij} number of consultations (patient-initiated or physician-initiated)
t = time 2005, 2006, 2007
i = patient 1, ... n
j = practice 1 ....N
$timedum1_{tij}$ difference between 2006 and 2005
$timedum2_{tij}$ difference between 2007 and 2005
insurance insurance type in 2005
X patient level covariates (estimated on patient level β_{0x0})
Z practice level covariates (estimated on practice level β_{00z})
μ_{t0j} full yearly between practice variance/covariance matrix (normal distribution)
ε_{t0ij} full yearly between patient variance/covariance matrix within practice (extra Poisson distribution)

Table III. Relative risk for total patient-initiated utilisation of GP, 2005–2007 (n = 35 336)[a]

	Patient-initiated utilisation	
	Model 1	Model 2
$Time_{dum1}$ (difference 2005–2006)[b]	**1.05***	**1.07****
$Time_{dum2}$ (difference 2005–2007)[b]	**1.10*****	**1.07***
Insurance	**0.78*****	**0.91*****
$Time_{dum1}$*insurance (Insurance*2005–2006)[c]	1.00	0.98
$Time_{dum2}$*insurance (Insurance*2005–2007)[c]	1.01	1.00

[a]For full information on relative risks of control variables, we refer to the full table on the website of the journal;
[b]Differences between 2005–2006 and 2006–2007 were estimated with two dummy variables for time;
[c]Insurance*2005–2006 and insurance*2005–2007 represent the difference in trend between privately and socially insured consumers.
Significant difference of * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table IV. Difference-in-differences effect for patient-initiated utilisation per age group[ab]

	Insurance*2005–2006[c]	Insurance*2005–2007[c]
18–25 years	1.00	**0.91***
25–34 years	**0.92***	**0.89***
35–44 years	**0.92***	**0.96***
45–54 years	**0.96***	0.98
55–64 years	1.00	**1.06***
65–74 years	**1.05***	**1.10***
75 or older	**1.12***	**1.14***

[a]Age 18–25 years was used as the reference category.
[b]Model estimations available on request.
[c]Insurance*2005–2006 and insurance*2005–2007 represent the difference in trend between privately and socially insured consumers.
*Significant difference of $p < 0.05$.

Table V. Relative risk for total physician-initiated utilisation of GP, 2005–2007. ($n_{2005}=26\ 315$; $n_{2006}=26\ 858$; $n_{2007}=27\ 128$)[a]

	Physician-initiated utilisation	
	Model 1	Model 2
$Time_{dum1}$ (difference 2005–2006)[b]	**1.13****	**1.19****
$Time_{dum2}$ (difference 2005–2007)[b]	**1.25*****	**1.21****
Insurance	**0.75*****	**0.92*****
$Time_{dum1}$*insurance (5nsurance*2005–2006)[c]	1.01	**0.95***
$Time_{dum2}$*insurance (5nsurance*2005–2007)[c]	0.97	**0.95***

[a]For full information on relative risks of control variables, we refer to the full table on the website of the journal;
[b]Differences between 2005–2006 and 2006–2007 were estimated with two dummy variables for time;
[c]Insurance*2005–2006 and insurance*2005–2007 represent the difference in trend between socially (reference) and privately insured consumers.
Significant difference of * $p<0.05$,** $p<0.01$, *** $p<0.001$.

Table VI. Difference-in-differences effect for physician-initiated utilisation per age group[ab]

	Insurance*2005–2006[c]	Insurance*2005–2007[c]
18–25 years	0.96	0.98
25–34 years	**0.89***	**0.79***
35–44 years	**0.91***	0.93
45–54 years	**0.88***	**0.90***
55–64 years	0.96	**0.93***
65–74 years	0.98	1.07
75 or older	**1.22***	**1.15***

[a]Age 18–25 years was used as the reference category.
[b]Model estimations under request available.
[c]Insurance*2005–2006 and insurance*2005–2007 represent the difference in trend between socially and privately insured consumers.
*Significant difference of $p<0.05$.

Table VII. Difference-in-differences effect for physician-initiated utilisation to chronic disease[ab]

	Insurance*2005–2006[c]	Insurance*2005–2007[c]
No chronic disease	**0.88***	**0.89***
Cardiovascular disease	1.00	0.98
Asthma/COPD	0.88	0.91
Diabetes mellitus	1.05	1.06
Depression/anxiety	1.06	0.94

[a]No chronic disease was used as the reference category.
[b]Model estimations under request available.
[c]Insurance*2005–2006 and insurance*2005–2007 represent the difference in trend between socially and privately insured consumers.
*Significant difference of $p<0.05$.