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ORIGINAL ARTICLE

## Impact of remuneration on guideline adherence: Empirical evidence in general practice

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### Abstract

**Background and objective.** Changes in the Dutch GP remuneration system provided the opportunity to study the effects of changes in financial incentives on the quality of care. Separate remuneration systems for publicly insured patients (capitation) and privately insured patients (fee-for-service) were replaced by a combined system of capitation and fee-for-service for all in 2006. The effects of these changes on the quality of care in terms of guideline adherence were investigated. **Design and setting.** A longitudinal study from 2002 to 2009 using data from patient electronic medical records in general practice. A multilevel (patient and practice) approach was applied to study the effect of changes in the remuneration system on guideline adherence. **Subjects.** 21 421 to 39 828 patients from 32 to 52 general practices (dynamic panel of GPs). **Main outcome measures.** Sixteen guideline adherence indicators on prescriptions and referrals for acute and chronic conditions. **Results.** Guideline adherence increased between 2002 and 2008 by 7% for (formerly) publicly insured patients and 10% for (formerly) privately insured patients. In general, no significant differences in the trends for guideline adherence were found between privately and publicly insured patients, indicating the absence of an effect of the remuneration system on guideline adherence. Adherence to guidelines involving more time investment in terms of follow-up contacts was affected by changes in the remuneration system. For publicly insured patients, GPs showed a higher trend for guideline adherence for guidelines involving more time investment in terms of follow-up contacts compared with privately insured patients. **Conclusion.** The change in the remuneration system had a limited impact on guideline adherence.

**Key Words:** General practice, guideline adherence, quality of care, remuneration system, The Netherlands

### Introduction

The literature suggests that a fee-for service (FFS) system encourages health care providers to provide services and not to delegate to other health care providers, while a capitation and salary system encourages providers to curtail services and more often refer to other providers [1–6]. The effects of these remuneration systems on the quality of care are less often discussed. It has been argued that health care providers under a capitation or salary system have a limited incentive to improve the quality of services, as their payment (per patient) is

effectively guaranteed in advance, while in an FFS system providers have an incentive to improve the quality of services, as patients may be discouraged from attending a provider if they have experienced inadequate care [7]. However, it has also been suggested that the incentive to provide more services in an FFS system might come at the expense of quality [8].

A review of the effects of remuneration on the quality of care showed only two studies with a rigorous design [3]. One study concluded that paediatric residents (students) with an FFS reimbursement

Few studies have examined the effect of remuneration on the quality of care in terms of guideline adherence.

- Guideline adherence increased in Dutch general practices between 2002 and 2008.
- Changes in the remuneration system for GPs did not have a strong effect on guideline adherence.
- Adherence to guidelines involving more time investment in terms of follow-up contacts was affected by changes in the remuneration system.

missed fewer recommended visits compared with residents with a salary [9]; the other study found no differences in hospital admissions and days comparing FFS only to a capitation system with an additional incentive payment for low hospital utilization rates [10]. More recently, the effects on the quality of care with a change from a capitation system with additional fees for certain services and target levels of services to a salaried system in general practice was compared with a control group with continued capitation [11]; no differences were shown in the trends between general practices on the quality of care in terms of access, communication, overall satisfaction, continuity of care, and coordination of care.

Changes in the remuneration system of general practitioners (GPs) in the Netherlands provided a unique opportunity to study the effects of changes in financial incentives on quality of care, and thereby to contribute to the scarce literature. Most GPs are free entrepreneurs in the Netherlands [12]; their income depends on the applicable remuneration system. Traditionally, the Dutch GP remuneration system was dependent on the type of insurance carried by the patient: public (63%) or private (37%). Below a gross annual income of €33 000, people were publicly insured. For publicly insured patients remuneration was based on a capitation system, whereas for privately insured patients an FFS system was in operation. GPs act as gatekeepers for secondary care, being the first point of contact for medical care in the Netherlands. In 2006, the Dutch government introduced a new Health Insurance Act [13], which abolished the differentiation between publicly and privately insured patients. With the revised health insurance system, the GP remuneration system changed to a combined capitation and modest FFS system for all patients (Table I). The differentiation in remuneration between publicly and privately insured patients was thought to be undesirable, and could lead to differences in the provision of care between these patient groups [14,15]. Also, GPs believed the former

Table I. GP remuneration system in 2005 and since 2006 in the Netherlands.

Remuneration system	2005		Since 2006
	Publicly insured	Privately insured	All insured <sup>1</sup>
Capitation fee:			
Basic capitation fee <sup>2</sup>	€77.00	–	€52.00
Fee-for-service:			
Consultation < 20 minutes	–	€24.80	€9.00
Consultation > 20 minutes	–	€49.60	€18.00
Home visit < 20 minutes	–	€37.20	€13.50
Home visit > 20 minutes	–	€62.00	€22.50
Telephone consultation	–	€12.40	€4.50

Notes: <sup>1</sup>Payments in 2006. <sup>2</sup>Additional capitation fee for older people and people living in a deprived area.

remuneration system of capitation for publicly insured patients did not reward their time investment.

The aim of this paper was to investigate whether changes in the GP remuneration system, through different financial incentives, affected GPs' guideline adherence using longitudinal data from the electronic medical records (EMRs) of GPs. Changes in the remuneration system of Dutch GPs were not directed to improve the quality of care or guideline adherence, such as in a pay-for-performance system. However, alterations in the remuneration system changed the incentives for providing services to both publicly and privately insured patients, with an increased incentive to provide services for publicly insured patients and a decreased incentive to provide services for privately insured patients. The number of provided services may impact on the quality of care. Therefore, we expected an increase in guideline adherence for publicly insured compared with privately insured patients (hypothesis 1); this effect may be greater for indicators involving more time investment (hypothesis 2).

## Material and methods

### Study design and population

This was a longitudinal study analysing differences in the trends for guideline adherence from 2002 to 2009 between publicly and privately insured patients. 2002–2008 EMR data were used from GP practices that participated in the Netherlands Information Network of General Practice (LINH) [16]. The LINH database contains longitudinal data on the patient level in terms of contacts, morbidity, prescriptions, and referrals. General practices are recruited based on certain characteristics of the practice (for example type of practice and region) to attain a representative sample of Dutch general practice. The network is a dynamic pool of practices,

with yearly small changes in composition. The LINH is registered with the Dutch Data Protection Authority; data are handled according to national data protection guidelines.

For guidelines regarding prescriptions, we included only data from practices that passed a number of checks regarding the quality of data on morbidity (care episodes) and prescription and where the patient's (former) health insurance type was known. For guidelines related to referral data, an additional inclusion criterion was the availability of adequate referral data throughout the year. Table II shows the number of general practices, patients, and decisions (each time a GP can decide to adhere to a specific guideline) per year for both selections: dynamic panel. Reason for exclusion were (a) no complete data on morbidity/care episodes (40%: no year-round data or low degree of morbidity coding), (b) no complete data on prescriptions (10%: low degree of morbidity coding) and (c) no patient's former health insurance type (5% in 2007, 15% in 2008). Included and excluded general practices did not differ with regard to their characteristics, except that more general practices from the south of the Netherlands were excluded. Overall, these GP practices were representative of Dutch GP practices in respect of the degree of urbanization and region, but not in respect of practice type (over-representation of group practices or health centres and under-representation of single-handed practices). Additional analyses showed that practice type did not largely influence guideline adherence.

### Measures

*Decision in accordance with guidelines.* Sixteen guideline adherence indicators were used, based on clinical guidelines (Table III) [17–18]. The condition-specific guidelines comprise a range of recommendations and considerations that are related to each other and that are often ordered in a decision tree. Based on the key

recommendations that were easy to extract from EMRs, quality indicators were developed.

*Health insurance type.* Patient's health insurance type in 2002–2005 was used from the specific year. For patients in 2006, 2007, and 2008, the last known health insurance type was used.

*Time investment.* The amount of time associated with guideline adherence was based on research by van den Berg et al. [19]. Workload was divided into the expected workload effect in the actual consultation (short-term) and the likelihood that the patient will return (long-term). Van den Berg et al. asked an expert panel of three practicing GPs whether the amount of work (short- and long-term) was likely to be greater, equal to, or smaller when adhering to the guideline. Indicators were given a score on the basis of the majority of the expert ratings. In the case of three different scores, the indicator was scored as 2. On the basis of the expected workload in actual consultation and long-term workload effect, we discerned nine categories (see Table V; for distribution in categories see Table III).

*Statistical analyses.* Effects of changes in the remuneration system on guideline adherence were analysed for all 16 indicators separately, as well as the overall score, and a comparison was carried out between indicators which differed with regard to the expected short- and long-term workload.

Differences in the trends for adherence to 16 separate guidelines between publicly and privately insured patients were analysed by multilevel logistic regression analyses (with random intercept, one variance on patient level, and a variance for each year on practice level), using a compound-symmetry model with three-level hierarchically structured data (decisions nested within patients, and patients nested within general practices) using MLwiN 2.02 (IGLS

Table II. Number of general practices, patients, and decisions concerning guideline adherence included in the analyses.

	2002	2003	2004	2005	2006	2007	2008
Data regarding guidelines related to prescriptions:							
General practices	44	52	36	32	52	45	35
Patients (with decisions)	29 704	34 449	23 851	21 421	39 828	32 453	26 722
Decisions	40 582	47 276	33 155	29 718	55 011	45 178	37 891
Data regarding guidelines related to referrals:							
General practices	38	37	28	27	39	38	30
Patients (with decisions)	8 632	8 373	6 313	5 582	9 427	7 293	5 752
Decisions	9 027	8 815	6 632	5 828	9 873	7 569	5 958

Table III. Guideline adherence indicators and their expected workload effect in actual consultation and expected long-term workload effect.

Guideline adherence indicator	Expected workload effect in actual consultation	Expected long-term workload effect
Indicators – prescription:		
1. Prescribing nitrofurantoin or trimethoprim for patients older than 12 years of age with uncomplicated cystitis	Smaller	Equal
2. <i>Not</i> prescribing antibiotics for patients with acute sore throat	Greater	Smaller
3. Prescribing narrow-spectrum instead of broad-spectrum penicillin when prescribing antibiotics for patients with acute sore throat	Smaller	Greater
4. <i>Not</i> prescribing antibiotics for patients with sinusitis	Greater	Smaller
5. Prescribing first-choice antibiotics (before 2006: ciprofloxacin & doxycycline; from 2006: ciprofloxacin & amoxicillin) when prescribing antibiotics for patient with sinusitis	Smaller	Greater
6. Prescribing diuretics to patient with uncomplicated hypertension instead of other hypertension medication	Equal	Equal
7. Prescribing a lipid modifying agent for patient with diabetes	Equal	Equal
8. Prescribing an antithrombotic agent for patients with angina pectoris	Equal	Equal
9. Prescribing an antithrombotic agent for patients with transient cerebral ischaemia	Equal	Equal
10. Prescribing parasympatholytics and/or beta-2-sympathomimetics without corticosteroids for patients with chronic obstructive pulmonary disease (COPD).	Equal	Smaller
11. <i>Not</i> prescribing a proton pump inhibitor to patients with a-specific stomach complaints	Equal	Equal
Indicators – referrals:		
12. <i>Not</i> referring patients with traumatic knee problem to an orthopaedic surgeon	Greater	Greater
13. <i>Not</i> referring patients with osteoarthritis of the knee to an orthopaedic surgeon	Greater	Smaller
14. <i>Not</i> referring patients with Acute otitis media to an ENT specialist	Smaller	Smaller
15. <i>Not</i> referring patients with otitis externa to an ENT specialist	Smaller	Smaller
16. <i>Not</i> referring patients with atopic eczema to a dermatologist	Greater	Greater

Source: Braspenning et al. (2004 [17]); Braspenning et al. (2006 [18]).

estimation; 1st order PQL) [20]. The covariates were estimated across years, assuming that the effect is constant over time. Guideline adherence was taken as the dependent variable. We included one dummy variable for year, score “0” for the years before the change in remuneration (2002–2005) and score “1” for the years after the change (2006–2008). Publicly insured patients were taken as the reference group in the analyses (variable *insurance*). We captured the effect of changes in remuneration between publicly and privately insured patients as the difference in trends between publicly and privately insured patients over time: *year\*insurance*. The use of the interaction term means that both group-specific and time-specific factors were controlled for, and therefore only the effect of the changes in remuneration system was estimated. In these analyses, the variable *year* captured the difference in guideline adherence between 2002–2005 and 2006–2008 for publicly insured patients, as publicly insured patients were the reference group. Additionally, differences in guideline adherence were estimated for privately insured patients.

The trend in adherence to all guidelines together was analysed by cross-classified logistic multilevel regression using a compound-symmetry model

developed by van den Berg et al. [19]. Decisions were nested within patients and patients within general practices, but decisions were also nested within the different guidelines. The dependent and independent variables in the analysis were equal to the analyses of individual guideline adherence indicators. As sensitivity analysis, we estimated the trend in adherence to all guidelines together for a stable panel (11 general practices with 2002–2008 data).

To investigate whether trend differences in guideline adherence between publicly and privately insured patients differed with regard to the expected short- and long-term workload, three-way interactions were included in separate analyses (for example: *insurance\*year\*smaller short-term workload*). Every combination of the expected short- and long-term workload was taken as reference category. By doing so, the interaction term *insurance\*year* represents the effect (and confidence interval) of the remuneration system on guideline adherences for the reference category. The difference in the trend for guideline adherence was determined for seven of the nine categories of labour intensity (two were excluded since these combinations were not available in the 16 included indicators; see Table V). All analyses were corrected for differences in age (as a

Table IV. Descriptive information on guideline adherence and results of multilevel logistic regression analyses.

	Percentage of guideline adherence per period and insurance status						Model		
	2002-2005		2006-2008		Trend (2002-2005 vs. 2006-2008) for publicly insured patients	Trend (2002-2005 vs. 2006-2008) for privately insured patients	Difference in trend between publicly and privately insured patients (reference publicly insured patients)		
	Publicly insured	Privately insured	Publicly insured	Privately insured				OR (95% CI)	OR (95% CI)
<b>Adherence to guideline indicators – prescription</b>									
1. Uncomplicated cystitis	67.8	67.4	68.8	65.8	1.07 (0.93-1.22)	1.02 (0.88-1.19)	0.96 (0.87-1.06)		
2. Acute sore throat	81.3	78.2	80.8	79.9	<b>0.80 (0.67-0.95)</b>	0.91 (0.74-1.10)	1.13 (0.96-1.34)		
3. Acute sore throat: narrow spectrum	40.3	37.8	38.3	38.6	0.95 (0.73-1.23)	1.07 (0.78-1.48)	1.13 (0.83-1.56)		
4. Sinusitis	26.1	25.2	26.6	26.7	1.01 (0.85-1.21)	1.08 (0.89-1.30)	1.06 (0.94-1.20)		
5. Sinusitis: first-choice antibiotics	65.6	63.8	26.0	25.6	<b>0.14 (0.11-0.17)</b>	<b>0.16 (0.13-0.20)</b>	<b>1.17 (1.02-1.34)</b>		
6. Uncomplicated hypertension	48.3	39.6	51.3	46.0	<b>1.23 (1.04-1.45)</b>	<b>1.42 (1.20-1.69)</b>	<b>1.16 (1.05-1.27)</b>		
7. Diabetes	35.8	35.9	60.6	61.3	<b>5.86 (5.03-6.84)</b>	<b>6.25 (5.21-7.50)</b>	1.07 (0.92-1.23)		
8. Angina pectoris	66.3	66.6	71.1	72.7	<b>1.23 (1.06-1.43)</b>	<b>1.48 (1.18-1.84)</b>	1.20 (0.96-1.51)		
9. Transient cerebral ischaemia	86.5	89.6	85.1	86.8	0.87 (0.69-1.11)	0.79 (0.54-1.16)	0.90 (0.58-1.39)		
10. COPD	90.1	86.9	93.5	91.7	<b>1.48 (1.20-1.81)</b>	<b>1.72 (1.20-2.45)</b>	1.16 (0.78-1.73)		
11. A-specific stomach complaints	47.1	45.2	29.4	29.9	<b>0.49 (0.42-0.58)</b>	<b>0.53 (0.44-0.65)</b>	1.08 (0.91-1.29)		
All guideline indicators prescription	54.1	50.4	55.0	51.7					
<b>Adherence to guideline indicators – referrals</b>									
12. Traumatic knee problem	82.9	84.3	81.6	78.7	0.91 (0.75-1.11)	<b>0.67 (0.52-0.86)</b>	<b>0.74 (0.55-0.98)</b>		
13. Osteoarthritis of the knee	87.2	84.7	83.4	80.6	<b>0.70 (0.57-0.87)</b>	<b>0.69 (0.50-0.96)</b>	0.98 (0.68-1.43)		
14. Acute otitis media to an ENT specialist	95.7	95.9	95.0	94.7	0.84 (0.68-1.04)	0.78 (0.59-1.02)	0.92 (0.66-1.28)		
15. Otitis externa	96.4	96.9	96.3	96.4	0.96 (0.77-1.22)	0.83 (0.61-1.14)	0.87 (0.60-1.24)		
16. Atopic eczema	95.6	96.2	95.4	95.9	0.91 (0.70-1.18)	0.85 (0.61-1.18)	0.94 (0.65-1.36)		
All guideline indicators referrals	93.6	94.4	92.9	92.9					
All indicators	60.2	59.1	60.1	58.8	1.07 (0.99-1.14)	<b>1.10 (1.02-1.19)</b>	1.03 (0.99-1.08)		

Significance at p&lt;0.05 (bold).

Table V. Estimation of differences in the trend in guideline adherence between publicly (reference) and privately insured patients for each combination of expected short- and long-term workload 2002–2005 vs. 2006–2008.

Expected long-term workload	Expected short-term workload		
	Smaller	Equal	Greater
Smaller	<b>0.72 (0.64–0.81)</b>	0.98 (0.87–1.12)	<b>1.13 (1.05–1.21)</b>
Equal	<b>0.91 (0.84–0.98)</b>	<b>1.24 (1.18–1.30)</b>	n.a.
Greater	<b>0.43 (0.40–0.47)</b>	n.a.	<b>0.68 (0.60–0.76)</b>

Significance at  $p < 0.05$  (bold).

polynomial: age, age<sup>2</sup>, and age<sup>3</sup>) and gender composition across years.

## Results

### *Trends in guideline adherence*

Guidelines related to referrals were generally more often adhered to than guidelines related to prescriptions (see Table IV). The sixth and seventh columns of Table IV show the difference in guideline adherence between 2002–2005 and 2006–2008 for publicly and privately insured patient separately. In general, guideline adherence increased between 2002–2005 and 2006–2008 for both publicly and privately insured patients. Additional analyses estimating the linear trend between 2002 and 2008 showed significant trends for both publicly and privately insured patients (not included). Analyses of separate indicators showed that in particular indicators related to chronic and cardiovascular diseases showed an increase in adherence (numbers 6, 7, 8, and 10). Guideline adherence with regard to prescribing first-choice antibiotics for patients with sinusitis showed a sharp decline since the reform, simultaneous with the change in recommended first-choice antibiotics in the guideline, which had nothing to do with the reform. Also, indicators related to a-specific stomach complaints and osteoarthritis of the knee showed a decrease in adherence between 2002–2005 and 2006–2008.

### *Effect of the remuneration system on guideline adherence*

To investigate whether the changes in remuneration systems, through differences in financial incentives, changed guideline adherence, we compared the difference in guideline adherence between 2002–2005 and 2006–2008 between publicly and privately insured patients (see eighth column in Table IV). For guideline adherence in general, no differences in the trends between publicly and privately insured patients were found. For 13 out of the 16 indicators, no

differences in trends were found between publicly and privately insured patients. For indicators regarding the prescription of first-choice antibiotics for sinusitis and uncomplicated hypertension, a greater increase in adherence was found for privately insured patients. In other words, the changes from capitation for publicly insured patients and FFS for privately insured patients to a combined system of capitation and FFS resulted in a greater increase (in the case of hypertension) or a smaller decrease (in the case of sinusitis) in guideline adherence for privately insured patients compared with publicly insured patients, whereas for the indicators regarding referral for traumatic knee problems the opposite effect was found. Sensitivity analysis with a stable panel showed similar effects of the remuneration system on guideline adherence in general (OR 1.04; 95% CI 0.97–1.13).

### *Effect of remuneration on guideline adherence to short- and long-term workload*

For guidelines that were expected to involve a greater long-term investment (a greater chance that the patient would return to the practice), consistently significant lower trends for privately insured patients were found in comparison with publicly insured patients (see Table V). In other words, guidelines that involve a higher chance that a patient would return to the practice were significantly more adhered to since the change in remuneration in publicly insured patients compared with privately insured patients. Also, for guidelines that were expected to involve a lesser short-term investment (less work in the actual consultation), significantly lower trends for privately insured patients were found in comparison with publicly insured patients.

## Discussion

The purpose of this study was to analyse whether the quality of care measured with the aid of guideline adherence indicators changed as a result of changes in the remuneration system of GPs. In general, changes in the Dutch remuneration system of GPs

did not affect guideline adherence, contrary to hypothesis 1. Adherence to guidelines involving more time investment in terms of follow-up contacts occurred more often since the reform in publicly insured patients compared with privately insured patients, in accordance with hypothesis 2.

### *Strengths and limitations*

We made use of a unique natural experiment regarding changes in the GP remuneration system and made use of EMR data, excluding potential socially desirable responses. A number of points should be considered regarding our study. First, general practices were selected on the basis of the quality of their EMR and may represent a more motivated portion of Dutch GPs. Effects of the remuneration system on guideline adherence could therefore be different in the Dutch GP population, although other Dutch GPs showed similar contact rates and types [21]. Second, analyses were based on a dynamic population. Included general practices varied between years, which could have affected the results. For this reason, we performed multilevel analyses to correct for variations in participating practices between years and performed a sensitivity analysis. Finally, the expected short- and long-term workload was based on the opinion of only three GPs. Unfortunately, we have no information about the representativeness of these three GPs.

### *Literature*

Guideline adherences increased between 2002 and 2008, especially for chronic and cardiovascular diseases. The increase in guideline adherence was similar for publicly and privately insured patients, suggesting the absence of an effect of the change in remuneration system on guideline adherence. This is contrary to our first hypothesis, but in accordance with some other studies on aspects of the quality of care [10,11]. The effect that changes in remuneration affected adherence to guideline adherence involving follow-up contacts supports a study in which the number of recommended visits increased due to remuneration [9]. In addition, these results are in accordance with previous research on changes in the GP remuneration system in the Netherlands using LINH data also, which showed a higher trend of follow-up contacts for publicly insured patients compared with privately insured patients [22]. The absence of an effect of changes in remuneration system on guideline adherence suggests that other non-financial factors, such as medical ethics, may have played a more important role with regard to GPs' behaviour.

The increase in guideline adherences related to chronic disease and cardiovascular diseases might be explained by the increased attention to these diseases. In this time period, chronic diseases such as diabetes mellitus and COPD as well as cardiovascular diseases received a lot of attention. For example, since 2006, general practices have been able to arrange new contracts for primary care nurses, who are especially involved in caring for patients with chronic and cardiovascular diseases [16]. Increases in guideline adherence related to chronic diseases were also found in the United Kingdom [23].

We showed that changes in the guidelines, as demonstrated by the first-choice antibiotic for sinusitis, led to a drop in guideline adherence. It seems that GPs do not automatically adjust their practice style to changes in guidelines, which has also been shown in other studies [24,25].

### *Conclusion*

To a large extent, GPs seem to do what they need or have to do, irrespective of the way they are remunerated. However, guidelines involving a greater long-term workload in terms of additional follow-up contacts were affected by the remuneration system.

### **Declaration of interest**

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

### **References**

- [1] Chaix-Couturier C, Durand-Zaleski I, Jolly D, Durieux P. Effects of financial incentives on medical practice: Results from a systematic review of the literature and methodological issues. *Int J Qual Health Care* 2002;12:133–42.
- [2] Krasnik A, Groenewegen PP, Pedersen PA, van Scholten P, Mooney G, Gottschau A, Flierman HA, Damsgaard MT. Changing remuneration systems: Effects on activity in general practice. *BMJ* 1990;300:1698–1701.
- [3] Gosden T, Forland F, Kristiansen IS, Sutton M, Leese B, Giuffrida A, Serginson M, Pedersen L. Capitation, salary, fee-for-service and mixed systems of payment: Effects on the behaviour of primary care physicians. *Cochrane Database Syst Rev* 2002;CD000531.
- [4] Boerma WGW. Profiles of general practice in Europe. Utrecht: NIVEL; 2003.
- [5] Donaldson C, Gerard K. Paying general practitioners: Shedding light on the review of health services. *J R Coll Gen Pract* 1989;39:114–17.
- [6] Iversen T, Lurås H. The effect of capitation on GPs' referral decisions. *Health Econ* 2000;9:199–210.
- [7] Brennan J, Fennessy E, Moran D. The financing of primary health care. Ireland: Society of Actuaries; 2000.

- [8] Labelle R, Stoddart G, Rice T. A re-examination of the meaning and importance of supplier-induced demand. *J Health Econ* 1994;13:347–68.
- [9] Hickson GB, Altemeier WA, Perrin JM. Physician reimbursement by salary or fee-for-service: Effect on physician practice behavior in a randomized prospective study. *Pediatrics* 1987;80:344–50.
- [10] Hutchinson B, Birch S, Hurley J, Lomas J, Stratford-Devai F. Do physician-payment mechanisms affect hospital utilization? A study of health service organizations in Ontario. *CMAJ* 1996;154:653–61.
- [11] Gosden T, Sibbald B, Williams J, Petchey R, Leese B. Paying doctors by salary: A controlled study of general practitioner behaviour in England. *Health Policy* 2003;64:415–23.
- [12] Hingstman L, Kenens RJ. Cijfers uit de registratie van huisarts: peiling 2010 [Data from registration of GPs: Measurements 2010]. Utrecht: NIVEL; 2010.
- [13] Enthoven AC, Van de Ven WPM. Going Dutch: Managed-competition health insurance in the Netherlands. *N Engl J Med* 2007;357:2421–3.
- [14] Biesheuvel BW, Commissie modernisering curatieve zorg. Gedeelde zorg: betere zorg: rapport van de Commissie modernisering curatieve zorg [Shared care: Better care: Report of the Committee on Modernisation of Curative Health Care]. Rijswijk: Ministerie van Welzijn, Volksgezondheid en Cultuur; 1994.
- [15] Tabaksblad M, Commissie toekomstige financieringsstructuur huisartsenzorg. Een gezonde spil in de zorg: rapport commissie toekomstige financieringsstructuurhuisartsenzorg [A healthy linchpin in health care: report of Committee on the Future GP Remuneration System]. Den Haag: Ministerie van Volksgezondheid, Welzijn en Sport; 2001.
- [16] Verheij RA, van Dijk CE, Abrahamse H, Davids R, van den Hoogen H, Braspenning J, van Althuis T. 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]. Utrecht/Nijmegen: NIVEL/IQhealthcare. <http://www.LINH.nl> (accessed 21 December 2010).
- [17] Braspenning JCC, Schellevis FG, Grol RPTM. Kwaliteit huisartsenzorg belicht [Quality in GP care illustrated]. Utrecht: NIVEL; 2004.
- [18] Braspenning J, Schellevis F, Grol R. Assessment of primary care by clinical quality indicators. In: Westert GP, Jabaaij L, Schellevis FG, editors. *Morbidity, performance and quality in primary care: Dutch general practice on stage*. Oxford: Radcliffe Publishing; 2006. p. 195–204.
- [19] Van den Berg MJ, De Bakker DH, Spreeuwenberg P, Westert GP, Braspenning JCC, Van der Zee J, Groenewegen PP. Labour intensity of guidelines may have a greater effect on adherence than GPs' workload. *BMC Fam Pract* 2009;10:74.
- [20] Rice N, Jones A. Multilevel models and health economics. *Health Econ* 1997;6:561–75.
- [21] Karszen B, Schipper M, Jurling BRA. Praktijkkosten en opbrengsten van huisartsenpraktijken: Eindrapportage van een onderzoek naar de praktijkkosten en opbrengsten van huisartsenpraktijken in Nederland in 2006 [Practice costs and revenue of GP practices: Final report on research practice costs and revenue of GP practices in the Netherlands in 2006]. Barneveld: Significant; 2006.
- [22] Van Dijk CE, van den Berg B, Verheij RA, Spreeuwenberg P, Groenewegen PP, de Bakker DH. Moral hazard and supplier-induced demand: Empirical evidence in general practice. *Health Econ* 2012; doi: 10.1002/hec.2801.
- [23] Campbell SM, Reeves D, Kontopantelis E, Sibbald B, Roland M. Effects of pay for performance on the quality of primary care in England. *N Engl J Med* 2009;361:368–78.
- [24] Ohlsson H, Vervloet M, Van Dijk L. Practice variation in a longitudinal perspective: A multilevel analysis of the prescription of simvastatin in general practices between 2003 and 2009. *Eur J Clin Pharmacol* 2011; doi:10.1007/s00228-011-1082-8.
- [25] Grol R, Grimshaw J. From best evidence to best practice: Effective implementation of change in patients' care. *Lancet* 2003;362:1225–30.