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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.

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 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>
<thead>
<tr>
<th>Table II. Number of general practices, patients, and decisions concerning guideline adherence included in the analyses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
</tr>
<tr>
<td>Data regarding guidelines related to prescriptions:</td>
</tr>
<tr>
<td>General practices</td>
</tr>
<tr>
<td>Patients (with decisions)</td>
</tr>
<tr>
<td>Decisions</td>
</tr>
<tr>
<td>Data regarding guidelines related to referrals:</td>
</tr>
<tr>
<td>General practices</td>
</tr>
<tr>
<td>Patients (with decisions)</td>
</tr>
<tr>
<td>Decisions</td>
</tr>
</tbody>
</table>
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 (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: $\text{year} \times \text{insurance}$. 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: $\text{insurance} \times \text{year} \times \text{smaller short-term workload}$). Every combination of the expected short- and long-term workload was taken as reference category. By doing so, the interaction term $\text{insurance} \times \text{year}$ 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.

<table>
<thead>
<tr>
<th>Percentage of guideline adherence per period and insurance status</th>
<th>Model</th>
<th>Difference in trend between publicly and privately insured patients (reference publicly insured patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publicly insured</td>
<td>Privately insured</td>
<td>Publicly insured</td>
</tr>
<tr>
<td>Adherence to guideline indicators – prescription</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Uncomplicated cystitis</td>
<td>67.8</td>
<td>67.4</td>
</tr>
<tr>
<td>2. Acute sore throat</td>
<td>81.3</td>
<td>78.2</td>
</tr>
<tr>
<td>3. Acute sore throat: narrow spectrum</td>
<td>40.3</td>
<td>37.8</td>
</tr>
<tr>
<td>4. Sinusitis</td>
<td>26.1</td>
<td>25.2</td>
</tr>
<tr>
<td>5. Sinusitis: first-choice antibiotics</td>
<td>65.6</td>
<td>63.8</td>
</tr>
<tr>
<td>6. Uncomplicated hypertension</td>
<td>48.3</td>
<td>39.6</td>
</tr>
<tr>
<td>7. Diabetes</td>
<td>35.8</td>
<td>35.9</td>
</tr>
<tr>
<td>8. Angina pectoris</td>
<td>66.3</td>
<td>66.6</td>
</tr>
<tr>
<td>9. Transient cerebral ischaemia</td>
<td>86.5</td>
<td>89.6</td>
</tr>
<tr>
<td>10. COPD</td>
<td>90.1</td>
<td>86.9</td>
</tr>
<tr>
<td>11. A-specific stomach complaints</td>
<td>47.1</td>
<td>45.2</td>
</tr>
<tr>
<td>All guideline indicators prescription</td>
<td>54.1</td>
<td>50.4</td>
</tr>
<tr>
<td>Adherence to guideline indicators – referrals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Traumatic knee problem</td>
<td>82.9</td>
<td>84.3</td>
</tr>
<tr>
<td>13. Osteoarthrosis of the knee</td>
<td>87.2</td>
<td>84.7</td>
</tr>
<tr>
<td>14. Acute otitis media to an ENT specialist</td>
<td>95.7</td>
<td>95.9</td>
</tr>
<tr>
<td>15. Otitis externa</td>
<td>96.4</td>
<td>96.9</td>
</tr>
<tr>
<td>16. Atopic eczema</td>
<td>95.6</td>
<td>96.2</td>
</tr>
<tr>
<td>All guideline indicators referrals</td>
<td>93.6</td>
<td>94.4</td>
</tr>
<tr>
<td>All indicators</td>
<td>60.2</td>
<td>59.1</td>
</tr>
</tbody>
</table>

Significance at p<0.05 (bold).
polynomial: age, age^2, and age^3) 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 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**

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