Quality in Primary Care 2009;17:179–89

Research paper

Financial incentives linked to self-assessment of prescribing patterns: a new approach for quality improvement of drug prescribing in primary care

Björn Wettermark MSc Pharm PhD
Senior Researcher, Department of Drug Management and Informatics, Stockholm County Council and Karolinska Institutet, Centre for Pharmacoepidemiology and Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska University Hospital – Huddinge

Åke Pehrsson BA
Administrator

Maria Juhasz-Haverinen, MSc Pharm
Pharmacist, Division of Finance and Healthcare Planning, Stockholm County Council, Sweden

Aniko Veg PhD
Senior Researcher, Department of Public Health and Caring Sciences, Uppsala University, Sweden

Maria Edlert BA
Administrator, Department of Drug Management and Informatics, Stockholm County Council

Gunilla Törnwall-Bergendahl BA
Chief Economist

Henrik Almkvist MD
Head of Department

Division of Finance and Healthcare Planning, Stockholm County Council, Sweden

Brian Godman BSc
Researcher, Institute for Pharmacological Research 'Mario Negri', Milan, Italy

Fredrik Granath PhD
Statistician, Centre for Pharmacoepidemiology and Clinical Epidemiology Unit, Department of Medicine, Karolinska Institutet and Karolinska University Hospital, Stockholm, Sweden

Ulf Bergman MD PhD
Senior Medical Officer, Department of Drug Management and Informatics, Stockholm County Council and Karolinska Institutet, Centre for Pharmacoepidemiology and Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska University Hospital – Huddinge

ABSTRACT

Background Financial incentives have been suggested to be effective in increasing the quality and efficiency of drug prescribing. Concern has been raised in relation to potential negative consequences on the quality of care.

Aims To describe and analyse the impact of an incentives model linking payment with adherence to drug and therapeutics committee (DTC) guidelines and self-reflection of prescribing pattern in a 'prescribing quality report'.

Methods The study was performed in the county of Stockholm, Sweden, with 139 (out of 154) primary healthcare centres (PHCs) participating in the project and 15 PHCs not participating. The study consisted of two parts: a quantitative observational study of prescribing patterns and a qualitative analysis of the submitted prescribing quality reports. All prescriptions issued from PHCs and dispensed at pharmacies during October to December 2005 and October to December 2006 were analysed, using adherence to

the regional DTC guidelines as the main outcome measure. Adherence was assessed using the drug utilisation 90% methodology, i.e. focusing on drugs constituting 90% of the prescribed volume and the proportion of drugs included in the guidelines. The qualitative analysis focused on reports on the quality of drug prescribing submitted by each PHC in early 2007.

Results The 139 PHCs participating in the programme accounted for 85% of all prescriptions issued in primary care during October to December 2006. Mean adherence to guidelines increased among participating practices by 3.3 percentage units (95% confidence interval (CI) 2.9–3.7%) to 83% (82.6–83.7%) during the year. The adherence among practices not participating increased by 3.1 percentage units (95% CI 1.7–4.4%) to 78.8% (95% CI 76.7–80.9%). The higher adherence achieved during the year corresponded to savings estimated at five times greater than the cost of running the programme including the financial incentives. In addition, many areas for improving prescribing were identified, such as limiting the prescribing of drugs with uncertain safety profiles and documentation as well as reporting adverse drug reactions.

Conclusion Although no causal effect can be attributed without a control group, we have shown the feasibility of a model linking payment to DTC adherence. This approach with its own quality assessment and goal setting offers an example to other regions and countries of how to increase the quality and efficiency of drug prescribing within limited resources.

Keywords: general practice, incentives, prescribing, primary health care, quality indicators

How this fits in with quality in primary care

What do we know?

There is room for improvement in adherence to guidelines for rational prescribing as current strategies have only limited effects in enhancing implementation. Financial incentives can be used to improve the quality and efficiency of prescribing. However, many incentive schemes are short lived and costly to administer and lead to uncertain effects on the quality of care. Few studies have reported whether the benefits/savings achieved using financial incentives outweigh the costs of performing the intervention.

What does this paper add?

A model linking financial incentives to drug and therapeutics committee (DTC) adherence and local assessment of prescribing performance in a 'prescribing quality report' demonstrated the feasibility of using financial incentives to stimulate activity to increase the quality of prescribing in primary health care. The increased adherence to DTC guidelines achieved during the first year of the programme corresponded to decreased annual expenditure for prescription drugs by approximately €21 000 per practice (with an average of six general practitioners). Self-assessment of quality and goal setting based on self-reflection of prescribing patterns differed from prescribing incentive schemes used in other countries, and offers a way to increase the quality, safety and efficiency of drug prescribing within relatively limited resources.

Introduction

Most countries are facing the challenge of growing healthcare demand with limited available resources. The cost of pharmaceuticals is particularly in focus since the growth in expenditure has been greater than for other healthcare components,[1–6] and will accelerate with increased prevalence of chronic diseases combined with the continued launch of new expensive medicines.[7] Consequently, various strategies have been applied in pharmaceutical policymaking to influence the quality and efficiency of prescribing, including positive and negative financial incentives, educational interventions, prescribing targets and regulatory changes.[6,8–15]

Financial incentives can be used to reduce the use of healthcare resources, improve compliance with practice guidelines or achieve general health targets. Allocating drug budgets to doctors has been suggested as an effective method to influence physicians and increase the cost-effectiveness of prescribing.[6,14,6–19] Consequently, incentive schemes and drug budgets are applied today in many countries in Europe and also in the United States.[3,6,12,18,20,21]

In Sweden, initiatives to improve the quality of drug prescribing have been organised by drug and therapeutics committees (DTCs).[6,22,23] These activities include decision-support systems for prescribing, educational programmes, feedback on prescribing patterns, and evidence-based guidelines for drug treatment.

In recent years, financial incentives have also been introduced. A range of models have been used, from financial incentives linked to certain targets to capitation-based drug budgets.[6,24] Some regions apply population-based models, while others allocate a specific budget to each practice based on historic prescribing patterns. The former model is more common in rural areas and the latter more common in major cities.

The provision and financing of health services in Sweden is a public sector responsibility, primarily resting with 21 county councils. Primary health care is the basis of the Swedish healthcare system but it has no gatekeeper function and therefore many healthcare providers are involved in patient management and drug prescribing. In the county of Stockholm, the local primary healthcare centres (PHCs) only account for one-third of consultations and dispensed prescriptions to the population in the surrounding area.[25,26] Consequently, it is not feasible to link drug budgets to specific patient populations, and a model with incentives linked to prescribing behaviour and adherence to guidelines was introduced in Stockholm in 2006.

The new model included extra payments linked to the level of adherence to the DTC guidelines (measured as the proportion of the drugs prescribed included in the guidelines) and the submission of a 'prescribing quality report'. Templates were issued including questions about the doctors' opinion of their adherence to DTC guidelines, goals for improvement including their prescribing of new medicines, documentation and reporting of adverse drug reactions (ADRs), contacts with the pharmaceutical industry, participation in clinical trials and continuing professional development. The intention of the model was to use financial incentives to increase doctors' cost-consciousness, while at the same time stimulating them to assess the quality of their drug prescribing and finding potential ways to improve it. The aim of this study is to describe the model and PHCs' experiences with it.

Methods

The study was performed in the county of Stockholm, Sweden, which has 1.9 million inhabitants and 169 PHCs; 154 PHCs were invited to participate, with one municipality excluded due to a separate healthcare organisation. This was an observational study without a formal control group and was based on quantitative data on prescribing patterns from 2005 to 2006 and qualitative data summarised in the 'prescribing quality reports' for 2006. The quantitative analyses provided a description of the adherence to the guidelines before and after the incentives were introduced, and the qualitative analysis contributed to a deeper understanding of which factors the PHCs considered important to improving the quality of drug prescribing.

Quantitative analysis of prescribing patterns

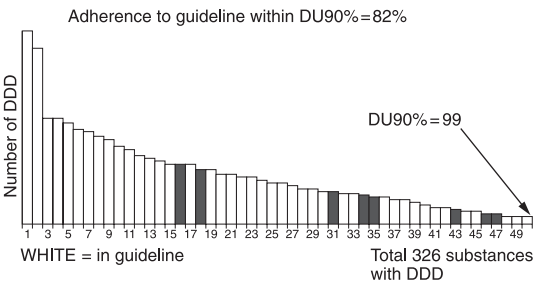
The quantitative analysis was performed with routinely collected data on dispensed prescriptions in ambulatory care patients from all PHCs participating in the programme. Data were collected from the Swedish National Prescription Register administered by the National Corporation of Swedish Pharmacies.

The time periods for analyses were October to December 2005 and October to December 2006. These periods were chosen to reflect prescribing before and after the schemes were introduced. Using dispensing data from the last quarter of each year would minimise the problem with older repeat prescriptions issued before the project started (a prescription is valid for one year in Sweden).

Data were classified according to the ATC (Anatomic Therapeutic Chemical) classification.[27] Drug utilisation was expressed as defined daily doses (DDDs), prescription items and expenditures in Euros. Adherence to DTC guidelines was assessed using the DU90% (drug utilisation 90%) method which assesses the number of drugs constituting 90% of the prescribed volume expressed in DDDs and adherence to guidelines within this segment (see Figure 1).[28–30]

The guidelines for comparison were the list of drugs recommended by the DTC in Stockholm in 2006, the so-called 'Wise Drug List'.[6,22,23,31] These guidelines are produced by over 20 expert groups, which include general practitioners (GPs), hospital specialists, pharmacists and clinical pharmacologists. They consist of diagnosis-specific evidence-based recommendations with some 200 to 240 pharmaceutical products suggested as first-line choices for outpatient treatment of common diseases.[6,22,23] In this study, adherence was calculated by substance regardless of which pharmaceutical product (brand or generic) was prescribed and dispensed to the patient.

Descriptive statistical values (mean, median, 95% confidence interval (CI) and range) were calculated. Crude comparisons of adherence to the DTC in 2005 with respect to activities reported in the prescribing quality reports were performed by *t* tests. The same comparisons were also performed using a multiple linear regression model. Crude and mutually adjusted differences are presented together with 95% CIs. The association between reported activities and change in adherence between 2005 and 2006 was assessed using analysis of covariance, where the 2005 value was included as a covariate in order to allow for ceiling effects. A corresponding analysis of covariance was performed to assess the change in adherence between



	SUBSTANCE	(DDD)	DDD	%TOT	Rx	COST	COST/DDD
1	**Acetylsalicylic acid**	1tablet	24 977	5.4%	291	14 755	0.59
2	**Enalapril**	10 mg	22 641	4.9%	236	14 379	0.64
3	**Simvastatin**	15 mg	13 263	2.9%	205	15 783	1.19
4	**Metoprolol**	0.15 mg	13 185	2.8%	289	60 001	4.55
5	**Metformin**	2 g	12 862	2.8%	184	22 515	1.75
6	**Paracetamol**	3 g	11 559	2.5%	385	31 773	2.75
7	**Cyanocobalamin**	1 mg	11 456	2.5%	137	9 549	0.83
8	**Hydroc.thiazide + amiloride**	1 tablet	11 106	2.4%	124	6 618	0.60
9	**Furosemide**	40 mg	10 861	2.3%	124	11 371	1.05
10	**Zopiclone**	7.5 mg	10 336	2.2%	212	10 056	0.97
11	**Omeprazole**	20 mg	10 094	2.2%	185	40 369	4.00
12	**Citalopram**	20 mg	9 400	2.0%	129	7 086	0.75
13	**Bendroflumethiazide**	2.5 mg	9 094	2.0%	70	8 188	0.90
14	**Budesonide**	*	8 792	1.9%	122	65 052	7.40
15	**Ramipril**	2.5 mg	8 412	1.8%	29	5 511	0.66
16	**Atenolol**	75 mg	8 401	1.8%	104	7 267	0.87
17	**Levothyroxine sodium**	0.15 mg	8 306	1.8%	143	11 303	1.36
18	**Felodipine**	5 mg	7 606	1.6%	79	8 264	1.09
19	**Terbutaline**	*	7 525	1.6%	147	28 560	3.80
20	**Propiomazine**	25 mg	6 458	1.4%	93	7 575	1.17
…							
99							
DU 90%	**1-99**		417 592	90.0%	6 935	1422 776	3.41
	100-326		46 152	10.0%	1 330	397 887	8.62
TOTAL	**1-326**		**463 744**	**100%**	**8 265**	**1820 664**	**3.93**

***Bold* = in guideline**
**** = different DDDs for various routes of administration***
Medicines without DDD excluded (64, corresponding to 108 009 SEK)

Figure 1 Example of a drug utilisation 90% (DU90%) prescribing profile for a PHC centre based on drugs dispensed at all pharmacies in the country October to December 2006. DU90% = drug utilisation 90% – the number of drugs constituting 90% of the volume expressed in DDDs. Adherence is calculated as the percentage of DDDs for drugs in the regional DTC guideline compared with the total number of DDDs within the 90% segment. Rx = number of prescription items, cost is presented in Swedish Crowns (SEK), 100 SEK = 10.5 Euro (March 2009)

units with and without incentives. Differences were considered statistically significant for $P < 0.05$.

Correlation between adherence and cost/DDD (see Figure 3) was calculated using Pearson's correlation coefficient (r). A value for $P < 0.05$ was considered significant. Potential savings relating to increased adherence to the guidelines were calculated by multiplying the proportional decrease in cost/DDD for each percentage increase in adherence with the total number of DDDs prescribed.

Qualitative analyse of submitted prescribing quality reports

Each PHC received a questionnaire by email. The questionnaire was developed through a consensus procedure by the regional division of finance and healthcare planning at the beginning of 2007 (see Box 1). Most questions were closed (yes/no), to facilitate analyses. The reports were submitted by the head physician in each PHC to enhance the robustness of the answers, and embodied reflections on one year's prescribing patterns at the local PHC. Two open-ended questions (Q2 and Q8, Box 1) were analysed qualitatively, since they were strongly related to the aim of the reports and the answers were sufficiently long to build a short text.

A thematic analysis of the contents of the submitted quality reports was made by two of the authors (AV and ME). The first step of the analysis was a thorough reading of each short text. The second step involved formulating the initial categories in order to start collating the replies. Additional categories were derived with ongoing analysis of the text. The derived

Box 1 Template for quality reports submitted in early 2007, *italic* = open-ended questions

Q1 Has the PHC participated in any former project to improve the rational use of drugs and/or to increase the cost-consciousness of drug prescribing?
Q2 Describe three observations acquired when analysing your prescribing patterns.
Q3 *Which prescribing feedback reports available through the internet (www.janusinfo.se) did you use to assess your quality of prescribing (DU90%, DC90%*, prescribing targets, others)?*
Q4 *Suggest three areas for improvement.*
Q5 *Which new drugs have you introduced recently and how do you assess the value of them for patient care?*
Q6 Does your PHC have routines for reporting adverse drug reactions (ADRs)? Do you discuss ADR case reports as a part of your continuing professional education?
Q7 How many and which ADR reports have you submitted during 2006?
Q8 Describe which other factors may have influenced your prescribing patterns.
Q9 *Describe your participation in educational activities arranged by the DTC, other professional organisations and the pharmaceutical industry.*
Q10 Have you received support from an information doctor/pharmacist when analysing your prescribing patterns?
Q11 Are the recommended drugs marked separately in your electronic medical record?
Q12 Did you participate in any clinical trial during 2006? For which drug?
Q13 Has any doctor at your PHC been a member of the DTC or any expert group during 2006?

*DC90% = drug cost 90%, substances accounting for 90% of the total expenditures

final list of categories constituted both factors promoting and factors explaining difficulties in reaching good adherence to recommendations (see Table 3). These categories were subsequently discussed with the other members of the research team before embarking on the analysis to enhance the robustness.

Results

A total of 139 out of 154 invited PHCs (90%) agreed to participate in the study. The main reasons for not participating were that PHCs missed the deadline for inclusion, or concerns about additional workload. The 15 non-participating PHCs subsequently served as the 'controls'. The first quality reports were submitted in early 2007 based on 2006 data. In 2006, a total of €2 million was spent on incentives to the 139 participating PHC centres, with payments per practice varying depending on their performance. As an example, a PHC with seven GPs and an adherence to the DTC guidelines of 87% received €18 000; average adherence was 82% in October to December 2006.

Quantitative analysis of prescribing patterns

During October to December 2006, after the incentives were introduced, 4.4 million prescription items were dispensed to the inhabitants of Stockholm County. This represents an average of 2.4 prescription items per inhabitant. Forty-three percent of all prescriptions had been issued in primary health care. The 139 participating PHCs accounted for 85% of all prescriptions issued by all 169 PHC centres in the county. The total expenditure for prescribing in primary health care was €35 million, constituting 26% of the total ambulatory care prescribing in the county. The number of prescriptions increased by 10% and the expenditure by 4% compared to October to December 2005.

Adherence to the DTC recommendations was on average 83.1% (95% CI 82.6–83.7%) in October to December 2006, and varied between 62% and 90% among participating practices. The practices not included were smaller (8000 versus 11 500 dispensed prescription items/practice/quarter). They also had a significantly lower adherence to guidelines than those participating in the scheme (78.8% (95% CI 76.7–80.9%)).

Adherence to DTC guidelines increased by 3.3 percentage units (95% CI 2.9–3.7%) among practices participating compared to 3.1 percentage units (CI 1.7–4.4%) in those not participating. A significantly lower increase among non-participating centres was observed after adjustment for the ceiling effect, i.e. that the participating practices had a significantly higher adherence prior to introduction of the schemes (see Figure 2).

After the incentives were introduced, a clear correlation was observed between high adherence and low

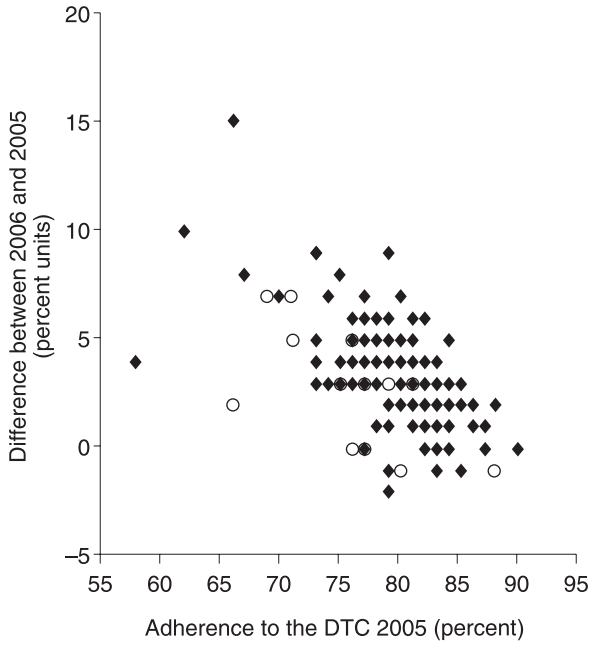


Figure 2 Baseline adherence to the DTC recommendations using DU90% in October to December 2005 and change between October to December 2005 and October to December 2006. Primary healthcare centres in the county of Stockholm were invited to participate in the schemes (n = 154). Dark diamonds represent the 139 practices participating in the schemes, white circles show the 15 non-participating PHCs serving as 'controls'

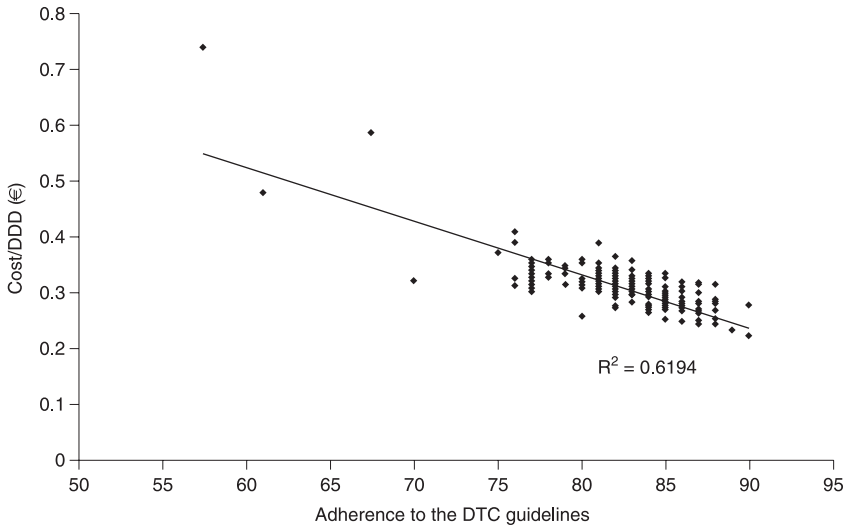


Figure 3 Correlation between adherence to DTC guidelines (within DU90%) and average cost/DDD, October to December 2006 in all PHC centres in the county (n = 169). R^2 = coefficient of determination

cost/DDD (see Figure 3). An increased adherence of 1% corresponded to €0.47 lower cost/prescription item. For a PHC of average size (six GPs), this corresponded to an approximately €21 000 lower annual drug expenditure. Consequently, with a total of 6.4 million prescription items dispensed in 2006 at participating PHC centres, increasing adherence by 3 percentage units resulted in estimated annual savings of more than €10 million.

Prescribing quality reports

More than half of all PHCs (58%) claimed that they had participated in previous projects with the aim of improving prescribing quality and/or increasing the cost-effectiveness of prescribing. A majority of participating and non-participating practices, 84% and 83% respectively, received support from information doctors and/or pharmacists (medical doctors or pharmacists with special training employed or financed by the Drug and Therapeutics Committee to disseminate guidelines and educate healthcare professionals in rational pharmacotherapy) or had guideline drugs highlighted in the electronic prescribing support system to enhance the quality and efficiency of prescribing. One-quarter of the PHCs (26%) had participated in clinical trials and 22% had doctors who were members of the DTC or one of the expert groups.

The analysis of the prescribing quality reports emphasised the need for improving documentation and reporting of ADRs. Fifty-two percent of the PHCs had local processes for documenting ADRs, and 85% claimed that they regularly discussed cases of ADRs at their internal meetings. However, many PHCs also suspected a substantial under-reporting of ADRs. In the prescribing quality reports, these PHCs stated that they had submitted a total of 300 ADRs to the regional ADR monitoring unit in 2006. This corresponded to half of all submitted ADR reports (n = 585) from all PHCs in the region.

There were certain differences in adherence to the DTC recommendations between participating PHCs in October to December 2005, before the programme started, with a significantly higher adherence at baseline for PHCs previously participating in projects or with doctors that were members of the DTC or one of the expert groups (see Table 1).

However, the change in adherence during the year showed the opposite pattern, with greater increases in adherence observed among PHCs having the lowest baseline adherence rates initially (see Table 2). These differences disappeared when adjusted for the ceiling effect.

Qualitative analysis of submitted quality reports

A total of 137 prescribing quality reports were submitted. The result of the analysis of question Q2, 'Describe three observations acquired when analysing your prescribing patterns', showed most PHCs were satisfied with their own improvements in drug prescribing, and they considered themselves to have good adherence to the DTC guidelines. A common conclusion was that the most frequently prescribed drugs were recommended in the guidelines. However, there were also observations of high prescribing of certain drugs that were not recommended, which is now being addressed, such as 'reducing unnecessary prescribing of antibiotics'. Some explanatory factors behind high or low adherence to the guidelines are presented in Table 3.

Table 1 Association between activities reported in prescribing quality reports (see Box 1) and guidelines adherence in October to December 2005

Question in prescribing quality report	Mean		Difference – crude			Difference – adjusted		
	Yes	No	Yes – no	95% CI	*P* value	Yes – no	95% CI	*P* value
Q1 Participation in former project	80.8	78.8	1.97	(0.46–3.48)	0.01	2.00	(0.41 to 3.59)	0.01
Q6a Routines for reporting ADRs	80.1	79.9	0.25	(–1.31 to 1.80)	0.75	–0.63	(–2.19 to 0.93)	0.43
Q10 Support from information doctor/ pharmacist	80.2	78.6	1.56	(–0.63 to 3.76)	0.16	0.73	(–1.59 to 3.05)	0.53
Q11 Recommended drugs marked in electronic medical record	80.2	78.8	1.36	(–0.69 to 3.42)	0.19	1.49	(–0.55 to 3.53)	0.15
Q12 Participation in clinical trial	79.1	80.3	–1.21	(–2.94 to 0.52)	0.17	–1.48	(–3.16 to 0.21)	0.08
Q13 Member of DTC	82.0	79.4	2.57	(0.78 to 4.36)	<0.01	2.44	(0.64 to 4.25)	<0.01

Univariate analysis (crude) and multivariate analysis (adjusted)
Data are mean and difference including 95% confidence intervals (n = 121 reports)

The PHCs identified therapeutic areas or single drugs where a substantial improvement in adherence would be possible, for example: 'reducing the prescribing of angiotensin receptor blockers in favour of ACE [angiotensin-converting enzyme]-inhibitors' or 'increasing the prescribing of start-packages when possible'. The suggested strategies were in accordance with the guidelines; these included increasing prescribing of recommended drugs when initiating drug therapy with new patients, or reserving certain drugs as second-line choice for more restricted indications. Furthermore, many PHCs wanted to increase their knowledge of pharmacotherapy through educational activities, perform regular reviews of their prescribing patterns, and in general: 'increase knowledge about drugs and their adverse effects'.

Discussion

This study has demonstrated the feasibility of using financial incentives to stimulate the quality of prescribing through increased adherence to evidence-based drug therapies recommended by the expert groups in the DTCs and through self-assessment of ways to improve future prescribing. In the first year of the programme, adherence to DTC guidelines increased on average by 3 percentage units from 80% to 83%, a substantially higher increase than the 0–2% achieved in previous years.[30] Although 3% does not seem to be a high figure, it is more than generally achieved through educational interventions.[11,13] In addition, the study started from a high average adherence rate of 80%. It is likely that the programme supported this increase, although this cannot be concluded with this observational study since it does not correct for other factors influencing prescribing patterns, such as pharmaceutical company marketing activities for new and existing drugs, new indications for existing drugs and changes in regulatory policies.[32–34] It is interesting that adherence rates increased by a similar extent among PHCs not participating in the programme. However, these PHCs were not completely comparable. As discussed, they were smaller and had a lower adherence to the guidelines initially with, consequently, greater room for improvement. Furthermore, they may have been contaminated by the intervention since they participated in the same professional networks and educational activities.[31]

It is a challenge to change professional behaviour. Simple diffusion or dissemination of printed material

Table 2 Association between activities reported in prescribing quality reports (see Box 1) and change in adherence to guidelines adherence between October to December 2006 and 2005, respectively

Question in prescribing quality report	Change 2005–2006			Adjusted difference (yes/no)		
	Yes	No	Crude difference	Yes – no	95% CI	*P* value
Q1 Participation in former project	3.00	3.97	–0.97	–0.15	–0.89 to 0.58	0.68
Q6a Routines for reporting ADRs	3.20	3.56	–0.36	–0.41	–1.12 to 0.29	0.25
Q10 Support from information doctor/pharmacist	3.29	3.88	–0.59	0.29	–0.75 to 1.35	0.58
Q11 Recommended drugs marked in electronic medical record	3.33	3.60	–0.27	0.35	–0.58 to 1.28	0.46
Q12 Participation in clinical trial	3.78	3.23	0.55	0.10	–0.67 to 0.87	0.80
Q13 Member of DTC	2.96	3.49	–0.53	0.69	–0.15 to 1.53	0.11

Crude change and multivariate analysis adjusted for 2005 value
Data are mean and difference including 95% confidence intervals ($n = 121$ reports)

Table 3 Perceived factors influencing the adherence to DTC guidelines reported by PHCs in prescribing quality reports

Promoting factors	Interfering factors
Internal review of prescribing patterns assisted by an information pharmacist or physician from the drug and therapeutics committee (DTC)	Therapy initiated by a hospital-based specialist or other physician
Continuing professional education organised by the DTC	Frequent changes in the recommendations
Participation in drug-related studies and/or carrying out studies at the PHC locally	The practice staff consist of temporarily employed doctors
	Patient characteristics, e.g. immigrants, elderly people living in nursing homes, demanding and self-sufficient patients
	Difficulties in changing recommendations from the previous year

and mailed feedback on prescribing patterns may influence professionals' awareness and knowledge, but they seldom change behaviour.[11,35–37] More intensive strategies such as 'academic detailing' as well as guideline development coupled with comprehensive dissemination strategies do change behaviour, although few studies have reported if the benefits/savings achieved using these strategies outweigh the costs of performing them.[11,15,35,38,39] Although it cannot be definitely concluded that the increased adherence was solely due to the incentives programme, the calculated savings were five times higher than the cost of running the programme. Alongside this, physicians identified a number of activities to help improve future prescribing

quality. Consequently, our model suggests a potential way to increase the quality and efficiency of drug prescribing with relatively limited resources. The calculated savings were based on the observed correlation between adherence and cost/DDD. This negative correlation between adherence and cost has arisen in recent years and is explained by ongoing reforms in Sweden to achieve low prices for generic medicines coupled with programmes to encourage generic prescribing as first line.[6,23] In most cases generic drugs are equally effective and less expensive than the corresponding patented drugs.[6,40–43] Recently, the National Audit Office in the UK also documented that considerable savings (£227million) could be achieved by increasing prescribing of generic simvastatin, omeprazole and ACE inhibitors compared with branded drugs in the same or related classes.[6,34]

Overall, financial incentives have been shown in previous studies to be effective in improving the quality and efficiency of prescribing.[18,19,21,44,45] However, the effects can be short lived,[16,17] and the long-term effects on the quality of care are less well studied. In a systematic review of studies published between 1993 and 1999, it was suggested that financial incentives for drug prescribing could decrease the quality of care by limiting continuity, reducing the preventive services offered and increasing inappropriate use of emergency services.[46] Concern was also raised about the potential change in the doctor–patient relationship, and the potential negative consequences in the long term of reducing time for teaching and research. Consequently, such initiatives must be carefully planned and monitored. We consider the risk of negative consequences to be low with our approach, since the incentives were not linked to specific medical decisions but used to stimulate overall adherence to guidelines that had been developed with robust technologies. In addition, the DU90% method used to monitor adherence offers advantages since it focuses on those medicines accounting for 90% of the volume, thereby leaving some latitude to deviate from guidance if needed. In addition, we gave physicians the opportunity to reflect on ways to improve their own prescribing. We believe that measuring adherence with routinely collected data is preferable since it is known that self-reported data produce an overestimate of adherence to guidelines.[39,47] Furthermore, too strong a focus on auditing and payment for performance may also pose a threat to the validity of the data recorded if physicians take the opportunity to manipulate the data to increase their incomes.[39,48,49]

As previously stated, the quality reports were an addition to the prescribing incentive scheme, enhancing the opportunity for physicians to increase both the quality and efficiency of their prescribing. They also offered the potential for local ownership and learning, which contrasts with the top-down approaches in most incentive schemes. The importance of local ownership is in line with the recent experience from the UK and the Netherlands.[13,21,45,50] Perhaps not surprisingly, future recommendations included reducing prescribing of drugs that were not recommended, as well as generally increasing knowledge about the effectiveness and safety of the drugs prescribed to improve future decision making. Future analysis will reveal whether PHC recommendations have been implemented. This will also reveal whether PHCs subsequently increase ADR documentation and reporting, compared to the under-reporting that was identified.

Finally, it is important to emphasise that adherence to prescribing guidelines and quality reports were only two aspects of quality of care. Quality assessment should include all aspects of care, including structure, process and outcome.[51] Nevertheless, drug prescribing is important and our findings should stimulate debate in other countries on future methods to enhance the quality and efficiency of prescribing. The model could also easily be adapted to include other aspects of patient management and outcome.

REFERENCES

1 Thorpe KE. The rise in health care spending and what to do about it. *Health Affairs* 2005;24:1436–45.
2 Zuvekas SH and Cohen JW. Prescription drugs and the changing concentration of health care expenditures. *Health Affairs* 2007;26:249–57.
3 Ess SM, Schneeweiss S and Szucs TD. European healthcare policies for controlling drug expenditure. *Pharmacoeconomics* 2003;21:89–103.
4 Garattini L, Motterlini N and Cornago D. Prices and distribution margins of in-patent drugs in pharmacy: a comparison in seven European countries. *Health Policy* 2008;85:305–13.
5 Henriksson F, Hjortsberg C and Rehnberg C. Pharmaceutical expenditure in Sweden. *Health Policy* 1999:47; 125–44.
6 Godman B, Wettermark B, Hoffmann *et al.* Multifaceted national and regional drug reforms and initiatives in ambulatory care in Sweden: global relevance. *Expert Review of Pharmacoeconomics and Outcomes Research* 2009;9:65–83.
7 Lee T and Emanuel E. Tier 4 drugs and the fraying of the social compact. *New England Journal of Medicine* 2008; 359:333–5.
8 Freemantle N and Bloor K. Lessons from international experience in controlling pharmaceutical expenditure. I: Influencing patients. *BMJ* 1996;312:1469–71.
9 Bloor K and Freemantle N. Lessons from international experience in controlling pharmaceutical expenditure. II: Influencing doctors. *BMJ* 1996;312:1525–7.
10 Bloor K, Maynard A and Freemantle N. Lessons from international experience in controlling pharmaceutical expenditure. III: Regulating industry. *BMJ* 1996;313:33–5.
11 Grimshaw JM, Thomas RE, MacLennan G *et al.* Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technology Assessment* 2004;8(6):iii–iv, 1–72.

12 Fattore G and Jommi C. The last decade of Italian pharmaceutical policy: instability or consolidation? *Pharmacoeconomics* 2008;26:5–15.

13 Chapman S, Durieux P and Walley T. Good prescribing practice. In: Elias Mossialos, Monique Mrazek and Tom Walley (eds) *Good Prescribing Practice in Regulating Pharmaceuticals in Europe: striving for efficiency, equity and quality*. Buckingham: Open University Press, 2004, pp. 144–57.

14 Hyde R. Doctors to pay for patients' medicines in Germany. *The Lancet* 2007;370:1118.

15 Godman B, Bucsics A, Burkhardt T *et al*. Insight into recent reforms and initiatives in Austria; implications for key stakeholders. *Expert Review of Pharmacoeconomics and Outcomes Research* 2008;8:357–71.

16 Walley T, Mrazwek M and Mossialos E. Regulating pharmaceutical markets: Improving efficiency and controlling costs in the UK. *International Journal of Health Planning and Management* 2005;20:375–98.

17 Harris C and Scrivener G. Fundholders' prescribing costs: the first five years. *BMJ* 1996;313:1531–4.

18 Walley T and Mossialos E. Financial incentives and prescribing. In: Elias Mossialos, Monique Mrazek and Tom Walley (eds) *Financial Incentives and Prescribing in Regulating Pharmaceuticals in Europe: striving for efficiency, equity and quality*. Buckingham: Open University Press, 2004, pp. 177–95.

19 Mason A, Towse A, Drummond M and Cooke J. *Influencing Prescribing in a Primary Care Led NHS*. London: Office of Health Economics, 2002.

20 Wallack S, Weinberg DB and Thomas CP. Health plans' strategies to control prescription drug spending. *Health Affairs* 2004;23:141–8.

21 Martens J, Werkhiven M, Severens J and Winkens R. Effects of a behaviour independent financial incentive on prescribing behaviour of general practitioners. *Journal of Evaluation in Clinical Practice* 2007;13:369–73.

22 Sjöqvist F, Bergman U, Dahl M-L *et al*. Drug and therapeutics committees: a Swedish experience. *WHO Drug Information* 2002;16:207–13.

23 Wettermark B, Godman B, Andersson K *et al*. Recent national and regional drug reforms in Sweden – implications for pharmaceutical companies in Europe. *Pharmacoeconomics* 2008;26:537–50.

24 Bergström G and Karlberg I. Decentralized responsibility for costs of outpatient prescription pharmaceuticals in Sweden. Assessment of models for decentralized financing of subsidies from a management perspective. *Health Policy* 2007;81:358–67.

25 Wettermark B, Bergman U and Krakau I. Using aggregate data on dispensed drugs to evaluate the quality of prescribing in urban primary healthcare in Sweden. *Public Health* 2006;120:451–61.

26 Bergman U, Andersson D, Friberg A *et al*. Quality indicators for drug use and drug handling. Issued by the Medical Quality Council founded by the Swedish Society of Medicine and the Swedish Medical Association. *Svensk Medicin* 1999;66.

27 WHO Collaborationg Centre for Drug Statistics Methodology. *Guidelines for ATC Classification and DDD Assignment*. Oslo: WHO Collaborating Centre for Drug Statistics Methodology, 2007

28 Wettermark B, Pehrsson Å, Jinnerot D and Bergman U. Drug utilisation 90% profiles – a useful tool for quality assessment of prescribing in primary healthcare in Stockholm. *Pharmacoepidemiology and Drug Safety* 2003; 12:499–510.

29 Wettermark B, Nyman K and Bergman U. Five years' experience of quality assurance and feedback with individual prescribing profiles at a primary healthcare centre in Stockholm, Sweden. *Quality in Primary Care* 2004; 12:225–34.

30 Wettermark B. *Drug Utilization 90% – Using Aggregate Drug Statistics for the Quality Assessment of Prescribing*. PhD thesis. Stockholm: Karolinska Institutet, Stockholm 2004.

31 Anon. *Wise Drug List (Kloka Listan): physician version* [in Swedish]. Stockholm: Stockholm County Council, Regional Drug and Therapeutics Committee, 2007. www.janusinfo.se/klokalistan/external/baselist.asp (accessed 20 April 2009).

32 Grimshaw J, Campbell M, Eccles M and Steen N. Experimental and quasi-experimental designs for evaluating guideline implementation strategies. *Family Practice* 2000;17:S11–S18.

33 Stephenson J and Imrie J. Why do we need randomised controlled trials to assess behavioural interventions? *BMJ* 1998;316:611–13.

34 Beishon J, McBride T, Scharaschkin S *et al*. The National Audit Office. *Prescribing Costs in Primary Care*. London: The Stationery Office, 2007. www.nao.org.uk/publications/0607/prescribing_costs_in_primary_c.aspx (accessed 20 April 2009).

35 Bero LA, Grilli R, Grimshaw JM *et al*. The Cochrane Effective Practice and Organization of Care Review Group. Closing the gap between research and practice: an overview of systematic reviews of interventions to promote the implementation of research findings. *BMJ* 1998;317:465–8.

36 O'Connell DL, Henry D and Tomlins R. Randomised controlled trial of effect of feedback on general practitioners' prescribing in Australia. *BMJ* 1999;318:507–11.

37 Söndergaard J, Andersen M, Stövring H and Kragstrup J. Mailed prescriber feedback in addition to a clinical guideline has no impact: a randomised, controlled trial. *Scandinavian Journal of Primary Healthcare* 2003;21:47–51.

38 Mason J, Freemantle N, Nazareth I *et al*. When is it cost-effective to change the behaviour of health professionals. *Journal of the American Medical Association* 2001;286: 2988–92.

39 Wettermark B, Godman B, Jacobsson B and Haaijer-Ruskamp F. Soft regulations in pharmaceutical policy making – an overview of current approaches and their consequences. *Applied Health Policy and Health Economy* 2009;in press.

40 Usher-Smith JA, Ramsbottom T, Pearmain H and Kirby M. Evaluation of the cost savings and clinical outcomes of switching patients from atorvastatin to simvastatin and losartan to candesartan in a primary care setting. *International Journal of Clinical Practice* 2007;61:15–23.

41 Usher-Smith J, Ramsbottom T, Pearmain H and Kirby M. Evaluation of the clinical outcomes of switching

patients from atorvastatin to simvastatin and losartan to candesartan in a primary care setting: 2 years on. *International Journal of Clinical Practice* 2008;62:480–4.
42 Wessling A and Lundin D. The review of drugs against disease caused by acid stomach – a summary. Solna: Pharmaceuticals Benefits Board, 2006. www.tlv.se/upload/genomgangen/summary-stommach-acid.pdf
43 Office of Fair Trading (UK). *The Pharmaceutical Price Regulation System: an OFT study. Annexe A: Market for prescription pharmaceuticals in the NHS*. London: The Office of Fair Trading, 2007. www.oft.gov.uk/shared_oft/reports/comp_policy/oft885a.pdf (accessed 20 April 2009).
44 Sturm H, Austvoll-Dahlgren A, Aaserud M *et al.* Pharmaceutical policies: effects of financial incentives for prescribers. *Cochrane Database of Systematic Reviews* 2007;(3):CD006731.
45 Mason AR, Drummond MF, Hunter JA, Towse AK and Cooke J. Prescribing incentive schemes: a useful approach? *Applied Health Economics and Health Policy* 2005;4:111–17.
46 Chaix-Couturier C, Durand-Zaleski I, Jolly D and Durieux P. Effects of financial incentives on medical practice: results from a systematic review of the literature and methodological issues. *International Journal of Quality in Health Care* 2000;12:133–42.
47 Adams AS, Soumerai SB, Lomas J and Ross-Degnan D. Evidence of self-report bias in assessing adherence to guidelines. *International Journal of Quality in Health Care* 1999;11:187–92.
48 Kesselheim AS and Brennan TA. Overbilling vs. down-coding – the battle between physicians and insurers. *New England Journal of Medicine* 2005;352:855–7.
49 Doran T, Fullwood C, Gravelle H *et al.* Pay-for-performance programs in family practices in the United Kingdom. *New England Journal of Medicine* 2006;355:375–84.
50 Smith PC and York N. Quality incentives: the case of UK general practitioners. *Health Affairs* 2004;23:112–18.
51 Donabedian A. The quality of care. How can it be assessed? *Journal of the American Medical Association* 1988;260:1743–8.

FUNDING

None.

ETHICAL APPROVAL

None.

PEER REVIEW

Not commissioned; externally peer reviewed.

CONFLICTS OF INTEREST

Henrik Almkvist, Maria Juhasz-Haverinen, Åke Pehrsson and Gunilla Törnwall-Bergendahl were employed by the Department of Finance and Healthcare Planning in Stockholm county responsible for running the programme. Ulf Bergman and Björn Wettermark were both members of the regional Drug and Therapeutics Committee, responsible for development of the DTC guideline.

ADDRESS FOR CORRESPONDENCE

Björn Wettermark, Department of Drug Management and Informatics, Stockholm County Council, Box 17533, SE-118 91 Stockholm, Sweden. Email: bjorn.wettermark@sll.se

Received 7 January 2009
Accepted 13 April 2009