Structuring prescribing data into traffic-light categories; a tool for evaluating treatment quality in primary care

Per Lagerløv, Per Hjortdahl\textsuperscript{a}, Line Saxegaard, Marit Andrew\textsuperscript{b} and Ingrid Matheson


**Background.** Prescribing feedback based on aggregated data alone does not give the information needed to improve treatment quality.

**Objectives.** Our aim was to develop a new method, or tool, of presenting prescribing feedback which, combined with guideline recommendations, makes it possible for doctors to judge their own prescribing as good or bad.

**Methods.** Asthma was chosen as a disease model, as treatment recommendations are readily available published as national and international guidelines. Four mean daily dosage intervals of inhaled short-acting \(\beta\)-agonists and four mean daily dosage intervals of inhaled steroids were combined into a \(4 \times 4\) matrix. This matrix of 16 combined dosage boxes was presented to 68 Norwegian GPs participating in peer review groups. As a first step, the GPs in the groups reached consensus on what they considered to be appropriate and inappropriate combined dosage intervals of these drugs based on national guideline recommendations and their joint clinical experience. Accordingly, traffic-light colours, green and red, were assigned to the combined dosage boxes in the matrix. Treatments in boxes difficult to judge were coloured yellow. During a 1-year period prior to the consensus meetings, the dispensed inhaled short-acting \(\beta\)-agonists and inhaled steroids of each of the doctors’ patients were recorded at the local pharmacies. As a second step in developing the new method, the number of patients treated within each of the coloured boxes was presented to the GPs in the peer review groups. These combined presentations provided an overview to the whole group, and individually to each GP, of how many patients were actually given appropriate or inappropriate treatment according to their own agreed upon standard.

**Results.** The GPs categorized 34\% of 1122 evaluated patients receiving inhaled short-acting \(\beta\)-agonists or inhaled steroids as treated inappropriately during the 1-year registration period. Appropriate treatment was given to 47\% of the patients, and in 19\% of the cases the treatment was difficult to evaluate.

**Conclusions.** A method has been developed enabling GPs to categorize prescribing information into good (green), bad (red) and difficult to judge (yellow) treatment qualities, based on guideline recommendations and clinical experience. The actual prescribing data for each GP were labelled according to the same colour scheme, thus revealing to each GP his or her own actual prescribing compared with their own treatment standard, yielding information and motivation for quality improvement efforts.

**Keywords.** Asthma management, consensus on treatment, prescribing data, quality assessment tool.

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**Received 3 August 2000; Revised 2 March 2001; Accepted 4 May 2001.**

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**Introduction**

Feedback on prescribing using aggregated data without accompanying specific information to the prescribers does not improve treatment.\textsuperscript{1} To influence the quality of patient care, the treatment given to individual patients...
should be evaluated. Treatment guidelines are usually developed as an aid for clinicians in their daily work with patients. Accepted clinical guidelines can, however, also be used as a yardstick when evaluating prescribing. Guidelines are seldom designed for this task, and interpretations are often needed to make comparisons between guidelines and prescribing data possible. The prescribing data must, furthermore, be compiled in such a way that they can be matched with the guideline recommendations. Discrepancies in recommended and actual prescribing behaviour may thus form the basis of further quality improvement efforts. The process of judging prescribing as good or bad may be useful in the education of doctors.

The aim of this study is to present a quality improvement tool where prescribing data are framed into combined dosage categories making comparisons with recommendations in international and national guidelines possible.

The study is the Norwegian part of a joint European Drug Education Project examining the effect of educational intervention on prescribing behaviour.

### Methods

**Framing prescribing data**

In our study, asthma was chosen as the disease model as there has been an international tradition for agreeing upon guidelines containing stepwise recommendations of asthma treatment, on the patient level. The principal drugs in treating asthma are inhaled short-acting β-agonists and inhaled steroids. Short-acting β-agonists in most countries are now recommended to be inhaled ‘when needed’ and are not to be used on a regular basis. Inhaled steroids are recommended primarily to be used regularly as prophylactic treatment in cases where patients experience daily symptoms.

Using prescribing data, the mean amounts per day of inhaled short-acting β-agonists and inhaled steroids for each patient were calculated using the concept of defined daily doses (DDDs). The World Health Organization (WHO) has standardized DDD units corresponding to the assumed average daily dose of the drug used by an adult patient. The DDDs of different anti-asthmatics based on the WHO standards are shown in Table 1.

The relationship between the combined use of inhaled short-acting β-agonists and inhaled steroids was tabulated in a 4 × 4 table of mean daily dosage intervals. Four mean daily dosage intervals of inhaled short-acting β-agonists presented in rows and four mean daily dosage intervals of inhaled steroids presented in columns resulted in 16 combined dosage boxes, the matrix of the prescribing feedback (Fig. 1). The patients of each doctor were fitted into this matrix, based on the calculated mean daily dose of these two groups of drugs dispensed to each patient during the 12-month period.

### Table 1 Recorded anti-asthmatics and their defined daily dose (DDD)

<table>
<thead>
<tr>
<th>Anti-asthmatics</th>
<th>DDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-acting β-agonists</td>
<td></td>
</tr>
<tr>
<td>Salbutamol</td>
<td>0.8 mg inhaled, 12 mg oral</td>
</tr>
<tr>
<td>Terbutaline</td>
<td>2.0 mg inhaled, 15 mg oral</td>
</tr>
<tr>
<td>Fenoterol</td>
<td>0.6 mg inhaled, 10 mg oral</td>
</tr>
<tr>
<td>Inhaled steroids</td>
<td></td>
</tr>
<tr>
<td>B clenomethasone</td>
<td>0.8 mg inhaled</td>
</tr>
<tr>
<td>Budesonide</td>
<td>0.8 mg inhaled</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>1.0 mg inhaled</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>0.6 mg inhaled</td>
</tr>
<tr>
<td>Other recorded anti-asthmatics</td>
<td></td>
</tr>
<tr>
<td>Salmeterol</td>
<td>0.1 mg inhaled</td>
</tr>
<tr>
<td>Ipratropium bromide</td>
<td>0.12 mg inhaled</td>
</tr>
<tr>
<td>Cromoglycic acid</td>
<td>40 mg inhaled aerosol</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>10 mg oral</td>
</tr>
<tr>
<td>Choline theophylline</td>
<td>600 mg oral</td>
</tr>
<tr>
<td>Theophylline</td>
<td>400 mg oral</td>
</tr>
</tbody>
</table>

Patients with mild asthma would probably end up in the upper left boxes of the matrix, as compared with patients with more severe asthma needing higher mean daily doses of both drugs ending up in the lower right boxes of the matrix.

### Prescribing data

The participating doctors gave the project co-ordinators consent to retrieve data related to their asthma prescriptions dispensed from the pharmacies during the 12-month period prior to the study. All reimbursed prescriptions of anti-asthmatics were recorded (Table 1). Prescriptions for patients older than 50 years were not included in order to limit the number of patients with chronic obstructive pulmonary disease. Nor were those younger than 17 years included, as guidelines on asthma treatment for younger people are more controversial and also more closely related to the patients’ specific age level.

### Peer review groups

GPs were recruited to the study from the southeastern part of Norway. They were invited to take part in an educational intervention randomly assigned to focus on either asthma or urinary tract infections. One hundred GPs assigned to focus on asthma were divided into 16 peer review groups, each consisting of 4–8 GPs. Each group had two evening meetings, each lasting an average of 3 hours. During the first meeting, the diagnostic approach and treatment decisions related to asthma were discussed. At the last meeting, national and international guidelines for asthma treatment were handed out and discussed among the GPs. These were then related to the participants’ own prescribing behaviour.
Structuring prescribing data into traffic-light categories

After a general discussion of the national guidelines on asthma management,5 the GPs were presented with a blank matrix (Fig. 1). Each GP individually marked with a green colour the combined dosage boxes in the matrix that they, on a theoretical and clinical basis, felt were consistent with appropriate or good treatment, and with a red colour those considered as wrong treatment. The boxes where the treatment quality was difficult to judge were given a yellow colour. The group as a whole subsequently discussed and agreed upon the final colour labelling of each of the 16 boxes in the matrix.

The matrix filled in with the number of patients treated within each box was then presented in two steps. First, the matrix with the pooled data for patients of the whole peer review group was presented to the group. Secondly, the matrix with the data for patients of each GP was presented individually. This allowed the GPs as a group to see and reflect upon how they had treated their asthma patients collectively during the last year, before being provided with their own prescribing pattern.

Validation of diagnoses

In this study, 17- to 50-year-old patients receiving short-acting β-agonists or steroids for inhalation at the pharmacy were used to identify asthma patients (proxy-identified patients). Our method of picking patients may falsely identify some users as asthma patients. In order to evaluate the extent of this misclassification, the project coordinators picked at random for each GP between four and five patients having received inhalant steroids or short-acting β-agonists during the last year. The GPs were then asked to state the diagnosis given in the patients’ medical record. The proportion of the sampled patients clinically diagnosed as having asthma, according to code R 96 in the International Classification of Primary Care (ICPC),9 compared with all proxy-identified patients within each combined dosage box of the matrix, was calculated.

Table: Traffic-light categories of treatment quality

<table>
<thead>
<tr>
<th>Inhaled steroids</th>
<th>0</th>
<th>&lt; ½</th>
<th>½ - 1</th>
<th>&gt;1</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; ¼ DDD per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¼ - &lt; ½ DDD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>½ - 1 DDD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 DDD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1* The combined dosage boxes to contain the number of patients according to their mean daily use of drugs

Results

Peer review meetings

Sixty-eight of the 100 GPs designated to the asthma groups participated in the meetings. The mean age of the attending GPs was 46 years and the proportion of females was 21%. In this respect, they did not differ significantly from all 3 509 Norwegian GPs in 1995, who had a mean age of 44 years and 26% of whom were females (A Taraldset, The Norwegian Medical Association, personal communication). Among the participating GPs, however, 77% were board certified as compared with 45% among all Norwegian GPs.

Traffic-light categories of treatment quality

The traffic-light categories of treatment quality of each combined mean daily dosage interval of inhaled β-agonists and inhaled steroids, as judged by each of the 16 peer review groups, are presented in Figure 2. Thirteen of the 16 groups labelled 11 of the 16 dosage boxes consistently green or red. The doctors in the groups uniformly agreed that patients should not be treated with mean daily doses of inhaled β-agonists corresponding to a quarter of a DDD or more, without simultaneously being treated with inhaled steroids (lower left boxes of the matrix). The GPs accepted a higher mean daily dose of inhaled β-agonist when combined with a higher mean daily dose of inhaled steroids. In this way, they accommodated differences in disease severity among the patients. When the mean daily dose of inhaled steroids exceeded one DDD, and the use of short-acting β-agonists was low (upper right box in the matrix), few groups found the treatment acceptable. Some groups voiced the opinion that in such cases the dosage of inhaled steroids most probably should be decreased. Other patients on high mean daily doses of inhaled steroids and frequently using inhaled short-acting β-agonists (lower right box in the matrix) should,
according to the groups’ consensus, be referred to pulmonary medicine specialists.

Prescribing feedback

Anti-asthmatic medication (Table 1) was dispensed to 1729 patients of the 68 GPs attending the meetings. Of these patients, 1598 (92%), with a mean of 26 patients per GP (range 5–80), received inhaled steroids, inhaled short-acting β-agonists or a combination of these. They are presented within the dosage boxes in the matrix as shown in Figure 3. A total of 243 of the 1598 patients (15%) in addition also received oral steroids, oral β-agonists, theophyllines, inhalation of ipatropium, cromoglycate or long-acting β-agonists. One hundred and forty patients received only oral β-agonists, theophyllines, inhaled ipatropium and cromoglycate, or combinations thereof, but without inhaled steroids or short-acting β-agonists, and were thus not included in the matrix.

Of the 1598 patients, 476 received only a small amount of short-acting β-agonists (upper left box). Although primarily assigned a green colour, a high proportion of sampled patients treated within this box actually did not have asthma when validating their diagnosis (see below). This upper left box was thus assigned a black colour and these patients were not included when judging treatment quality.

Of the 1122 evaluated patients, 380 (34%) received inappropriate treatment (red boxes), 216 patients (19%) received only oral β-agonists, theophyllines, inhaled ipatropium and cromoglycate, or combinations thereof, but without inhaled steroids or short-acting β-agonists, and were thus not included in the matrix.
received dosages making it difficult to assess the treatment quality (yellow boxes), and 526 patients (47%) received appropriate treatment (green boxes).

Validation of diagnosis
The 68 GPs attending the meetings were asked to state the diagnoses given in the medical records among a random sample of their proxy-identified patients. Sixty-two GPs (91%) responded, giving the diagnosis of 313 (93%) patients out of the 338 thus selected. Of these 313 evaluations, the medical records confirmed that 148 (47%) of the patients had the diagnosis of asthma (ICPC code R969) while 117 (37%) patients had a symptom diagnosis of cough, dyspnoea, exercise-induced dyspnoea or were given the medicines as part of a diagnostic procedure. Four were diagnosed as having chronic obstructive pulmonary disease. The GPs could not find the corresponding medical records of 48 of 313 (15%) randomly sampled proxy-identified patients in the prescribing database. Only 25 of the 100 evaluated patients using no inhaled steroids and less than a quarter of a DDD short-acting β-agonist as a mean per day, upper left box in the matrix, were diagnosed as having asthma. The overall percentage of evaluated patients given this diagnosis in all the remaining boxes was 58% (range 48–100%) which is significantly higher (chi-squared P < 0.001) than among the patients in the upper left box.

Discussion
Our study describes how GPs using guideline recommendations as a yardstick developed criteria for good and bad prescribing to asthma patients. Structuring prescribing data according to these criteria gave the GPs feedback on the quality of treatments they gave their patients. The development of criteria necessitated a reformulation of guideline recommendations in guiding treatment in the context of patient encounters to judging individual treatment based on prescribing data. The GPs in our study were able to make this translation by categorizing the prescribing information into traffic-light coloured categories applying the national guideline recommendations. Presenting the number of patients within each category revealed that half of their patients received appropriate treatments, while one-third received inappropriate treatments. The judgement given on the quality of treatment in general was not biased by the GPs’ own prescribing pattern as these data were presented after the group decision. The pattern which emerged from the GPs’ actual prescribing may deviate somewhat from the GPs’ stated ‘intention to treat’, as not all prescriptions were handed in by the patients to the pharmacy. Feedback based on recording dispensed drugs rather than prescribed drugs, however, probably reflects more closely the actual treatment of the patients. A high proportion of the participating doctors were board-certified. It is thus fair to assume that the groups taking part in our study mirror those GPs keeping in touch with continuing medical education.

To make possible a comparison between different drugs, the mean daily doses were calculated in DDD units, which is considered to be the unit of choice in drug utilization studies. The frequency of inhalation of short-acting β-agonists is often used to reflect symptom intensity in asthma guidelines on patient management. The amount of drug delivered in a metered dose is different for the different products, however, and their effects are dose dependent related to both their immediate and long-term effects. The drugs also have different potencies, which are adjusted for when calculating the DDDs. Thus the average number of DDDs dispensed reflects in a better way the need for symptomatic treatment than what can be inferred from the mean number of daily inhalations of the same drug. The treatment of individual patients with inhaled short-acting β-agonists and inhaled steroids was characterized in our study by combining the relative use of these two drugs.

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Prescribing data—a tool for evaluating treatment quality

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**Conclusion**

Guidelines giving patient specific advice on treatment enabled peer review groups of doctors to derive criteria for good (green), bad (red) and difficult to judge (yellow) treatment categories. By sorting prescribing data into these traffic-light coded categories, doctors received feedback on good and bad prescribing to their own individual patients. This traffic-light coded prescribing feedback was developed as a tool to improve asthma treatment. This approach may be developed further so that it can be used to guide doctors’ performance in other treatment areas.

**Acknowledgements**

We thank the GPs for sharing their experience with us, and the pharmacies for their engagement in the study. The other core members of the European Drug Education Project: FM Haaijer-Ruskamp (international co-ordinator), P Denig and CCM Venninga (The Netherlands); V Diwan, G Tomson, R Wahlström, T Oke and C Stålsby Lundborg (Sweden); M Loeb (Norway); MM Kochen and E Hummers-Pradier (Germany); and M M uskova and Z Kopernicka (Slovak Republic) are appreciated for their input. The Norwegian Medical Association’s Fund for Quality Improvement, The Research Council of Norway and The Norwegian Community Pharmacy Foundation financially supported the project.

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