Interventions on the principle of Pulmonary Medication Profiles
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Chapter 6

Pharmaceutical care improves medication profiles of pulmonary patients

A randomized controlled trial

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submitted
Introduction

Pulmonary patients generally use their prescribed medication to decrease their symptoms. The major classes of medication are beta-agonists, anticholinergics, corticosteroids, cromones, methylxanthines and leukotriene antagonists. Patients treated according to the (inter)national guidelines (1-4) are expected to be well informed to control symptoms and to prevent inflammation by using their medication correctly. However, the European AIRE-study (5) found that the level of asthma control in 1999 fell far short of the goals for long-term asthma management despite patients considering their asthma as well controlled. In The Netherlands, patients with asthma or COPD (chronic obstructive pulmonary disease) also showed insufficient knowledge about the management of their disease and medication and wanted to be better informed (6).

In the Dutch health care system each patient first consults his family physician regardless of the type of medical problem. This general practitioner (GP) may refer the patient to a medical specialist or a hospital. In this way patients can consult several physicians but they usually have their off-clinic prescriptions filled at the same community pharmacy (their ‘family pharmacy’). All Dutch pharmacies use a computer system to register all prescriptions dispensed to an individual patient; this system provides an almost complete overview of patients’ prescribed medication of at least five years (7,8).

Besides being dispenser of medicines, a Dutch pharmacist is responsible for prospective drug use evaluation and the patients’ instruction on how to use medication (9). When a major problem concerning a prescription occurs, the pharmacist will contact the prescribing physician to solve the problem (10). Normally the patient is informed, if necessary afterwards.

Based on the ideas of Hepler and Strand (11) pharmaceutical care was introduced in The Netherlands in 1993 and pharmacists started to support and counsel patients with pulmonary diseases. When a new medication is prescribed, they generally give instruction on how to handle an inhaler and give information about medication to motivate correct drug use and adherence to therapy. The aim is to achieve optimal efficacy of the medication with as few as possible adverse effects: optimum pharmacotherapy.

There are a number of studies aiming at improving adherence to drug use by providing pharmaceutical care to pulmonary patients. They showed...
positive results concerning improved inhaler technique or knowledge about medication and pulmonary diseases (12-17). In the European TOM-studies (Therapeutic Outcome Monitoring) Herborg and others considered both physicians and patients as active participants in their pharmaceutical care projects. In controlled studies (on pharmacy level) they not only showed an improvement of isolated factors as knowledge, skills, and compliance to prescription guidelines or self-management, but also of the quality of drug therapy and the overall health status (18-21).

Selection of patients based on a drug utilization review appeared to be a good start for pharmaceutical care by giving priority to patients showing (or suffering from) severe drug-related problems (22,23).

Recently a randomized controlled trial (on pharmacy level) was published investigating the effectiveness of pharmaceutical care provided by community pharmacists in pulmonary patients in Indianapolis (USA) with disappointing results, presumably due to insufficient implementation of the pharmaceutical care (24). This publication received a number of comments about its methodology (25,26).

In 2001 we carried out a randomized controlled trial (on patient level) named the IPMP study (Interventions on the principle of Pulmonary Medication Profiles). The study emphasized comprehensive implementation and monitoring of tailored pharmaceutical care interventions provided to selected patients with drug use theoretically deviant from Dutch evidence-based pulmonary guidelines (2,4). The aim was to optimize the patients’ treatment and drug use in pulmonary diseases.

In this article we describe the results of this IPMP study and look at the efficacy of the intervention and its sustainability over time.

Methods

Participating pharmacists
During three national pharmacists’ meetings pharmacists in 24 Dutch community pharmacies replied to requests and volunteered to participate in the IPMP study. They were located all over The Netherlands. All participating pharmacists commonly gave inhaler instructions to their patients when they dispensed a new inhaler type and provided information about new medicines. All participating pharmacies had separate
consultation rooms. All pharmacists had regular meetings with GPs (academic detailing, called FTO) to discuss new medicines, drug-related problems and pharmacotherapy (27,28). Pharmacists were familiar with reviewing drug use profiles (DUPs) based on patients’ medication records and with discussing drug use with the patient or the prescribing physician (29).

In five meetings during the IPMP-study all pharmacists were informed about the study and comprehensively educated about pulmonary diseases. A manual with complete background information was distributed. This support resulted in well-implemented intervention and documentation procedures, which could be assessed by the researchers in the periodical reports of all participants.

Selection and classification of patients with theoretically deviant drug use
Anonymous patient medication records of the participating pharmacies concerning the year 2000 (period T0) were analysed by the researchers using the algorithmic IPMP computer instrument (30). This algorithm leads to ten selection profiles, which are based on combinations of Anatomical and Therapeutic Classification (ATC) codes of pulmonary drugs and number of defined daily doses (DDDs) dispensed to one individual patient in one year. The ten profiles as indicators for drug use theoretically deviant from the Dutch pulmonary guidelines are described in Table 1. Because each of the ten profiles identifies a specific deviation they can be named deviant-treatment profiles (DTPs). To stratify the size of deviation from the guidelines the profiles are grouped into two divisions. The first division is composed of six profiles indicating patients probably at risk of suboptimal drug therapy. The second division is composed of four profiles indicating patients whose drug treatment may be optimized.

For the IPMP study a maximum of 60 patients was selected per pharmacy. The selection concerned patients who were 13 to 60 years of age in 2000. By priority all patients characterized by profiles of the first division were selected. When the maximum of 60 patients was not reached, profiles of the second division were used.

Within each pharmacy researchers randomly allocated selected patients per division of DTPs to the intervention or reference group.
Table 1 Selection profiles according to the IPMP computer instrument (30)

<table>
<thead>
<tr>
<th>Selection Profile</th>
<th>Description of the selection profile: (expressed as the average use over a one-year period)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First division</strong></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Disproportionately high use of any drug by inhalation (&gt; 950 DDDS)</td>
</tr>
<tr>
<td>A</td>
<td>Daily use of &gt; 2 inhalations of short-acting beta-2 agonists without corticosteroids by inhalation</td>
</tr>
<tr>
<td>B</td>
<td>Daily use of &gt; 2 inhalations of short-acting beta-2 agonists with low dosage or no concurrent use of corticosteroids by inhalation</td>
</tr>
<tr>
<td>C</td>
<td>Daily use of &gt; 2 inhalations of short-acting beta-2 agonists with low dosage or no concurrent use of corticosteroids by inhalation; also using long-acting beta-2 agonists</td>
</tr>
<tr>
<td>E</td>
<td>Long-acting beta-2 agonists without corticosteroids by inhalation</td>
</tr>
<tr>
<td>F</td>
<td>Long-acting beta-2 agonists without concurrent use of corticosteroids by inhalation</td>
</tr>
<tr>
<td><strong>Second division</strong></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>Daily use of &gt; 2 inhalations of short-acting beta-2 agonists with daily use of corticosteroids by inhalation without long-acting beta-2 agonists</td>
</tr>
<tr>
<td>D2</td>
<td>Daily use of &gt; 2 inhalations of short-acting beta-2 agonists with daily use of corticosteroids by inhalation and long-acting beta-2 agonists</td>
</tr>
<tr>
<td>G</td>
<td>Oral adrenergics</td>
</tr>
<tr>
<td>H</td>
<td>Long-acting beta-2 agonists with concurrent use of corticosteroids by inhalation, but without fast-acting rescue medication</td>
</tr>
</tbody>
</table>

**Intervention group**
In February 2001 participating pharmacists received the codes of selected patients belonging to the intervention group of their pharmacy including their adjudged DTPs. On the basis of the developed IPMP protocol they reviewed the most recent drug use profile (DUP) of the patient to consider whether an invitation for a consultation could be profitable to this patient at that specific moment.
DUP review judgements were validated by the researchers as a part of the implementation programme to ensure strong agreement between all pharmacists.

Exclusion criteria were pharmacists’ anticipation of incomplete data because of patients’ decease or because patients meanwhile moved to another ‘family pharmacy’ or because of personal circumstances such as living in prison or a mental health institute.

To start the IPMP intervention pharmacists invited their patients by letter and then by telephone, for a consultation in the pharmacy from April 2001 onwards. In this letter informed consent was asked to the documentation of all anonymous details of the provided pharmaceutical care and of their drug use; and to be sent additional questionnaires.

**Interventions**

The consultation was guided by a protocol tailored to the drug use defined by the judged DTP. The protocol was targeted at identifying the reason for the drug therapy and existing additional drug-related problems. Observed drug-related problems generally led to a tailor-made intervention with a modular approach. Briefly, the contents of the consultation and the pharmaceutical care modules were patient counselling on the reason, the use and the effect of the current medication, patient education and instruction concerning devices, medication and disease, and improving patient’s adherence. If useful or necessary, new devices or medication changes were suggested to patients and physicians. After four weeks pharmacists evaluated changes in medication together with the patients. This tailored intervention is named the Type I intervention.

At the end of the intervention period patients’ opinions were investigated in a satisfaction and evaluation survey. The tailored IPMP intervention and the patients’ opinion survey are described in detail in Chapters 4 and 5.

The pharmacists could discuss the DUPs of patients, who did not respond to the invitation or of those who could not be reached by telephone, with their physician in order to improve the drug treatment (Type II interventions). The different interventions including no intervention are divided into six categories (shown in Figure 1).

The drug treatment of all patients and the refill rate of the prescriptions were monitored by reviewing the medication records regularly during a whole year. Irregularities in the predicted refill rate could be a reason to
contact the patient or the physician to start a new intervention. The whole sequence of activities is summarized in Figure 2. Pharmacists documented all activities in great detail. Every three months the participating pharmacists informed the researchers about the progress of their activities. Problems or limitations could be discussed at any time.

After one year pharmacists invited patients who had consented to a final consultation to evaluate patients’ drug use and disease status.

Reference group
In order to ensure that reference patients received care as usual, the pharmacists were not informed of their identity. For ethical reasons the participating pharmacists received the codes of these patients after the end of the study period (in May 2002).

Assessment of the changes in selection profiles
The main outcome measure was the change in deviant-treatment profile per patient.

To assess the changes in profiles the IPMP patients were classified again using the same algorithm concerning their medication records during the one-year period after the first consultation with the pharmacist (period T1). For intervention patients who did not accept the invitation of the pharmacist, the one-year period after the contact with the physician was used. For all other patients including the reference group the period from April 2001 till April 2002 was taken. Patients were excluded from the analyses when there were no complete medication records during the one-year study period.

The classified DTPs in period T1 could be the same as in the first period (T0) or could have been changed. But it was also possible that patients’ drug use did not lead to any DTP indicating that no deviation from the guidelines was identified any more.

The profiles in period T1 were compared with the profiles selected in period T0.
Figure 1  Participant flow, follow-up and analysis in the IPMP study

999 patients selected and randomized in 24 pharmacies

- 517 allocated to intervention group
- 38 excluded from intervention group
- 479 remained in intervention group

- Patients had moved to another pharmacy (27)
- Personal circumstances (11)

- 482 allocated to reference group

- 56 lost to follow-up because of incomplete medication records

- Different interventions, including no intervention
  - No invitation (11)
  - Not eager to come \(^1\) (3)
  - Unable to reach \(^1\) (12)
  - Direct physician contact (Type II intervention) \(^1\) (14)
  - Accepted consultation (without informed consent) \(^2\) (10)

- 59 lost to follow-up because of incomplete medication records
423 included in analysis (88%)

<table>
<thead>
<tr>
<th>Different interventions, including no intervention</th>
<th>423 included in analysis (88%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tailored intervention (Type I intervention) 2)</td>
<td>6</td>
</tr>
<tr>
<td>Different interventions, including no intervention</td>
<td></td>
</tr>
<tr>
<td>No invitation</td>
<td>54</td>
</tr>
<tr>
<td>Not eager to come 1)</td>
<td>39</td>
</tr>
<tr>
<td>Unable to reach 1)</td>
<td>42</td>
</tr>
<tr>
<td>Direct physician contact (Type II intervention) 1)</td>
<td>85</td>
</tr>
<tr>
<td>Tailored intervention (without informed consent) 2)</td>
<td>35</td>
</tr>
<tr>
<td>Enhanced consultation (Type I intervention) 2)</td>
<td>168</td>
</tr>
</tbody>
</table>

1) Patients were invited for a consultation but did not respond (N= 195)
2) Patients accepted the invitation and showed up (N=219)
Figure 2  Sequence of activities in the intervention group and the reference group of the IPMP study

Reference group: care as usual

Selection + adjudged selection profiles in period T0

Patients' medication records

Drug Use Profile

Invitation to consultation

Consultation + pharmaceutical care and/or physician contact

One-year period of follow-up

Intervention group:

Second classification in period T1

Reference group: care as usual
In the IPMP study the principle is assumed that pulmonary treatment according to evidence-based guidelines will lead to optimal clinical outcomes. Therefore improvement of drug therapy was considered an important and objective result of an effective intervention towards patients at risk of suboptimal drug use. A profile change algorithm was developed for the IPMP study based on the Dutch pulmonary guidelines (2,4). This algorithm valued changes in profiles as strong improvement, improvement, equality or deterioration according to criteria shown in Table 2 and was developed with pharmacists, a pulmonologist and a general practitioner.

**Statistical analysis**
Analyses were done on an intention-to-treat principle unless stated otherwise. Differences and associations were investigated using t-tests and chi-square statistics where appropriate. Significance was set at \( P < 0.05 \). Confidence intervals were calculated using the software package CIA (31). Other analyses were done using SPSS version 11.0 for Windows.

**Results**

**Patients’ descriptive, participant flow and follow-up**
In 24 pharmacies 999 patients showing a deviant treatment profile and thus at risk of suboptimal drug use were selected and randomly allocated to an intervention group (N=517) and a reference group (N=482). No significant difference was found between both groups at the start of the study (Table 3).

Of the 517 patients in the intervention group 27 were excluded because they had moved and 11 because of personal circumstances. After the exclusion of these patients the intervention group remained comparable with the reference group, except that intervention patients were on average 21 months older (\( P=0.03 \)). Of the remaining 479 patients in the intervention group 65 were not invited by the pharmacist because in the meantime their drug use had been changed according to the guidelines.

Hence, a total of 414 patients were invited for consultations. The invitation was accepted by 231 patients (56%). The other patients did not accept the invitation or could not be reached. Of the patients who accepted the invitation 219 actually showed up (53%). For 99 of the 195 patients in the intervention group who did not come to see their pharmacist, the pharmacist contacted the physician with prescribing suggestions (Type II intervention). Of the 219 patients who did have a consultation with their pharmacist, 174 gave their informed consent (Type I intervention).
A total of 423 out of 479 patients in the intervention group as well as 423 out of 482 patients in the reference group could be used for analyses (88% [Figure 1]).

Changes in deviant-treatment profile
Table 2 shows the changes of DTPs between the periods T0 and T1.

Table 2 Change in deviant-treatment profiles (DTPs) per patient in the intervention group classified in period T0 and period T1

<table>
<thead>
<tr>
<th>DTPs of the intervention group in period T0 1)</th>
<th>Classification in period T1 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td>X  75</td>
<td>38</td>
</tr>
<tr>
<td>A  75</td>
<td>3</td>
</tr>
<tr>
<td>B 113</td>
<td>3</td>
</tr>
<tr>
<td>C  23</td>
<td>3</td>
</tr>
<tr>
<td>E  19</td>
<td>1</td>
</tr>
<tr>
<td>F  31</td>
<td>1</td>
</tr>
<tr>
<td>D1 39</td>
<td>3</td>
</tr>
<tr>
<td>D2 14</td>
<td>1</td>
</tr>
<tr>
<td>G  2</td>
<td>-</td>
</tr>
<tr>
<td>H  32</td>
<td>-</td>
</tr>
<tr>
<td>Total 423</td>
<td>53</td>
</tr>
</tbody>
</table>
Table 2  Change in deviant-treatment profiles (DTPs) per patient in the reference group classified in period T0 and period T1

<table>
<thead>
<tr>
<th>DTPs of the reference group in period T0 1)</th>
<th>Classification in period T1 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X  59</td>
<td>A  29</td>
</tr>
<tr>
<td>A  74</td>
<td>B  38</td>
</tr>
<tr>
<td>B  120</td>
<td>C  55</td>
</tr>
<tr>
<td>C  40</td>
<td>D  13</td>
</tr>
<tr>
<td>E  13</td>
<td>F  6</td>
</tr>
<tr>
<td>F  26</td>
<td>G  3</td>
</tr>
<tr>
<td>D1 35</td>
<td>H  2</td>
</tr>
<tr>
<td>D2 24</td>
<td>G  1</td>
</tr>
<tr>
<td>G  4</td>
<td>H  2</td>
</tr>
<tr>
<td>H  28</td>
<td>Total 423</td>
</tr>
</tbody>
</table>

1) Number of DTPs according to the IPMP computer instrument (as described in Table 1) of 423 patients of the intervention group respectively 423 patients of the reference group in period T0
2) Number of classified profiles after the one-year intervention period in period T1
3) Classification 0 means no deviant-treatment profile was classified
4) Change in DTPs is expressed in shades, meaning:

<table>
<thead>
<tr>
<th>Strong improvement</th>
<th>Improvement</th>
<th>Equality</th>
<th>Deterioration</th>
</tr>
</thead>
</table>

110
Table 3  Baseline characteristics of patients in the IPMP study

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Intervention group (N=517)</th>
<th>Reference group (N=482)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%) of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intervention group</td>
<td>Reference group</td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, mean [SD], y</td>
<td>41.7 [12.1]</td>
<td>40.2 [12.8]</td>
<td>0.053</td>
</tr>
<tr>
<td>Men</td>
<td>241</td>
<td>237</td>
<td>0.419</td>
</tr>
<tr>
<td>Women</td>
<td>276 (53.4)</td>
<td>245 (50.8)</td>
<td></td>
</tr>
<tr>
<td>Concomitant medication use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes medication</td>
<td>17 (3.3)</td>
<td>16 (3.3)</td>
<td>0.978</td>
</tr>
<tr>
<td>Cardio-vascular medication</td>
<td>87 (16.8)</td>
<td>80 (16.6)</td>
<td>0.922</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>195 (39.6)</td>
<td>203 (42.1)</td>
<td>0.156</td>
</tr>
<tr>
<td>Systemic corticosteroids *)</td>
<td>102 (26.0)</td>
<td>106 (28.4)</td>
<td>0.373</td>
</tr>
<tr>
<td>Deviant-treatment profiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTPs grouped as first division in period T0</td>
<td>410</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Profile X</td>
<td>89</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Profile A</td>
<td>96</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Profile B</td>
<td>138</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>Profile C</td>
<td>27</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Profile E</td>
<td>21</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Profile F</td>
<td>39</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>DTPs grouped as second division in period T0</td>
<td>107</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>Profile D1</td>
<td>45</td>
<td>37</td>
<td>0.195</td>
</tr>
<tr>
<td>Profile D2</td>
<td>18</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Profile G</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Profile H</td>
<td>39</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

*) Counted for 18 out of 24 pharmacies because of incomplete data concerning systemic corticosteroids.
For instance, the drug use of patients of the intervention group classified in period T0 as DTP A (N=75) could have been changed because corticosteroids per inhalation were prescribed for the first time. The number of prescribed DDDs in the one-year period resulted in profiles B and C in 14 cases, which meant improvement, and in 4 cases in profiles D1 and D2 grouped in the second division, which meant strong improvement. In 29 cases drug use did not lead to any DTP and meant strong improvement per definition. In 24 cases the same profile A was selected and once profile E, both valued as equal. In three cases profile X was adjudged indicating that drug use had deteriorated.

With regard to the change in all profiles after the one-year period, there was a statistically significant difference between the results in the intervention and the reference group (Table 4).

Table 4  Results of IPMP study: Changes in deviant-treatment profiles after a one-year period, according to Table 2

<table>
<thead>
<tr>
<th>Value of change in profiles</th>
<th>Intervention group</th>
<th>Reference group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deterioration</td>
<td>34 (8.0%)</td>
<td>56 (13.2%)</td>
</tr>
<tr>
<td>Equality</td>
<td>177 (41.8%)</td>
<td>198 (46.8%)</td>
</tr>
<tr>
<td>Improvement</td>
<td>48 (11.3%)</td>
<td>40 (9.5%)</td>
</tr>
<tr>
<td>Strong improvement</td>
<td>164 (38.8%)</td>
<td>129 (30.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>423 (100%)</td>
<td>423 (100%)</td>
</tr>
</tbody>
</table>

P = 0.009 Chi-Square; P = 0.001 for Linear Trend

The overall relative risk (RR) of improvement was 25% higher for patients in the intervention group compared with the reference group (95% CI 1.08-1.46, Table 5). The improvement nearly doubled (RR=1.43, 95% CI 1.20-1.71) when comparing the enhanced (Type I) intervention group with the reference group.
Table 5  Relative Risk of improvement of patients belonging to the intervention group compared with those of the reference group

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of patients</th>
<th>Rate</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Included in analysis</td>
<td>Improved</td>
<td></td>
</tr>
<tr>
<td>Reference group</td>
<td>423</td>
<td>169</td>
<td>0.3995 1</td>
</tr>
<tr>
<td>Intervention group</td>
<td>423</td>
<td>212</td>
<td>0.5012 1.25 (1.08 – 1.46)</td>
</tr>
<tr>
<td>Type I intervention ¹</td>
<td>168</td>
<td>96</td>
<td>0.5714 1.43 (1.20 – 1.71)</td>
</tr>
<tr>
<td>Type II intervention ²</td>
<td>85</td>
<td>36</td>
<td>0.4235 1.06 (0.81 – 1.39)</td>
</tr>
</tbody>
</table>

¹) Enhanced patient intervention.
²) The patient did not visit the pharmacist but the pharmacist advised the patient’s physician.

The relative risk of improvement in case the patient did not visit the pharmacist but the pharmacist only advised the patient’s physician was 1.06 (95% CI 0.81-1.39).

The influence of the kind of DTP in period T0 was also investigated (Table 2). Patients with profile A in period T0 gained most from the intervention: 62.7% of the intervention group (47 out of 75) improved compared with 43.2% of the reference group.

Discussion

The IPMP study showed that pharmaceutical care provided by Dutch community pharmacists to pulmonary patients at risk of suboptimal drug use resulted in a significant improvement of patients’ drug therapy. The improvement was most pronounced in patients who received the tailored pharmaceutical care intervention. This suggests the added value of the collaborative action involving pharmacist, physician and patient. The randomized controlled trial framework of the IPMP study is the important objective proof of the efficacy of this pharmaceutical care project.
We anticipated that one or more DTPs would have a major influence on the improvement. Statistical tests could not support this suggestion. This means that the overall improvement has to be contributed to a change in all profiles.

Good implementation and documentation of the intervention strategy is necessary to obtain significant improvements. Weinberger et al. (24) were unable to demonstrate any advantages of pharmaceutical care in their study. They contributed their results to a probably incomplete implementation of the intervention program in the pharmacies. The pharmacies involved in the IPMP study reached a high level of implementation and documentation of the interventions (29). This might partly explain the results of our study.

Important parts of the IPMP study were pharmacists’ documented observations in the final consultation and the completed questionnaires of patients. Pharmacists ascertained that as a result of the intervention these patients were more educated about their medication. Patients reported fewer drug-related problems and symptoms. They attributed these results to the intervention by their pharmacist and were very satisfied with the asthma services of their pharmacy. These results were discussed in Chapter 5.

The IPMP results were in line with the results of a recent Canadian study (32). Enhanced pharmaceutical care led to reported fewer symptoms and a decrease of the use of beta-2 agonists compared to patients who received usual care.

Finally, pharmacists in the IPMP study were very satisfied with the consultations, the provided interventions and the achieved results and reported these all worthwhile (29).

Limitations
Dutch pharmacists have generally no access to the patient’s diagnosis. The treatment of patients with asthma or COPD differs especially concerning anti-inflammatory treatment.

In general, the probable reason for drug use could be fairly estimated by the pharmacists. It is standard practice that a pharmacist suggesting an addition of a corticosteroid to monotherapy of beta-2 agonists to the patient’s physician will be informed about the diagnosis at that very moment to make their decision collaboratively (29).
No additional clinical outcomes were measured such as PEFR or FEV1. Patients’ reported health gain (Chapter 5, published separately), such as fewer symptoms and fewer adverse effects as a result of better drug treatment calls for further investigation.

The invitation for personal counselling was accepted by 219 patients (53%). This percentage is in agreement with Herborg (57.5% [18]) and higher than Weinberger, who reported only 8% [24].

A technical limitation of our method of patient selections from pharmacy data is that patients, who no longer received pulmonary drugs in the one-year intervention period, were not selected. Therefore, they were excluded from the analyses. This may have resulted in an underestimation of the intervention effects. However, the rate of missing values of 12% was low compared with other studies (18,20,23,32).

In conclusion, the IPMP study has shown that this enhanced format of pharmaceutical care provision by community pharmacists contributed significantly to a drug treatment that was more in concordance with the pulmonary guidelines. The effect was sustainable during the follow-up period.

Since a treatment that is more in concordance with the standards most probably leads to a better health in the patient, it should be studied if comparable results can be attained with similarly constructed individualized pharmaceutical care interventions in other diseases as well.

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