Trends in cardiovascular drug prescribing in Dutch general practice
Greving, Jacoba Petronella

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2007

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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Chapter 4

Hyperlipidemia and hypertension management in type 2 diabetes patients between 1998-2004: longitudinal observational study

Jacoba P Greving, Petra Denig, Dick de Zeeuw, Henk JG Bilo, and Flora M Haaijer-Ruskamp
Submitted
Abstract

Objective
To assess trends in risk management and identify determinants for medication adjustments in type 2 diabetes patients with uncontrolled hypertension and/or hyperlipidemia.

Methods
We conducted a retrospective cohort study using data from the Zwolle Outpatient Diabetes project Integrated Available Care (ZODIAC)-study in The Netherlands. Management of hypertension and hyperlipidemia was assessed yearly from 1998-2004 by measuring the percentage of patients receiving a treatment initiation or intensification (dose increase or additional drug class added) among all patients with elevated risk factor levels.

Results
During the study period, the percentage of patients with elevated TC/HDL ratio (> 6) decreased considerably (from 29% to 4%) whereas the percentage of hypertensive patients decreased only slightly (≥ 150/85mmHg; from 58% to 51%). Initiation of lipid-lowering therapy, and both initiation and intensification of antihypertensive therapy was higher in more recent years. However, still two-third of patients with insufficiently controlled blood pressure in 2003 did not receive an initiation or intensification of antihypertensive treatment in the following year. Treatment changes were mainly triggered by elevated levels of the corresponding risk factor. We did not observe increased initiation rates for lipid-lowering therapy in patients with both hypertension and hyperlipidemia.

Conclusions
Hypertension and hyperlipidemia management in type 2 diabetes patients has improved in the past decade but further improvement is possible. Greater effort is especially needed to stimulate medication adjustments in patients with insufficiently controlled and combined risk factors.
Introduction

The increased incidence of cardiovascular disease (CVD) among patients with type 2 diabetes has led to increased recognition of hypertension and hyperlipidemia as important targets of therapy in addition to hyperglycemia. Clinical trials in patients with type 2 diabetes convincingly demonstrated that cholesterol reduction and tight blood pressure control reduce the risk of major cardiovascular events. Diabetes guidelines therefore advocate an intensified multifactorial treatment approach and often incorporate risk tables to guide adequate management in the primary prevention of CVD. The Dutch General Practitioners’ guidelines have recommended a combined assessment of blood pressure and lipid levels to target treatment to patients at high risk for CVD. As a result, lipid-lowering therapy is recommended in patients with high lipid ratio levels but also in patients with lower lipid ratio levels who have hypertension. There are doubts, however, that this high-risk approach has been sufficiently implemented in daily practice.

In addition, it has been shown that although increasing numbers of diabetes mellitus patients are tested for risk factors, much smaller percentages reach target goals. These findings might be explained by low rates of medication initiation and dose adjustment in patients with elevated risk factor levels. Up to now, however, drug regime changes in type 2 diabetes patients have only been studied over short time periods, not allowing for the assessment of trends. Insight into changes in drug regime initiation and intensification over time can help us guide future efforts to improve the quality of diabetes care.

In this article we present trends in initiation and intensification of lipid-lowering and antihypertensive drug therapy in type 2 diabetes patients during 1998-2004. We examine predictors of drug regime changes, and in particular whether patients with hypertension and hyperlipidemia are more likely to receive an initiation of lipid-lowering therapy.

Methods

Setting

This study was conducted as part of an ongoing longitudinal study, the Zwolle Outpatient Diabetes project Integrated Available Care (ZODIAC)-study in The Netherlands. The ZODIAC-study is a shared-care project for type 2 diabetes within the primary setting that started in 1998. Details about design have been published previously. In brief, general practitioners (GPs) are supported by hospital-based diabetes specialist nurses (DSNs) for the annual control of type 2 diabetes patients. The GPs kept the full responsibility for the care of the patients and remained responsible for the check-ups that should take place every three months. The number of participating GPs ranged from 32 in 1998 to 46 in 2004.
Study subjects

The study population represents a dynamic cohort of type 2 diabetes patients who had at least two visits in consecutive years for their annual control to a DSN between 1998 and 2004. Patients were included when they met the following criteria in the judgement of the GP: (1) they had known type 2 diabetes mellitus, according to the Dutch diabetes guidelines; (2) they were treated exclusively in primary care; (3) they had no terminal illness, and (4) they had no severe deficits in memory and understanding.

Measurements

The annual visit to the DSN included registration of the following data: (1) medication use (general and diabetes medication) and medical history as provided by the GP and checked with the patient; (2) height, weight, blood pressure measured at the visit; and (3) laboratory values that had been measured before the visit. The laboratory measurements were glycosylated haemoglobin (HbA1c), total cholesterol (TC), high-density lipoproteins (HDL) and low-density lipoproteins (LDL). All laboratory measurements were performed in a central laboratory. Medical history included year of diabetes onset and history of myocardial infarction and/or angina pectoris. Body mass index was calculated from weight and length (kg/m\(^2\)). The TC/HDL ratio was calculated from total cholesterol and HDL cholesterol.

Guideline recommendations

According to the Dutch General Practitioners’ guideline for diabetes effective during our study period, patients with hypertension (systolic blood pressure (SBP) ≥ 150 mmHg or diastolic blood pressure (DBP) ≥ 85 mmHg) should be treated with antihypertensive drugs. Lipid-lowering therapy should be targeted to patients at greatest risk for CVD: i.e. patients with pre-existing CVD, patients with a (suspected) hereditary lipid disorder or patients with a 10-year coronary heart disease (CHD) risk larger than 25%. To eliminate the need for GPs to calculate risk scores, the guidelines incorporate colour-coded risk tables that indicate the predicted CHD risk and guide management for primary prevention based on a person’s age, sex, smoking status, blood pressure, and TC/HDL ratio. From these tables, it can be derived that the presence of hypertension determines the need for lipid-lowering treatment in non-smoking patients with a TC/HDL ratio of 5-7, and in smoking patients with a TC/HDL ratio of 4-6. The guideline, however, also provides two simplified recommendations for the primary prevention: men aged 50-70 years and women aged 50-75 years should receive lipid-lowering therapy when their TC/HDL ratio is higher than 6 for non-smoking patients and when their TC/HDL ratio is higher than 5 for smoking patients.

Changes in drug therapy

Using the prescribing information from reports of annual controls by the DSNs, we determined for each patient in each year whether the patient had received an initiation or intensification of
drug therapy. Drug therapy was considered to have been intensified if the dose was increased or an additional drug class was added. A switch to another drug class without continuation of the original medication was not considered as an intensification of therapy, because patients could have been switched due to side effects.

**Statistical analyses**

Descriptive analyses characterize the population of type 2 diabetes patients over time, and show the frequencies of drug regime initiations and intensifications in patients with elevated risk factor levels. To identify determinants for initiation and intensification of lipid-lowering and antihypertensive drug therapy, generalized estimating equation analyses were performed using STATA 8. With generalized estimating equation analysis, the relation between longitudinally measured variables can be studied correcting for within person correlations caused by the repeated measurements for one subject. Models were constructed for the changes in antihypertensive treatment and changes in lipid lowering treatment, and for initiation and intensification separately. We assessed the influence of the following factors: age, gender, SBP, DBP, TC/HDL ratio and TC. Factors that contributed significantly ($P < 0.05$) to the model were maintained in the final model (forward stepwise regression). To test a possible combined effect of blood pressure and lipid levels, an interaction term of SBP with TC/HDL ratio was included in the models. We adjusted for HbA1c, diabetes duration, history of myocardial infarction and/or angina pectoris, and body mass index. Because initiation of lipid-lowering treatment was only recommended in men younger than 70 years and women younger than 75 years, we repeated analyses for lipid-lowering therapy on only these patients. Results are presented as odds ratios (OR) with corresponding confidence intervals (CI).

**Results**

**Characteristics of the study cohort**

The study population ranged from 946 to 1485 type 2 diabetes patients over the years 1998 to 2003. Mean age was 67 years and women represented the majority (57%) of the study population (Table 1). The median duration of diabetes was 5 years and remained reasonably stable over the years. Overall, 65% of the patients was treated with oral hypoglycaemic drugs only, and 15% received a combination of oral hypoglycaemic drugs and insulin or insulin alone. We observed an increase in the use of lipid-lowering drug treatments (from 12% to 34%) and antihypertensive drug treatments (from 48% to 69%) and substantial decreases in mean HbA1c, TC/HDL ratio, and systolic blood pressure values between 1998 and 2003 (Table 1).
### Table 1  Characteristics of type 2 diabetes patients

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Age (years)</th>
<th>Female sex (%)</th>
<th>Duration of diabetes (years)</th>
<th>History of MI/AP</th>
<th>Body mass index (kg/m²)</th>
<th>HbA1c (% units)</th>
<th>TC/HDL ratio</th>
<th>Systolic blood pressure (mmHg)</th>
<th>Diastolic blood pressure (mmHg)</th>
<th>Number of glucose-lowering drugs</th>
<th>Use of cardiovascular drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>946</td>
<td>68 ± 11</td>
<td>57%</td>
<td>5 (2-10)</td>
<td>25%</td>
<td>29.0 ± 4.7</td>
<td>7.5 ± 1.2</td>
<td>5.3 ± 1.6</td>
<td>155 ± 25</td>
<td>84 ± 11</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td>1999</td>
<td>1075</td>
<td>68 ± 11</td>
<td>58%</td>
<td>5 (2-10)</td>
<td>22%</td>
<td>29.0 ± 4.7</td>
<td>7.4 ± 1.2</td>
<td>4.8 ± 1.3</td>
<td>150 ± 23</td>
<td>82 ± 11</td>
<td>17%</td>
<td>43%</td>
</tr>
<tr>
<td>2000</td>
<td>1248</td>
<td>67 ± 11</td>
<td>57%</td>
<td>5 (2-10)</td>
<td>21%</td>
<td>29.4 ± 4.8</td>
<td>7.3 ± 1.3</td>
<td>4.5 ± 1.2</td>
<td>150 ± 23</td>
<td>81 ± 11</td>
<td>18%</td>
<td>22%</td>
</tr>
<tr>
<td>2001</td>
<td>1374</td>
<td>67 ± 11</td>
<td>57%</td>
<td>4 (2-9)</td>
<td>19%</td>
<td>29.5 ± 4.8</td>
<td>7.0 ± 1.2</td>
<td>4.4 ± 1.2</td>
<td>146 ± 20</td>
<td>80 ± 10</td>
<td>18%</td>
<td>41%</td>
</tr>
<tr>
<td>2002</td>
<td>1295</td>
<td>67 ± 11</td>
<td>57%</td>
<td>4 (2-9)</td>
<td>18%</td>
<td>29.5 ± 4.7</td>
<td>7.0 ± 1.2</td>
<td>4.1 ± 1.2</td>
<td>145 ± 21</td>
<td>80 ± 10</td>
<td>18%</td>
<td>26%</td>
</tr>
<tr>
<td>2003</td>
<td>1485</td>
<td>67 ± 11</td>
<td>55%</td>
<td>5 (2-9)</td>
<td>18%</td>
<td>29.5 ± 4.8</td>
<td>7.0 ± 1.2</td>
<td>3.9 ± 1.1</td>
<td>148 ± 21</td>
<td>84 ± 11</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Values are percentages, means ± standard deviations or median (interquartile range). MI, myocardial infarction; AP, angina pectoris; HbA1c, haemoglobin A1c; TC, total cholesterol; HDL, high-density lipoprotein; ACE inhibitors, angiotensin-converting enzyme inhibitors; ARBs, angiotensin II receptor blockers.

### Management of hyperlipidemia

From 1998 to 2003, the percentage of patients with elevated TC/HDL ratio (> 6) decreased considerably from 29% (273/939) to 4% (59/1471). Of these patients, 9% (25/273) were on lipid-lowering drug therapy in 1998 and 25% (15/59) in 2003 (Table 2). Among untreated patients with elevated TC/HDL values, significant improvements occurred in the percentage of patients who started on lipid-lowering therapy (12% in 1999 vs. 35% in 2004). Of those uncontrolled patients already on therapy, most had no intensification of their lipid-lowering drug therapy (12% in 1999 vs. 7% in 2004). In multivariable analyses, TC/HDL ratio, SBP, age, history of myocardial infarction and/or angina pectoris, and year of screening were predictors of subsequent initiation of lipid-lowering therapy, while gender was not found to be associated with treatment initiation (Table 3). There was no significant interaction between TC/HDL values and SBP levels, suggesting that the association between TC/HDL ratio and subsequent initiation of lipid-lowering therapy does not differ by SBP levels.
### Table 2 Changes in lipid-lowering and antihypertensive drug regimes from 1998 to 2004 in type 2 diabetes patients with elevated risk factor levels.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No intensification</td>
<td>Start / add drug</td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Use of lipid-lowering drugs in patients with TC/HDL &gt; 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>219 (88%)</td>
<td>29 (12%)</td>
</tr>
<tr>
<td>Yes</td>
<td>22 (88%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>All patients with TC/HDL &gt; 6</td>
<td>241 (88%)</td>
<td>30 (11%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No intensification</td>
<td>Start / add drug</td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Number of antihypertensive drugs in hypertensive patients‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>213 (80%)</td>
<td>52 (20%)</td>
</tr>
<tr>
<td>1</td>
<td>90 (74%)</td>
<td>22 (18%)</td>
</tr>
<tr>
<td>2</td>
<td>94 (88%)</td>
<td>8 (7%)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>40 (85%)</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>All hypertensive patients</td>
<td>437 (81%)</td>
<td>84 (16%)</td>
</tr>
</tbody>
</table>

* Numbers in each row may add up to less than the total number of patients in each year due to missing values. † 20 patients with antihypertensive drug therapy intensification in 2003/2004 received both an increase in dose as an addition of a new antihypertensive drug class and are counted in both categories. Therefore, the numbers in each column may add up to more than the total number of patients. ‡ Hypertension was defined as blood pressure > 150/85 mmHg.
Table 3 Multivariable analyses of risk factors associated with initiation and intensification of lipid-lowering and antihypertensive drug therapy in type 2 diabetes patients.

<table>
<thead>
<tr>
<th></th>
<th>Lipid-lowering drug therapy</th>
<th>Antihypertensive drug therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initiation</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Age (per 10 years)</td>
<td>0.7</td>
<td>(0.6-0.8)</td>
</tr>
<tr>
<td>Gender</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>1.1</td>
<td>(1.0-1.1)</td>
</tr>
<tr>
<td>(per 10 mmHg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>1.2</td>
<td>(1.1-1.4)</td>
</tr>
<tr>
<td>(per 10 mmHg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC/HDL ratio</td>
<td>1.8</td>
<td>(1.7-2.0)</td>
</tr>
<tr>
<td>History of MI/AP</td>
<td>1.9</td>
<td>(1.4-2.6)</td>
</tr>
<tr>
<td>Year (ref: 1998)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>3.2</td>
<td>(2.1-5.0)</td>
</tr>
<tr>
<td>2000</td>
<td>3.5</td>
<td>(2.3-5.4)</td>
</tr>
<tr>
<td>2001</td>
<td>3.2</td>
<td>(2.1-5.1)</td>
</tr>
<tr>
<td>2002</td>
<td>5.1</td>
<td>(3.3-8.0)</td>
</tr>
<tr>
<td>2003</td>
<td>6.1</td>
<td>(4.0-9.6)</td>
</tr>
</tbody>
</table>

Models were constructed for the two drug treatments and for initiation and intensification separately. OR, odds ratio; HbA1c, haemoglobin A1c; TC, total cholesterol; HDL, high-density lipoprotein; MI, myocardial infarction; AP, angina pectoris. * additionally adjusted for body mass index.
Hyperlipidemia and hypertension management in type 2 diabetes patients

Figure 1 Percentage* of patients initiated on lipid-lowering therapy stratified by TC/HDL values and SBP levels.

black bars = lipid-lowering therapy recommended for most patients aged 50-70; grey bars = lipid-lowering therapy recommended for most smoking patients and males aged 60-70 years; white bars = lipid-lowering therapy seldom recommended. * percentage of all patients in each subgroup. SBP, systolic blood pressure; TC, total cholesterol; HDL, high-density lipoprotein.

Accordingly, we observed no difference in the proportion of patients initiated on lipid-lowering therapy who had elevated SBP levels compared to normal SBP levels (Figure 1). Only 9% of patients with SBP levels above 160 mmHg and TC/HDL values between 5 and 6 were receiving a treatment initiation, which was not higher than for patients with similar TC/HDL values and SBP levels below 150 mmHg.

Intensification of lipid-lowering therapy was associated with TC/HDL ratio, but not with SBP or other risk factors (Table 3). In a subgroup analyses of younger patients (men aged 70 years or younger and women aged 75 years or younger), we found similar point estimates, but age and SBP were not statistically significant determinants anymore. Using total cholesterol as risk factor instead of TC/HDL ratio yielded similar results (data not shown).

Management of hypertension

From 1998 to 2003, the percentage of hypertensive patients (SBP ≥ 150mmHg or DBP ≥ 85 mmHg) decreased from 58% (544/930) in 1998 to 51% (754/1479) in 2003. Of the hypertensive
patients, 51% (279/544) were on antihypertensive drug therapy in 1998 and 72% (543/754) in 2003. Among untreated patients not reaching blood pressure targets, few were started on antihypertensive therapy (20% in 1999 vs. 29% in 2004). Among treated patients not reaching these targets, 19% (52/276) received an intensification of their antihypertensive drug regime in 1999 vs. 35% (186/539) in 2004. As expected, treatment intensifications were less likely to occur in patients taking already two or more antihypertensive drug classes.

In multivariable analyses, subsequent initiation of antihypertensive therapy was positively related to SBP, DBP, TC/HDL ratio, age, history of myocardial infarction and/or angina pectoris, and year of screening, and negatively related to HbA1c. Intensification of antihypertensive drug therapy was positively related to SBP, DBP, age, and year of screening, but not with TC/HDL ratio or other risk factors (Table 3).

**Discussion**

In this large observational study, we observed an overall increased use of antihypertensive and lipid-lowering drugs, and better control of risk factors between 1998 and 2004. The proportion of type 2 diabetes patients who were initiated on lipid-lowering therapy increased substantially, whereas intensification of lipid-lowering therapy hardly changed over time. The proportion of patients initiated on antihypertensive therapy slightly increased, as did the percentage of intensifications in patients already on antihypertensive therapy. Treatment changes were mainly triggered by elevated levels of the corresponding risk factor. We did not observe increased initiation rates for lipid-lowering therapy in patients with hypertension and hyperlipidemia.

Despite these generally favourable improvements in the management of hyperlipidemia and hypertension, still only one-third of patients with insufficiently controlled blood pressure or lipid ratio levels in 2003 received an initiation or intensification of antihypertensive or lipid-lowering treatment in 2004. Other studies have reported similar low rates of treatment initiations, but higher rates of intensifications particularly for lipid-lowering therapy.\(^\text{14,21,22}\) In a study in an US academic medical centre in 1997 to 1999, 30% with elevated LDL cholesterol levels received a treatment intensification, and 30% of patients with elevated SBP levels.\(^\text{22}\) In a Veterans Affairs study in 1998 to 1999, 39% of patients with diabetes and elevated LDL cholesterol levels received either a treatment initiation or intensification.\(^\text{21}\) More recently, a study within a US medical care program in 2002 to 2003 showed even higher rates of therapy initiation or intensification: 64% of patients with insufficiently controlled SBP levels and 47% for insufficiently controlled LDL cholesterol levels.\(^\text{18}\) However, their study population included all patients with hypertension, hyperlipidemia, diabetes mellitus or a combination of these conditions. It is known that patients with diabetes receive less intensive antihypertensive and lipid-lowering medication therapy than patients without diabetes.\(^\text{17}\) It should be noted that in
in our study, the number of patients with insufficiently controlled lipid levels was quite low in the latter years, leaving not much room for further improvement in this group of patients. Furthermore, we observed that the percentage of lipid-lowering treatment initiations was not higher in patients with elevated blood pressure levels. Results of multivariable analyses also showed that TC/HDL ratio was the strongest predictor of the initiation of lipid-lowering therapy and SBP levels only had a weak effect. More importantly, there was no significant interaction between TC/HDL values and SBP levels, which suggests that the recommended combined assessment of blood pressure and lipid levels has not yet been adopted in clinical practice. Our finding that physicians primarily manage single risk factors is consistent with results from recent studies.\textsuperscript{14,23-25}

Several causes have been proposed why physicians may not initiate or intensify therapy appropriately. It has been ascribed to overestimation of care provided, lack of education, training and organizational support necessary in order to achieve therapeutic goals, and lack of adherence with guidelines for risk factor control.\textsuperscript{26} Physicians may have been reluctant to prescribe complex medical regimes because of concerns related to side effects, drug interactions, or increased non-adherence. In some cases, physicians may have been reluctant to prescribe additional medicines to those who do not regularly adhere to their current drug regime. Barriers related to the content and format of the cardiovascular risk tables and its recommendations have also been reported, and risk calculator use in still not common.\textsuperscript{11,12} The high-risk approach to primary prevention was not always clear to physicians, risk tables were difficult to understand, and physicians were confused by the lack of agreement with other (inter)national risk tables.\textsuperscript{11} For many years, different Dutch practice guidelines existed for hyperlipidemia, hypertension and type 2 diabetes, and as a result various guideline recommendations for the prevention of CVD were given.\textsuperscript{6,10,20,27-30} For example, the Dutch type 2 diabetes guideline incorporated risk tables but focused on two simplified recommendations with thresholds for TC/HDL ratio to guide decisions for lipid-lowering drugs, while the cholesterol guideline advised to use the risk tables.\textsuperscript{6,10} Recently, the Dutch practice guidelines have been brought in agreement with each other: the hypertension and cholesterol guidelines have been combined into a new cardiovascular risk management guideline.\textsuperscript{31} In addition, the updated type 2 diabetes guideline now closely follows this cardiovascular risk management guideline.\textsuperscript{7} Such integrated guidelines may reduce the lack of consistency and may provide better support for health care practitioners.

A limitation of this study is that we evaluated the management of hyperlipidemia and hypertension within a shared-care project. Hospital-based diabetes specialist nurses, who performed the annual control of type 2 diabetes patients, may have facilitated physicians to provide better care.\textsuperscript{19} Our findings may therefore reflect a best-case scenario. Another limitation is that the data were collected on an annual basis. As a result we could not assess whether physicians responded immediately to a visit of an elevated risk factor level. Since
many patients with insufficiently controlled blood pressure or lipid ratio levels did not receive a treatment initiation or intensification in the following year, our results suggests that physicians missed several opportunities to increase medication regimes or dosage. We also did not directly link therapy modifications to clinical outcomes, but several other studies have shown that initiation and intensification of therapy was associated to better levels of control.⁵²-⁵³ An important strength of this study is that data was collected over a long time period enabling to assess trends in treatment initiation and intensification over a 6-year period. Furthermore, sufficiently detailed medication data was collected to distinguish untreated patients from patients already on therapy.

In conclusion, this study has demonstrated that although management of hypertension and hyperlipidemia has improved in the past decade, further improvement is possible. Greater effort is especially needed to stimulate medication adjustments in patients with insufficiently controlled and combined risk factors.
References


