

# Influence of Elevated Cardiometabolic Risk Factor Levels on Treatment Changes in Type 2 Diabetes

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Undertreatment of risk factors in patients with type 2 diabetes is common. We assessed the influence of elevated levels of blood pressure, total cholesterol, and A1C on decisions of Dutch general practitioners to change drug treatment in a cohort of 3,029 patients during a 1-year period. Respectively, 58, 71, and 21% of patients remained untreated despite poor blood pressure, lipid levels, and glycemic control. Of poorly controlled but already drug-treated patients, 52% did not receive intensification for antihypertensive medication, 81% not for lipid-lowering medication, and 43% not for glucose-lowering medication. We observed a significantly lower treatment intervention rate in moderately than in poorly controlled patients for blood pressure. This was not seen for decisions on cholesterol or A1C results. The low overall action rates observed for blood pressure and especially lipid management cannot sufficiently be explained by the use of treatment thresholds higher than those indicated by guidelines.

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Considerable progress has been achieved regarding the quality of diabetes care, but undertreatment remains a topic of concern (1–3). Low rates of starting and intensifying treatment in patients with type 2 diabetes have been observed (4–7). Although accepting higher risk-factor levels than indicated by guidelines has been reported as a reason for not changing treatment, few studies have examined differences in treatment intervention rates for moderately and poorly controlled patients (8–11). Results from two provider survey studies suggest that physicians treat near-goal A1C levels more aggressively than near-goal blood pressure levels (10,12). Our aim was to assess the influence of moderately and highly elevated levels of cardiometabolic risk factors on the decision to change antihypertensive, lipid-lowering, and glucose-lowering treatment in primary care.

## RESEARCH DESIGN AND METHODS

We conducted a cohort study including 3,029 type 2 diabetic patients managed by 62 general practitioners. Clinical measurements and prescriptions were gathered from electronic patient records at the general practitioners' offices and a regional diabetes facility (13). Of the general practitioners, 20% practiced in a rural area and 18% in a private practice, and 16% were allowed to dispense drugs at their practice.

We assessed treatment status and risk-factor level at baseline (1 October 2003), using the most recent measurements in the preceding year. Thresholds for moderately and highly elevated levels, respectively, were set, following national guidelines, at  $\geq 140$  and  $\geq 160$  mmHg for systolic blood pressure,  $\geq 85$  and  $\geq 95$  mmHg for diastolic blood pressure,  $\geq 5$  and  $\geq 7$  mmol/l for total cholesterol, and  $\geq 7$  and  $\geq 8.5\%$  for A1C. Treatment

changes were determined during a follow-up period of 1 year. Patients receiving maximal medication at baseline, as defined by national guidelines for general practitioners and the Dutch Pharmacotherapy Compendium, were excluded (14).

Treatment change was defined as the start or intensification of drug treatment for antihypertensive, lipid-lowering, and glucose-lowering treatment. Patients were considered to start treatment when they received a first prescription during the study period after receiving no prescriptions for this therapeutic group during the previous 6 months. A treatment change was considered intensification when a new drug class was added or the medication dosage was increased. A switch to another drug class without continuation of the original medication was not considered treatment intensification. A prescription was considered discontinued when it was not repeated within 120 days from the calculated end date.

Results are presented as proportions of patients with treatment changes with 95% CIs, and differences were tested by means of  $z$  approximation to the binomial distribution.

**RESULTS**— The patients were aged  $66.4 \pm 12.3$  years, and 56% were female. At baseline, 14% had a recorded history of coronary disease and 13% suffered from other macro- or microvascular complications. The number of concurrently prescribed chronic drugs was  $4.7 \pm 3.1$ . Annual testing rates were 81.8% for blood pressure, 74.8% for total cholesterol, and 76.9% for A1C. The average risk factor levels were  $147 \pm 20$  mmHg for systolic blood pressure,  $81 \pm 10$  mmHg for diastolic blood pressure,  $5.1 \pm 1.0$  mmol/l for total cholesterol, and  $7.3 \pm 1.3\%$  for A1C.

## Treatment status

Of the 3,029 patients, 63, 31, and 80%, respectively, were using antihypertensive, lipid-lowering, and glucose-lowering medication at baseline, and 22, 16, and 36%, respectively, of untreated patients started treatment during the study period.

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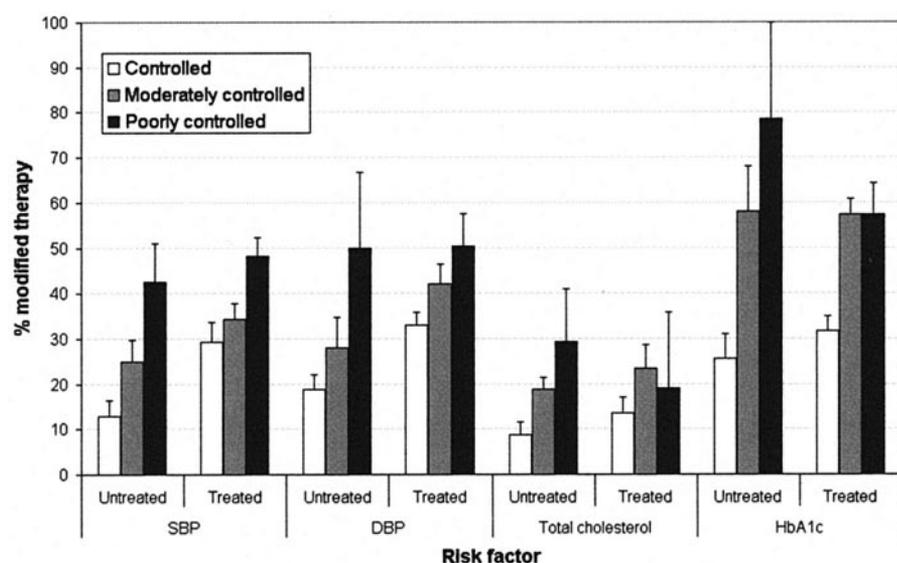
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\*A complete list of the members of the GIANTT Group can be found in the APPENDIX.

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**Figure 1**—Percentages of treatment changes (95% CIs) during a 12-month period in patients with controlled, moderately controlled, and poorly controlled risk factor levels at baseline. Thresholds for moderate and poor control, respectively, were set at  $\geq 140$  and  $\geq 160$  mmHg for systolic blood pressure (SBP),  $\geq 85$  and  $\geq 95$  mmHg for diastolic blood pressure (DBP),  $\geq 5$  and  $\geq 7$  mmol/l for total cholesterol, and  $\geq 7$  and  $\geq 8.5\%$  for A1C.

Of patients treated at baseline, 25, 1, and 17%, respectively, were already on maximal treatment. Of patients not on maximal treatment, 32% received intensification for antihypertensive, 17% for lipid-lowering, and 45% for glucose-lowering medication.

Figure 1 shows the percentage of patients starting and intensifying treatment according to control status. Medication change was significantly more likely in patients with elevated A1C levels than with elevated blood pressure or cholesterol levels. Of the patients with poorly controlled systolic or diastolic blood pressure, 58 and 50%, respectively, remained untreated. This was the case for 71% with poorly controlled total cholesterol levels (68% in patients  $< 75$  years of age) and for 21% with poorly controlled A1C levels. For patients already treated, 52% of the poorly controlled for systolic blood pressure did not receive intensification for antihypertensive medication, whereas this was observed in 81% for lipid-lowering medication and 43% for glucose-lowering medication.

We observed a significant difference in treatment intervention rate between moderately and poorly controlled patients for blood pressure only. Furthermore, in patients with moderately controlled blood pressure, intervention was less likely in untreated than treated patients.

**CONCLUSIONS**— This study shows that general practitioners were more likely to change glucose-lowering treatment than antihypertensive or lipid-lowering medication, especially in moderately controlled patients. Regarding blood pressure management, we confirmed previous findings that treatment changes are less likely in moderately controlled than in poorly controlled patients and that there is more reluctance to start than to intensify treatment (10). For lipid management, action remained low even at high cholesterol levels. A reluctance to prescribe lipid-lowering medication has been observed before in patients with diabetes (15) and might be explained by concerns about medicalization and cost-effectiveness of such treatment (16).

The strength of our study is that it is based on actual practice patterns and therefore not biased by recall or Hawthorne effects that may be present in provider survey studies. The results may be limited by the completeness of medical record data. Prescribing data and test results are generally well recorded in primary care (17). All general practitioners in our study use electronic patient records and prescribe electronically. Furthermore, the general practitioners in our study may not be representative of those in other settings or countries. Guideline recommendations on treatment thresholds are changing over time and differ

slightly between countries, and there can be differences in the health care system that influence the treatment intervention rates. However, similar low rates have been observed in other recent studies (6,7,18,19).

This study shows that the use of higher thresholds than those recommended for starting and intensifying treatment cannot sufficiently explain the low rates of treatment intervention observed for blood pressure and especially lipid management. Other factors, such as compliance concerns or postponing treatment changes because of achieved progress or expected transient events might be more important in these cases (10–12).

**APPENDIX**— The members of the Groningen Initiative to Analyze Type 2 Diabetes Treatment (GIANTT) Group are D. de Zeeuw, F.M. Haaijer-Ruskamp, P. Denig, R.O.B. Gans, B.H.R. Wolffenbuttel, F.W. Beltman, K. Hoogenberg, P. Bijster, J. Bolt, L.T.W. de Jong-van den Berg, J.G.W. Kosterink, J.L. Hillege, R.P. Stolk, and H.J.G. Bilo.

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