Primary prevention of coronary heart disease in general practice: a cross sectional population study

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SUMMARY

The aim of this study was to assess the interventions by general practitioners on cardiovascular risk factors among persons without a history of cardiovascular disease attending for a cardiovascular check-up. All inhabitants of three Belgian towns aged between 45 and 64 years were invited for a cardiovascular check-up and blood test. Of all the attending persons without a history of cardiovascular disease ($n = 898$), 51% received at least one prescription, diet or health advice: 28% for hyperlipidaemia, 23% for physical activity, 22% for caloric intake, 9% for blood sugar, 5% for blood pressure and 4% for smoking. Interventions on lipoproteins, blood sugar and smoking habits were significantly more often proposed to persons with a medium or high cardiovascular risk compared to those at low cardiovascular risk. For persons at low cardiovascular risk, therapeutic lifestyle changes are often not advised, and isolated risk factors often remain untreated.

Keywords: Coronary heart disease; primary cardiovascular prevention; cardiovascular risk factors; screening; primary health care

INTRODUCTION

Although there is compelling evidence about modifiable risk factors, such as hypertension, diabetes, hypercholesterolaemia, smoking and obesity, a lot of persons with these risk factors are undiagnosed, insufficiently treated or not treated at all. A Scottish study revealed that only 50% of the hypertensive men were diagnosed. Only 50% of the diagnosed hypertensive men were treated out of which only 50% reached the treatment target levels (1).

In the United States, the National Health and Nutrition Examination Surveys (NHANES) showed similar figures (2). However, over the years, the awareness, treatment and control of cardiovascular risk factors have improved. Awareness of hypertension at the 140/90 mmHg threshold increased from 51 to 73% of the population with hypertension between NHANES II (1976–1980) and NHANES III (1988–1991). Trends in the rate of anti-hypertensive treatment have mirrored trends in awareness. Between NHANES I (1971–1974) and NHANES III, the control rates increased fourfold for hypertension at the 160/95 mmHg threshold. It increased nearly threefold at the 140/90 mmHg cut-off point in the 12 years between NHANES II and III, remaining, however, at 29%. Similar figures could be expected for the other modifiable risk factors. For example, the Belgian Ocapi survey demonstrated that 42% of the type 2 diabetics had glycosylated haemoglobin (HbA1c) of 7.0% or more (3).

Despite the fact that diabetes, blood pressure and lipid-lowering therapies have shown to be efficacious, a gap exists between what is achieved in clinical practice and the evidence-based therapeutic goals that should be obtained (4). Practice...
guidelines were proposed to help decrease those gaps (5), but their effects are disappointing (6).

The aim of this study was to assess the intervention by general practitioners (GPs) on cardiovascular risk factors in a sample of the population aged between 45 and 64 years who were attending for a cardiovascular check-up.

**MATERIALS AND METHODS**

**Study Population and Design**

Data were collected in spring 2002 in three small Belgian towns (Overijse, Hoeilaart and Merchtem). All inhabitants aged between 45 and 64 years were invited by the local authorities to visit their GPs for a cardiovascular check-up and blood test. An information campaign in the local press had been set up to augment the recruitment. All local GPs (n = 50) agreed to participate in the screening and received the study protocol.

Two questionnaires had to be completed. The first was completed by the participant and included weekly physical activity, smoking behaviour, alcohol intake, medical history, the followed diets and pharmaceutical treatment. Physical activity was defined as any physical exercise including sports, walking and gardening. The questionnaire was checked by the GP, and the unanswered questions were answered in consultation with the participant during the health check-up.

During the first visit, the second questionnaire was completed by the GP and included blood pressure, weight, length and waist circumference, cardiovascular history and risk factors and current treatment. A venous blood sample was collected after the participant had fasted for 12 h. Blood sugar, total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), uric acid and creatine kinase were determined. For known diabetic persons, HbA1c was measured.

The second visit was planned after an interval of 2 weeks. During that visit, the blood pressure was measured again, the results of the blood analysis were discussed and the interventions proposed by the GPs were recorded. For blood pressure analysis, we used the mean values from the first and the second visit. Blood pressure measurements were taken with a sphygmomanometer on the left upper arm of sitting patients after they had rested for at least 5 min.

Because few patients with coronary heart disease (CHD), peripheral arterial disease or stroke participated in the registration (n = 37), we limited the analyses for the present study to those at primary prevention.

Twenty-four months after the initial recording, an evaluation is planned to measure the outcome of the intervention in terms of smoking habits, body weight, blood pressure and levels of fasting blood sugar and lipoproteins.

**Laboratory Testing**

Serum TC, TG and HDL-C were measured enzymatically. Low-density lipoprotein cholesterol (LDL-C) levels were calculated with the Friedewald formula, except when the TG levels were above 3.4 mmol/l (7). In that case, LDL-C levels were measured enzymatically. All measurements were done by local laboratories. The quality of their measurements is guaranteed by the fact that they are, according to the Belgian rules for clinical biology, regularly subjected to internal as well as external quality control.

No central laboratory was used because the absolute value of the lipids and the other tests was of minor importance. One of the aims of this study was to evaluate how GPs deal in real life conditions with the results they receive from their usual laboratories. Therefore, we believe it was not relevant to perform all tests in one central laboratory or to standardise the results.

**Screening and Target Goals**

According to the recommendations of the European Second Joint Task Force, the screening and target goals for hypertension were defined as systolic blood pressure (SBP) at 140 mmHg and/or diastolic blood pressure (DBP) at 90 mmHg (8). We used the term moderately increased blood pressure for SBP between 140 and 159 mmHg and/or DBP between 90 and 99 mmHg and high blood pressure for SBP of 160 mmHg or more and/or DBP of 100 mmHg or more. This is in accordance with the World Health Organization–International Society of Hypertension (WHO-ISH) definition and classification of blood pressure levels (9).

We defined high TC as 6.5 mmol/l or more and high TG as 2.3 mmol/l or more because these levels are used as reimbursement criteria for lipid-lowering drugs in Belgium. We are aware that these levels are not the optimal treatment levels. Moderately high TC was defined as TC between 4.9 and 6.4 mmol/l. High LDL-C was defined as LDL-C of 4.1 mmol/l or more, and moderately high LDL-C was defined as LDL-C between 3.0 and 4.1 mmol/l. These definitions correspond with the recommendations of the European Second Joint Task Force (8).

Type 2 diabetes is defined as fasting plasma glucose of 7.0 mmol/l or more on more than one occasion (10). Because we had only one measurement of the fasting plasma glucose, we were only able to have a suspicion of diabetes, but we could not confirm the diagnosis in this study. Impaired fasting glucose (IFG) was defined as fasting plasma glucose between 6.1 and 7.0 mmol/l. According to the recommendations of the European Second Joint Task Force, the goals for adequate glucose control in type 1 (insulin dependent) diabetes are: fasting blood glucose between 5.1 and 6.7 mmol/l with HbA1c between 6.2 and 7.5% and avoidance of serious hypoglycaemias (8). For persons with type 2 (non-insulin...
dependent) diabetes, even lower goals can be safely achieved. HbA1c below 8.0% is generally recommended in all treated persons (11). We defined adequate glucose control as HbA1c below 7.0% and moderate glucose control as HbA1c between 7.0 and 7.9%.

Persons were categorised as overweight when the body mass index (BMI) was between 25.0 and 29.9 kg/m² and obese persons had a BMI of 30.0 kg/m² or more.

Risk assessment for determining 10-year risk for CHD was carried out according to the updated Framingham risk scoring (12). The CHD risk was high for participants with a calculated 10-year risk over 20% and for participants having diabetes. The risk was medium for a calculated 10-year risk between 10 and 20%. Low-risk participants had a calculated 10-year risk below 10%.

**Interventions**

The participating GPs received a short briefing on risk stratification, motivational interventions, therapeutic lifestyle changes, optimal pharmaceutical treatment and recommended treatment targets.

The interventions advised to the patients included new pharmaceutical treatments, orally given lifestyle advice, printed handouts, referral to a dietician and other non-specified interventions such as referrals to specialists or advice about drug compliance. The GPs had the possibility to use printed handouts especially designed for this study with brief advice about smoking cessation, physical activity, healthy food, caloric intake, cholesterol, salt and hypertension, gout and blood sugar.

Although the GPs were briefed about optimal treatment, they were not compelled to initiate a treatment or a lifestyle change when recommended targets were not achieved. The interventions were rather based on an intention to treat.

**Ethical Approval**

The ethics review board of the Flemish Institute for General Practice (Vlaams Huisartsen Instituut; VHI) approved the study protocol.

**Statistical Analysis**

SPSS-PC 10® (SPSS Inc., Chicago, IL, USA) was used for analysis and statistical processing. The χ² test was performed to detect differences between groups.

Interventions by GPs are known to show high intrapractice correlations. Patients attending a particular practice are much more similar than patients from different practices when it comes to information, drug treatment and lifestyle advice. To account for clustering of patients within some practices, multi-level logistic regression analysis was used on the patient-level data. These were performed using MLwiN (1.10.0007) software packages (13). To assess the potential of confounding by differences in patient populations among practices, all rates were adjusted for the effects of particular practice as well as for patient age and sex. Because these adjusted rates were nearly identical to the unadjusted rates, only the latter are presented in this paper.

The three CHD risk groups characterised on the basis of the Framingham risk scoring are likely to differ substantially in their age and gender distribution. Therefore, any comparison between these groups is likely to be confounded by age and sex. For that reason, the figures for the CHD risk groups are standardised for age and sex according to the Belgian population aged between 45 and 64 years in 2001.

**RESULTS**

**Participant Characteristics**

In total, 898 persons in primary prevention attending for a cardiovascular check-up were included. Patient characteristics are summarised for both genders separately in Table 1. Significantly more men than women were obese (p < 0.001). Eighteen per cent of the participants had a history of hypertension, 16% had hyperlipidaemia and 3.7% had diabetes. Eleven per cent of the participants had a family history of premature CHD.

**Cardiovascular Parameters**

A blood test was performed for 831 participants. The 67 persons without blood analysis did not differ from the 831 with blood analysis with respect to their age, gender, BMI,
smoking behaviour and other cardiovascular risk factors. Among the persons treated for hyperlipidaemia (n = 133), 34% had LDL-C below 3.0 mmol/l, 86% had LDL-C below 4.1 mmol/l and 85% had TG below 2.3 mmol/l. Of those without treatment for hyperlipidaemia (n = 698), 20% had TC of 6.5 mmol/l or more, 80% had TC of 4.9 mmol/l or more and 8% had TG of 2.3 mmol/l or more.

Among the persons treated for hypertension (n = 150), 63% had blood pressure below the 140/90 target. Among those without treatment for hypertension (n = 681), 25% had blood pressure below the 140/90 target.

Only 14% of the known diabetics (n = 31) had HbA1c below 7.0%, and 48% had HbA1c below 8.0%. Among the persons without treatment for diabetes (n = 800), 8% had fasting blood sugar between 6.1 and 6.9 mmol/l and 2.4% had 7.0 mmol/l or more.

The LDL-C target (3.0 mmol/l) was reached by 25% of the persons at high or medium cardiovascular risk (n = 402). Seven per cent of the persons at high or medium cardiovascular risk had fasting blood sugar of 7.0 mmol/l or more, and 14% had levels between 6.1 and 6.9 mmol/l. In total, 74% of the persons at high or medium cardiovascular risk had blood pressure below the 140/90 target (Table 2).

### Interventions in General

Already before the screening, some participants had had interventions on lipoproteins, blood pressure, blood sugar and body weight. The results are summarised separately for both genders in Table 3. The interventions resulting from the present study are summarised separately for both genders in Tables 4 and 5.

For 51% of the participants, an intervention was advised: 18% received only one intervention, 16% received two interventions, 8% received three interventions and 9% received four interventions or more.

### Table 2 Proportions attaining the treatment target levels for persons at low cardiovascular risk (CVR) and for persons at high or medium cardiovascular risk

|                  | Men | Women |
|------------------|-----|-------|
|                  | Low CVR (n = 148) | Medium or high CVR (n = 180) | Low CVR (n = 281) | Medium or high CVR (n = 222) |
| TC < 190 (%)     | 24  | 17    | 25  | 17    |
| TC < 250 (%)     | 82  | 77    | 87  | 73    |
| LDL-C < 115 (%)  | 26  | 23    | 36  | 28    |
| LDL-C < 160 (%)  | 76  | 69    | 88  | 75    |
| HDL-C > 40 (%)   | 89  | 92    | 97  | 97    |
| TG < 200 (%)     | 90  | 87    | 95  | 91    |
| GLYC < 110 (%)   | 94  | 86    | 94  | 87    |
| GLYC < 126 (%)   | 98  | 92    | 98  | 94    |
| BP < 140/90 (%)  | 78  | 72    | 76  | 66    |
| BP < 160/100 (%) | 98  | 97    | 94  | 92    |

BP, blood pressure; CVR, cardiovascular risk; GLYC, fasting blood sugar; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglycerides.

### Table 3 Interventions before the screening according to the lipoprotein levels (mmol/l), fasting blood sugar (mmol/l), blood pressure (mmHg) and body mass index (kg/m²)

|                  | Men | Women |
|------------------|-----|-------|
|                  | Diet | Drug treatment | Dietician | Diet | Drug treatment | Dietician |
| TC ≥ 6.5 (n = 161) (%) | 12  | 9    | 2    | 15  | 7    | 2    |
| 4.9 ≤ TC < 6.5 (n = 496) (%) | 8   | 8    | 1    | 10  | 9    | 1    |
| LDL-C ≥ 4.1 (n = 180) (%) | 11  | 6    | 1    | 13  | 6    | 2    |
| 3.0 ≤ LDL-C < 4.1 (n = 402) (%) | 9   | 8    | 1    | 11  | 9    | 1    |
| TG ≥ 2.3 (n = 71) (%) | 19  | 18   | 2    | 22  | 16   | 3    |
| GLYC ≥ 7.0 (n = 28) (%) | 27  | 47   | 10   | 31  | 45   | 12   |
| 6.1 ≤ GLYC < 7.0 (n = 43) (%) | 20  | 22   | 4    | 22  | 19   | 6    |
| BP ≥ 160/100 (n = 42) (%) | 4   | 44   | 0    | 6   | 42   | 0    |
| 140/90 ≤ BP < 160/100 (n = 185) (%) | 3   | 33   | 0    | 3   | 31   | 1    |
| BMI ≥ 30 (n = 133) (%) | 11  | 2    | 8    | 13  | 2    | 10   |
| 25 ≤ BMI < 30 (n = 324) (%) | 6   | 1    | 2    | 8   | 1    | 6    |

BP, blood pressure; BMI, body mass index; GLYC, fasting blood sugar; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglycerides.
Interventions on Lipids

Before the screening, 8% of the participants with increased TC or LDL-C received a lipid-lowering drug. A diet had already been advised to 11%. Those with high TG had received drugs (p < 0.05) and dietary advice (p < 0.05) more frequently before the screening compared to those with normal TG.

As a result of the study, 73% of those with high LDL-C, 54% of those with high TC and 53% of those with high TG received an intervention. Those with moderately increased TC or LDL-C received fewer interventions (p < 0.05).

More participants with high TC (78%) received an intervention before or during the study compared to those with moderately increased TC (49%) (p < 0.001). Similarly, more participants with high LDL-C (93%) received an intervention compared to those with moderately increased LDL-C (36%) (p < 0.001).

In total, 28% of all participants received an intervention for high lipoproteins as a result of the screening. The intervention was almost always oral advice often in combination with a leaflet. Eight per cent were sent to a dietician. Lipid-lowering drugs were prescribed more frequently for patients with high TC or LDL-C compared to those with moderately increased TC or LDL-C (p < 0.001).

The proportions of interventions on physical activity (p < 0.001) and the total caloric intake (p < 0.001) were

Table 4 Total proportions of interventions on smoking, lipids, blood pressure, blood sugar, physical activity and caloric intake according to the lipoprotein levels (mmol/l), fasting blood sugar (mmol/l), blood pressure (mmHg), smoking behaviour and body mass index (kg/m²) and for low and medium or high cardiovascular risk

| Lipoprotein Levels | Smoking | Lipids | Blood Pressure | Blood Sugar | Physical Activity | Caloric Intake |
|--------------------|---------|--------|---------------|-------------|------------------|---------------|
| TC ≥ 6.5 (n = 161) (%) | 8       | 56     | 7             | 22          | 42               | 35            | 9             | 52       | 7       | 24     | 47     | 40     |
| 4.9 ≤ TC < 6.5 (n = 496) (%) | 3       | 27     | 3             | 4           | 15               | 15            | 3             | 24       | 3       | 6      | 18     | 18     |
| LDL-C ≥ 4.1 (n = 180) (%) | 5       | 75     | 8             | 10          | 26               | 32            | 6             | 70       | 7       | 14     | 32     | 35     |
| 3.0 ≤ LDL-C < 4.1 (n = 402) (%) | 3       | 19     | 3             | 6           | 18               | 14            | 3             | 16       | 3       | 8      | 20     | 17     |
| TG ≥ 2.3 (n = 71) (%) | 8       | 56     | 7             | 21          | 42               | 35            | 6             | 51       | 7       | 24     | 45     | 40     |
| GLYC ≥ 7.0 (n = 28) (%) | 7       | 26     | 12            | 60          | 37               | 31            | 7             | 24       | 11      | 63     | 41     | 34     |
| 6.1 ≤ GLYC < 7.0 (n = 43) (%) | 0       | 35     | 2             | 31          | 14               | 19            | 0             | 36       | 2       | 36     | 14     | 19     |
| BP ≥ 160/100 (n = 42) (%) | 2       | 42     | 35            | 10          | 45               | 35            | 2             | 33       | 28      | 10     | 32     | 32     |
| 140/90 ≤ BP < 160/100 (n = 185) (%) | 3       | 36     | 9             | 3           | 27               | 27            | 3             | 28       | 6       | 9      | 22     | 21     |

BP, blood pressure; GLYC, fasting blood sugar; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglycerides.

Table 5 Kind of interventions during the screening according to the lipoprotein levels (mmol/l), fasting blood sugar (mmol/l), blood pressure (mmHg), smoking behaviour and body mass index (kg/m²)

| Lipoprotein Levels | Oral advice | Leaflet | Dietician | New drug |
|--------------------|-------------|---------|-----------|----------|
| TC ≥ 6.5 (n = 161) (%) | 100         | 80      | 7         | 14       |
| 4.9 ≤ TC < 6.5 (n = 496) (%) | 100         | 73      | 4         | 5        |
| LDL-C ≥ 4.1 (n = 180) (%) | 100         | 77      | 6         | 11       |
| 3.0 ≤ LDL-C < 4.1 (n = 402) (%) | 100         | 65      | 3         | 2        |
| TG ≥ 2.3 (n = 71) (%) | 100         | 72      | 6         | 10       |
| GLYC ≥ 7.0 (n = 28) (%) | 75          | 65      | 10        | 16       |
| 6.1 ≤ GLYC < 7.0 (n = 43) (%) | 100         | 70      | 24        | 0        |
| BP ≥ 160/100 (n = 42) (%) | 91          | 8       | 3         | 9        |
| 140/90 ≤ BP < 160/100 (n = 185) (%) | 96          | 4       | 4         | 4        |
| Smoking ≥ 10 (n = 84) (%) | 85          | 52      | –         | 1        |
| 1 ≤ Smoking < 10 (n = 51) (%) | 60          | 45      | –         | 2        |
| BMI ≥ 30 (n = 133) (%) | 75          | 45      | 23        | 1        |
| 25 ≤ BMI < 30 (n = 324) | 82          | 60      | 14        | 0        |

BP, blood pressure; BMI, body mass index; GLYC, fasting blood sugar; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglycerides.
higher in the group with high TC or LDL-C compared to those with moderately increased TC or LDL-C.

The proportions of interventions on lipoproteins were higher among persons at high or medium cardiovascular risk compared to those at low cardiovascular risk (p = 0.001).

**Interventions on Blood Sugar**

Diet, drug treatment and advice from a dietician had already been intensified before the screening for the participants with the highest fasting blood sugar. Sugar-lowering drugs had already been prescribed for 46% of those with fasting blood sugar of 7.0 mmol/l or more compared to 21% of those with IFG (p = 0.04).

As a result of the study, 61% of the participants with fasting blood sugar of 7.0 mmol/l or more received an intervention compared to 33% of the participants with IFG (p = 0.036).

In total, 9% of all participants received an intervention for increased fasting blood sugar as a result of the screening. The intervention often was oral advice or a leaflet. Twenty percent were sent to a dietician and drugs were only prescribed for patients with fasting blood sugar of 7.0 mmol/l or more.

The proportions of interventions on physical activity were higher among the participants with fasting blood sugar of 7.0 mmol/l or more compared to those with IFG (p = 0.03).

The proportions of interventions on blood sugar were higher among persons at high or medium cardiovascular risk compared to those at low cardiovascular risk (p = 0.02).

**Interventions on Blood Pressure**

In total, 43% of the participants with high blood pressure had already received a pharmaceutical treatment for hypertension before the screening.

As a result of the study, 31% of the participants with high blood pressure received a new intervention for their blood pressure. The proportion of interventions was lower among those with moderately increased blood pressure (p < 0.001).

In total, 79% of the persons with high blood pressure received an intervention before or during the screening.

As a result of the screening, 5% of all participants received an intervention for high blood pressure. The intervention often was oral advice on the importance of the regular intake of the blood pressure-lowering drugs. Only occasionally, a new drug was prescribed.

The proportions of interventions on physical activity and total caloric intake were not significantly higher among those with high blood pressure compared to those with moderately increased blood pressure.

**Interventions on Smoking Habits**

Among the heavy smokers (10 cigarettes/day or more), 30% had an intervention on smoking habits. But, 20% of the moderate smokers (less than 10 cigarettes/day) also had an intervention.

As a result of the screening, 4% of all participants received an intervention to help them to quit smoking. The intervention often was oral advice or a leaflet. Only few smokers were prescribed a drug to help them to quit smoking.

In total, 33% of the heavy smokers also had an intervention to reduce cholesterol.

The proportions of interventions to quit smoking were higher among persons at high or medium cardiovascular risk compared to those at low cardiovascular risk (p < 0.001).

**Interventions on Body Weight**

As a result of the screening, one in two of the obese persons received an intervention.

Before as well as during the screening, most of the interventions were focused on those with the highest BMI. In total, 73% of the obese persons received an intervention to reduce body weight before or during the screening compared to 34% of the overweight participants (p < 0.001).

As a result of the screening, 22% of all participants received an intervention to decrease caloric intake and 23% received an intervention to promote physical activity. The intervention often was oral advice or a leaflet, but 27% of the obese and 17% of the overweight patients were sent to a dietician. Only few of them were prescribed a drug to help them to lose weight.

The proportions of interventions on blood sugar (p = 0.04) were also higher among the obese compared to those with overweight.

**DISCUSSION**

**Limitations of the Study**

We are aware of the fact that we did not investigate a representative sample of the population. Only 7% of the 12,756 invited persons showed up. The low participation rate could be related to the fact that participants had to fast for at least 12 h before the screening. The low participation rate could be a selection bias for those who already had reasons to worry about their health, on the one hand, or perhaps for those who already were health conscious, on the other hand. For that reason, the figures about achievement of target levels are probably not representative of the total population. However, the study was not undertaken to estimate the achievement of target levels or to estimate the prevalence of risk factors in a sample of the population, but to evaluate the interventions provided by GPs in patients with cardiovascular risk factors.

Finally, it remains difficult to motivate persons without complaints or symptoms to participate in a preventive
campaign like ours and to encourage them to modify their life styles or to take drugs daily.

Despite the fact that all GPs agreed to participate in the study, some of them did not record any patient. This was probably due to the heavy workload of some GPs or to a lack of participating patients. However, the high participation rate among GPs (86%) guarantees that a representative sample of the GPs of Overijse, Hoeilaart and Merchtem has participated.

Because we had only one measurement of the fasting lipoproteins and plasma glucose, the diagnosis of hyperlipidaemia and diabetes was probable but not definitely confirmed. We had only two measurements to evaluate the blood pressure, instead of three as recommended by the guidelines. This could be a cause for the low prescription rate of drug treatment among the newly detected hypertensive patients.

**Interventions on Cardiovascular Risk Factors**

The proportions of interventions were quite high among the participants with high lipoproteins, blood sugar, BMI or blood pressure. Participants with moderately increased lipoproteins, fasting blood sugar or blood pressure received fewer interventions.

Interventions on lipoproteins, blood sugar and smoking were more frequently proposed to persons with a high or medium cardiovascular risk compared to those at low cardiovascular risk. Interventions on the blood pressure, caloric intake and physical activity were also more often proposed to persons with high or medium cardiovascular risk, but the difference was not significant.

Women received more dietary interventions and men received more drug treatment, but the difference was again not significant.

It seems remarkable that in a study on primary prevention, not all smoking patients received an intervention. Unfortunately, the proportion of persons who had already received an intervention to quit smoking before the screening was not recorded in our study. On the other hand, the study was carried out among GPs who were caring for their own patients whom they have known for many years. The GPs were well placed to evaluate the chance that their patients could stop smoking. Probably, their interventions were influenced by this factor. Although smoking is one of the most important cardiovascular risk factors, the GPs may have preferred to promote other interventions which had more chance to be successful.

We strongly recommend the idea that future screening programs do not focus on isolated risk factors such as diabetes, high blood pressure or hyperlipidaemia but take into consideration the global cardiovascular risk.

The fact that interventions focused on participants with TC of 6.5 mmol/l or more could be related to the Belgian reimbursement criteria. Reimbursement of lipid-lowering drugs is only authorised for patients with TC of 6.5 mmol/l or more or TG of 2.3 mmol/l or more. Possibly, GPs also interpret the reimbursement levels as targets for the treatment of hyperlipidaemia.

The higher proportion of interventions for persons with high LDL-C compared to those with high TC illustrates the importance given by GPs to LDL-C as primary target in the prevention of CHD.

However, not all patients at high cardiovascular risk received an intervention. Because of the usually long relationship that exists between the GPs and their patients, the GPs may long before the study have performed some interventions, which were not recorded in this study as such. Moreover, GPs take into account the willingness of the patients for therapeutic lifestyle changes. Patients, for whom the GPs thought the intervention might have no effect, may have been given no intervention at all. On the other hand, the GPs received only a short briefing on the screening and treatment of cardiovascular risk factors. They received no strict study flowchart with the obligatory interventions for each risk factor. The GPs were only evaluated on their intention to treat. However, it has been proved by other studies that GPs have a low adherence to guidelines for the management of hypertension, hyperlipidaemia and diabetes (2,14,15). Poor compliance with the guidelines has also been pointed out for other diseases such as asthma (16). However, poor compliance of the patients with their GPs' advice and prescription can also play an important role.

Clearly, something more than just writing and distributing brief practice guidelines has to be done to increase knowledge and change the attitudes and performance of physicians. Practice guidelines tell you what to do but seldom how and when to do it. Furthermore, the context and contents of a consultation in daily clinical practice is unstructured, unlike the strictly structured situation in which a person is enrolled in a clinical trial (17). The frames of clinical practice decisions will thus vary from person to person.

Several explanations have been offered for the inefficiency of practice guidelines (6,18–22). One is that practice guidelines are not written for practising physicians but focus on scientific knowledge (23). In-depth interviews indicate that personal experience or the advice and recommendations of colleagues are the most important factors determining attitudes and behaviour (24). Some authors also claim that physicians tend to disagree or distrust guidelines written by experts (25–27). Specialists are more influenced by medical journals and scientific conferences, whereas GPs are more influenced by medical newspapers and postgraduate meetings (25).

On the other hand, it has been proved that the lipid-lowering primary prevention trials are not applicable to the general population. In the Framingham Heart Study, 40% of men and 80% of women had lipid profiles that were not studied in the large lipid-lowering trials (28). In general, subjects with isolated hypertriglyceridaemia or patients with normal TC levels but low or high HDL-C levels were not included.
CONCLUSION

In this study directed on the prevention of CHD, GPs took into account the global cardiovascular risk. The GPs intensified the interventions for persons at high or medium cardiovascular risk compared to those at low risk. Less attention was given to interventions for moderately increased hypertension, lipoproteins and BMI. For persons at low cardiovascular risk, therapeutic lifestyle changes are often not advised and isolated risk factors often remain untreated.

There is a certain discrepancy between the known effectiveness of many measures of cardiovascular prevention and their implementation in primary health care. Not all persons received all the appropriate interventions from their GP despite firm scientific evidence.

Efforts should be made to increase the availability of practice guidelines in primary health care and to increase the adherence to these guidelines.

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