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Uptake and detection rate of a stepwise cardiometabolic disease detection program in primary care-a cohort study

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Background: Early detection and treatment of cardiometabolic diseases (CMD) in high-risk patients is a promising preventive strategy to anticipate the increasing burden of CMD. The Dutch guideline 'the prevention consultation' provides a framework for stepwise CMD risk assessment and detection in primary care. The aim of this study was to assess the outcome of this program in terms of newly diagnosed CMD.
Methods: A cohort study among 30 934 patients, aged 45–70 years without known CMD or CMD risk factors, who were invited for the CMD detection program within 37 general practices. Patients filled out a CMD risk score (step 1), were referred for additional risk profiling in case of high risk (step 2) and received lifestyle advice and (pharmacological) treatment if indicated (step 3). During 1-year follow-up newly diagnosed CMD, prescriptions and abnormal diagnostic tests were assessed.
Results: Twelve thousand seven hundred and thirty-eight patients filled out the risk score of which 865, 6665 and 5208 had a low, intermediate and high CMD risk, respectively. One thousand seven hundred and fifty-five high-risk patients consulted the general practitioner, in 346 of whom a new CMD was diagnosed. In an additional 422 patients a new prescription and/or abnormal diagnostic test were found. Conclusions: Implementation of the CMD detection program resulted in a new CMD diagnosis in one-fifth of high-risk patients who attended the practice for completion of their risk profile. However, the potential yield of the program could be higher given the considerable number of additional risk factors—such as elevated glucose, blood pressure and

cholesterol levels—found, requiring active follow-up and presumably treatment in the future.

Introduction

Cardiometabolic diseases (CMD) defined as cardiovascular disease (CVD), diabetes type 2 (DM2) and chronic kidney disease are the leading cause of death and of a reduced quality of life worldwide.[1,2] CMD are causally related to modifiable lifestyle factors such as smoking, physical inactivity, unhealthy diet and overweight[3,4] which can be reduced through a healthy lifestyle. About a quarter of the Dutch population smokes and almost half of the people are overweight or obese.[5] Due to an increasing prevalence of obesity,[5] the related risk factors such as hypertension, dyslipidaemia and an impaired fasting glucose will rise; indivertibly leading to increasing rates of CMD.

Early detection and treatment of CMD risk factors could diminish overall CMD risk and a combined approach targeted at case finding of high-risk individuals with subsequent CMD screening might be an efficient preventive strategy.[6] This is supported by the European Society of Cardiology considering targeted systematic risk assessment for men 40 and women 50 without known CMD risk factors.[4]

Although programs for systematic CMD risk assessment[7–9] have been implemented in several countries, early detection of CMD in Dutch primary care is still non-programmatic and mainly directed at individual case finding.[7,10]

In 2011, the Dutch College of General Practitioners (DCGPs) developed a clinical practice guideline to provide a framework for structured stepwise CMD risk assessment and detection in primary care ('the prevention consultation').[11] It focuses on all individuals aged 45–70 without known CMD or CMD risk factors. This stepwise program entails the self-assessment of CMD risk through a risk score (first step) and—in case of high risk—a referral to the practice for further risk profiling (second step) and individualized treatment if indicated (third step). Pilot studies evaluating precursors of this program showed participation rates between 33% and 75% and found a new CMD in about one-fifth of high-risk patients who attended the practice.[12–14] As the CMD detection program is not yet widespread implemented, its overall impact is unknown. Therefore, the aim of the present cohort study was to assess the yield of implementing this stepwise CMD detection program in terms of uptake and detection rate of newly diagnosed CMD in 37 general practices across the Netherlands.

Methods

Design

We performed a cohort study within the framework of the INTEGRATE study among 12 738 patients in the Dutch CMD detection program. The INTEGRATE study is a stepped-wedge randomized controlled trial that was conducted in 37 general practices in the Netherlands. The design of the study has been described previously.[15] The study was considered by the UMC Utrecht Institutional Review Board and exempted from full ethical assessment.

Participants

Patients, aged 45–70 years without recorded CMD, CMD risk factors or treatment with antihypertensive, lipid-lowering or antidiabetic drugs were invited through a personal letter by their GP in a time frame of 2 years.

The Dutch CMD detection program

The Dutch CMD detection program has a stepwise approach.[11] The first step is an online risk score (paper version available), consisting of questions regarding sex, age, smoking status, body mass index (BMI) (increased if ≥25 kg/m2), waist circumference (increased if ≥80 cm for women and ≥94 cm for

men) and a family history of premature CVD (age <65 years) and DM2. The risk score incorporates components of the widely accepted FINDRISK score and the SCORE Risk Charts, and is externally validated.[6,16–18] On the basis of the risk score, patients are categorized as having low, intermediate or high risk. A high risk is defined as a chance to develop CMD in the next 7 years of ≥23% for men and ≥19% for women.[6] Patients with a score below threshold are categorized as having a low risk (no risk factors present) or an intermediate risk (one or several risk factors present). These patients receive tailored lifestyle advice online. In case of high risk, patients are referred to their GP for additional risk profiling (step 2)—including blood pressure measurement and laboratory tests on fasting glucose, total cholesterol, high-density lipoprotein (HDL) and low-density lipoprotein (LDL) levels—and appropriate follow-up treatment (step 3).

Outcome variables

The primary outcome was newly diagnosed International Classification of Primary Care (ICPC)-coded CMD recorded in the electronic health record (EHR) (see table 1) in high-risk patients who completed the two-step risk assessment.

Secondary outcomes were (i) new prescriptions of antihypertensive, lipid-lowering or antidiabetic drugs without a CMD diagnosis during 1 year follow-up; (ii) abnormal diagnostic test results reported during the first GP visit [blood pressure ≥140/90mmHg, total cholesterol/HDL ratio ≥5–8, total cholesterol level ≥8mmol/l and/or total cholesterol/HDL ratio ≥8, fasting glucose ≥6-7mmol/l (prediabetes) or fasting glucose levels ≥7mmol/l] without a CMD diagnosis or prescription and (iii) newly diagnosed ICPC-coded CMD and new prescriptions in patients with a risk score below threshold.

Measurements

All patients completed the risk score and filled out additional online questionnaires at baseline and 1-year follow-up including topics on demographic characteristics and CMD risk factors. Measurements have been described in detail elsewhere.[15]

Data collection

Baseline data on CMD risk factors (sex, age, smoking status, BMI, waist circumference and a family history of premature CVD and DM2) were derived from the CMD risk score.

For high-risk patients who attended the practice—as confirmed in the EHR, case report forms or self-report—we collected data on newly diagnosed ICPC-coded CMD and prescriptions of antihypertensive, lipid-lowering and antidiabetic drugs during 1-year follow-up (see table 1). In addition, we collected data on abnormal diagnostic test results during the first GP visit (see table 1). Abnormal diagnostic test results were defined according to thresholds for hypertension and impaired fasting glucose levels and treatment thresholds for hypercholesterolemia in Dutch and/or European guidelines.[4,19,20] For low- and intermediate-risk patients, we collected data on newly diagnosed ICPC-coded CMD and new prescriptions from the EHR during 1-year follow-up.

Analysis

Demographic characteristics and CMD risk factors were tabulated for all patients.

The yield of the program was based on the number of high-risk patients (i) who attended general practice and (ii) were identified with a new ICPC-coded CMD diagnosis during 1-year follow-up.

We calculated the number needed to screen (NNS) as the inverse of the proportion of high-risk patients with a new CMD diagnosis to all invitees.

In order to estimate the potential additional yield of the program, we examined the number of new prescriptions without a CMD diagnosis during 1-year follow-up and abnormal diagnostic test

results reported during the first GP visit without a CMD diagnosis or prescription recorded in the EHR.

For the low- and intermediate-risk groups, we tabulated newly diagnosed ICPC-coded CMD and new prescriptions recorded during 1-year follow-up. Analyses were performed using STATA version 15.

[Table 1]

Results

Participants

In total 30 934 eligible patients were approached, of whom 12 738 (41%) consented to participate and completed the risk score as first step of the program. Of those 67% was below the age of 60 years, and 54% were female (5-year age categories displayed in table 2). Of those who completed the risk score 7% (*n*=865) was categorized as having a low CMD risk, 52% (*n*=6665) as having an intermediate risk and 41% (*n*=5208) as having a high risk. Detailed description of CMD risk factors per risk category is summarized in table 2.

Of the 5208 high-risk patients, 1755 (34%) consulted their GP (see figure 1). These patients had a mean systolic blood pressure of 134.4 (SD 17.6) mmHg, a total cholesterol/HDL ratio of 3.9 (SD 1.1), LDL of 3.7 (SD 0.9) mmol/l and a fasting glucose of 5.4 (SD 0.9) mmol/l. Their mean 10 years CVD mortality risk (SCORE Risk Charts) was 3.1% (SD 2.6) (table 2).

Detection rate of the program

EHR data were available for 12 393 (97%) patients. Table 3 shows that in about one in five at least one CMD (19.7%) was newly diagnosed. In total, 9.2% was diagnosed with hypertension, 9.6% with hypercholesterolemia and 1.6% with diabetes. In addition, we found new prescriptions for antihypertensive and lipid-lowering drugs in absence of an EHR recorded CMD diagnosis in 1.3% and 1.4% of the patients, respectively. No antidiabetic prescriptions were found without a DM2 diagnosis. In an additional 21.9% of patients in whom no CMD diagnosis or prescription was recorded, we found abnormal diagnostic test results for CMD; elevated blood pressure (1≥40/90 mmHg) in 18.1%, abnormal cholesterol levels (total cholesterol/HDL ratio ≥5 or total cholesterol ≥8 mmol/l) in 8.4% and an increased fasting glucose level (≥6 mmol/l) in 22.2%. In 43.8.% of patients, either a new CMD diagnosis, a new prescription or an abnormal diagnostic test result was found.

[Tabel2] [Figure 1]

Number needed to screen

The calculated NNS among all invitees (*n*=30 934) to find a newly confirmed CMD diagnosis was 89 (table 3). Although a detailed and thorough cost-effectiveness analysis is required, a first estimation demonstrates that costs per newly diagnosed individual with CMD would be €489. For this estimation, direct medical costs were taken into account: €2 per patient for invitation, €40 per high-risk patient who attended the general practice (two standard consultations and laboratory costs) and an estimated €1000 per practice for implementation (15–20 h of time investment at €50/h). Taking a broader definition of new CMD (confirmed diagnosis, prescription or an abnormal diagnostic test result), the NNS would decrease to 40.

Newly diagnosed CMD in low- and intermediate-risk categories

A new ICPC-coded CMD diagnosis was found in 1.6% of patients with a low risk and in 4.3% of patients with an intermediate risk (Supplementary table S3).

Discussion

Summary of results

Implementation of a structured stepwise CMD detection program in general practice results in a participation rate of 41%, and new diagnosis of CMD in 20% of the high-risk-patients (NNS 89).

[Table 3]

Over 40% of patients required active follow-up, receiving either a new diagnosis, a new prescription or had an abnormal diagnostic test result during their GP visit. In low- and intermediate-risk categories, small numbers of new CMD diagnoses were found (2% and 4%, respectively).

Strengths and limitations

This is the first large study evaluating the uptake and detection rate of the Dutch CMD detection program in a real-life clinical setting. The roll-out of the 'prevention consultation' was coordinated and implemented by the local staff of each practice. This resulted in a pragmatic and feasible implementation in each practice. With this approach, we have tackled some earlier identified challenges such as good preparation of involved staff and the integration of the program within everyday practice.[21] Another strength was that we were able to collect the EHR data of 97% of the patients, instead of the anticipated 90%.[15] The small number of missing data (3%) was equally distributed among patients of different risk categories and therefore we assume these data were missing at random and did not influence our results.

The risk score we used was recently externally validated among 3544 patients of the Australian Diabetes, Obesity and Lifestyle Study, showing robust discriminative performance across populations, though recalibration was recommended to account for disease incidence per region.[6,18]

However, some limitations should be considered.

Due to the stepwise nature of the program, we anticipated non-response.[15] This was 59% on the initial invitation and 66% on the second step of the risk assessment. In case of non-response, we did sent reminders after 2weeks as recommended in the guideline. The response and accompanying detection rate of the program may have been larger if we had incorporated more labour-intensive strategies for enhancing the response (e.g. telephone reminders or reminders by email)[14,22]

Another limitation was that our primary outcome was based on ICPC-coded diagnoses in the EHR. Under-registration may have differed between professionals and practices. However, even if under-registration did play a role, this would have resulted in an underestimation of the total estimated yield.

Interpretation of results and comparison with existing literature

We found a new CMD diagnosis in 20% of high-risk patients attending general practice. This is comparable with the results of previous Dutch pilot studies.[12,13] A population-based cohort study estimating the yield of the UKNHS health check identified 18.4% active smokers, ≥22.7% obese patients (BMI ≥30 kg/m2), 30.1% patients with blood pressure levels ≥140/90mmHgand 66.1% with total cholesterol levels ≥5 mmol/l.[23] However, it is hard to compare our results with those from international equivalents, since variable selection criteria for participation in structured CMD risk assessment are used in different countries.[7,9,24] For example, the NHS health check targets all patients 40–75 without knownCMDorCMDrisk factors for complete screening and does not use a stepwise approach.[25]

A remarkable result is that we found abnormal diagnostic test results recorded in an additional 22% of the high-risk patients who attended general practice, without a CMD diagnosis or prescription recorded in the EHR. In some patients (e.g. with a total cholesterol ≥8 mmol/l, a total

cholesterol/HDL ratio ≥8 or fasting glucose levels ≥7 mmol/l), these abnormal diagnostic test results may reflect under-registration of a diagnosis. However single abnormal test results do not always implicate the presence of CMD. For example, in case of high blood pressure, they may reflect a 'white coat' effect or a transient deviation of the norm due to stress or temporary illnesses. In addition, single abnormal test results do not always require treatment, because treatment indications are frequently based on the overall CMD risk instead of single risk factors.[4,19] Nevertheless, abnormal diagnostic test results often require active follow-up and one could argue that at least a part of these individuals will develop CMD in the (near) future. For example, it is estimated that one- to two-third of those with prediabetes (fasting glucose between 6 and 7 mmol/l) will develop diabetes within 6 years.[26] Moreover, impaired fasting glucose levels are associated with an increased risk for CMD.[20] Taking this into account, the program has the potential to identify additional patients who are likely to develop CMD in the future.

Implications for research and practice

Stepwise screening methods—such as in the Dutch CMD detection program—are preferred, selecting people at high risk—who are likely to benefit most from interventions—reducing the number of people that needs to be screened.[27] In addition, previous studies have shown that this stepwise program is positively evaluated by GPs and patients.[28,29] To further optimize acceptance, compliance and participation rates of the program, additional analyses of nonresponse and response-enhancing strategies are warranted.

The cost-effectiveness of CMD detection programs has not yet been established;[24,30] however, prevention of CMD either by lifestyle changes or medication is considered cost-effective in many scenario's.[4] Future economic evaluation of this program will add to the evidence on this topic.[15] It is important to establish the cost-effectiveness in order to justify and create wider acceptance for large-scale implementation of stepwise CMD detection programs in primary care.

Conclusion

The Dutch CMD detection program proved adequate in identifying high-risk patients in general practice, and resulted in the detection of a newly diagnosed CMD in one-fifth of patients. The future yield of this program is expected to be higher given the considerable amount of additional risk factors found, such as prediabetes and elevated blood pressure and cholesterol levels, requiring active follow-up and presumably treatment in the (near) future.

Supplementary data

Supplementary data are available at EURPUB online.

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Conflicts of interest: None declared.

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Key points

- Early detection and treatment of CMD in high-risk patients is a promising preventive strategy and recommended by European guidelines
- The Dutch CMD detection program adequately identifies high-risk patients in general practice and detects a new CMD diagnosis in one-fifth of patients
- The future yield of this program is expected to be higher given the considerable amount of additional risk factors found, requiring active follow-up and presumably treatment in the future

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Table 1 CMD, prescriptions, abnormal diagnostic test results

ICPC-codes of CMD:
K74: angina pectoris
K75: acute myocardial infarction
K76: other chronic ischemic heart disease
K77: heart failure
K86: uncomplicated hypertension
K87: hypertension with secondary organ damage
K89: transient cerebral ischemia
K90: stroke/cerebrovascular accident
K91: atherosclerosis
K92: peripheral vascular diseases
T90: diabetes mellitus
T93: lipid metabolism disorder
ATC clusters of prescriptions:
A10: antidiabetic drugs
C02–03, C07–C09: antihypertensive drugs
C10: lipid-lowering drugs
Abnormal diagnostic test results:
Blood pressure ≥140/90 mmHg
Total cholesterol/HDL ratio ≥5–8
Total cholesterol ≥8 mmol/l or total cholesterol/HDL ratio ≥8
Fasting glucose ≥6–7 mmol/l (prediabetes)
Fasting glucose ≥7 mmol/l

CMD, cardiometabolic disease; ICPC, International Classification of Primary Care; ATC, Anatomical Therapeutic Chemical Classification System.

Table 2 Baseline characteristic

		Risk category			
		Low *N* = 865	Intermediate *N* = 6665	High *N* = 5208	Total group *N* = 12 738
Demographics					
Sex (%)					
Female		39.4	58.7	49.4	53.6
Male		60.6	41.3	50.6	46.4
Age (5-year categories) (%)					
45–49 years		35.8	36.3	1.6	22.1
50–54 years		36.8	37.2	6.5	24.6
55–59 years		26.2	23.0	17.1	20.8
60–64 years		1.2	3.5	36.1	16.7
65+ years		–	–	38.8	15.9
CMD risk factors					
Positive CVD family history (%)		0	29.0	36.0	29.9
Positive DM2 family history (%)		0	17.9	21.5	18.1
Current smoker (%)		0	9.3	21.6	13.7
BMI (categories) (%)					
<25 kg/m^2		100	57.7	45.4	55.5
25–30 kg/m^2		–	37.2	41.5	36.5
>30 kg/m^2		–	5.1	13.1	8.0
Waist circumference (categories) (%)					
Women	<80 cm	98.8	9.5	5.7	12.6
	80–88 cm	0.3	32.6	15.4	24.5
	>88 cm	0.9	57.9	79.0	63.0
Men	<94 cm	100	20.3	20.2	27.3
	>94 cm	–	79.8	79.8	72.7
Additional CMD risk factors of high-risk participants who consulted their GP [mean (SD)]					
				N = 1755	
Systolic blood pressure in mmHg (*n* = 1477)				134.4 (17.6)	
Diastolic blood pressure in mmHg (*n* = 1461)				79.9 (9.8)	
Total cholesterol in mmol/l (*n* = 1411)				5.8 (1.0)	
Total cholesterol/HDL ratio (*n* = 1407)				3.9 (1.1)	
LDL in mmol/l (*n* = 1334)				3.7 (0.9)	
Fasting glucose in mmol/l (*n* = 1283)				5.4 (0.9)	
SCORE Risk Charts[a] (%) (*n* = 1285)				3.1 (2.6)	

Note: Total of percentages may not equal 100% due to rounding.
[a]10 years CVD mortality risk, The Netherlands is considered as a 'low-risk' country.[17]
CMD, cardiometabolic disease; CVD, cardiovascular disease; DM2, diabetes mellitus type 2; BMI, body mass index; GP, general practitioner; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

Figure 1 Flowchart of participants

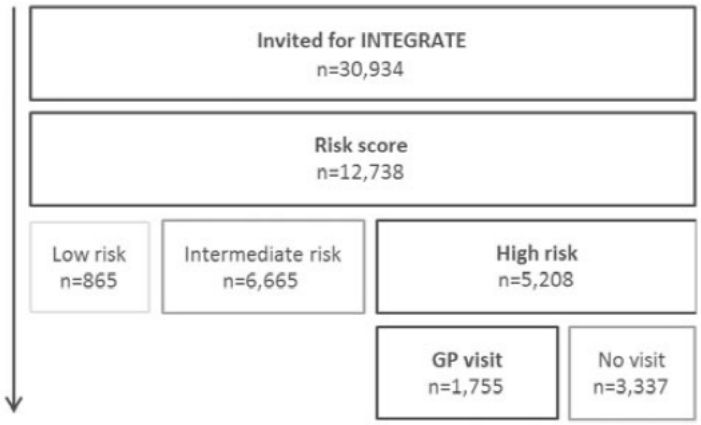

Table 3 Detection rate and potential yield of stepwise CMD risk assessment

	High-risk category GP visit *N* = 1755	NNS *N* = 30934
Newly diagnosed: % (*n*)		
Hypertension[a]	9.2 (*n* = 161)	
Hypercholesterolemia[b]	9.6 (*n* = 169)	
Diabetes mellitus[c]	1.6 (*n* = 28)	
Newly prescribed without recorded diagnosis: % (*n*)		
Antihypertensives[d]	1.3 (*n* = 23)	
Lipid-lowering drugs[e]	1.4 (*n* = 25)	
Antidiabetics[f]	0 (*n* = 0)	
Abnormal diagnostic test without recorded diagnosis or prescription: % (*n*)		
Blood pressure ≥140/90 mmHg	18.1 (*n* = 318)	
Total cholesterol/HDL ratio ≥5–8	8.0 (*n* = 140)	
Total cholesterol ≥8 mmol/l or total cholesterol/HDL ratio ≥8	0.4 (*n* = 7)	
Fasting glucose ≥6–7 mmol/l (prediabetes)	21.9 (*n* = 385)	
Fasting glucose ≥7 mmol/l	0.3 (*n* = 5)	
Newly diagnosed CMD, newly prescribed or abnormal diagnostic test result % (*n*)		
No. of participants with newly diagnosed CMD[g]	19.7 (*n* = 346)	89
No. of participants with newly diagnosed CMD or prescription[h]	21.9 (*n* = 385)	80
No. of participants with new CMD, prescription or abnormal diagnostic test	43.8 (*n* = 768)	40

[a]ICPC codes: K86/K87.
[b]ICPC code: T93.
[c]ICPC code: T90.
[d]ATC cluster: C02–03, C07–C09.
[e]ATC cluster: C10.
[f]ATC cluster: A10.
[g]ICPC codes: K74, K75, K76, K77, K86, K87, K89, K90, K91, K92, T90 and T93.
[h]ICPC codes + ATC cluster: A10 and C02–03, C07–C10.
CMD, cardiometabolic disease; GP, general practitioner; NNS, number needed to screen; ICPC, International Classification of Primary Care; ATC, Anatomical Therapeutic Chemical Classification System.

Stol, D.M., Hollander, M., Badenbroek, I.F., Nielen, M.M.J., Schellevis, F.G., Wit, N. de.Uptake and detection rate of a stepwise cardiometabolic disease detection program in primary care-a cohort study. European Journal of Public Health: 2020, 30(3), p. 479-484

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[Figuur 1]

[Tabel 1]

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