Identification of cardiovascular risk factors in a general practice*

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What contribution can primary health care make to the identification of cardiovascular risk factors? This problem definition was the starting-point for a health care project in Heer (province of Limburg). The procedure adopted proved to fulfill two important criteria: effectiveness and efficiency. In most general practices, however, the clerical work involved will pose insurmountable problems.

Introduction

Early identification and prevention of ischemic heart diseases has received special attention in recent years. Examples of identification activities in The Netherlands are the mass screening project of the Committee on Identification and Prevention of Ischemic Heart Diseases and the Public Health Clinic Project ,,Heart Diseases" now being carried out under the auspices of the Netherlands Heart Foundation in a number of Public Health Clinics for Tuberculosis Control.

General practitioners have long taken an interest in the early identification and prevention of diseases. Several procedures have been evolved for ,,anticipatory medicine" and ,,surveillance of at-risk groups" (*Van den Dool*). *Van der Feen* described a method to identify hypertension in general practice. Meanwhile it has not yet been made quite clear what contribution primary health care could make to the identification of cardiovascular risk factors. In order to study this question, a health care project was established in Heer, where general practitioners focused for a limited period on the early identification of these risk factors via the presence of hypertension. The evaluation of the project focused especially on effectiveness, efficiency and feasibility of the method used *(Postscript)*.

Group studied and methods used

The practice. The project was carried out in 1975 in the practice of two associated general practitioners in Heer, an urbanized community with an old village center near the city of Maastricht. The practice had a total of about 7000 patients. The physicians worked with two office assistants and in close cooperation with the Green Cross Society of district nurse services and the Social Work Service. The general practitioners, district nurses and social workers constituted a home-team.

Target population. The group studied comprised all males aged 20-65 years (birth years 1910-1955). They numbered 1824. The males were chosen because – especially under age 50 – they are more at risk as regards the consequences of hypertension than women of the same age group.

Procedure. A screening study as a rule takes place in phases of increasing intensity, the meshes of screen becoming smaller and smaller. The risk of false positive findings is reduced by series of measurements. In this case, pre-screening for hypertension was first carried out; this made it possible to divide the target population into a group with blood pressure values below 150 mm Hg systolic and/or 95 mm Hg diastolic, and a group with higher blood pressure values.

The latter group was examined again in the screening phase, both as to hypertension and as to other cardiovascular risk factors: hypercholesteremia, smoking, overweight, insufficient exercise and socalled X-factors (*Meijer et al*): a history of hypertension treated by medication, ECG changes suggestive of the probability or possibility of ischemia, imminent myocardial infarction, angina pectoris and diabetes mellitus.

Summoning method. The target population as a whole was invited once in writing to participate and summoned after receipt of an affirmative reply. This made it possible to complete the entire screening within a short time.

As already mentioned, the blood pressure was the yardstick used for screening. In the actual screening the angle of incidence was widened because hypertension is an important risk factor also for atherosclerotic coronary diseases; those in the higher blood pressure group were in addition examined for other risk factors concerning this category of heart diseases. For this reason, and in order to be able to compare the results of our project with those obtained in the Public Health Clinic Project ,,Heart Diseases" (PHC-project), we proceeded in principle from the protocol for blood pressure determination and estimation of the other risk factor used in the PHC-project. When early in 1976 the PHC-project was extended to encompass the Public Health Clinic in Maastricht, the use of this protocol facilitated cooperation.

Methods. In the pre-screening phase, blood pressures were measured with the aid of normal mercury manometers with an adhesive cuff of 12 × 23 cm. The measurements were made by medical students especially trained for this purpose. In the screening phase, the random zerometer was used in accordance with the protocol. These measurements were made by general practitioners. All meters had been standardized.

The PHC-project questionnaire was used to identify the risk factors smoking and insufficient exercise, and to identify the X-factors angina pectoris, imminent myocardial infarction and hypertension treated by medication.

Standardized platform scales were used to weigh the subjects.

Heigt was measured with aid of a „microtoise" ribbon.

Serum cholesterol level: a vacuum tube was used to obtain a blood sample, which was sent to the Clinico-Chemical Laboratory of the Dijkzigt Hospital,

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Rotterdam, where the direct Huang method was used for determination.
The ECGs were registered with the aid of a three-channel electrocardiograph, and interpreted by the Electrocardiography Foundation, University Hospital, Leiden.
Urinary glucose and protein levels were examined with the aid of test strips.
A difference from the PHC-protocol was that no chest X-ray was made, because this would have meant an expenditure of time and money not compatible with the purpose of this study.

Control group. For evaluation of the results of screening in the high blood pressure group (HB-group) and the effects of health care given, a control group was made up of men who at prescreening had a blood pressure of < 140 mm Hg systolic and < 90 mm Hg diastolic, and who had no history of hypertension treated by medication. For every other patient in the HB-group, a patient of the same age was selected from the low blood pressure group. In this way the control group was matched for age with the HB-group, but kept half as large as this group. The control group, too, was submitted to the screening procedure.

Classification in the care scheme. On the basis of the risk scores *(appendix 1)*, the screened men were assigned to various care groups *(appendix 2)*. The procedure differed from that in the PHC-project in that we proceeded from the blood pressure score; consequently this score was given greater weight than in the PHC-procedure. For example: a man with a smoking score of 7 (25-39 cigarettes/day) was assigned to the advise and guidance group (AG-group) according to the PHC-project, but in our procedure a person with a smoking score of 7 was assigned to the AG-group only if in addition he had a blood pressure score of 6 or higher.

Supplementary study. Those assigned to the AG-group according to the care scheme, were submitted to a supplementary study in accordance with the hypertension scheme of the Netherlands Institute of General Practitioners *(Van Veen);* this was done in order to establish by means of an aimed history, physical examination and laboratory studies, if necessary, whether:
- the hypertension was essential or showed features suggestive of a particular cause;
- the hypertension had given rise to direct complications.
- there were manifest signs of vascular disease.

Finally, serum potassium levels were determined in those who were likely to receive a saluretic in future therapy.
Thus the function of the supplementary

*Diagram 1. Design of the study.**

	Population	Factors	Methods	Setting
Pre-screening February-April 1975	men aged 20-65 in an associate practice in Heer (n=1524)	blood pressure heart rate height weight	mercury manometer stopwatch ruler scales	in Green Cross building; by receptionists
Screening April-June 1975	men with S > 150 and/or D > 96 (n=336) Control group S < 140 and/or D < 90 (n=164)	blood pressure heart rate weight serum choles- terol by PHC protocol urinary gluc- ose and al- bumin ECG anamnestic data	random zerometer ECG scales test strips three-channel electrocardio- graph PHC questionnaire	in Green Cross building; by re- ceptionists, dis- trict nurses and general practiti- oners
Assignment to care group	AG-group (n=155) biannual check- up group (n=83) annual check-up group (n=81) no-advise group (n=17)	does not apply	according to risk profile (see Appendix B)	does not apply
Supplementary study September-October 1975	AG-group (not control group) (n=152)	always serum creatinine; if indicated: renal function retinal lesions sclerosis of peripheral vessels	according to NIGP schema „increased blood pressure" *(Van Veen)*	in surgery by appointment; by the general practitioner
Individualized care	AG-group (n=152) biannual check- up group (n=83) annual check-up group (n=81)	based on risk factors found idem idem	medication and/or instruction check-ups check-ups	in surgery by ap- pointment; by the general practiti- oner

* For reader convenience, numbers are given in the „Population" column, in anticipation of the results.

study was to individualize the care provided: by searching for indications of causes and consequences of hypertension and by verification and differentiation of the other screening results, indications for an individual therapy plan could be found.
A survey of the various phases of the study is presented in *diagram 1.*

Results

Response. The target population for the pre-screening consisted of 1824 men aged 20-65 years; 1524 men turned up for examination, which is a response rate of 83,5 percent. The age group 35-49 years showed the same response rate. The PHC-project reported a response rate of 80 percent for the corresponding sex and age group. In this context it is to be noted that the pre-screening was less comprehensive than that in the PHC-project.
The target population for the screening consisted of:
– 180 men serving as control group; of these, 164 turned up for examination (response rate 91 percent);
– 365 men with hypertension found at pre-screening (HB-group); of these, 336 men turned up (92 percent).
The age group 35-49 years likewise had a response rate of 92 percent, while the men aged 35-49 from the PHC-project who were considered for re-examination, showed a response rate of 90 percent.

Blood pressure. In the pre-screening phase, 24 percent of the men examined proved to have blood pressure values of ≥ 150 mm Hg systolic and/or ≥ 95 mm Hg diastolic. In 55 percent of cases the blood pressure measured was < 140/90 mm Hg. The percentual distribution of the blood pressure scores at screening of the HB-group is shown in *table 1.* This table indicates that 34 percent could after all be considered normotensive. This finding is consistent with the frequently observed phenomenon that repeated blood pressure measurements generally show a decreasing trend.
On the other hand, 5 percent of the control group proved to have a blood pressure score of 5-6 at screening; the others were again normotensive (blood pressure scores 1 through 4).

Cholesterol. The percentual distribution of the risk scores for the second most important factor – serum cholesterol – is presented in *table 2.* In this respect the HB-group proves to score higher than the control group. This can be explained on the basis of the positive correlation between blood pressure and serum cholesterol level (*Stamler et al.*).
Comparison of the mean cholesterol scores in Heer with those in the PHC-project reveals a small difference:
PHC-group 6.2 mmol/1; HB-group 6.1 mmol/1; control group 6.0 mmol/1.

Table 1. Blood pressure scores in the HB-group and the control group during screening (percentual distribution).

Blood pressure scores	HB-group (n = 336)	Control group (n = 164)
≤ 4 (≤ 140/90)	34	95
5-6 (140-159 and/or 90-99)	41	5
≥ 7 (≥ 160 and/or ≥ 100)	25	–

Table 2. Cholesterol scores in the HB-group and the control group during screening (percentual distribution).

Cholesterol scores	HB-group (n = 336)	Cntrol group (n = 164)
≤ 4 (≤ 6.2 mmol/l)	64	71
5-6 (6.2-7.2 mmol/l)	25	22
7 (≥ 7.3 mmol/l)	11	7

Table 3. Smoking scores in the HB-group and the control group during screening (percentual distribution).

Smoking scores	HB-group (n = 336)	Control group (n = 164)
4 (< 5 cigarettes/day)	44	45
5-6 (5-24 cigarettes/day)	35	36
7 (> 25 cigarettes/day	21	19

Table 4. Prevalence (in percents) of X-factors in the HB-group and the control group during screening.

X-factors	HB-group (n = 164)	Control group (n = 164)
Medicated hypertension	6.3	0
ECG changes	5.4	2.4
Angina pectoris	4.2	1.2
Imminent myocardial infarction	3.6	1.2
History of myocardial infarction	0.6	3.1
Medicated diabetes	0.3	0

Smoking. The third major risk factor is cigarette smoking. *Table 3* shows that the HB-group and the control group hardly differ in this respect. This is consistent with the fact that there is no correlation between blood pressure and smoking (*Stamler et al.*). Comparison of the smoking scores of the PHC-group, HB-group, and control group in age group 35-49 years shows that in Heer there are more heavy smokers than in the PHC-group (the respective percentages with a score of ≥ 7 being 15, 27 and 20).

X-factors. An X-factor is defined as a factor which entails an extra risk and has a potentiating effect on the risk profile of the major risk factors. Six of these X-factors were distinguished in the PHC-project. The prevalence of these six factors in the HB-group and the control group is shown in *table 4.* The following notes serve to ensure proper understanding:
– the item „hypertension treated by medication" was obtained from the PHC-project questionnaire, supplemented with information available to the general practitioner;
– the percentages given for ECG changes suggestive of possible or probable ischemia refer solely to cases in which the changes are not related to a history of myocardial infarction;
– angina pectoris and imminent myocardial infarction were established with the aid of the PHC-project questionnaire's passages based on the Rose questionnaire (*Rose and Blackburn*); here again, the percentages given refer solely to cases in which the changes are unrelated to a myocardial infarction in the history;
– as regards the incidence of a history of myocardial infarction, the control group shows a rate of 3.1 percent; this is explained by the fact that the controls

were selected exclusively on the basis of age and absence of hypertension (untreated or treated by medication).
The value to be attached to the findings with regard to angina pectoris and imminent myocardial infarction is debatable. There are doubts about the reliability of such findings, obtained by means of a questionnaire (*Zeiner-Hendrikson*).
For two X-factors a comparison can be made between the PHC-group, the HB-group and the control group: ECG changes and hypertension treated by medication (*table 5*). It is to be borne in mind that, in the PHC-project, the percentage of hypertension treated by medication pertains to all men in the study, whereas the percentage of ECG changes pertains to the men in the general population aged 35-49 years. The table reveals that the HB-group shows the highest prevalence of ECG changes, even in comparison with the PHC group, despite the fact that in Heer the percentage was corrected for a history of myocardial infarction; we do not know whether this procedure was also carried out in the PHC-project. The relatively large percentage of hypertension treated by medication in the HB-group is partly a result of preselection as to hypertension (which in these cases was evidently treated with insufficient effect), and partly due to the fact that in our study more data on the patient were available than in the PHC-project.

Assignment to the care groups. The final result of application of *appendix 2* to the group studied, is presented in *diagram 2*. From the control group, 20 men were transferred to the AG-group (this group will be discussed separately from the AG-group that emerged from the HB-group).

An overview of the risk factor level is presented in *table 6,* which lists the means of all individual risk factors. Of course the AG-group shows the least favorable risk profile. Not entirely unexpected is the finding that this group is relatively old. The annual check-up group seems to be slightly better off than the biannual check-up group, except as to blood pressure. This is of course to do with the fact that blood pressure was the yardstick in the assignment to care groups. The relatively low average age of the biannual check-up group justifies this choice in retrospect. From the control group and the HB-group, all who did not belong were removed: patients (n = 20) subject to certain risks from the control group, and patients (n = 17) subject to only one risk from the HB-group.

Supplementary study. In the AG-group, the supplementary study consisted of an aimed history, physical examination and, if necessary, laboratory tests. This was done to establish whether the hypertension was essential and whether there were indications of complications. Another aspect of this study was verification of the other screening results. Although the scheme of the Netherlands Institute of General Practitioners is intended as a strategy in the approach to hypertension, the normotensive patients (7 percent of the AG-group) were likewise submitted to a supplementary study, in which the history-taking mainly served the purpose of verification and differentiation of the risk factors revealed by screening.
Of the 155 patients in the AG-group, 152 reported for the supplementary study; this is a response rate of 98 percent. In all these 152 cases a history was taken and a physical examination made. Supplementary laboratory tests were performed in 95 instances. All in all, the laboratory work comprised: determination of serum creatinine, serum potassium, vanillylmandelic acid, creatinine clearance, intravenous pyelogram and urinary culture; in 47 percent of cases laboratory work was restricted to determination of serum creatinine. For eighteen persons, recent data from the specialist were available. In the remaining thirty-nine cases, no determinations were made; these men all had a blood pressure score of ≥ 5. Thirty-three men were referred to an ophthalmologist for funduscopy.
The overall results of the supplementary study are presented in *diagram 3.*
The supplementary study yielded positive results in 30 percent of cases, although probable organic lesions were found in only 2 percent; a previously undetected disorder of renal function was found in one person. Of the eighteen persons without peripheral vessel pulsations, five had distinct complaints and were referred; four of them underwent angioplasty.
An important finding is that the group of persons in whom supplementary findings were in some way positive, had a higher average age than the group with negative findings (51 versus 44 years) and included more high blood pressure scores (70 percent versus 50 percent with a blood pressure score of ≥ 7).
In a follow-up on the positive screening results with regard to angina pectoris (a total of eight men in the AG-group), six were found to have a negative history in this respect.
The tracing of possible complications and verification of the screening results served the purpose of finding indications for an individual therapy plan. Since all persons in the AG-group received hygienic advise, the ..yield" should be most visible in the medication. After the supplementary study, forty-seven of the 153 persons (31 percent) were given antihypertensive medication. Twenty-three of these, however, had been or were already being treated with such drugs; the pure yield in this respect was therefore twenty-four persons.

Table 5. Prevalence (in percents) of ECG changes and medicated hypertension in the PHC-project, the HB-group and the control group (only age 35-49).

	PHC-project	HB-group (n = 137)	Control group (n = 67)
ECG changes	4.5*	5.1	1.5
Medicated hypertension	1.5**	0.8	0

* n = 1604 ** n = 2616

Table 6. Mean values for all risk factors, according to care group.

	Control group		HB-group			
	Risk group (n = 20)	Others (n = 144)	No advise (n = 17)	Annual check-up (n = 81)	Biannual check-up (n = 83)	Advise and guidance (n = 155)
Blood pressure (mm Hg)	124/78	120/77	133/82	131/81	142/90	152/98
Smoking (cigarettes/day)	18	15	2	15	12	17
Cholesterol (mmol/l)	6.7	5.6	5.4	5.7	5.5	6.3
Relative weight (percents)	97	100	98	107	104	108
Physical activity score	3.8	3.7	2.5	3.6	3.5	4.0
Age in years	47	43	40	44	39	46

Effectiveness and efficiency

As pointed out in the introduction, it is important to evaluate a health project like the one under discussion in terms of effectiveness and efficiency. Effectiveness involves the extent to which the aim

Diagram 2. Assignment to care groups.

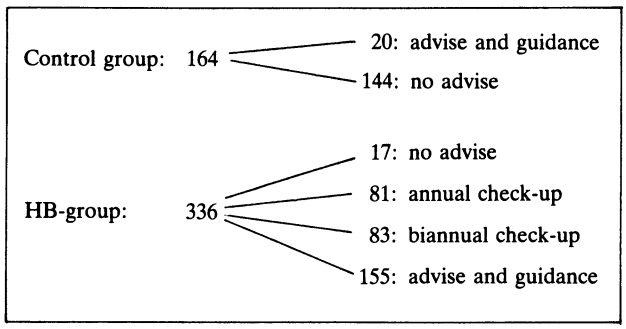
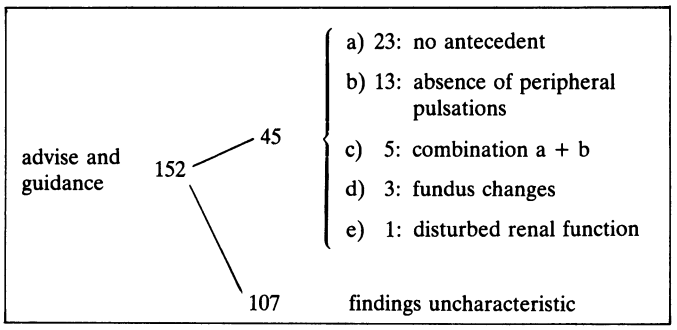


Diagram 3. Results of supplementary study.



is achieved (the yield); efficiency concerns the question as to the cost at which the aim is achieved *(Postcript)*. Another important point in evaluation is the feasibility of the procedures used, i.e. the question whether the procedure can be applied in the average general practice. This point will receive due attention in the discussion.

Pre-screening. With regard to pre-screening, the summoning method used can be described as effective in view of the response rate of 87 percent. The expenses made for the written summons (printing, postage and clerical salary) were fl. 7000. The cost of summoning per respondent was therefore about fl. 5; the efficiency of the method can therefore be described as good.

The yield of pre-screening was determined on the basis of the number of men with previously undiagnosed hypertension, proceeding from the data on the general practitioner's care record over the preceding five years. A total of 365 men were found to have a blood pressure reading exceeding 150 mm Hg systolic and/or 95 mm Hg diastolic; in 257 of these cases this had been previously unknown. The yield of pre-screening is defined as the ratio between the unknown (257) and the total number of cases (365) and is therefore 70 percent. This result strikes us as a clear argument for the effectiveness of the pre-screening.

The total cost of pre-screening, including the expenses for summoning, amounted to fl. 14,000, that is fl. 55 per person with a previously unknown blood pressure in excess of 150 mm Hg systolic and/or 95 mm Hg diastolic. In the absence of objective criteria, one may of course debate the question whether this per capita cost is an argument for the efficiency of the method. In our opinion it is.

Screening. The yield of screening is less easily established. After all, the focus on ,,hypertension" was extended to include cardiovascular risk factors. It can be fairly objectively established whether increased blood pressure and ECG changes are present, but with regard to other risk factors this is much more difficult. Of course the physician is often aware that a patient is smoking too much or is overweight, but in most cases he does not record such facts as risk factors, and his awareness does not lead to an aimed history. In the context of a clearly defined care scheme, however, such risk factors are indeed systematically recorded. In this sense, detection of all other increased risks might be regarded as ,,yield".

When we accept this argument, we find that the screening of 336 men led to the identification of a total of 209 men with a previously unknown increased risk, that is a yield of 62 percent. However, this figure is biased by the fact that all men with high blood pressure were in fact known after pre-screening; correction of the yield for the men with only high blood pressure results in a figure of 141 men with a previously unknown increased risk: a proportion of 42 percent. In this respect, too, effectiveness was therefore fairly high.

The total expenses made for screening were fl. 32,000, major items being ECG registrations (fl. 14,000), cholesterol determinations (fl. 7500) and clerical work (fl. 7500). The cost per individual ,,yield case" was therefore about fl. 150. It should be noted that these sums include the expenses for the control group. Since in a normal situation there is no need for a control group, this sum should be revised to about fl. 100 per unknown at-risk patient.

The ECG registrations accounted for a large part of the expenses; they yielded eighteen persons with changes suggestive of possible or probable ischemia. Five of these were already known as such. The amount spent per unknown at-risk patient identified is therefore about fl. 1100.

Supplementary study. As already explained, the yield of supplementary study in terms of persons with complications is rather low: eight persons. However, the twenty-four persons given medication on the basis of the supplementary findings should also be regarded as yield. Effectiveness, therefore, is rather low: supplementary information was obtained on thirty-two of the 152 persons (21 percent). The expenses made for this study* were fl. 2800, which works out at about fl. 90 per unknown at-risk patient.

Total expenses. The total expenses made for pre-screening, screening and supplementary study were fl. 40,000; but in addition there were some more or less concealed expenses. Hardly concealed was the time spent on the project by the general practitioners. They spent no time on pre-screening but the screening took them 20 minutes per patient: this makes a total of 170 hours for 500 patients (115 hours without control group). The supplementary study took 45 minutes per patient, that is a total of about 120 hours. The total time spent by the practitioners was therefore about 300 hours. Given an hourly remuneration of fl. 90, this means that the total sum should be increased by some fl. 27,000.

Estimating the total yield to be 209 persons, this means a cost of about fl. 370 per at-risk patient identified. Without a control group this would have been about fl. 335. As such, this indicates a fair degree of efficiency. However, a more comprehensive view of the question can only be obtained when we know whether these 209 men with an unknown increased risk can be treated with any degree of success. But this subject is not within the scope of this study.

* Determination of creatinine in 84, potassium in 23, creatinine clearance in 5 and vanillylmandelic acid in 1 case; intravenous pyelography in 5 cases; 33 referrals to the ophthalmologist.

Finally a few remarks may be made about the approach taken: via hypertension. After completion of the entire procedure the prevalence of hypertension (blood pressure score ≥ 5) was found to be 14.6 percent, which is within the limits reported in the literature *(Arntzenius and Styblo)*. Of the hypertensive men, 56 percent were not known as such to the family doctor. Of the 44 percent known as hypertensives to the family doctor, one-third were – at least according to the anamnestic data – receiving (evidently inadequate) antihypertensive medication at the time of the study. These findings clearly point in the direction of *Freis'* hypothesis of a ,,half-half disease", and indirectly give a fair indication of the effectiveness of screening in this respect.

Of course persons with risk factors other than hypertension were lost in the pre-screening. On the basis of a comparison with the control group and in view of the results of the PHC-project, we believe that a few tentative conclusions can be reached in this context. We certainly missed the increased risk of smoking in pre-screening; this applies to a lesser extent also to the increased risk of high serum cholesterol values, but it applies hardly, if at all, to the ECG changes *(tables 3, 4 and 6)*. Apart from this, blood pressure is more tractable to individual therapy than hypercholesteremia or smoking.

Discussion and conclusion

The purpose of this health care project was to trace, within a relatively short time, those individuals in a male population aged 20-64 years that were hypertensives, and to test these individuals for other cardiovascular risk factors. We are confident that this aim was achieved in a fairly effective and efficient way.

However, the feasibility of this procedure in an average general practice seems doubtful. The procedure used requires substantial clerical support, for one thing (provided by the faculty in this case), and much extra time spent by the general practitioner.

The pre-screening was highly effective and efficient, but its feasibility in other situations is low: the summoning method involves much clerical work, the pre-screening work requires substantial manpower (students, receptionists).

The screening could likewise be described as effective and efficient. The principal factors reducing feasibility were: the time spent by the general practitioner (115 hours in three months), the extra-expenses (ECG, cholesterol) and the considerable clerical work.

In this respect the supplementary study is relatively less problematic: the time required (120 hours in three months) and the clerical work involved were the factors which reduce feasibility. The supplementary study was neither very effective nor efficient. Along with the ECG registrations, this is evidently the weak spot in the procedure. In our opinion ECG registration should take place in a later phase and on the basis of better-defined indications. The supplementary study, too, should be based on more indications to be effectively and efficiently used in this fascinating but difficult area of transition between epidemiology and individual health care.

Reverting finally to the problem definition formulated in the introduction – the contribution of primary health care to the identification of cardiovascular risk factors – we conclude that the group approach used in this project may seem effective and efficient, but is not very feasible in an average general practice. This means that screening and guidance cannot be done within the same organizational set-up. The screening of large groups should be done by such agencies as public health clinics (always provided that screening of cardiovascular diseases is a sensible undertaking). Screened persons should be returned to primary health care (that is in most cases to the general practitioner) for guidance and individual therapy.

Another approach, however, is also possible: case-finding as described by *Van der Feen*. Every person presenting in the consulting-room could be screened for hypertension, and screening for other risk factors could then take place at a diagnostic center or a public health clinic. In that case a diagnostic center – as link between primary and secondary health care – is to be preferred for two reasons: in many ways such a center is closer to the general practitioner, and in addition such a set-up prevents an overloading of secondary health care agencies with clinically uncharacteristic cases.

Summary. What can the general practitioner do about identification of cardiovascular risk factors? In an effort to contribute to an answer to this question, a screening project was set up in an associates' practice in Heer-Maastricht. Hypertension was the focus chosen. All 1824 men aged 20-65 were summoned, and 1524 responded. In a pre-screening these men were examined with special reference to increased blood pressure. Those with blood pressure readings exceeding 150 mm Hg systolic and/or 95 mm Hg diastolic were then screened with regard

Appendix 1. Risk factor scores.

Score	Cholesterol (mmol/l)	Blood pressure* (mm Hg)	Smoking (cigarettes/day)	Relative weight**
1-4	≤ 6.2	< 140 and < 90	< 5	< 110 percent
5	6.2 - 6.6	140-149 and/or 90-94	5-9	110-119 percent
6	6.7 - 7.2	150-159 and/or 95-99	10-24	> 120 percent
7	7.3 - 7.7	160-179 and/or 100-104	25-39	
8	7.8 - 10.3	180-199 and/or 105-114	≥ 40	
9	≥ 10.4	≥ 200 and/or ≥ 115		

* over age 50, only the diastolic value counts

** $\frac{\text{weight}}{\text{height-100}}$ 100.

Appendix 2. Assignment to care groups.

	No advise	Annual check-up	Biannual check-up	Advise and guidance
Blood pressure score ≥ 6			Risk scores 6 5+6 6+6	Higher scores or higher combinations
Blood pressure score 5			Risk scores 8 No X-factor	8, 9 or X-factor
Blood pressure score ≤ 4	All other scores ≤ 4 No X-factor	Risk scores 5, 6 or 7 No X-factor		8, 9 or X-factor
Control group	Risk scores ≤ 8			8, 9 or X-factor

to the other cardiovascular risk factors according to the protocol of the Public Health Clinic Project ,,Heart Diseases" (N = 336). The patients were then assigned to care groups on the basis of the risk factors identified. The group with the least favorable risk profile submitted to a supplementary study according to the protocol of the Netherlands Institute of General Practitioners.
Due to the focus chosen, persons with an increased risk due to smoking and increased serum cholesterol level were lost in the pre-screening, but both the effectiveness and the efficiency of the study were thus enhanced. The procedure on the whole could be described as fairly effective and efficient. 14 percent of all men involved in pre-screening had a previously unknown increased risk; the cost per risk case was fl. 335 (about $ 160). The ECG study and the supplementary study were relatively ineffective and inefficient. However, the group approach can only be effected in a general practice if substantial clerical support is available. Consequently, a more incidental approach seems more suitable for identification of increased blood pressure patients in general practice. The other risk factors can be screened elsewhere, for example at a diagnostic center.

Samenvatting. Het opsporen van risicofactoren voor hart- en vaatziekten in een huisartspraktijk. Wat kan de huisarts doen aan de opsporing van risicofactoren voor hart- en vaatziekten? Om een bijdrage te leveren aan de beantwoording van deze vraag werd een screeningsproject opgezet in een associatiepraktijk in Heer-Maastricht. Als invalshoek werd gekozen voor verhoogde bloeddruk. Alle 1824 mannen van 20-65 jaar werden opgeroepen; hiervan gaven er 1524 aan de oproep gehoor. Deze mannen werden in een pre-screening onderzocht op verhoogde bloeddruk. Degenen die een bloeddruk hadden van meer dan 150 mm Hg systolisch en/of 95 mm Hg diastolisch, werden vervolgens gescreend op de overige risicofactoren voor hart- en vaatziekten volgens het protocol van het Consultatie Bureau Project ,,Hartziekten" (N = 336). De patiënten werden vervolgens ingedeeld in zorggroepen op basis van de gevonden risicofactoren. De groep met het ongunstigste risicoprofiel onderging een aanvullend onderzoek volgens het schema van het Nederlands Huisartsen Instituut.
Weliswaar gingen door de gekozen invalshoek bij de pre-screening personen met een verhoogd risico door roken en cholesterol verloren, maar de doeltreffendheid en doelmatigheid van het onderzoek werden hierdoor bevorderd. De gevolgde werkwijze kon als geheel als redelijk doeltreffend en doelmatig gekenschetst worden: 14 procent van alle mannen die deel hadden genomen aan de prescreening, had een onbekend verhoogd risico; de kosten bedroegen per risicogeval fl. 335 (= ± $ 160). Het ECG-onderzoek en het aanvullend onderzoek waren naar verhouding ineffectief en inefficiënt. De groepsgewijze benadering is in een huisartspraktijk echter slechts te realiseren, indien aanzienlijke administratieve steun beschikbaar is. Daarom lijkt een incidentele aanpak meer aangewezen als methodiek bij het opsporen van verhoogde bloeddruk. De overige risicofactoren kunnen dan elders – bijvoorbeeld in een diagnostisch centrum – gescreend worden.

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Editorial postscript

In epidemiology the terms „effectiveness" and „efficiency" have acquired a very special meaning by adopting them as criteria in the evaluation of screening. Seelen et al. use these terms in their report on the initial stages of the process. This could create considerable confusion.

In epidemiology, the ruling that a proposal to screen must be „effective" means that each proposal should be treated as a hypothesis and tested scientifically, to see whether screening, followed by relevant therapy, will alter the natural history of the condition significantly for the better in a reasonable proportion of those screened. Normally the test should be a randomized controlled trial. The rules on „efficiency" derive from the phrase „reasonable proportion" as a definition of „effective". „Efficiency" covers serveral subrules which partially overlap: response to screening, treatment-adherance, cost and acceptability to providers of care and their clientele.