Preventive care in the elderly

Studies on cardiovascular disease and hearing loss

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Studies on cardiovascular disease and hearing loss

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It is better to be healthy than ill or death. That is the beginning and the end of the only real argument for preventive medicine. It is sufficient. Geoffrey Rose

Voor mijn ouders

Voor Leonie

Contents

Manuscripts based on studies described in this thesis

Chapter 1

P.J. van den Berg, A. Prins, A.W. Hoes. Health checks in the elderly, promises and unresolved areas. *Submitted for publication.*

Chapter 2

P.J. van den Berg, C.L. van Dalsen, R.A.M. de Rooij, A. Prins, A.W. Hoes. Cardiovascular health check in the elderly in one general practice: does it offer new information and lead to interventions? *Family Practice, in press.*

Chapter 3

P.J. van den Berg, A. Prins, A.W. Hoes. Is repeating of cardiovascular health checks in the elderly effective? *Submitted for publication.*

Chapter 4

P.J. van den Berg, A. Prins, A.W. Hoes. The potential of cardiovascular drug review in older people. *Submitted for publication.*

Chapter 5

P.J. van den Berg, A. Prins, J.A. Kors, A.W. Hoes. Is electrocardiography a useful screening test in general practice? *Submitted for publication.*

Chapter 6

P.J. van den Berg, A. Prins, H. Verschuure, A.W. Hoes. Effectiveness of repeated screens for hearing loss in the elderly. *Audiology, in press.*

Introduction

Need for prevention?

One of the major achievements of medicine in this century is its contribution to the increase in life expectancy at birth. Nowadays, this is reflected in the growing number of older adults. Unfortunately, part of this group will spend old age in poor health. The consequences for older individuals, their care givers and the society at large, raises the question whether the occurrence of disease in later life can be postponed or even prevented.

Goals of prevention

Prevention of disease can have different aims. Firstly, it can be directed at preventing premature death. Secondly, prevention can aim at reducing morbidity. If our preventive programmes are successful, morbidity may be compressed to a short period at the end of life. However, if preventive programmes also increase life expectancy, expansion of morbidity may occur. Thirdly, preventive efforts can try to improve functional status and maintain independence of older adults.

Prevention in the elderly

Ideally, prevention of morbidity and mortality should start early in life, before a life long exposure to risk factors has caused irreversible damage. Nevertheless, many preventive measures are beneficial at old age. It should be recognised that in later life a similar relative reduction in the occurrence of, for example cardiovascular, disease often has a more substantial impact on the absolute number of cases of disease that can be prevented, since the absolute risk of most diseases is higher in older compared to younger subjects. Towards the end of life, the first goal of prevention, the reduction

of premature death, is progressively replaced by the other two goals of prevention; the prevention or postponement of morbidity and the improvement of quality of life.

Structured preventive care offered to older adults?

Different health care systems offer diverging preventive care for older adults. In the United Kingdom, the health status of patients of 75 years is assessed yearly during a screening examination by their general practitioner. In the Netherlands, where no such structured form of preventive care is offered to the elderly, case finding, i.e. a targeted screen for risk factors of disease in those visiting the general practitioner, is advocated by many. A lack of research data contributes to these divergent policies.

Objective of this thesis

This thesis aims at investigating the screening yield and feasibility of two distinct types of preventive care that can be offered to older adults by their general practitioner; screening on cardiovascular risk factors and screening on hearing loss. Screening on cardiovascular risk factors represents screening efforts directed at reducing morbidity and mortality, while screening on hearing loss aims at improving functional status.

In chapter 1 we discuss the promises and drawbacks of these two types of screening by applying the criteria of Wilson.

Chapter 2 to 5 describe several studies we conducted to establish the value of screening older adults for cardiovascular risk indicators. The cardiovascular screening examination, which was offered to all adults aged 60 and over (n=1002) enlisted in one group practice, is described in chapter 2. The number of risk factors observed during the screening examination but not recorded in the patient file at that time is taken as the screening yield. We offered a repeated screening examination to the same group of patients five years later to explore the desirability of repeated screening. (Chapter 3) The screening yield of the repeated screening examination is assessed. Next we focus on one aspect of a cardiovascular screening examination that is often advocated in the Netherlands, although empirical evidence on its value is virtually lacking; the review of cardiovascular medication use by older adults. A cardiovascular

screening examination may include electrocardiography, notably since computerised interpretation programs have become available which facilitate the use of ECGs by general practitioners. Chapter 5 describes the screening yield of an electrocardiographic screening performed among 489 older adults. Furthermore, the consequences of the detection of previously unknown electrocardiographic abnormalities are reported.

Screening on hearing disorders is discussed in chapter 6. The effects of screening by pure tone audiometry on the issuing of hearing aids is determined after a single and repeated audiometric screen after five years.

Finally, chapter 7 critically discusses the issues addressed in this thesis. As a guideline for the discussion, the controversies of screening which were identified by Schaapveld et al. are reviewed with reference to the results of our studies.

Chapter 1

Health checks in the elderly: promises and unresolved areas

Introduction

During the last decades, western countries have witnessed a growth of their older population. Nowadays, people live longer than ever before. (1) In the Netherlands, life expectancy at birth in 1994 was 2.1 year higher for men and 1.1 year higher for women compared to 1980 and is predicted to have risen by 2.5 years for men and by 1.0 year for women by 2015. (2) However, not all older adults spend those extra years in good health. Of their 74.3 years, which is the life expectancy at birth in the Netherlands, men will spend on average only 60.1 years in good health. (3)

In view of this seemingly inevitable burden of disease, efforts to postpone disease and preserve good health in the elderly are becoming more important. Although major diseases of later life are associated with the presence of risk factors in earlier life, preventive efforts can still be fruitful at an older age. (4, 5) Prevention at older age aims at increasing the ability of older adults to live independently by offering interventions to reduce or postpone mortality and the occurrence of disease or to improve functional status. For example, the treatment of hypertension is directed at the latter two endpoints whereas the prescription of a hearing aid is expected to reduce disability and handicap. Generally, the older a person becomes, the more the aim of prevention shifts toward improvement of functional status. (6)

The usefulness of offering preventive services to older persons in primary care has been vigorously debated. In the UK, the Royal College of General Practitioners advocates more emphasis on preventive care for the elderly. This is in line with the obligation general practitioners in the UK have to perform health checks as a part of their contract with the NHS, which in the early nineties considered prevention a powerful tool to reduce health care costs. However, in clinical practice the effort which practices invest in performing the contractual health checks varies greatly. (7-9) Apparently, most general practitioners are not fully convinced of the benefits of preventive care in the elderly and consider it superfluous.

The present article addresses this issue by discussing the promises and unresolved areas of preventive care for the elderly in general practice. As a guideline for the desirability of screening initiatives, we use Wilson's criteria. (10) (Table 1) Although these criteria were published in 1965, they remain relevant today and are cited in somewhat revised form in many national guidelines involving screening. (11-14) Although the possibilities for preventive care in older adults are numerous, this article

will be restricted to discuss the prevention of cardiovascular disease, which is the main cause of morbidity and mortality in the elderly, and the prevention of the consequences of hearing loss, which is a major cause of disability and handicap at older age, with reference to these criteria.

Table 1 Wilson's criteria for screening.

The disease	should be an important problem
	there must be a recognised latent or early symptomatic stage
	the natural history must be understood
The screen	a suitable test or examination must be available
	the test must be acceptable to the population screened
	screening must be a continuous process
Follow-up	facilities must exist for assessment and treatment
	there must be an accepted form of effective treatment
	there should be an agreed policy on whom to treat
Economy	the cost must be economically balanced in relation to possible expenditure on medical care as a whole

Prevention of cardiovascular disease

The disease should be an important problem.

This condition is clearly met by cardiovascular disease, as it is the most common cause of mortality and is one of the leading causes of limitations of activities in later life. Although in developed countries age-adjusted cardiovascular disease mortality rates tends to decrease since the seventies, it remains the most important cause of death. For example, in the Netherlands cardiovascular disease is responsible for 39% of all deaths, while neoplasms cause 27% of all deaths. (15)

One of the reasons for the decline in cardiovascular mortality is the improved case fatality after myocardial infarction. However, survivors of myocardial infarction are at

high risk for other cardiovascular morbidity, particularly heart failure. A decrease in cardiovascular mortality is not matched by a equal decrease in morbidity, as is illustrated by the increase in hospital admissions because of heart failure in this age group. (16)

There must be a recognised latent or early symptomatic stage

The existence of subclinical cardiovascular disease can be demonstrated in a number of ways. Examples include the presence of certain ECG abnormalities, echographically determined intima media thickness or stenosis of the carotid artery, and a low ankle/arm index. These objective measures of subclinical disease have been shown to independently predict mortality in older adults. (17)

Nevertheless, although cardiovascular disease can be identified before its clinical stage, the strategy of preventive cardiology is directed at detecting those with cardiovascular risk factors. The fact that many of these risk factors can be modified explains their importance for clinical practice. Risk factors discussed in this thesis include hypertension, hypercholesterolaemia and diabetes mellitus. In addition, however, inappropriate use of cardiovascular medication is considered a risk factor since it significantly influences the risk of cardiovascular disease. (18)

Risk factors do not, by definition, predict cardiovascular disease in older adults in the same way as in younger adults. Generally, the association between the risk factor and cardiovascular disease becomes somewhat weaker as one ages, probably because of selective survival. Because of the high absolute risk for cardiovascular disease in older adults, however, even a weaker association is clinically significant.

The natural history must be understood

The natural history of cardiovascular disease has been studied extensively and the prognosis of its different forms is rather poor. The first presentation of cardiovascular disease is fatal in one third of all cases. The prognosis after myocardial infarction is variable and unfavourable when pre-existing cardiovascular conditions are present. (19) Heart failure is highly lethal, as approximately one third of patients dies within two years. (20) Peripheral arterial disease is progressive, leading not only to

amputation and arterial reconstruction in 8% of those with claudication over a five year period, but has also been associated with an increased risk for other cardiovascular events. (21) Stroke is fatal in 30% and only 72% survive the following four years. (22, 23)

A suitable test or examination is available

Tests that can be used in general practice for cardiovascular risk assessment include history taking, measurement of blood pressure, serum cholesterol- and glucose concentration, electrocardiography and measurement of the ankle/arm index. In contrast to the other tests, the latter two tests are not widely used by general practitioners in the Netherlands.

The test must be acceptable to the population screened

Because many cardiovascular screenings tests are also part of the normal care of general practitioners, patients are familiar with them. Preventive studies including such tests generally reach response rates of 80% among middle aged participants. The response rates among older adults vary. In two comprehensive screening programmes of those above 75 years in the UK, response rates were 64% and 82%. (9)

Screening must be a continuous process

Since general practice is characterised by continuity of care, screening in general practice should be able to meet this criterion. For example, general practitioners in the UK are contractually obliged to perform health checks at predefined intervals of adults above 75 years of age. (7) Likewise, the opportunistic screening advocated in the Netherlands is firmly based in guidelines of the Dutch College of General Practitioners, which mention screening intervals. (24) Nevertheless, there is a significant variation between general practitioners in preventive activities.

Facilities must exist for assessment and treatment

A potential advantage of screening in general practice is the close link between assessment and treatment. However, the feasibility of screenings programmes performed by general practitioners is debated. The workload associated with screening and, at least equally importantly, the follow-up should not be underestimated. Additional investments in general practice to facilitate preventive care may be needed.

It should be noted, however, that preventive care is only one of the new challenges facing general practice today. For example, the ageing of the population itself will inevitably lead to a higher demand for primary care. Thus, improvement of the organisation of primary care seems mandatory to meet future requirements.

There must be an accepted form of effective treatment

The efficacy of drug treatment of cardiovascular risk factors in older adults has been investigated in many randomised controlled trials. (5, 25-36) Table 2 summarises the major results of these trials. It is evident that cardiovascular morbidity and mortality can be postponed in older people. For example, a meta analysis of trials on the treatment of isolated systolic hypertension showed that during approximately five years of treatment cardiovascular morbidity and mortality was reduced by 34 percent. In absolute terms, this implied that in one of every 19 patients treated by antihypertensive drugs for five years a cardiovascular event would be prevented. (5) Another example deals with the treatment of hypercholesterolemia in adults aged 55-65, without a history of myocardial infarction. In these patients, treatment over a 4.9 year period with pravastatine reduced the occurrence of non fatal myocardial infarctions and deaths from cardiovascular disease by 27 percent. However, because the absolute risk of cardiovascular disease was low in this group, the relative reduction translated into a less impressive absolute risk reduction; in only one out of forty patients a cardiovascular event would be prevented during the 4.9 years of treatment. (25)

Table 2. Efficacy of drug interventions on cardiovascular risk factors in older adults.

RRR= Relative Risk Reduction of the treated versus the placebo group in percentages during the follow up time of the trial.

ARR= Absolute Risk Reduction of the treated versus the placebo group in percentages during the follow up time of the trial.

NNT= Number of patients which must be treated for five years to prevent a primary endpoint in one of them.

Risk factor	Intervention	Trial or Meta analysis	Primary Endpoint	Follow up time	Age group	RRR (%)	ARR (%)	NNT (5 years)
hypertension, including isolated systolic hypertension	anti-hypertensive drugs	Mulrow et al (5)	cardiovascular morbidity and mortality	~ 5 years	60-80"	29	5.1	20
isolated systolic hypertension only	anti-hypertensive drugs	Mulrow et al (5)	cardiovascular morbidity and mortality	~ 5 years	60-80"	34	5.3	19
hypercholesterolaemia	statins	WOSCOPS (24)	non fatal mi and deaths from CVD	4.9 years	55-65	27	2.5	40
diabetes mellitus	strict glycaemic control	UKPDS 33 (25)	myocardial infarction stroke	10 years	25-65 years	13-22 -2.0-0.6	0.21-0.38 -0.20-0.06	476-263 n.a.-1666
myocardial infarction	ß blocker	BHAT (26) Norwegian Study (27)	all cause mortality	25 mnth 33 mnth	60-69 years 20-75 years	36 39	5.0 6.9	8 8
	aspirin	Antiplatelet Trialists (28)	vascular events	27	?S	21	3.6	13
	statins	CARE (30)	major coronary events	5 years	60-75 years	27	7.0	14
myocardial infarction and hypercholeserolaemia	statins	4S (29)	major coronary events	5.4 years	60-70 years	29	7.3	15

myocardial infarction and left ventricular dysfunction	ACE inhibitors	AIRE (31) SAVE (32) TRACE (33)	total mortality	15months 42months 24-50 mn	65 years^ >64years ≥65years	27 25 17	6.0 8.2 7.2	4 8 6-12
atrial fibrillation	aspirin	AFI (34)	Stroke	1 year	70 years^	21	1.8	11
	coumarine derivates	AFI (35)	Stroke	1 year	67%≥65yrs	68	3.1	6

" : Most patients between 60-80 years. # : Absolute risk reduction in %. $: Age of participants not mentioned. The relative risk reduction in the group <65 however, was in the same range as in the group ≥65 years. ^ : Mean age.

Table 3. Efficacy of life style interventions on cardiovascular risk factors in older adults.

Risk factor	**Intervention**	**Meta analysis**	**Primary Endpoint**	**Age group**	**Effect**
Smoking	advice from physician	Sigaly et al (36)	abstinence from smoking ≥ 6 months	adults (few ≥ 60 years)	Odds of quitting: 1.73 (1.47-2.02)
Hypertension	dietary salt reduction	Midgley et al (37)	reduction in diastolic and systolic blood pressure	45-73 years	SBP: 6.3 (4.11-8.44) mm Hg per 100 mmol/l change* DBP: 2.2 (0.58-3.87) mm Hg per100 mmol/l change*
Elevated serum cholesterol	step 1 diet adviced by dietitians or occupational physicians	Ramsay et al (38)	reduction in total serum cholesterol concentration	adults, predominantly men, few ≥ 60 years	average reduction of 2%

* : The dietary intervention effect averaged a reduction of 95 mmol/d in daily sodium excretion for hypertensive subjects.

Only a few studies determined the effect of life style modifications on the risk of ardiovascular disease in older people with prevalent risk factors. (37-39) The majority of these studies were performed in the middle-aged (Table 3). First it should be emphasised that effects in older adults might differ from the results obtained in the middle aged. For example, in trials with dietary salt reduction, a greater reduction in blood pressure was observed in older compared to younger hypertensives. Nevertheless, it seems plausible that in accordance with the observations in drug trials, most beneficial effects of life style interventions demonstrated in middle aged people can also be expected to occur in older people, although the magnitude of these effects is not precisely known.

There should be an agreed policy on whom to treat

European and national guidelines and consensus reports agree on treatment of hypertension and isolated systolic hypertension for the prevention of coronary heart disease and stroke in subjects up to 80 years. (24, 40) The desirability of the use of lipid lowering drugs by older adults, however, is debated. (41) Recently, it was recommended in the Netherlands to restrict the prescription of lipid lowering drugs to patients with evidence of coronary heart disease or with an 10-year absolute risk of coronary heart disease exceeding 25%. Furthermore, the latter group should not be older than 70 to be candidates for lipid lowering drugs. (42)

The beneficial effects of coumarines or aspirin in patients with atrial fibrillation has been established, but a guideline of the Dutch College of General Practitioners on this subject is still lacking. (43, 44) Therapy to prevent the recurrence of myocardial infarction, for example by aspirin or lipid lowering drugs, is well recognised as useful in clinical practice. (40)

The cost must be economically balanced in relation to possible expenditure on medical care as a whole

Two important clinical trials assessing the efficacy of cardiovascular health checks in middle aged adults, the British Family Heart study and the OXCHECK trial, presented a cost effectiveness analyses. (45-47) The programme cost per life year

gained was strongly depended on the assumed duration of the risk reduction. The costs for an individual aged 50 ranged from £15 300 assuming an one year effect in the British Family Heart study to £ 900 assuming a 20 year effect after intervention in the OXCHECK study. When the costs of these interventions were compared with other interventions in the field of preventive cardiology, it was concluded that the effect of the cheaper OXCHECK study and the more expensive British Family Heart study should last at least 5 years and 10 years, respectively, to justify the costs. Unfortunately, there is only limited data on the duration of the effect of such interventions. It should be noted, however, that the beneficial effects of the OXCHECK study were still present after three years of follow-up.

Prevention of the consequences of hearing loss

The disease should be an important problem

Hearing disorders are prevalent among older people. Hearing impairment takes the second place in men and the third place in women on the list of most frequent chronic conditions of older people in the US. (48)

Hearing impairment is associated with social and emotional isolation and may even lead to depression and cognitive impairment. (49-51)

There must be a recognised latent or early symptomatic stage

By far the most frequent form of hearing disorder among older people is presbyacusis. Presbyacusis can be recognised on screenings tests or audiometric testing, even when patients are not aware of their hearing problems. (52) When patients first become aware of their hearing loss, they may adapt themselves over time to their lower hearing ability. It is only when patients or their surroundings do not accept the lower quality of life associated with hearing impairment, that hearing loss becomes clinically apparent to the treating physician.

The natural history must be understood

The prevalence of hearing impairment increases with age. (53) In an general practice based study, the prevalence increased from 23% in those aged 60-64 years to 76% in those over 80 years. (52) The rate of progression of hearing loss is studied in a few longitudinal investigations only. (54, 55) A recent study showed that after eight years, but not after three years, the deterioration of the hearing ability was statistically significant in a cohort of men aged 57-65 at the first audiometric screening. (56) The rate of deterioration was higher in older participants.

A suitable test or examination is available

To detect hearing loss, audioscopy or other portable screening audiometers, whispered voice tests and self assessment questionnaires are available. An audioscope is an hand-held otoscope with a build-in audiometer and capable of delivering a 20, 25 or 40 dB tone at frequencies of 500, 1000, 2000 and 4000 Hz.

The whispered voice test is performed by whispering six words at a fixed distance and asking the patient to repeat those words. Of the self assessment questionnaires, the ten item Hearing Handicap Inventory for the Elderly – Screening Version (HHIE-S) is studied most extensively.

Audioscopy will invariably detect hearing loss more than 40 dB, but does not measure hearing ability in noisy environments. Questionnaires perform better in the detection of hearing handicaps, and may therefore better predict hearing aid use after a positive screening result. However, they might miss successful hearing aid candidates and may not be preferred by patients. (57, 58) The whispered voice test is easy to apply by general practitioners and is recommended in the UK to use as a screening test as part of the compulsory screening of older adults. (7) Unfortunately, its validity in a general practice setting has not been established. (59)

Thus, all three screening tests have their own merits and a combination of tests may further improve the detection rate of hearing loss (57).

The test must be acceptable to the population screened

Pure tone audiography, audioscopy and the whispered voice test are used as screening devices in general practice. Respons rates of 80% and 73% have been reported for studies in general practice. (60, 61) The acceptance of questionnaires when distributed by mail depends on the amount of effort invested in the follow-up of non-responders and may vary from 51% to 98%. (62)

Screening must be a continuous process

As already discussed in the section on prevention of cardiovascular disease, although continuity of screening is theoretically guaranteed in the general practice setting, considerable differences between practices have been observed.

Facilities must exist for assessment and treatment

This issue has already been discussed in the section on prevention of cardiovascular disease. In brief, there is doubt whether general practice can deal with the workload associated with screening activities and its follow up.

There must be an accepted form of effective treatment

The effects of the prescription of hearing aids among hearing impaired elderly has been evaluated in one randomised controlled trial only. (63) This trial showed an improvement among those who received a hearing aid compared to those on a waiting list for such a device, in social and emotional function (85%) and communication function (68%). Furthermore, among those with a hearing aid, the scores on the Short Portable Mental Status Questionnaire and the Geriatric Depression Scale were 30% and 26% higher, respectively. However, care must be taken when generalising these results of this trial to all hearing impaired subjects in the population at large since the trial participants consisted of motivated male patients with mild degrees of hearing loss.

In addition, the effects of hearing aids were studied in before-after trials and case control studies, confirming the benefits of hearing aids on psychosocial functioning observed in the randomised trial.

Although this evidence shows that hearing aids may be effective, studies show that in only 19% to 48% of hearing impaired subjects detected at audiometric screenings a hearing aid is prescribed. (60, 61) Patients with hearing loss can refrain from using hearing aids for various reasons including perceived low severity of the hearing problem, presumed passive acceptance of hearing loss, belief that the hearing problem is caused by others who do not speak clearly, poor image of hearing aids, costs, stigmatisation, lack of knowledge and misconceptions about hearing rehabilitation, professional attitudes and lack of social pressure from others to do something about the hearing problem. (64) In addition, age of the participant or degree of hearing loss differentiated potential users from non users in some, but not all studies. (65) As mentioned above questionnaires, originally developed to measure hearing handicap, may better predict the uptake of hearing aids after screening. (66)

There should be an agreed policy on whom to treat

There is no generally accepted guideline to assist in the decision whether or not to prescribe a hearing aid in subjects with hearing impairment. Hearing aids are reimbursed in the Netherlands if the average hearing loss in the best ear is above 35 Hz.

The cost must be economically balanced in relation to possible expenditure on medical care as a whole

The cost of a screening programme on hearing loss has never been fully assessed. However, the major costs will follow from the intervention; the issuing of hearing aids. These costs can be justified as long as the hearing impaired individual regularly wears his aid. However, non use of hearing aids frequently occurs, and this reduces the cost effectiveness of screening programmes on hearing loss. (67)

To sum up, screening of older adults on cardiovascular risk factors and hearing loss meets most of Wilson's criteria. Nonetheless, the evidence is not complete because there are areas which are not covered by these criteria. Therefore, we discuss two additional criteria, which address the generalisability of the evidence and the feasibility of screening older adults for cardiovascular disease and hearing disorders in general practice.

The empirical evidence must be applicable to older adults in a primary care setting

Much of the evidence for the efficacy of screening has been obtained in adults up to 70 years of age. The number of elderly above this age is large and increasing.

The screening yield among older subjects may differ from middle aged subjects. On the one hand, the prevalence of risk factors is higher, which increases the screening yield. On the other hand, since the elderly visit their general practitioner often, risk factors are more likely to have been already identified, making screening redundant. Indeed, a large Norwegian study showed that almost all elderly patients with

hypertension had already been identified as such by their general practitioner. In contrast, a cardiovascular health check in adults up to 70 years in New Zealand suggested 'that there were enough newly found risk factors to justify the effort'. These are the only earlier studies on the screening yield of cardiovascular health checks in older adults. Thus, there clearly is too little evidence on the issue.

Knowledge of the screening yield can serve as a first step to assess the efficacy of screening, which is further determined by the number of interventions following a positive test results, the compliance with and the efficacy of that intervention.

The screening programme must be feasible in every day practice

Wilson's criteria provide a theoretical basis for making an informed decision about the desirability of screening programmes, but the feasibility of these programmes in every day practice remains to be proven. (68) This is illustrated by the variable way in which the compulsory screening for adults above 75 years is performed in the UK. (69) Although candidates are usually willing to participate, the organisation of preventive care by their general practitioner limits the uptake. For screening on cardiovascular disease or hearing disorders in older adults, there is no data to indicate what proportion of the eligible elderly will actually be screened, once these screenings programmes are introduced in general practice.

Conclusion

We conclude that screening on cardiovascular risk factors and hearing loss by general practitioners seems promising as it meets most of Wilson's criteria of screenings activities. Unfortunately, however, doubt remains on three of Wilson's criteria; whether screening can be performed on a continuous basis in general practice, whether the facilities exist in general practice to assess and follow-up those screened and whether screening is economically justifiable.

In addition, two other areas of uncertainty which are not defined by Wilson's criteria exist and require further study; the applicability of the evidence on the efficacy of screening for older adults in primary care and the feasibility of screening programmes in every day practice

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Chapter 2

A cardiovascular health check in the elderly in general practice: does it offer new information and lead to interventions?

Introduction

Cardiovascular disease is a major cause of death and disability in developed countries. Nowadays, an increasing number of persons suffer from cardiovascular disease, mainly because of reduced case fatality after myocardial infarction and the rapidly growing number of elderly. Primary and secondary prevention of cardiovascular disease focusing on the elderly will become increasingly important. (1)

Elderly men and women have a high absolute risk of cardiovascular events, (2, 3) and thus are liable to profit from interventions targeted at improvement of their cardiovascular risk profile. This is illustrated by the impressive results of trials on the treatment of hypertension in the elderly. (4, 5) However, these data do not necessarily translate to treatment in clinical practice.

There is confusion over the role and type of screening in general practice to detect patients with unfavourable cardiovascular risk profiles. General practitioners in the United Kingdom are obliged to perform a three-yearly cursory health check in adults, and to offer an annual comprehensive health check to those aged 75 years and over. Patients can be invited for this health check opportunistically as well as systematically. The cost-effectiveness of this general screening, including screening for cardiovascular risk factors, however, is still under debate. (6-9)

In contrast, in the Netherlands cardiovascular screening is restricted to opportunistically measuring blood pressure or cholesterol level in patients with a high risk of cardiovascular disease. This approach may disregard some who might profit from antihypertensive treatment or cholesterol lowering. Even the implementation of such a restricted screening strategy may be hampered by the high workload in general practice. (10)

Few studies have compared the relative merits of systematic and opportunistic cardiovascular screening in older adults. Holmen et al found that Norwegian GPs can detect and diagnose hypertension equally well with opportunistic screening and systematic screening. (11) On the other hand, McMenamin reported that in New Zealand, where opportunistic screening is advocated, offering a health check gave sufficient new findings to justify this effort. (12) Thus, it remains unclear which strategy a GP should choose to detect patients prone to develop cardiovascular disease.

The present study adds to this debate by examining the value of a systematically offered cardiovascular health check in general practice in the Netherlands, where selective opportunistic screening is advocated. We investigated the number of previously unknown cardiovascular risk indicators that could be detected by a single cardiovascular health check of patients aged 60 years and over. It was also determined whether knowledge on some of these previously undetected risk factors led to further diagnostic or therapeutic interventions by the GP.

Subjects and methods

The study was performed in a general practice in Krimpen aan den IJssel, a suburban town near Rotterdam, from January 1991 until January 1992. Three GPs share the practice facilities. The GPs use computerised patient records as the main source of information about the health of their patients. All medical data, including consultations, prescriptions, laboratory results and summaries of letters from specialists, is recorded in the computerised patient file. A previous study showed that the computerised patient files were accurate in identifying 84% of all medication use. (13)

All persons aged 60 years and over registered with this general practice received a letter from their GP, offering a single cardiovascular health check. This was followed by a telephone call from the research physician to arrange the health check. Those with dementia (n=20) or with a severe disabling illness (e.g. terminal malignancies) according to the general practitioner (n=80), did not receive an invitation. Participants of the pilot study (n=30) were also excluded.

A research physician performed the cardiovascular health check. Firstly, the summary of the patient's medical history, which was made by the GP and recorded in the computerised patient file, was checked by the participant for its completeness. For example, if the GP had not included hypertension in the summary and the participant reported the use of antihypertensive medication, hypertension was added to the summary. Similarly, hypercholesterolaemia or diabetes mellitus could be added as a result of discussing the summary with the participant. Secondly, the health check consisted of a structured questionnaire and a physical examination. The questionnaire enquired about cardiovascular symptoms, diseases and family history, smoking and

drinking habits, and current medication use. The physical examination consisted of auscultation of heart, major vessels and lungs, evaluation of peripheral pulsations and oedema, and palpation of the abdomen. In addition, blood pressure, glucose and cholesterol levels, heart rate, height and weight were measured.

Blood pressure was measured in sitting position with a standard desktop mercury sphygmomanometer; the mean of two readings with a one-minute interval was determined. Hypertension was diagnosed in accordance with the Dutch College of General Practice guidelines. (14) In participants with a diastolic blood pressure of ≥95 mm Hg, or a systolic blood pressure of ≥160 mm Hg, two more sets of blood pressure values were obtained within the following 4 to 8 weeks. If the mean diastolic blood pressure of these sets was on average between 95 and 104 mm Hg, another two sets of measurements were obtained in the subsequent 4 to 8 weeks. In these latter participants the mean of all five sets was taken as the blood pressure. Hypertension was defined as a mean diastolic blood pressure ≥95 mm Hg, and isolated systolic hypertension as a mean systolic blood pressure ≥160 mm Hg with a mean diastolic blood pressure < 95 mm Hg.

Non-fasting capillary glucose levels were assessed by means of the Glucometer Gx (Ames). If a capillary glucose of 10 mmol/l or higher was measured, a venous fasting sample was obtained. Diabetes mellitus was defined as a fasting sample above 6.7 mmol/l. (15) Cholesterol level was determined only in participants with known hypertension, diabetes mellitus or hypercholesterolaemia as recommended by the Dutch College of General Practice guidelines. (16) This was done by a regional laboratory using standardised techniques. In the present study a single total cholesterol level of 6.5 mmol/l or higher was required to diagnose hypercholesterolaemia. The body mass index was calculated as weight/lenght^2 and a cut-off point of 30 kg/m^2 was used to define obesity.

For each participant the presence of the following risk indicators was assessed at the health check; hypertension, diabetes mellitus, hypercholesterolaemia, smoking, obesity, a history of coronary heart disease in a first degree relative before the age of 60 years, angina pectoris, intermittent claudication and a history of myocardial infarction, transient ischaemic attack or stroke.

After the cardiovascular health check, a specially trained practice assistant and the research physician entered the risk indicators found at the health check in the patient's

computerised medical record at the general practice office. Subsequently the cardiovascular risk indicators found at the health check were compared with those mentioned in the summary of the patient's medical history in the computerised patient files. Each risk indicator which had been detected at the health check but was not mentioned in the summary was defined as newly found during the health check.

In 1996 we systematically reviewed the patient records of all participants (n=110) who, during the cardiovascular health check in 1991-1992, had been newly diagnosed with hypertension, diabetes or hypercholesterolaemia to assess whether diagnostic and therapeutic interventions were initiated within one year after the cardiovascular health check. Repeated measurements of blood pressure, glucose or total cholesterol levels in cases where one of these parameters was elevated during the cardiovascular screening examination, were considered diagnostic interventions. Therapeutic interventions were defined as the prescription of antihypertensive, antidiabetic or lipid-lowering drugs. Because all participants with hypertension or hypercholesterolaemia had been given dietary advice by the research physician, this was not considered a therapeutic intervention initiated by the GP. Dietary advice in diabetes mellitus, however, was defined as a task of the GP. Therefore, dietary advice recorded in the patient file of a newly detected diabetic patient was considered a therapeutic intervention by the GP.

DBase and the Statistical Package for the Social Science (SPSS) were used to store and analyse data.

Results

Of the 1132 registered persons aged 60 years or older, 1002 were invited. In total, 805 subjects participated, giving a response rate of 80.3%. Non-responders (n=197) did not differ from responders in age and gender but were less likely to be insured by the National Health Service which indicates a higher social economic status. Most health checks (91%) were performed at the GP's office, and some were at the patient's home (n=35) or nursing home (n=39).

The prevalence of cardiovascular risk indicators was considerable in this older population. In 32% of the 805 participants one risk indicator was observed, in 27% two risk indicators, in 17% three risk indicators, and four or more risk indicators were found in 11%. Only 13% of the participants were free from any of the cardiovascular

risk indicators included in the risk profile. Table 1 shows the cardiovascular risk profile of the participants, according to gender and age.

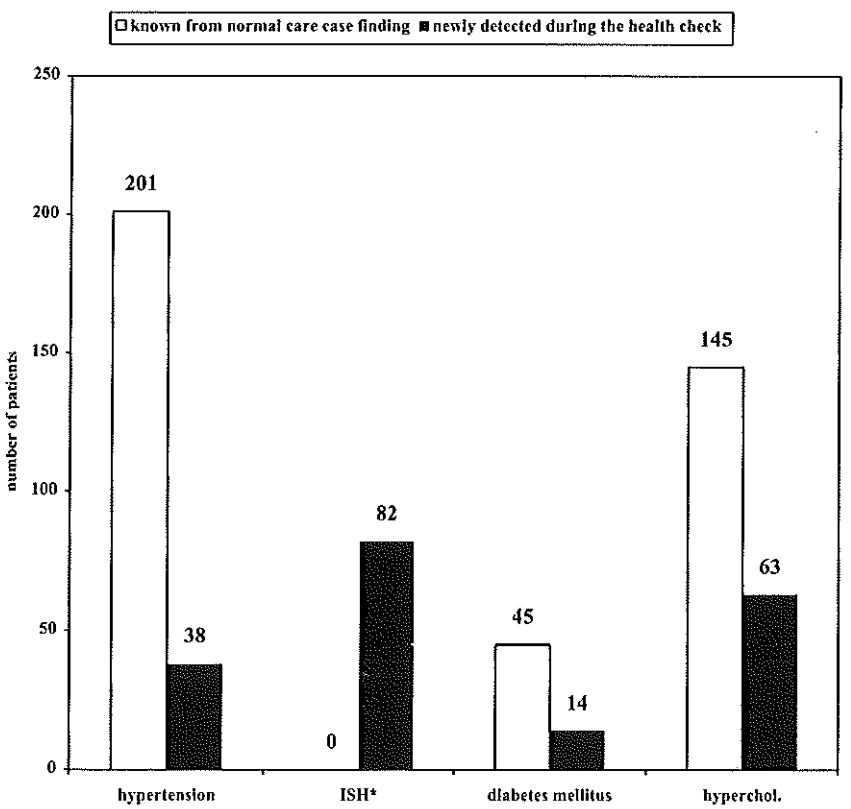
Table 1. Prevalence (%) of cardiovascular risk indicators during a single cardiovascular screening examination of 805 persons ≥ 60 years in general practice. n = number of patients.

Cardiovascular risk indicator	Men n=379	Women n=426	60-69 yrs n=526	>70 yrs n=279	total n=805
Hypertension	25.7	33.4	27.6	33.8	29.8
Isolated systolic hypertension	9.0	11.3	6.9	16.6	10.2
Diabetes mellitus	6.6	8.0	4.6	12.5	7.3
Cholesterol ≥ 6.5 mmol/l	22.2	29.1	30.2	17.6	25.8
Current cigarette smoking	31.5	12.5	24.1	16.5	21.4
Body Mass Index ≥ 30 kg/m^2	6.6	15.3	10.1	13.3	11.2
Family history of cardiovascular disease	19.6	21.8	22.4	17.6	20.7
Angina pectoris	11.4	11.5	8.0	17.9	11.4
Intermittent claudication	5.3	1.6	2.9	4.3	3.4
History of myocardial infarction	12.1	5.9	6.7	12.9	8.8
History of transient ischaemic attack	5.3	3.1	3.4	5.4	4.1
History of stroke	1.3	0.9	0.8	1.8	1.1

Risk indicators previously unknown to the GP were found in 25.1% of the participants (Figure 1), including 38 (4.7%) cases of hypertension, 82 (10%) cases of isolated systolic hypertension, 14 (1.7%) cases of diabetes mellitus and 63 (7.8%) cases of hypercholesterolaemia. Furthermore, 8 (1%) participants suffered from angina pectoris and 10 (1.3%) from intermittent claudication, while these complaints were not known to their GP. In addition, the summary of the participant's medical history contained no information on cigarette smoking (n=172), family history of cardiovascular disease (n=166) or obesity (n=89). If these three latter risk indicators are taken in account, 59% of all participants had at least one risk indicator which was not recorded in the summary of the patients medical history.

Figure 1. Prevalence of cardiovascular risk indicators known from the general practitioner's normal care case finding and newly detected risk indicators during a single health check in 805 participants.

- No diagnoses of isolated systolic hypertension (ISH) were included in the general practitioners summary of the patient's medical history.



In almost all participants with newly diagnosed diabetes mellitus the GPs gave dietary advice (n=4) or started medication (n=3) (Table 2). These diabetic patients had no complaints of diabetes mellitus recorded in their patient file and treatment was started only because of the repeatedly elevated glucose levels found at the health check. Of 25 patients with previously unknown hypertension, treatment was initiated in 6 participants only, while further diagnostic measurements of the blood pressure took place in as few as 5 cases. The GPs hesitated to actively manage hypercholesterolaemia. The cholesterol level was measured again within one year in 11 of 48 participants with a single cholesterol measurement above 6.5 mmol/l, while in 1 patient lipid-lowering medication was prescribed.

Table 2. Number of interventions (%) within one year after hypertension, diabetes mellitus or hypercholesterolaemia detected during a single cardiovascular health check.

Cardiovascular risk indicator	Number of cases detected	Diagnostic interventions	Therapeutic interventions	No interventions
Hypertension	25	5 (20)	6 (24)	14(56)
Diabetes mellitus	8	0 (0)	7 (88)	1 (13)
Cholesterol ≥ 6.5 mmol/l	48	11(23)	1 (2)	36(75)

Discussion

Screening for cardiovascular risk indicators aims at detecting subjects with unfavourable risk profiles and preventing the occurrence of coronary heart disease or stroke. This may be even more relevant in the elderly, who are at a higher risk of such events. During a cardiovascular health check of 805 men and women aged 60 years and over, we found cardiovascular risk indicators that were previously undetected by the GP in 25.1% of the participants. Although detection of diabetes almost always led to therapeutic actions by the GP, previously unknown hypertension and elevated

cholesterol levels did not initiate diagnostic or therapeutic interventions in the majority of cases.

A health check in all subjects enlisted in a general practice is not the advocated method in the Netherlands to detect unfavourable cardiovascular risk profiles. Rather, the Dutch College of General Practitioners guidelines recommend that GPs actively screen for hypertension or hypercholesterolaemia only when they are consulted by patients with at least one other cardiovascular risk indicator. Because risk indicators tend to cluster and because their harmful impact increases exponentially when other risk indicators are present, this case finding of high-risk patients is considered to be cost-effective. However, as our study shows, this advantage must be balanced against the disadvantage of having incomplete information on the presence of modifiable cardiovascular risk indicators in a large proportion of elderly in general practice.

Our study has a number of limitations. First, it is obvious that the end-point chosen in this study, i.e. the number of newly detected risk indicators, depends on pre-existent efforts and interests of the GPs in preventive cardiology. With only three GPs from one practice participating in this study, the higher than average interest of the participating GPs in preventive cardiology could have led to a smaller number of newly detected cardiovascular risk indicators. Another limitation is that the study was conducted in 1991-1992; new reports on the therapy of isolated systolic hypertension and hypercholesterolaemia have led to more active intervention policies being advocated. (4, 5, 17, 18)

The lack of diagnostic or therapeutic actions of the GPs following a single increased cholesterol level in our study is understandable. The efficacy of lipid lowering in the elderly was debated during the time our study was performed. (15, 19) However, more recent studies suggest that treatment is effective up to 64 years in patients without myocardial infarction and up to 70 years in patients with myocardial infarction. (17, 18)

In our study population, hypertensives were not always treated. This finding concurs with other reports, indicating that GPs are hesitant to treat hypertension in the elderly and only do so if blood pressure values are significantly higher than the cut-off value for treatment advised in the guidelines and used in the present study. (20-22) Nevertheless, the evidence provided by the recent trials on the favourable effect of

treating hypertension and isolated systolic hypertension in the elderly will probably reduce the proportion of untreated elderly hypertensive patients. (23)

Although a recent report suggested an increase in case finding for diabetes mellitus by Dutch GPs in the last decade, 1% of patients in our study still had undetected diabetes. (24) Fortunately, the GP initiated treatment in almost all cases.

Large studies comparing the effectiveness of selective opportunistic screening and more extensive systematic screening for cardiovascular risk indicators in the elderly, are scarce. (11, 12) The OXCHECK and the British Family Heart study, which included younger participants up to 64 and 59 years, respectively, showed only modest effect of systematic screening and subsequent intervention on the cardiovascular risk profile. Their results add to the debate on whether the costs of cardiovascular health checks on such a large scale can be justified in view of other health care expenditures. (7, 25, 26) Calculations based on the OXCHECK findings and the Framingham data showed a greater cost effectiveness of more selective forms of screening, such as a strategy targeted at hypertensive men in their seventh decade of life. (27)

We conclude that a single cardiovascular health check in the elderly may identify risk indicators which are not recorded in the patient file. In the general practice setting of the present study, these risk indicators were not detected by the normal care selective opportunistic screening. These gains should be balanced against the costs of this health check, which amount to £30 per participant. Furthermore, the lack of interventions in elderly hypertensive and hypercholesterolaemic patients indicates that more effort is needed to ensure that the beneficial effects following risk factor intervention are not limited to participants in clinical trials but can be extended to patients in general practice.

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Chapter 3

Is repeating of cardiovascular health checks in the elderly effective?

Introduction

Among the elderly, first manifestations of cardiovascular disease may cause dependency or death. To prevent or postpone these endpoints, knowledge of the cardiovascular risk profile is elementary. (1) A general practitioner can increase this knowledge above the level achieved by normal care alone by using screening or case finding strategies.

In a screening programme, subjects are asked to attend a preventive examination at the general practitioner's office, whereas in case finding or opportunistic screening preventive services are offered during routine visits. In an earlier study we assessed the value of a single screening examination among elderly patients in general practice. We observed previously unknown (i.e. not detected through normal care and case finding) hypertension, isolated systolic hypertension, diabetes mellitus and hypercholesterolemia in a considerable proportion of patients (25%). (2)

To keep an individual's cardiovascular risk profile up to date repeated cardiovascular health checks may be of value. In the United Kingdom, general practitioners are advised to perform a health check triennially, including an assessment of cardiovascular risk indicators, in patients up to 75 years. In patients above this age, health checks are to be performed yearly, but do not include measurements of the cardiovascular risk profile. (3) These frequencies, however, are chosen rather arbitrarily. (4, 5) The ideal frequency, as determined by its effectiveness in finding information that may alter subjects preventive management, lacks support from empirical evidence.

In the present study, we addressed this issue by repeating a cardiovascular health check in an elderly cohort after 5 years. We assessed the value of the repeated health check by comparing risk indicators detected at the second health check with the information known to the general practitioner, i.e. obtained during normal care and case finding activities and at the first health check.

Methods

The study was performed in one general practice with three general practitioners in Krimpen aan den IJssel, a suburban town near Rotterdam, the Netherlands. During the study period, one general practitioner retired and was replaced by a younger

colleague. Participants received two consecutive cardiovascular health checks, one in 1991 and one in 1996-1997. The time between these two investigations ranged from 4.3 years to 6.4 years.

Details of the first health check in 1991 were reported elsewhere. (2) In brief, all enlisted patients aged 60 years and over, who were not suffering from terminal diseases or dementia, were invited for a cardiovascular screening examination at the general practitioner's office. The methods applied to recruit participants and measure cardiovascular risk indicators in the second health check were similar to those of the first health check. In addition, in the second health check the ankle/arm index was measured (6, 7) and a twelve-lead electrocardiogram was made and analysed by the computer programme MEANS. (8)

Participants of the first health check were invited by a letter from their general practitioner to participate in a repeated cardiovascular health check. Patients with terminal diseases or dementia were not invited. Non-responders received a repeated invitation near the end of the study period. Patients who still chose not to participate were asked by telephone to provide a reason.

A research physician assisted by three specially trained medical students performed all cardiovascular health checks. Medication use and the presence of cardiovascular risk indicators were assessed by a structured questionnaire, which included the Rose questionnaires to establish the presence of angina pectoris and intermittent claudication. (9) A positive family history for cardiovascular disease was defined as having one or more first-degree relatives under the age of 60 with angina pectoris, myocardial infarction, sudden death or stroke.

Physical examination included measurements of height, weight and pulse rate, auscultation of the heart, major vessels and the lungs, evaluation of peripheral pulsations and oedema, and palpation of the abdomen. Blood pressure was measured in sitting position with a standard desktop mercury sphygmomanometer. The mean of three readings with a one-minute interval was determined. Hypertension and isolated systolic hypertension were defined according to the guidelines of the Dutch College of General Practitioners.(10) In these guidelines, isolated systolic hypertension is defined as a systolic blood pressure above 160 mmHg combined with a diastolic blood pressure below 95 mmHg. Patients with elevated blood pressure were offered three additional appointments with three readings, each within the following 3-6

weeks. Both baseline and follow-up measurements were used to calculate the mean blood pressure.

The Glucometer Gx (Ames) was used to measure non-fasting capillary glucose levels. A repeated measurement was performed in those whose initial measurement was 11.1 mmol/l or higher. Diabetes mellitus was diagnosed if the mean of these non-fasting glucose samples exceeded 11.0 mmol/l. (11) According to the cholesterol guidelines of the Dutch College of General Practitioners, total cholesterol level was determined in patients with a diagnosis of hypertension, diabetes mellitus or hypercholesterolemia only. (12) To analyse the capillary blood specimen the desktop analyser Lipotrend(13) was used. All subjects with capillary cholesterol above 6.4 mmol/l were offered a determination of the serum cholesterol level and this was obtained in 37% of the cases with capillary cholesterol above 6.4 mmol/l. Hypercholesterolemia was defined as a single, or, if available, mean total cholesterol of 6.5 mmol/l or more.

The presence of all cardiovascular risk indicators observed at the repeated cardiovascular health check was recorded. To determine whether a risk indicator was already known to the general practitioner at the time of the repeated health check, a systematic search of the information available in the computer-based patient records of all participants was made. The study practice used the computerised patient file since 1991 to record all data on medical history, consultations, prescriptions and abstracts of letter from specialists; no other sources of recorded information exist to guide the management of patients in this study practice.

Hypertension and isolated systolic hypertension were considered to be known if the participant had been prescribed antihypertensive drugs, or if such a diagnosis was mentioned in the patient file together with elevated blood pressure values. A diagnosis of diabetes mellitus was considered to be known by the general practitioner if the patient file mentioned the diagnosis, or if insulin or oral antidiabetic drugs were used. A diagnosis of hypercholesterolemia at the repeated health check was considered previously known by the general practitioner if the participant's file mentioned either the prescription of lipid-lowering drugs or at least one total cholesterol measurement exceeding 6.5 mmol/l, or a diagnosis of hypercholesterolemia.

After the cardiovascular health check, the practice assistants and the research physician entered the risk indicators for each participant in the patient record at the general practice office. Participants received a letter including the results on

modifiable risk indicators hypertension, isolated systolic hypertension, diabetes mellitus, hypercholesterolemia, smoking and adiposity. If necessary, they were advised to visit their general practitioner.

Results

Table 1. Prevalence (%) of cardiovascular risk indicators during the initial health check (1991) in participants of a repeated health check in 1996 (n=509), in non-responders of the repeated health check and in those who died or moved between the two health checks or were excluded for the repeated health check (n=170). n: number of patients *: statistically significant difference ($p \leq 0.05$) with responders.

Cardiovascular risk indicator		Responder n=509	Non-Responders n=126	Died between two health checks, n=100	Lost to follow-up or excluded n=170
Age	60-69 years	76.6	52.3*	30.0*	50.0*
	70-79 years	19.8	35.7*	35.0*	31.5*
	>= 80 years	3.3	11.9*	35.0*	18.6*
Gender	(% male)	48.9	42.9	46.0	77.1*
Hypertension		20.8	27.8	38.0*	31.4*
Diabetes mellitus		3.1	8.7*	13.0*	11.4*
Hypercholesterolemia		19.8	16.7	14.0	12.9
Smokers.		20.0	28.6*	25.0	14.3
Angina pectoris		9.0	9.5	20.0*	7.1
Myocardial infarction		6.5	5.6	24.0*	10.0
Stroke		0.2	0.8	6.0*	1.4
Transient ischemic attack		2.8	4.0	19.0*	5.7
Intermittent claudication		0.6	4.8*	6.0*	8.6*
Collective health insurance		38.5	52.4*	49.0	14.1*

Of the 805 patients who participated in the first health check, 509 (63%) participated in the repeated health check. In the five-year interval between the health checks, 100 subjects had died, 52 had moved to another area or general practitioner, and 4 were not registered with the practice for unknown reasons. Furthermore, 6 patients who

suffered from a terminal illness and 8 patients with dementia were not invited. The response rate among the 635 eligible patients was 80%. Reasons not to attend were listed among 47 (37%) non-participants and included no motivation (n=27), treatment by specialist (n=11), old age (n=5) and other reasons (n=4).

Responders were younger and had a lower prevalence of cardiovascular disease, hypertension and diabetes mellitus at the first health check than non-responders or those who had died or moved between the health checks (Table 1). In addition, the number of individuals insured by the National Health Service was relatively low, indicating a higher social economic status. The prevalence of cardiovascular risk indicators observed at the repeated health check is shown in Table 2.

Table 2. Prevalence of cardiovascular risk indicators among participants (n=509) at the repeated health check. Mean age was 71.6 (SD; 5.2) years.

Cardiovascular risk indicator	Number of patients	% of patients
Hypertension	23	4.5
Isolated systolic hypertension	77	15.1
Diabetes mellitus	11	2.2
Hypercholesterolemia	76	14.9
Smoking	80	15.7
Obesity (BMI ≤ 30.0)	63	12.4
Family history of cardiovascular disease	106	20.8
Angina pectoris	62	12.2
Myocardial infarction	48	9.4
Stroke	8	1.6
Transient ischemic attack	23	4.5
Intermittent claudication	12	2.4

In 14.5% of all participants the health check detected at least one modifiable risk indicator not present in the general practitioner's patient file (Table 3). Isolated systolic hypertension was the most frequently encountered unknown risk indicator. However, after subtraction of risk indicators that were already diagnosed at the first

health check but apparently not adequately followed-up by the general practitioner, new information was found in 9% of the subjects only.

Table 3. Prevalence (%) of cardiovascular risk indicators observed at the repeated health check; categorised according to whether or not they were mentioned previously in the patient file at the general practice office or whether or not they were already observed at the first health check. (n=509). Cholesterol was measured only in participants with hypercholesterolemia, hypertension or diabetes mellitus (n=208).

Cardiovascular risk indicator	**Observed at repeated health check**			**Total**
	Mentioned in patient file	Not mentioned in patient file		
		Observed at first health check	Not observed at first health check	
Hypertension	2.4	0.8	1.3	4.5
Isolated systolic hypertension	5.9	3.1	6.1	15.1
Diabetes mellitus	1.4	0	0.8	2.2
Hypercholesterolemia	10.0	2.2	1.3	13.6

Modifiable risk indicators diagnosed during the repeated health check but already known to the general practitioner, were found in 19.8% of the participants (Table 3).

The majority of these cases consisted of subjects with known hypercholesterolemia in whom total cholesterol exceeded 6.5 mmol/l at the repeated health check.

Discussion

This study is, to our best knowledge, the first to assess the value of a repeated cardiovascular health check in the elderly in general practice. New information for the general practitioner about modifiable risk indicators, notably isolated systolic hypertension, was observed in 14.5% of the participants. However, about 40% of these risk indicators were already detected at the first health check five years earlier.

The response rate of 80% in our study is comparable to that achieved in the younger population of the OXCHECK study. However, the fact that those with a more beneficial cardiovascular risk profile attended the health check more often decreases its potential effectiveness. (14, 15)

The value of the repeated cardiovascular screening among the oldest subjects in our cohort was limited. Of those alive after 5 years, only 58% of the elderly who were 75 years and over during the first health check attended the second examination. This implies that in the oldest subjects other methods leading to higher participation rate (e.g. by offering home visits) and more tailored to the needs of the elderly should be applied. (16) The results of the limited number of studies taking this approach, however, are conflicting. (17-20)

Our study confirms the idea that isolated systolic hypertension in the elderly is underdiagnosed by general practitioners. (21-24) The revised guideline of the Dutch College of General Practitioners on hypertension was published after our study and explicitly states that blood pressure in the elderly should be measured opportunistically each year. Implementation of this and similar guidelines will reduce the proportion of elderly with undiagnosed isolated systolic hypertension. (25)

Our prevalence of hypercholesterolemia (13.6%) should be interpreted with care. In the five years between the health checks, new evidence from secondary prevention trials concerning the effectiveness of treatment with statins in elderly up to 70 years of age has emerged. (26, 27) Guidelines have long been contradictory about whether or not to treat elderly with hypercholesterolemia. (28, 29) According to the revised guideline of the Dutch College of General Practitioners on hypercholesterolemia, to be published in 1999, only 5 of the 69 patients with hypercholesterolemia that were detected in our study would require treatment with lipid-lowering agents.

Our study has a number of limitations. Firstly, benefits were expressed as the detection of unknown modifiable risk indicators and other potential endpoints, notably morbidity or mortality reduction, were not included. The proportion of risk indicators unknown to the general practitioner is, however, an acceptable endpoint since the evidence concerning the effectiveness of some preventive interventions in the elderly, e.g. antihypertensive treatment, is beyond doubt. Secondly, the motivation of the participating general practitioners (n=4) in our study practice to detect cardiovascular risk indicators in day-to-day practice may be relatively high. This will decrease the number of unknown cardiovascular risk indicators that can be found at a health check and underestimate its benefit. Thirdly, regression to the mean could overestimate our findings. The number of measurements performed among our participants to diagnose hypertension or hypercholesterolemia is lower than recommended. (30)

Although our repeated screening detected previously unknown cardiovascular risk indicators in 14.5% of the participants, about forty percent of the risk indicators were already observed at the first health check. Clearly, identification of risk is not enough to guarantee a beneficial change in a patient's risk profile. (31) Attention given at intervention after screening is of paramount importance for screening to be successful.

The most important outcome of the repeated cardiovascular health check was the finding of isolated systolic hypertension in 47 participants. Treatment of these patients for five years may prevent a major cardiovascular event in approximately 2.5 patients and stroke in 1.4 patients. (32, 33) The total cost of our programme was estimated as £14,650, i.e. £28.8 per participant. These costs and the workload associated with repeated systematic screening and its follow-up measurements make repeated health checks, as performed in our study, not feasible in general practice. Furthermore, the cost effectiveness of our health check contrasts sharply with the cost effectiveness of blood pressure measurements during opportunistic screening in normal care. (34-36) Therefore, rather than repeated health checks, optimisation of case finding, notably directed at isolated systolic hypertension, should be pursued. Apparently, general screening is too general for general practice.

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Chapter 4

The potential of cardiovascular drug review in older people

Introduction

Older people are important drug consumers. In the Netherlands, two thirds of older men and women use at least one prescribed medication (1). Furthermore, these numbers are likely to increase, as the population is ageing and indications for drug treatment in older people are expanding. Cardiovascular drugs are among the most frequent prescribed drugs in this age group. (2).

Optimising cardiovascular drug therapy in older people can be difficult (3, 4). It is estimated that 28% of admissions of older people to acute care centres in the US is caused by adverse events or non-compliance, often related to cardiovascular drugs (5). Because these problems may be preventable (6, 7), the Royal College of General Practitioners in the UK and others advocated an annual review of the medication use of older people by their primary care physician (8-12). However, quantitative assessment of the benefits of such an intervention is lacking.

General practitioners (GPs) in the Netherlands are in a unique position to monitor the medication use by older adults. The central role of GPs in the health care system, continuity of care, the increasing use of computer-assisted prescribing and the co-operation of pharmacists and the availability of numerous clinical guidelines all enhance the GP's ability to prevent inappropriate use of medication by older patients. Therefore, it could be argued whether a regular review of the medication use of older people in primary care offers *additional* value.

We addressed this issue by reviewing the use of cardiovascular medication in older persons enlisted in one group practice in the Netherlands. Emphasis was on the dose of the drugs prescribed and on the adherence of the prescription to the guidelines of the Dutch College of General Practitioners. Furthermore, we determined whether the GP had a complete overview of all the drugs used by their older patients.

Methods

The medication review was performed in one group practice with three partners in Krimpen a/d IJssel, a suburban town near Rotterdam, the Netherlands. The GPs of the study practice have been using computer-assisted prescribing since 1990. This means that every prescription is checked by the computer regarding double medication,

interacting medication, contra-indications and high doses, based on a medication database developed by the Dutch Royal College of Pharmacy (13). Furthermore, the computer checks the interval between repeated prescriptions to detect possible under- or overuse of medication. Almost all drugs prescribed in this practice are obtained at two pharmacies. The pharmacists monitor the prescription similar to the computer check and contact GPs in case of doubtful prescriptions. Peer review meetings between pharmacists and GPs are organised every 6 weeks as a means of continuing education on pharmacotherapy.

The medication review was part of a larger survey aimed at determining the effectiveness of single and repeated cardiovascular health checks among the elderly. (14) and was performed in 1996. A total of 560 elderly men and women, aged 64 years and over, participated. They comprised 80% of those participants of the first health check in 1991 who were still eligible in 1996 (n=509), plus a small group of spouses of participants (n=22) or patients who had been eligible and willing to participate in the first health check but had not participated due to various reasons (n=29).

All participants were interviewed by a research physician (PJB) at the GP's office. They were asked to bring containers of every drug they used. All prescription and non-prescription drugs that were used during the previous 14 days were recorded. The generic or non-generic name of the drug was classified by means of the Anatomical Therapeutic Chemical (ATC) classification index (15). Cardiovascular medication was defined as medication with an ATC coding starting with 'c'.

Information on the dose that the patient actually used and the prescriber, if it was not an over-the-counter drug, was obtained. Drug containers or medication charts could serve as a reminder for the participant. To gain insight in the perceived indication for the drug therapy by its users the participants were asked the indication for each drug by answering the question 'Why do you use this drug?' Their answers were categorised in specific and non-specific categories, e.g. 'for angina pectoris' or 'for the heart'.

After the screening examination, the computerised patient files at the GP's office of the 209 participants who reported the use of cardiovascular medication were audited. The prescriptions recorded in the patient file were compared with the use reported by the patient. Of the medications present in the patient file the prescribed doses were

recorded. These doses were compared with the minimum effective doses as determined in the Dutch National Formulary (16). Preferably, a specific minimum dose for the elderly was used for this comparison, but if this was not available the minimum dose for adults was used.

Medications that could interact with cardiovascular medications were identified by using the Dutch National Formulary. For each participant who reported the use of cardiovascular medication, all other used drugs mentioned in their interview were assessed to identify possible interactions.

We reviewed the guidelines on hypertension, angina pectoris and heart failure of the Dutch College of General Practitioners (17-19) to identify drugs of first, second and third choice for these conditions. The indication for treatment with cardiovascular drugs was determined through assessment of the computerised patient files by the research physician. When the patient file was inconclusive or in case more than one indication was mentioned, one of the prescribing GPs (AP) was asked to clarify this issue.

Results

Participants (n=560) reported a high use of cardiovascular medication (Table 1). Only drugs of the alimentary tract were used more often, mainly due to the self-determined use of vitamin preparations. In 34% of men and 41% of women at least one cardiovascular drug was used. Participants who used cardiovascular drugs (n=209) also used more drugs simultaneously (mean 3.6) than users of medications other than cardiovascular drugs (mean 2.2).

Almost all cardiovascular medication mentioned by the patient (92%) was recorded in the computerised patient file. Medication that was missing from the patient file included short-acting nitrates (n=8), diuretics (n=6), β-blockers (n=6), calcium antagonists (n=3) and ACE inhibitors (n=3). Medication the patient reported to be prescribed by a specialist was most likely to be missing from the patient file; in 14% of specialist prescriptions there was no record in the patient file.

Table 1. Numbers (n) and percentages (%) of all reported medication use in older men (n=273) and women (n=287), categorised according to ATC coding.

Medication class (ATC coding)	Men n=273		Women n=287		All n=560	
	n	%	n	%	n	%
Alimentary tract and metabolism (A)	86	31.5	129	44.9	215	38.4
Cardiovascular system (C)	92	33.7	117	40.8	209	37.3
Nervous system (N)	44	16.1	89	31.0	133	23.8
Blood and blood-forming organs (B)	62	22.7	54	18.8	116	20.7
Musculoskeletal system (M)	25	9.2	29	10.1	54	9.6
Respiratory system (R)	24	8.8	26	9.1	50	8.9
Sensory organs (S)	12	4.4	20	7.0	32	5.7
Dermatologics (D)	21	7.7	8	2.8	29	5.2
Genitourinary system (G)	6	2.2	12	4.2	18	3.2
Hormonal preparations (H)	4	1.5	13	4.5	17	3.0
General anti-infectives (J)	1	0.4	4	1.4	5	0.9
Antineoplastic agents (L)	1	0.4	1	0.3	2	0.4
Any medication	188	68.9	236	82.2	424	75.7
No medication	85	31.1	51	17.8	136	24.3

The prescribed dose, recorded in the patient file, was below the minimum effective dose in 19% of prescriptions. On average, however, our participants used a dose which was almost 40% higher than the defined minimum dose.

In 18% of all cardiovascular medications used by the participants, interacting medication was present. The class of drugs most frequently involved in drug-drug interactions were diuretics (Table 2). The agents which caused most interactions with cardiovascular medications were non steroidal anti-inflammatory drugs (NSAIDs); the majority of NSAIDs used were over-the-counter drugs. A qualitative description of the most frequent interactions and their effects can be found in Table 3.

Table 2. Numbers (n) and percentages (%) of prescriptions for cardiovascular medication (n=253) among the 209 users of cardiovascular medication that may cause interactions with other currently used drugs.

Cardiovascular drug class	Prescriptions	Prescriptions with potential interactions	
	number	number	%
Cardiac glycosides	13	5	38.5
Nitrates	23	0	0.0
Diuretics	46	16	34.8
ß-Blockers	71	10	14.1
β Blocker and diuretic combinations	29	1	3.4
Calcium antagonists	31	2	6.5
ACE inhibitors	40	11	27.5

Table 3. Most frequently recorded combinations of interacting medications among the 209 users of cardiovascular medications (n= 253 prescriptions).

Interacting medications		Number of interactions	Effect
ß-Blocker	NSAID	9	diminished effect of antihypertensive treatment
ACE inhibitor	Diuretic	9	hypotension
Digoxin	Furosemide	7	increased risk of intoxication by glycosides
Diuretic	NSAID	6	diminished effect of antihypertensive treatment
ACE inhibitor	NSAID	2	diminished effect of antihypertensive treatment and hyperkalemia
Diuretic	Prednison	2	increased potassium loss
Diltiazem	ß-Blocker	1	hypotension, atrioventricular conduction delay, left ventricle dysfunction

The type of drugs used for the treatment of hypertension, angina pectoris and heart failure differed considerably from the type of drugs recommended in the guidelines of the Dutch College of General Practitioners (Table 4). A first choice drug was used by 28%, 41% and 73% of the persons treated for hypertension, angina pectoris and heart failure, respectively. In 3% of the cases, a drug was contra-indicated. For example, two patients were using β-blockers together with medication to treat their chronic obstructive pulmonary disease.

Table 4. Number (n) and percentages (%) of patients with hypertension (n=123), angina pectoris (n=46) and heart failure (n=11) who are treated with first, second, third choice or contra-indicated drugs, according to the guidelines of the Dutch College of General Practitioners.

Medication	**Hypertension** n=123		**Angina Pectoris** n=46		**Heart failure** n=11	
	n	%	n	%	n	%
Use of:						
1st choice drugs	34	27.6	19	41.3	8	72.7
2nd choice drugs	61	49.6	16	34.8	2	18.2
3rd choice drugs	25	20.3	8	17.4	1	9.1
contra indicated drugs	3	2.4	3	6.5	0	0

Patients were not always aware of the reason their GP or specialist prescribed the drug (Table 5). Although 78% correctly reported to use antihypertensive medication for hypertension, only 35% of heart failure patients knew the purpose of their medication.

Discussion

In this study we investigated whether a review of cardiovascular medication of older people is fruitful in a primary care practice in the Netherlands where many conditions for strict medication control are met. To our knowledge, no other study has addressed this issue.

Table 5. Comparison of the indication according to the patient file and mentioned by the patient among users of drugs for hypertension, angina pectoris, heart failure and atrial fibrillation.

Indications according to patient file		Indications according to patient					
		similar to patient file		other than patient file		unknown	
	n	n	%	n	%	n	%
Hypertension	144	113	78.5	29	20.1	2	1.4
Angina pectoris	95	54	56.8	35	36.8	6	6.3
Heart failure	20	7	35.0	12	60.0	1	5.0
Atrial fibrillation	19	10	52.6	9	47.4	0	0.0

By means of computerised patient files, the participating GPs had an almost complete overview of the medication use of their patients. Prescriptions initiated by specialists, however, were not recorded in the patient file in 14% of the cases. Extra care is needed to ensure prompt reporting of these data by the specialist or pharmacist to the GP. The expanding possibilities of electronic communication may assist in this task.

Our estimates of the prevalence of prescribing below the minimum effective dose should be interpreted carefully. A specific minimum dose for the elderly was not always mentioned in the Dutch National Formulary. Furthermore, some patients may have used lower doses because of combinations with other drugs. Nevertheless, it is unlikely that these factors will fully explain the 19% of the prescriptions that were below the minimum effective dose. Studies on underuse of medications in the elderly are seldom performed (20). Medication reviews offer the opportunity to question whether drugs at these low dosages exert the desired effect and whether dosage adjustments or cessation of medication use is appropriate (21, 22).

In our study practice, where both the computer system and the pharmacist warn the GP in case the drug prescribed interacts with other medication, in as much as 18% of all prescriptions interacting drugs were involved. This was mainly due to the use of over-the-counter drugs, notably NSAIDs, which are not recorded in the patient file (23). Among drugs which were recorded in the patient file, only a small number of

combinations, such as digoxin and diuretics (n=6), diuretics and prednison (n=2) and diltiazem and ß-blockers (n=1), were liable to cause a serious drug interaction (24). Furthermore, awareness of interactions is more important than absolute avoidance of combinations of interacting medications.

The discrepancy we found between drugs advised in guidelines and those used in practice, e.g. for the treatment of hypertension, has been reported before (25). A medication review may serve as an opportunity to adjust the type of prescribed drugs to the current guidelines. However, a lack of consensus between GPs and specialists on the preferred type of drugs may impede this. General practitioners may repeat prescriptions of medication initiated by a specialist, which are only second or third choice drugs according to the guidelines developed for general practice. Furthermore, the benefit of prescribing a first choice drug should be large enough to justify a change in an individual patient's drug regimen (26); this is often open to debate. Nevertheless, a medication review can act as a barrier against the uncritical use of second and third choice cardiovascular drugs among older people (27).

Our study showed that patients who use cardiovascular medication were not always aware of the reason for prescription. The literature on this subject is conflicting, possibly because of the methods used to test the knowledge of patients about their drugs (28). We asked our participants the simple question 'Why do you use this drug?' If a GP adds this question to his medication review, he must have ample time to discuss the answers of his patients. However, this might be worth the effort since better understanding might lead to better compliance, and the consequences of non-compliance with cardiovascular medication may be serious (5).

Some limitations of our study have to be mentioned. Firstly, a research physician determined most of the indications for medication use by means of the computerised patient file. This requires the patient file to be complete. Although in case of doubt one of the GPs was asked to provide the indication, misclassification could have occurred. Secondly, questions about side-effects and compliance were not included in our medication review. Thirdly, the revised guideline on hypertension from the Dutch College of General Practitioners we used was not yet published at the time we conducted our study. However, this guideline reflects knowledge which was already available from the literature and was partly incorporated in the previous guideline, published in 1991.

We conclude that regular review of cardiovascular medication is valuable, even in general practices where many conditions to adequately monitor medication use are met. In particular, dosages below the minimum effective dose, low adherence to guidelines and patients' lack of knowledge about the indication for their drug are issues that could be addressed at a yearly medication review of older users of cardiovascular medication. Since these patients visit their GP regularly, this could be done opportunistically during routine consultations, provided that the patient is notified to bring all drug containers to the GP's office. Prescribing cardiovascular medication does not end with signing the prescription; active monitoring is mandatory.

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Chapter 5

Is electrocardiography a useful screening test in general practice?

Introduction

Electrocardiography is frequently used in clinical practice for the diagnosis and management of heart disease. In the Netherlands, general practitioners have easy and rapid access to this facility, either because they own an electrocardiograph themselves or because they can use medical laboratory- and hospital-based services. Electrocardiography is especially valuable in the analysis of complaints of palpitations or chest pains. (1, 2) In addition, a general practitioner may consider to use the electrocardiograph in asymptomatic patients as a tool to guide in cardiovascular risk stratification. (3)

The use of the ECG for screening purposes in asymptomatic middle aged men is considered not useful. (4-6) In the elderly, however, ECG abnormalities have a more pronounced prognostic importance for future cardiovascular events. (7-11), while the prevalence of electrocardiographic abnormalities is higher. (10) Detection of several of these ECG abnormalities, notably silent infarctions, left ventricular hypertrophy and atrial fibrillation, could have therapeutic implications. Thus, screening for these abnormalities may beneficially influence prognosis.

In this study, the value of electrocardiographic screening, in terms of detection of previously undiagnosed atrial fibrillation, left ventricular hypertrophy and silent infarctions, is examined. The prevalence of these newly detected electrocardiographic abnormalities, and some additional ECG abnormalities with established prognostic significance, is reported. Furthermore, we determined whether electrocardiographic screening would be more valuable when targeted at certain subgroups of older people, notably those with hypertension or diabetes.

Methods

The general practice office where the study was performed was located in Krimpen a/d IJssel, a suburban town near Rotterdam. Electrocardiographic screening was part of a larger study on the effectiveness of single and repeated cardiovascular health checks in the elderly (12) and was performed in 1996, during the repeated screening examination of participants of a first health check in 1991. Five hundred sixty elderly men and women, aged 64 years and over, participated. They comprised 80% of those participants of the first health check in 1991 still eligible in 1996 (n=509), and a small

group of spouses of participants (n=22) or patients who had been eligible and willing to participate at the first health check but had not participated because of various reasons (n=29). Of all participants at the repeated health check, cardiovascular complaints, medical history and use of medications was recorded and blood pressure, capillary cholesterol and glucose concentrations were measured.

The ECGs were recorded with an ACTA electrocardiograph (ESAOTE, Florence, Italy) at a sampling rate of 500 Hz. All ECGs were stored digitally and interpreted by the Modular ECG Analysis System (MEANS). The MEANS program has been evaluated extensively. (3) It provides several ECG diagnoses, often including an indication of the certainty of the diagnosis. In addition, ECGs are classified according to the Minnesota Code. (13)

The MEANS program was first used to diagnose myocardial infarction, left ventricular hypertrophy and atrial fibrillation. For the diagnosis of myocardial infarction and left ventricular hypertrophy, the MEANS program gives a graded scale of certainty, being 'no', 'possible', 'probable' and 'certain'. Myocardial infarction or left ventricular hypertrophy was considered present when the MEANS program diagnosed the condition 'probable' or 'certain'. All ECGs were also interpreted by a research physician (PJB) to determine the presence of atrial fibrillation. For this diagnosis, the judgement of the research physician served as a gold standard.

Secondly, several ECG measurements that have been associated with an increased risk of cardiovascular disease, were performed. These measurements, and their definitions of abnormality, can be found in table 1. An overall QT interval was determined from the common QRS onset and T offset for all 12 leads together. To adjust for heart rate, Bazett's formula ($QTc = QT/\sqrt{RR}$) was used.(14)

The T axis was calculated from vectorcardiographic X, Y and Z leads, which can, in good approximation, be reconstructed from the standard ECG leads. (15) The mean spatial axis is obtained by vectorially adding instantaneous heart vectors during the T wave. The mean frontal axis is then taken to be the angle between the X axis and the projection of the mean spatial axis on the XY plane.

Table 1. Definitions of ECG abnormalities assessed at the screening examination.

ECG abnormality	Definition
ECG abnormalities with potential therapeutic consequences	
Myocardial infarction	Presence of pathological Q waves or loss of R-wave potential in the precordial leads
Left ventricular hypertrophy	Combination of voltage and ST-T criteria
Atrial fibrillation	Absence of P waves, irregular RR intervals
Other ECG abnormalities	
Atrio ventricular block	PR interval >200 ms
Intra ventricular block	Prolonged QRS duration
Premature ventricular complexes	Any PVC in 10 seconds
ST depression	Minnesota Code 4.1 or 4.2
T inversion	Minnesota Code 5.1 or 5.2
Prolonged QTc	Abnormal: >460 ms
Frontal T axis deviation	Abnormal: between −180° and −15° or between 105° and 180°

After the ECGs had been recorded, we reviewed the computerised patient files at the GP's office on the presence of the diagnoses myocardial infarction, left ventricular hypertrophy, atrial fibrillation at any date before the screening examination. These conditions were considered known to the general practitioner if they were mentioned in the free text or problem lists of the computerised patient file. Silent infarctions were defined as electrocardiographically diagnosed myocardial infarction without the mentioning of a diagnosis of myocardial infarction in the patient file.

Because the diagnoses of previously unrecognised myocardial infarction, left ventricular hypertrophy and atrial fibrillation are most likely to have clinical implications, they were analysed separately. The prevalences of these ECG abnormalities in different subgroups, notably patients with cardiovascular risk indicators, were assessed to determine in which subgroup electrocardiographic screening may be most efficacious. Furthermore, in a multiple logistic regression model patient characteristics, including those defining the subgroups mentioned

before were tested to detect independent predictors of these previously unrecognised ECG abnormalities.

Results

An ECG was recorded among 489 (87%) participants. The characteristics of the participants with ECG recordings are described in table 2. Missing ECG recordings were mostly due to temporary technical problems with the electrocardiographic equipment. Participants with an ECG recording had a higher prevalence of several cardiovascular risk indicators compared to participants without an ECG recording, although these differences were not statistically significant.

Table 2. Characteristics of the 489 participants included in the electrocardiographic screening examination.

Characteristic	Mean (SD) or %
Male gender (%)	48.1
Age (years)	71.1 (5.3)
Systolic blood pressure (mm Hg)	152.0 (20.7)
Diastolic blood pressure (mm Hg)	81.7 (10.2)
Total cholesterol (mmol/l)	6.1 (1.2)
Current smoking (%)	17.0
Body mass index (kg/m^2)	26.2 (3.7)
History of angina pectoris (%)	11.0
History of myocardial infarction (%)	10.1
History of stroke or transient ischemic attack (%)	4.5
History of diabetes mellitus (%)	5.1

Table 3. Prevalence of ECG abnormalities among 489 older participants in an electrocardiographic screening.

ECG abnormality	Prevalence (%)	
Abnormalities with potential therapeutic consequences		
Myocardial infarction	9.4	
Left ventricular hypertrophy	2.9	
Atrial fibrillation	3.5	
Total		14.7
Other ECG abnormalities		
Atrio ventricular block	12.5	
Intra ventricular block	9.4	
Premature ventricular complexes	5.3	
ST depression	5.5	
Negative T wave	9.0	
Prolonged QT c	10.2	
Deviation of the frontal T axis	10.7	
Total		36.4
Normal ECG		58.3

In total, 41.7% of all subjects had an ECG recording with at least one abnormality. (Table 3) ECG diagnoses that are most likely to have therapeutic consequences, i.e. myocardial infarction, left ventricular hypertrophy and atrial fibrillation, were present in 14.7% of all ECG recordings and these diagnoses had not been recorded previously in the patient file in 8.8% of the participants. The prevalence of newly detected myocardial infarction, left ventricular hypertrophy and atrial fibrillation was 4.9%, 2.9% and 1.2% respectively. Other ECG abnormalities were observed in 36.4% of all recordings, the most frequent being atrio ventricular block (12.5%), deviation of the frontal T axis (10.7%) and prolonged QTc (10.2%).

Of the different subgroups of patients, the yield of electrocardiographic screening appeared to be the highest in patients with diabetes mellitus or hypertension. If screening had been restricted to these subjects, 51.2% of all previously unknown ECG abnormalities would have been detected by screening only 30.5% of all participants. (Table 4)

Table 4. The efficacy of selective electrocardiographic screening in terms of the percentage of all patients needed to be screened and the percentage of all previously unknown abnormalities which are detected.

Selection criteria	Number (%) of patients to be screened	Number (%) of patients with ≥1 unknown abnormality	% of all unknown abnormalities that is detected
All patients	489 (100)	43 (8.8)	100
Age >= 75 years	112 (22.9)	13 (11.6)	30.2
Male sex	235 (48.1)	25 (10.6)	58.1
Hypertension	134 (27.4)	19 (14.2)	44.2
Diabetes mellitus	25 (5.1)	7 (28)	16.3
Hypertension and/or diabetes mellitus	149 (30.5)	22 (14.8)	51.2
Smoking	83 (17.0)	11 (13.3)	25.6
Hypercholesterolemia	104 (21.3)	7 (6.7)	16.3
History of cerebrovascular disease	22 (4.5)	4 (18.2)	9.3

Diabetes mellitus (OR 4.0, 95%CI 1.5-11.2) and hypertension (OR 2.3, 95%CI 1.1-4.4) proved to be independent predictors of these previously unknown electrocardiographic abnormalities in a multivariate model. (Table 5)

Table 5. Independent predictors of the presence of previously unknown myocardial infarctions, left ventricular hypertrophy or atrial fibrillation in older people. Results of multiple logistic regression analysis. History of hypertension, hypercholesterolaemia and diabetes mellitus was determined through review of patient files.

Patient characteristic	Odds ratio (95% CI)
male sex	1.7 (0.8-3.3)
age (per 5 years)	1.4 (1.0-1.8)
history of hypertension	2.3 (1.2-4.6)
history of hypercholesterolaemia	0.7 (0.3-1.8)
history of diabetes mellitus	4.0 (1.5-11.0)
current smoker	1.7 (0.8-3.6)
history of cerebrovascular disease	1.4 (0.4-5.2)

Discussion

In this general practice based study on the use of the ECG as a screening device in older people, we found ECG abnormalities in as much as 42% of participants. Moreover, clinically important ECG abnormalities with potential therapeutic consequences, were detected in 8.8% of all participants. These included silent infarction (4.9%) and previously unknown left ventricular hypertrophy (2.9%) and atrial fibrillation (1.2%).

We could only find one other study that explicitly dealt with the use of the ECG by general practitioners for screening purposes. In their screening survey Wheeldon and colleagues diagnosed atrial fibrillation in 5.4% of participants aged 65 years and over and estimated that among 20% of these coumarine derivates could be prescribed. (16) However, the proportion of patients with atrial fibrillation which were newly detected by the screening was not described. Most other studies in general practice focus on the use of the ECG by general practitioners to create sufficient diagnostic certainty to start thrombolysis at home in patients with suspected acute myocardial infarction (17, 18) or its use as a means to select patients with suspected heart failure for echocardiography. (19-21)

Population based studies have documented the relatively high prevalence of silent infarctions.(7, 22, 23) However, some relied on self reported history of myocardial infarction and do not take the knowledge of the general practitioner about the medical history of the patient into account. Importantly, the prevalence of ECG abnormalities in our study sample did not differ from larger population based studies.

The therapeutic consequences of detecting ECG abnormalities during screening need to be considered carefully. In atrial fibrillation, intervention studies demonstrated beyond doubt that oral anticoagulants, and to a lesser extent aspirin, reduce the risk of stroke. So far, no intervention studies have been performed in patients with silent infarctions. However, the prognosis of silent infarctions is as poor as clinically recognised infarctions. (7) Therefore, it seems logical to treat silent infarctions similar to clinical infarctions. This would include the prescription of aspirin and/or β blockers. Furthermore, as silent infarctions indicate arteriosclerotic target organ damage, preventive measures in the domain of secondary prevention, such as the prescription of lipid lowering drugs, may be indicated. Finally, the presence of left ventricular hypertrophy may serve as an argument to initiate antihypertensive treatment earlier.

Although the overall prevalence of previously unrecognised myocardial infarctions, left ventricular hypertrophy and atrial fibrillation was not very low (8.8%), it may be desirable to target electrocardiographic screening at groups where a higher yield of screening can be expected. In our study, these abnormalities were more likely to be found in subjects who were older and had a history of diabetes mellitus or hypertension. This finding is in accordance with larger population based studies, that showed that infarctions are more likely to be unrecognised among those with hypertension and those with a higher post load glucose. (7, 22) In addition, atrial fibrillation is more frequently encountered among older subjects with diabetes mellitus or a history of transient ischemic attack or stroke. (24, 25)

Although electrocardiographic measurements are not commonly used in clinical practice to assess an individual's risk of cardiovascular disease, they could improve the prediction of cardiac death. These measurements include the more recently reported prolonged QTc interval and the deviation of the T axis, that have been associated with cardiac death in older people, independent of other cardiovascular risk indicators. (26, 27)

Our study had several limitations. We used an intermediate endpoint, the prevalence of previously unrecognised myocardial infarction, left ventricular hypertrophy and atrial fibrillation, to describe the benefits of electrocardiographic screening. Effects of such a screening on morbidity and mortality remain to be proven.

A second limitation concerns the generalisability of our results. Only one practice of three general practitioners took part in our study. Because these general practitioners were interested in cardiology and possessed an electrocardiograph, the rate of electrocardiographic recordings in daily practice is probably higher than in other practices. This would lead to a relatively low prevalence of previously unrecognised ECG abnormalities. Generalisability is further hampered by the fact our ECG study was part of a repeated health check in a cohort of older people. Because those who did not take part in the first health check were not invited at the repeated check five years later, which included the electrocardiography, the study group comprised only of 60.4% of all patients of that age group registered in the practice. Among the patients who were invited however, we were able to achieve a response rate of as much as 80%, which is comparable to the rates generally reached by screening activities in general practice.

In conclusion, the ECG offers the general practitioner a possibility to screen patients on subclinical cardiovascular disease and initiate preventive treatment. When this strategy is applied to all elderly, potentially therapeutic consequences will follow in approximately 10% of all participants. Targeting screening to those with diabetes or hypertension can further improve cost effectiveness of electrocardiographic screening.

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Chapter 6

Effectiveness of repeated screens for hearing loss in the elderly

Introduction

Hearing loss is amongst the most frequent impairments of the elderly. (1) Untreated it may lead to social isolation and it may interfere with the wish of many elderly to live independently. (2, 3) Correlations between hearing impairment, depression and cognitive impairment have been reported. (4-9) The regular use of a hearing aid can improve communicative and cognitive functioning and increase quality of life. (10) Hearing impairment, however, is often not recognised, even not in patients who visit their physician regularly. (11)

A systematic assessment of hearing loss by audiometric screening, whispered voice test or by questionnaires will identify some patients who may benefit from the use of a hearing aid. In addition, the hearing test itself may provide a reason for the physician to discuss the possibilities of hearing rehabilitation with the patient. However, studies show that the effect of a single screen with a pure tone audiometer, as measured by the provision of hearing aids, is not optimal. In 19% to 48% of the hearing impaired subjects that could benefit from a hearing aid, such a device was actually prescribed. (12-14) Repeated hearing assessments may help to remind patients and physicians of the continued need of assessing the possible benefits of hearing aids. Furthermore, repeated screenings will allow the detection of new cases and the identification of patients with progressive hearing loss. (15)

We addressed this issue by comparing the number of hearing aid provisions in patients with a hearing loss after the first and a repeated hearing screen in a cohort of elderly aged 60 years and over. In addition, our study provides information on the development of hearing impairment in the elderly over a period of five years.

Methods

The study was carried out in a group practice with three general practitioners in Krimpen a/d IJssel, a residential town near Rotterdam, the Netherlands. In 1991, all men and women of 60 years and over who were registered in this practice and who did not suffer from severe physical or mental diseases according to their general practitioner were invited to participate in a screening survey. The screening survey was repeated in 1996. Hearing assessments were part of these two surveys, which

further focussed on the detection and management of risk indicators for cardiovascular disease among elderly.

The results of the first hearing screen of the 660 participants in 1991 were published elsewhere.(16) In 1996, 69 of the participants of the first screening examination had died, 35 had moved to another area or to another general practitioner and 3 were lost from the files for some unknown reason. Another 9 persons had to be excluded from further study because of a terminal disease (n=5), dementia (n=3) or for not being able to come to the general practitioner's office (n=1). The resulting 544 patients were invited by letter to visit the surgery for a combined cardiovascular health check and hearing screen. If they did not respond, the written invitation to participate was repeated once near the end of the study. In total 444 (81.6%) persons participated in the study. A hearing assessment was not performed in 39 patients (8.1%) because of one of the following reasons: ear wax that could not be removed (n=2), wearing of a hearing aid (n=18) or logistic reasons (n=7) e.g. the temporary unavailability of the audiometer. Twelve persons did not participate for unknown reasons. Thus, a hearing screen took place in 405 persons.

The hearing screen was performed by a research physician (PJB). It consisted of a questionnaire including questions about hearing complaints as part of a larger interview about the cardiovascular health status. Next, the ears were examined for wax or abnormality. Wax was removed and abnormalities registered and, if needed, treated. Finally, audiometry was carried out in a quiet, but not acoustically isolated, consulting room using the Bosch ST20 pure tone screening audiometer. Both ears were tested at the frequencies 1, 2 and 4 kHz. The average loss was calculated and categorised using the criteria developed by Herbst et al. (4) The result of the hearing screen was immediately discussed with the participants and was also send by mail to the patients a few weeks after the hearing screen. Mild hearing impairment was defined as an average loss of 35-44 dB, moderate impairment as an average loss of 45-69 dB and severe impairment as an average loss of 70 dB or more. When the hearing loss in one or both ears was more than 40 dB, patients were recommended to contact their general practitioner to discuss the possible use of a hearing aid. In the Netherlands, general practitioners are responsible for referring patients to audiologic centres or specialists in otolaryngology. The cut-off point of hearing loss of 40 dB in one or both ears was chosen after discussion with the general practitioners in the research practice and is slightly higher then the cut-off point of 35dB in the best ear,

that is used by the health authorities in the Netherlands to reimburse the costs of hearing aids.

The computerised patient records of the participants whose hearing was found to be impaired at the first hearing screen in 1991 were reviewed to obtain a complete follow up on the possible prescription and use of a hearing aid between 1991 and 1996. The computerised patient records are used by the participating general practitioners to record every consultation. Analogously, the number of hearing aids prescribed before 1 January 1998 were determined in those whose hearing was found to be impaired at the second hearing screen in 1996.

We used the Chi-Square test to examine whether discussion of patients with the general practitioners about hearing complaints, referral to a specialist in otolaryngology and provision of hearing aids differed between patients with and without relevant characteristics. Differences in number of patients with the presence or absence of hearing loss or hearing complaints in 1991 and 1996 among patients who attended both hearing screens were tested by applying Mc Nemar's test. We analysed the change in the average hearing loss at the frequencies 1,2, and 4 kHz for each patient between the first and the second audiometric screen by using the general linear mixed model of the SAS package. A logarithmic transformation was performed to obtain a normal distribution of the mean hearing loss values.

Results

Effectiveness first screen

In the five years after the first hearing screen and before the second screen, a hearing aid was prescribed in only a minority (16.9%) of the 177 participants in whom an average hearing loss of 40 dB or more on the frequencies 1,2 and 4 kHz for the left or right ear had been found and whom thus had an indication for a hearing aid. (Table 1) In almost all of these patients, the hearing aid was prescribed within one year after the audiometric screen. In only 50 (28.2 %) of participants with hearing impairment in 1991, a notice was found in the patient's file referring to a discussion of this problem between patient and general practitioner. Forty-three (86%) of those patients were referred to an otolaryngololist and fifty-four percent of these received a hearing aid.

Table 1. Effect of the first screen categorised in discussion of the hearing loss with the general practitioner (GP), number of hearing aid prescriptions and referrals to a specialist in otolaryngology among those with a hearing impairment (n=247) in the five years following the first hearing screen. An asterisks (*) denotes a statistically significant difference ($p<0.05$) between hearing impaired patients with the characteristic compared to hearing impaired patients without the characteristic.

	Total	Discussed with GP		Referral		Hearing aid	
		number	%	number	%	number	%
Hearing impairment							
All hearing impaired	247	60	24.3	53	21.5	30	12.1
Lightly impaired	166	33*	19.9*	28*	16.3*	15*	9.0*
Moderately impaired	77	25*	32.5*	23*	29.9*	14	18.2
Severely impaired	4	2	50.0	2	50.0	1	25.0
Indication hearing aid	177	50*	28.2*	43*	24.3*	27*	16.9*
Hearing impairment and:							
Male sex	137	37	27.2	22	19.8	18	13.2
Age 75 years and over	65	17	26.2	12	18.5	7	10.8
Two sided hearing loss	155	39	25.2	36	23.2	22	14.2
Complaints of hearing loss	159	48*	30.2*	43*	27.0*	26*	16.4*

Progression of hearing loss between the two screens

In 1996, 80.2% of the eligible patients participated in the repeated hearing screen. Those participants were younger and had a lower prevalence of hearing impairment at the first screen in 1991 as compared to those who did not attend or had died or moved between the two screenings surveys (Table 2). Of the 23 subjects prescribed a hearing aid after the first assessment in 1991and participating in the 1996 study, five had stopped wearing the aid.

Table 2. Population characteristics (%), determined at the first hearing screen in 1991, of the subjects attending a repeat screen after 5 years in 1996(n=405), of non-attenders in 1996(n=100), of those who

were lost from the follow up (i.e. had died or moved, n=107) and of those who were excluded (n=48). An asterisk (*) denotes a statistically significant difference (p<0.05) with attenders.

Characteristic	Attenders n=405	Non attenders n=100	Died or moved n=107	Excluded n=48
Age (years)				
60-69	78.7	62.0*	52.3*	66.7
70-79	18.0	32.0*	24.3	31.3*
>= 80	3.2	6.0	23.4*	2.1
Hearing impairment				
Light	24.0	29.0	17.8	45.8*
Moderate	5.7	13.0*	27.1*	25.0*
Severe	0.7	0.0	0.0	2.1
Hearing aid prescribed	1.2	4.0	2.8	37.5*
Male sex	48.4	47.0	48.6	52.1
Collective health insurance	37.0	52.0*	42.1	41.7

The mean hearing loss at the first audiometric examination was 25.58 dB for the right and 25.3 dB for the left ear. On average, the hearing loss increased between the first and the second measurement by 1.9 dB (95%CI 1.2-2.8) and 2.1 dB (95%CI 1.3-2.8) dB for the right and left ear respectively. The prevalence of moderate hearing loss increased in the five years between the two measurements from 5.7% to 13.1% (Table 3). In contrast, the number of people with a light hearing loss had decreased. Of the 82 subjects whose hearing loss was above the cut off value for the prescription of a hearing aid in 1991, hearing loss had decreased below that value in 19 (23%) patients.

Table 3. Prevalence of hearing complaints and hearing loss for those attending the first and second hearing screen (n=405). An asterisk (*) denotes a significant difference of the second screen with the first screen. (McNemar) The mean age of attenders was 68.4 years in 1991 and 71.4 years in 1996.

Degree of hearing impairment	First hearing screen (1991)	Second hearing screen (1996)
Hearing complaints		
Tinnitis	17	41*

Difficulty with hearing	101	69 *
Both	15	40*
Hearing loss		
Light	97	75*
Moderate	23	54*
Severe	3	8

Effectiveness of the repeated screen

Hearing aid prescription after the second screen was about half as frequent as after the first screen (Table 4). A hearing aid was prescribed in 10 (2.5%) participants or in 7.3% of those with a hearing loss of over 40 dB in the right or left ear. Most of the participants who had a hearing aid prescribed had a moderate hearing loss. None of those with a severe hearing loss (n=8) discussed this problem with their general practitioner or had a hearing aid prescribed. However, this hearing loss was one-sided in all these patients.

Factors influencing prescription of hearing aids

After both screens, more hearing aids where prescribed if the severity of the hearing loss was more severe and if complaints where present. Even among these subjects, however, the incidence of hearing aid prescription after the screens was never higher than 18.2%. Gender, age and whether the hearing loss was two sided or not did not clearly influence prescription rate of hearing aids (Table 4).

Table 4. Effect of the second screen categorised in discussion of the hearing loss with the GP, referrals to a specialist in otolaryngology and number of hearing aid prescriptions and among those with a hearing loss (n=137) in at least ½ year after the second hearing screen. An asterisks (*) denotes a statistically significant difference ($p<0.05$) between hearing impaired patients with the characteristic compared to hearing impaired patients without the characteristic. Light, moderate and severe hearing impairment and indication hearing aid corresponds to an average hearing loss at 1, 2 and 4 kHz of 35-44, 45-69, 70 or more, and 40 or more, respectively, in the right or left ear.

	Total	Discussed with GP		Referral		Hearing aid	
		number	%	number	%	number	%
Hearing impairment							
All hearing impaired	137	23	16.8	19	13.9	10	7.3
Lightly impaired	75	3*	4.0*	1*	1.3*	1*	1.3*
Moderately impaired	54	20*	37.0*	18*	33.3*	9*	16.7*
Severely impaired	8	0	0.0	0	0.0	0	0.0
Indication hearing aid	101	22*	21.8*	19*	18.8*	10	9.9
Hearing impairment and:							
Male sex	80	15	18.8	13	16.3	6	7.5
Age 75 years and over	50	9	18.0	7	14.0	5	10.0
Two sided hearing loss	90	18	20.0	14	15.6	8	8.9
Complaints of hearing loss	94	21*	22.6*	18*	19.4*	10*	10.8*

Discussion

Hearing aid provision in this sample of the elderly people living independently was disappointingly low after a single hearing screen. We hypothesised that a second screen would increase awareness and promote rehabilitation. The added value of the repeated screen was limited to a hearing-aid provision in only an additional 7.4% of the participants with hearing loss.

The number of patients with hearing loss that had a hearing aid prescribed after a single audiometric screening (12.5%) is lower than that reported in the literature. Other studies of hearing screens in general practice show a hearing aid prescription rate of 19%, 28% and 49% respectively among elderly with hearing loss. (4, 13, 14) Since these surveys specifically aimed at detecting hearing problems, they might have attracted more motivated elderly than those who attended our health check, in which the audiogram comprised only a small part of the measurements. Furthermore, these

higher rates may be attributable to a more intensified follow-up of the hearing-impaired participants. This suggests that general practitioners should be prepared to invest more time and effort in an adequate follow up of identified people with a hearing loss in case audiometric screens are performed.

To our knowledge, the effect of a repeated audiometric screens on hearing aid prescription has not been reported before. The response rate to participate in the repeated screen was high (80.2%). However, the younger age and the better hearing in responders compared to non-attenders, may result in a smaller detection rate of hearing-impaired patients. Because successful acceptance of a hearing aid is on average better in younger than in older subjects, and because the time period during which they may profit from the aid is longer, these new cases are, however, potentially more important. (17) The shorter follow up time after the repeated (6 months or less) compared to the first (5 years or less) audiometric screen could partly explain the lower prescription rate. However, after the first screen most hearing aids were prescribed within a short time span.

Audiometric examinations have certain limitations. They are performed in a quiet room, while hearing problems can be most apparent in conversations in noisy environments. Furthermore, they measure only loss and not the way the patient deals with this loss in daily life. Therefore, one could screen on hearing handicap instead of hearing loss by using a questionnaire. It has been shown that help seeking behaviour is higher when the perceived handicap is higher. (18, 19) Thus, screening by means of a combination of a questionnaire and audiometry and subsequently offering a hearing aid is likely to be more efficient than audiometric screening alone. (20) In our study, the presence of complaints was associated with a higher hearing aid use after the screening.

Our data provide information on the development of hearing impairment in the elderly. However, these data should be interpreted with caution. Firstly, regression to the mean will have diluted observed progression of hearing impairment and interobserver variation will have resulted in reduction of the precision of our estimates. Secondly, the hearing screen was not repeated for those who had been prescribed a hearing aid in the five years between the two screens and were still using the aid (n=18). Thirdly, those with better hearing were more prone to participate in the repeated hearing screen. These factors may explain why we found only a moderate

progression of hearing loss. Nevertheless, hearing loss was progressive in our study, which in itself is an argument in favour of repeated screenings.

We conclude that hearing impairment is frequent and progressive but that it leads to referral to an otolaryngolist and the prescription of a hearing aid in only a minority of the cases. Repeated audiometric screens are of limited value when the aim is to increase the use of hearing aids. Standardised follow up procedures of those with hearing loss are crucial, while attention to the self perceived handicap may further increase the rate of hearing aid provisions. If these conditions are not met, efforts to screen on hearing loss will be fruitless and can best be avoided in general practice.

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Chapter 7

Preventive care for older adults between promises and controversies

General discussion

Introduction

Preventive health care is promising. Nevertheless, not all preventive programmes are desirable. In deciding which programme should be implemented, experts often disagree. These controversies were categorised by Schaapveld et al. for a number of preventive initiatives and include efficacy, effectiveness, ethics, competing causes of morbidity and execution of the programme. These controversies can be found in more detail in table 1. (1)

Table 1. Controversies frequently associated with preventive programmes, as categorised by Schaapveld et al.(1)

Field of controversy	Description of controversy
Efficacy	Does the intervention offered by preventive programs lead to a substantial improvement in health in randomised trials?
Effectiveness	Does the intervention offered by preventive programs lead to a substantial improvement in health in every day patient care?
Ethics	To what extent are the benefits of a screening programme outweighed by unwanted effects which harm the health of its participants?
Competing causes of morbidity and mortality	To what extent are the benefits of the screening programme outweighed by a shift to other prevalent causes of morbidity and mortality?
Execution	How must the screening programme be carried out within the health care system?

This thesis demonstrates the promises of some forms of preventive health care in the elderly, notably screening for cardiovascular risk indicators, the assessment of cardiovascular medication used, and screening for hearing loss. However, the introduction of this research programme as a screening programme in general practice would undoubtedly lead to controversies. We discuss these controversies, as mentioned in table 1, with reference to our research findings.

Efficacy

The efficacy of screening programmes depends on the proportion of patients screened positive (e.g. in whom an elevated blood pressure was found) and the efficacy of the interventions.

At the single and a repeated cardiovascular health check after five years, we found at least one risk indicator not recorded in the patient file in 25.1% and 14.5% of the participants, respectively. In addition, 8.8% of the participants had ECG abnormalities with potential therapeutic consequences. Furthermore, the cardiovascular medication review identified ample possibilities to improve prescription. Finally, audiometric screening detected hearing loss in 37.4% and 33.8% of patients at the first and repeated screening respectively. These proportions compare favourably with detection rates of other screening programmes, such as screening for cervical cancer.

Evidence on efficacy of interventions in the elderly is scarce. Older adults, notably those above 75 years of age, are often excluded from randomised trials. In major medical journals, one third of all published trials exclude elderly people without justification. (2) In 73% of trials that focussed on the treatment of acute myocardial infarction in 1980-1991, a maximum age was defined. The average age of participants of these trials was 56.8 years while most people experience their first myocardial infarction later in life. (3)

Recent hypertension trials did include older people up to eighty years and clearly demonstrated the benefit of antihypertensive treatment. (4-7) Most of these trials were performed decades after such benefit was demonstrated in middle aged adults. In the meantime, practitioners have been left with little scientific data on the risk-benefit ratio of treating older patients for hypertension. In retrospect, this lack of conclusive evidence will have contributed to undertreatment of hypertension and isolated systolic hypertension.

The efficacy of lowering cholesterol levels in older subjects has been debated. (8-12) Recently, trials that focussed on secondary prevention clearly demonstrated a risk reduction in the occurrence of major cardiovascular events in patients aged 60 and over. (13, 14) On the other hand, the benefits of lipid lowering in elderly without evidence of cardiovascular disease are only modest. (15) Thus, measuring cholesterol levels in older patients should primarily be targeted at those with manifest

cardiovascular disease. This illustrates that evidence on the efficacy of interventions can change substantially over time. Periodic health checks can serve as a means to adjust therapy to the current standards.

Effectiveness

Controversies about the effectiveness arise when experts do not agree on the extent to which the theoretical benefits of an efficacious screening programme translate into benefits in clinical practice. The effectiveness particularly depends on the response rates when screening programmes are introduced, on the extent to which positive screening results are followed by interventions and finally on the benefits of the interventions when they are offered to 'real life' patients instead of participants of clinical trials.

The response rates strongly depend on the way the screening programme is executed. Invitation and execution of the program by the general practitioner and a repeated invitation to non-responders all improve response rates. In this way, we were able to reach response rates of 80%. These are comparable to the high response rate achieved by the national screening program on cervical cancer, also executed by general practitioners.

Knowledge of the presence of a risk indicator by the treating physician or the patient is not enough, as not all patients will subsequently receive an intervention. After the first cardiovascular health check in 1991, only 6/25 patients with previously unknown hypertension received antihypertensive drugs. The literature confirms that, although efficacious, antihypertensive treatment is often not initiated in patients with hypertension. Factors that determine whether drug treatment is initiated include blood pressure level and the patient's age. (16-18) The threshold blood pressure used by general practitioners to prescribe antihypertensive treatment is usually higher than the level advised in the guidelines. In a survey performed in 1993, 51% of the general practitioners in the UK, contrary to existing guidelines, did not treat isolated systolic hypertension at all. (16)

Another example of the way in which lack of interventions after screening hampers the effectiveness of a screening programme is the issuing of hearing aids after screening on hearing loss. Although one trial and several observational studies

unequivocally showed the efficacy of these devices, few elderly will use a hearing aid after audiometrically demonstrated hearing loss. (19, 20)

When interventions are started after a positive screening result, the benefits of these interventions are often less than expected on the basis of the findings in randomised controlled trials. This can be explained partially by the highly selective process by which participants of clinical trials are recruited and by the efforts to motivate patients during the follow up period. The lack of comorbidities and comedications make trial participants quite distinct from patients seen in every day practice. (21, 22) In addition, non compliance and poor patient management play a role.

For example, when treatment with anti hypertensive drugs is started, target blood pressure levels are often not reached. Berlowitz et al showed that among older men with more than six hypertension related visits per year, 40 percent had a blood pressure above 160/90. This can be explained by a lack of compliance or, as the authors suggest, by inadequate patient management. (23)

Ethics

'Primum non nocere' is an ethical principle which is used to guide the practice of medicine. In preventive medicine, this principle is even more crucial since we are actively offering medical care instead of responding to needs of care. The potentially harmful effects of screening include taking away healthy time from people, decreased quality of life, the offering of false assurance and increased medicalisation of old age. (24, 25)

Screening of poor quality, i.e. which does not fulfil the criteria of Wilson (Chapter 1), may cause more harm than benefits. In addition to Wilson's criteria, respect for the patients autonomy and a focus on the patient's and society's well-being can be mentioned as criteria for an ethically acceptable screening programme. Patients must have the freedom to decide whether or not to participate in the programme or to accept the intervention. The well-being of the patient and the society at large should be kept in mind all times to ensure that screening programmes do more good than harm.

Quantitative evidence of harmful effects of screening on cardiovascular risk indicators which cast doubt on the ethics of screening efforts was first reported by Haynes et al,

who found an increased absenteeism from work among those who were labelled hypertensive at a screening examination in the workplace. (26) In a general practice setting, Stoate demonstrated that compared to controls, patients' own assessment of psychological distress was significantly increased three months after a cardiovascular screening programme. (27) However, these results were not confirmed by the investigators of the British Family Heart Study, a randomised clinical trial aimed at demonstrating the effects of nurse lead intervention on the prevalence of cardiovascular risk indicators. Indeed, they found that the intervention group rated their health higher than the control group. As the authors state, this might be partly explained by the patient centred approach adopted by the nurses and by changes in the social and cultural acceptance of screening. (28) In a study in the Netherlands, among those patients at high risk for cardiovascular disease the perception of the general health status did not decrease after one year of intervention. (29) Thus, cardiovascular screening in the middle aged does not seem to do much harm. It is unlikely that cardiovascular screening will have more harmful effects in older adults than in middle aged adults.

The effects of screening for hearing loss, either beneficial or harmful, have not been evaluated in older people. The prevalence of hearing loss is high but only a minority of patients does accept a hearing aid. This means that screening often leads to a diagnosis only and treatment will not be initiated in a substantial number of participants. It can be questioned whether this is ethically acceptable. The same holds for electrocardiographic screening. In our study we detected electrocardiographic abnormalities that would not have led to differences in treatment in 36% of all patients.

Competing causes of morbidity and mortality

The pessimist's argument, which is often heard when it is comes to preventive care in older age, is that it is simply started too late. What can be gained by prevention of one disease, eg. cardiovascular disease at older age, may be lost as a consequence of a shift to other frequent causes of morbidity and mortality, such as cancer. It was calculated that if all cardiovascular disease could be eliminated, the life expectancy of a 65 year old male would increase by 3.5 years, of which 2.7 years would be spend

with disabilities. (30) These models raise the question whether healthy life expectancy increases substantially, when we are offering preventive care to older adults.

Improvement in prevention and treatment may accomplish a trade-off between mortality and morbidity. In the Netherlands, for example, the decreased case fatality rate after myocardial infarction increased the prevalence of more chronic forms of cardiovascular diseases, notably heart failure. (31, 32) A case fatality decline has also been observed in acute stroke, the survivors being at high risk to develop a major stroke at older ages. (33) Nevertheless, in the Netherlands the recent increase in life expectancy has been associated with a proportional increase in healthy life expectancy. (34)

In contrast with prevention for cardiovascular disease, which aims at reduction of morbidity and mortality, competing causes of mortality and morbidity are not an issue for preventive measures directed at functional limitations, such as hearing loss. This makes increasing functional status a valuable goal for prevention in the oldest old where competing causes of morbidity and mortality are highly incident. (30, 35)

Execution

Although some forms of preventive care are promising, general practice may not be adequately equipped to execute these programmes. This is illustrated by the various ways in which the compulsory health checks for older adults are carried out in the UK. (36, 37) On the other hand, simple preventive programs, such as influenza vaccination, have been implemented successfully in general practice. (38) Apart from motivational issues, practical barriers to the implementation of preventive care can be identified. (39)

Firstly, it may not be clear which strategy should be preferred to identify those with a high risk of cardiovascular disease. Since the strategy determines the workload of the screening, the pro's and con's of each strategy should be carefully considered. A general practitioner could offer a screening test (e.g. measurement of blood pressure) while being consulted by a patient for another reason. This case finding strategy may be appropriate when screening the elderly because this age group frequently consults a general practitioner and those who do not are relatively healthy. However, not all

consultations offer the possibility for case finding and thus it may take a long time before the entire population at risk is screened.

In addition, care must be taken to perform case finding systematically. Not surprisingly, we identified many hypertensive subjects at our health checks who were not detected previously by normal care case finding.

Actively inviting subjects by mail or telephone to participate in a preventive programme is the alternative. More patients can be reached systematically in a short time span. However, this approach contrasts with the roles practitioners and patients have adopted over time. Furthermore, it requires more effort from practices and patients. Probably a combination of the two strategies, case finding followed by invitations for those who have not been screened opportunistically after a fixed period of time, combines the strong points of each strategy.

Secondly, it should be decided at which interval the screening examinations have to be performed. We repeated our screening examination after five years in the same group of patients and our major finding was that 9.2% of the participants had isolated systolic hypertension which had not been recorded previously in the patient file. Thus, after a five year interval repeated screening on isolated systolic hypertension will detect sufficient numbers of new cases or cases with insufficient follow-up after the first screening. Repetition of the screening on hearing loss after five years revealed comparable proportions of patients with hearing loss after the first and the repeated screening, but a reduced number of hearing aid prescriptions after the repeated screening. Thus, repetition of screening on hearing loss is not a preferable strategy to diminish the problems of hearing loss. Instead, the follow-up after screening should be improved to ensure that more hearing aids are issued among those in whom a hearing loss is detected.

Thirdly, the demand the introduction of a preventive programme in a general practice places the organisation of the practice needs to be considered. A survey in the Netherlands in 1991 showed that more than half of the practices were not equipped to perform preventive services. (39) Improvement of the practice organisation may prove to be the most important challenge facing the implementation of preventive care. Aids to improve the practice organisation include the use of the expertise of practice nurses, practice assistance and facilitators, and optimal use of computers.

Practice nurses have not been introduced in the Netherlands on a large scale. Several experiments show that the introduction of nurses may improve patient care mainly because health care is offered according to guidelines more systematically. (40) Preventive care, which requires such a systematic approach, may benefit from the introduction of these health professionals. In the United Kingdom, nurses already execute many preventive tasks. Practice assistance in the Netherlands have long been involved in administrative duties only, but could, if appropriately educated, play a more active part in preventive care.

Facilitators are health care professionals who assist general practitioners and practice assistants with the implementation of preventive care by using a structured approach, including practice visits and group education. Facilitators have shown to be able to improve practice organisation in the UK. In the Netherlands, the may have comparable beneficial effects (41, 42)

Finally, computers are mandatory to identify patients for case finding or selective screening. Furthermore, they may guide treatment decisions, including those on preventive therapy, and may educate patients about their cardiovascular risk. (43)

Although investments to improve practice organisation are costly, it should be noted that they will also serve to adapt general practice to future requirements, such as providing care for the ageing population, consultations for specific groups of patients (e.g. diabetic patients) and transmural care.

Conclusion

This chapter discussed the implications of offering a cardiovascular screening program and a screening program on hearing loss to older adults. Both screening programmes offer the GP ample new information on the health of their older patients. Screening on hypertension or isolated systolic hypertension by a combination of case finding and screening by invitation and a regular review of the cardiovascular medication used by older adults should be introduced in general practice. To assure systematic execution of these programmes and adequate follow up, improvement of practice organisation is mandatory.

Until now, screening on hearing loss fails to live up to its promises. Although many patients with hearing loss could be identified, only a minority accepted an intervention, the issuing of a hearing aid. Research should firstly be focused on the identification of barriers to accept an hearing aid and thus offer ways to better educate patients and their doctors about the benefits of these devices.

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Summary

During the last decades, Western countries have witnessed a growth of their older population. Nowadays, people live longer than ever before. In the Netherlands, life expectancy at birth in 1994 was 2.1 year higher for men and 1.1 year higher for women compared to 1980 and is predicted to have risen by an additional 2.5 years for men and 1 year for women in 2015. However, not all older adults spend those extra years in good health. Of their 74.3 years, which is the life expectancy at birth for males in the Netherlands, on average only 60.1 years will be spend in good health.

In view of this seemingly inevitable burden of disease, efforts to postpone disease and preserve good health in the elderly are becoming more important. Prevention at older age focuses on offering interventions that reduce premature death or prevent or postpone the occurrence of disease or improves functional status. For example, the treatment of hypertension is directed at the first two endpoints whereas the prescription of a hearing aid is expected to improve functional status. Generally, the older a person becomes the more the aim of prevention shifts toward improvement of functional status.

Prevention is considered a task of general practitioners but it is debated if general practitioners should offer preventive services to older patients.

In chapter 1 we discussed the promises and unresolved areas of preventive care for the elderly in general practice, with reference to the prevention of cardiovascular disease, which is highly prevalent and is the main cause of death among older adults, and the prevention of the consequences of hearing loss, which is a major cause of functional limitation at older age.

Screening on cardiovascular risk indicators and hearing loss by general practitioners seems promising as it meets most of Wilson's criteria of screenings activities.

Unfortunately, however, doubt remains whether screening can be performed continually in general practice, whether the facilities exist in general practice to assess and follow-up those screened and whether screening is economically justifiable. We conclude that more research is needed to solve two additional areas of uncertainty; the applicability of the evidence on the efficacy of interventions in older adults in primary care and the feasibility of screening programmes in every day practice.

In chapter 2 we studied the feasibility and the diagnostic or therapeutic consequences of a single cardiovascular health check in adults aged 60 and over.

In 1991, 1002 persons aged 60 years and over, enlisted in one general practice were invited. Of the 805 subjects who responded (response rate 80%) the cardiovascular risk profile was determined by a research physician. The proportion of newly detected cardiovascular risk indicators was the main outcome measure.

In 25.1% of the participants one or more cardiovascular risk indicators were found that were previously unknown to the GP, including 38 (4.7%) cases of hypertension, 82 (10%) cases of isolated systolic hypertension, 11 (1.4%) cases of diabetes mellitus and 63 (7.8%) cases of hypercholesterolaemia. On the basis of these findings, the GP initiated therapeutic interventions in almost all subjects with newly detected diabetes. However, reports of newly detected hypertension or high cholesterol levels were usually not followed by an intervention.

Thus, although a single cardiovascular health check in the elderly can detect a considerable number of risk indicators, its effectiveness may be limited by the lack of interventions. More efforts are needed to ensure that the beneficial effects of these interventions are not limited to participants in clinical trials but can be extended to patients in general practice.

Since cardiovascular risk changes over time, a repeated cardiovascular health check may be of value. In chapter 3 we describe our finding of a repeated cardiovascular health check performed five years after a first health check, within the same cohort. A total of 509 elderly men and women, registered at the study practice and aged 60 years and over at the first health check participated (response rate 80%). We observed newly detected risk indicators in 14.5% of all participants; these risk indicators being

hypertension (2.2%), isolated systolic hypertension (9.2%), diabetes mellitus (0.8%) and hypercholesterolemia (3.5%). However, about 40% of these risk indicators were already observed at the first health check but were not adequately followed-up.

We concluded that a repeated cardiovascular health check in the elderly may be of value to inform the general practitioner about previously unknown risk indicators, notably isolated systolic hypertension. However, this benefit would be significantly reduced if all risk indicators found at the first health check were adequately followed-up. Furthermore, the same benefit at lower cost is likely to be obtained by focusing preventive efforts on improving case finding for isolated systolic hypertension.

In addition, a cardiovascular health check can be of value to review the use of cardiovascular medication or to be more informed about the cardiovascular risk of participants by means of electrocardiographic findings. Among participants of the repeated cardiovascular health check, we performed two studies to demonstrate the effects of the health check on these endpoints.

Inappropriate prescription or improper use of cardiovascular medication can cause undesired effects, particularly in older people. To prevent such effects, it has been suggested to regularly review the medication used by older persons. In the Netherlands however, where routine monitoring of prescribed medication is high, the additional value of medication reviews may be limited.

In chapter 4 we addressed this issue by reporting the results of a quantitative assessment of the benefits of a medication review. A total of 560 men and women, aged 64 years and over, were interviewed about their medication use and current medications, dosages, reasons for use and the prescribing doctors were registered. Among these subjects, 209 (37.3%) users of cardiovascular medication were identified. After the interview, the information given by the participants who used cardiovascular medication was compared with the information available in the general practitioner's (GP's) computerised patient file.

The GPs knew of 92% of the prescribed cardiovascular drugs used by their older patients. Dosages below the minimum effective dose were present in 19% and interactions in 18% of all prescriptions for cardiovascular drugs. Generally, there was

a low adherence to prescription guidelines for hypertension, angina pectoris and heart failure. In many cases, patients were unaware of the indication for their drug treatment.

We concluded that medication reviews are a valuable tool to ensure safe and effective use of cardiovascular medication by older people, even when standards of medication monitoring are relatively high, such as in the Netherlands.

Electrocardiograhpy is frequently used in clinical practice for the diagnosis and management of heart disease. In addition, a GP may consider to use the ECG in asymptomatic patients as a tool to guide cardiovascular risk stratification.

In chapter 5 we report the results of an assessment of the value of electrocardiographic screening of older people in general practice. ECG recordings were obtained from 489 patients, aged 64 years and over. The ECG recordings were interpreted by the Modular ECG Analysis System (MEANS), a validated ECG interpretation programme.

Among 41.7% of our participants an ECG abnormality was found. The ECG detected one of the following previously unknown ECG abnormalities that may have therapeutic consequences in 8.8% of the participants; myocardial infarctions (4.9%), left ventricular hypertrophy (2.9%) and atrial fibrillation (1.2%). Diabetes (OR 4.0) and hypertension (OR 2.2) were independent predictors of the presence of these newly detected abnormalities. The most frequent other ECG abnormalities included atrioventricular block (12.5%), deviation of the frontal T axis (10.7%), and prolonged QTc interval (10.2%).

In conclusion, electrocardiographic screening provides the GP with additional information about the presence of silent infarction, left ventricular hypertrophy and atrial fibrillation in approximately 10% of the screened patients. Targeting screening at those with diabetes or hypertension will further improve the cost effectiveness of electrocardiographic screening in older people.

In chapter 6 we change focus from cardiovascular disease, which is the major cause of death in the Netherlands, to a major cause of functional limitation, hearing loss.

Hearing loss is amongst the most frequent impairments of the elderly. Untreated hearing loss may lead to social isolation and may interfere with the wish of many elderly to live independently. Correlations between hearing impairment, depression and cognitive impairment have been described. The regular use of a hearing aid can improve communicative and cognitive functioning and increase quality of life. Hearing impairment, however, is often not recognised, even not in patients who visit their physician regularly.

A systematic assessment of hearing loss by audiometric screening will identify some patients who may benefit from the use of a hearing aid. However, it has been observed that the effect of a single screen with a pure tone audiometer, as measured by the provision of hearing aids, is not optimal. Repeated hearing assessments may help to remind patients and physicians of the continued need of assessing the possible benefits of hearing aids. Furthermore, repeated screenings will allow the detection of new cases and the identification of patients with progressive hearing loss.

The aim of the study described in chapter 6 was to assess the value of repeated audiometric screens offered to elderly in general practice. In 1991, an audiometric screen was performed on 660 participants, simultaneously with the first cardiovascular health check. We repeated the audiometric screen 5 years later in 80.2% (405/505) of the eligible participants of the first screen. After the first screen, 28.2% of those who had an indication for a hearing aid, i.e. who had a hearing loss of 40 dB or more in the right or left ear, had discussed this with their general practitioner, 24.3% were referred to a specialist in otolaryngology and 16.9% had been prescribed a hearing aid. The effect of the repeated screen was lower as only 9.9% of the hearing impaired participants received a hearing aid.

We conclude that efforts to screen on hearing loss will be fruitless and can best be avoided in general practice unless strategies are developed to increase the use of hearing aids after a positive screening result.

In chapter 7 the implications of the studies reported in this thesis are mentioned. Both the screening on cardiovascular risk indicators and on hearing loss offer the GP ample new information on the health of their older patients. Screening on hypertension or isolated systolic hypertension by a combination of case finding and screening by invitation and a regular review of the cardiovascular medication used by older adults

should be introduced in general practice. To assure systematic execution of these programmes and adequate follow up, improvement of practice organisation is mandatory.

Until now, screening on hearing loss fails to live up to its promises. Although many patients with hearing loss could be identified, only a minority accepted an intervention, the issuing of a hearing aid. Research should firstly be focused on the identification of barriers to accept an hearing aid and thus offer ways to better educate patients and their doctors about the benefits of these devices

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Samenvatting

Gedurende de laatste decennia is het percentage ouderen in de bevolking van Westerse landen toegenomen. Op dit moment leven mensen langer dan ooit tevoren. In Nederland was in 1994 de levensverwachting bij de geboorte 2,1 jaar (mannen) en 1,1 jaar (vrouwen) hoger dan in 1980. In de toekomst zal de levensverwachting verder stijgen; voorspeld wordt dat mannen in 2015 2,5 jaar en vrouwen 1 jaar langer leven dan nu. Helaas is dit langere leven voor ieder niet even gunstig omdat een deel van dat extra leven in ziekte wordt doorgebracht. Van de 74,3 jaar die mannen gemiddeld leven wordt maar 60,1 jaar in goede gezondheid beleefd.

Gezien de schijnbaar onvermijdbare ziektelast die deze demografische ontwikkelingen met zich meebrengen, worden pogingen om gezond oud te worden steeds belangrijker. Preventieve maatregelen op oudere leeftijd bestaan uit het aanbieden van interventies die de kans op vroegtijdig overlijden verkleinen, ziekten voorkomen of uitstellen en functionele beperkingen zo veel mogelijk opheffen. Zo is bijvoorbeeld het voorschrijven van middelen tegen hoge bloeddruk gericht op uitstel van ziekte of sterfte terwijl het voorschrijven van een gehoorapparaat meer tot doel heeft het functioneren te optimaliseren. In het algemeen geldt dat hoe ouder de persoon is, hoe meer het doel van preventie zich verplaatst naar het voorkomen van functionele beperkingen.

Preventie wordt tot het takenpakket van de huisarts gerekend, maar het geven van preventieve zorg aan ouderen staat ter discussie.

In hoofdstuk 1 worden de voor- en nadelen van preventieve zorg voor ouderen door de huisarts besproken. We beperken ons in deze bespreking tot preventie van hart- en vaatziekten, de belangrijkste oorzaak van sterfte en ziekte, en tot de preventie van de gevolgen van slechthorendheid, wat een belangrijke functionele beperking is op oudere leeftijd.

Screening op cardiovasculaire risico-indicatoren en gehoorsverlies door huisartsen lijkt veelbelovend omdat het voldoet aan een groot aantal criteria van Wilson, die bepalen of screening wenselijk is. Twijfel blijft echter bestaan of preventieve programma's wel op een continue basis kunnen worden uitgevoerd, of de faciliteiten nodig voor verdere diagnostiek en behandeling in de huisartpraktijk beschikbaar zijn en of de verhouding tussen de kosten van het preventieve programma en de overige kosten van de gezondheidszorg zich wel goed verhouden.

In aanvulling op deze criteria blijven er ook vragen bestaan over de toepasbaarheid van het bewijs over de doelmatigheid van interventies op oudere patiënten die de huisarts bezoeken en de uitvoerbaarheid van preventieve programma's in de alledaagse praktijk

In hoofdstuk 2 onderzochten we de uitvoerbaarheid en de diagnostisch en therapeutische gevolgen van een screenings-onderzoek gericht op hart- en vaatziekten bij patiënten van 60 jaar en ouder.

In 1991 werden alle personen boven de 60 jaar die in goede gezondheid waren en ingeschreven als patiënt in de onderzoekspraktijk uitgenodigd voor het screenings-onderzoek. Bij 805 patiënten, 80% van degene die waren uitgenodigd, werd een cardiovasculair risicoprofiel bepaald door een onderzoeksarts. De ratio tussen het aantal nieuw ontdekte risico-indicatoren en het aantal deelnemers was de belangrijkste uitkomstmaat.

Bij 25.1% van de deelnemers werden één of meer cardiovasculaire risico-indicatoren gevonden die niet eerder bekend waren bij de huisarts. Dit betrof 38 (4.7%) patiënten met hypertensie, 82 (10%) patiënten met geïsoleerde systolische hypertensie, 11 (1.4%) patiënten met diabetes mellitus en 63 (7.8%) patiënten met hypercholesterolemie. Op basis van dit screenings-onderzoek werd bij alle patiënten met nieuw ontdekte diabetes mellitus een behandeling gestart. Echter, na het ontdekken van hypertensie of een verhoogd cholesterol volgde meestal geen behandeling.

Uit dit onderzoek blijkt dat, hoewel een eenmalig cardiovasculair screenings-onderzoek veel nieuwe informatie oplevert, het uiteindelijke effect op de therapie gering is. Er moet meer aandacht komen voor het vertalen van de gunstige resultaten

van therapie in klinisch onderzoek naar het voorschrijven van deze interventies in de huisartspraktijk.

Omdat het risico dat een persoon loopt op het krijgen van een hart- en vaatziekten niet constant blijft kan het waardevol zijn een screenings-onderzoek te herhalen.

In hoofdstuk 3 beschrijven we de resultaten van het herhalen van het screenings-onderzoek vijf jaar na het eerste onderzoek. Alle patiënten die deel hadden genomen aan het eerste onderzoek, ingeschreven waren in de huisartspraktijk en in goede gezondheid waren werden hiervoor in 1996 uitgenodigd. Tachtig procent (n=509) van de patiënten ging op deze uitnodiging in en nam deel aan het herhalingsonderzoek.

Bij 14.5% van de deelnemers vond een onderzoeksarts voor de huisarts nieuwe informatie, wat bestond uit patiënten met hypertensie (2.2%), geïsoleerde systolische hypertensie (9.2%), diabetes mellitus (0.8%) en hypercholesterolaemie (3.5%). Een belangrijke bevinding was dat de aanwezigheid van 40% van deze risico indicatoren al tijdens het eerste onderzoek was vastgesteld.

Onze conclusie luidt dat herhaling van het cardiovasculaire screenings-onderzoek zeker zin heeft, vooral voor het ontdekken van geïsoleerde systolische hypertensie. De opbrengst van het herhalingsonderzoek zou evenwel duidelijk minder zijn geweest indien er meer aandacht was besteed aan de resultaten van het eerste onderzoek. Verder is het efficiënter het herhalingsonderzoek uitsluitend te richten op het opsporen van geïsoleerde systolische hypertensie. Een algemene screening lijkt, zelfs voor een generalist als de huisarts, te algemeen.

Een screenings-onderzoek op het gebied van hart- en vaatziekten door de huisarts kan zich verder richten op het evalueren van de gebruikte cardiovasculaire medicatie en op het verkrijgen van electrocardiografische gegevens om het cardiovasculaire risico beter te kunnen inschatten. Onder de deelnemers van het herhaalde screenings-onderzoek deden we twee aanvullende studies om de waarde van medicatie evaluatie en het electrocardiogram (ECG) vast te stellen.

Het sub optimaal voorschrijven of het onjuist gebruik van cardiovasculaire medicatie kan, zeker bij ouderen, lijden tot ongewenste effecten. Om deze effecten te

voorkomen wordt geadviseerd regelmatig het medicatiegebruik van ouderen te evalueren. In de Nederlandse situatie echter, waar de medicatiebewaking goed ontwikkeld is, kan men zich afvragen of er voor dit advies wel een grond bestaat. In hoofdstuk 4 gaan we hierop in door de effecten van het evalueren van cardiovasculaire medicatie te kwantificeren.

In het totaal werden 560 mannen en vrouwen van 64 jaar en ouder geïnterviewd over hun medicatiegebruik. Alle gebruikte medicatie, doseringen, voorschrijvers en redenen voor gebruik werden geregistreerd. Na het interview werd de informatie van degenen die cardiovasculaire medicatie gebruikten (n=209) vergeleken met de informatie over medicatiegebruik uit het electronisch medisch dossier van de huisarts.

De huisarts was op de hoogte van 92% van de voorgeschreven cardiovasculaire medicatie die door hun oudere patiënten werd gebruikt. Doseringen lager dan de minimum effectieve dosis stonden op 19% van de recepten en bij 18% van de recepten was een interactie met een ander gebruikt geneesmiddel mogelijk. Voor de behandeling van hypertensie, angina pectoris en hartfalen werd weinig gebruik gemaakt van het middel van eerste keus volgens de NHG-standaarden. Vaak waren patiënten niet op de hoogte van de indicatie voor het gebruik van hun geneesmiddel.

Medicatie evaluatie biedt veel mogelijkheden het cardiovasculaire medicatiegebruik te optimaliseren. Het is daarom een waardevol middel om veilig en doeltreffend gebruik van cardiovasculaire medicatie door ouderen te garanderen, zelfs wanneer medicatie controle al op een hoog niveau staat.

Electrocardiografie wordt veel gebruikt in de klinische praktijk voor de diagnostiek en behandeling van hartziekten. Hiernaast kan een huisarts overwegen het ECG te gebruiken om het cardiovasculaire risico bij asymptomatische patiënten beter in te schatten.

In hoofdstuk 5 vermelden we de resultaten van een studie naar de waarde van electrocardiografische screening van ouderen in de huisartspraktijk. Bij 489 patiënten van 64 jaar en ouder werd een ECG gemaakt. Het ECG werd vervolgens geïnterpreteerd met behulp van de computer door het Modular ECG Analysis System (MEANS), een gevalideerd ECG interpretatie programma.

In het totaal werd bij 41.7% van alle deelnemers een ECG afwijking gevonden. De volgende, niet eerder bekende ECG afwijkingen werden aangetroffen bij 8.8% van de deelnemers; stille infarcten (4.9%), linkerventrikelhypertrofie (2.9%) en atrium fibrilleren (1.2%). Diabetes mellitus en hypertensie voorspelden, onafhankelijk van andere factoren, de de aanwezigheid van deze ECG afwijkingen. De meest frequente overige ECG afwijkingen waren atrioventriculair blok (12.5%), deviatie van de frontale T as (10.7%) en een verlengd QTc interval (10.2%).

Samenvattend kunnen we zeggen dat één op de tien gemaakte ECG's de huisarts nieuwe informatie geeft over stille infarcten, linkerventrikelhypertrofie en atrium fibrilleren. Wanneer de screening beperkt zou worden tot patiënten met hypertensie of diabetes mellitus zou de kosten effectiviteit van de ECG screening bij ouderen verder verbeteren.

In hoofdstuk 6 verandert het onderwerp van hart- en vaatziekten, de meest levensbedreigende ziekte, naar een functioneel belangrijke beperking, slechthorendheid.

Slechthorendheid is één van de meest voorkomende beperkingen op oudere leeftijd. De gevolgen van slechthorendheid zijn sociale isolatie en een vermindering van het vermogen zelfstandig te leven. Ook zijn correlaties beschreven tussen slechthorendheid enerzijds en depressie en cognitieve stoornissen anderzijds. Het gebruik van een gehoorapparaat verbetert het communicatieve en cognitieve functioneren en verbetert de kwaliteit van leven. Vaak wordt slechthorendheid niet herkend, ook al bezoeken patiënten hun huisarts regelmatig.

Een systematisch onderzoek naar gehoorsverlies door audiometrische screening zal patiënten ontdekken die kunnen profiteren van een gehoorapparaat. Uit dit soort onderzoeken is echter gebleken dat het aantal gehoorapparaten dat na de screening wordt voorgeschreven minder is dan verwacht. Herhaling van het gehooronderzoek biedt dan mogelijkheid aan patiënten en artsen de mogelijkheden van een gehoorapparaat te heroverwegen. Bovendien kan herhaling nuttig zijn om nieuwe patiënten met slechthorendheid te ontdekken en om de progressie van het gehoorsverlies vast te leggen.

Het doel van het onderzoek dat in hoofdstuk 6 beschreven wordt is het vaststellen van de waarde van een herhaald audiometrisch onderzoek naar slechthorendheid. In 1991

werd, gelijktijdig met het screenend onderzoek naar hart- en vaatziekte, bij 660 deelnemers een audiogram gemaakt. Wij herhaalden het audiogram vijf jaar later in 80.2% (405/505) van de patiënten die nog uitgenodigd konden worden voor het onderzoek. Tijdens het eerste onderzoek werd bij 247 (37.4%) deelnemers en tijdens het tweede onderzoek bij 137 (33.8%) deelnemers slechthorendheid vastgesteld. Na het eerste onderzoek werd door 24.3% van de slechthorende patiënten het gehoorsverlies besproken met de huisarts. In het totaal 21.5% van de slechthorende patiënten bracht een bezoek aan de KNO arts of een audiologisch centrum en uiteindelijk kreeg 12.1% een gehoorapparaat voorgeschreven. Het effect van de herhaalde screening was lager dan van de eerste screening; uiteindelijk ontvingen maar 7.3% van de slechthorenden een gehoorapparaat.

Huisartsen kunnen beter wachten met screenen op gehoorsverlies totdat strategieën zijn ontwikkeld die een beter gebruik van gehoorapparaten als interventie bij gehoorsverlies garanderen.

In hoofdstuk 7 worden de implicaties van de onderzoeken van dit proefschrift besproken. Enkele belangrijke controversen op het gebied van preventieve zorg voor ouderen worden besproken. Screening op risico indicatoren voor hart- en vaatziekten en op gehoorsverlies bevindt zich op dit moment in een niemandsland tussen beloften en onzekerheden. Totdat wij meer zekerheden krijgen, is het raadzaam preventieve zorg voorzichtig in te voeren, gebaseerd op kennis die al wel beschikbaar is. Dit betekent dat op dit moment alleen plaats is voor een systematische opsporing van geïsoleerde systolische hypertensie bij ouderen tot 80 jaar. Van alle andere mogelijkheden is een jaarlijkse medicatie evaluatie het meest veelbelovend en het minst onzeker.

Dankwoord

'No man is an island, we are all part of the continent' Ernest Hemingway

De promovendus als eenzame, in toenemende mate wereldvreemde, noeste werker aan zijn levenswerk behoort tot de voltooid verleden tijd. De meeste proefschriften bevatten dankwoorden waarin gesproken wordt over samenwerking, wederzijdse inspiratie en relativering. Graag sluit ik mij hierbij aan.

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Curriculum vitae

Pieter Johannes (Pieter) van den Berg was born on September 11, 1966 in Bleiswijk, the Netherlands. After graduating from secondary school at Groevenbeek College in Ermelo, he started his medical studies at Utrecht University in 1986. During his study he showed interest in the different aspects of medicine, including research on the prenatal echographic diagnosis of hydrocephalus (supervisor: Dr. R.H.J.M. Gooskens, child neurologist) and tropical medicine. In 1994 he obtained his medical degree.

Following his graduation he worked as a resident in Cardiology at the Lange Land Ziekenhuis in Zoetermeer and as a resident in Pediatrics at the Antonius Ziekenhuis in Nieuwegein

In 1995 he started the work described in this thesis at the Department of General Practice, Erasmus University Medical School, Rotterdam. (promotors: Prof. dr. A Prins and Prof. dr. A.W. Hoes)

In 1998 he achieved the Master of Science in Clinical Epidemiology at the Netherlands Institute for the Health Sciences in Rotterdam. (head: Prof. dr. A. Hofman)

From March 1, 1999 he started his training as a general practitioner at the Department of General Practice, Erasmus University Medical School, Rotterdam (head: Prof. dr. S. Thomas)