Surveillance of routine practice for screening and monitoring of dyslipidaemia

A population based study in a large geographical area

Helle Kanstrup, PhD[1, 2, 3], *Jens Flensted Lassen*, PhD[4], *Lene Heickendorff*, DMSc [1], *Torsten Lauritzen*, DMSc[3] & *Mogens Lytken Larsen*, DMSc[2]

1) Department of Internal Medicine and Cardiology, Aarhus Sygehus, Aarhus University Hospital. 2) Department of Clinical Biochemistry, Aarhus Amtssygehus, Aarhus University Hospital. 3) The department of General Practice, University of Aarhus. 4) Department of Cardiology, Skejby section Aarhus University Hospital, Denmark.

Correspondence: Helle Kanstrup, Department of Internal Medicine and Cardiology, Aarhus Sygehus, Tage-Hansens Gade 2, DK-8000 Århus C.
E-mail: H.Kanstrup@dadlnet.dk

ABSTRACT

Introduction: The aim was to develop a method for continuous monitoring of routine practice of screening and monitoring of dyslipidaemia, and to present the present status of cholesterol screening and monitoring in a large well-defined geographic area in Denmark.

Methodology: Population based register survey, based on the electronic laboratory information system (LIS) as primary data source. All lipid measurements from both hospitals and primary health care, were included for a five-year period (1995.8.1.-2000.7.31.), and civil registration number was used to separate measurements from subjects living in an area comprising 248,475 adult inhabitants.

Results: An increasing number of subjects was screened every year, and during the five-year period approximately 25% of the total population older than 16 years were screened for dyslipidaemia (61,102), and half the subjects between 60 and 69 years were screened. The proportion of measurements prescribed from general practice increased significantly from 62.2% to 66.8%. The fraction of laboratory request forms including LDL-cholesterol increased from 39.8% to 58.5%. The number of subjects monitored for dyslipidaemia, by three plasma cholesterol measurements during 1½ years increased by 71%.

Conclusions: The method adequately identified subjects monitored for dyslipidaemia, and provided important information on routine practice for screening and monitoring of dyslipidaemia.

Dan Med Bull 2004;51:121-4.

INTRODUCTION

Ischaemic heart disease is a major cause of death and morbidity in the Western countries, and its prevention constitutes a significant public health challenge. A number of clinical trials have shown that correction of dyslipidaemia reduces the risk of developing ischaemic heart disease (IHD) (1, 2), as well as reduces the risk of progression of coronary heart disease in patients with known IHD (3-5). Furthermore it seems that cholesterol reduction results in favourable cost benefit outcomes, caused by a reduction in hospitalisations and procedures related to cardiovascular disease (6). The expanding scientific documentation is communicated through both local, national and European clinical guidelines (7), but it is not known to what extend the knowledge is implemented and used in routine health care services in general, though the information is crucial for health care planning and budgeting.

Former studies have revealed poor adherence to preventive therapy guidelines, despite the abundant evidence supporting the efficacy of risk factor intervention (8-16). Therefore considering the importance for the public health, it seems necessary to develop methods to monitor routine practice, continuously. In this study we have developed a monitoring system for continuous surveillance, and we present the method as well as the present status of cholesterol screening and monitoring in a large well-defined geographic area in Denmark. The method is based on the use of the electronic laboratory information system (LIS) as primary data source, since laboratory monitoring is a necessity in both cholesterol screening and monitoring, and since plasma cholesterol analyses are not used for other purposes. LIS was used to identify the subjects screened and monitored for dyslipidaemia to assess the current diagnostic practices. Furthermore it was used to identify the prescribing doctors, to assess the organisation and the dimensions of the activities concerning dyslipidaemia monitoring in a large geographic area with more than 300,000 inhabitants.

METHODS

The study was a population based register survey using an electronic laboratory information system with prospective data registration as the primary data source. The survey was carried out in Aarhus County in three municipals (Aarhus, Hørning and Hinnerup), located around university hospitals. The area makes a total of 304,000 inhabitants accounting for 5.7% of the inhabitants in Denmark. In addition to the hospitals the health care system also comprises 134 general practice clinics served by 227 general practitioners.

Blood samples drawn at the hospital departments and at the general practitioners in the area were analysed in the three hospital laboratories (Aarhus Amtssygehus, Skejby Sygehus, and Aarhus Kommunehospital). The results were registered and kept for years in the electronic laboratory information system (LIS). Results were stored together with date of blood test, patient identification (civil personal registration number, CPR), and an identification code for the physician or hospital department ordering the blood test.

All lipid measurements including total cholesterol, low density cholesterol (LDL), high density cholesterol (HDL), and triglycerides (TG) were extracted from the electronic laboratory databases from a five-year period from 1st August 1995 until 31st July 2000.

In order to delimit the lipid measurements from the subjects living in the three municipals, from the whole pool of lipid samples analysed at the hospitals, civil registration numbers of all inhabitants older than 16 years from the municipals were delivered from the local authorities. New lists with CPR-numbers were reviewed every ½ year to include newcomers as well as to identify migrating subjects.

The two data sources were matched to build a database including all the lipid measurements from all inhabitants in a well-defined area, regardless of the prescribing physician's position in general practice, specialist practice, or at a hospital department.

Subsequently it was possible to identify the population screened or having blood samples taken to monitor lipid values during the five years. Registration of three or more cholesterol tests during 1½ years was chosen to identify subjects monitored for dyslipidaemia. The year including the first measurement was stated as the index year to facilitate comparison of activity in various years. The number of new subjects with three or more cholesterol measurements compared to the preceding year was used as an indicator of increased cholesterol monitoring.

VALIDATION OF THE METHOD

To validate whether subjects monitored for dyslipidaemia were actually were included by the study algorithm, information was collected on subjects claiming lipid lowering medications. Lipid lowering medications have to be prescribed by a doctor, and the prescription data are computerised at the pharmacies and subsequently transferred to the Danish Health Service. Information from this prescription database on subjects, from the three municipals, claiming lipid lowering medication in august 1999, was related to the lipid database to see if they appeared with the required minimum of three cholesterol samples during 1½ years.

In total 1321 subjects were registered in the prescription database claiming lipid lowering medications between 1st August and 31st August 1999, and 99% (1312) also occurred in the lipid database with cholesterol measurements. Likewise 95% (1253) of the subjects from the prescription database appeared with at least three measurements during $1^1/_2$ years in the cholesterol database.

DATA PROCESSING AND STATISTICS

SPSS was used for construction of the study database, and for data processing (SPSS for Windows, Rel. 8.0. 1998. Chicago). Differences between proportions are shown with 95% confidence intervals (CI).

ETHICS

The study fulfils the declaration of Helsinki II, and approval and permission to conduct the study were give by the Scientific Ethical Committee of Århus County and the Danish Data Protection Agency.

RESULTS

The final study database contained all lipid measurements (total cholesterol, LDL, HDL, TG) from a five-year period (1995.8.1.-2000.7.31.), from a well defined geographic area with 248,475 (1998.2.1.) inhabitants older than 16 years. It resulted in 467,712 measurements from 61,611 adults, older than 16 years.

The 467,712 measurements corresponds to 160,078 laboratory forms, and 64.7% were prescribed by a general practitioner, 30.6% prescribed fromby a hospital department, and the last 4.7% by a specialist practice. An increasing proportion of the measurements during the five years, were prescribed from general practice (62.2% to 66.8%, difference 0.046, CI 0.042-0.051).

Cholesterol screening was mainly performed in adults, as only 0.3% of all lipid measurements were measured on subjects under the age of 16 years.

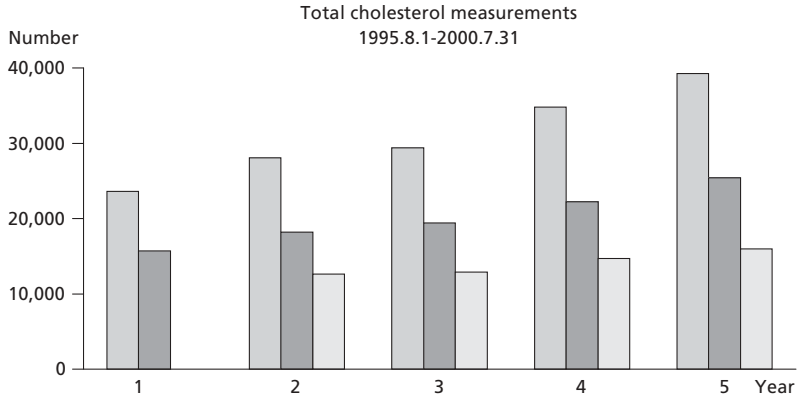
During the survey the blood sample prescription patterns changed. A significant decrease was observed in the fraction of samples in which only total cholesterol was analysed (20.0% to 13.2%, dif. 0.068, CI 0.062-0.074), and furthermore a profile not including LDL cholesterol (total-cholesterol, HDL-cholesterol + triglycerides) decreased from 19.3% to 6.1% (dif. 0.132, CI 0.127-0.137). On the other hand the fraction of laboratory request forms including LDL-cholesterol increased from 39.8% the first year to 58.5% the fifth year (dif. 0.187, CI 0.179-0.195).

Total cholesterol was the most frequent measurement (33.2% of all the measurements), compared to HDL-cholesterol (26.2%), LDL cholesterol (17.4%), and triglycerides (23.2%). All four lipid types increased during the five years, and the total number of lipid measurements increased by 84% from the first to the fifth year (67,494 to 124,061). LDL measurements increased by 144%, total cholesterol by 66%, HDL by 86% and triglycerides by 71%. The number of subjects screened every year is illustrated in Figure 1. (For comparison, the routine blood samples P-creatinin and B-haemoglobin only increased by 49% and 39% during the same period).

The most common pattern was a single cholesterol measurement during the five years, as 54.5% of the subjects screened (33,310/61,102) only appeared once, 11,206 subjects corresponding to 18.3% appeared with two measurements, 8.5% (5220) with three measurements, 18.6% (11,366) had four or more measurements during the period (maximum 159).

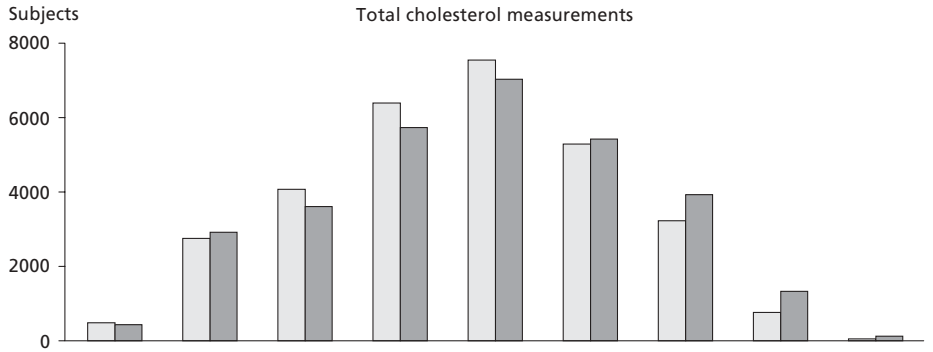
The frequency of screening/monitoring of plasma cholesterol was different according to gender and age (Figure 2), but in total an

Figure 1. Cholesterol measurements 1995.8.1-2000.7.31, in a population with approximately 250,000 adults.



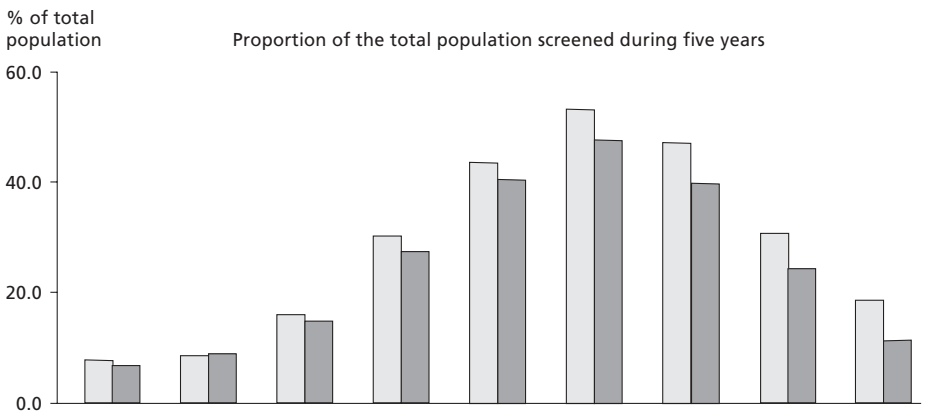
	1	2	3	4	5
Number of measurements	23,599	28,067	29,406	34,818	39,245
Number of subjects	15,701	18,172	19,406	22,236	25,401
New subjects compared to the preceding year		12,647	12,900	14,694	15,969

Figure 2. Cholesterol measurements according to gender and age groups (n = 61,102).



Age group	16-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-100
Men	487	2753	4074	6393	7549	5284	3225	765	49
Women	434	2920	3612	5732	7030	5418	3924	1333	120

Figure 3. Proportion of the total population according to age and gender screened 1995.8.1-2000.7.31.



Age group	16-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-
% men	7.8	8.7	16.2	30.5	43.8	53.5	47.4	31.0	18.8
% women	6.9	9.1	15.0	27.7	40.7	47.9	40.0	24.6	11.4

equal number of men and women were screened. During the five-year period nearly one fourth (61,102/248,475) of the whole background population older than 16 years had a blood test drawn for hypercholesterolaemia screening, one or several times. The relatively most frequently screened age group compared to the number of subjects registered in the area in the middle of the period (1998.2.1.), was the age group between 60 and 69 years, in which approximately fifty percent had been screened (Figure 3).

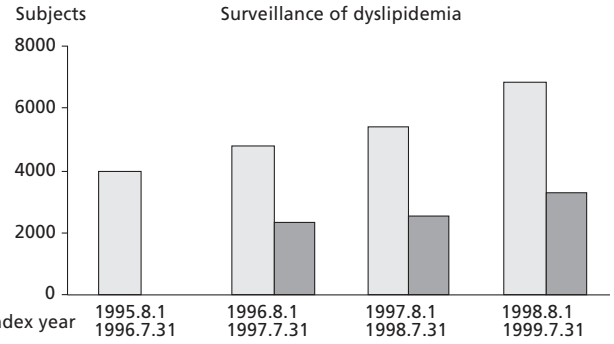
The prevalence of subjects monitored for dyslipidaemia, evaluated as number of subjects with three or more measurements during 1½ years, increased by 71% from the first to the forth year (Figure 4) (For this estimation plasma cholesterol measurements from 2000.8.1. to 2001.1.31. were added to the database). For the monitored subjects identified by this algorithm, the median number of measurements during 1½ years was four measurements (75 and 90 percentile, five and seven measurements).

The monitored subjects were more often men than women compared to the rest of the screened population (53%/47% vs. 49%/51%), and they more often had a whole lipoprotein profile registered in the database (84% vs. 48%).

DISCUSSION

Using an electronic laboratory database we could demonstrate how the use of plasma cholesterol screening increased from august 1995 until august 2000. The study showed that during this period nearly one fourth of the adult population had been screened one or several times.

Whether screening of ¼ of the population is the wanted level could be discussed. American guidelines recommend all adults to bee screened every fifth year (17), whereas the European recommendations are less exact at this point recommending a high risk strategy, with highest priority to patients with known atherosclerotic disease, and subjects at high risk because of hypertension, diabetes, obesity, smoking or relatives to patients with premature IHD.



Index year	1995.8.1 1996.7.31	1996.8.1 1997.7.31	1997.8.1 1998.7.31	1998.8.1 1999.7.31
Prevalence	3994	4765	5412	6821
New		2357	2519	3283

Figure 4. Prevalence and new cases with three or more cholesterol measurements during 1½ years.

Most other studies investigating screening practice were not investigating whole populations but subsets, either patients with known ischaemic heart disease or subjects visiting their general practitioners. A Scottish study has investigated pattern and determinants of cholesterol testing also by use of laboratory data, but only with data from general practice. They found testing rates of 27.0/ 1000 for men and 19.6/1000 for women during one year (1992) (18).

Some of the remaining inhabitants probably had their cholesterol level measured in the years preceding our data collection, and the proportion of subjects in the population with known lipid levels will be higher than shown here. Obviously neither this nor other methods illustrates the lipid levels of subjects not screened, but it showed that the lipid level is known for a considerable percentage of subjects in the age groups with highest risk of ischaemic heart disease.

Cholesterol screening is a prerequisite for treatment, and therefore assessment of the degree of screening is one of the first steps when evaluating the handling of dyslipidaemia in an area.

Using the electronic laboratory database made it possible to investigate the practice for screening and monitoring dyslipidaemia in a large geographic area, comprising approximately five per cent of the Danish population. The method using all lipid samples from the whole area and not just a test sample reduced the risk of selection bias, and it enabled us to investigate a field in which the activity was carried out at multiple different sites. The blood samples were included no matter whether they were prescribed by a cardiologist, another physician at the hospital, or by one of the more than 200 general practitioners (GPs) in the area. Reflecting that cholesterol screening and treatment are performed in both hospital outpatients clinics as well as in the primary health care system (ie general practice and in specialist practice), and in collaboration between the two.

The database eliminates recall bias as source of error compared to asking patients themselves which could have been an alternative method. Point of care testing of plasma lipids was not performed in this region, mainly because of lack of reimbursement, which was important for the completeness of LIS. Less important sources of error are patients admitted to hospitals outside the area, or if they live at the border of the area, they might have their blood samples analysed at another hospital.

Blood sample measurements as an indicator of prevalence of

monitoring dyslipidaemia make it possible to include both subjects monitored because of treatment solely by diet, and those monitored because of treatment with medications.

The number of measurements used as an indicator for the prevalence of monitoring is debatable, as practice might differ between physicians. Blood samples every half year is a general recommendation from hospitals and guidelines when subjects with dyslipidaemia are monitored, and furthermore there are good reasons to believe that a subject was monitored, and that it was not just an accidental sign on a laboratory form, if a physician ordered three or more cholesterol samples during 1½ years. Some well treated patients who had been treated for years with stable levels might not appear with three measurements during 1½ years and could be missed by this method. Validating the developed method and the algorithm requiring three plasma cholesterol measurements pr 1½ years in the LIS, by prescriptions for lipid lowering medications appeared to be very sensitive however, since it identified 95% of the subjects claiming lipid lowering medications. The study was performed in three municipals, centred around university hospitals, and a department of cardiology with special interest in dyslipidaemia which reduces external validity. The activity might be higher here than in other parts of the country, but official medicinal statistics do not indicate that this county should be more aggressive than other counties. Other studies have used the laboratory database to identify subjects with hypercholesterolaemia (19-23), and another study used LIS to demonstrate an increase in the total number of cholesterol tests between 1984 and 1992 (24), but the advantage of our study was the solid information on background population and the combination of measurements from all settings making it useful as a method for surveillance of actual practice in cholesterol screening and monitoring during longer periods. After being established the method will be less time consuming than ordinary audits, and therefore it will be possible to reflect the actual practice in the field before it has changed. By the electronic laboratory information system we have identified the physicians, the patients and their lipid levels, and based on this information studies are carried out to evaluate the quality of care.

CONCLUSION

The method based on plasma cholesterol measurements adequately identified subjects monitored for dyslipidaemia, and provided important information on routine practice for screening and monitoring of dyslipidaemia. The method is useful for quality assurance and for health care planning. It illustrated that handling of dyslipidaemia was shared between hospitals and GPs with the majority taking place in general practice (⅔), and that the GP's proportion of measurements increased during the period. The prescription pattern changed, and LDL-cholesterol was more frequently prescribed now than five years ago, the last year involving 58.5% of all the request forms with lipids. The number of different subjects screened for dyslipidaemia increased every year, and during five years from 1995 to 2000 nearly one fourth of the population older than 16 years had been screened. Screening most frequently took place in men in the age group between 60 and 69 years.

REFERENCES

1. Shepherd J, Cobbe SM, Ford I, Isles CG, Lorimer AR, MacFarlane PW et al. Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia. West of Scotland Coronary Prevention Study Group. N Engl J Med 1995;333:1301-7.
2. Downs JR, Clearfield M, Weis S, Whitney E, Shapiro DR, Beere PA et al. Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of AFCAPS/TexCAPS. Air Force/Texas Coronary Atherosclerosis Prevention Study. JAMA 1998;279: 1615-22.
3. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). Lancet 1994;344:1383-9.
4. Lewis SJ, Sacks FM, Mitchell JS, East C, Glasser S, Kell S et al. Effect of pravastatin on cardiovascular events in women after myocardial infarction: the cholesterol and recurrent events (CARE) trial. J Am Coll Cardiol 1998;32:140-6.
5. The Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. N Engl J Med 1998;339:1349-57.
6. Pedersen TR, Kjekshus J, Berg K, Olsson AG, Wilhelmsen L, Wedel H, et al. Cholesterol lowering and the use of healthcare resources. Results of the Scandinavian Simvastatin Survival Study. Circulation 1996;93: 1796-802.
7. Prevention of coronary heart disease in clinical practice. Recommendations of the Second Joint Task Force of European and other Societies on coronary prevention. Eur Heart J 1998;19:1434-503.
8. Walsh JM, Baron RB, Browner WS. Predictors of screening for hypercholesterolemia in a general internal medicine practice. West J Med 1993; 158:359-63.
9. Giles WH, Anda RF, Jones DH, Serdula MK, Merritt RK, DeStefano F. Recent trends in the identification and treatment of high blood cholesterol by physicians. Progress and missed opportunities. JAMA 1993;269: 1133-8.
10. Robinson MK, DeHaven MJ, Wallace JB, Fost T. Hypercholesterolemia: case finding in family practice. South Med J 1992;85:1091-5.
11. EUROASPIRE. A European Society of Cardiology survey of secondary prevention of coronary heart disease: principal results. EUROASPIRE Study Group. European Action on Secondary Prevention through Intervention to Reduce Events. Eur Heart J 1997;18:1569-82.
12. Marcelino JJ, Feingold KR. Inadequate treatment with HMG-CoA reductase inhibitors by health care providers. Am J Med 1996;100:605-10.
13. Pearson TA, Laurora I, Chu H, Kafonek S. The lipid treatment assessment project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. Arch Intern Med 2000;160: 459-67.
14. Shepherd J, Pratt M. Prevention of coronary heart disease in clinical practice: a commentary on current treatment patterns in six European countries in relation to published recommendations. Cardiology 1996; 87:1-5.
15. Lifestyle and risk factor management and use of drug therapies in coronary patients from 15 countries. Principal results from EUROASPIRE II Euro Heart Survey Programme. Eur Heart J 2001;22:554-72.
16. Monkman D. Treating dyslipidaemia in primary care. The gap between policy and reality is large in the UK. BMJ 2000;321:1299-300.
17. National Cholesterol Education Program. Second Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). Circulation 1994;89:1333-445.
18. Smith BH, Vranjkovic V, McEwan SR, Ritchie LD. Cholesterol testing by general practitioners in Grampian: patterns and outcomes. Scott Med J 1996;41:78-82.
19. Levin SJ, Ornstein SM. Management of hypercholesterolemia in a family practice setting. J Fam Pract 1990;31:613-7.
20. Madlon-Kay DJ. Improvement in family physician recognition and treatment of hypercholesterolemia. Arch Intern Med 1989;149:1754-5.
21. Bell MM, Dippe SE. Recognition and treatment of hypercholesterolemia in a family practice center. J Fam Pract 1988;26:507-13.
22. Reed RG, Fong SY, Pearson TA. Role of a central laboratory in implementing national cholesterol education panel guidelines in rural practices: model system for managed care. Clin Chem 1995;41:271-4.
23. Oster G, Borok GM, Menzin J, Heyse JF, Epstein RS, Quinn V et al. Cholesterol-reduction intervention study (CRIS): a randomized trial to assess effectiveness and costs in clinical practice. Arch Intern Med 1996;156: 731-9.
24. der Weijden van, Winkens RAG, Schouten BJ, Knottnerus JA, Grol RP. Trends in cholesterol testing in general practice. Eur J Gen Pract 1996;2: 148-52.