Screening in general practice and primary care

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General practice and its associated primary care services are the final common pathway for the delivery of most screening programmes. The absence of nationally agreed priorities, guidelines and identifiable resources has meant that screening in primary care remains somewhat arbitrary, practice varies widely and programmes remain largely unevaluated. Discussion of screening has focused largely on test characteristics and performance with less attention being given to issues of policy formation, priority setting, implementation and quality assurance. Without these elements, quality and test performance deteriorate, recruitment and follow-up are incomplete and a poorly discriminating test of doubtful utility is applied inequitably and inefficiently.

For general practice there are two major concerns. The first is to improve delivery of programmes of proven efficacy, such as breast or cervical screening, that already have a national framework. The second is to develop and provide a national structure for preventive programmes for cardiovascular and smoking-related disease. For cardiovascular disease, the issue is no longer whether to screen and advise whole populations for multiple risk factors, but how best to implement this programme. In this chapter, the case for screening for cardiovascular disease is reviewed and potential strategies for improving delivery of screening in general practice and primary care discussed.

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The last 20 years have witnessed increasing demands on general practitioners to carry out screening[1]. The absence of nationally agreed priorities, guidelines and identifiable resources has meant that screening in primary care remains somewhat arbitrary, practice varies widely and programmes remain largely unevaluated. The demand led, episodic health check has proved to be a lucrative procedure of doubtful efficacy[2,3]. In contrast, continuing systematic screening of whole populations with interventions of proven efficacy have been more successful. In the 1970s, preventive care became a major component of British general practice after Hart demonstrated that screening for raised blood pressure in general practice was feasible[4] and the Royal College of General Practitioners acknowledged that anticipatory care was a key component of clinical practice[5,6].

For general practice there are two major concerns. The first is to improve delivery of programmes of proven efficacy, such as breast or

Table 1 Proposed screening programmes in general practice and primary care by strength of evidence and consensus

High	Moderate	Low
Cervical cancer	Muliple risk factors for	Congenital dislocation of the hip
Breast cancer	ischaemic heart disease	Deafness (child distraction tests)
Phenylketonuria	Aortic aneurysm	Childhood squint
Congenital hypothyroidism	Haemoglobinopathies	Childhood development
Rhesus incompatibility	Rubella immunity in pregnancy	Vaginal chlamydia
Raised blood pressure	Diabetic retinopathy	Diabetes
Down syndrome	Pre-eclampsia	Gestational diabetes
Spina bifida	TB (school based Heaf test)	Iron deficiency anaemia
Smoking	Syphilis in pregnancy	(pregnancy and childhood)
	HIV in pregnancy in selected areas	Antenatal ultrasound for
	ABO incompatibility	congenital abnormality
	Family history of cardiovascular	Glaucoma
	disease under 55 years	Asymptomatic bacteriuria (childhood)
	Deafness (neonatal evoked	Domestic violence
	responses)	Depression
	Colorectal cancer	Falls in the elderly
		Alcohol dependence
		Testicular cancer
		Prostate cancer

cervical screening, that already have a national framework. The second is to develop and provide a national structure for preventive programmes for cardiovascular and smoking-related disease.

For cardiovascular disease, the issue is no longer whether to screen and advise whole populations for multiple risk factors, but how best to implement this programme. There is good evidence for effective intervention for smoking and raised blood pressure. In addition, there is a consensus on the treatment of those with established coronary heart disease and new evidence on treatment with aspirin and statins for those at increased risk of developing coronary heart disease.

In this chapter, the case for screening for cardiovascular disease is reviewed and potential strategies for improving delivery of screening in general practice and primary care discussed.

Conditions for which screening in general practice has been advocated are shown in Table 1, grouped into three categories based on strength of evidence and consensus. These include: (i) conditions for which there is good evidence of screening effectiveness and a high degree of consensus that implementation is desirable; (ii) conditions where the evidence or consensus is moderate or contested; and (iii) conditions in which the evidence or consensus is poor or even detrimental, as may be the case with screening for gestational diabetes[7,8]. While the allocation of specific conditions to these three groups is controversial, they serve to illustrate

the number and diversity of conditions for which claims have been made and the difficulties facing GPs who have to decide which to support, which to prioritise and which to leave alone.

In the absence of comprehensive and authoritative review – including evidence of benefit, hazard, and costs – it is often difficult to know whether the advocates of these screening programmes are leading the pack or bringing up the rear. The situation is further confused when different conclusions are reached by different major reviews. National agreement on potential screening programmes, indicating priorities for support, is urgently needed. It is not clear whose responsibility is it to formulate such a list and respond to policy issues.

In the US, the Agency for Health Care Policy and Research provides a national focus for assessing the evidence and by ranking, affords some degree of prioritisation and Canada has a similar organisation[9]. In the UK, this role is undertaken by a number of bodies including the Population Screening Panel of the Standing Group on Health Technology, the NHS Centre for Reviews and Dissemination, the Cochrane Collaboration and the National Screening Committee. However, while assessment of the evidence is a necessary step, it is still a long way from policy formulation and strategies for implementation. The major implications of a screening policy for primary care services must not be underestimated. The assessment and prioritisation of competing claims on workload and resources is a complex task and policy formulation often has as much to do with the political process as it does with science[10].

Systematic and policy reviews in different countries have drawn very different conclusions from the same evidence, which indicates that the **process** and **context** of policy formation is at least as important as the final conclusion. The process remains even when the questions and their answers have long since altered. Attention to the way in which decisions are made influences implementation as much as the vagaries of shifting evidence. The failure to give general practice smoking cessation and blood pressure screening the degree of priority they deserve reflects, in part, a failure of policy formation. While yielding less community benefit[11], the cervical screening programme is better organised and supported.

Even after a policy has been formulated, the task of implementing a programme needs to be articulated with primary care teams. Preventive programmes for cardiovascular and smoking related disease such as those prioritised in *The Health of the Nation* initiative, could not be fully realised because of the lack of an effective infrastructure at practice level. There was no organisation which connected national strategy with local practice nor was there any mechanism for co-ordinating action within and between practices. The shift towards a primary care led NHS signals a change in perspective, but whether the new National Institute for Clinical Excellence and primary care led commissioning will provide

these connections remains to be seen[12]. Recent Government and Medical Research Council reports on research and development in primary care suggest that some of these infrastructural issues are beginning to be debated[13,14]. There is no simple route from evidence to implementation and the absence of structures capable of bridging the gaps in this process remains a major obstacle to delivery of screening services within primary care. It is to be hoped that these organisational changes will provide new opportunities for more transparent priority setting and coherently organised implementation.

Risk factors and cardiovascular disease

Coronary heart disease remains the leading cause of premature death in Britain for both men and women, accounting for a quarter of all deaths. Among middle-aged men, 20% are at high risk with a 1 in 5 chance of death or a major cardiovascular event within the succeeding 10 years. Stroke makes a substantial contribution to the burden of cardiovascular death and morbidity accounting for 12% of all deaths in this age group.

Britain has one of the highest rates of coronary heart disease in the Western world. The UK epidemic peaked in the 1970s and has been slower to decline than in Finland, USA or Australia where changes in public consciousness in response to public health programmes have been more pronounced. In the UK, coronary heart disease deaths were halved between 1972 and 1992 and continue to show a decline of 4% per annum. This overall decline conceals major disparity between social groups. There has been a failure to generalise the benefits of the public health message. In the 1970s, there was a 50% difference in mortality rates between unskilled and professional workers which, by 1990, had increased to a 3-fold difference, as rates among the latter fell rapidly, whilst those of the unskilled declined little, if at all.

The decline in coronary heart disease is largely due to changes in smoking, blood pressure, diet and exercise. The absence of national legislation and initiatives on these issues has been notable. Increasing income inequality is also likely to have been an important underlying cause of increasing inequity in mortality from this cause[15].

Overall, smoking has declined and in 1995 was 39% among unskilled men and 32% among unskilled women compared to 18% and 13%, respectively, amongst professional workers. Diastolic blood pressure fell by 3 mmHg between 1991–5, while consumption of saturated fat declined by a quarter since 1975. However, total fat consumption remained constant with little change in serum cholesterol. Inadequate physical exercise remains the most ubiquitous risk factor affecting two-thirds of

men and three-quarters of women, who are either sedentary or irregularly active. Though reliable data on trends of physical activity are not available, improvement, if any, has been small. In contrast, obesity shows a steady and massive increase, most pronounced in lower income groups but apparent across all sections of society, with trends in children indicating that things are likely to get worse[16].

Age is the most important risk factor for cardiovascular disease, followed by sex, smoking, blood pressure, obesity and physical exercise. A family history of coronary heart disease in first degree relatives under the age of 55 years predicts high risk; South Asian ethnic group or low income are also associated with higher risks.

With the possible exception of age, no single risk factor has a high level of predictive discrimination separating those who will have a heart attack from those who will not. By itself, serum cholesterol is a poor predictor of risk and is best combined as the ratio of total cholesterol/high density lipoprotein cholesterol in a multiple risk factor score which includes age, sex, smoking status, blood pressure and the presence or absence of diabetes or left ventricular hypertrophy[17].

While the task of reducing coronary heart disease is primarily an issue for government, organised medical intervention offers important benefits for people at increased risk as a result of either established cardiovascular disease or multiple risk factors. For the first time, there is almost universal consensus on interventions for established coronary heart disease. However, screening and intervention for those at high risk but without established disease lacks national consensus and is poorly applied.

Screening for high blood pressure is an accepted part of general practice. It is based on the level of blood pressure, rather than upon multiple risk factors. Guidelines offer a variety of levels of blood pressure as the treatment threshold, and interventions and population coverage and control remain less than optimal. Recording of smoking status and advice to stop smoking is also in widespread usage and again lacks single national guidelines. Early guidelines promoted screening for hyperlipidaemia and a treatment threshold based on serum cholesterol alone and relative, rather than absolute, risk. These have failed to gain widespread acceptance and have been superseded by risk ascertainment based upon absolute risk and multiple risk factors. There are a number of risk scores available[18] and the Framingham score (based on a cohort of people followed up in the American town of that name) has proved to be the most popular tool for this purpose. Factors include level of blood pressure, serum total and HDL cholesterol, smoking, and presence or absence of diabetes or left ventricular hypertrophy. The 5 or 10 year probability of a coronary event or stroke may be computed[19]. This has been adapted in both hospital outpatients[20] and on one of the larger GP computer systems[21], so that absolute risk is easily accessible in the clinical setting.

The big issue: screening for cardiovascular disease

Screening and management of cardiovascular disease is the single most important issue for primary care. For people who do not already have established cardiovascular disease, there is already general agreement that screening for individual risk factors for cardiovascular disease, such as blood pressure and smoking, is feasible and cost-effective. As GPs are already screening their populations for two major risk factors, the outstanding issue is not whether to screen whole populations for multiple risk factors, but **how** best to screen, and **at what level of risk** and **how intensely** to intervene.

The Oxcheck and Family Heart Studies tested the efficacy of screening and management of multiple coronary heart disease risk factors by general practice based teams in adult populations. In the intervention group, there were important improvements in diet, blood pressure and serum cholesterol, which were most pronounced for those at higher risk. However, the significance of these findings has been disputed, some considering that they demonstrate reasonable return on effort and cost[22–24], particularly as changes appeared to be sustained and might also have impacted on stroke[25]. Others considered that the improvements, if they were real at all, were not worth the effort or money[26,27].

In 1997, a review and meta-analysis of 14 relevant trials of multiple risk factor intervention was undertaken, 9 of which included deaths or coronary events as an outcome[28]. Systolic blood pressure decreased by 4.2 mmHg (SE 0.19 mmHg), smoking prevalence by 4.2% (SE 0.3%) and blood cholesterol by 0.14 mmol/l (SE 0.01 mmol/l). All were significant and important reductions.

However, trial methodology is likely to have exaggerated these reductions in risk factors and they were not reflected in reductions in mortality. Total mortality was reduced by 3% (odds ratio 0.97; 95% CI 0.92–1.02) and mortality from coronary heart disease was reduced by 4% (odds ratio 0.96; 95% CI 0.88–1.04). However, the sample was only large enough to confidently exclude a reduction in mortality of 8%. In order to have confidently excluded a reduction of 3%, 600,000 people would be required in each group, whereas group size averaged only 7000. The trials were, on average, of 5 years duration and the annual reduction in coronary mortality was about 0.8% per annum. This is not negligible when compared to annual reductions in coronary heart disease in men over the decade 1982–1992 of around 2% per annum for manual social classes and 4% per annum for non-manual classes[29]. No information was presented on cost-effectiveness.

This meta-analysis showed evidence of heterogeneity. The reduction in risk factors and mortality was greatest in those at highest risk, particularly those receiving drug treatment for high blood pressure. For these groups,

reductions in mortality achieved significance. However, even amongst higher risk groups, the gains were only 1.1% per annum, around half that anticipated.

From these studies, it can be concluded that multiple risk factor screening, combined with systematic advice and treatment of raised blood pressure, results in a small improvement in risk factors and a small reduction in coronary mortality. The magnitude of change that is being debated is at best 1% per annum and national trends of decline are of a similar order of magnitude. Would a medical programme which improved the rate of decline by 50% or even 10% be worthwhile and at what cost? The question is whether the improvement is justified by the effort and the interpretation of current evidence on cost-effectiveness is contested. These studies were undertaken before the widespread introduction of statins and have failed to take account of the additional costs of a more comprehensive programme over existing programmes.

Cost-effectiveness

The threshold for intervention and the cost effectiveness of programmes continue to be contentious. While the utility of **intensive** advice rather than usual advice in addition to drug treatment is in doubt[30], prudent advice to whole populations is a necessary consequence of any screening programme and is associated with a small but demonstrable reduction in mortality.

Were the intensity of advice and results of the Oxcheck and Family Heart studies to be sustained for 5 years, these would be cost-effective interventions. Further cost-effectiveness analysis based on the Oxcheck trial reached similar conclusions[31]. This study examined a number of different options, ranging from simply recording blood pressure and asking about personal history of cardiovascular disease, to more extensive risk factor recording. The cost differences between the various options were relatively small and, for men, relatively cost-effective. Once

Table 2 Cost per year of life gained from six screening programmes[31]

	Screening programme	Cost (£ per discounted life year gained)	
		Men	Women
1	Blood pressure + personal history of cardiovascular disease	1240	4730
2	1+ Smoking	1640	5150
3	2+ Height and weight	2040	6270
4	3+ Dietary assessment	2090	6480
5	4+ Family history	2080	6700
6	5+ Blood cholesterol	2180	6850

smoking, height and weight had been included in the programme, there was little additional cost per year of life gained. The difference between maximum and minimum programmes was only £940 per discounted life year gained (Table 2). Compared to the cost of many medical interventions these are relatively small sums. Once again, those at highest risk gained added years at least cost.

Those at highest risk as a result of raised blood pressure or multiple risk factors can only be identified by screening and it is questionable whether screening for coronary heart disease should be assessed economically as a stand alone programme. Given that the cost-effectiveness of screening for raised blood pressure and smoking is already established, economic analyses in primary care need to consider the **additional** or marginal costs of multiple risk factor screening[31,32] to reduce both stroke and heart disease. For men, a more comprehensive programme of cardiovascular prevention can be established at an additional cost of £540 per discounted year of life gained and, for women, £1700[33]. This study confirmed that intervention for multiple risks in whole populations is cost effective, more so at older ages and at higher risks. If treatment with statins based on absolute risk derived from multiple risk factors were now included in these programmes, together with stroke as well as coronary heart disease as an outcome, cost-effectiveness would be further improved.

The way forward

The outstanding question is not whether, but how best to screen whole populations for multiple risk factors and what is the threshold for treatment. How many people should be treated with statins, aspirin and hypotensives and what intensity of advice should be given? For every person with established heart disease there are at least another two with multiple risk factors who are at a similar level of risk and who would benefit from treatment[18]. At what lower threshold do the benefits of treatment and advice outweigh the workload, costs and hazards?

Reviews of individual interventions on diet[34], smoking[35] and blood pressure[36] have all shown that benefit is greatest among those at highest risk, and that interventions to reduce blood pressure and smoking are cost effective. It has been proposed that management of raised blood pressure should also be based on absolute risk and should take account of other cardiovascular risk factors rather than simply depending upon the level of blood pressure[37].

In addition to the evidence on multiple risk factor intervention already cited, new evidence on the efficacy of statins[38,39] and aspirin[40,41] for those at higher risk of coronary heart disease provides further evidence of worthwhile benefit at reasonable cost. For the top 20% of the risk

distribution, which for men is equivalent to an absolute risk of a coronary event of 2–3% per annum, treatment with statins reduces mortality by 20–30%, though whether the effects of statins and thrombolysis are additive remains uncertain.

In 1997, the Standing Medical Advisory Committee to the Department of Health proposed the biggest change in clinical practice for the past 20 years[42]. It recommended that people who had pre-existing ischaemic heart disease and those with multiple factors, generating an absolute risk of heart attack above 3% per annum, should be treated with statins[26]. This absolute risk is the treatment threshold and small changes in this threshold result in big changes in the numbers of people receiving treatment. As individuals with risks of 3% or more per annum constitute 8% of the older adult population under 70 years, the cost, resource and workload implications are enormous. The recommendation was criticised for ignoring cost effectiveness, policy issues and strategy for implementation[43]. However, although grey areas remain, there is more consensus on this issue than at any other time and the similarities between proposals are much more striking than the differences. What is at issue now is the threshold for intervention which determines numbers treated and total programme costs[44].

Unfortunately, the differences in view have obscured the areas of agreement. There is almost universal agreement that smoking and blood pressure programmes are the top health promotion priorities for implementation[45]. A national framework for their implementation, with well defined aims and standards comparable to those adopted by the breast and cervical screening programmes is lacking. For blood pressure, such a programme would need to rely on practice or shared hospital based recall[46] and there should be agreed specifications for ascertainment and intervention with a national system for collating agreed outcomes, processes and reporting of results[47].

However, screening and management of cardiovascular disease does not simply comprise a set of stand-alone programmes. Risk factors for stroke are almost identical to those for coronary heart disease and there is mounting evidence that treatment of both raised blood pressure and lipids should be based on absolute risk derived from multiple risk factors rather than on blood pressure or cholesterol alone[48,49]. In general practice, these programmes have a common organisation, common risk factors and common subjects. Screening using multiple risk factors for cardiovascular disease followed by drug treatment is now an effective option when absolute risk remains above agreed thresholds[37]. In the context of screening, the general population can be given prudent advice on smoking, diet and exercise – not because advice is likely to have a large effect, but because silence is not an option and advice is of some benefit.

The workload and cost implications of cardiovascular screening are considerable. The absolute risk threshold, which determines whether or

not to treat, is a key consideration. Were the absolute risk threshold to be lowered to a coronary event rate of 2% per annum, 20% of men in the 35–69 year age group would require treatment with statins. Conversely, if the threshold were raised to 4% per annum, around 5% of this population would require treatment.

Primary and secondary care teams have so far been struggling to deal adequately with individuals with diabetes who constitute only 2% of the population. Implementing a programme such as that proposed by the Standing Medical Advisory Committee would amount to a major change in clinical practice, costing over £600 million per annum for statin treatment alone[50]. Without a national and local infrastructure and additional support and resources, programmes would only scratch the surface, missing many of those who have most to gain. The optimal risk threshold for intervention and the nature of the intervention remain controversial[44].

The impact of national policy on diet, smoking, exercise and transport outweighs the contribution of the medical sector. But as Susser has pointed out, the pace of change is glacial and will come too late for the current generation. Deaths from cardiovascular disease should no longer be regarded as a regrettable, but necessary, part of a consumer society. The growing inequalities in death from cardiovascular disease are a stark reminder of the cost of inaction[15]. The better off have been able to afford and effect changes in diet, smoking behaviour and exercise which have not been accessible to the majority of the population. Treatment and advice to people at high risk show unequivocal evidence of substantial benefit at reasonable cost and this has to involve whole populations in screening and advice. The outstanding issue is how best to implement and resource this programme. There is a greater consensus now than ever before on what is and what is not worth doing. If the NHS is to be primary care led, the prevention and amelioration of cardiovascular disease should be its first priority.

The need for developing and implementing screening for cardiovascular disease in primary care is compelling. Implementation has to fit in to the overall context of general practice and there are organisational issues that are shared with other screening and clinical programmes. These include disease registers, population coverage, equity of delivery, quality assurance and review.

How well are screening services delivered?

The implementation of new and existing screening programmes requires a common organisational framework within general practice. This includes accurate patient registers, computerised facilities for recall, follow-up and audit, and programmes to assist development and quality

assurance. Potential obstacles to delivery of screening include the acceptability and accessibility of the intervention, inaccuracy of the patient register and poor quality screening and intervention. The concentration of risk factors in some inner city, industrial and other disadvantaged areas ensures that when national coverage is below 80%, the unscreened are inequitably distributed. National figures conceal the fact that many local communities are inadequately served by current services.

Equity

Although a key issue for screening services, equity has been given little priority over the past two decades. Where health services aim to provide maximum health gain for the nation at minimum cost, equity is likely to receive low priority as this strategy gives priority to those best able to make use of services, namely the young, white and better off. However, where the aim is to maximise the **potential** for good health in all individuals at minimum cost, then equity becomes a major consideration[32,51].

Geographical inequity in general practice and community services funding has been pronounced and has been exacerbated by fundholding. Deprivation payments to GPs, additional payment *per capita* for patients living in particularly deprived areas, were introduced to ameliorate some of the worst discrepancies. In such areas, workload is 50% above the national average and resources are often 50% below leaving little opportunity for anticipatory care. Although there has been substantial improvement in GP services, a minority continue to fall below adequate levels[52,53]. Such discrepancies have prompted review of basic funding formulae. Twenty years after such inequity in the hospital sector was reduced by the Resource Allocation Working Party, geographical financial inequity is finally, though slowly, being addressed for primary care through new allocation formulae.

Inequity by age, social class and ethnic group is as much a feature of screening services as other aspects of primary care[54,55]. The results of a survey among selected practices in an inner London Borough are summarised in Table 3. Differences in the coverage of selected preventive activities between white and minority ethnic groups and different socio-economic groups were most pronounced for centralised recall systems for breast and cervical cancer screening and less pronounced for activities such as blood pressure screening which are practice based and can utilise the opportunities presented by routine practice visits[56].

There is now substantial evidence from selected practices that, given organisation and resources, inequity of delivery of screening services can be largely eradicated and levels of coverage in excess of 85% or 90% achieved. In 1994, in one of London's most disadvantaged inner London

Table 3 Preventive activity by ethnic group. Sampled from records of 43 GPs in one inner London borough[56]

	White *n* = 187 (%)	Odds ratio *standardised to* age and sex of white population	All non-white *n* = 294 (%)	Odds ratio *standardised to* age and sex of white population	(95% CI)
Blood pressure	163 (87)	**1.0**	244 (83)	**0.9**	**(0.5, 1.5)**
Smoking	143 (76)	**1.0**	213 (72)	**0.9**	**(0.6, 1.4)**
Dietary advice	45 (24)	**1.0**	64 (22)	**1.0**	**(0.6, 1.6)**
Weight	141 (75)	**1.0**	209 (71)	**0.9**	**(0.6,1.4)**
Height	129 (69)	**1.0**	190 (65)	**0.9**	**(0.6, 1.4)**
Cervical smear	92/104 (88)	**1.0**	228/264(86)	**0.6**	**(0.3, 1.3)**
Mammography	17/37 (46)	**1.0**	4/20 (20)	**0.2***	**(0.1, 0.8)**

Number (percentage). *P = 0.03.

Boroughs, 34% of practices achieved 80% cervical smear coverage and 16% failed to reach 50%. For the latter group, the major obstacles to change remain largely infrastructural: adequate premises, employment of a nurse and a practice computer are necessary prerequisites[57,58].

Registers

All screening programmes rely on population registers for selection of subjects, follow-up and audit. These registers are based on general practice populations registered with the Family Health Services Authority. The importance of a national and comprehensive system of registration should not be underestimated. Privately funded systems, characterised at one extreme by the American system, have major problems because there is no such thing as a whole population register. The uninsured in such systems are often effectively disenfranchised and national data are hard to come by because of fragmentation of services. In Britain, a national system of registration provides a unique opportunity to identify people at risk, audit population coverage and improve the quality of screening programmes. But although 98% of the population are registered, some outstanding problems remain.

Up until 1995, new patient registration, or change of details, depended on manual notification by the local practice. As people often fail to record their previous GP there is considerable potential for delay or failure to remove people from the register once they have left the area and little incentive for GPs to identify those who have left the practice. Conversely people moving into a new area may delay registration with a local GP, or fail to notify change of address within the same area.

In areas with high turnover there is substantial register inaccuracy[59]. In such areas, registers may be inflated by 25%[60] with up to 50% of addresses incorrect[61–63]. However, these are exceptional rates and nationally inflation is around 10–15%. Recent administrative change has improved the situation. From 1995, the notification of registration became computerised as GP-LINKS was introduced, which allowed connection between the central Family Health Services Authority computer and the local general practice computer. This shared register, on which details may be easily changed by either party, has substantially improved notification of change and matching of patients. The implementation of a new unique NHS number is likely to further enhance matching of details and register accuracy.

Opportunistic contact

A register is only one mechanism for patient contact. Each member of the population visits their GP on average four times per year, 70% of the population consults in any one year and 90% within five years. These contacts are an opportunity for personal invitations to participate in screening programmes. As registration data lag behind the patient's current residence, routine surgery visits enable opportunistic contact to be maintained. In many practices, additional systems are employed to identify those overdue for screening procedures or follow-up.

However, by itself, opportunistic contact is an inefficient method of contact. It needs to be an adjunct to a systematic programme and an organised framework. Combining opportunistic methods with systematic mailing or telephone contact to non-respondents is the most effective vehicle for improving coverage[56,64]. Failure to capitalise on opportunistic contact wastes a valuable and important resource and was the most remedial deficit in screening services for women found to have invasive carcinoma of the cervix[65].

Quality

Specification of quality standards for measurement, recording and intervention are as important for smoking cessation or raised blood pressure screening as they are for cervical or breast cancer. Although a number of authoritative guidelines exist in the UK, there are no nationally agreed specifications for smoking and blood pressure programmes between GPs and contracting authorities. For example, should mandatory components of ascertainment include the numbers of cigarettes smoked per day, age started and date stopped, or is it sufficient to simply record whether a smoker or non-smoker? Cuff size has an appreciable influence

on measurement of blood pressure. Although the standard cuff is too small for the majority of arms, it persists in routine use in most NHS institutions including general practice. The proliferation of terminal zeros in many records indicate that measurement is often to the nearest 5 or even 10 mmHg rather than to 2 mmHg with which sphygmomanometers are calibrated[66]. The increasing use of electronic blood pressure measuring devices provides an opportunity to improve practice and requires clear national guidance and support[67]. A national specification based on evidence of best practice for measurement, ascertainment and intervention is needed to inform local practice.

The same considerations apply to other aspects of delivery. What information should be provided on smoking or diet for people with raised blood pressure? Although there is good evidence that written material significantly enhances verbal advice, its routine provision is not widespread. How often should individuals with raised blood pressure be reviewed and what should take place? Drug treatment of raised blood pressure is similarly variable. Existing guidelines vary and a national consensus is lacking to inform treatment thresholds and preferred drug regimes[48,68].

The quality and comparability of electronic data recording are also important. Agreement on code definitions may have pronounced effects on the apparent prevalence of hypertension. Data entry templates containing pre-agreed codes act as both check-lists and improve accuracy. For the majority of practitioners who currently maintain both paper and computerised records, the completeness of the latter requires verification by practice staff if it is to be relied upon.

Improving screening services

The expansion and improvement of screening in general practice has depended upon the employment and training of practice nurses[69]. In the decade up to 1995, the numbers of practice employed nurses more than doubled: 90% of general practices now employ at least one nurse[52]. Practice nurses have extended their role from a restricted list of activities to include a broad range of skills for screening and health promotion, including blood pressure measurement, venepuncture, cervical cytology, behavioural counselling, contraceptive services, pre-test counselling for inherited disorders, vision screening, spirometry, audiometry and many other techniques[70,71]. When records were paper based, nurses maintained manual call and recall systems for both screening and chronic disease management[72] and they now actively participate in the maintenance and recall of patients using computerised systems. The participation of nurses in these organised programmes significantly enhances uptake of screening[73].

During the 1980s, facilitation schemes were adopted in which administrative authorities employed nurse facilitators to help practice nurses and primary health care teams develop local health promotion and screening programmes. A National Association of Facilitators was formed and, in 1992, 200 were employed nationally[74,75]. Changes in the 1990s made it more difficult for health authorities to employ such staff using General Medical Services' money reserved for general practice activities. Although American experience confirms that it is as easy to facilitate procedures of doubtful effectiveness as those of proven value[76], the contribution of facilitators have played an important role in developing preventive care in general practice.

GPs employ a number of methods to improve uptake for screening programmes. These include opportunistic face-to-face advice during surgery visits for other reasons, flagging manual or computer records, identifying non-respondents systematically and sending them letters, using health advocates or interpreters from minority ethnic groups, providing home visits and the option of a test performed by female staff. With training, GP reception staff have been effective in improving uptake among non-respondents for breast screening, particularly for women in minority ethnic groups[56].

By 1995, local guidelines were being developed in many areas, comprised of local interpretation of national recommendations, research evidence and best practice[77]. Their importance lay in establishing collective objectives and co-operation between practices, providing criteria for local audit and review and a basis for continuing education and improvement. It is difficult to estimate the extent to which local screening services for raised blood pressure or cervical cytology are influenced, but guidelines have proved a useful focus for change and year on year improvement of patient coverage in most areas[78–80].

Information flow

For centrally organised screening programmes, there is a need to have a two-way flow of information. Not only does the central organisation require information regarding registration and tests from the practices up-the-pipe, but practices need information about individual results, lists of non-respondents and population coverage back down-the pipe. Computerisation of these functions is both feasible and necessary. The involvement of general practice and primary care as active participants in the recruitment and management of people involved in screening programmes is necessary for all but the most laboratory centred of programmes.

General practice computing has been transformed over the last 15 years and over 90% of practices are now computerised. Many GPs are actively maintaining call and recall systems for screening and disease registers for coronary heart disease, asthma/chronic lung disease, diabetes and raised blood pressure[81]. Around half are actively maintaining a Read (or similar) coded clinical record at each surgery consultation[82]. Paperless surgeries are not uncommon and the sophistication of software and hardware capabilities has transformed possibilities for decision support, audit and review, communications and linkage.

While linkage between central recall systems for breast and cervical screening and the Family Health Services Authority register is now routine, linkage of practice computers to the screening services is not generally available. However, in some programmes printed lists of non-respondents are sent to each GP and coverage by practice may also be available. As practice computers are often routinely linked with hospital pathology laboratories for blood and other results, it will hopefully be a short time before practice linkage with screening programmes is established. This will make redundant the tedious business of manually uploading central recall systems, and manually downloading screening results onto the practice computer. Conformance standards and accreditation of GP computing systems could ensure that a standard interface between the many different brands of local computers and central computer systems is facilitated.

Financial incentives

The investment and continuing costs of nursing and clerical time for preventive programmes in general practice are substantial, despite the fact that, in the UK, employing authorities reimburse 70% of practice nurse salaries and 50% of the capital cost of the practice computer. The introduction of target payments in 1990, to promote immunisation and cervical screening, provided financial resources pegged to performance. GPs currently receive a payment of £870 on reaching a 50% target for cervical cytology and £2160 for the 80% target. No such scheme exists for mammography and it is notable that many practices report rates of mammography substantially below their rate for cytology for women of the same age[83]. For cervical cytology, the combination of well-organised local recall registers and financial resourcing of general practices have transformed population coverage. In 1970, coverage was below 50% in many areas, but is now around 80%, although problems remain in disadvantaged areas and among some minority ethnic groups.

In 1990, the UK Government introduced payments for health promotion[84]. These initially took the form of payment for an extremely

diverse range of health promotion activities, payment being generated by a clinic attended by 10 individuals. The doubtful benefit of this activity soon became clear and, in 1993, the government introduced a new patient registration check, together with an over 75 years check and chronic disease management payments for coronary heart disease, raised blood pressure, asthma and diabetes. Payment was dependent upon extensive recording of data and year on year rises in population coverage[85].

This approach was criticised as being too prescriptive, generating large amounts of centrally held data of variable quality with no obvious purpose. In addition, the requirement to routinely check urine glucose[86] and aspects of the over 75s check lacked an evidence base. In a climate which had already divided general practice into fundholders and non-fundholders, top down initiatives were viewed with some distrust[87]. The requirement to produce data on health promotion activities was discontinued in 1997 and practices were asked merely to submit outlines of their health promotion strategies, though payments for new patient, elderly checks and chronic disease management were continued.

Resourcing change through performance rather than facilitation failed to develop programmes. The ensuing controversy did nothing to enhance the progress of cardiovascular health or screening and the inclusion of screening unsupported by evidence further undermined credibility of health promotion in general. An important opportunity to develop the recording and organisation of preventive activities was missed during this turbulent decade and there were many who felt both baby and bathwater were jettisoned in the attempt to appease critics[88].

The alternative approach of supporting existing initiatives from the bottom-up has proved more productive. Organised local input from practices, combined with central co-ordination, has tended to be more successful than either component alone. The question is whether this model can be successfully applied not only to single-shot programmes such as cervical screening, where relatively small numbers of people are subsequently managed by secondary care, but also to conditions such as smoking or raised blood pressure, requiring continuing primary care management and behavioural change for large numbers of people. The emergence of locality diabetic registers suggest that it can. Whether the current initiative to promote clinical effectiveness can develop practice-based community registers, promote implementation and improve quality and audit remains to be seen[89].

Reviewing progress and quality

Routine review and audit of results, comparing individual practices with anonymised peers is a realistic proposition now that clinical computer

systems are in day-to-day use in many general practices. Despite the additional payments designed to encourage recording of smoking, blood pressure and other cardiovascular risk factors, no systematic attempt was made to aggregate the large amounts of data generated by the chronic disease management and health promotion initiatives. Unlocking clinical data in a fashion which allows comparison of results remains an outstanding task for general practice.

While national programmes often generated more heat than light, sporadic initiatives in East London[60], Wales[90], Somerset[91], Wakefield[92], Buckinghamshire[93] and Northumberland[94] established locally valued programmes with published aggregated results from large groups of practices. Agencies involved include health authorities, Medical Audit Advisory Groups, University Departments and individual GPs. A pilot project by the National Health Service Executive (NHSE), *Collecting Data in General Practice*, aims to establish a national core dataset with agreed Read coded definitions and data collection from a range of general practice computer systems using a data extraction programme called MIQUEST. This includes training in establishing and maintaining datasets[95].

Unlike the *National Morbidity Survey of General Practice* which contains cross-sectional data, the NHSE Collecting Health Data in General Practice initiative will permit the linking of morbidity codes to process. For example, it will be possible to quantify the number of individuals with hypertension with a systolic blood pressure above 160 mmHg, or the number of hypertensive patients who have not had their blood pressure measured within the preceding year. As well as examining coverage and activities in whole populations, this in effect establishes disease registers for specific conditions which can then be examined in terms of their process. Not only will this allow coverage to be documented but it can also begin to address the quality of interventions.

Smoking and blood pressure ascertainment within the preceding 5 years in better organised practices averages around 80%, though hypertension definition is variable. These figures are derived from volunteer practices and the national or regional picture is likely to include a more diverse range[47]. Comparisons between practices or areas are difficult as treatment and control of raised blood pressure vary according to treatment thresholds and practice age structure. Age standardisation and an agreed range of target thresholds could address these problems. However, training of practice teams around agreed definitions and quality of data entry are essential if the value of such information is to be realised. The aim is to improve clinical practice: the production of information is only a means to that end.

Conclusion

There is now compelling evidence that general practice based screening and intervention are a valuable and cost-effective way of reducing cardiovascular mortality through the identification of smokers, raised blood pressure and other multiple risk factors for cardiovascular disease. However, the cost and resource implications are formidable and need to be considered within a national framework with explicit aims, as well as support for disease registers, quality assurance, implementation, audit and review. All screening programmes in general practice share common organisational elements which require support if delivery of screening services is to be equitably improved. A national framework to support evidence-based practice on screening and treatment is required which articulates with local development and clinical effectiveness groups. This would improve the coherence and implementation of current and new initiatives to prevent death from cardiovascular disease.

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