Computer-enhanced assessment of cardiovascular risk

Prevalence rates of coronary heart disease rise with deprivation and in industrial areas. This study, carried out in a general practice in an ex-mining town in Yorkshire, looks at whether a computer-enhanced assessment of cardiovascular risk can help primary care teams reduce morbidity in their community.

Abstract

This study investigated the impact of the use of a computer programme to collect data on cardiovascular risk factors, which could also provide patient education. A retrospective analysis was carried out of data recorded over three years in a general practice in Barnsley, an area with the second highest prevalence of ischaemic heart disease in England.

The study found that use of a simple computer-based system by the primary care team led to 55% of the population being assessed within three years. Consequent patient education and lifestyle changes led to a reduction of risk factors in those at high risk who were re-screened. A possible reduction on admissions to hospital for cardiovascular disease was also noted.

Key words: cardiovascular disease, risk assessment, computer data collection patient education.

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Introduction

Assessment of an individual's risk for the prevention of coronary heart disease (CHD) is one of the major problems facing primary care in the UK. Intervention is well established as being possible and effective;[1] it is thought that lifestyle changes are more important in reducing overall risk than therapeutic interventions.[2] Guidelines from the British Cardiac Society and the British Hypertension Society have set new ambitious targets[3] and the National Service Framework (NSF) for CHD calls for assessment of the risk of the whole population by 2005.[4]

Several computer-aided assessment systems have been developed for coronary risk assessment in primary care but we are not aware of any that also provide patient education. Results of their use have rarely included outcome measures.[5] Previous reviews have highlighted the lack of patient-centred research in this area[6] and called for more.[7] A study on secondary prevention showed the difficulty of extracting the relevant information from GP computer systems to identify those who needed intervention.[8] A similar report recently concluded: "Routine calculation of the risk of CHD in primary care is hampered by poor availability of data on risk factors. General practitioners and practice nurses are able to evaluate the risk of CHD with only moderate accuracy. Data about risk factors need to be collected systematically, to allow the use of the most appropriate calculation tools".[9] Many also consider the collection of risk calculation data difficult, time consuming and expensive.

> ***'Assessment of an individual's risk for the prevention of coronary heart disease is one of the major problems facing primary care'***

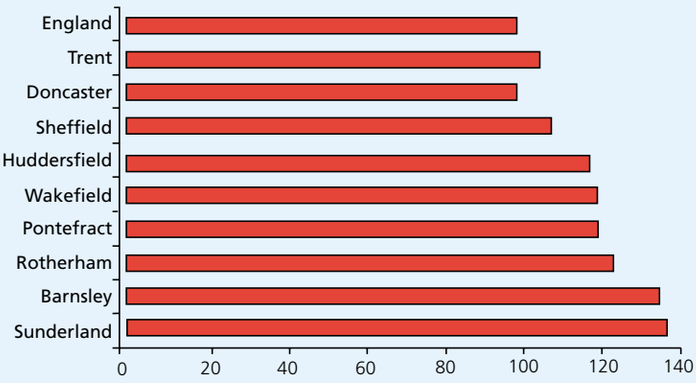
We report nearly 5,000 patient/years experience in a practice with potentially one of the worst levels of CHD in the country. Reductions in smoking, hypertension, hyperlipidaemia and obesity were achieved, some of them significant. A reduction in admission rates for ischaemic heart disease was observed. We believe this is the first time an association has been claimed between a computer-aided assessment programme used in a community and a reduction in cardiovascular risk factors.

Background

Heart disease is one of the major killers in the Western world.[10] Geographical variations have been well described and rates rise with deprivation and in industrial areas.[11] Barnsley is an ex-mining town with a much higher prevalence of ischaemic heart disease than most areas. It is second only to Sunderland in the UK for premature deaths due to heart disease. (figure 1). The standardised mortality ratio for CHD in Barnsley was 137 in 1998,[12] which means that over a third more people die in Barnsley from this cause compared with the rest of the UK. Athersley is an area of Barnsley which has a very high rate of heart disease and a deprivation score of 22.8, which is twice the Barnsley average and one of the highest in South Yorkshire. In all other respects, the population served by the practice appears to be the same as the rest of Barnsley.

The major practice in Athersley is the Rotherham Road Medical Centre, which – in keeping with the rest of this area – has a rate of heart disease nearly a third above the Barnsley average. Knowing the particular problems of the area, the practice started to assess risk of coronary artery disease in its adult population over five years ago using a

Figure 1. Standardised mortality rates for the UK, Trent, Yorkshire 1988–1992



programme written by one of the partners. The programme has already been described elsewhere.[13] In summary, it uses clear visual signals and printed advice to show the patient which risk factors are acceptable, which need altering and which are unalterable. Previous data are easily recalled and improvements can be shown. Patient acceptability is high and it can be used to screen large numbers in a short time.[14] By showing the effect of potential lifestyle changes on the calculated risk score, the point can be emphasised in the consultation that their risk can be lowered by intervention.

'The number of admissions for MI and angina has fallen over the course of the study'

Methods

The Rotherham Road Medical Centre in Barnsley, South Yorkshire has used the RISK computer programme (Medcal)[15] for over three years. During consultations with the nurse or doctor, the programme is used to calculate risk and to show the patient how changes to each parameter could reduce the risk of heart disease. The system was used to assess as many of the patients as possible, who were given written information tailored to their results during the consultation.[13] Reassessment was carried out at intervals during consultations. As well as showing the initial risk for the individuals, recording these reassessments in the system led to the possibility of demonstrating a reduction in risk factors over time and across the population. The resulting data were imported into a commonly-used statistical package (SPSS) for analysis. Information was obtained from the health authority and the local Health Action Zone on various aspects of the practice population and data on admissions to local hospitals.

Results

Data collection started in January 1998. In nearly three years, 1,995 patients (898 female and 1,097 male), who represented nearly 60% of the adult population, were assessed; 2,765 assessments were completed. Complete data sets were obtained for all of these patients. Table 1 gives the age/sex breakdown of these patients. The age/sex breakdown of the practice population for this parameter is typical of Barnsley as a whole. There have been no significant changes in the structure of the total practice population of 5,200 in the last three years (Paul Foster, Barnsley Health Authority, personal communication 2001).

Table 1. Age/sex profile of patients assessed

Age (years)	Total	Female	Male
< 25	180	0	180
> 25, < 35	263	127	136
> 35, < 45	312	153	159
> 45, < 55	368	164	204
> 55, < 65	325	161	164
> 65, < 75	370	203	167
> 75	177	90	87
Total	**1,995**	**898**	**1,097**

Table 2. Numbers assessed repeatedly by number of visits

Number of visits	Number attending
2	475
3	200
4	57
> 4	42

Analysis of those attending more than once showed that 774 patients compared the sample of 2,020 visit occasions distributed as shown in table 2. The age/sex profiles of these 774 patients were no different from practice norms.

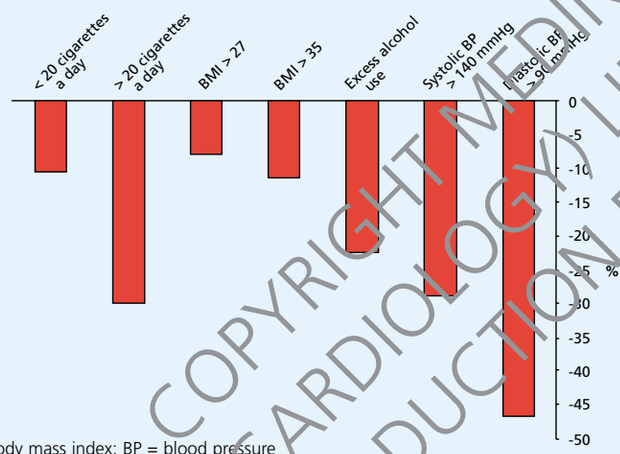
Regression slopes were calculated, on at least two occasions, for all those individuals with data for the following variables: weight, body mass index (BMI), systolic blood pressure (BP), diastolic BP, cholesterol, high-density lipoprotein (HDL), triglycerides, computer-generated risk score, target score and the Framingham percentage risk. An individual's regression slope gives the expected annual rate of change of the variable if the change experienced over the measurement interval were to persist for a year. In some cases, where the measurement interval was small but the change was great, the annual rate of change is so great as to be unrealistic and occasional values appeared unlikely. Some data had been imported from an early version of the programme with a decimal point in the wrong place. In order to reduce the influence of these unrealistic values, the bottom

Table 3. Raw scores (number of patients) and percentage change

	Number at start	Number after reassessment	Increase or decrease (%)
Non-smokers	161	173	+ 6.9
Ex-smokers	139	162	+ 14.19
< 20 cigarettes a day	120	108	- 10
> 20 cigarettes a day	71	50	- 29.57
BMI > 27	303	280	- 7.59
BMI > 35	71	63	- 11.26
Excess alcohol use	76	59	- 22.36
Systolic BP > 140 mmHg	310	221	- 28.70
Diastolic BP > 90 mmHg	202	108	- 46.5

Key: BMI = body mass index; BP = blood pressure

Figure 2. Percentage change in risk factors over three years at the Rotherham Road Medical Centre



Key: BMI = body mass index; BP = blood pressure

2.5% and top 2.5% of values were excluded from the calculation to guard against erroneous results.

From comparing different cohorts by age, sex and smoking status, some significant trends were noted (see table 3 and figure 2). There is no evidence of a significant average annual change in weight or BMI for either men or women or in any age. There is a significant average annual reduction in diastolic and systolic BP for both the full data set and for the trimmed dataset. This is mainly in younger men (< 45 years). There is no evidence of a significant average annual change in cholesterol for all the data. There is evidence of a significant average reduction in cholesterol of 1.6 for the trimmed dataset in both men and women and a significant decrease in HDL concentrations, mainly in the middle-aged cohort (45–65 years). Additionally, a significant average annual reduction in triglycerides of 0.74 for the trimmed dataset is demonstrated.

Smoking behaviour was also examined and showed significant changes. There is evidence of a change in smoking behaviour between the first recorded value and the final recorded value.

Possible effect on morbidity

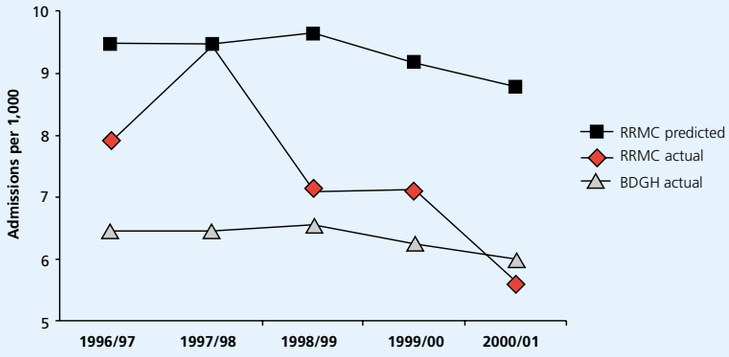
Admission rates to hospital for Barnsley Health Authority are only available since 1996. Total number of admissions for causes other than ischaemic heart disease for the Barnsley population compared with the Rotherham Road Medical Centre have remained the same since then. Broadly speaking about one in 40 admissions to Barnsley District General Hospital (BDGH) is from the practice. This is true for childhood accidents, respiratory disease and cancer admissions, and was true for myocardial infarction (MI) and angina before the study began. For the rest of Barnsley, admissions for all causes, including MI and angina, have fallen slightly over three years (Barnsley Health Authority data 2001).

For the Rotherham Road Medical Centre, the number of admissions for MI and angina has fallen over the course of the study. In 1996/97 the practice was above the Barnsley average and the following year the rate per 1,000 population rose. Over the next three years, following the introduction of the programme in February 1998, the numbers and the percentage of admissions for MI and angina fell to less than the Barnsley average. From one in 38 admissions to the DGH for MI being from the practice in 1996/97, the number has fallen to one in 85 in 2000/01. Admissions for other reasons from the Rotherham Road Medical Centre as a proportion of all admissions to the DGH have remained at around one in 40. The nationally available figures[11] suggest that the mortality for ischaemic heart disease in Athersley is about a half above the national average and one third above the Barnsley average.

Figure 3 shows the actual figures for

'The education and advice given has led to reduction in parameters known to affect disease progression'

Figure 3. Admission rates for coronary heart disease (actual and predicted) for the Rotherham Road Medical Centre compared to the Barnsley average



Key: RRMC = Rotherham Road Medical Centre; BDGH = Barnsley District General Hospital

Key messages

- Cardiovascular risk assessment of the whole population is vital for the implementation of the NSF for CHD
- Data collection is problematical and takes a large amount of time
- This study shows an easy way of involving all of the practice team and the patients using a computer programme to aid risk assessment
- The accompanying patient education improves the risk of the whole population and may have an effect on morbidity

Barnsley, the predicted figure for the Rotherham Road Medical Centre based on this assumption, and the actual figures provided by the Health Authority for the Rotherham Medical Centre. It could be argued that as there is a progressive fall in admissions anyway, the Rotherham Road figures are a reflection of an overall trend. Equally it could be argued that the only improvement in admissions for ischaemic heart disease in Barnsley has been down to the fall in admissions from the Rotherham Road Medical Centre. Much larger studies would be required to show whether this was a significant effect.

Discussion

It is known that reducing smoking rates, obesity, cholesterol levels and BP all lead to lower rates of cardiovascular disease. The figures we have collected demonstrate noticeable and, in many cases, statistically significant effects on all of these parameters for over half of the population. It is thought likely that those more at risk are more likely to be assessed because co-morbidity with respiratory and other problems are more likely to bring them into the surgery. Thus, we may have assessed those most at risk. We also feel that there has been an effect on one measure of morbidity, admission rates for MI. The reduction in admissions is noteworthy, although the figures are too small to say that they are significant.

Unfortunately, it may be that self-reporting of risk factors reduces with further reassessment as patients realise what the target levels are. They will also learn what the questions are and may report lower levels in order to lower their risk to please the doctor. This, however, would not have any effect on admissions. There may also be some bias in the study with the highest risk patients returning more frequently to the surgery (for example to have their hypertension treated). Further investigation will be needed to resolve these issues. Data collection is continuing within this practice and across other practices. We hope to shortly see effects on other practice populations.

Conclusions

The Medcal Risk Programme has been extensively used in a deprived area of the country with higher than average morbidity and mortality from cardiovascular disease. Over half the population of the practice has been screened and the education and advice given has led, on rescreening, to reductions in parameters known to affect disease progression within a few years of the intervention starting. The number of admissions for ischaemic heart disease in this population has fallen steadily over three years. We will continue to monitor the effect but we believe this is the first report of use of a computer programme having a possible effect on morbidity in a community.

Acknowledgements

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Declaration of interest

Dr P Tyerman is a director of Medcal Ltd and designed the software; Dr Trefor Roscoe has worked as an advisory consultant to Medcal Ltd.

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● **A commentary on this article by Dr Mark Davis is published opposite**

Book review

A-Z of management for healthcare professionals

Author: Lilley R
Publisher: Radcliffe Medical Press, Oxford, 2002
ISBN: 1-85775 953-2 Price: £19.95

Healthcare management is a growth industry and there is an increasing number of books written on the subject. Although the title suggests that this book has been written specifically for healthcare professionals, this could not necessarily be deduced from reading it. Of the 26 chapters, only six make any mention of the health service. Much of the content is generic and resembles that found in other introductory management texts.

The 'A-Z' structure means a piecemeal approach is adopted to the various topics, which are a collection of ideas or routines that have apparently impressed the author; this also means that a personal view is presented. Each of the chapters is preceded by a quote from a famous figure, including Einstein and Roosevelt. The book is easy to read with a chatty style, sometimes exhortative and occasionally irreverent.

It is a characteristic of some management books that they can border on becoming self-improvement manuals and this is no exception, as the main thrust seems to be on personal style and behaviour. The recommended fast track to greater confidence ("if you want to feel good, then just feel good") would probably not inspire much confidence in reality.

There is reference to some contemporary concepts in management theory but occasional suggestions that readers 'drop' into conversation the names of various management 'gurus' neither enhances the credibility of this book or its purpose. Similarly, within the alternative alphabet at the end of the book, the letter 'D' is assigned to 'ducking and diving'. A recurring theme is the concept of healthcare as a product that can be successfully managed, as in any other industry, but despite the author's experience, few illustrations are provided.

Few readers will gain a specific understanding of healthcare management through reading this book, although some may find it useful as a basic and light-hearted introduction to personal management concepts. This is a missed opportunity really, as there is a genuine need for improving the understanding of healthcare management.

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Computer-enhanced assessment of cardiovascular risk: a comment

With the advent of the Joint British Society Guidelines for the prevention of Coronary Heart Disease (CHD), the British Hypertension Society Guide-lines and the National Service Framework for CHD, priority has been given to risk assessment. Our first priority was to use practice disease registers to identify those people eligible for secondary prevention and address all of their cardiovascular risk factors. But we also need to concentrate on high-risk primary prevention. Here quantifying cardiovascular risk factors enables us to calculate absolute risk. We can then decide whether therapeutic interventions are indicated, in addition to lifestyle advice.

The use of computer programmes to calculate risk is well established. In this issue, Tyerman *et al*. (see pages 472–6) discuss the use of a computer programme to collect data on cardiovascular risk factors. The authors include general practitioners in Barnsley, an area which is second only to Sunderland in the UK for premature deaths due to heart disease. The standardised mortality ratio for CHD in Barnsley was 137 in 1990. The practice is situated in an area of Barnsley, which has a rate of heart disease a third higher than the Barnsley average.

For the past five years the practice have assessed risk of CHD using a computer programme written by one of the partners. This programme uses clear visual signals and printed advice to show patients which risk factors require attention. The programme can be used as an aid to patient education by illustrating that if certain risk factors are addressed then that individual's risk of CHD is reduced. The authors will be aware that we cannot use post-intervention data to accurately calculate risk. However, it can be used to motivate change in behaviour.

'This practice reports a reduction in hospital admissions for myocardial infarction and angina in excess of what might have been expected'

Mark Davis

The programme was used opportunistically to assess as many of the patients as possible during consultations and re-assessment was carried out at intervals. Patients were given written information tailored to their results. In three years from January 1998, 60% of the adult population was assessed and 2,765 assessments were completed.

Audit revealed that there were significant average annual reductions in diastolic and systolic blood pressure and that there was a significant average reduction in cholesterol. Statistically significant improvement was also shown in smoking behaviour.

Benefit suggested

On a population basis one would expect these improvements in risk factors to produce a beneficial impact on cardiovascular event rates. Cardiovascular event rates are falling across the country but, interestingly, this practice reports a reduction in hospital admissions for myocardial infarctions and angina in excess of what might have been expected. In 1996/97 the practice was above the Barnsley average for such admissions. By the end of the project, they had fallen to below the Barnsley average. The practice provided one in 38 admissions to the District General Hospital for myocardial infarcts in 1996/97 but, by 2000/01, the practice provided one in 85 such admissions. The authors state that the reductions in admissions is noteworthy, although the figures are too small to be sure of the significance.

Primary care is challenged with identifying the individuals who are at the greatest risk of cardiovascular disease and intervening appropriately. Even once the task of identifying these patients is completed, a greater challenge is to obtain a change in behaviour. This may be done by achieving concordance with drug treatment for hypertension and hyperlipidaemia. We also need to modify lifestyle in the form of smoking cessation, diet and exercise. This programme will help to record the risk factors and monitor our progress in addressing them. Importantly it may also help us to motivate our patients to behave in a way that would protect them from the morbidity and mortality associated with cardiovascular disease.

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