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Risk factors for coronary heart disease in a self-referred population compared with a general population

Timothy P. Gill, Mark L. Wahlqvist, Peter M. Dennis, Nick D. Balazs, Boyd J.G. Strauss and P. Geoffrey Matthews

ABSTRACT Screening programmes for community coronary heart disease risk factors aim to identify persons who are at a high risk of the development of coronary heart disease by screening the population for the prevalence of smoking, obesity, high blood pressure and high blood cholesterol concentrations. The effectiveness of such screening programmes is dependent on a number of factors. The characteristics of individuals who attend such screening programmes voluntarily, and the prevalence of abnormal coronary heart disease risk factors that is detected, give a strong indication of the population reach and the potential benefits of this preventive strategy. In this study, persons who attended a self-referred risk-factor screening programme for coronary heart disease were compared with a random sample of the Australian urban population. A disproportionately high number of older persons and of women presented for the self-referred screening programme while smokers were underrepresented. In general, the risk-factor levels of those in the older age-groups who attended the screening programme were lower than were the corresponding measurements that were found in the random sample; the opposite was true for those in the younger age-groups. These results suggest that coronary heart disease risk-factor screening programmes in the community appeal more to those in the health-conscious older age-groups and to women. For heart disease prevention programmes to be more effective, it will be necessary to design screening programmes to attract more men, those in younger age-groups and smokers. (Med J Aust 1989; 151: 518-525)

Cardiovascular disease is the major cause of premature death in Australia. It is responsible for one in every two deaths, 22% of which occur before the age of 65 years.¹ In international comparisons, Australia has an unfavourably high prevalence of heart attacks and strokes.² In spite of recent reductions in cardiovascular disease mortality rates, cardiovascular disease still costs Australia over \$2000 million each year in hospital, medical and pharmaceutical expenses and in lost productivity.³ Obviously a great deal of interest exists in any measures that have the potential to reduce the burden of this disease on the Australian population.

The association among elevated levels of blood cholesterol, hypertension and cigarette smoking and the development of coronary heart disease is well-established. Recent large, well-controlled interventional trials, in which blood-cholesterol levels were lowered by means of drug therapy or dietary measures, have demonstrated a reduction in the incidence of coronary heart disease and a slowed progression of coronary atherosclerosis.^{4,5} This has led to a renewed enthusiasm for the treatment of hypercholesterolaemia and other risk factors for coronary heart disease.⁶

Several policy options are available to reduce risk factors for coronary heart disease in the Australian population. Risk-factor screening programmes are one option which has been proposed as a useful means to alert individuals to their risk-factor levels and, thus, to initiate appropriate changes to reduce these risks. However, many factors will affect the success of a community risk-factor screening programme. Some important considerations are: the acceptability of the programme to all sections of the community;

the prevalence of abnormal measurements of risk factors that are detected; and the motivation of the subjects to make effective life-style changes to reduce their risk-factor levels.⁷ Reports on the outcome of risk-factor screening programmes are meaningless unless some attention is given to the characteristics of persons who attend such programmes compared with those of the population as a whole.

This article examines some health characteristics of persons who attended a self-referred risk-factor screening programme for coronary heart disease voluntarily and compares these characteristics with those that were measured during the 1983 National Heart Foundation's Risk Factor Prevalence Study⁸ which was undertaken in a random sample of the Australian urban population.

Subjects and methods

During "Heart Week" in April 1986, a risk-factor screening unit for coronary heart disease was established by Prince Henry's Hospital, Melbourne, in a large shopping mall in the central business district of Melbourne. Self-referred subjects attended the unit for an assessment of their risk factors.

Because of its popularity, the screening process took up to 90 minutes. Subjects initially were enrolled and were interviewed regarding their smoking habits. The following measurements then were assessed by trained operators: repeated blood-pressure measurements with an automatic sphygmomanometer (Dinamap 845),⁹ with the subjects seated and by means of an established protocol;¹⁰ capillary whole-blood cholesterol measurements by means of a reflectance analyser (Reflotron; Boehringer, Mannheim, West Germany); and height and weight measurements by means of a height stick and beam scales, with the subjects in light clothes and no shoes. After the risk factors had been measured a physician and a dietitian were available to assess the results and to advise the subjects on appropriate life-style modifications or medical care.

The data that were obtained from this risk-factor screening programme were compared with the pooled data that were collected from all major Australian urban centres during the 1983 National Heart Foundation's Risk Factor Prevalence Study.⁸ The age distribution was compared with the Victorian population at the 1981 Census.¹¹

The distribution of risk factors was established by calculating the mean risk-factor levels of subjects in each five-year age-group from 25 to 64 years in the self-referred population, and comparing these with data that were presented in the same manner for the National Heart Foundation's study sample. These age-specific means then were weighted with the 1981 Census data¹¹ in the manner that was outlined in the National Heart Foundation's study to allow a direct comparison of the mean risk-factor levels for the total population.

Results

The population sample

A total of 1124 subjects, who were aged between 16 and 82 years of age, attended the risk-factor screening unit during Heart Week. The self-referred population is compared with the Victorian population at the 1981 Census in Figure 1 and clearly shows a skewing of the age distribution towards the older age-groups for both men and women. Table 1 shows the age and sex distributions of the self-referred population, compared with those of the 1983 National Heart Foundation's study; a greater proportion of persons in older age-groups and of women attended the self-referred study.

The ages of the self-referred subjects ranged from 16 to 82 years, whereas the National Heart Foundation's study was limited to persons between the ages of 25 to 64 years. Therefore, a subsample

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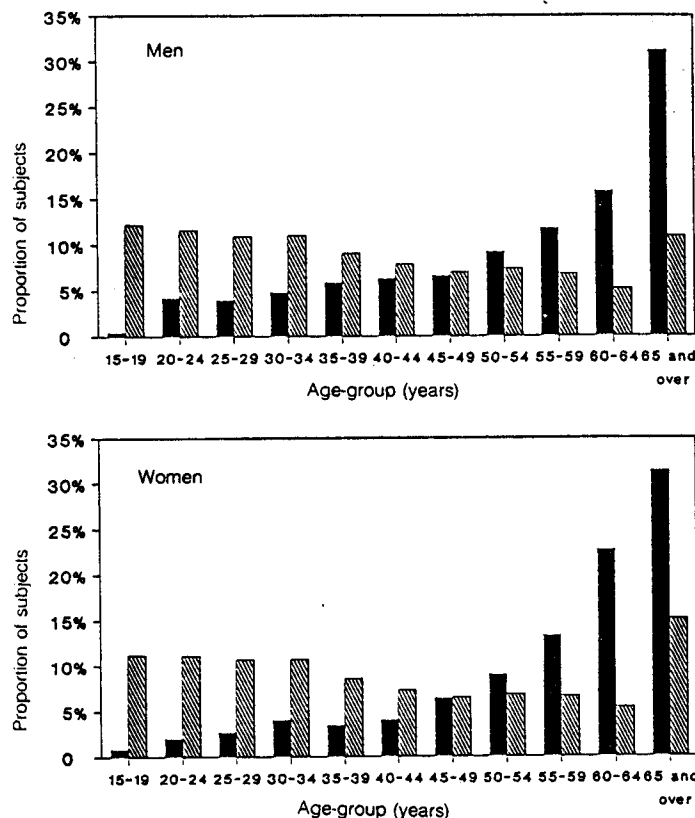


FIGURE 1: Age distribution of the study sample (■) compared with 1981 Census data of the Victorian population (▨).¹¹

TABLE 1: Age and sex distributions of the study sample and comparison with the 1983 National Heart Foundation's Risk Factor Prevalence Study

Age-group (years)	Study sample (n = 1124)		1983 National Heart Foundation's Study (n = 7615) ^a	
	Men	Women	Men	Women
Less than 25	21	18	—	—
25-29	18	18	472	493
30-34	22	27	534	554
35-39	27	23	572	574
40-44	29	27	458	484
45-49	30	44	428	445
50-54	42	60	445	441
55-59	54	89	450	478
60-64	72	152	381	406
65 and over	142	209	—	—
Total	457(40.7%)	667(59.3%)	3740(49.1%)	3875(50.9%)

TABLE 2: Age-weighted mean risk-factor levels of the study sample compared with those in the 1983 National Heart Foundation's Risk Factor Prevalence Study^a

Risk factors	Study sample		1983 National Heart Foundation's Study ^a	
	Men	Women	Men	Women
Blood pressure (mmHg)				
Systolic	140	132	131	124
Diastolic	83	79	81	76
Blood cholesterol level (mmol/L)	5.15	5.33	5.61	5.65
Body mass index (kg/m ²)	25.1	24.4	25.3	24.0

^aValues were weighted by means of the 1981 Census data;¹¹ only those subjects of between 25 and 64 years of age are included.

of 731 self-referred subjects, of between 25 and 64 years of age, is used in any comparisons between the two populations.

Risk factors for coronary heart disease

A comparison of the age-weighted mean risk-factor levels for the two populations is shown in Table 2; in Table 3, the proportions

TABLE 3: Proportion of the study sample with elevated risk factors compared with that in the National Heart Foundation's Risk Factor Prevalence Study^a

Elevated risk factor	Study sample (n = 731)		1983 National Heart Foundation's Study (n = 7615) ^a	
	Men	Women	Men	Women
Diastolic blood pressure (greater than 95 mmHg)	17.0%	10.5%	10.9%	5.6%
Blood cholesterol level of: 6.5 mmol/L and greater	18.3%	27.7%	19.0%	20.9%
5.5 mmol/L and greater	42.5%	55.2%	NA	NA
Body mass index (greater than 30 kg/m ²)	8.8%	11.8%	6.4%	8.7%
Current smoker	14.2%	11.2%	32.2%	25.1%

^aOnly subjects between 25 and 64 years of age are included. NA = not available.

of the two study samples with highly elevated levels of the assessed risk factors are shown.

Smoking. Self-reported smoking patterns differed markedly between the self-referred group and the National Heart Foundation's study group. Only 14.2% of men and 11.2% of women who attended the self-referred risk-factor screening programme were current smokers while 32.2% of men and 25.1% of women from the National Heart Foundation's study group were smokers (Table 3). This trend was consistent across most age-groups but was more pronounced among the older age-groups and in women.

Blood pressure. Substantially higher mean systolic and diastolic blood pressures were found for both men and women in the self-referred study than were found in the National Heart Foundation's study (Table 2). This is supported by the greater proportion of hypertensive men and women in the self-referred population (Table 3). However, comparisons of the mean systolic and diastolic blood pressures in each age-group (Figures 2 and 3) show that, while those in younger age-groups in the self-referred population consistently had higher blood-pressure readings compared with the National Heart

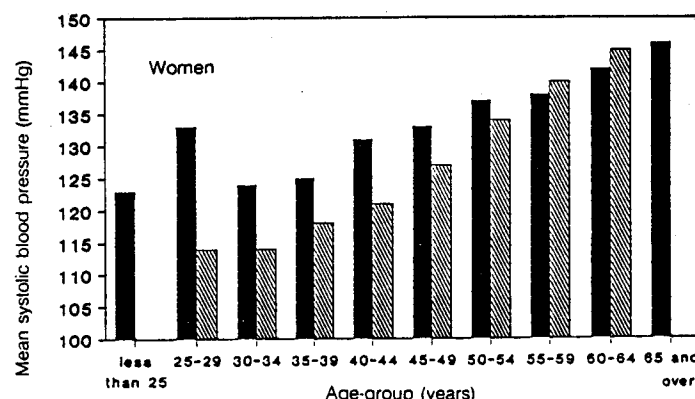
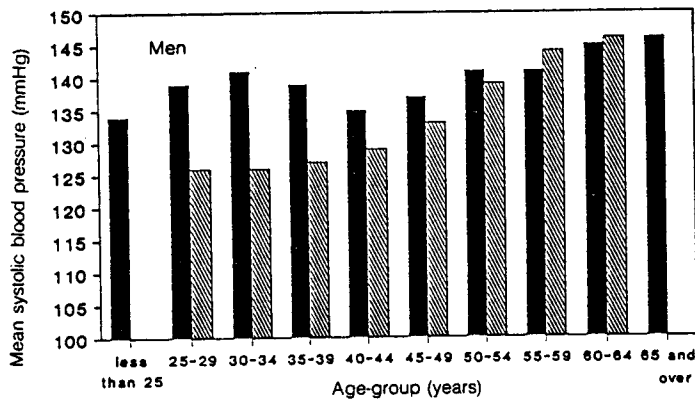


FIGURE 2: Mean systolic blood pressure of subjects of the study sample (■) and the 1983 National Heart Foundation's Risk Factor Prevalence Study (▨).^a

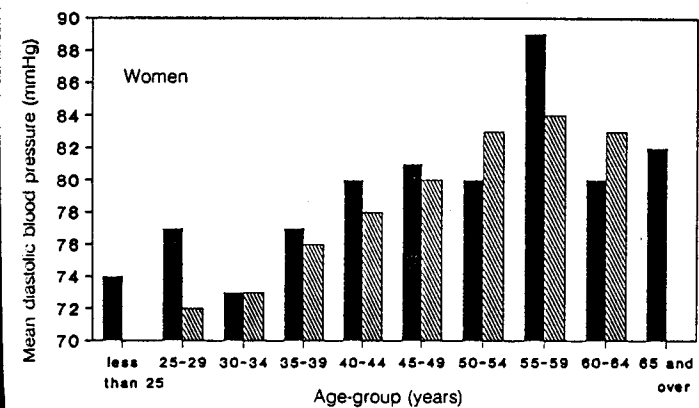
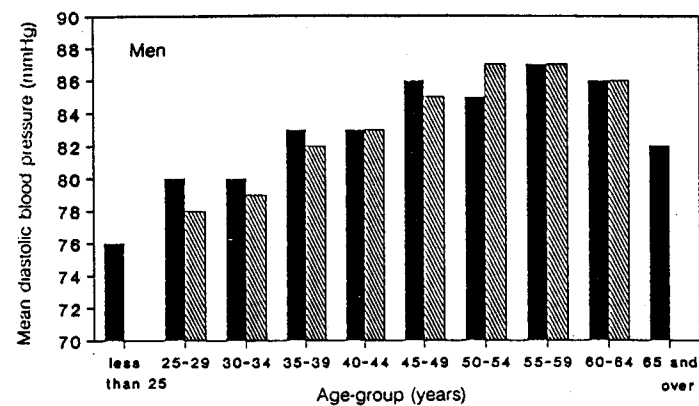


FIGURE 3: Mean diastolic blood pressure of subjects of the study sample (■) and the 1983 National Heart Foundation's Risk Factor Prevalence Study (▨).*

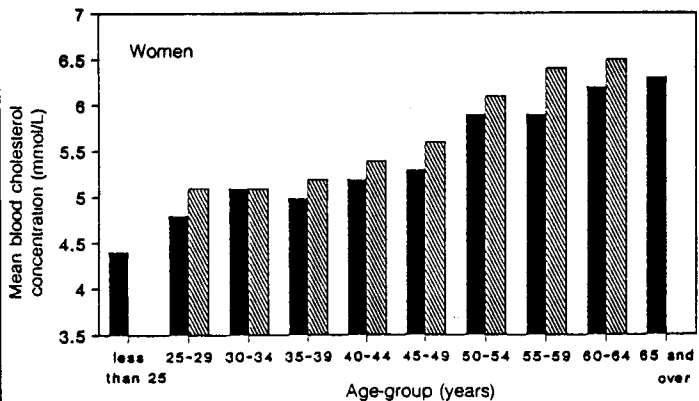
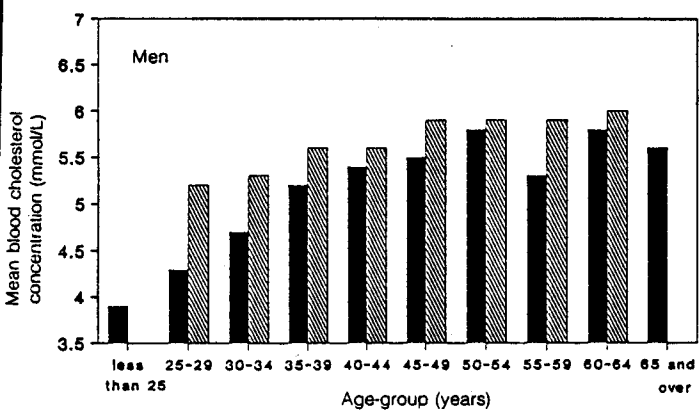


FIGURE 4: Mean blood-cholesterol concentration of subjects of the study sample (■) and the 1983 National Heart Foundation's Risk Factor Prevalence Study (▨).*

Foundation's study population, this trend did not persist into the older age-groups. Older self-referred age-groups showed lower mean systolic and diastolic blood-pressure measurements consistently.

Cholesterol levels. The comparison of the mean blood cholesterol levels for the two studies is given in Table 2 and shows that both self-referred men and women had substantially lower mean blood cholesterol concentrations than did their National Heart Foundation's study counterparts. However, a greater proportion of self-referred women with a blood cholesterol level of 6.5 mmol/L or more was found, although the mean blood cholesterol level was lower in this group (Table 3). A comparison of the mean blood cholesterol concentrations in each age-group reveals that self-referred men and women had consistently lower mean cholesterol levels; this difference was particularly pronounced in the older age-groups (Figure 4). There was an appreciable rise in mean blood cholesterol concentrations with age among women of both populations. This rise was not as pronounced in men.

A large proportion of both men and women from the self-referred population showed blood-cholesterol concentrations above those which currently are recommended as acceptable (5.5 mmol/L; Figure 5). Again, the proportion of older men was less than was that of older women.

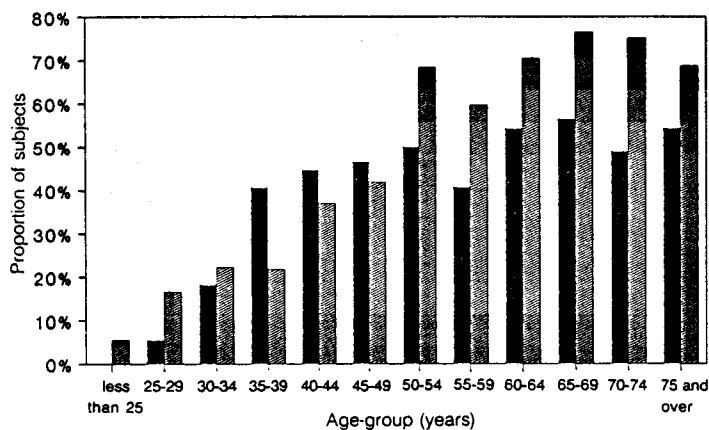


FIGURE 5: Percentage of male (■) and female (▨) subjects with a blood cholesterol concentration of greater than 5.5 mmol/L.

Body mass index. Although the mean body mass index (BMI) differed little between the two populations (Table 2), a greater proportion of the self-referred men and women were obese (BMI, greater than 30 kg/m²; Table 3). A comparison of the mean BMI in each age-group revealed a higher mean BMI among younger self-referred men and women but a lower BMI among older self-referred men and women when compared with the figures for the National Heart Foundation's study population (Figure 6).

Discussion

Several regional studies on risk-factor prevalence rates for coronary heart disease have been conducted in Australia.^{7,12-14} However, the National Heart Foundation's Risk Factor Prevalence Study is the only comprehensive study of such risk factors among the Australian population⁸ and, therefore, has been used in this article as the reference point with which the risk factors of subjects who attended a self-referred screening programme were compared. The comparison of these two populations enables us to determine whether the risk-factor levels of subjects who volunteered for a screening programme differed significantly from those which are found in the general population. Differences in any of the assessed factors may suggest the presence of a bias in the self-referral risk-factor screening technique which could strengthen or weaken its effectiveness in the primary prevention of coronary heart disease.

In the National Heart Foundation's study, a random sample of persons who were between 25 and 64 years of age was selected from the Commonwealth electoral rolls in each capital city and was invited

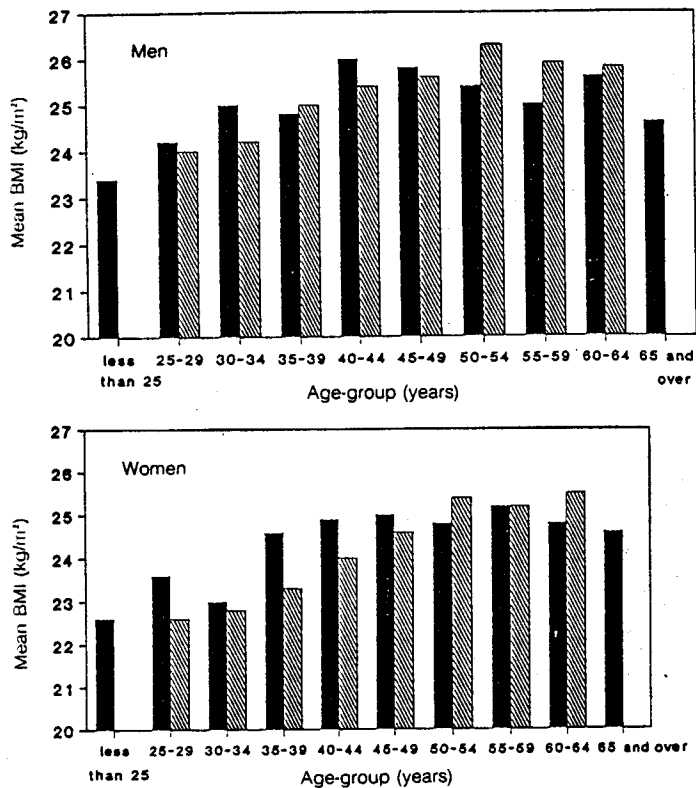


FIGURE 6: Mean BMI of subjects in the study sample (■) and the 1983 National Heart Foundation's Risk Factor Prevalence Study (▨).⁶

to attend an assessment centre. The response rate varied at the different assessment centres but an effective response rate of 75% was achieved at the national level. The risk factors were assessed by a trained survey team and the methods that were used were similar to those in our study with the following exceptions: in the National Heart Foundation's study, the blood pressure of rested subjects was measured manually by means of a mercury sphygmomanometer and the mean of two consecutive measurements was used for analysis; and plasma cholesterol levels were determined by means of a Technicon Auto Analyser II system (Technicon, Sydney) with venous blood samples that were collected from fasting subjects.⁶

The risk-factor profile of the self-referred population differed in some important aspects from that of the National Heart Foundation's study. The most striking difference between the two populations was the age and sex distributions, with an overrepresentation of subjects from the older age-groups and of women in the self-referred group. The skewing of the age distribution towards the older age-groups was emphasized when the ages of the self-referred population were contrasted with those of the Victorian population in the 1981 Census (Figure 1).

A number of possible explanations for this discrepancy in ages exists. The location of the assessment centre, the hours during which screening was available, and the length of time that was required to complete the screening procedure limited the accessibility of screening to those persons who were working or shopping in the centre of Melbourne and who did not have significant time constraints. Retired persons were more likely to have been able to fulfil these criteria than were those persons with work commitments. Risk-factor screening also may be more appealing to persons in older age-groups as they are likely to suffer the consequences of heart disease sooner than are the younger generations.

Three factors may explain the preponderance of women among the self-referred individuals: the naturally higher proportion of women in the older age-groups; the higher proportion of women who were able to visit the screening unit; and/or a greater utiliz-

ation of community-health services by Australian women.¹⁵

Apart from the discrepancy in the age-range, Table 1 also indicates large variations in the total number of participants in each age-group, both within the self-referred population and between the self-referred and National Heart Foundation's study populations. Although risk-factor data can be weighted to take into account the significant differences in age distribution, the accuracy of this process is limited by the number of participants in each age-group. A comparison of the mean values in each age-group may be a more reliable guide to the distribution of risk factors in the two populations.

The greater number of observations in the self-referred older age-groups explains the greater proportion of self-referred subjects with elevated risk-factor levels. However, comparisons of the mean cholesterol levels, mean systolic and diastolic blood pressures and the mean BMI for each age-group show that older self-referred subjects had a lower risk-factor level if they were compared with National Heart Foundation's study participants of a similar age.

The higher blood pressure measurements of the younger (less than 50 years of age) self-referred subjects may reflect the conditions under which blood pressure measurements were made. In our study, repeated measurements were made by means of an automated sphygmomanometer, and the values that were recorded were the means of the second and third automated readings.¹⁰ Although subjects were seated and rested before their blood pressure measurements were taken, they had been subjected to a long wait — young participants with time constraints may have become anxious. The National Heart Foundation's study was conducted in a clinical setting and participants had fixed appointments. The higher mean BMI of the younger self-referred subjects also could have contributed to their higher mean blood pressure values (Figure 6). Other studies have reported that hypertensive subjects are represented disproportionately in self-referred health-screening programmes.¹³

The mean cholesterol concentrations of the self-referred subjects were consistently lower in every age-group when compared with those of the National Heart Foundation's study. A methodological difference in the determination of the cholesterol concentration may have contributed to this discrepancy, but this is unlikely to be the sole reason. The Reflotron system, which was used in our study, determines the cholesterol concentration in whole capillary blood, but the enzymatic technique that was used to determine the plasma cholesterol concentration in the National Heart Foundation's study is considered to be an acceptable equivalent.^{16,17}

In both studies there was a higher proportion of women with unacceptably high (6.5 mmol/L or greater) blood cholesterol concentrations which increased with age. This may reflect the presence of a higher proportion of overweight and obese women compared with men in both populations or, alternatively, it may have been contributed to by the increase in the serum cholesterol level that occurs in postmenopausal women.⁸ The high proportion of self-referred subjects of both sexes and of all age-groups with blood cholesterol concentrations in excess of 5.5 mmol/L is ominous.

The unwillingness of smokers to attend health-screening programmes has been documented previously,^{13,18} and is demonstrated in all the age-groups of the self-referred population. Unfortunately, smokers who may benefit most from life-style changes may be self-alienated from health promotional programmes.

Our study has shown that among persons who attend self-referred screening programmes there is an overrepresentation of older age-groups and of women and an underrepresentation of smokers. It appears that older self-referred subjects who attend cardiovascular risk-factor screening programmes have lower levels of risk factors for coronary heart disease than does a similar sample of the general population. However, self-referred subjects of younger age-groups may have levels of risk factors that are higher than are usual for persons of their age in the general population.

While it may not be possible to make risk-factor screening equally appealing to all sections of the community, it is apparent that efforts

should be made to design screening programmes that attract more men, persons of younger age-groups and smokers, in addition to the highly-motivated older age-groups. This would help to maximize the potential benefits of this heart disease prevention strategy.

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Staff members' acceptance of the introduction of workplace smoking bans in the Australian public service

Ron Borland, Neville Owen, David Hill and Simon Chapman

ABSTRACT The acceptability to employees of workplace smoking bans is an important factor in their introduction and in subsequent compliance. This study describes the acceptance by affected staff members before the ban on smoking in Australian public-service premises. Four thousand, two hundred and fifteen (79% of those who were approached) public servants were surveyed from areas of six departments across three states. Twenty-five per cent of the sample were current smokers. Support for the bans was strong, with 76% of the sample approving over all. Approval among smokers was less, with 40% of smokers approving, compared with 82% of ex-smokers and 90% of "never" smokers. Thus, the results show a generally favourable attitudinal milieu among employees who were facing an impending ban on smoking, and far-from-unanimous opposition from smokers. Among smokers, acceptance of the bans was predictable from the attitudes towards smoking in general, and from the perceived impact of the bans on smokers. The existence of restrictions on smoking at the time of the survey was associated with slightly higher levels of approval of the impending total ban, especially when the restrictions were not seen as being imposed on the respondents by others. (Med J Aust 1989; 151: 525-528)

Smoking is the most significant preventable cause of illness and premature death in developed countries.¹ Together with the danger of smoking to the health of smokers, recent evidence indicates that passive exposure to cigarette smoke affects the health of non-smokers who are subjected to it.^{2,3} As the health consequences of smoking and of passive exposure to cigarette smoke increasingly have become known and publicized, some organizations have imposed bans and restrictions on smoking in workplaces.⁴ However, until recently, no major attempts have been made to place mandatory restrictions on smoking in workplaces as a whole. This situation now is changing both in Australia⁵ and in other countries.⁶

A recent survey of community attitudes in Australia found that only 17% of respondents favoured unrestricted smoking at work.⁷ While 30% of smokers were opposed to restrictions, a majority of smokers favoured some restrictions, with 5% of smokers favouring a total ban. These findings suggest strong community support for

at least some limitations on smoking in the workplace. However, they do not necessarily reflect the acceptability of smoking bans which have a direct impact on the respondents themselves. This information can be obtained only from those persons either who have been subject to bans or who are facing their impending implementation in their workplace. Workers' willingness to accept smoking bans may affect the implementation of these bans and, thus, both the effectiveness of environmental restrictions on smoking and the potential to extend them.

Only limited evidence is available on the acceptance of smoking bans in the workplace by smokers and non-smokers. Andrews studied the attitudes of hospital staff members and found high levels of approval of a workplace smoking ban by both non-smokers (93%) and by smokers (83%), 20 months after a ban was implemented.⁸ Rosenstock et al. surveyed a sample of employees of a health maintenance organization four months after a ban on smoking at work was introduced.⁹ They examined current attitudes and self-reported smoking behaviour, and also obtained retrospective data for the period before the implementation of the ban. Approval of the ban increased after its implementation, with similar changes being evident among smokers and non-smokers. Fewer than half the smokers disapproved of the ban. Both of these studies were conducted in health-related organizations, and it seems likely that the attitudes of those who work in such organizations would be more favourable to bans when compared with those of workers in other organizations.

In 1986, the Commonwealth Public Service Board announced that there would be a total ban on smoking in all Commonwealth government offices in Australia as from March 1, 1988. As part of the policy of implementation, some departmental sections implemented total or limited bans before the formal introduction date. The aim of our study was to report on the level of acceptance of the smoking ban in the workplace in the weeks that led up to its formal implementation, and to identify factors which influenced the degree of acceptance, particularly among current smokers. Restrictions that already were in place at some worksites at the time of the survey also provided an opportunity to study acceptance of the smoking ban as a function of the extent and nature of existing restrictions.

Methods

The survey was conducted in early February, 1988, two to four weeks before

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