5 Potential gains from interventions to prevent and treat heart, stroke and vascular disease

Chapters 3 and 4 described the contribution that both prevention and management have made to the significant decline in heart, stroke and vascular disease over the last 30 years in Australia, and the extent of knowledge on which to base further endeavours. This chapter illustrates the potential for further reductions in morbidity and mortality if effective preventive and treatment strategies are used for the whole population and for high-risk groups, for both coronary heart disease and stroke.

The potential for reducing heart, stroke and vascular disease and the methods for achieving health gains vary for different groups of people. For example, for people with high blood pressure, the risk of having a heart attack or stroke can be reduced substantially by drug treatment to lower their blood pressure. Even for people without high blood pressure, the cardiovascular risk can be reduced by managing blood pressure through preventive strategies such as reducing overweight and obesity or lowering dietary salt intake. Similarly, there can be large benefits from reducing the average cholesterol level of the entire population, not just of those with high levels.

5.1 Coronary heart disease

This section looks at the main effects of prevention and treatment on coronary heart disease risk.[7] First, preventive approaches can reduce the incidence of coronary 'events' (heart attack or coronary death), many of which will prove to be fatal once they occur. This will reduce the number of deaths by reducing the number of cases. Second, fatalities can be reduced further by improved treatment of those who do have an event. Thus, overall coronary deaths can be lowered by both reducing the incidence and the case fatality.

Table 5.1 summarises the falls in the prevalence of major risk factors and the resulting reduction in risk of a coronary event, based on evidence from the latest literature on randomised trials and population studies. The estimates are given for people without any history of coronary heart disease, with or without elevated risk factors, and for people with established coronary heart disease. The term 'high-risk strategy' is used to describe medical interventions in people with elevated risk, for example, because they have high blood pressure. The term 'population strategy' is used to describe interventions that can benefit everyone, for example changes in diet. The table also examines the reduction in risk of death during an acute episode associated with various medical therapies.

7 The estimates are taken from early work by the University of Newcastle, which will be published by the AIHW in 1999 after further refinement and peer review. Further details of the methodology, assumptions and limitation will be given in the published report.

Table 5.1: Estimated reduction in risk of suffering a major coronary event, or death during an acute episode, associated with reduction in risk factors or with medical therapy*

		Biological stage of coronary heart disease		
Risk factor reduction/ treatment	**Study**	**Without established coronary heart disease**	**Acute phase**	**With established coronary heart disease**
Smoking	English et al 1995	67% lower risk for never smokers aged < 65 years; 40% lower risk for never smokers aged ≥ 65 years	NA	67% lower risk for never smokers aged < 65 years; 40% lower risk for never smokers aged ≥ 65 years
Blood pressure	Collins et al 1990	*Population strategy* 14% reduction for a 5–6 mmHg reduction in diastolic BP *High-risk strategy* 14% reduction in risk	NA	*High-risk strategy* 14% reduction in risk
Cholesterol	Law et al 1994; Gotto 1996	*Population strategy* 17% reduction for a 0.6 mmol/L reduction in cholesterol *High-risk strategy* 31% reduction in risk	NA	*High-risk strategy* 34% reduction in risk
Physical inactivity	Manson et al 1992; O'Connor et al 1989	35–55% for active compared with physically inactive	NA	20% for active compared with physically inactive
Obesity	Manson et al 1992	35–55% for desirable weight compared with obesity	NA	
Aspirin	Antiplatelet Trialists Collaboration 1994	8% reduction in vascular events (includes stroke)	21% reduction	19% reduction in vascular events (includes stroke)
Beta blockers	Wikstrand et al 1991; ISIS-I Collaborative Group 1986; Yusuf et al 1985	24% reduction for beta blockade compared with diuretics	15% reduction	20% reduction
Calcium antagonists	Yusuf et al 1990	No significant difference	No significant difference	No significant difference
ACE inhibitors	Lonn et al 1994; Mant & Hicks 1995	NA	15% reduction	23% reduction
Streptokinase	Fibrinolytic Therapy Trialists' Collaborative Group 1994	NA	18% reduction	NA
Coronary angioplasty		NA		No difference from treatment with coronary bypass surgery
Coronary bypass surgery	Yusuf et al 1994	NA		Reduction in risk of death of 68% for LM disease, 42% for 3 vessel disease, 23% for 2 vessel disease

* Calculations assume that the benefit of increased medical therapy applies to all subjects who are likely to benefit from it.

Note: BP = blood pressure; LM = left main artery.

This evidence was used as the basis for estimating the potential reduction in coronary events by measures covering the entire Australian population. The estimation involves several steps:

- The adult population aged 35–79 years is divided into three groups based on their level of coronary risk and whether or not they have heart disease:
  - — people with no known history of high blood pressure, high blood cholesterol or coronary disease (Group I);
  - — those with a known history of hypertension or high blood cholesterol but without any evidence of coronary heart disease (Group II); and
  - — those with a known history of coronary heart disease (Group III).

  The percentage of the population in each group was estimated from the 1995 National Health Survey of Australians (ABS 1997a).
- Calculations are then made of approximately how many coronary events occur in each of the three groups. These estimates are based on the findings of studies of risk factors, treatments and coronary events in Perth and Newcastle during the 1980s and 1990s as part of a multi-country project coordinated by the WHO.
- It is also assumed that more people with known high levels of blood pressure or blood cholesterol receive drug treatment and that risk factor reductions can be achieved in various subgroups. These changes are:
  - — a fall in the prevalence of cigarette smoking by 50 per cent in all groups;
  - — reducing the prevalence of physical inactivity to 25 per cent in all groups;
  - — reducing by 50 per cent the proportion of people with known high blood pressure or high blood cholesterol who are not receiving treatment (for example, 82 per cent of people in Group II reported having high blood pressure, and 70 per cent were on treatment but 12 per cent were not; so if the proportion untreated were halved there would be a total of 76 per cent receiving drug treatment and the remaining 24 per cent [6 per cent with hypertension and 18 per cent without] would receive the benefit of the population strategies);
  - — lowering the average level of cholesterol by 0.5 mmol/L in people who are not receiving drug treatment for high blood cholesterol; and
  - — lowering the average level of diastolic blood pressure by 4 mmHg in people who are not receiving drug treatment for high blood pressure.

While these changes are somewhat arbitrary they are seen as achievable within five to ten years, based on past experience of risk factor reductions in Australia and elsewhere.

Finally, the gains from the prevention and treatment interventions, expressed as percentage falls in rates or numbers of coronary events, are estimated. The potential gains are estimated separately for each risk group by age and sex. The percentages of people in Groups I, II and III and the percentages of coronary events that occur in these groups are shown in Table 5.2.

Table 5.2: Percentage of population aged 35–79 years in various risk groups and percentage of coronary events in each group

Group	Level of coronary risk	Percentage of population	Percentage of coronary events
I	People with no history of hypertension, high blood cholesterol or coronary heart disease	72	21
II	People with a history of hypertension or high blood cholesterol but not coronary heart disease	23	48
III	People with a history of coronary heart disease	5	31
Total		**100**	**100**

Source: 1995 National Health Survey and the World Health Organization's MONICA Project collaborating centres in Perth, Western Australia and Newcastle, New South Wales.

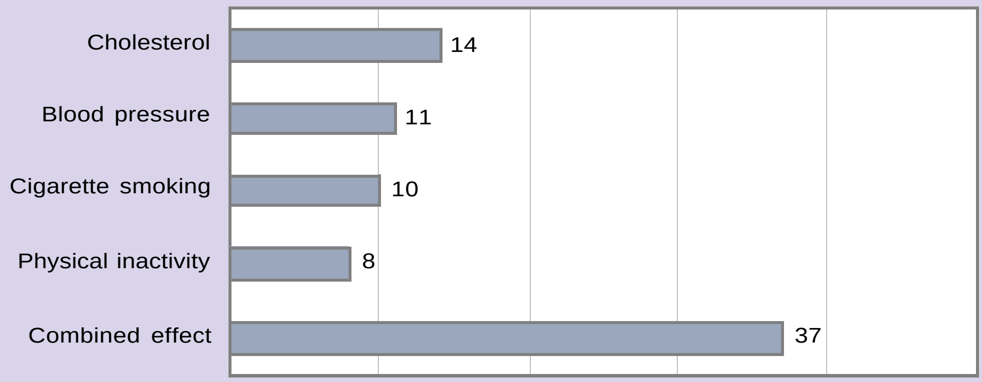
Potential gains from interventions

The potential reductions in rates of coronary events that could be achieved through various prevention and treatment strategies for Groups I, II and III are shown in Figures 5.1, 5.2 and 5.3 respectively. The combined effects of risk factor reductions and treatment are also shown, as they are not simply the sum of the component parts (Sturmans et al 1977).

Group I

This is a large group (72 per cent of all persons in Australia aged 35–79 years). They have relatively low risk of coronary heart disease as individuals but, even so, 21 per cent of all coronary events occur in this group. Their risk could be reduced if the average levels of blood pressure and cholesterol in the population were lowered, by improvements in diet, exercise and weight, and if the prevalence of cigarette smoking and physical inactivity were reduced.

Figure 5.1: Reductions (per cent) in coronary events achievable in people with no history of hypertension, high blood pressure or coronary heart disease (Group I)*



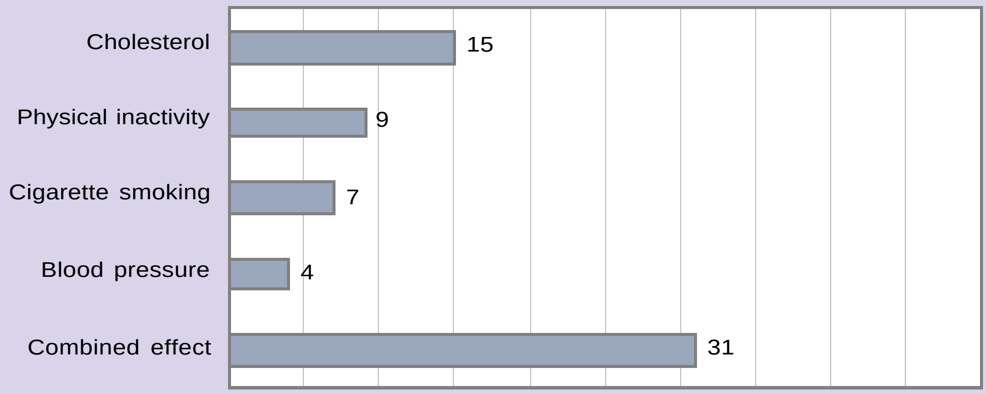
* If the average level of cholesterol was reduced by 0.5 mmol/L, the average level of diastolic blood pressure by 4 mmHg, the prevalence of cigarette smoking halved and the prevalence of physical inactivity reduced to 25 per cent.

These estimates show that substantial gains could be achieved with reductions in risk factor levels. Overall, it is estimated that the rate of coronary events in this group could be reduced by 37 per cent.

Group II

This group comprises 23 per cent of the population but suffers 48 per cent of coronary events, and is therefore an important group for risk reduction. For those with high blood pressure or high blood cholesterol, increasing the proportion who receive medical treatment and other special measures is an important strategy for reducing risk. This should be complemented by reductions in the prevalence of cigarette smoking and physical inactivity and by population-based strategies to lower the average levels of cholesterol and blood pressure in those who do not receive medical treatment for hypertension or high cholesterol.

Figure 5.2: Reductions (per cent) in coronary events achievable in people with a history of high blood pressure or high blood cholesterol but no known coronary heart disease (Group II)*



* If levels of cholesterol and blood pressure were lowered by drug treatment (high-risk strategy) and other means (population strategy), the prevalence of cigarette smoking halved and the prevalence of physical inactivity reduced to 25 per cent.

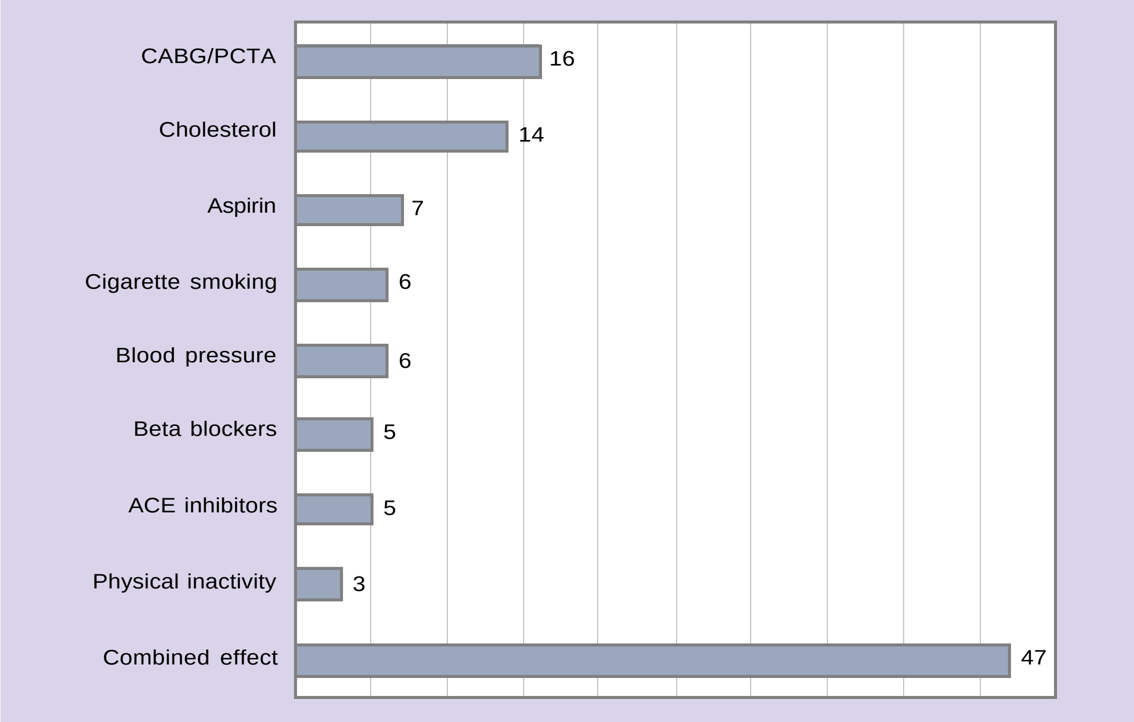
The gains in this group from various interventions are similar to those for Group I. Reductions in levels of cholesterol through drug treatment of those with high cholesterol levels and dietary change and other strategies for the others, and reductions in the prevalence of physical inactivity and cigarette smoking, are most important. Together with drug treatment for high blood pressure, the combined effect is estimated to be a 31 per cent reduction in coronary events in this group. The relatively smaller gains from blood pressure control, compared to the other interventions, is due to the fact that a high proportion of people in this group are already on treatment for high blood pressure so there is less room for further gains.

Group III

This is a small group (5 per cent of the population in this age group) but they are at high risk of recurrent events and death. This group accounts for 31 per cent of the coronary events. Their risk can be reduced by aggressive medical treatment including coronary bypass surgery, coronary angioplasty, and treatment with aspirin, beta blockers and ACE inhibitors, as well as other drugs aimed specifically at control of high blood pressure or high blood cholesterol. Reductions in the prevalence of smoking and physical inactivity can further reduce their risk. They would also benefit from population-based strategies to improve diet, exercise and other lifestyle factors.

Potential gains from interventions

Figure 5.3: Reductions (per cent) in coronary events achievable in people with a history of coronary heart disease (Group III) through medical and surgical treatment as well as lifestyle changes



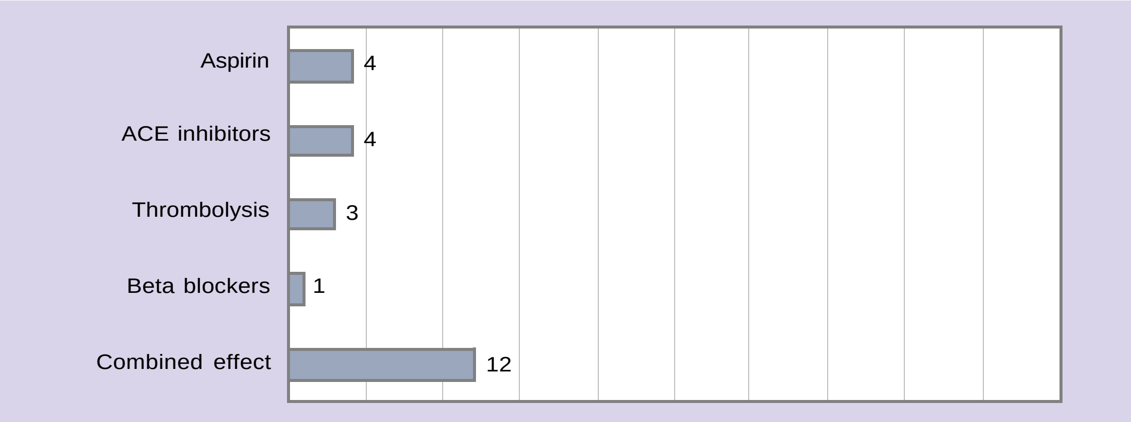
For Group III, a reduction in coronary events of about 16 per cent can be achieved through more extensive use of coronary bypass surgery and coronary angioplasty for revascularisation. Lowering cholesterol and blood pressure, by drug treatment in half of those with elevated levels but who are not already being treated, and by diet and other means in the rest, is also important. Higher use of aspirin and other drugs, such as beta blockers and ACE inhibitors, would lead to further gains. Reductions in prevalence of cigarette smoking and physical inactivity could also make important contributions. Overall, it is estimated that around 47 per cent of coronary events in this group could be prevented by these means.

Treatment of heart attack

It is also possible to estimate the additional lives that could be saved through optimal acute treatment of people who are having a heart attack (Figure 5.4). Early administration of thrombolytic therapy has an important role. If aspirin, ACE inhibitors and beta blockers were also used in all eligible patients it is estimated that the risk of death in those who reach hospital alive could be reduced by 12 per cent. The smaller potential gains from acute care are due to the relatively high levels of good quality treatment already used in Australia.

Cardiac rehabilitation has an impact in reinforcing preventive strategies including modification of lifestyle and compliance with pharmacological therapies.

Figure 5.4: Reductions (per cent) in case fatality achievable through acute treatment of people with a heart attack



Integrated approaches to prevention and management

Table 5.3 shows the percentages of coronary events and deaths that could be avoided in the Australian population aged 35 to 79 years by improved intervention in each of the three risk groups and through improved acute management of patients with heart attacks. Overall, it is estimated that 38 per cent of events could be prevented. In Group II the benefits could be achieved through reductions in smoking and physical inactivity and drug treatment and lifestyle changes for people with high blood cholesterol or high blood pressure. Medical treatment for people with established coronary heart disease, Group III, could result in another 15 per cent of events prevented. While the greatest opportunities for gain are in Groups II and III, prevention in Group I is very important as it can stop people moving into the other groups where the risks of morbidity and mortality and the costs of treatment are much higher.

In total, it is estimated that 41 per cent of deaths could be prevented. The greatest gains, 17 per cent, are achievable in Group III, mainly through aggressive secondary prevention. Another 13 per cent could be saved from Group II by a combination of effective medical treatment of known conditions and by reductions in the average level of cholesterol and prevalence of smoking and physical inactivity.

Table 5.3: Percentage of coronary events potentially preventable through improved interventions

Outcome	Percentage of coronary events	Percentage of coronary deaths
Preventable through interventions in		
Group I	8	7
Group II	15	13
Group III	15	17
Acute treatment of heart attack		4
Subtotal	*38*	*41*
Non-preventable	62	59
Total	**100**	**100**

Potential gains from interventions

The percentage reductions in coronary events shown in these figures are estimates based on a number of assumptions. As already stated, risk factor prevalence and risk reduction estimates were obtained from the scientific literature and recent Australian data. The changes assumed for some risk factors, such as the 4 mmHg reduction in blood pressure, and improvement in the use of effective medical treatment are considered feasible within five to ten years. The feasibility of other changes, such as halving in the prevalence of cigarette smoking and reducing the prevalence of physical inactivity, to the national target of 25 per cent (from 30–40 per cent), is less well established.

Some risk factors have not been considered directly, for example, overweight and obesity, fat intake and other aspects of nutrition. Additional gains could be expected through improvements in diet, reductions in overweight and obesity and increased exercise levels in those who already undertake some physical activity. Appropriate drug dosage, cardiac rehabilitation, the most up-to-date interventions (such as use of angioplasty during a heart attack and the trend to use drug treatment to lower cholesterol levels in everyone with coronary heart disease) have not been taken into account. Nevertheless, the estimates given here relate to the major modifiable determinants of risk of coronary events and they can be used to calculate approximate gains achievable through well-targeted interventions.

5.2 Stroke

At this time, less detailed information is available for assessment of the potential impact of various interventions on stroke than for coronary heart disease. However, it is known that the impact of stroke can be reduced, mainly by primary prevention, and also by effective management of acute stroke and secondary prevention.

Prevention

The underlying causal and modifiable risk factors for stroke are the same as for coronary heart disease, so the overall prevention strategies are also the same. Therefore, the above discussion of potential benefits for coronary heart disease from reductions in risk factor levels will also apply to stroke, although the percentage reductions may differ.

The most effective strategy for reducing the incidence of stroke is likely to be a lowering of the average blood pressure of the population, through reducing salt intake, alcohol consumption and body weight of the population. In addition, the incidence of stroke, particularly in the young, could be substantially reduced by reducing the prevalence of cigarette smoking, alcohol abuse and physical inactivity, and improvement in nutrition to lower saturated fat intake.

Acute management

About 25 per cent of people who have a stroke die within one month and about 60 per cent are dead or dependent at 12 months after the stroke (Anderson et al 1994; Bamford et al 1988). The aim of acute stroke management is to minimise death or dependency after stroke. As discussed in Section 4.1, the most effective treatments for reducing death and dependency are organised care by a coordinated multidisciplinary team in a stroke unit, and treatment with aspirin. As can be seen from Table 5.4, both approaches are likely to be effective and at relatively low cost. The development of stroke units often requires only the re-organisation of existing services, and aspirin therapy is inexpensive, safe and effective. While thrombolytic therapy is effective in some patients, it carries risks, it is expensive and is only appropriate for a minority of patients. Further data are required before it becomes a routine form of management.

Table 5.4: Effectiveness of acute stroke management approaches in reducing death and dependency after stroke

	Target population (% acute stroke patients)	Odds reduction* (%)	Absolute risk reduction* (%)	Lives benefited* per 1,000 patients treated	Patients treated to save one life *
Stroke units	80[#]	29	6.0	60	15
Aspirin	80[#]	5	1.2	13	83
tPA**	5	25	6.5	65	15

This assumes that all of those admitted to hospital with acute stroke are given the treatment.

***** Terms defined in Appendix 3, page 180.

** tPA is only likely to be applicable in about 5 per cent of all strokes so the total impact on stroke is likely to be minimal in comparison to that from management in stroke units.

Source: Hankey (in press).

Secondary prevention

The secondary prevention strategies with the greatest potential to reduce recurrent stroke are: anticoagulation for high-risk individuals in atrial fibrillation (8 per cent); blood pressure lowering drug therapy (7 per cent); smoking cessation (4 per cent); aspirin (4 per cent); cholesterol-lowering drug therapy with statins (at least 3 per cent); and least of all carotid endarterectomy in symptomatic individuals (1–2 per cent).

If all those with TIA or stroke were to lower their diastolic blood pressure by 5–6 mmHg through changes in lifestyle (and medication if necessary), these costs would be far less and about twice as many strokes would be prevented (Rose 1992).

Table 5.5 shows that the most cost-effective strategies of secondary prevention of stroke are appropriate use of anticoagulants, aspirin, diuretics and other anti-hypertensive agents, and smoking cessation.

Table 5.5: Summary of the cost-effectiveness of different strategies for the secondary prevention of stroke

Strategy/ intervention	Target population ('000s)	Stroke risk per year (%)	Relative risk reduction (%)	Absolute risk reduction (%)	No. of strokes avoided per year	Strokes avoided per year (%)	No. of TIA or stroke patients needed to treat	Cost per stroke avoided ($)
BP-lowering therapy	80	8.75	28	3.32	2,660	6.70	30	900 (diuretic)
Smoking cessation	48	8.75	33	2.89	1,400	2.90	34	0 (voluntary)
Cholesterol-lowering drug therapy	64	8.75	24	2.54	1,624	4.10	39	27,300
Antiplatelet therapy								
Aspirin	120	8.75	25	2.19	2,625	6.60	46	460
Clopidogrel	120	8.75	33	2.89	3,500	8.80	34	68,000
Aspirin + dipyridamole	120	8.75	37	3.24	3,885	9.70	30	18,000
Anticoagulant therapy	32	12.00	70	8.00	2,560	6.40	12	1,200
Carotid endarterectomy								
Symptomatic	10	13.00	65	8.50	1,360	3.40	11	77,000
Asymptomatic	80	2.00	55	1.00	880	2.20	91	637,000

Notes: Relative risk reduction was calculated by dividing the difference in risks between the control and treatment groups by the risk in the control group. For explanation of 'absolute risk reduction' see Appendix 3, page 180.

BP = blood pressure.

Source: Hankey (in press).

5.3 Other cardiovascular conditions

Much less is known about the potential for interventions to reduce vascular disease and heart failure, although vascular diseases share many of the same risk factors as coronary heart disease and stroke, and the same primary and secondary prevention strategies should be of benefit.

Vascular disease and heart failure occur predominantly among older people, and are likely to increase significantly as the population ages. In addition, most people with these diseases also have other cardiovascular conditions, and the major cause of mortality in these people is atherosclerosis. Data from the Framingham study indicate that within 18 months of diagnosis with intermittent claudication, 4 per cent of patients will have a cerebrovascular event, 4 per cent will have a peripheral vascular event, and 3.4 per cent will have a coronary event (Violi et al 1996). Within 10 years of onset of intermittent claudication, 43 per cent of patients develop coronary heart disease, 21 per cent have a stroke and 24 per cent develop heart failure (Kannel 1996).

5.4 Conclusions

This chapter demonstrates the likely benefits of various strategies through targeting specific interventions to appropriate groups in the population. This knowledge can be used to base further endeavours in the control of heart, stroke and vascular disease.

The analyses presented here illustrate the importance of both prevention and treatment targeted to particular risk groups. For example, for coronary heart disease it is estimated that there could be about 38 per cent fewer coronary events and 41 per cent fewer deaths in people aged 35–79 years in Australia if the interventions considered here were fully implemented. Reductions in the average levels of cholesterol and blood pressure and the prevalence of smoking and physical inactivity are important for the whole population and would save lives from heart, stroke and vascular disease, as well as other diseases such as some cancers and diabetes.

In addition, more widespread and appropriate use of effective drug therapy would produce significant reductions in morbidity and mortality from heart, stroke and vascular disease. The importance of medical interventions may, in fact, have been underestimated, as newer treatments may be more effective than the better established ones for which good risk reduction data are available.

Although the estimates of potential reductions in coronary events are impressive, the overall benefits would go beyond coronary heart disease. For example, treatment of high blood pressure reduces risk of both coronary heart disease and stroke. Quitting smoking also reduces the risk of peripheral vascular disease. If the risk of heart disease were lowered, there would be reductions in hospital admissions for unstable angina and less need for revascularisation procedures. Also, if there were fewer heart attacks there would be reductions in numbers of heart failure.

Potential gains from interventions

The same risk factors, such as high blood pressure, and the same treatments, such as aspirin, are shared by a range of conditions as well as stroke and peripheral vascular disease. Therefore, the range of preventive and treatment strategies considered here have the potential for health benefit across a spectrum of disease.

It is important to emphasise 'broad-spectrum' and integrated approaches to both prevention and treatment. The means by which these may be achieved are considered in Chapter 8, along with some opportunities for directing future effort towards enhancing lifestyle change and improving care.