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CENTRE FOR HEALTH
PROGRAM EVALUATION

RESEARCH REPORT 23

Cancer and Heart Offensive: Resource Investment Project

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Summary and Conclusions

1 Scope of Research Program

There is worldwide interest in obtaining better value from the health dollar. Governments are under pressure to meet ever growing health service demands with limited budgets. There are three broad thrusts in this endeavour: one is to seek to ensure that health services are provided at minimum cost - technical efficiency. The second strategy is pursuit of optimisation of the health service mix, through shifting resources to better performing programs – allocative efficiency. A third thrust of government policy (possibly unique to Australia), is to increase private contributions to health care, as a replacement for government spending, essentially a cost shifting exercise.

The research program reported here is designed to contribute to the achievement of allocative efficiency in relation to cancer and heart disease. Specifically the primary objectives are:

1. to develop an overview of disease burden associated with cancer and cardiovascular disease (CVD) and to comment on the suitability of available (secondary) data sources for this purpose;

2. to develop, document and illustrate an approach to identification of areas of inefficiency in resources applied to cancer and cardiovascular disease, and identify where redirection of health expenditures would contribute to health gain.

2 Overview of Disease Burden Cancer and Heart Disease

2.1 Australia

Data Sources

In calculating the burden of illness, we have focused on mortality and health services use attributable to cancer and circulatory disorders. The primary source of information on deaths and life years lost is the ABS 'Cause of Death' bulletin and the cancer registries. Information on costs of management has been extracted from the 'Cost of Illness' data base,* for 1989/90 and 1993/94. The 'Cost of Illness' data set is being continually extended and upgraded as assumptions are changed, creating some difficulty in use of this data set. Other data sources have been accessed where available to improve the quality of the costing information. Only indicative estimates could be derived for public health and health promotion expenditures allocated to cancer and heart disease.

Mortality & Morbidity

In 1995 there were 53,402 deaths from CVD and 34,367 deaths from cancers in Australia. CVD deaths have fallen by 4% since 1990, while deaths from cancers have increased by 5%. Cancer is responsible for more premature death, with an estimated 283,106 life years lost to age 75, compared with 160,000 for CVD, reflecting the younger age at which cancer deaths typically occur.

* Developed by Mr Rob Carter, the Centre for Health Program Evaluation (CHPE) Monash University, and Dr John Goss and Mr Colin Mathers, the Australian Institute for Health and Welfare (AIHW).

The incidence rates for all cancer appears to have stabilised in the recent past at approximately 350 new cases per 100,000 population.

Table 1 Mortality & Morbidity: CVD & Cancer 1989/90, 1993/94

	1989/90		1993/94	
	CVD	Cancer	CVD	Cancer
Total Deaths	57,227	30,669	50,800	32,000
PYLL	199,097	237,218	160,000	241,000
Hospital Admissions	283,915	238,650	365,000	310,000
Hospital Days	2,769,000	1,761,000	2,690,000	1,703,000

Source: AIHW Cost of Illness Data 1989/90 & 1993/94

Expenditure/Health Service Use

Based on the Cost of Illness Data Set, total national expenditure on CVD was $3,671 million in 1993/4, with $1,902 million on cancer (excluding recent additions to the estimate for outpatients) (see Table 2). Expenditure on CVD and cancers consumed approximately 17% of Australia's total health resources. This proportion appears small, given that some 70% of all deaths are due to cardiovascular disease and neoplasms. (See Section 2 Main Report).

Hospital in-patient cost is the largest single item of health expenditure for both CVD and cancers, at $1,657 million and $1,327 million respectively, but represents a far higher share of the costs of cancer management (70%) than for CVD (45%). Hospital admissions for CVD were 365,000 in 1993/94 and for cancers 442,000, with hospital bed-days at 2,690,000 and 1,945,000 for CVD and cancer respectively. Despite increasing hospital admissions, hospital bed-days have remained relatively static through reduction in average length of stay. (Some of this increase may reflect incentives under case mix arrangements to maximise the number of admissions). The capacity to continue to increase hospital admissions without eventually increasing bed-days is ultimately limited.

Table 2 Expenditure ($M) on CVD & Cancer by Health Delivery Setting: Australia 1993/94

	CVD		Cancer	
	$ million	per cent	$ million	per cent
Total Expenditure (est.)	3,671	100	1,902#	100
Hospital In-patient *	1,657	45	1,327	70
Medical services	504	14	260	14
Pharmaceuticals	715	19	53	3
Allied Health Professional	40	1	12	1
Nursing Home	541	15	32	11
Public Health / Screening	215 *	6	65	4
Research			74	3
Other			78	4

Source: AIHW Cost of Illness Data 1993/94; excludes community and public health and disability services(non-medical).

Notes: # Total expenditure does not include outpatients estimated at $131 million – a recent addition to the data set.

* includes only public health / screening, research and other.

The substantial hospital cost component for cancer management, means that a large proportion of the cost of managing cancer is funded through the State funded hospital sector. With tight budget caps on the hospital sector, the capacity of the health delivery system to respond appropriately to cancer, as now one of the most important, certainly in terms of premature mortality may be compromised. In contrast, in relation to the management of CVD, pharmaceutical and medical costs represent a far higher share, reflecting the chronic nature of CVD and the practice of life-long preventive drug therapy. Thus a larger part of the costs of managing CVD is met through uncapped components of the Commonwealth Health Budget.

Components of CVD

In 1993/94 CHD accounted for 32,000 deaths (63% of all CVD deaths) and stroke 12,000 deaths. Mortality rates for CHD and stroke have continued the pattern of decline evident since the late 1960s. Between 1983 and 1993 the average annual decline in CHD mortality was 3.8% for males and 3.3% for females. The death rate in males is nearly twice that for women, at 217/100,000 compared with 1151100,000 (1993). Death rate from stroke has been declining at 3.8% per year between 1983 and 1993, with rates for men and women similar at 67.5/100,000 for males and 65.3/100,000 for female in 1993.

Expenditure on the management of hypertension was estimated at $812 million in 1993, with over half, $480 million, on drugs (not including the use of anti-hypertensive agents for other conditions such as angina). Drug cost for the management of hypertension has nearly doubled between 1989/90 and 1993/4. Management of hypertension is identified as an area of possible inefficiency and has been selected for case study.

Major Forms of Cancers

The cancers responsible for most deaths in 1993/94 were lung cancer, 6711 deaths; colorectal cancer, 4644 deaths; breast cancer, 2655 deaths; prostate cancer, 2590 deaths; and skin cancer, 1172 deaths. These five cancers accounted for 52% of all cancer deaths. Deaths from colorectal, lung, prostate, skin and breast cancers all slightly increased between 1989/90 and 1993/94. Skin cancers were responsible for the largest number of hospital admissions at 66,000 in 1993/4, followed by colorectal cancer 65,000, breast cancer 30,000 and lung cancer 22,000.

Table 3 Comparative Burden of Colorectal, Skin, Breast, Lung and Prostrate Cancers: Australia 1993/94

	Colorectal Cancer	Skin Cancers	Breast Cancers	Lung Cancers	Prostate Cancer
Deaths	4,644	1,172	2,655	6,711	2,590
Hospital Admission	65,000	66,000	30,000	13,700	22,000
Hospital Days	257,000	128,000	116,000	150,000	112,000
Life Years Lost to Age 75	33,636	12,500	31,800	48,332	6,572
Total Expenditure ($M)	207	277	169	103	98
Hospital Care Expenditure ($M)	171	129	80	81	66

Source AIHW/CHPE Burden of Illness Data 1989/90 & 1993/94

Note: lung, skin and breast cancers are compilations of figures for malignant, benign and in-situ forms.

Colorectal cancer was responsible for most hospital bed-days, due to a higher average length of stay. Skin cancer was responsible for the largest expenditure ($257 million), followed by colorectal cancer ($207 million), breast cancer ($169 million) and lung cancer ($103 million).

Burden of Illness by Age and Gender

Stroke affects a predominantly elderly population with 61% of stroke expenditure consumed by those aged 75 years or older, whereas 33% of expenditure for the management of CHD is on those aged 75+. Skin and breast cancer involve morbidity across a wider age range, occurring in younger and mid-age brackets, as well as the elderly, with those aged less than 45 responsible for 27% and 21% of expenditure respectively. Lung and colorectal cancer are managed predominantly in those over 55, who account for 86% of all expenditures in both cases.

There is little overall difference in expenditure on CVD and cancers for males and females. However, by subclass and health delivery setting differences do emerge, which may reflect differences in incidence and also some differences in management patterns. The reasons may well be worth exploring.

Public Health /Health Promotion Expenditure: Australia

There is no single source of information on public health or health promotion expenditure, in total, by disease area or by risk factor targeted. Data sources we have used include the AIHW Cost of Illness data base, Health Expenditure Bulletins, Richardson *et al* 1996, and publications and annual reports from the Department of Human Services, Victoria, the Victorian Health Promotion Foundation (VicHealth) and the Commonwealth Department of Health and Family Services.

Some programs that specifically target CVD and cancers can be identified within the reports of VicHealth and the Department of Health and Family Services. However many public health or health promotion projects which are targeted at lifestyle (smoking, nutrition, physical activity etc.) cannot easily be allocated to a single disease. Further, many programs are joint Commonwealth/State/community programs and it can be difficult to distinguish transfers between levels of government from additional resources allocated to programs.

Finally health promotion, illness prevention and screening can form a part of standard health service delivery, such as lifestyle advice provided by the GP, or dietitian services within the hospital setting. There is no evidence on the level of this activity.

Commonwealth expenditure on Community & Public Health in 1993/4 was reported to be $1,568 million (Richardson *et al* 1996), with $205.8 million for health promotion and $1,362 million for community health services. In relation to the former, it is estimated that around half could be attributable to CVD and cancers.

Expenditure by Disease Stage

There is no published evidence on expenditure by disease stage (primary prevention, screening, management of established disease, end stage/palliative care). Indicative values can be derived by consideration of health delivery setting and the application of professional judgment. (See Section 2.10) This analysis, while speculative, suggests that less than 5% of total expenditure on CVD and

neoplasms is allocated to primary prevention, with perhaps 7% for screening. Given the high disease burden of CVD and cancers, and the possibility for prevention through adoption of a favourable lifestyle, the relatively low level of resourcing of primary prevention, may be indicative of a misallocation of resources. A paradox arises in that the fewer resources allocated to prevention, the greater the demand for disease management, potentially limiting the resources available for prevention.

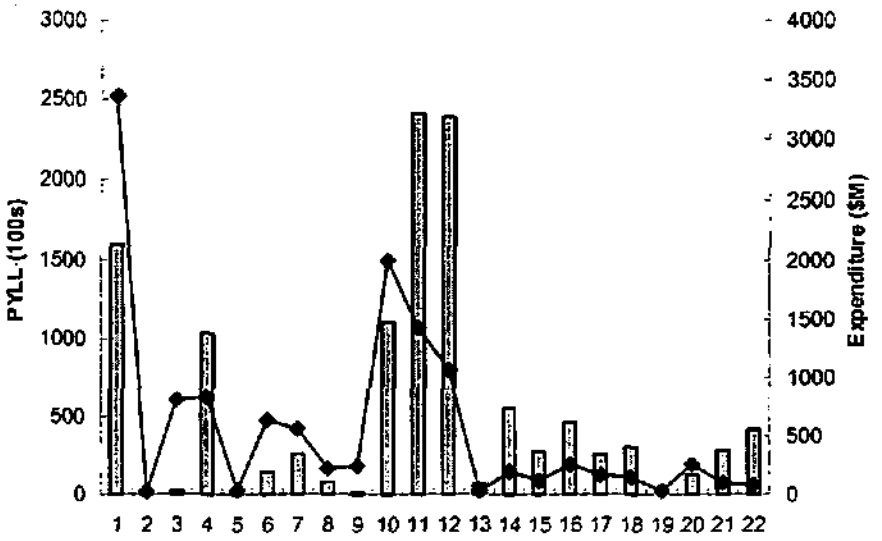
Overview of Health Expenditure and Life Years Lost

A comparison between annual expenditure and life years lost to age 75 for CVD and subcomponents and selected cancers is illustrated in Figure 1 for 1993/94. (Reference list of disease categories shown in Table 4). Expenditure on CVD is notably higher in comparison with life years lost to age 75, than cancers. An exception to this pattern is ischaemic heart disease, responsible for relatively high deaths. Expenditure on cancer seems low relative to mortality. While this may in part reflect incompleteness in the expenditure estimates, it may also represent distortions created by health funding and delivery arrangements, which could potentially restrict the allocation of health care resources into cancer management and prevention.

Table 4 List of Disease Categories for Figure 1

1	**CVD (total)**	2	Acute/chronic rheumatic disease	3	Hypertension
4	Coronary disease	5	Pulmonary circulation disease	6	Other heart disease
7	Stroke	8	Diseases of arteries/arterioles	9	Diseases of veins & lymphatics
10	**Total CHD**				
11	**Total Neoplasms**	12	**Total Cancers**	13	Lip, oral & pharyngeal
14	Digestive organs	15	Colorectal	16	Bone, connective tissue & skin
17	Genitourinary organs	18	Lymphatic & haemopoetic	19	Carcinoma in situ
20	Skin cancers	21	Breast cancers	22	Lung cancers

Figure 2.4 Life Years Lost to Age 75 (PYLL) (100s) & Annual Expenditure ($M): CVD & Cancer 1993/94



Source: CHPE / AIHW Cost of Illness Data 1993/94
Bars are PYLL: Dots are Expenditures

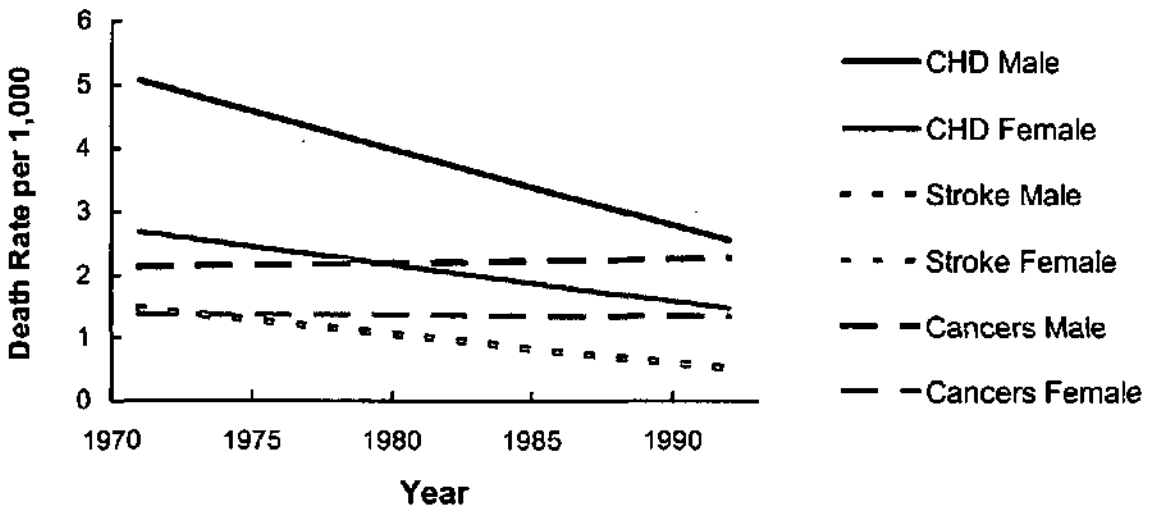
Whether these observations reflect a misallocation of resources can only be determined by a study of intervention options and their cost-effectiveness. Some progress in this regard is achieved through the three case studies reported in Sections 5, 6, 7 and 8.

2.2 Victoria

Mortality & Morbidity

In 1994, CVD was identified as the principal cause of death in 13,520 Victorians, 43% of all deaths. Neoplasms were identified as the principal cause of death in 8,297 Victorians, 28% of all deaths. Cancers account for most premature death responsible for 107,000 life years lost to age 65 compared with 63,000 for CHD and stroke. The age standardised death ratio for Victorians was 6% below the average for Australia for CVD (0.94) and 2% above average for cancer (1.02). The pattern of fall in death rates from heart disease and stroke has been similar in Victoria to that for Australia, while death rate from cancer has remained relatively stable over the same period (see Figure 2).

Figure 2 Standardised Victorian Death Rates 1971, 1992



Source: ABS Trends in Mortality 1996

In Victoria, in 1993, colorectal cancer was the leading cancer site with 2,620 cases (15% of all cancers), and second ranking site of fatal cancer with 1,208 deaths (14%). Breast cancer was the third most common new cancer in Victorians accounting for 2,186 new cases (12%), and the third ranking site for deaths (8.5%). Lung cancer remains the leading cause of cancer death.

Small area statistics for deaths in 1991/2 published in the ABS Trends in Mortality Bulletin, report six non-metropolitan Victorian regions with standardised mortality ratios from heart disease at least 15% higher than average: West Central Highlands (SMR=1.42), South Loddon-Campaspe (SMR=1.31), West Gippsland (SMR=1.21), Gippsland Lakes (SMR=1.19), Latrobe Valley (SMR=1.18), Ballarat (SMR=1.15). In relation to neoplasms, regions experiencing significantly and substantially higher than average standardised mortality rates were Wodonga (SMR=1.25), Gippsland Lakes

(SMR=1.22), Central Melbourne (SMR=1.18), LaTrobe Valley (SMR=1.16), Hopkins (SMR=1.16), Bendigo (SMR=I. 16) and West Inner Melbourne (SMR=I. 1 5).

Analysis of those regions with the highest rates may be desirable. It might be possible to identify reasons for the excess incidence, and then develop suitable strategies to address the observed health differential. Differences in socioeconomic status may explain part of the variation.

Resource Use: Methods

Expenditure on the management of cancer and heart disease in Victoria cannot be readily ascertained from published data. Interrogation of secondary data sources and primary data collection is recommended:

i) Interrogation of the Victorian hospital in-patient data base.

The use of hospital in-patient services in Victoria is recorded in the Hospital Minimum In-patient Data Set, held by the Department of Human Services. Rules can be established for allocating each admission to disease class and a unit cost applied to each admission, based on actual costing data or based on the DRG weight (requiring allocation to a suitable DRG). This approach has been taken to determine hospital admissions and costs for the management of colorectal cancer (Section 5). To do this across the whole of CVD and cancers is a substantial research task and one that will not, by itself, provide evidence about the efficiency of resource allocation.

ii) Hospital out-patient services

An ambulatory classification system has recently been developed in Victoria for the classification and costing of out-patient occasions of service. Thus provided, attribution rules can be established for allocating visit by clinic type to disease classes, the attributable cost of out-patient services by disease could be calculated. Additional patient level information and/or survey work to establish the pattern of work in the various clinics, may be required to devise suitable attribution rules.

iii) Utilisation of Medical Benefit Schedule and Pharmaceutical Benefit Schedule services -funded through the Health Insurance Commission (HIC)

The Health Insurance Commission maintains records all medical services, excluding those funded by other agencies such as transport or work accident compensation schemes. It should be possible to obtain from the HIC information on all (or selected) medical services to persons resident in Victoria. Attribution to disease grouping would depend on type of service and access to relevant survey data. In relation to GP services, attribution could be based on the Bridges Webb database (1994).

iv) Use of pharmaceuticals

The Pharmaceutical Branch of the Department of Health and Family Services maintains comprehensive information on the use and cost (to the Government and to the recipient) of all prescriptions drugs. Our understanding is that data is not able to be supplied by State, and patient level information is only available for Health Care Card holders, prior to reaching the Safety Net. It would be necessary to explore with the Department possible means for obtaining state level data. The problem of attribution of each drug to different disease categories would need to be addressed

which is easier for certain drugs and disease than others. In relation to the use of non-prescription drugs and other health care products the only possible source of information is the ABS Health Survey, or health diaries collected for a specific purpose. Health diaries are being implemented as part of the National Coordinated Care Trials, access to this information other than for the evaluation of these trials is unclear.

(v) Public Health / Health Promotional Community Based Services

Partial information is available on expenditure on public health/health promotion and community based services in Victoria, with limited capacity to attribute to disease class. The only exception is in relation to projects funded through the Victorian Health Promotion Foundation for which detailed information is available, through their Annual Reports.

Resource Use CVD and Cancer: Estimate for Victoria

Based on a simple population adjustment to the 1993/4 Cost of Illness estimate for Australia, expenditure on cancer and heart disease in Victoria would amount to $879 million for CVD, and $358 million for cancers. (Allocating 25.1% of expenditure to Victoria). This presumes confidence in the Cost of Illness estimates and similarity in patterns of disease and management across Australia. Expenditure on public health/community health in 1994/95 for CVD and cancers can only be guessed at, but may amount to perhaps $90 million ($29 million through community health centres, $8.2 million through the Victorian Health Promotion Foundation and assuming 30% of the $175 million Departmental public health expenditure). This would make total expenditure in Victoria for the prevention and management of cancer and heart disease at just over $1,300 million in 1994-5, with public health/health promotion (including screening) representing perhaps 7% of the total.

Table 5 summarises available data on health expenditure for Victoria attributable to CVD and cancer. The information is incomplete and reliant on untested assumptions. If a comprehensive understanding of expenditure by (or in) Victoria, by disease category is important, a specific research program, including primary data collection would be required.

Table 5 Incomplete Victorian Costing Data

Item	$ million	Data Source	Comment
All CVD	879	AIHW Cost of Illness data set 1993/4	Based on population proportion
All Cancers	358	AIHW Cost of Illness data set 1993/4	Based on population proportion
PUBLIC HEALTH			
Dept Human Services Public Health Division	90 ??	Dept Annual Report	Order of magnitude estimate only for all cancers and CVD
Victorian Health Promotion Foundation	8.2	Annual Report 1994	Based on program descriptions funded through VicHealth
Screening for breast, & cervical cancer	12.6	Annual Reports 1994 Breastscreen, Victorian Cytology Service, Victorian Cervical Register	
Community Health Centres	29 ??	Report of activities of Community Health Centres	Indicative: based on attribution according to occupation

Notes: # of which $42.5 million is hospital costs for the management of colorectal cancer.

3 Policy Analysis

3.1 Approaches to Establishing Areas of Inefficiency in Health Service Provision for Cancer and Heart Disease

As a matter of logic, if resources can be directed from services or interventions that yield low health benefit per dollar allocated, to an area yielding higher benefit per dollar, a net improvement in community wellbeing will be achieved. (Provided there is no unacceptable redistribution of health gain/wellbeing). The relationship between additional resources allocated and benefits derived is known as the marginal benefit (MB), marginal cost(MC) ratio. Community wellbeing will be maximised when MB/MC is identical across all health programs (provided equity/access implications are acceptable). A detailed knowledge of current levels of expenditure does not of itself shed light on the capacity to gain from resource redirection, or provide evidence on the 'return' on investment in health. While information on the current allocation of resources to health is useful, it does not by itself provide insights into the appropriateness of resource allocation.

There is no simple approach to determining the appropriateness of current investment in health or the direction of desirable resource shifts. This an extremely demanding task. It requires a knowledge of the full range of intervention options, (currently funded and potential), that may contribute to health gain/quality of life and their costs and benefits at the margin (in relation to an expansion or contraction in program size). Popular 'priority setting' mechanisms, such as 'goals and targets' that suggest priorities can set without the need for a detailed understanding of intervention options their costs and benefits, have been found wanting.

A knowledge of broader health system issues, particularly of health funding and delivery arrangements can be extremely valuable in identifying possible areas of under or over investment, specifically through an analysis of incentives and distortions inherent in current arrangements. The key is to identify perverse incentives or rigidness which may prevent or discourage desirable resource shifts.

Role for Information About Current Resource Allocation to Cancer and Heart Disease

Information about total resources allocated to the prevention and management of cancer and heart disease can be of value in a number of ways:

- Potential resource saving through investment in primary prevention:
  One benefit of a successful prevention program is avoidance of down stream costs of disease management. A crude estimate of average attributable cost of disease management per person per year can be calculated from total attributable disease cost, divided by the total number of persons with the disease. While there are methodological problems with this approach, it can provide an indicative estimate for use in an analysis of the role for disease prevention.

- Development of hypotheses about possible areas of inefficiency:
  Knowledge of the total resources allocated to disease prevention and management, and of changes over time, may provide insights which, taken together with other information may enable hypotheses to be developed about possible inefficiencies.

For instance, while size of disease burden does not necessarily indicate whether resources are allocated efficiently, there is perhaps greater possible gain from redirection of health care resources where total expenditure is greater.

Use of Marginal Benefit Cost Ratios to Ascertain Desirable Resource Shifts

Where program areas can be identified that have different levels of benefit per dollar invested the possibility for health gain through resource shifts is identified. Thus, a means for determining desirable resource shifts is to establish the marginal benefit cost ratios of a range of interventions for the prevention and management of cancer and heart disease. While this requires a substantial research effort, it can be staged to consider in the first instance areas identified with prima facie expectation of gross inefficiency.

Use of Health System Issues to Identify Potential Opportunities for Efficiency Gain

An analysis of health system issues can highlight a range of distortions in the way health services are allocated. This provides another means for developing hypotheses about likely inefficiencies in resource allocation. Propositions developed in this way can then be tested through cost-effectiveness analyses, or the results of such analyses can confirm general propositions about the effect of the distorted incentives. Characteristics of current health funding and delivery arrangements which will distort resource flows include:

- Multiple funders - health services are funded through all levels of government and various agencies, in a way that does not make responsibilities clear. This encourages a focus on short term/immediate health needs at the expense of long term health outcomes. It also encourages a narrow financial focus and cost shifting behaviours. The result is likely to be more resources for critical care and crisis management and less on preventative care or health promotion;

- Reimbursement of services through Medicare - only medical services (physician, pathology, radiology, procedures) and optometry are funded through the Commonwealth Medicare Benefits Schedule (CMBS). This provides an advantage to these professional groups, with the result that medical services are likely to be over utilised relative to possible alternatives, such as allied health services. The nature of the schedule also influences delivery modality, encouraging one-on-one service delivery with the patient, rather than group programs or multi-disciplinary care, or wider family involvement in decisions about health care. Similarly, the subsidy of pharmaceuticals listed on the Pharmaceutical Benefits Scheme supports the use of drugs;

- Program Based Funding - resources are allocated to programs rather than persons with health needs. This discourages a creative response to health problems, and means consumers must access services for which they are eligible, rather than service providers seeking to deliver services that more effectively and cost-effectively meet the needs of consumers/patients;

Unit cost payment arrangements - are being introduced through case mix based payment systems within the hospital sector and community health centre sector. These payment systems reward throughput/or hours allocated to direct care. They discourage the provision of high quality services (quality may compromise throughput and thus revenue). It also discourages preventative services. Consider a hospital participating in a preventative program for asthma. If this were successful, it would results in fewer admissions, with consequent loss in revenue;

Uninformed and disempowered consumers - it is extremely difficult for consumers either as patients or as members of a community to contribute to decisions about the health services that they access. Consumers, as a rule, are neither encouraged nor actively supported to participate in decisions about the health services they access. Service choice is dominated by health professionals, particularly the medical practitioner as the dominant primary health care provider. This is likely to favour medical solutions to health problems. In addition, neither consumers, nor any health provider, nor funders are aware of, let alone have control over all the health services used by that consumer. This reduces the opportunity to determine and implement the optimal care package to meet the health needs of an individual.

These attributes of health funding and delivery arrangements create distortions which mean the health service mix will not be optimal. They encourage cost shifting, medicalisation of health service delivery, a focus on throughput at the expense of quality, a focus on the short term and on critical care rather than health promotion. It also favours the delivery of services through one-on-one consultation with the patient, rather than through multi-disciplinary teams or group sessions. Primary prevention and allied health services are likely to be underprovided relative to medical services. In response to concern about health funding arrangements a range of new health service arrangements are being piloted, such as the Coordinated Care trials arising out of COAG.

3.2 Selection of Program Areas for Case Study Analysis

Based on consideration of disease burden, expectations about cost-effectiveness and health system issues, three program/disease areas were selected for more detailed exploration of resource allocation efficiency related to cancer and heart disease. A substantial on-going work program would be required to consider efficiency in resources investment across all services for the prevention and management of cancers and circulatory disorders. The case studies demonstrate how to proceed beyond the general to the specific, they provide insights into efficiency of resource allocation within the selected studies. Specific conclusions are developed from the case studies, some of which might be generalised.

i The management of hypertension: specifically the role for non-drug / lifestyle-based management (Section 8)

The role for non-drug management of hypertension was selected as an area of research because: the total cost of management of hypertension was high, at an estimated $812 million per year (1993/4), underpinned by a high and increasing cost of pharmaceuticals, estimated at $480 million per year (1993/4);

- a potential role for non-drug management is reported in the literature;
- current funding arrangements favour medical management of disease and discourage non-medical management, suggesting a possible imbalance.

These factors suggest a possible inefficiency in the management of hypertension warranting further analysis.

A simple model was developed to estimate the costs of drug and lifestyle management, in achievement of target blood pressure control. Estimates of the effectiveness of lifestyle management were drawn from the literature.

Based on this analysis we concluded that lifestyle management, particularly for those now well controlled on anti-hypertensive agents, and who choose to participate in lifestyle management, can achieve equivalent control with a substantial cost saving. Initiatives to support lifestyle change could result in a reduction in the use of anti-hypertensive agents, which more than offsets the cost of achieving lifestyle change, while retaining equivalent blood pressure control. This research supports the proposition that health funding arrangements encourage medical approaches to care, with too few resources allocated to lifestyle management of hypertension.

ii The prevention of colorectal cancer (Section 6).

The prevention of colorectal cancer was selected as an area of research because

- burden of disease - high morbidity and mortality (second major cause of cancer death after lung cancer, responsible for 4,644 deaths in 1993/4), increasing cost of management, absence of any reduction in incidence or mortality;

- observational evidence linking nutrition to incidence of colorectal cancer, suggesting a possible role for primary prevention;

- analysis of health system issues which suggests a bias against primary prevention, and lifestyle interventions, suggesting that too few resources may be allocated to the prevention of colorectal cancer;

- the current focus on colorectal cancer and the likely promotion of screening, which will identify persons at high risk of colorectal cancer. The time is thus opportune for a targeted prevention program which would provide other than medical options to those identified at high risk.

The research proceeded firstly through a literature review to establish the nature of the relationship between nutrition and other lifestyle variables and colorectal cancer. And secondly through development of a model to establish the possible effect on costs of a nutrition intervention targeted at persons with colonic adenoma identified on screening.

Evidence from the literature suggests that promotion of a diet high in fibre and fruit and vegetables and low in fat would reduce the incidence of colorectal cancer. A preliminary cost-effectiveness analysis also suggests that the promotion of lifestyle change in those at high risk of colorectal cancer (colonic adenoma identified through screening), is likely to be cost saving, through a reduction in the requirement for repeat colonoscopy. In short, our analysis suggests too few resources are being allocated to the promotion of lifestyle modification for those at high risk of colorectal cancer. However, due to the lack of intervention trials, the recommendation is to proceed by way of pilot programs for lifestyle change, to gather additional evidence on costs and outcomes. A watching brief on overseas intervention trials is also desirable, as well as a follow up of the Australian Adenoma Study.

iii A review of the costs of emergency admissions for colorectal cancer (Section 5).

A review of the costs of emergency admissions for colorectal cancer was selected as a case study as:

- hospital admissions represent the major cost of management of colorectal cancer;

- there was a clinical view that emergency admissions may be more expensive than elective admissions, and that it may be possible to encourage earlier presentation and reduce the number of emergency presentations;

- funding arrangements may discourage hospitals investing in programs to reduce the rate of emergency admissions, as they would have no way of recouping the benefits should the program be successful;

- finally this case study provided an opportunity to demonstrate how the Victorian hospital data base could be used to derive disease costing estimates, and also explore other aspects of expenditure.

A precise estimate of the hospital in-patient costs for colorectal cancer in Victoria was able to be obtained by interrogation of the Victorian Inpatient Minimum data set. It was also possible to establish the importance and relative cost of emergency and elective admissions, using the costing data base developed for calculation of the 1994/5 DRG cost weights. For 1994/5 23,403 admissions for colorectal cancer were identified, at a cost of $42.5 million (based on 1996 inpatient cost weights and 1995/6 in-patient admissions). Patients admitted as emergencies were found to be different. The average cost of emergency admissions was higher than for elective admissions by 19%, average length of stay was 25% higher and rate of intensive care use was also higher. The difference was most apparent in relation to large bowel surgery (but not for rectal surgery). A substantial part of this difference was still observed when analysed on a DRG basis. Hospitals that attract high levels of emergency admissions are effectively penalised by current case mix funding arrangements, which do not allow extra payment for emergency admissions.

The analysis suggests savings may be achieved through encouraging earlier presentation, in the hope of transferring an emergency to an elective admission. (Potentially implemented in conjunction with a screening program for asymptomatic people). Whether this would be cost effective would require an in-depth study, including a review of patient records. This was beyond the scope of the current research program.

4 Conclusions

4.1 Disease Costing

National disease costing data, is available, but not necessarily suitable for developing State-based estimates of expenditure by disease. The national cost of illness data base incorporates assumptions which may not be acceptable, and is subject to on-going revision which can make it difficult to work with. Where data incorporated in the National estimates is based on state data, for instance for hospitals, access of this data directly through State information systems is preferable. This will provide access to more current data and the researchers will be able to exercise control over the attribution process.

If comprehensive State based disease costing is required, it may be necessary to implement an on-going program of work for that purpose. However, before embarking on such a program, the objectives of such an exercise should be clearly defined. Any attempt to improve the disease costing estimates would require a better understanding of the activities of the Public Health Division of the Department and of community health centres.

4.2 Nature of Current Inefficiencies

Through the 'investment' work program some general aspects of resource misallocations have been identified. These are considered relatively robust as they reflect three separate methods vis i) the analysis of health system issues, ii) information about current resource allocations and iii) the case studies.

Specifically the analysis suggests:

Over medicalisation of health care and management. This is the logical result of Medicare which provides reimbursement for medical services and pharmaceuticals. The case studies of the management of hypertension and prevention of colorectal cancer both support this conclusion. This suggests an urgent need to address distortions imposed by health funding arrangements, and to seek ways to facilitate non-medical approaches to management.

Too few resources for primary prevention. Under-resourcing of primary prevention is also a logical consequence of health funding arrangements which split responsibilities between funders and agencies, with no one body with responsibility (or funding) for the health of the community. This split in responsibility encourages a short term view and a reactive rather than proactive approach. (This can be contrasted with the Transport Accident Commission and Workcare, which have total responsibility for their constituency and have major investments in prevention). The disincentive to prevention is compounded by the medical focus. Many approaches to primary prevention, such as lifestyle change and community empowerment, rely on expertise and services outside of medicine and the medical paradigm. The case study on the prevention of colorectal cancer confirms this problem.

Potential distortions through case mix funding. These are well recognised. If within-DRG variability is high and related to predictable attributes, selection of lower cost patients may be encouraged. Further, because hospitals cannot be assured of reaping any benefits of a prevention program, in fact might lose revenue, preventative activity is discouraged. In the example with colorectal cancer emergency admissions, we note that the current incentives may discourage optimal care.

4.3 On-going Research Program to Ascertain 'Value' in Health Investment

The research program reported here was completed with a relatively modest research budget and was able to identify probable areas of resource inefficiency in the management of cancer and heart disease. We have identified a number of general impediments to efficiency in resource allocation, which may only be addressed through health system reform, specifically in relation to funding mechanisms. An on-going research program into the value of investment in health can provide greater insights into the nature of health system reform that is needed, and also particular areas where resource redirection is warranted.

This could proceed through further case studies, (e.g. cardiac rehabilitation) and by exploring some of the anomalies highlighted in the cost of illness data (for instance, to look at those regions identified with higher rates of incidence of CVD and cancers, or to consider the reasons for differences in male and female patterns of management).

Our research suggests that resources are not currently allocated to maximise health gain, and that resource shifts are desirable but are unlikely to occur in the context of current health funding arrangements.

Cancer and Heart Offensive: Resource Investment Project

1 Introduction

1.1 Scope of Research Program

Cancer and Heart Disease are two of the priority disease/health areas for Victoria and a focus for public health initiatives. The Centre for Health Program Evaluation was commissioned to undertake a research program to contribute to the initiatives for the Cancer and Heart Offensive. The ultimate purpose of the research program was to contribute to an understanding of the efficiency of resources allocated for the prevention and management of cancer and heart disease and to establish and document an approach for determining desirable resource shifts. Some specific objectives were also nominated:

- to develop an overview of disease burden associated with cancer and heart disease, specifically morbidity and mortality and health services applied to prevention and management;
- to determine the extent to which available (secondary) data sources enable the resources applied to the prevention and management of cancer and cardiovascular disease to be established, and the possibility of determining resource allocation by disease stage, source of funds etc.;
- to consider primary data collections that may contribute to a knowledge of the current application of resources to cancer and cardiovascular disease;
- to develop, document and illustrate an approach to identification of areas of inefficiency in investment for cancer and cardiovascular disease, where redirection of health expenditures would contribute to health gain.

It was recognised that the objectives of the research program were extremely ambitious especially given a twelve month time frame for the initial research. For this reason a set of study deliverables were agreed which were likely to make the greatest contribution to the ultimate goal of the research - that of contributing to an understanding of efficiency in current resource allocation for cancer and heart disease and desirable resource shifts. Four broad research tasks/deliverables were agreed to. These are listed below. The result of the research on these topics is documented in this report.

Disease Costing (Sections 2/3)

Relevant secondary data sources on health service use were identified that could provide information on health resources applied to cancer and heart disease. Information from these data sources was collated and reviewed to establish a suitable basis for attribution to disease class, and quality of data in terms of comprehensiveness and likely reliability and accuracy of costings. The types of data collections that could fill the data gaps or improve the quality of the data were considered, and limited primary data collection undertaken.

Role for Disease Costings and Other Approaches for Determining Desirable Resource Shifts (Section 4)

A framework for assessing the appropriateness of the current resource distribution to health services was derived. The role for information on resource allocation to cancer and heart disease management in a framework was explicitly considered. Possible areas for more detailed analysis, to explore issues of resource investment effectiveness, suggested by the framework wore identified. (This list was not comprehensive). A selection was made of three topics for further, more detailed consideration, in consultation with the Department.

Exploration of Approaches to Resource Investment Through Selected Case Studies

The case studies were developed to both further develop and document approaches to determining efficiency in resource allocation, and to answer questions about the possible need for resource shifts in the case study areas. The selected areas are noted below where we also summarise the conclusions of that research.

- Colorectal cancer: emergency admission (Section 5)
  This topic was chosen based on disease burden and clinical considerations which suggested emergency admissions may represent m area of possible inefficiency, with the possibility of converting emergency to elective admission. Our preliminary review of this matter indicated that while cost of emergency admissions was higher than for elective admissions, particularly for bowel surgery, whether it would be cost-effective to fund a program to encourage earlier presentation would require an in-Department study including review of patient records. This was beyond the scope of the current research program.

- Colorectal cancer: prevention (Section 6)
  This involved the selection of health/resource allocation as a topic based primarily on health system issues. Preliminary conclusions about desirable resource shifts were able to he developed based on an in-Department review of the literature, without the need of a detailed knowledge of current resource investment. Specifically we were able to conclude that the promotion of a favourable diet was likely to he highly cost-effective, particularly for those at high risk identified on colonoscopy. However due to the lack of intervention trials the conclusion was to proceed by way of pilots with a commitment to deliver lifestyle programs but in a way that would generate additional evidence on costs and outcomes.

- Hypertension: non-drug management (Section7)
  This involved selection of health/resource allocation as a topic based on health system issues and disease burden, specifically the current high level of spending on the management of hypertension. It is estimated that over $800 million is spent on the management of hypertension of which some $400 million is on anti-hypertensive medications. There is extensive evidence of the capacity to control blood pressure in a sizeable proportion of persons with hypertension through lifestyle modification.

  We conclude that too few resources are allocated to encourage lifestyle management. Specifically that greater support to lifestyle change could result in a reduction in the use of anti-hypertensive agents, which would more than offset the cost of achieving lifestyle change, while retaining equivalent blood pressure control and thus at least equivalent health outcomes. This

case study illustrates the capacity to draw preliminary conclusions based on literature review and economic modeling, provided there is a reasonable published literature from which to draw parameter values for program cost and effectiveness.

Draw Conclusions (Section 8)

Conclusions have been developed based on the research program covering:

- quality and comprehensiveness of data for defining resource investment in health by disease and stage;
- role of disease costing information;
- type of work program that will contribute to a better understanding of current resource allocation and desirable resource shifts;
- specific conclusions about desired resource shifts based on the three case studies, health system issues and resource costing data.

1.2 Data Sources and Quality of the Data Set

Cardiovascular disease (CVD) and cancer are responsible far substantial morbidity, premature mortality and the extensive use of health care resources for their prevention and management.

To gain an overview of the burden of these illnesses, data from various Victorian and national sources have been collected and collated. Information on deaths and life years lost has been taken from ABS Cause of Death statistics and the ABS Trends in Mortality publication. Further statistics on causes of death for Victoria by gender, age and region have also been obtained from the ABS. Information on costs of management has been extracted from the 'Cost of Illness' data base developed by Mr Rob Carter from the Centre for Health Program Evaluation (CHPE) and Dr John Goss and Mr Colin Mathers from the Australian Institute of Health and Welfare (AIHW). The cost of Illness data base is available for 1989/90 and 1993/94. Separate data for Victoria is not available from this data set.

The 1993/94 AIHW figures are essentially an evolving data set, as changes and additions are ongoing. The data contained within this report are based on that currently available from the AIHW, and may need to be updated for future reporting stages as further inclusions or alterations occur and methodologies refined.

The CHPE/AIHW data set is not comprehensive, covering only public and private hospital costs (in-patient services for 1989/90), use of general practitioner and other medical services, some allied health services, pharmaceuticals and nursing home. The 1993/94 Cost of Illness data set is being progressively updated to also include out-patient service, research and some public health. The interface between health and welfare services is poorly covered, with no accounting of HACC programs, or other disability services where these are not delivered through the traditional health/medical network. The figures do not include hostel care, case management and a range of direct services to people within the community or disability services area. Furthermore, as general attribution rules are used which inevitably incorporate assumptions based on incomplete information, it is suggested that the estimates should be considered indicative.

The AIHW data sea from 1989/90 which complicate comparisons, The 1993/94 set incorporates health delivery setting categories of "out-patients" and "other", which are not part of the 1989/90 figures. Calculations of hospital costs in 1993/94 were based directly on DRG records from all hospitals, whereas 1989/90 figures are calculated from average costs in sample hospitals within sample states compensated by length of stay and population adjustments. Nursing home attribution, for the 1989/90 data set was based on reasons for admission to nursing home from public hospital, while for the 1993/4 data set, attribution was based on a survey of nursing home residents. Further, different age groupings have been used in each data set.

As part of this research program we have drawn together published data on public health spending, by program area to provide an indicative estimate of public health expenditure that is directed to cancer and CVD. This estimate is drawn from a recent CHPE research for the Health Australia initiative (CHPE 1996) for Commonwealth expenditures, and various Victorian sources for public health expenditures in Victoria related to cancer and CVD (VicHealth 1995, Community Health Centre Report 1995, Public Health Division unpublished data on expenditure by program). Data on Public health/Health Promotion is still incomplete and a separate research would be required to gain a more complete understand of public health and health promotion expenditures by disease class, or by level of government/funding source.

Secondary data collections have been accessed where readily available to improve quality of the costing information. Thus we obtained pharmaceutical data directly from the Commonwealth Department of Health & Family Services (H&FS), as well as hospital admissions information for Victoria. Anti-Cancer Council reports have provided information on cancer incidence and mortality.

In reporting this compilation of data, reservations regarding reliability should be noted. This is due to variances in methodology over time, limitations in types of services covered and also because of the way data sets have hem created. Information on mortality is based on published data sets, but is subject to the common problem with such data sets, confidence in nominated cause of death. The potential life years lost is calculated from a model based on deaths prior to the nominated age (e.g. 75 years), but also takes account of all cause mortality. As with all models the validity of the results is dependent on the quality of the assumptions incorporated in the model. The information presented is thus indicative of actual costs, mortality and morbidity.

2 Cardiovascular Disease & Cancer: National Data

2.1 Definitions of Disease Categories

Cardiovascular disease (CVD) is classified according to the International Classification of Diseases (ICD-9) Code: 390 - 459. CVD includes the disease categories of acute and chronic rheumatic diseases, hypertension, ischaemic heart disease, pulmonary circulation diseases, stroke (cerebrovascular disease), diseases of the arteries, arterioles and capillaries, diseases of the veins, lymphatics and other diseases of the circulatory system, and other heart diseases. A number of subcategories are comprised within these diseases. Coronary heart disease (CHD) is a category formed by the combination of ischaemic heart disease, hypertension and heart failure.

The term cancer is used to describe all neoplasms (ICD-9 140 -239), including malignant and benign forms. This includes the disease categories of cancers of the lip, oral cavity and pharynx; digestive organs and peritoneum, respiratory organs, bone connective tissue, skin and breast, genito-urinary organs, lymphatic and haemopoetic tissue, other unspecified organs, benign neoplasms, carcinoma

in situ, and unspecified neoplasms. Skin, lung and breast cancers are combinations of malignant, benign and in situ cancers for their specific region/organ. For a full listing of disease categories, subcomponents and ICD-9 codes, see Appendix 1 Table 1.22.

2.2 Expenditure

Based on the CHPE/AIHW Burden of Illness Data Set, total national expenditure on CVD was $3671 million in 1993/4. This is almost double the health service expenditure on cancer management of $1902 million, (see Table 2.1). In 1989/90 CVD expenditure was $2485M, while expenditure on all cancers was an estimated $1076M (see Table 2.1). Expenditure increase between 1989/90 and 1993/4 is estimated at 47% for CVD and 76% for cancer, (excluding out-patient and other costs which are not in the 1989 data set). Whether these represent actual change in resource use is not certain, although in relation to cancer, the 1993/94 data set includes some additional cost items. For both diseases, the basis for attribution of hospital costs is quite different.

Estimated total health services expenditure in 1993/94 exceeded $31 billion, with expenditure on CVD and cancers, at slightly over $5.5 billion, consuming approximately 17% of total health resources (see Section 2.9). This proportion appears small, given that the 1994 mortality figures demonstrate approximately 70% of all deaths are due to cardiovascular diseases and neoplasms. While as explained elsewhere disease burden does not demonstrate a role for effective and cost effective intervention, a substantial imbalance provides a basis for a more detailed analysis.

Hospital in-patient cost is the largest single item of health expenditure for the management of CVD and cancers (see Appendix 1 Tables 1.11, 1.12). In-patient costs for management of CVD were estimated at $1657 million in 1993/4 representing 45% of total expenditure on the management of CVD, while in-patient costs for management of cancers at $1327 million was 70% of the total expenditure on management of cancers (see Tables 2.1 and 2.2). Taking into account outpatient services, hospital costs accounted for 47% of expenditure on CVD, and 74% of expenditure on cancer. The importance of hospital costs was similar to that in 1989/90 (although out-patient data were not available).

Pharmaceutical costs represent a far higher share of the costs of managing CVD than cancer. This reflects in part the chronic nature of CVD and the practice of life-long drug therapy once commenced. This results in very high expenditures on anti-hypertensive agents (selected as a case study) and to a lesser extent for cholesterol lowering drugs. We note that in-patient drug use appears under in-patient costs not pharmaceuticals, which for cancer patients may be not in-substantial. In a recent analysis of the costs of managing advanced breast cancer patients (Segal 1995), drug costs represented at estimated 10% of in-patient costs.

A substantial change in the nursing home methodology from 1989/90 to 1993/94 makes analysis of changes to this category very difficult. The 1989/90 methodology was based on transfers from hospitals whereas the later data is based on principal disabling condition of nursing home residents. The older methodology did not take into account the life expectancy of patients in nursing homes. Whilst a high proportion of hospital transfers are for patients with cancer, many of these die a lot sooner than transfers for other conditions such as musculoskeletal disease and this led to an overestimation of the costs associated with the more fatal diseases.

Tables 2.1 and 2.2 show that hospital based costs constitute a far greater share of health care costs for cancer than CVD. It is interesting to note that hospital care, is provided by State Governments, funded through joint Commonwealth/State Medicare Agreements, plus private contributions (largely

through private health insurance). Hospital payments are capped, even where ostensibly based on case mix payment systems, global budgets are determined for hospitals based largely on historic budgets, with throughput targets set accordingly. By comparison, medical, pharmaceutical and nursing home care are Federally funded, the former two through uncapped budgets. Over the last decade medical and pharmaceuticals services have made up an increasing share of the total health budget increasing from 18.0% and 8.8% respectively in 1985/86 to 20.2% and 11.8% in 1993/94. Hospitals account for a reducing share of total health expenditure, down from 42.9% in 1985/86 to 37.1% in 1993/94. While this might in part be due to a change in the preferred/cost-effective patterns of management this has not been demonstrated and is undoubtedly underpinned by the payment arrangements for pharmaceuticals and medical services. For these latter services, while unit costs are set, total level of service is open-ended.

The pattern of management cost in Table 2.1 indicates that a far larger proportion of cancer costs is funded through capped budgets managed by the States, whereas a large part of the costs of managing CVD are met through uncapped components of the Commonwealth Health Budget. This means that even though cancer is becoming a relatively more important health problem, responsible in 1995 for 27.5% of deaths (up from 16.2% in 1970), to now represent the single most important cause of death (reflecting also the reduction in mortality from stroke and coronary heart disease in recent decades), health funding arrangements may limit the capacity of the health delivery system to respond appropriately.

Table 2.1 Estimated Expenditure ($M) on CVD & Cancer by Health Delivery Setting: Australia 1989/90 & 1993/94

	1989/90		1993/94	
	CVD	Cancer	CVD	Cancer
Total Expenditure (approx)	2,485	1,076	3,517	1,495
Hospital In-patient	1,140	798	1,442	1,004
public	*995*	*629*	*1,110*	*732*
private	*145.5*	*169.5*	*332*	*272*
Hospital Out-patient	n/a	n/a	135	123
Medical services	356	127	496	208
Pharmaceuticals	424	20	713	52#
Allied Health Professional	35	9	38	12
Nursing Home	530	121	541	32*
Public Health / Screening	n/a	n/a	218	65
Research	n/a	n/a		74
Other	n/a	n/a		78

Source: AIHW Cost of Illness Data 1989/90 & 1993/94; excludes community and public health and disability services(non-medical)

Notes: n/a = not available

* An explanation of the apparent fall in nursing home costs is yet to be obtained.

data from PBS suggests this figure may be too high.

^ includes only public health expenditures in identifiable Commonwealth programs, research and other

Table 2.2 Estimated Proportions of Expenditure on CVD & Cancer by Health Delivery Setting: Australia 1989-90 & 1993-94

	1989-90		1993-94	
	CVD	Cancer	CVD	Cancer
Total Expenditure (approx)	$2,485 M	$1,076M	$3,517M	$1,495M
Hospital In-patient	*46%*	*74%*	*43%*	*70%*
public	*40%*	*58%*	*33%*	*51%*
private	*6%*	*16%*	*10%*	*19%*
Hospital Out-patient	n/a	n/a	4%	9%
Medical services	14%	12%	15%	15%
Pharmaceuticals	17%	2%	1%	4%
Allied Health Professional	1%	1%	1%	1%
Nursing Home	21%	11%	16%	2%
Public Health / Screening	n/a	n/a	6%	4%
Research	n/a	n/a		3%
Other	n/a	n/a		4%

Source: AIHW Cost of Illness Data 1989/90 & 1993/94

Note: 1989/90 data excludes community and public health and disability services (non-medical)
Also see notes to Table 2.01.

2.3 Mortality & Morbidity: CVD & All Cancers

In 1993/94 there were 54,888 deaths from CVD and 32,206 deaths from cancers, which represents a 4% fall in CVD deaths since 1989/90, but a 5% increased in cancer deaths. The most recent mortality data shows deaths from CVD in 1995 was 53,402 and there were 34,367 deaths from cancer. Based on 1993/4 data, life years lost to age 75 through CVD was estimated at 160,000 and from cancers at 283,106, (see Table 2.3). Cancer is thus responsible for a far greater toll than CVD in terms of premature deaths, reflecting the younger age at which cancer deaths typically occur.

Hospital admissions for CVD were 365,000 in 1993/94 and admissions for cancers were 442,000. Hospital bed-days were 2,690,000 and 1,945,000 for CVD and cancer respectively. Despite a substantial increase in hospital admissions of 81,085 for CVD (29%) and 203,000 for cancers (85%) between 1989/90 and 1993/4, hospital bed-days were relatively static in both periods. The substantial increase in admissions, in the face of capped hospital budgets has been achieved through a reduction in average length of stay. We note that efficiency gains through reduction in length of stay must eventually be exhausted, restricting the possibility for continued increases in hospital admissions without substantial cost implications.

Over the four year period, (1989/90 to 1993/94) there were fewer people dying from CVD, but more from cancers with roughly the same amount of hospital days accumulated, but with hospital admissions substantially higher.

Table 2.3 Mortality & Morbidity: CVD & Cancer 1989/90, 1993/94

	1989/90		1993/94	
	CVD	Cancer	CVD	Cancer
Total Deaths	57,227	30,669	54,888	32,206
PYLL	199,097	237,218	160,000	283,106
Hospital Admissions	283,915	238,650	365,000	442,000
Hospital Days	2,769,000	1,761,000	2,690,000	1,945,000

Source: AIHW Cost of Illness Data 1989/90 & 1993/94

2.4 Coronary Heart Disease & Stroke

In 1993/94 CHD contributed a significant portion of the burden of CVD, with approximately 63% of CVD mortality and 59% of total CVD expenditure attributable to CHD. Stroke consumed 17% of CVD expenditure and contributed 23% of CVD mortality. Mortality rates for CHD were 2.6 times that of stroke and potential years of life lost were 4.2 times that of stroke. Expenditure on the management of hypertension was estimated at $812 million with $481 million in drug cost. Our own estimate based on data from the Pharmaceutical Branch of the Commonwealth Department of Health and Family Services established that $570 million was spent on anti-hypertensive agents, but applying appropriate attribution rates (see Chapter 7) suggests the drug cost may be closer to $400 million. We note that drug cost for the management of hypertension is estimated to have nearly doubled since 1989/90 when it was an estimated $251 million (or increased by 65% based on our estimates) (see Table 2.4). The increase over the last 5 years will reflect a number of influences such as more intensive management of persons with high blood pressure, greater prevalence of high blood pressure (possibly), and an increase in the use of ACE inhibitors which are substantially more expensive than traditional drugs, especially diuretics.

Mortality rates for CHD and stroke over the past decade continue the pattern of decrease since the late 1960s. Between 1983 and 1993 the average annual decline in CHD mortality was 3.8% for males and 3.3% for females. Despite the slightly higher rate of decline in male mortality, the death rate in males is nearly twice that of women at 217/100,000 in 1993 compared with 115/100,000 for women. Death rate from stroke is similar for males and females, with a parallel decline of 3.8% per year for both males and females between 1983 and 1993. Death rate from stroke is now (1993) 67.5/100,000 for males and 65.3/100,000 for female, representing a 32% fall over the decade.

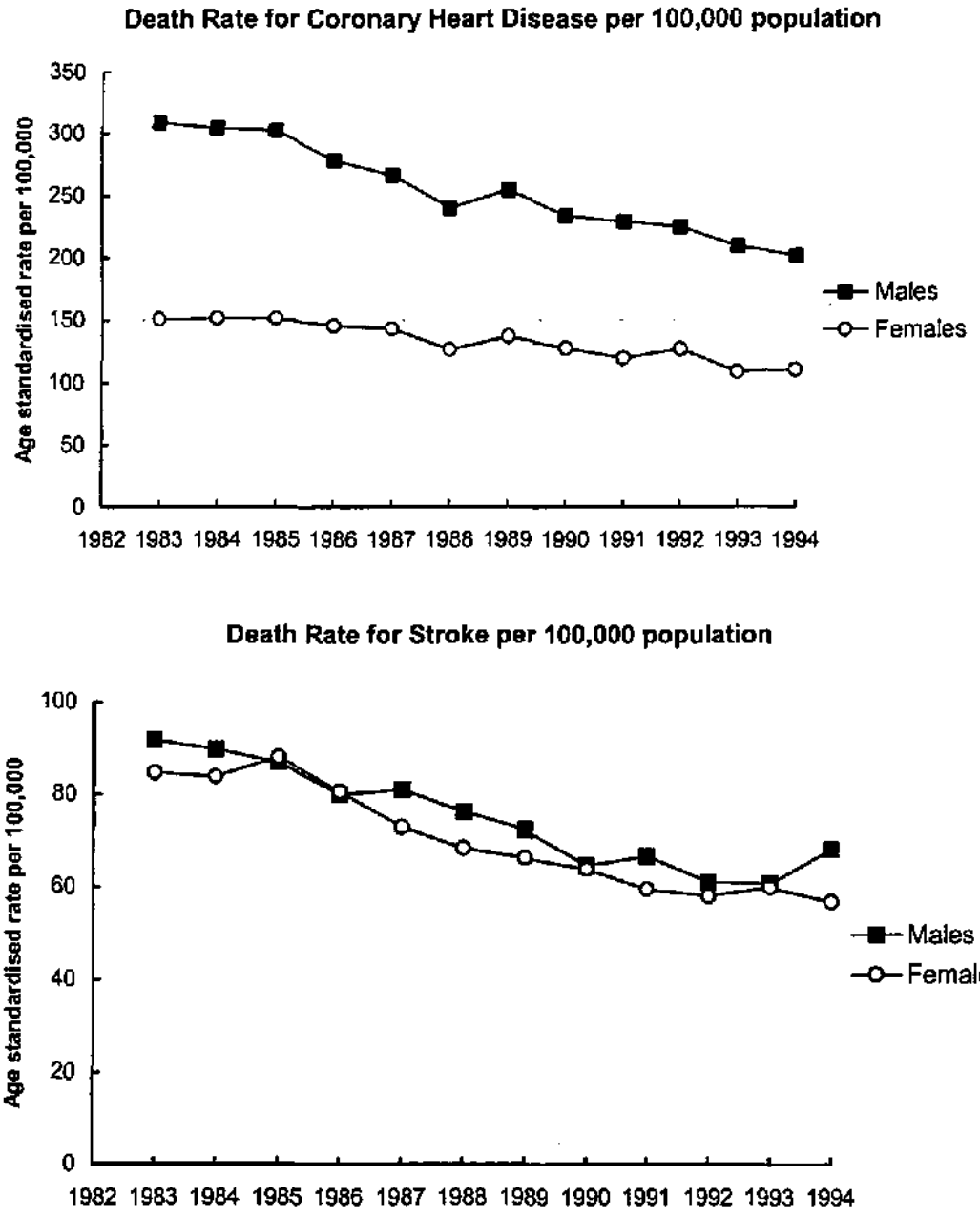
Table 2.4 Burden of Illness 1993/94: CHD, IHD Hypertension & Stroke

	IHD	*Hypertension*	*all CHD*	*Stroke*
Expenditure ($M)			1999	*562*
Hospital-inpatient	547	21	701	*256*
Hospital-outpatient	15	71	95	*6*
Medical	87	214	347	*31*
Pharmaceutical	110	481	630	*14*
Allied health	5	19	28	*5*
Nursing home	68	6	198	*250*
Total Deaths	26,000	1,000	32,000	*12,000*
PYLL	103,000	3,000	110,000	*26,000*
Hospital Admissions	137,000	9,000	185,000	*46,000*
Hospital Days	976,000	55,000	1,259,000	*682,000*

Source: AIHW Cost of Illness Data1993/94

Note: All CHD is comprised of IHD (ischaemic heart disease), hypertension and heart failure

Figure 2.1 Death Rates for Coronary Heart Disease and Stroke per 100,000 Population



Source: AIHW Health Trends 1995 p35, 37

2.5 Major Forms of Cancer

Cancer is a leading cause of death (32,206 in 1993/94) and premature death (283,106 life years lost to age 75), and a major cause of death continuing to increase. The cancers responsible for most deaths in 1993/94 were lung cancer (6711 deaths), colorectal cancer (4644 deaths)), breast cancer (2655 deaths), prostate cancer (2590 deaths) and skin cancer (1172 deaths). These five cancers accounted for 52% of all cancer deaths. Skin cancers were responsible for the largest number of hospital admissions at 66,000 in 1993/4, followed by colorectal cancer (65,000), breast cancer (30,000) and lung cancer (22,000). Colorectal cancer was responsible for most hospital bed-days, indicating a high average length of stay. Skin cancer was responsible for the largest expenditure ($257 million), followed by colorectal cancer ($207 million), breast cancer ($169.2 million) and lung cancer $103 million) (see Table 2.5 and Appendix 1 Tables 1.11, 1.12).

Colorectal cancer occupies a significant position in the burden of cancer illnesses. In 1993/94, the burden of colorectal cancer was substantial, responsible for 4,644 deaths and 33,636 life years lost to age 75. Its management is responsible for substantial health service expenditure, at an estimated $207 million, and for the most hospital bed-days of any cancer, as seen in Table 2.5 (also Appendix 1 Tables 1.12, 1.14).

Table 2.5 Comparative Burden of Colorectal, Skin, Breast, Lung and Prostrate Cancers: Australia 1989/90 & 1993/94

		Colorectal Cancer	Skin Cancers	Breast Cancers	Lung Cancers	Prostate Cancer
Deaths – Australia	1989/90	4,200	1,100	2,500	6,300	2,100
– Australia	1993/94	4,644	1,172	2,655	6,711	2,590
Hospital Admission	1989/90	14,300	45,300	23,000	14,900	8,300
	1993/94	65,000	66,000	30,000	13,700	22,000
Hospital Days	1989/90	197,000	156,200	135,600	153,400	95,000
	1993/94	257,000	128,000	116,000	150,000	112,000
Life Years Lost to Age 75						
	1989/90	26,900	11,600	26,900	43,500	5,200
	1993/94	33,636	12,500	31,800	48,332	6,572
Total Expenditure ($M)						
	1989/90	100	184	73	82	45
	1993/94	207	277	169	103	98
Hospital Care Expenditure ($M)						
	1989/90	79	105	53	65	25
	1993/94	171	129	80	81	66

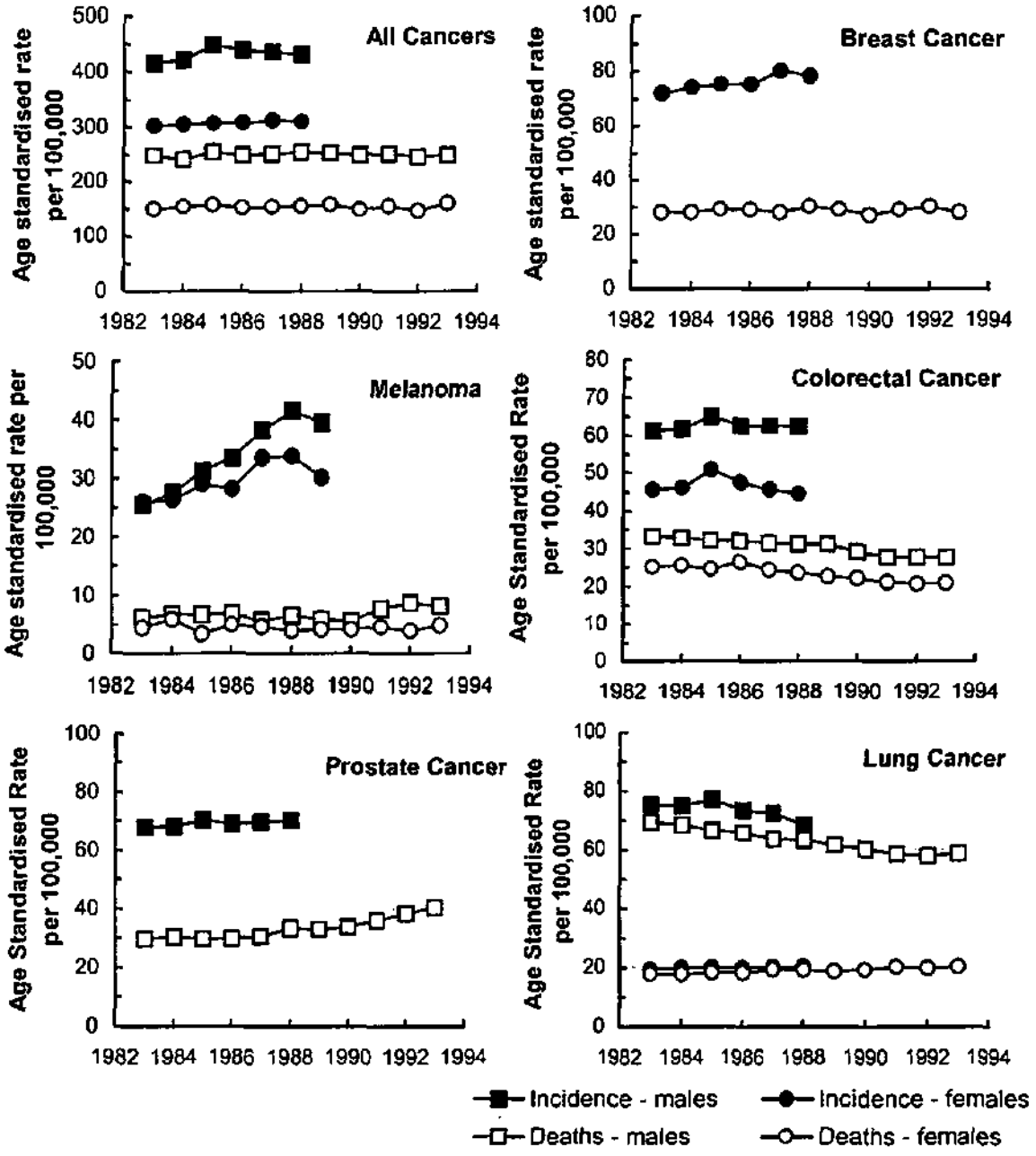
Source AIHW/CHPE Burden of Illness Data 1989/90 & 1993/94

Note: AIHW figures stated for lung, skin and breast cancers are compilations of figures for malignant, benign and in-situ forms for each.

Table 2.5 demonstrates some interesting points. Deaths from colorectal, lung, prostate, skin and breast cancers all slightly increased between 1989/90 and 1993/94, (reflecting an almost static death rate applied to an increasing population). Hospital admissions for each form of cancer also rose as did potential years of life lost. Total expenditure increased for each type of cancer over this period, as did hospital expenditure. However hospital days for skin, breast and lung cancers decreased. Against this trend, hospital days for colorectal cancer increased by slightly over 30% and for prostate cancer by approximately 17%. The smallest increase across the categories analysed was for lung cancer, which may reflect an impact of anti-smoking campaigns/legislation etc., resulting in a substantial drop in smoking prevalence (with a large reduction in smoking amongst males, but a small increase in the smoking prevalence of females).

Death rates for all cancers combined have remained relatively unchanged over the last decade with death rates rising for some cancers and falling for others, as shown in Figure 2.2. The incidence rates for all cancer appears to have stabilised in the recent past at approximately 350 new cases per 100,000 population.

Figure 2.2 Incidence and Death Rates for all Cancers and Major Forms of Cancer per 100,000 Population



Source: AIHW Health Trends 1995, p38, 39, 42, 43, 44

2.6 Age Group

Over 37% of CVD expenditure was consumed by the 75+ age group, and 55% for management of those aged 45-74 years. Stroke affects a more elderly population with 61% of stroke expenditure consumed by those aged 75 years or older. (see Appendix 1 Tables 1.8, 1.18).

Data on expenditure per age group indicates that skin and breast cancer involve substantial morbidity in younger and mid-age brackets, with those aged less than 75 responsible for 56% and 60% of expenditure respectively. Lung and colorectal cancer are managed predominantly in those

over 55, who account for 86% of all expenditures in both cases. See Tables 2.6 (also Appendix 1 Tables 1.8,1.18).

Table 2.6 Expenditure ($M and %) Per Age Group for Selected Cancers CHD and Stroke 1993/94

Age group		CHD	Stroke	Colorectal	Skin	Breast	Lung
0 – 24	$M	6	4	0	26	2	0
	%	*0*	*0*	*0*	*10*	*2*	*0*
25 – 44	$M	34	14	5	48	19	2
	%	*6*	*2*	*4*	*17*	*19*	*2*
45 – 74	$M	179	210	76	143	62	56
	%	*61*	*35*	*31*	*28*	*38*	*31*
75+	$M	*678*	*368*	41	*61*	*20*	*23*
	%	*33 62*	*62*	*65*	*44*	*40*	*66*

Source: AIHW Cost of Illness Data 1993/94

Note: Figures for skin, breast & lung are each compilations of malignant, benign & in-situ forms

2.7 Gender

In terms of total expenditures for CVD and cancer, there was little overall difference in expenditure for males and females. By subclass and health delivery setting substantial differences do emerge. For instance, for females, medical costs were 12% higher, pharmaceutical costs 26% higher and nursing home costs 35% higher than for males. 70% of lung cancer expenditure is attributed to health services for males.

Differences are also seen in expenditure by gender for hypertension, (60% on females), ischaemic heart disease (62% for males) and diseases of the arteries and veins. (See Table 2.7, also Appendix 1 Tables 1.10, 1.20). When gender is looked at together with health delivery setting, further differences emerge. Looking at total CVD costs in 1993/94, 57% of hospital expenditure was on males, whereas 57% of pharmaceutical costs were for females. Nursing home costs were 50% higher for females than males. CHD costs showed a similar, albeit more marked, trend whereby overall CHD expenditure is evenly divided between males and females but differences occur between health delivery settings. Hospital costs were 70% higher for males, while pharmaceutical costs were 40% higher for females and both allied professionals and nursing home costs were each over 70% higher for females.

Within CHD perhaps most notable is estimated expenditure on pharmaceuticals for the management of hypertension, with 60% of these costs for females. We note however, that the quality of the Cost of Illness Data Set in relation to attribution to gender has not been validated, so it is unclear what credence should be placed on these observations. The data does potentially suggest topics for further analysis, perhaps through primary data gathering. (Based on discussions with the Pharmaceutical Branch of the Department of Health and Family Services, they are unable to provide data by gender or region). We note also that hospital costs for management of ischaemic heart disease in males is more than double that for females. This observation could be revisited with current Victorian hospital data, should this be identified as a research priority.

Table 2.7 Expenditure ($M) by Gender & Health Setting for Selected CVDs & Selected Cancers 1993/94

	Hospital	Medical	Pharm.	Allied profess.	Nursing home	Out–patient	Total
CVD (total)	1442	496	713	38	541	135	3517
male	*825*	*243*	*302*	*20*	*213*	*70*	*1749*
female	*617*	*253*	*411*	*18*	*328*	*65*	*1768*
Stroke	256	31	14	5	249	15	595
male	*123*	*17*	*6*	*3*	*101*	*7*	*269*
female	*133*	*14*	*8*	*1*	*148*	*8*	*326*
CHD	704	348	631	28	198	71	2072
male	*441*	*168*	*264*	*15*	*72*	*33*	*1036*
female	*263*	*176*	*367*	*13*	*126*	*38*	*1036*
Hypertension	21	214	481	19	6	32	810
male	*8*	*94*	*191*	*9*	*1*	*10*	*327*
female	*13*	*121*	*290*	*11*	*5*	*23*	*483*
Ischaemic HD	547	87	110	5	68	27	883
male	*371*	*52*	*56*	*4*	*28*	*17*	*551*
female	*176*	*36*	*54*	*1*	*40*	*11*	*332*
Lung Cancer	58	7	3	2	2	6	78
male	*40*	*4*	*2*	*1*	*1*	*4*	*52*
female	*18*	*3*	*1*	*1*	*1*	*2*	*26*
Breast Cancer	62	0	0	1	1	9	73
male	*0*	*0*	*0*	*0*	*0*	*0*	*0*
female	*62*	*0*	*0*	*1*	*1*	*9*	*73*
Colorectal Cancer	97	8	3	1	3	7	125
male	*52*	*5*	*1*	*1*	*1*	*4*	*66*
female	*45*	*3*	*2*	*0*	*2*	*3*	*58*

Source: AIHW Cost of Illness Data 1993/94
Note: "other" costs are included in Total column

2.8 Overview of Health Expenditure and Life Years Lost

A comparison between annual expenditure and life years lost to age 75 for CVD and subcomponents and selected cancers for is illustrated in Figures 2.3 and 2.4 for 1989/90 and 1993/94 respectively. (Reference list of disease categories shown in Table 2.8)

In 1993/94, CVD, with an expenditure of approximately $3365 M was responsible for estimated potential life years lost to age 75 (PYLL) of 160,000. CHD, with an expenditure of $1999 M had a PYLL of 100,000. In comparison, the expenditure for all cancers was approximately $1431 M, and PYLL was over 280,000. Expenditure on the management of Colorectal cancer was estimated at $207 M and a PYLL of approximately 34,000 (see Appendix 1 Tables 1.7, 1.17). Thus, expenditure figures for CVD and CHD (and some other categories of cardiovascular diseases), were notably higher in comparison with life years lost to age 75, than cancers. An exception to this pattern is for ischaemic heart disease, responsible for relatively high deaths. It is also notable that between 1989/90 to 1993/94, expenditure on CVD has risen substantially PYLL has fallen such that the relation between the two has changed markedly. It is not of course possible to argue directly that the extra expenditure was responsible for the fall in mortality nor that in the fall in PYLL. However what

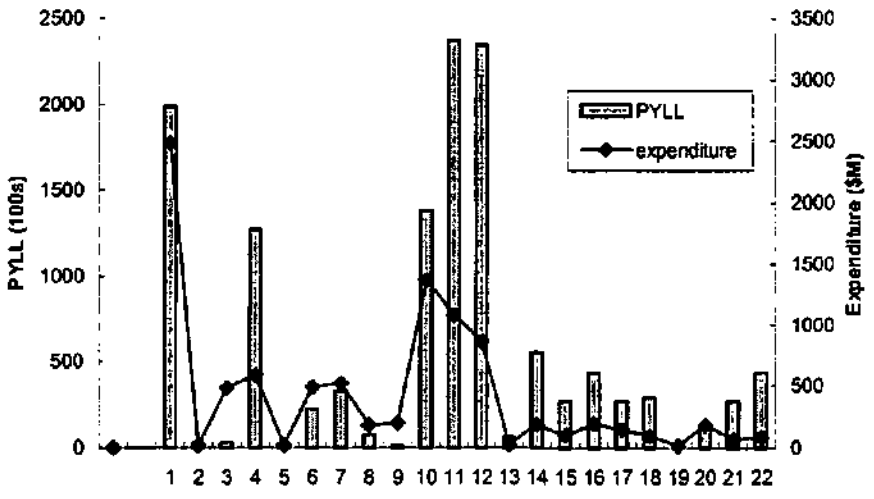
can be noted is that expenditures on cancers seem low relative to mortality. While this may in part be an artifact, reflecting the inadequacy of the expenditure data base which excludes public health and screening initiatives, it may also represent distortions created by health funding and delivery arrangements. As discussed further in Section 4, these limit the flexibility of resource shifts, and could potentially restrict the allocation of health care resources into cancer management and prevention. However, whether these observations reflect a misappropriation of resources can only be determined by a review of intervention options and their cost effectiveness. Some progress in this regard is achieved through three case studies which are reported in Sections 5, 6, and 7.

Table 2.8 Reference List of Disease Categories to Accompany Figures 2.3 & 2.4

No	Disease	No	Disease
1	CVD (total)	12	Cancer
2	Acute/chronic rheumatic disease	13	Lip, oral & pharyngeal
3	Hypertension	14	Digestive organs
4	Ischaemic disease	15	Colorectal
5	Pulmonary circulation disease	16	Bone, connective tissue & skin
6	Other heart disease	17	Genitourinary organs
7	Stroke	18	Lymphatic & haemopoetic
8	Diseases of arteries & arterioles	19	Carcinoma in situ
9	Diseases of veins & lymphatics	20	Skin cancers
10	Coronary heart disease	21	Breast cancers
11	All neoplasms	22	Lung cancers

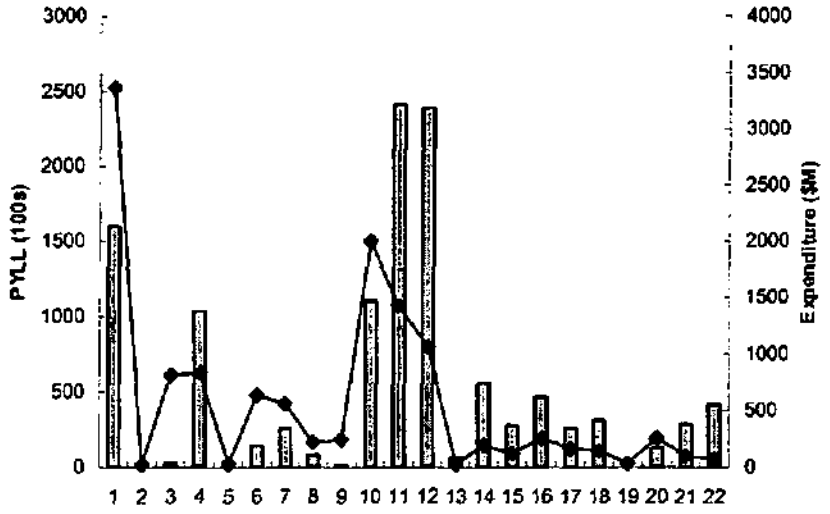
Source: AIHW Cost of Illness Data 1989/90 & 1993/94

Figure 2.3 Years Lost to Age 75 (PYLL) (100s) & Annual Expenditure ($M): CVD & Cancer 1989/90



Source: AIHW Cost of Illness Data 1989/90
Note: CVD = 1, Stroke = 7, CHD = 10, All Cancers = 11, Colorectal Cancer = 15, Breast = 21

Figure 2.4 Life Years Lost to Age 75 (PYLL) (100s) & Annual Expenditure ($M): CVD & Cancer 1993/94



Source: AIHW Cost of Illness Data 1993/94

2.9 Public Health/Health Promotion Expenditure: Australia

There is no single source of information on public health or health promotion expenditure, in total or by disease area or by risk factor targeted. For this project we have drawn together the readily available material, to provide an indicative view of total public health expenditure, and the possible share pertinent to cancer and heart disease. We note that this attempt has been quite frustrating and the resulting material is incomplete. Data sources include the AIHW Cost of Illness data base, AIHW Health Expenditure Bulletins, Richardson *et al* 1996, and publications and annual reports from the Department of Human Services, Victoria, the Victorian Health Promotion Foundation (VicHealth) and the Commonwealth Department of Health and Family Services.

Some programs that specifically target CVD and cancers can be identified within the reports of VicHealth and the Department of Health and Family Services. However many public health or health promotion projects which are targeted at lifestyle (such as smoking, nutrition and physical activity) cannot easily be allocated to a single disease. Further, many programs are joint Commonwealth/State/community programs. It is not simple to distinguish payments between levels of government from additional resources allocated to programs/services. Finally health promotion and illness prevention and screening can form a part of standard health service delivery. This includes for instance lifestyle advice provided by the GP, or dietitian consulting to a diabetic in hospital. There is no satisfactory evidence on the level of this activity.

AIHW have recently prepared cost of illness data for 1993/4, which includes screening programs and other preventative measures. Preventative services are defined to include only those services with an attributable ICD-9 or ICPC code, and excludes other public health/health promotion strategies or projects. It thus consists essentially of health promotional services delivered through direct patient care. Using the limited AHW definition, preventative and screening services are estimated at $32 million for CVD and $271 million for cancers. (The figure for CVD looks exceptionally low and clearly could not include a range of 'screening' tests undertaken by the GP e.g. of cholesterol, blood glucose, measurement of blood pressure. These must be presumed to be 'management'). Taking the estimates as supplied, it brings total spending on CVD for 1993/94 to $3,549 million, and on neoplasms to $1,766 million. Based on these estimates, CVD and neoplasm represent in total 18% of a total health care expenditure of $30 billion. We note that these figures were received too late to include in the core analysis.

Commonwealth expenditure on Community & Public Health in 1993/4 was reported to be $1568 million (Richardson *et al* 1996). The recurrent expenditure comprising this figure was Commonwealth Government ($332 M), State & Local Government ($1233 M) and Private Sector ($3 M). The category of Community & Public Health includes Community Health Services and Health Promotion & Illness Prevention. Of the $1568 M overall expenditure, $205.8 M was designated as expenditure on Health Promotion, which included the subprograms of Drug Abuse Reduction, Environmental Health Standards, Health Promotion & Disease Prevention, and Research. This breakdown is shown in Table 2.9. From an analysis of the programs included within the sub-programs of the Health Promotion & Illness Prevention category, various activities relate to CVD and cancers, and of the total expenditure, $101.5M could be attributable to CVD and cancers, including approximately $25 M to breast cancer screening (see Appendix 1 Table 1.21).

Table 2.9 Public Health Expenditure ($M) 1993/94

Community & Public Health Expenditure		
	Community Health Services	$1362.2
	Health Promotion & Illness Prevention	$ 205.8
		$1568.0
Health Promotion & Illness Prevention:		
	Drug Abuse Reduction	$ 34.5
	Environmental Health Standards	$ 19.2
	Health Promotion & Disease Prevention	$ 145.5
	Research	$ 6.6
		$ 205.8
CVD & Cancer Activities:		
	NCADA (1)	$ 30.5
	Administration	$ 10.25
	Public Health Education	$ 8.9
	National Health Promotion Program	$ 4.72
	National Women's Health Program	$ 8.72
	MLSWH (2)	$ 0.02
	Cervical Screening	$ 6.19
	Early Detection of Breast Cancer	$ 25.6
	Research	$ 6.6
		$ 101.5
Other Activities (3)		$ 104.3
		$ 205.8

Source: Richardson *et al* AIHW 1996

Notes: (1) National Council Against Drug Abuse
(2) Major Longitudinal Study into Women's Health
(3) see Appendix 1 Table 1.21 for a detailed listing of 'other activities'

The bulk of the Community & Public Health expenditure is allocated to Community Health Services ($1362 M), and the distribution of this is difficult to establish. Due to the dearth of information available it has not been possible to make an actual allocation of this expenditure to cancer and heart disease. The recurrent funding to this area is largely from state and local government, and whilst further investigation at this level would be timely and necessary, it would most likely also be time consuming and difficult.

Without any firm evidence on which to determine an attribution, it is reasonable to use a simple attribution rule as a first step. Considering the mortality, morbidity and potential years of life lost contributed by CVD and cancers, it would appear reasonable that a great deal of public health projects would target reducing risk factors and incidence of these two broad disease categories. Together they account for approximately 70% of all deaths.

On the other hand in relation to other health care costs the AIHW data base suggests that less than 20% of all health expenditures are allocated to CVD and neoplasms. To yield an indicative estimate, we have assumed that the proportion of public health expenditure directed at CVD and cancers is 45% (less than that indicated by mortality but greater than that indicated by its share of all health expenditure). On that basis, a total of $705 million would be allocated to public health and community health in relation to cancer and heart disease (which includes direct service provision e.g. through community health centres).

2.10 Expenditure by Disease Stage

We have endeavoured to develop indicative estimates of spending per disease by disease stage. We have crudely divided disease process and options for intervention into primary prevention with the healthy population or those at high risk, screening and early diagnosis, management of those with established disease, and end stage care/palliative care. Direct information regarding expenditure by disease stage is not available, and this has been approximated through consideration of expenditure by health care setting, which is to an extent aligned with disease stage. For each health delivery setting we have, based on professional judgment, allocated total expenditure between disease stages, as shown in Table 2.10. This is translated into dollars by relating the proportions to total estimated expenditure on CVD and cancers as shown in Table 2.11.

By incorporating estimates of screening programs, expenditures for breast and colorectal cancer can also be approximated. These are shown in Tables 2.12 and 2.13. We note that in relation to breast cancer, a substantial share of total health expenditure is allocated to screening via the national breast cancer screening program. Estimated at 27%, this figure could in fact be higher than identified here, as this does not include private screening undertaken outside the formal program. In relation to colorectal cancer, while there has been some screening activity, there are no specific prevention programs targeted at colorectal cancer, or addressed to persons at high risk. On the other hand, general nutrition and activity campaigns may incorporate the same healthy lifestyle message appropriate for reducing the risk of colorectal cancer. In that sense it may be argued that some resources are allocated to prevention. However, given the observational data which suggests the potential to halve the risk of colorectal cancer through an appropriate diet, the lack of attention to prevention perhaps requires further consideration. This matter is taken up as one of our case studies in Section 6.

This analysis, while speculative, suggests that a low priority is given to prevention, a modest priority to screening, with most spending occurring in the areas of management and end stage and palliative

care. Our estimate is that less than 5% of total expenditure on CVD and neoplasms is allocated to primary prevention, with perhaps 7% for screening. Given the high disease burden of CVD and cancers, and the possibility for prevention through adoption of healthy lifestyle, along with preliminary evidence of acceptable cost-effectiveness of prevention programs[1], the relatively low level of resourcing seems to be evidence of inefficiency/misallocation of resources.

It is also probable that allocating relatively few resources to prevention, inevitably condemns the community to ever increasing demand for disease management. This then further limits the opportunity to allocate resources to prevention. At the least this analysis, together with other aspects covered in Section 4 on health system issues and possible cost-effectiveness, indicates at the least a need to review priorities.

Table 2.10 Estimated Proportions of Expenditure Per Disease Stage and Health Care Setting

Disease stage	Health delivery setting						
	Medical	Allied Health	Hospital	Nursing Home	Out-Patients	Pharma-ceutical	Public and Community Health
Prevention	5%	10%					30%
Screening	5%		5%				30%
Management	85%	80%	95%		100%	95%	35%
End stage	5%	10%		100%		5%	5%

Table 2.11 Expenditure Per Disease Stage 1993/94: CVD and all Cancers

Disease Stage(a)	Health Care ($M)	Public Health ($M)	Total ($M)	%
Prevention	40	211	251	4.5
Screening	157	211	368	7.0
Management	3943	247	4,190	76.0
End stage	651	35	686	12.5
Total(b)	4791	706	5497	100.0

Source a see text:
b AIHW Cost of Illness Data 1993/94

Table 2.12 Expenditure Per Disease Stage 1993/94: Breast Cancer

Disease Stage	Health Care ($M)	Public Health ($M)	Total ($M)	%
Prevention	1	0	1	1
Screening	4	25	29	27
Management	78	0	78	72
End stage	2	0	2	2
Total	83	25	108	100

Source: See text

[1] Segal L., Dalton A. and Richardson J., The cost-effectiveness of primary prevention of non-insulin dependent diabetes mellitus. CHPE Research Report 8, Monash University, Health Economics Unit. 1996.

Table 2.13 Expenditure Per Disease Stage 1993/94: Colorectal Cancer

Disease Stage	Health Care ($M)	Public Health ($M)	Total ($M)	%
Prevention	.1	0	.1	0
Screening	4.9	1	5.9	5
Management	102.8	0	102.8	92
End stage	3.25	0	3.25	3
Total	111	1	112	100

Source: *See text*

3 Cardiovascular Disease & Cancer: Victorian data

3.1 Mortality & Morbidity

In 1994, CVD was identified as the principal cause of death in 13,520 Victorians, 43% of all deaths (a slightly higher proportion in women than men). Neoplasms were identified as the principal cause of death in 8,297 Victorians, 28% of all deaths (the proportion slightly higher in men than women) (ABS 1995). Cancer is the leading cause of death in Victoria and responsible for most premature death, as measured by life years lost to ages 65 or 75. The standardised death rate for Victoria relative to Australia was slightly lower for CVD (0.94) and slightly higher for cancer (1.02). Death rates from heart disease and stroke have fallen substantially over recent decades, the pattern of fall has been similar in Victoria to that for Australia. The death rate from heart disease has fallen by nearly 50% between 1971 and 1991, and by over 60% for stroke. Death rates from cancers have, by contrast remained relatively stable over the same period. In 1971 death rate from heart disease was over twice that from cancer, whereas by 1992 death rate from heart disease was only 10% greater than for cancers (see Table 3.1, Figure 3.1).

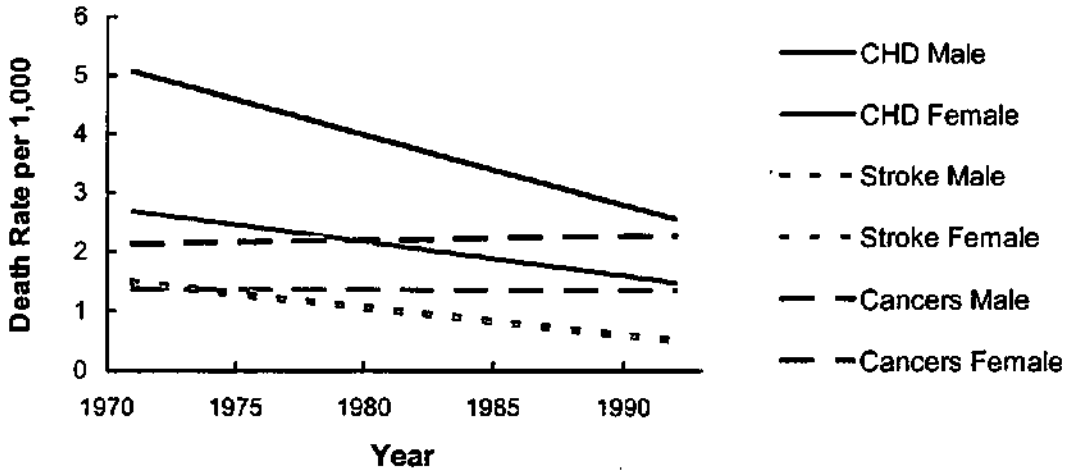
By 1994 the death rate of cancer had overtaken that of coronary heart disease. The standardised incidence rates for 1993 for cancer were 344 per 100,000 males and 248 per 100,000 females. 18,088 Victorians presented with new cases in this year. Standardised mortality rates in 1993 were 1.58 per 1,000 males and 1.04 per 1,000 females. Potential years of life lost to age 75 were 32,945 for males and 29,629 for females.

Table 3.1 CHD, Stroke, Cancers: Victoria by Gender

Attribute		CVD	CHD	Stroke	Cancers
Total deaths					
1990	male	6,583	4,606	1,097	4,621
	female	6,937	4,248	1,663	3,676
1994	male	6,572	4,413	1,290	4,969
	female	7,005	4,279	1,926	4,110
Life years lost (b)					
to age 65	male	n a	38,357	5,925	54,888
	female	n a	13,380	5,169	52,126
Standardised death rates					
Per 1,000					
1971	male	n a	5.084	1.521	2.145
	female	n a	2.716	1.470	1.382
1992	male	n a	2.551	0.563	2.287
	female	n a	1.496	0.523	1.371

Source: a) ABS Cause of Death 1994 cat no 3302.0 b) ABS Trends in Mortality 1996
c) CHPE/AIHW Cost of Illness data base n a not available

Figure 3.1 Standardised Victorian Death Rates 1971 to 1992



Source: ABS Trends in Mortality 1996

Death rates from the main types of cancer and CHD and stroke are shown in Table 3.2. In Victoria in 1990 there were 2,441 new cases of colon and rectal cancer and 1222 deaths from colon and rectal cancer. This represented 15.5% of all new cases of cancer and 15% of deaths. For comparison there were 1814 new cases of lung cancer and 1597 deaths, and 1905 new cases of breast cancer and 718 deaths, and 177 deaths from skin cancer. (Giles *et al* 1993). In 1993, colorectal cancer was the leading cancer site with 2,620 cases (15%), and second ranking site of fatal cancer with 1,208 deaths (14%). Breast cancer was the third most common new cancer in Victorians accounting for 2,186 new cases (12%), and the third ranking site for deaths (8.5%). Lung cancer remained the leading cause of cancer death with 1,693 deaths (20%), and ranked fourth in incidence with 1,839 new cases.

Colorectal cancer thus represents an important form of cancer, responsible for an increasing number of deaths. It has recently become the focus of attention, in terms of options for reduction in mortality and morbidity. It has been selected as a suitable area for further analysis as part of this research program. In Sections 5 and 6 we report on options for prevention and issues to do with emergency admissions. Hospitalisation represents the dominant cost of management.

Table 3.2 Comparative Burden of CVD, CHD, Colorectal, Breast, Lung, Prostate and All Cancers: Victoria 1990 & 1994

	All Cancer	Lung	Prostate	Breast	Colorectal
1990	**8,297**	**1,612**	**534**	**718**	**1,222**
male	*4,621*	*1,191*	*534*	*7*	*640*
female	*3,676*	*421*	*0*	*711*	*582*
1994	**9,079**	**1,800**	**693**	**778**	**1,304**
male	*4,969*	*1,255*	*693*	*5*	*648*
female	*4,110*	*545*	*0*	*773*	*656*

Source: ABS Mortality Tabulations 1990, 1994

Table 3.3 Victorian Cancer Incidence 1993: Top Four Ranking Sites

	Persons	*Male*	*Female*
Lung	1,839	*1,271*	*568*
Prostrate	2,609	*2,609*	*0*
Breast	2,186	*13*	*2,173*
Colorectal	2,620	*1,373*	*1,247*

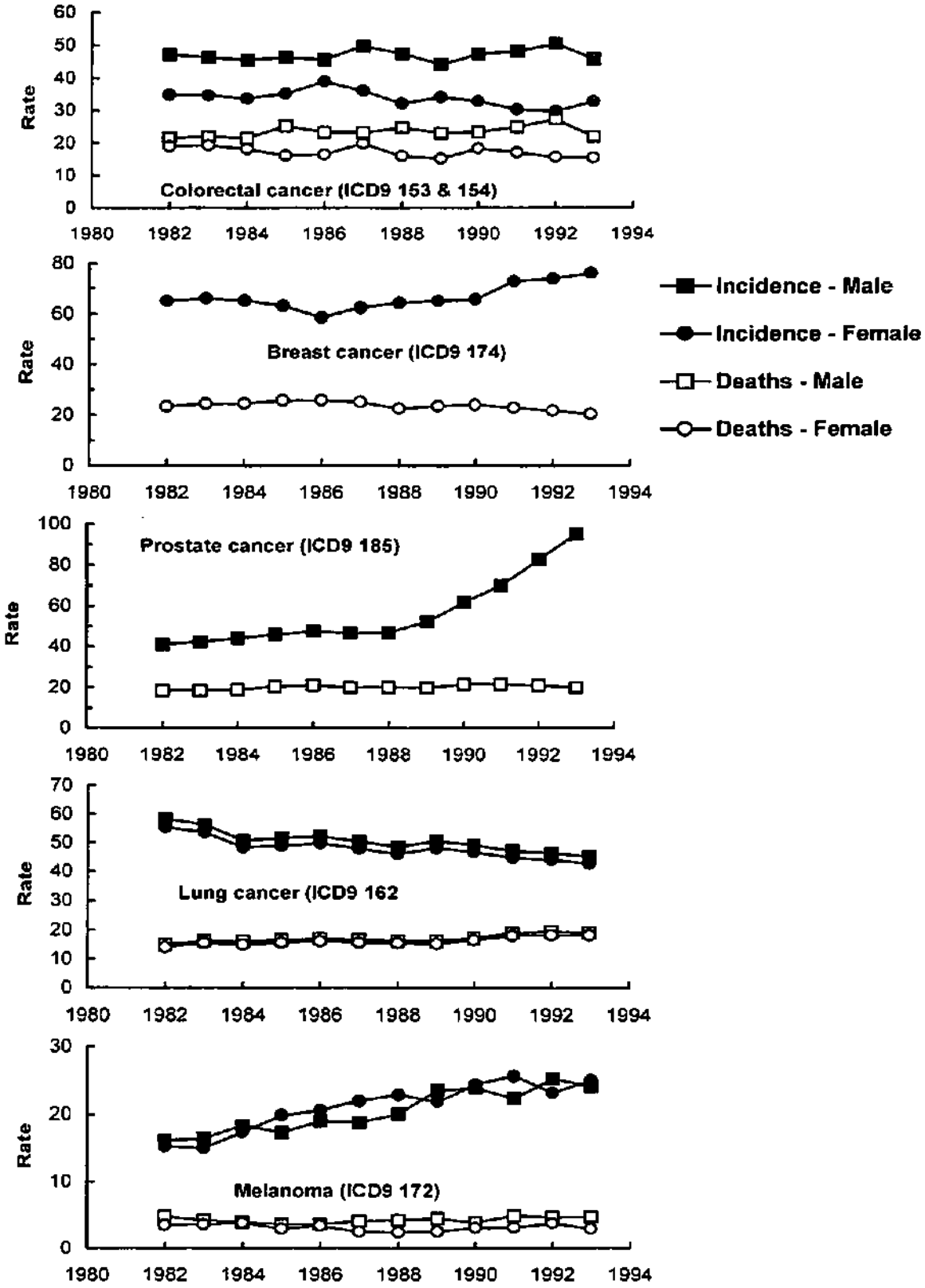
Source: Canstat: Cancer in Victoria 1993

Figure 3.2 demonstrates trends in incidence and mortality for various cancers for the period 1982 to 1993 for males and females in Victoria. Leading sites for cancer incidence for Victoria in 1992 by age groupings for males and females are shown in Figure 3.3. Approximately 2/3 of all Victorian deaths in 1994 occurred in the Melbourne statistical division.

Small area data for deaths in 1991/2 are published in the ABS Trends in Mortality Bulletin. Six non-metropolitan Victorian regions had standardised mortality rates for deaths from heart disease significantly (@5% level) and substantially (at least 10%) higher than average: West Central Highlands (RR=1.42), South Loddon-Campaspe (RR=1.31), West Gippsland (RR= 1.21), Gippsland Lakes (RR= 1.19), Latrobe Valley (RR= 1.18), Ballarat (RR= 1.15).

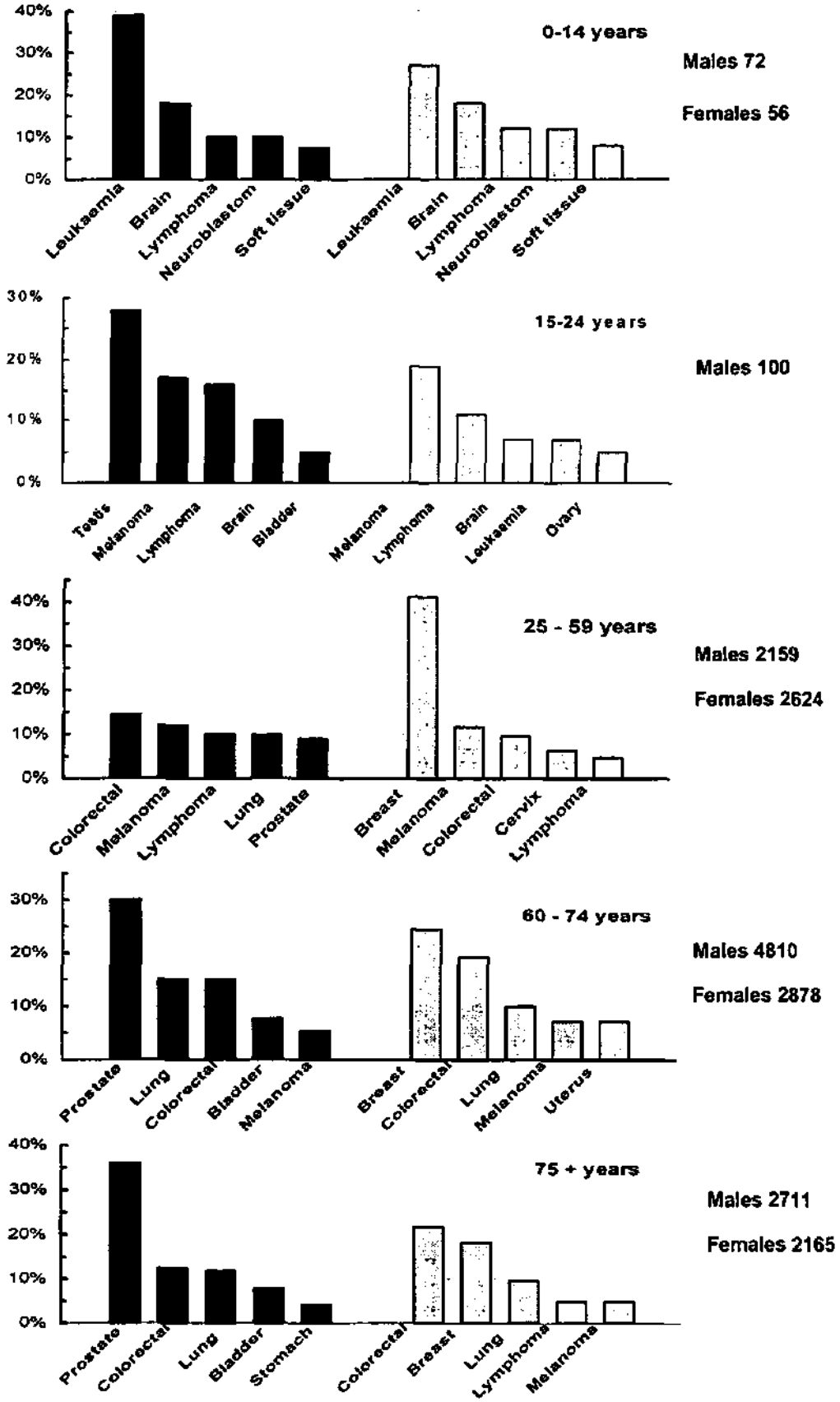
In relation to neoplasms, regions experiencing significantly and substantially higher than average standardised mortality rates were Wodonga (RR=1.25), Gippsland Lakes (RR=1.22), Central Melbourne (RR=1.18), LaTrobe Valley (RR-=1.16), Hopkins (RR=1.16), Bendigo (RR=1.16), West Inner Melbourne (RR=1.15) and North Middle Melbourne (RR=1.14).

Figure 3.2 Age Standardised Incidence and Mortality Trends by Sex in Victoria 1982 - 1992 for Leading Sites of Cancer Incidence



Source: Canstat Vol 22. Cancer in Victoria 1993. Anti-Cancer Council of Victoria Epidemiology Centre No. 22, Aug 1996 p12.

Figure 3.3 Leading Sites for Cancer Incidence, Victoria 1992 by Sex and Age Group (Percentage of Total Cancers in Each Age Group, and Total Number in Males and Females)



Source: Canstat Vol.22. Cancer in Victoria 1993. Anti-Cancer Council of Victoria Epidemiology Centre

3.2 Resource Use: Definition of a Research Program

Data on expenditure on the management of cancer and heart disease in Victoria is not readily available. The 'Cost of Illness' data set does not report expenditures by State. It is possible for 1993/4 (but not 1989/90) to obtain limited information from this source; specifically cover hospital admissions and bed-days by disease. However, a request needs to be submitted through the Department of Human Services, Victoria, in order for this information to be released. This data would in any case, provide only limited insights into resources spent on the prevention and management of CVD and cancers in Victoria. The problem relates both to the limited scope of services covered, as well as concern with the process of attribution to disease class. In order to gain a more complete and valid picture of resources allocated to CVD and cancers in Victoria it would be desirable to seek this information directly. This would represent a substantial research program that would need to cover the main health service types.

i) Interrogation of the Victorian hospital in-patient data base

The use of hospital in-patient services in Victoria is recorded in the Hospital Minimum Data Set. In order to establish hospital admissions and cost by disease class, it is necessary to establish the attribution rules for allocating each admission to disease class. This involves a number of steps usually commencing with the selection of pertinent ICD 9 codes. Relevant diagnostic codes would normally be selected which potentially relate to management of the disease, or management of a complication or co-morbidity, or more broadly identify types of admissions for which excess incidence for persons with the disease in question is expected. Most admissions have a number of diagnostic - (more than one of which can be a primary diagnosis) and each diagnosis may potentially be attributable to a number of different diseases. This presents difficulties in allocating admissions to disease categories. In practice it will often be clear to which primary diagnosis the admission relates. But, simple rules such as an allocation to the diagnosis that appears first are unlikely to be appropriate. Each admission with its associated ICD 9 codes must be apportioned between the potentially pertinent disease groups. Evidence on which to base attribution is incomplete. In any case, many admissions will genuinely reflect a number of underlying problems, such as that even with full knowledge attribution would be to some extent arbitrary.

Once admissions have been allocated to disease class, to determine cost of hospital admissions, a unit cost has to be applied to each admission. Either this can be done by using actual costing data collected by individual hospitals, or as collated for the sample of hospitals for the Department's case mix, case weight studies. Alternatively admissions can be allocated to a suitable DRG (for which there are standard protocols available) and then the cost weight for the DRG applied to the admission.

To undertake this tasks across the whole of CVD and cancers represents a substantial research task and one that by itself, will not provide evidence about the efficiency of resource allocations. It has not been pursued further as part of this research project, except for the case study purposes. It does however represent a manageable follow-up research task, which could be undertaken, should it be of interest to the Department. Having accessed the Victorian hospital data set, as part of this study, to determine hospital admissions and costs for the management of colorectal cancer, we have an excellent understanding of the hospital data set and how to use it for disease costing purposes.

ii) Hospital out-patient

An ambulatory classification system has recently been approved in Victoria. Victorian Hospitals are now required to record all out-patient occasions of service and classify these into the 41 broad clinic categories defined by the Victorian Ambulatory Classification System (VACS), (Jackson and Sevil 1996). Unit costs have also been developed for each clinic type, (Jackson and Sevil 1996). The Department of Human

Services is collating hospital data on outpatient services reported by the 41 items in the Victorian Ambulatory Classification System. This data set is expected to be completed by mid 1997. It should then be possible to obtain information on total outpatient occasions of service in Victorian (public) hospitals, by the 41 clinic categories. Occasions of service could be weighted by unit cost (for each clinic type) to yield a total resource cost to each clinic category.

In order to allocate to disease class, attribution rules would need to be established, in a similar fashion to that required in relation to in-patient admissions. Because the out patient classification system is simpler, having far fewer categories the task would be simpler. On the other hand it would be possible to make allocations only to broad disease categories, such as all cancers, CHD, diabetes, etc. Even to allocate to broad categories, some problems would emerge. Taking cancers for instance, while attendance at the oncology clinic would clearly be attributed to cancer, attendance at the gastroenterology clinic could be assigned to a number of disease classes. To resolve attribution in those cases, either patient level information would be needed from which to identify primary diagnosis, or detailed survey work would need to be undertaken to establish the pattern of work in the various clinics as a basis for devising suitable attribution rules.

Accessing these data bases at the level of the 41 clinic categories would be feasible once that data set is complete and a further research program to attribute outpatient services to disease class could be undertaken, if this were considered of value.

iii) Utilisation of Medical Services - funded through the Health Insurance Commission

The Health Insurance Commission has records of all medical services that they fund, which covers, direct medical services, (general practitioner, specialist, consultant) pathology, radiology and optometry. This represents the vast majority of medical services provided outside public hospitals and community health centres. The other exceptions are services funded through Veterans Affairs, Transport Accident

Commissions and Work-based insurance (such as WorkCover in Victoria). The Health Insurance Commission maintains patient level data and it is possible to obtain information on health service use for groups of individuals.

Access to patient level data requires informed consent of the individual. In theory it should be possible to approach the Health Insurance Commission to provide information on all (or selected) services to persons resident in Victoria, or possibly location of the medical practice/service. If such information were able to provided say by postcode of recipient, a mechanism could be devised to attribute this to disease grouping. For instance, in relation to pathology services, information on costs of tests may be sought and judgments made about allocation to pertinent conditions. Attribution rules would need to be identified for each item number on the Commonwealth Medical

Benefits Schedule. This is no simple task, but represents a major undertaking to cover the broad disease groupings covered by CVD and cancer.

In relation to GP services, once total GP services in Victoria are established then an attribution of general practitioner services to broad disease grouping can be based on the Bridges Webb data base (1994). This data base is drawn from a survey of 495 full time general practitioners covering approximately 100,000 consultations in total. This data source forms the basis of the attribution of GP services in the AIHW/CHPE Cost of Illness Data Base.

iv) Use of Pharmaceuticals

The Pharmaceutical Branch of the Department of Health and Family Services maintains comprehensive information on the use and cost (to the Government and to the recipient) of all prescriptions drugs listed on the Pharmaceutical Benefits Schedule (and non PBS drugs). Data can be supplied for use in Australia, by payment category i.e. full payment, safety net, health care card, and health care card plus safety net.

Recent attempts as part of the Coordinated Care Trials to obtain information on use of prescription drugs through the Department for sets of individuals have been unsuccessful, with patient level information retained only for Health Care Card holders. In theory, it should be possible to obtain information on pharmaceutical use of resident Victorians who are Health Care Card holders. The possibility of obtaining this information by location of pharmacy might provide a better way of gaining approximate information on use of prescription drugs in Victoria.

This option has not been explored. Even if information on drug use in Victoria can be obtained, it would then be necessary to attribute drug use to different disease categories. With certain drugs and disease this quite simple, but for others it is more complex.

We did obtain data on use of all oncology drugs for Australia (not including anti-emetics which can be used in a number of indications), as well as anti-hypertensive agents, and other major classes of drugs used in the management of CVD. This information was used for comparison with the estimates of drug cost provided through the Cost of Illness data base. The estimated drug cost for Australia, for management of hypertension derived through the Pharmacy Branch data set, was similar to that contained in the Cost of Illness data set. On the other hand, the estimated cost of oncology drugs based on information from the Pharmaceutical Branch was lower than that suggested by the Cost of Illness data base.

In relation to the use of non-prescription drugs, the only possible source of information is the ABS Health Survey. This can also be used to estimate use of medical and allied health services by broad disease grouping.

(v) Public Health/Health Promotion/Community Based Services

Some information is available on expenditure on public health/ health promotion and community based services in Victoria, but the attribution of this expenditure by disease class is possible using only the most rudimentary methods. Comprehensive data is available on projects funded through the Victorian Health Promotion Foundation, through their Annual Reports. In relation to Community Health Centres, there is no summarised information on activities undertaken. What is available is a publication identifying staffing by professional grouping (Human Services 1995). In relation to the

activities of the Public Health Division of the Department of Human Services, we were unable to locate published or unpublished sources of information that would enable the expenditure of the Division to be allocated to disease area. Attempts to gather this type of information, for example as part of the Health Australia/Public Health Partnerships initiative, have proved problematic.

3.3 Resource Use CVD and Cancer: Victoria

Due to the size of the research task of deriving a direct estimate of the health services use from the prevention and management of cancers and CVD in Victoria, we have resorted to an approximation derived by a simple population adjustment to the national Cost of Illness estimate. We know that average use of medical and hospital services by Victorians is somewhat less than the Australian average. For instance, for 1992-3 Victoria reports 1,171 bed-days per 1,000 population compared with the Australian average of 1,332 (AIHW 1996). Medicare services per head are close to the national average at 11.9 per head in Victoria in 1993-4 compared to 12.2 for Australia. In terms of rates of disease, while there are some differences, for instance with skin cancer far more prevalent in Queensland, in relation to CVD and cancers as a whole the incidence in Victoria is similar to the national averages (see Section 3. 1).

Victoria's share of the Australian expenditure on health care would thus be expected to be somewhat less than its population share. Taking the population share as a first approximation would put total health care expenditure in Victoria at 25.1% in 1994 and 27% in 1990. This translates into a total cost of management for CVD in 1993/94 of $879 million and for cancers of $358 million. In 1989/90 it would have been some $621 million for CVD and $270 million for cancers.

We need to add in estimated expenditure on public health/community health. In 1994195, $80.8 million was spent on community health centres in Victoria. This expenditure is not captured in the primary Cost of Illness data set. Community health centres provide a wide range of personal and community based services/programs. The report Activities of Community Health Centres (Human Services 1995) provides a description of staffing of Community Health Centres.

Based on this document, we estimate that approximately one third of the activities of community health centres, or an estimated $29.1 million may have been allocated to services within the areas of CVD and cancer.

This is an extremely rough estimation and reflects a subjective allocation of staff resources between major disease categories. Much of this expenditure will be on disease management, although we are unable to establish the proportional allocation between health promotion/disease prevention and management.

The activities of the Victorian Health Promotion Foundation (Vic Health) are described in some detail in their Annual Reports, which contain a detailed listing of projects/contracts they fund. In relation to the $22.7 million budget for 1993/94, $8.2 million is attributable to CVD and cancers, based on the project title and a brief project description. Most of this expenditure broadly fits into the category of public health or health promotion. Financial data for the Department of Human Services, Victoria, indicates total public health spending in Victoria at $175 million in 1994. We were unable to obtain information from the Department of Human Services as to the split between different programs or disease areas. Commonwealth public health expenditure that might be considered as being allocated to Victoria within the cancer and CVD disease areas was not established, except for $ 8.3 million spent on the breast cancer screening program in Victoria in 1993/94 (Breastscreen Annual Report 1994), and $4.3 million on the screening of cervical cancer.

These figures suggest that for Victoria, perhaps as much as 575 million per year may be spent on public health and health promotion initiatives related to cancer and heart disease. This includes large, high profile programs such as the breast cancer screening program, publicity programs for cancer prevention, and the relatively small food and nutrition programs, part of the work of community health centres, and approximately one third of the expenditure by the Victorian Health Promotion Foundation. It does not include any of the health promotion role of medical practitioners.

If we add the estimated public health /health promotion expenditure of perhaps $100 million (see above), this would put total expenditure in Victoria for the prevention and management of cancer and heart disease at over $1,300 million in 1994-5, with public health/health promotion/public sector primary care representing perhaps 8% of the total.

As we discussed in Section 3.2, a more precise estimate of the hospital in-patient costs for colorectal cancer in Victoria can be obtained by interrogation the Victorian Inpatient Minimum data set. This was carried out in relation to admissions for colorectal cancer. Actual admissions and costs of management of colorectal cancer in Victoria was obtained by interrogating the Victorian In-patient Minimum data set for 1994/95.

The method used was to:

- nominate ICD 9 codes pertinent to colorectal cancer as the criteria for a search of admission diagnoses (primary diagnoses only), and access data set of admissions with the nominated ICD 9 codes, scan admissions information to establish whether colorectal cancer is likely to be the direct or indirect cause for the admission to determine the attribution principle. (This established that virtually all admissions with colorectal cancer as a primary diagnosis could be presumed to be attributable to colorectal cancer) allocate admissions to the appropriate ANDRG code and derive total admissions by DRG for all admissions with the nominated ICD 9 codes;

- obtain estimated average cost by DRG, for all DRGs for which there are admissions for colorectal cancer (Jackson *et al*);
- calculate total annual cost and record total admissions by DRG for colorectal cancer and sum to obtain estimate of total in-patient costs attributable to colorectal cancer.

What we found from the direct interrogation of the Victorian Minimum In-patient data base was a total of 23,403 admissions for colorectal cancer, at an estimated annual cost for these admissions of $42.5 million for 1995/96 (based on 1996 inpatient cost weights and 1995/6 in patient admissions).

The AIHW Cost of Illness estimates for the management of cancers has recently been revised, to incorporate an alternative attribution process. We had noted that the original estimated in-patient cost for colorectal cancer for Australia (provided to us April 1997) at $97 million for 1993/94, which translates on a population basis to $26 million for Victoria, seemed far too low. We communicated our concern with the estimates. The recently revised estimate (obtained mid May) includes additional categories, but also a substantially higher estimate of in-patient cost for colorectal cancer, at $150.6 million. This is now consistent with the estimate derived from the Victorian Hospital data set. This experience highlights the lack of robustness of parts of the Cost of Illness data base, and the advantage of directly accessing local data sources, where possible.

Table 3.4 summarises available costing data for Victoria with regard to cardiovascular disease and cancer. This enables an overview, albeit incomplete, of spending in various settings.

As explained in Section 3.2, the cost of in-patient admissions in Victoria, for other disease areas could be estimated, by application of this method, together with the estimate of the cost of out patient services by disease, should this be required. In Section 4, we review the evidence on disease burden as reported in Sections 2 and 3, together with other policy dimensions to develop a series of further research tasks, which have been progressed as part of this research program and reported on in Sections 5, 6 and 7.

In summary, the lack of completeness of the above table highlights a need for more direct state data. The initial reliance on the AHW data set and the lack of availability of direct data has created a need to use estimates in many calculations. In order to effectively gain a comprehensive overview, there is a need for the state to examine establishing mechanisms to report expenditure by disease categories. Hospital data can be directly accessed, however public health expenditure breakdowns are not available. The only current source of information on medical services is the Bridges-Webb database, which will soon be outdated. Changes to the structure and availability of such information will enable more detailed, appropriate and specific analysis.

Table 3.4 Incomplete Victorian Costing Data

Item	Victorian $	Data Source	Comment
All CVD	$ 879 million	AIHW Cost of Illness data set 1993/4	Based on population proportion
All Cancers	$ 358 million	AIHW Cost of Illness data set 1993/4	Based on population proportion
Hospital Costs: Colorectal Cancer	$ 37.8 million	AIHW Cost of Illness data set 1993/4, revised attribution assumptions	Based on population proportion
Hospital Costs: Colorectal Cancer	$ 42.5 million	Victorian Inpatient Minimum Dataset 1995/96	Using 1996 Cost Weight figures
Public Health			
Dept Human Services All public health Possible exp on CVD and cancers	 $ 175 million (??) $52 million	 Victorian Dept Human Services	Total, based on internal program data, attribution to cancer and CVD conjectural
VicHealth Total CVD and cancers	 $ 22.7 million $ 8.2 million	 Annual Report 1994	 Based on program descriptions
Community Health Centres Total CVD and cancers	 $ 80.8 million $ 8.2 million	 Community Health Centres Annual Report 1993/94	CVD and cancers based on crude attribution of expenditure by occupation
Breast Screening	$ 8.3 million	Breastscreen Annual Report 1994	
Cervical Screening	$ 4.3 million	Annual Reports 1994 Victorian Cytology Service, Victorian Cervical Register	For $340,000 funding to the Register, and $4m for the cytology service.

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4 Introduction to Policy

4.1 Identification of Areas of Inefficiency in Health Service Provision: Cancer and Heart Disease

Overview

There is worldwide interest in obtaining better value from the health dollar. Governments are under pressure to meet ever growing health service demands with limited budgets. Growth in health budgets is restricted, at best, to the rate of growth of the total economy. There are three broad thrusts in this endeavour: one is to seek technical efficiency – to ensure that the health services that are provided are delivered at minimum cost. This has occupied policy for the last few decades, and underpins the introduction of case mix based funding systems and global budget caps combined with throughput targets. The second approach, receiving increasing attention is the achievement of allocative efficiency - that of optimisation of the health service mix. This requires resource shifts between program areas, individual programs and service providers to maximise health gain (or community wellbeing) for resources allocated. The research program reported here is essentially related to this latter agenda - the achievement of a preferred health service mix. The third thrust of government policy is to increase private contributions to health care, as a replacement for government spending, essentially a cost shifting exercise.

To determine whether the current health service mix is optimal and to establish desirable resource shifts, requires information on the possibility for health gain through the allocation of additional resources to specific services/programs, and expected loss in wellbeing from a reduction in allocation of resources to services/programs. As a matter of logic, if resources can be directed from services or interventions that yield low health benefit per dollar allocated, to an area yielding high benefit per dollar, a net improvement in community wellbeing will be achieved. The relationship between additional resources allocated and benefits derived is known as the marginal benefit-cost ratio. Community wellbeing will be maximised when MB/MC is identical across all health service/program areas. A detailed knowledge of current levels of expenditure does not of itself shed light on the capacity to gain from resource redirection, or provide evidence on the 'return' on investment in health. Information on the current allocation of resources to health is of value for a range of purposes (briefly outlined below), but does not by itself provide insights into the appropriateness of resource allocation.

There is no simple means for determining the appropriateness of current investment in health or desirable resource shifts. This an extremely demanding task. It requires a knowledge of the full range of intervention options, both currently funded and potential, that may contribute to health gain/quality of life and their costs and benefits at the margin (that is in relation to an expansion or contraction in program size). Popular 'priority setting' mechanisms, such as 'goals and targets' that seem to enable priorities to be set without the need for a detailed understanding of intervention options their costs and benefits, fail to provide clear direction for resource shifts. When there is an attempt to operationalise such documents, this involves the adoption of assumptions about relative capacity for health gain and costs of alternative strategies, which is usually implicit rather than explicit, without documentation of critical assumptions and their likely robustness.

A knowledge of broader health system issues, particularly of health funding and delivery arrangements can be extremely valuable in identifying possible areas of under or over investment. A careful analysis of health funding and delivery arrangements will identify the nature of incentives and

distortions, inherent in current arrangements which can suggest in what ways and where it is most likely that health services/programs will be over-supplied and where under-supplied. The key is to identify perverse incentives or rigidness which may prevent or discourage resource movements into high valued areas.

4.2 Role for Information About Current Resource Allocation to Health

Information about total resources allocated to the prevention and management of a nominated disease can be of value in a number of ways:

i Potential resource saving through investment in primary prevention:

In order to assess the benefits from primary prevention programs it is necessary to derive an estimate of downstream demand for services for disease management which should be avoided through any reduction in disease incidence. An estimate of the annual cost of disease management, per patient, forms a part of the benefits of a successful prevention program. An estimate of typical or average cost of management can be derived either from a description of management reflecting for instance best practice guidelines or surveys of actual practice combined with unit costings, or from data records of actual expenditure on services for disease management. Ideally costs of management would be established as a function of disease stage and other relevant parameters. A crude estimate of average attributable cost of management per person per year can be obtained from the estimate of total attributable disease cost per annum, divided by the total number of persons with the disease.

There are many methodological problems in developing an accurate estimate of attributable cost. The aim is to identify and cost those health service which are related to the disease and avoidable through primary prevention. This is particularly problematical for diseases with complications which have an incidence in the wider population, such as diabetes and CHD. It is not easy to establish that component of incidence and thus cost that can be argued to be due to the subject disease (in this case diabetes) and that which is coincidental, essentially reflecting the 'normal' population prevalence. While attributable fractions are developed and used for this purpose, the evidence on which they are based is often slim and derived from a different population. There is surprisingly little debate in the literature of the problems of attribution of health service use to disease, as it is in fact both complex and often quite arbitrary. It also is unclear how to handle what might seem to be unrelated conditions and which do not represent management of the primary disease, but which may well be more common in those weakened through chronic disease (such as pneumonia).

ii For development of hypotheses about possible areas of inefficiency

A knowledge of the total level of resources allocated to disease prevention and management, and of changes over time, should provide insights which can, especially if taken along with other information, enable hypotheses to be developed about current resource allocations. These can then provide an input into research agendas.

The capacity to develop pertinent hypotheses will be greater if particular details about current resource allocation are gathered to cover not just total resources allocated per annum, but also resources allocated by disease stage (to prevention, screening/early diagnosis, management and end stage care); by source of funds; by health delivery setting; by gender and age and by geographic region. As we have found and reported in above Sections, it is not always possible with available data sets to obtain information about resource use at this level of detail. By itself costing

information does not establish priorities but can contribute to the development of hypotheses about possible inefficiencies.

For instance, a knowledge of disease burden in terms of morbidity and mortality, combined with information on disease prevalence and incidence, and how this is changing over time, may indicate the nature of future resource demand and future dominant causes of mortality and morbidity. Such information could be used to identify appropriate targets for research effort on efficiency. The size of disease burden does not necessarily mean resources are more or less efficiently allocated, where morbidity and mortality are high and health service allocation substantial, there is perhaps greater possible gain from redirection of health care resources in a way that is efficient. Areas of high health expenditure are likely to provide larger opportunities for resource shifts and consequent health gain.

4.3 Use of Marginal Benefit Cost Ratios to Ascertain Desirable Resource Shifts

Information about current health service investment can be used to highlight possible areas for investigation concerning whether resource shifts are desirable. Once priority areas are selected for research, the analysis must then focus on issues of cost and effectiveness.

Specifically the task then involves:

- selection of health issue for analysis,
- gain in-Department understanding of health area and key influences on morbidity and mortality,
- identification and description of intervention options that may reduce morbidity/mortality,
- collection of evidence about costs and effectiveness of intervention options,
- review of evidence to draw conclusions about cost effectiveness and relative desirability of services/interventions under review.

We note that while the process of undertaking numerous cost-effectiveness analyses is time consuming and will require a budget commitment, it will often be the only way of assessing the efficiency of current resource allocation and the nature of resource shifts required to move the health sector towards optimal. The report by Segal and Richardson (1997) provides a description of this Framework and its application to diabetes.

4.4 Use of Health System Issues to Identify Likely Areas of Poor and Good Investment in Health

An analysis of health system issues, specifically health funding and delivery arrangements, highlights a range of impediments to efficient resource allocation. The impediments are such that they promote consistent distortions in the way health services are allocated. A knowledge of health system failures and the nature of the distortions created, provides another means for developing hypotheses about likely inefficiencies in resource allocation. It provides a means for identifying the types of services likely to be under funded and under supplied and those likely to be over funded and over supplied. Propositions developed in this way can then be tested through cost-effectiveness analyses of specific interventions. The results of such an analysis could be used to confirm the general principle and potentially support general statements about the likely nature of the

misallocation of health resources. Many of the distortions in the pattern of resource allocation for health arise from specific characteristics of current health funding and delivery arrangements.

These include:

- Multiple funders - health services are funded through all levels of government and various agencies, in way that does not make responsibilities clear. No one agency or level of government has designated responsibility for the health status of the community. This encourages, addressing of short term/immediate health needs at the expense of long term health outcomes, it encourages a narrow financial focus and cost shifting. Health planning based on cost-effectiveness analysis will not be supported. The result is likely to be a greater focus on critical care and crisis management, and less on preventative care or health promotion.

- Reimbursement of services through Medicare - only medical services (physician, pathology, radiology, procedures) and optometry are funded through the Commonwealth Medicare Benefits Schedule (CMBS). This provides a clear advantage to those professional groups, as consumers of their services obtain government reimbursement (up to the scheduled fee), or for many no fee is paid at all where the clinician uses the bulk billing arrangement. The use of items/professional services listed on the CMBS is thereby encouraged, with the result that medical services are likely to be over utilised relative to possible alternatives, such as allied health services. The nature of the schedule also influences delivery modality, encouraging one-on-one service delivery with the patient, rather than group programs or multi-disciplinary care, or wider family involvement in decisions about health care. Similarly the subsidy of pharmaceuticals listed on the Pharmaceutical Benefits Scheme supports the use of drugs.

Program Based Funding - resources are allocated to programs rather than persons with health needs, with access to services based on eligibility criteria. This discourages a creative response to health problems, and rather means consumers must access services for which they are eligible, rather than service providers seeking to deliver services that more effectively and cost-effectively meet the needs of consumers/patients. It does nothing to encourage agencies to seek a cooperative approach to service delivery.

- Unit cost payment arrangements - are being introduced through case mix based payment arrangements within the hospital sector and community health centre sector. These payment systems reward throughput/or hours allocated to direct care. They pay on the basis of cost and do not discriminate on the basis of the value of services. Unit cost payment arrangements discourage the provision of high quality services, as quality will tend to be at the expense of throughput, thus at the expense of revenue. It can also discourage the provision of preventative services. Consider for instance a hospital participating in a preventative program for asthma. If this were successful, it would results in fewer admissions, with consequent loss in revenue. There is a disincentive to provision of preventative services even though such programs might be desirable from a community perspective.

- Uninformed and disempowered consumers - it is extremely difficult for consumers either as patients or as members of a community to contribute to decisions about the health services that they access. The relationship between health service and health gain is extremely complex and variable. In general, consumers are neither encouraged nor actively supported to participate in decisions about the health services they access. Service choice is dominated by the health professional, particularly the general practitioner as the dominant primary health care provider.

This is likely to favour medical solutions to health problems. In addition, neither consumers, nor any health provider, nor funders are aware of, let alone control all the health services used by that consumer. This reduces the opportunity to derive the optimal care package, given total resources allocated to the health care of an individual, to meet the various health needs of an individual.

These attributes of health funding and delivery arrangements result in a range of distortions which mean the health service mix will not be optimal. They encourage cost shifting, medicalisation of health service delivery, a focus on throughput at the expense of quality, a focus on the short term and not long term, on critical care rather than health promotion. It also favours the delivery of services through one-on-one consultation with the patient rather than through multi-disciplinary teams or group sessions. Primary prevention is not encouraged and the role of allied health professionals is not supported. Thus primary prevention and allied health services are likely to be under-provided relative to medical services. A review of health system issues can yield a set of hypotheses about likely inefficiencies in current resource allocation for health.

We note that it is because of concern with the distortions created by health system funding and delivery arrangements that a range of new health service arrangements are being piloted. These include the Commonwealth/State coordinated care trials for persons with complex chronic care needs and the NSW integrated care trial for persons with diabetes.

4.5 Selection of Program Areas for Detailed Analysis

Based on consideration of disease burden, expectations about cost-effectiveness and health system issues, three program/disease areas were selected for more detailed exploration of resource allocation efficiency related to cancer and heart disease. We note that a substantial on-going work program would be required to consider efficiency in allocation of resources across all services for the prevention and management of cancers and circulatory disorders. The selection of case studies was chosen as the basis for proceeding, to demonstrate how to proceed beyond the general to the specific, and also to explore the efficiency of resource allocation within the case studies.

The management of hypertension: specifically the role for non-drug/life style based management. (Section 8)

This was selected as an area of research for a number of reasons. Total health cost of management of hypertension is high at an estimated $812 million per year (1993/4), of which an estimated $480 million was for pharmaceuticals (largely anti-hypertensive agents). Further, the drug cost has increased rapidly in recent years from an estimated $251 million in 1989/90. A preliminary review of the literature suggested that non-drug management was potentially effective for a substantial proportion of persons traditionally treated with anti-hypertensive agents, indicating that alternative approaches to management may well be cost-effective. This suggested the possibility for redirecting resources to alternative management strategies with capacity for achieving the same outcomes at reduced cost. An analysis of health system issues also confirms the appropriateness of the case study. Current funding arrangements favour medical management of disease and discourage non-medical management, confirming the likelihood of a possible inefficiency in the form of an over medicalisation of the management of hypertension, which warrants further analysis.

The prevention of colorectal cancer (Section 6)

This was selected as an area of research reflecting evidence on disease burden, preliminary literature review concerning possible effectiveness of prevention and health system issues. Colorectal cancer represent the second major cause of cancer death after lung cancer, responsible for 4,229 deaths in 1993/4. Incidence and number of deaths have been relatively stable over the last decade, unlike lung cancer for which mortality has been falling. In relation to potential cost-effectiveness, a preliminary review of the literature provides strong observational evidence of a link between nutrition and colorectal cancer and thus the possibility of prevention. Finally our analysis of health system issues suggests a bias against primary prevention, and lifestyle interventions, supporting the proposition that too few resources are allocated to the prevention of colorectal cancer. We were also aware of the current focus on colorectal cancer and the likely promotion of colorectal cancer screening. In that context it seemed a priority to consider whether it would be cost-effective to rim a prevention program to complement a screening program and to provide other than medical options to those identified at high risk.

A review of the costs of emergency admissions for colorectal cancer (Section 5)

In terms of disease burden, hospital admissions represent the major cost of management of colorectal cancer. It is thus appropriate to focus attention on hospital admissions for possible efficiency gains. The decision to consider emergency admission arises from clinical and health system considerations.

We note that even if a campaign to encourage earlier presentation of persons with symptoms of colorectal cancer, were be able to convert an emergency to an elective admission, with reduced morbidity and cost, case mix based payment systems mean that the individual hospital would have no financial interest in supporting a program to encourage earlier presentation. If successful, the promoters of such a campaign, would have no way of ensuring they obtained the higher proportion of elective admissions. The first phase of the research task was to establish whether there was in fact a differential in morbidity and cost between emergency and elective admissions. The ultimate focus of this case study, which was beyond the scope of the current research program would be to explore whether it would be cost effective to encourage earlier presentation of colorectal cancer to reduce the likelihood of emergency admissions.

The results of our research into these three case studies is reported in the following sections. The ensuing analysis has confirmed the selection of these areas, as vehicles to explore the issue of efficiency and as health issues/areas of investment, possibly associated with poor performance.

5 Emergency Admissions for Colorectal Cancer

5.1 Overview of the Costs of Management of Colorectal Cancer

Colorectal cancer is a common cancer on which is allocated substantial resources for management. Approximately 80% of management costs occur in hospital, 72% in-patient and 10% non-admitted patients (see Table 5.1). The role of pharmaceutical and medical services are relatively unimportant, and the use of allied health services estimated at less than $1 million. We were unable to identify any targeted expenditure for the prevention of colorectal cancer. In relation to efficiency in resource allocation for the prevention and management of colorectal cancer the key matters to establish are:

- Is there a role for prevention of colorectal cancer: and if so the total resources that should be allocated to disease prevention, and the optimal mix of population based and targeted programs - consideration of this issue commenced in Section 6, focused on the preventability of colorectal cancer.

- The optimal cost-effective and efficient approach to management - largely within hospital. We have looked at one aspect of management; whether presentation as an emergency or elective admission has a significant influence on cost and morbidity, and whether there may be possibilities for cost saving and improvement in health outcomes through a strategy to encourage earlier presentation with symptoms for colorectal cancer. The results of that research are presented here. Our analysis was only able to confirm the hypothesis that emergency admissions for surgery, were more expensive than elective admissions, although only for colon and not rectal cancer. We were not able to develop conclusions in terms of efficiency of resource allocation, which require a more complete analysis involving access to case records. A study of this nature is beyond the scope of this initial research program.

- Optimal strategy for screening for early disease detection - the subject of an AHTAC review to be reported on mid 1997, thus not reviewed as part of this research program.

Table 5.1 Cost of Management of Colorectal Cancer (A$) in 1993/94

	Hospital	Medical	Pharm.	Allied profess.	Nursing home	Out-patient	Total
Colorectal Cancer	97	8	3	1	3	7	125
Male	*52*	*5*	*1*	*1*	*1*	*4*	*66*
female	*45*	*3*	*2*	*0*	*2*	*3*	*58*

Source: AIHW/CHPE Burden of Illness data set 1993/94.

5.2 The Research Question

It could be hypothesised that very little of the hospital expenditure for the management of colorectal cancer, can be regarded as discretionary or subject to alternatives once colorectal cancer has developed, although improvements in the efficiency of service delivery may be available. The one exception to this might be emergency admissions for colorectal cancer. Emergency admissions for colorectal cancer is associated with very late presentation of the disease, and a higher incidence of metastatic spread of cancer (Waldron *et al*, 1986). It is known that a significant proportion of people with colorectal cancer have symptoms for several months before presentation. This might provide

an opportunity for the introduction of an intervention to achieve earlier presentation with the possibility of reducing morbidity and in-patient costs (see Table 5.2).

Table 5.2 Presentation of Symptoms of Colorectal Cancer

	< 3 mth (n = 309)	3 - 6 mth (n = 126)	6 - 12 mth (n = 68)	> 12 mth (n = 121)
Bleeding per rectum (%)	7	16	20	20
Abdominal pain (%)	35	36	30	31
Diarrhoea (%)	11	9	9	13
Constipation (%)	9	11	9	9
Altered bowel habit (%)	8	12	10	8
Tumour mass and/or distension (%)	12	9	10	10
Lassitude (%)	7	6	9	8
Other symptoms (%)	1	1	3	2

We hypothesise that a proportion of people with colorectal cancer who present with life threatening conditions, such as intestinal obstruction, which increase their immediate suffering and chances of dying, and also increases the costs of management, could be avoided if the cancer were detected earlier. For these reasons, we have analysed routinely collected data in order to determine the proportion of people presenting as emergency cases and to estimate the cost difference between the emergency and the elective presentations. This may indicate a potential saving.

5.3 Methods

As a preliminary examination of the hypothesis, routinely available hospital data were examined retrospectively. Data was obtained from the Victorian Hospitals Cost Weight Database for 1994/5, through Terri Jackson of the Centre for Health Program Evaluation (and with the knowledge of the acute health sector of the Department of Human Services, who have been informed of the results). Cases were selected if these was a principle diagnosis of colorectal malignancy (ICD 9: 153, 154 & 159).

The Victorian Hospitals Cost-Weight Database for 1994/5 contains a sample of 427,000 admissions, representing 53% of the Victorian acute public hospital total (Tate *et al*, 1996). Age, length of stay (LOS), total in-hospital costs, Australian National Diagnosis-Related Group (ANDRG3) and source of admission were collated for each admission with the nominated ICD-9 codes. The mean cost per admission was calculated for each ANDRG3 for emergency and elective cases, and the attributable excess cost of emergency cases calculated.

The method for comparing emergency and elective admissions was to:

- Select all cases with a principle diagnosis of Colorectal Cancer(ICD-9 153-4);
- For each admission in the nominated ICD-9 codes select from the database; age, sex, length of stay, total and ICU cost, ANDRG3 and transfer to a SPSS file;
- Recode source of admission either emergency or elective;

- Calculate the average length of stay, and costs for each ANDRG3 was calculated;
- Compare costs and length of stay for emergency and elective cases using Student's t test;
- Calculate excess attributable cost of emergency admission by ANDRG3 using the equation: Excess attributable cost = (mean emergency cost - mean elective cost) x n (emergency).

5.4 Results

In relation to the Case Weight Data Base we found that emergency admissions were associated with greater morbidity, they were higher cost, involved longer length of stay and more frequent admission to ICU.

i) Description of admissions:

There were 1085 cases admitted with a diagnosis of colorectal cancer, 242 (22.3%) as emergency admissions. These cases were selected from a total of 427,000 admissions to the 15 participating hospitals in the 1994/5 financial year contributing to the database. Of the 1085 cases, 664 (61%) had major surgical procedures for resection of colorectal cancer. Just over one quarter, 172 (26%) of these surgical procedures were performed following emergency admission.

ii) Differential cost and length of stay, emergency and elective admissions:

The mean cost per admission was 47% higher for emergency cases than elective cases across the 1085 cases (Table 5.3). The cases in whom major surgery was performed had a 26% increased length of stay and 19% increased average cost when admitted as emergency compared to elective admissions (Table 5.4).

iii) Differential Cost on a DRG Basis

For small and large bowel procedures, the cost increase for emergency admissions was 12.5% when complications were present (ANDRG 305) and 15% without complications (ANDRG 306). The difference in average length of stay was 17% and 35% respectively. (Table 5.4). On a DRG basis there were no significant cost differences between emergency and elective presentations in relation to rectal resection. The cost differences were substantial for the 'other 'category, with emergency admissions nearly twice as costly, suggesting the emergency cases were quite different to the elective cases, possibly warranting a different DRG classification.

Table 5.3 Number of Cases Admitted and Mean Total Cost of Admission for Colorectal Cancer in Different ANDRGs as Emergency and Elective Cases

ANDRG3		Mean Cost per Admission	Cases	Total Costs
All		$9,176	1085	$9,956,232
	Emergency Cases	$12,227	242	$2,958,855
	Elective Cases	$8,301	843	$6,997,377
305-306		$12,483	530	$6,616,237
	Emergency Cases	$14,042	160	$2,246,780
	Elective Cases	$11,809	370	$4,369,458
307-309		$10,364	134	$1,388,743
	Emergency Cases	$11,759	12	$141,111
	Elective Cases	$10,226	122	$1,247,631
Others		$4,464	414	$1,848,279
	Emergency Cases	$7,627	65	$495,746
	Elective Cases	$3,875	349	$1,352,533

ANDRG3: 305 : major small and large bowel procedures with complications;
306 : major small and large bowel procedures without complications;
307-309 : rectal resection with and without complications, aged above and below 70.

Table 5.4 Mean Difference in Age, Length of Stay and In-hospital Costs between Emergency and Elective Admissions for Colonic Surgery Procedures for Colon Cancer with and without Complications

	n	Mean Age (years)	Mean Length of Stay (days)	Mean In-patient Costs (A$)
All Colonic Surgery				
Emergency	160	69.4	19.7	14,042
Elective	370	68.6	15.6	11,809
Mean Difference		0.8	4.0	2,233
(± CI 95%)		(-1.6 to 3.1)*	(1.6 to 6.5)***	(550 to 3,916)***
ANDRG 305 : Surgery With Complications				
Emergency	130	69.7	20.8	15,082
Elective	255	70.5	17.8	13,410
Mean Difference		-0.8	3.0	1,672
(± CI 95%)		(-3.3 to 1.7)*	(0.06 to 6.0)**	(-472 to 3,816)*
ANDRG 306 : Surgery Without complications				
Emergency	30	68.1	14.6	9,537
Elective	115	64.5	10.8	8,260
Mean Difference		3.7	3.8	1,277
(± CI 95%)		(-1.8 to 9.1)*	(1.4 to 6.2)***	(81 to 2,472)**

* N.S. ** p<0.05 *** p<0.01

iv) Level of morbidity

Complications of all types, defined by DRG coding, occurred more often following colorectal operations in those admitted as emergencies (81%) compared to elective admissions (69%). A higher proportion of emergency admissions were admitted to the intensive care unit (25% compared with 19%).

iv) Implied excess costs for emergency admissions for Victoria

In translating these results to Victorian equivalents, we note that the total excess costs for operations for colorectal cancer was $375,676 ($2,233x160=$3,457,280 + $1,533 x 12 =$18,396). This represents 4.7% of the total cost of surgery for colorectal cancer of $8 million. These 664 cases

represent 26% of the 2,589 major operations for colorectal cancer performed across Victoria. (As identified from the Department of Human Services, Victoria, In-patient Minimum Data Set). Assuming representativeness of the participating hospitals, the excess costs attributable to emergency admission for surgery for colorectal cancer would be A$1,445,000 per annum. If 'other' admissions (DRG 307 to 309) also represented 261/o of the total, the cost differential there of $3,752 for 65 emergency cases, would translate to $938,000 across Victoria. This analysis suggests emergency admissions might contribute some $2.38 million additional cost in the management of colorectal cancer, relative to emergency presentation.

We also note that the total figure of 2,589 major operations for colorectal cancer is consistent with the annual incidence of 2,625 new cases.

5.5 Discussion

i) Need for patient level data

This analysis is base on admissions and does not describe cost of management for individuals, that is to reflect repeat admissions. However, people presenting as emergency cases will usually not have had previous admissions for investigations. Diagnosis of colorectal cancer is most likely to have been made during the emergency operation, required within a few hours of admission (for example, the emergency surgical relief of large bowel obstruction). For people presenting electively, a separate admission for diagnosis of colorectal cancer (for example, involving day-case colonoscopy) may occur before they are admitted for their major surgical procedure. Those admitted as emergencies may require more than one major surgical procedure (in particular, an initial temporary defunctioning colostomy for patients with intestinal obstruction or major peritoneal sepsis, with bowel resection six weeks later once the bowel has recovered, in order to avoid the surgical repair breaking down internally).

Additional research utilising patient records and matching of admissions to patients would be required to gain an overall view of resource use per patient for the management of colorectal cancer and the role and impact of emergency admission.

ii) Policy implications

Colorectal cancer is a slowly progressive disease, although there is a wide spectrum, with a minority of cases with early metastasis (Cuthbertson *et al*, 1984). In a large proportion of cases, the cancer will arise from a pre-existing benign adenoma (Johnson et a], 1995). The onset of symptoms is usually gradual and occurs late in the progress of the disease (McDermott *et al*, 1981). Treatment in the early stages of the disease results in greatly improved chances of survival. Thus the rationale for screening for colorectal cancer before the onset of symptoms is to detect colorectal cancers early and treat them when the chances of cure are higher. Before a screening program is fully implemented and all prevalent cases of colorectal cancer have been detected, there will be people with colorectal cancer present who have not yet presented or been investigated and treated. Even when a screening program has been fully implemented, there will still be a number of people who have not participated in the program who have colorectal cancer, or who have had false negative screening tests.

Thus there will be some who develop colorectal cancer who may have symptoms attributable to the disease for weeks, months or even years before they present for or receive adequate investigation and therapy (McDermott *et al*, 1981). This may be due to failure by the person to recognise the

significance of their slowly-developing symptoms, failure to overcome the inertia to seeking medical advice, and sometimes failure by the doctor (Hughes *et al*, 1979) to inquire after or to adequately investigate the symptoms present. As a result, a proportion of people with colorectal cancer will not present until some emergency condition develops, such as intestinal obstruction (Serpell *et al*, 1989), which forces action to be taken.

Those who present as emergencies will have an increased likelihood that metastatic spread has already occurred before the primary cancer is resected, thus reducing the chances of eventual survival (Serpell *et al*, 1989). Diagnosis and treatment weeks or a few months earlier, may not greatly affect likelihood of metastases. On the other hand, becoming severely ill as a result of emergency presentation of colorectal cancer might slow recovery from the surgery to resect the primary cancer, and thus might reduce the duration of comparative good health between recovery from surgery and onset of terminal ill-health when metastases have occurred. In addition, it seems likely that people would want to avoid the conditions of emergency colorectal cancer presentation in their own right (the pain, distension and malaise of intestinal obstruction and abdominal sepsis for example). The increased length of stay and increase rate of intensive care unit admission demonstrated in this study suggests that the emergency cases were significantly more unwell than elective cases, although these measures are indirect and may hide much larger quantitative and qualitative differences in the subjective experience of the people involved.

The results suggest further research initiatives specifically:

- An examination of case records to gain information about duration of symptoms, mode of presentation and disease stage at presentation. Combined with interviews with patient and/or clinician, to gain evidence concerning the reason for emergency presentation and whether it may have been avoidable,

- A qualitative assessment by patient interview of the experience of the different ways that colorectal cancer might present,

- A prospective or retrospective quantitative measurement of frequency and severity of admissions and other management costs for colorectal cancer, on a patient basis.

iii) Consideration of options for prevention of emergency admission

Strategies for the prevention of emergency colorectal cancer admissions could be devised once a better understanding of the reasons for emergency presentation were identified (as per study 1 above). This might include health promotion advertising to encourage presentation with symptoms earlier, and to sensitise general practitioners to inquire and investigate those symptoms. This would result in an increased numbers of investigations in people who have suggestive symptoms but do not have colorectal cancer, as well as investigation (with the associated costs) of those who do have colorectal cancer but who otherwise be diagnosed during emergency surgery. The cost of publicity would depend on the context in which such an initiative were introduced If, it were part of a comprehensive colorectal cancer service involving primary prevention, screening and early treatment, then the additional cost might be small. Awareness of the need to prevent emergency presentation may provide an additional incentive for people and their doctors to respond. Emergency presentation as a proportion of total presentations may be one performance indicator, along with stage of presentation, that could be used to judge the effectiveness of a screening/early intervention campaign.

A substantial research program would be required to establish the likely resource implications of a strategy to encourage earlier presentation and reduce the likelihood of emergency admission. In the absence of additional work it is not possible to even speculate whether such an approach would realise resource savings, or if more costly, whether any additional cost would be justified by a reduction in morbidity.

A possible consequence of this argument is that an attempt to prevent emergency admission for colorectal cancer should not be undertaken because it might increase costs. We reject this argument, since it seems to run counter to the primary aim of the hospital services, which we believe to be to offer to people the opportunity to prevent death and serious ill health resulting from identifiable serious disease. However, it does illustrate the need, when choosing between alternate ways of providing a service, to identify all cost implications of those alternatives.

iv) Funds

In the prevention of colorectal cancer, not only should the aim of service providers and funders be to reduce the incidence of colorectal cancer, but also that the service should bring about presentation of those cases that do occur, at an earlier stage of the disease. Targeted screening for early colorectal cancer and cancer precursor lesions, may bring about this shift in disease stage at presentation. To encourage earlier presentation, funders of health services might find it useful to know the stage of disease at presentation (e.g.Dukes' classification stage). This would create the possibility of providing incentives for initiatives that would result in earlier presentation.

Full integration of hospital, community and public health management of the issue of colorectal cancer is impeded by the organisational separation of those service providers and funding through separate programs. These problems may need to be addressed in order for management of colorectal cancer to move towards optimal, in resource allocation terms.

The Australian DRG system takes no account of emergency presentation at present. Our finding that emergency admissions incurred higher average costs than elective admissions, with two surgery-based DRGs showing 12% and 15% excess and one diagnostic-based DRG showing 100% excess, highlights a problem. An incentive is created in a competitive environment for hospitals to divert emergency cases towards another hospital. This argues for a review of the pertinent DRG codes to assess whether there are really two types of admissions, which need to be separately classified and costed. The best way of defining the different admission populations would need to be determined. Use of form of admission, elective or emergency may not be optimal.

Annex 5.1 References

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Annex 5.2 Measurement of Volume and Costs of Hospital In-patient Management of Cancer

For the purposes of planning and management of health services it may be necessary to estimate on a routine basis the volume and costs of provision services for particular diseases. This should in normal circumstances be derived from routinely collected data. This appendix describes the method used in this study to derive those costs. This methodology will apply to certain "dominant" disease conditions, in this case colorectal cancer, but may not apply to conditions that may be primary diseases or secondary results of other diseases, such as pneumonia or heart failure.

The costs and length of stay for admissions with colorectal cancer were estimated using the Victorian Inpatient Minimum Dataset (1995/6) and the 1995 Cost Weights Study Final Report (Tate *et al*, 1996). The full Victorian Inpatient Minimum Dataset was searched and cases selected if there was a principal diagnosis of colorectal cancer (ICD9 153 or 154) in any of the 12 diagnosis data-fields. From the selected admissions, data on length of stay, sources of admission, diagnoses, operations, ANDRG3 were selected (age and sex should be selected for in depth epidemiological assessments).

The selected database was then analysed by a statistical package (e.g. SPSS). The number of admissions in each ANDRG3 was counted, and the counts transferred to a spreadsheet package. This procedure was performed separately for daycase and overnight admissions. The mean cost for each ANDRG3 derived from the 1995 Cost Weights Study Final Report was then multiplied by the number of admissions to calculate the total cost per ANDRG3 in patients with colorectal cancer. Summation of the individual ANDRG3 costs will produce an estimate of total costs.

For the dataset thus created consisting of 23,399 admissions, there were 6920 admissions in which the ICD9 principle diagnosis code in the diagnosis 1 datafield was that for colorectal cancer (153-154). From the sequence of diagnoses in the twelve diagnostic datafields, it was possible to read a clear outline of the reasons for the admissions. For the vast majority of other admissions, the first principle diagnosis was a disease process or procedural event that definitely or probably resulted from a diagnosis of colorectal cancer that appeared in a later datafield. For example, 46 admissions had a first principle diagnosis of iron-deficiency anaemia, a known and common presentation of colorectal cancer due to slow bleeding from the cancer into the bowel. The largest single group of admissions were for maintenance chemotherapy (15,494 admissions). There were 28 admissions for other cancers, of which 16 were various urogenital tract cancers.

This procedure will produce a small overestimate due to the existence of concurrent colorectal cancer being recorded in someone admitted with an apparently unrelated underlying disease. The reasons for the occurrence of multiple independent diagnoses will include:

1. chance;

2. appropriate diagnostic bias (a lower threshold for investigation of symptoms in someone with colorectal cancer that excludes recurrent disease and diagnoses unrelated diseases); and

3. clustering of multiple diseases in a particular sicker group of people (e.g. those with high chronic alcohol intake).

In theory, none of the costs related to the chance occurrence of multiple diagnoses should be ascribed to colorectal cancer, whilst an indeterminate proportion of the other two reasons for the occurrence of multiple diagnoses should be so ascribed. It can be expected that a very complicated epidemiological investigation would be required to differentiate and quantify these effects, and in practice, for colorectal cancer, the difference in estimates will be very small.

Table 5.5 Costs* of Admissions for Colorectal Cancer in Victoria 1995/6 in Both Public and Private Hospitals, Analysed by ANDRG3 Code

ANDRG3	n	Cost/case	Total per ANDRG3	ANDRG3	n	Cost/case	Total per ANDRG3
Non-day case Inpatient				*Day case Inpatient*			
3	38	$45,467	$1,727,746				
305	1277	$12,479	$15,935,517				
306	755	$7,627	$5,758,695				
307	130	$11,438	$1,486,888				
308	249	$9,820	$2,445,180				
309	167	$6,946	$1,160,062				
322	38	$7,896	$300,055	322	7	$1,139	$7,973
329	45	$2,738	$123,198	329	23	$547	$12,576
330	22	$685	$15,074	330	142	$475	$67,500
336	900	$2,423	$2,180,520	336	765	$398	$304,554
780	17	$513	$8,726	780	15473	$432	$6,681,087
781	111	$5,763	$639,687	781	5	$500	$2,498
941	67	$7,023	$470,562				
Total	5178		$37,187,142	Total	18225		$8,046,328

* Assumes that DRG costs in 1995 Cost Weight Study can be applied to all Victorian hospitals; applying 1994/5 costs to 1995/6 admissions.

ANDRG3: 780 = Maintenance chemotherapy
781 = Radiotherapy

6 Colorectal Cancer, Diet & Lifestyle Factors: Opportunities for Prevention

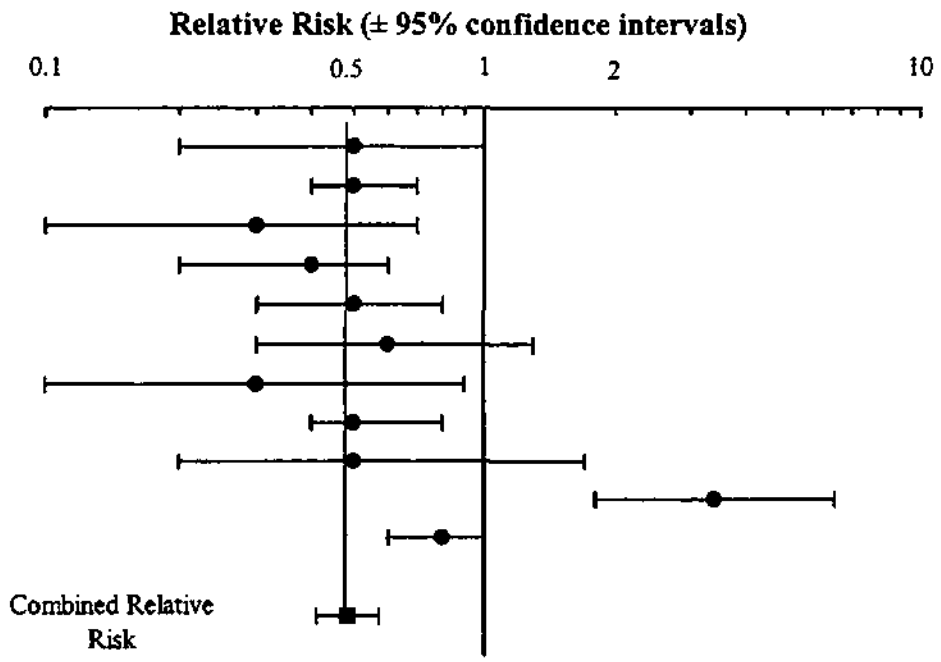
6.1 Summary

A considerable amount of observational evidence from case-control and cohort studies demonstrates an association between various dietary and lifestyle factors and risk of colorectal cancer. There is the potential for colorectal cancer risk reduction by decreasing consumption of animal fats, red meat, alcohol and cigarettes, by increasing physical activity levels, and by increasing intake of fruits, vegetables and dietary fibre. Few intervention studies have been performed to corroborate this potential. We argue, however, that the evidence is sufficient to support pilot implementation of lifestyle-modification programs in the context of targeted screening programs, and also the integration of prevention of colorectal cancer within a non-communicable disease strategy aimed at the general population. Evaluation of the costs and benefits of alternative strategies must be an integral part of program implementation, in order to advance the knowledge that we have on the impact of prevention strategies, so that resources are not wasted on ineffective interventions. Given the consistency of evidence relating lifestyle behaviours to colorectal cancer incidence and the negligible risk of undesirable consequences from promotion of a diet high in fruit, vegetables and fibre and low in red meat and animal fats, inaction can no longer be justified.

6.2 Introduction

Colorectal cancer is one of the most common forms of cancer in Australia, with an incidence similar to that of lung cancer. There were 4495 deaths in Australia in 1995 with an annual mortality rate for men of 26.6 and for women of 23.5 per 100,000 (Australian Bureau of Statistics 1996). There has been little change in mortality from colorectal cancer in marked comparison with the large reduction in mortality from cardiovascular disease (Figure 6.1) (Abraham *et al*, 1995).

Figure 6.1 Meta-Analysis of 9 Case Control Studies Demonstrating the Effect of Vegetable Consumption on the Risk of Colorectal Cancer, Comparing the Highest and Lowest Quintiles (Data from Trock *et al*, 1990)



Surgical excision of the bowel is normally curative when the cancer is detected before metastatic spread occurs, but symptoms often do not develop until after metastasis. Once metastasis has occurred, radiotherapy and chemotherapy may slow the progress of the disease, but death from colorectal cancer still eventually occurs. The mortality rate for colorectal cancer in Victoria is about 50% of the incidence rate (Giles 1993). colorectal cancer in most cases develops slowly over many years, and screening of asymptomatic populations allows a larger proportion of cases to be identified and treated before metastasis occurs. Such screening has been demonstrated to be effective (Mandel 1993; Kronborg 1996; Hardcastle 1996), but involves either fecal-occult-blood testing and sigmoidoscopy which are of low specificity and sensitivity, or colonoscopy which has greater accuracy but is costly (A$500-A$1000), unpleasant and associated with a definite risk of morbidity and mortality. Most colorectal cancer arises in colorectal adenomas, which are commonly found in older people (Peipins 1994). Local excision of adenomas during screening colonoscopy both treats the individual lesions, and identifies people at increased risk of future adenomas and colorectal cancer. These higher-risk individuals are then recommended for more intensive screening, such as with biannual colonoscopy. Currently, countries such as Australia (Solomon 1996), USA (J.A.M.A. 1996) and United Kingdom (Lieberman 1996) are considering systematic screening of asymptomatic populations in order to reduce colorectal cancer mortality. Such new services would increase resource use, at least in the short term. The major focus of such screening is the identification of colorectal cancers and adenomas for surgical excision. It also provides a context for a general population health promotion intervention, and the opportunity to identify a high-risk population for more intensive lifestyle interventions.

Epidemiological evidence suggests the possibility of prevention of colorectal cancer by changing diet and lifestyle, either by reducing the incidence of colorectal adenomas and cancers, and/or by slowing the rate of progression from adenomas to cancers to metastases. This section reviews recent studies addressing the association of colorectal cancer with dietary and lifestyle factors, and discusses these effects in the context of a strategy for the prevention of colorectal cancer and other non-communicable diseases.

6.3 Dietary and Lifestyle Factors in Colorectal Cancer

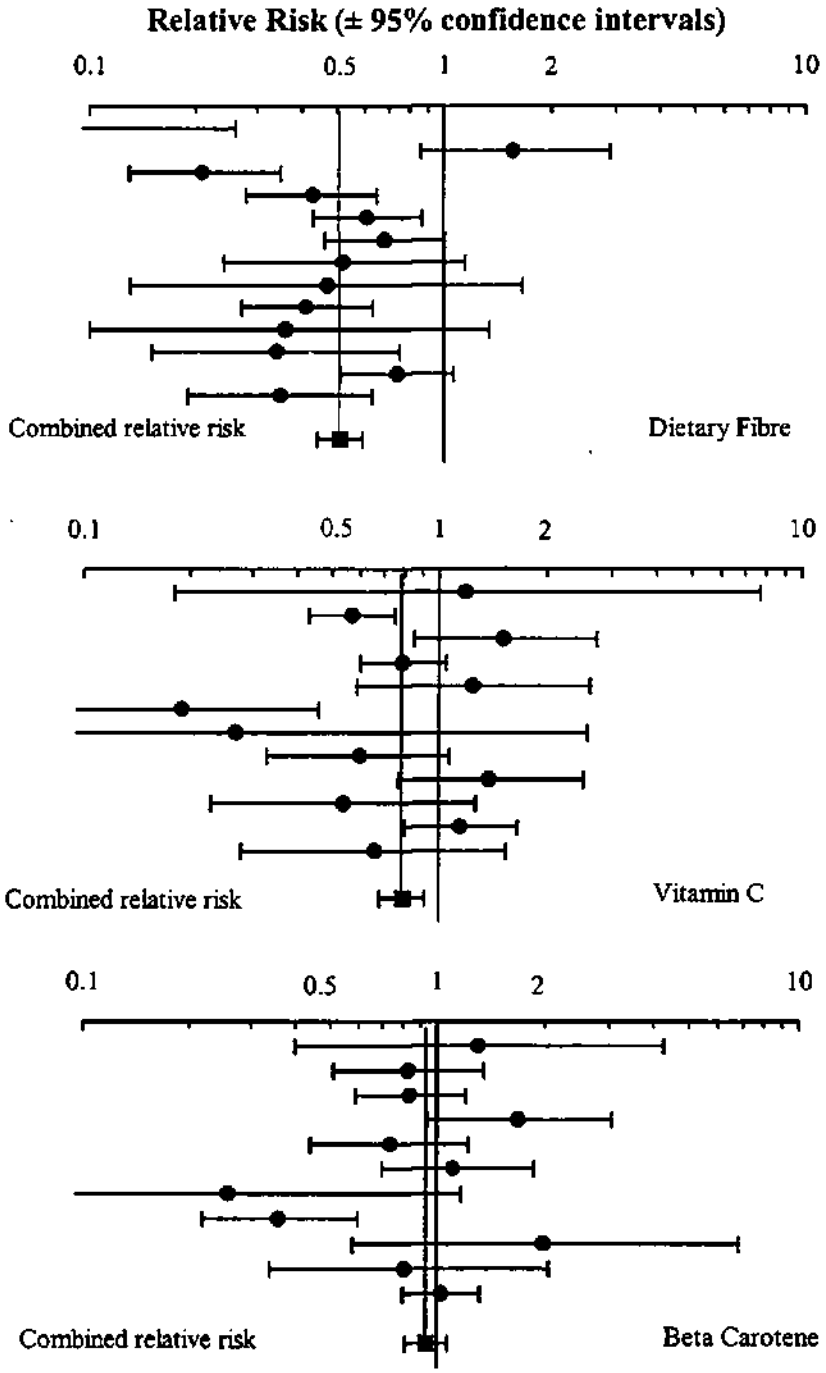
Wide geographic variation in colorectal cancer incidence, and changes in colorectal cancer incidence in migrant populations indicated the importance of environmental factors in colorectal cancer risk. In the 1960's, work by Wynder (1969) on dietary fat, and by Burkitt (1971) on dietary fibre indicated the importance of diet in colorectal cancer. A number of recent reviews (Potter *et al*, 1993; Willett 1995; Reddy 1995) have summarised our current understanding. They identify animal fat and red meat, and alcohol consumption as positively associated with colorectal cancer, and fruit, vegetable and dietary fibre consumption as negatively associated with colorectal cancer. In addition, physical inactivity and central obesity have been consistently associated with increased colorectal cancer incidence (Shephard 1996).

i) Fruit & vegetables

Greater consumption of fruit and vegetables is consistently reported to be associated with a lower risk of colorectal cancer. In a quantitative overview of the published results of 9 case-control studies (Trock *et al*, 1990), a combined relative risk of the effect of high and low intakes of vegetables of 0.48 (95% confidence intervals (CI 95%) 0.41 to 0.57) was calculated (see Figure 6.2). Thun *et* al (1992) found in a large cohort study that the relative risk for the highest versus the lowest quintile of vegetable consumption was 0.76 for men and 0.62 for women. A vegetarian diet has been shown in a cohort study (Frentzel-Beyme *et al*, 1994) to be associated with a relative risk of 0.44 for men and

0.78 for women compared to the general population, and long-term vegetarian diet (over 20 years) being associated with a relative risk of 0.51 compared to shorter duration of such a diet.

Figure 6.2 **Meta-Analysis of 13 Case-control Studies Demonstrating the Effect of Dietary Fibre, Vitamin C and Beta Carotene on the Risk of Colorectal Cancer, Comparing the Highest and Lowest Quintiles (Data from Howe *et al*, 1992).**

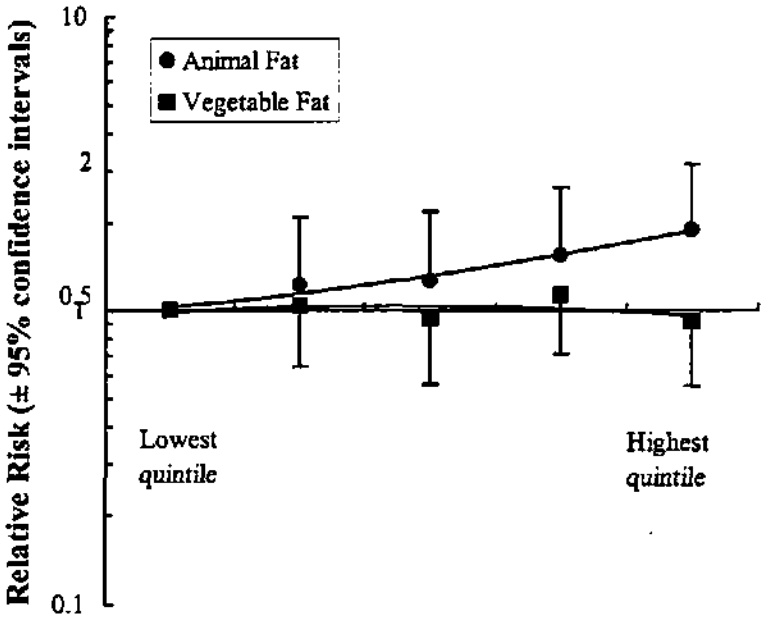


ii) Dietary fibre

Dietary fibre intake has been a focus of research into colorectal cancer risk following the observations of Burkitt (1971). In a meta-analysis of 13 case-control studies using the original study

data, Howe *et al* (1992) demonstrated that high fibre intake was associated with a combined relative risk of 0.51 for colorectal cancer (CI 95% 0.44 to 0.59), whilst the effects of the nutrients associated with high fibre foods (not taken as food supplements) had smaller independent roles: combined relative risk for vitamin C was 0.78 (CI 95% 0.68 to 0.91) and for beta-carotene was 0.93 (CI 95% 0.81 to 1.07) (see Figure 6.3). This study was not able to differentiate between different forms of dietary fibre, as an accompanying editorial points out (Dwyer *et al*, 1992). Fruit and vegetables, and cereals both contribute to the measured quantities of dietary fibre in epidemiological studies, and the different sources may contain different quantities of nutrients (Kaaks *et al*, 1995). For example, animal experiments suggest that wheat fibre has a beneficial effect whilst other cereals have little measurable effect.

Figure 6.3. Relationship Between Risk of Colorectal Cancer and Quintiles of Animal and Vegetable Fat Intake in American Women in the Nurses Cohort Study (Data from Willett *et al*, 1990)

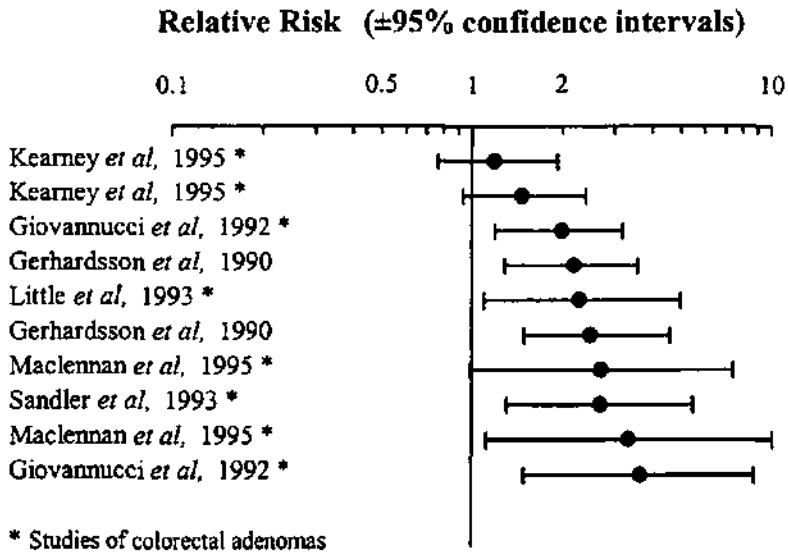


iii) Fats and oils

Wynder (1969) identified a strong correlation between colorectal cancer incidence and postulated dietary fat consumption, by comparing mortality rates and food disappearance data in a number of different countries. Case-control and prospective cohort studies have substantiated this effect within populations (Reddy 1993; Potter *et al*, 1993), although the magnitude of the effect is smaller because of relatively narrow ranges of fat intakes within populations. Willett (1990) demonstrated in a large cohort of women that animal fat is associated with this effect rather than vegetable fat (see Figure 6.4), particularly when associated with red meat, with the highest quintile having a relative risk of 1.9 compared to the lowest. The relationship between foods and colorectal cancer has been consistently identified in observational studies as illustrated in Figures 6.1 to 6.5.

The mechanism by which dietary fats increase the risk of colorectal cancer is unclear, but may be associated with the increased levels of fecal bile acids occurring in people on high fat diets. Fat increases bile acid production, thus increasing the exposure of the bowel mucosa to the trophic effects of bile acids (Hill *et al*, 1971). High animal fat intake is also associated with increased energy density and low fibre intake.

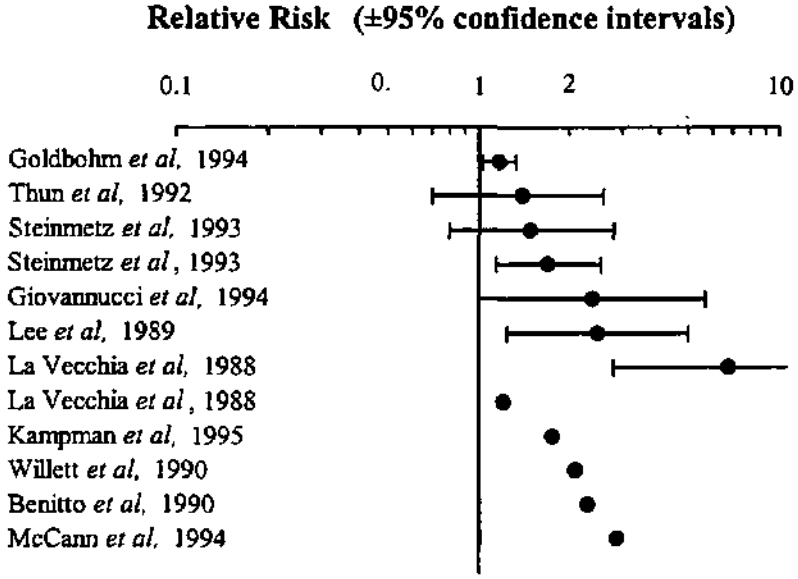
Figure 6.4 Relationship Between Risk of Colorectal Cancer and Fat Intake in Six Case-Control and Intervention Studies (Highest Intake Group Versus Lowest Intake)



iv) Meat, fish & eggs

A clear association of high red meat intake with colorectal cancer is demonstrated in a number of studies, and in particular, the analysis of the US male professional cohort study by Giovannucci (1994) demonstrated a strong effect. In this study, men who ate beef, pork or lamb as a main dish five or more times a week had a relative risk of 3.6 (CI 95% 1.58 to 8.06) compared to men eating these foods less than one a month. The consistency of finding in relation to red meat is illustrated in Figure 6.5. Poultry was generally associated with a decreased risk (Giovannucci *et al*, 1994; Iscovich *et al*, 1992). Fish and other forms of seafood intake may be a factor in risk reduction (Giovannucci *et al*, 1994; Iscovich *et al*, 1992; Kato *et al*, 1990; Potter *et al*, 1986). Eggs are in most cases associated with elevated colorectal cancer risk (Steinmetz *et al*, 1994) with risk ratios ranging from 1.6 to 6.3.

Figure 6.5 Relationship Between Risk of Colorectal Cancer and Red Meat Intake in Six Case-control and Cohort Studies



v) Dairy products

Studies have reached mixed conclusions concerning the effect of dairy products as colorectal cancer risk factors (Iscovich *et al*, 1992; Steinmetz *et al*, 1993; Centonze *et al*, 1994; Phillips *et al*, 1985). Dairy products are usually high in saturated fat associated with increased colorectal cancer risk, but also high in calcium associated with reduced colorectal cancer risk (Sorenson *et al*, 1988). Thus, there is the possibility of beneficial effects of low-fat dairy products, but this has not been directly examined by epidemiological studies.

6.4 Other Lifestyle Factors

i) Alcohol

Alcohol consumption has been found in a meta-analysis of published studies to be a small but significant risk, with a combined relative risk in 5 cohort studies of 1.32 (CI 95% 1.16 to 1.51), and a combined relative risk in 22 case-control studies of 1.07 (CI 95% 1.02 to 1.12) (Longnecker *et al*, 1990). The greater effect in the cohort studies may be explained by the inappropriate use of hospital controls in the case-control studies (Kune 1992).

ii) Smoking

Cigarette smoking was shown in a very large cohort study of 250,000 American veterans followed-up for 26 years to be a small but significant risk (Heineman *et al*, 1995), with a relative risk of 1.2 for colon cancer (CI 95% 1.1 to 1.4) and 1.4 for rectal cancer (CI 95% 1.2 to 1.7) in current cigarette smokers. Given the small magnitude of this effect, it is not surprising that smaller studies have found no consistent effect (Kune *et al*, 1992a).

iii) Aspirin

Regular ingestion of aspirin may have a protective effect against colorectal cancer, particularly when continued over a long period of years (Giovannucci *et al*, 1994a, Giovannucci *et al*, 1995, Thun *et al*, 1992), with a risk reduction of up to 44%. It can be noted that sulindac, a non-steroidal anti-inflammatory drug with an action similar to aspirin, has been demonstrated in a randomised controlled trial to delay recurrence of colorectal adenomas in people at high genetic risk of colorectal cancer development (Labayle *et al*, 1991).

iv) Physical activity

Both occupational and recreational activity is associated with reduced colorectal cancer risk (Potter *et al*, 1993; Shephard 1996). For example, in a nested case-control study (Giovannucci *et al*, 1995a), the relative risk was 0.53 (95% CI, 0.32 to 0.88) in those with the highest levels of activity. *Much of the benefit was seen in those with moderate levels of exercise, such as regular brisk* walking. Giovannucci (1995b) argued that elevated insulin levels associated with the insulin resistance of central obesity, inactivity and elevated saturated fat intake might be partially responsible for the adverse effect of sedentary lifestyle.

v) Overweight

Overweight has been shown to be a risk factor for colorectal cancer, particularly where body weight is in excess of 125% of ideal weight (Bostick *et al*, 1994; Giovannucci *et al*, 1995a; Phillips *et al*, 1985; Thun *et al*, 1992). Waist-to-hip ratio of 0.99 or more can elevate risk to over 3.4 (Giovannucci *et al*, 1995a). This study also demonstrated a positive association between height and colorectal cancer risk, a finding suggestive of early nutritional influences but whose interpretation is difficult because of socio-economic and behavioural confounding.

6.5 Intervention Trials

Five human intervention trials (Greenberg *et al*, 1994; MacLennan *et al*, 1995; McKeown-Eyssen *et al*, 1988; McKeown-Eyssen *et al*, 1994; Roncucci *et al*, 1993) have been performed to assess the effect of diet or dietary supplements on the recurrence rate of colorectal adenomatous polyps. No intervention trials have yet assessed the effects of diet on rates of colorectal cancer. The Australian Adenoma Study (Maclennan *et al*, 1995) was a three-factorial randomised trial of intake of fat, fibre and beta- carotene in subjects in whom at least one adenoma had been excised following colonoscopy. The beta-carotene arm of the trial was discontinued early because there was an increased rate of large adenoma recurrence. Both a fat-reduced diet and wheat-bran fibre supplements reduced the numbers of recurrent large adenomas, with no recurrent adenomas occurring in those receiving the combine low fat, fibre supplemented diet at the 24 and 48 month follow-up. A study (Greenberg *et al*, 1994) with reasonable subject numbers examining the effect of beta carotene and other anti oxidant supplements failed to detect a risk reduction associated with beta carotene, vitamin C or vitamin E supplementation. Two studies performed by a group in Toronto examining the effect of vitamins C and E (McKeown-Eyssen *et al*, 1988) and low fat high fibre diet (McKeown-Eyssen *et al*, 1994) failed to detect a difference, but subject numbers were inadequate to draw definitive conclusions. A small Italian study (Roncucci *et al*, 1993) found a large favourable effect of combined supplementation with vitamins A, C and E on the recurrence rate of adenomatous polyps. There is marked heterogeneous in these results, due in part to the small number of subjects studied to date, and differences in interventions and outcome variables.

6.6 Causal Mechanisms for Colorectal Cancer

Researchers from a number of different disciplines have addressed the causes of colorectal cancer (Potter *et al*, 1993), and the nature of the explanations have reflected the technologies and preferred models of each discipline. Thus there are epidemiological ("fat/fibre"), physiological ("bile acid/volatile fatty acid" and "hormonal"), cell biology ("growth media"), histopathological ("adenoma/carcinoma") and molecular genetics ("congenital and acquired mutation") hypotheses. It is likely that these can explain some of the observed behaviour of colorectal cancer, and it should be recognised that these explanations are not mutually exclusive. Thus, a high-fat diet may increase bile acid production and delivery to the colon, stimulating increased colonic cell proliferation, whilst fibre may increase bowel transit time, bind bile acids and be fermented to volatile fatty acids which reduce the toxic effects of bile acids. Hyperinsulinism as a result of low physical activity, obesity and a high saturated fat diet may slow bowel transit times. Anti-oxidant vitamins and minerals from fruit and vegetables may also reduce the toxic effects of bile acids. Increased toxic colonic cell proliferation would increase the rate of accumulation of genetic mutation in the crypt cells, making it more likely that combinations of mutations will occur that initiate adenomatous growths and the transformation of adenomas to cancers. Individuals already carrying inherited mutations may proceed along this path more rapidly.

6.7 Discussion

This review demonstrates that a variety of modifiable environmental and behavioural factors are associated with differences in colorectal cancer and colorectal cancer precursor incidence rates. This suggests the potential for colorectal cancer risk reduction by reducing animal fat, red meat and alcohol consumption, and by increasing fruit, vegetable and fibre intake, and undertaking regular physical activity. However, no intervention trials have yet been conducted that confirm the effectiveness of dietary or lifestyle factors in colorectal cancer prevention in unselected populations. This is due in part to the low disease incidence in unselected populations and the requirement for long-term intensive interventions in large numbers of subjects, in order to reliably demonstrate the

effect of dietary and lifestyle changes. Thus it is necessary to make judgements of the likely effects of dietary and lifestyle changes in the absence of optimum information.

A cautious approach should be taken towards a program of health promotion, particularly in the light of the effects of beta-carotene supplementation. Observational studies have shown consistent, strong beneficial effects of diets high in beta-carotene (La Vecchia *et al,* 1996), although as has been shown above, these beneficial effects are reduced when corrected for other nutrients. A recent Finnish trial (Heinonen *et al,* 1994) of beta-carotene and vitamin E supplements in smokers showed an increased incidence of lung cancer in those receiving beta-carotene. There is no clear explanation for this effect of beta-carotene supplements, although an Australian study showed that those taking beta-carotene supplements had significant changes in blood levels of a number of other vitamins (Wahlqvist *et al,* 1994).

The general point to be taken from the beta-carotene story is that food is not just a mixture of known food chemicals. It is a structured mix of interacting chemicals, some known, some not fully understood, some completely unknown. A prudent approach to these results would be a bias towards whole foods rather than adding or subtracting individual nutrient chemicals.

The complexity and uncertainty of food, its health effects, and the overlapping individual and social determinants of people's dietary behaviour make the conduct of rigorous randomised-controlled trials of different diets extraordinarily difficult, compared to a trial of a vitamin or fibre supplement. Achieving substantial dietary differences between intervention and control groups, and maintaining those differences over many years would be difficult and possibly ethically troubling. A high degree of confidence that the intervention was likely to be effective increases the confidence to commit the resources to conduct a trial, but also increases the ethical concerns about the advice to the control subjects. Large numbers of subjects would be required. As a substitute, the short-term effects of diet on intermediate indicators of colorectal cancer risk have been measured. The most relevant intermediate measure of colorectal cancer risk is the rate of colonic adenoma recurrence, especially adenomas greater than 10 mm. in diameter, following colonoscopic adenoma excision.

We believe that the remaining uncertainty in our understanding of modifiable risk for colorectal cancer is no excuse for failure to promote the conclusions that can be drawn from the observational studies. It seems justifiable to promote a whole food diet high in fresh fruit and vegetables, high in wheat fibre and low in fat, particularly saturated fat, combined with regular physical exercise. Fruit and vegetable intake is also inversely associate with the incidence of other cancers, particularly lung and stomach cancers (Steinmetz KA *et al,* 1996) Furthermore, this pattern of diet is similar, if not identical, to the one recommended to reduce CHD mortality, where the strength of evidence for lifestyle interventions is much more substantial.

The implementation of health promotion programs of lifestyle changes through a series of trials can also contribute to our knowledge of the costs and effectiveness of alternative strategies for colorectal cancer prevention. As the resources of the community are not unlimited, it is important to determine which intervention strategies can most effectively achieve the greatest reduction in morbidity and morality from colorectal cancer for the resources applied. It is possible to describe many alternative approaches to the prevention of colorectal cancer. A campaign may be population-based or targeted at those at elevated risk, defined for instance through family history, positive FOB test, diagnosis of colonic adenoma. A campaign may be focused solely on colorectal cancer prevention, or one conducted as part of a broader lifestyle campaign for all non-communicable diseases. The focus may be entirely on prevention of colorectal cancer, or integrated with a screening campaign for early detection of the

disease. Health promotion in the context of a screening program might encourage collaboration between the service provider and recipient, each being active in making a contribution to the desired outcome. A further option is to address the broad societal context of colorectal cancer, seeking alliances with for example the food and retail industries in order to facilitate behavioural change.

An important high risk group is persons with colonic adenomas. Current methods of screening for early colorectal cancer involve colonoscopy at some stage. A small number of people will be identified as having cancer, but a significant number will have colonic adenomas of varying sizes which will be excised. When one or more adenomas are found and excised, there is an increased risk of developing further adenomas, which have the potential for malignant change, and repeat screening at regular intervals is recommended for these patients. This group will be significant for at least three reasons. Firstly, it has been found that the prevalence of colonic adenomas at death is about 30% in US and European populations, that 37% of adenomas enlarge, and that the risk of progression from large adenoma to carcinoma is estimated as 25% over 20 years (Peipins *et al*, 1994). Secondly, people who have had a colonic adenoma excised will perceive themselves to be at risk of colorectal cancer, and may wish to take charge of their destinies and reduce that risk, and respond to behavioural change advice. Furthermore, access to a preventative component may improve the acceptability of a colorectal cancer screening program. Thirdly, the large group of people who have an adenoma excised and then have repeated colonoscopy after a fixed interval would be an ideal subject group for dietary intervention trials. The incidence of adenoma recurrence is relatively high, so the numbers of subjects per trial would not need to be as large to detect clinically significant differences. Since adenoma formation is believed to be a necessary late intermediate stage in the development of many colorectal cancers, it would seem justifiable to use this as an outcome measure to test the efficacy of a particular diet.

Dietary and lifestyle intervention trials in persons with colonic adenomas might be used to determine the optimum management of these patients, since finding a diet that prevents large adenoma recurrence might allow longer intervals between follow-up colonoscopies, thus reducing the costs to the health budget, and reducing morbidity and inconvenience to the patient. They may also be used to select the optimum diet for whole population intervention trials.

Determination of the preferred strategies, and the appropriate level of resourcing, requires consideration of both costs and likely effectiveness of a wide range of intervention options. Some of this analysis can be undertaken based on modeling incorporating best available evidence. However pilot implementation of intervention programs (incorporating an evaluation component), will be clearly valuable as a means of gathering evidence on costs and effectiveness to guide future decisions, and as potentially reducing the incidence, morbidity and mortality from colorectal cancer of Australians.

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7 Cost-Effectiveness Analysis of Diet and Lifestyle Intervention in Colorectal Cancer

7.1 Summary

When colorectal cancer is discovered because of the symptoms it produces, the disease will have progressed in about 50% of people to the point where the best treatment does not cure but only delays death from the disease. However, screening investigations in at-risk people can identify cancer earlier when a cure is more likely. Also, pre-cancerous changes can be detected identifying people at higher-risk of cancer, who can receive more intensive screening, and who may benefit most from health promotion services.

At present, there is no information available that demonstrates the effectiveness of diet and lifestyle changes in preventing colorectal cancer, although observational studies are suggestive. Any benefit would be expected to take some considerable time. However, there is some evidence that dietary change can influence the rate of recurrence of pre-cancerous lesions, which may be relevant to the frequency of repeat screening investigations.

Our analysis indicates that, assuming the effectiveness of dietary advice, a dietary advice component of a colorectal cancer screening program in higher-risk individuals would be cost saving. Therefore, there is an urgent need to confirm or refute the possible effectiveness of such a service.

In addition, our analysis indicates that a population-wide colorectal cancer screening program would dramatically increase costs. The service would depend on the supply of specialist colonoscopists, and that scarcity of these personnel might result in major cost increases and cost shifting that would need to be taken into account in the planning and roll-out of the service.

7.2 The Adenoma – Carcinoma Sequence and Possible Points of Intervention

Colorectal cancer arises from the epithelial layer of cells that lines the colon and rectum[1]. This layer of cells is constantly shedding and replacing itself by growth and cell division. Recent understanding of the molecular biology of colorectal cancer has identified a series of genetic changes that result in loss of control of this process, leading to the rate of cell replication exceeding the rate of cell differentiation and shedding. This leads to accumulation of undifferentiated, abnormal cells that do not respond to normal signals that limit their growth and movement. The genetic changes, of which about a dozen have so far been identified, have either been passed on from the person's parents, or arise by spontaneous mutations that accumulate as the person ages.

These cellular-level changes correspond roughly to a sequence of naked-eye adenocarcinoma progression. The normal epithelium first shows a diffuse overgrowth of apparently normal cells (hyperproliferative epithelium), followed by the development of distinct adenomas (abnormal epithelial growths that do not show evidence of local invasion). These adenomas are initially commoner in the rectum and lower colon. They progress by increasing in size and number. They also may develop stalks when more advanced, at which point they are referred to as polyps.

Essentially, abnormal appearances develop in the cell nuclei, and there follows invasion through the layers of the bowel wall into the abdominal spaces to affect adjacent tissues and organs. Once

localised invasion has occurred, distant spread of cancer deposits (metastases) becomes increasingly likely, with the liver and lungs most likely to be affected.

It should be noted that the genetic mutations that drive the development of the colorectal adenomas and carcinomas are found not only in the adenoma itself, but also in an area of normal looking cells around the adenoma. Thus removal of just the adenoma leaves cells bearing genetic mutations that trigger recurrence of adenomas, which can progress to carcinomas. This has relevance to people identified as having colorectal adenomas identified by diagnostic or screening investigations.

Observational epidemiological studies suggest that diet and lifestyle factors influence the rate of occurrence of colorectal cancer (see Chapter 6). These factors have the potential to influence the development of colorectal cancer at a number of points: increasing the rate of colorectal epithelial cell proliferation; increasing the rate of occurrence of mutations; increasing the incidence of adenoma formation; increasing the rate of adenoma enlargement; increasing the rate of Malignant transformation; and increasing the rate of growth of a carcinoma.

Therefore, dietary and lifestyle interventions to modify the development of colorectal cancer may be directed in a number of ways. Advice may be given to people before colorectal cancer its precursor adenomas manifest themselves. This may be directed at the general population, of to those identified as being at increased risk because of family history of colorectal cancer. Alternatively, advice may be given to those at increased risk of colorectal cancer because of demonstrated development of adenomas, particularly those who have developed large adenomas (>9mm).

In practice, this would mean:

- population-wide healthy eating / healthy living advice as part of general health promotion programs;

- general healthy eating / healthy living advice distributed to all participants in colorectal cancer screening programs;

- individual counseling and management including dietary and lifestyle advice, of those with family history of colorectal cancer;

- specific dietary and lifestyle counseling to those who have colorectal adenomas excised after being identified as a result of diagnostic investigations or screening of asymptomatic individuals;

- specific dietary and lifestyle counseling to those who have colorectal cancer excised.

At present, there is no evidence for the effectiveness in terms of reduction in incidence or mortality form colorectal cancer, of any of these strategies. There have been very few relevant studies performed, and none have used the incidence or mortality from colorectal cancer as endpoint's. The few intervention studies that have been performed have used the recurrence of colorectal adenomas after colonoscopic excision as a proxy measure for the development of colorectal cancer. Few of these studies have included sufficient numbers of subjects to reliably detect small but still valuable effects of dietary interventions. The one study that demonstrated a positive effect was the Australian Polyp Prevention Project[2], which showed a strong effect of a combined low-fat high-fibre diet, with a lower rate of development of large adenomas. (However, the study design meant that only 25% of the subjects were on this combination of diets, so that the number of adenomas observed was low).

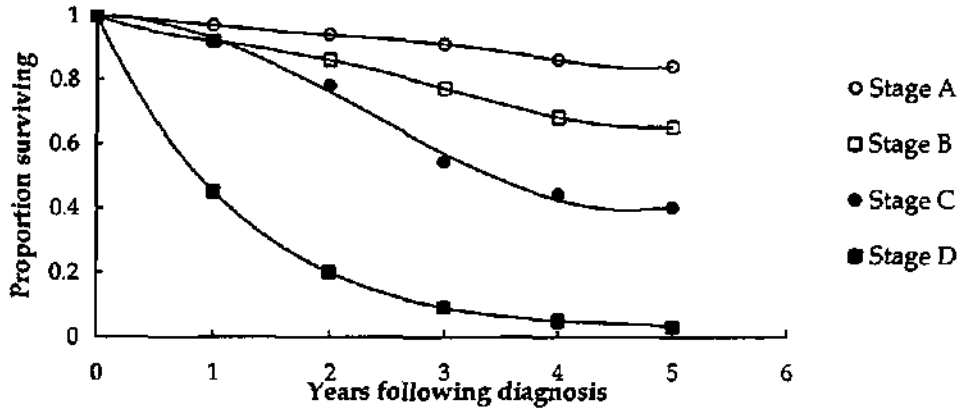
7.3 Quantitative Description of Changes in Rates of Adenoma – Carcinoma Events Over Time

Although it is unclear how long it takes for a small adenoma to progress to adenocarcinoma estimates range from 7 to 10 years[1]. However, it is likely that progression in a small number of individuals is much more rapid, whilst in others progression will never occur. The prevalence of adenomatous polyps is low in young adults with an exponential increase in frequency as people grow older[3]. This increase in frequency precedes and parallels the rise in adencarcinoma rates. At the time of death, between 20 and 45% of the population have small adenomas, depending on the country and local population examined.

A minority of small adenomas (possibly 37%) progress to large adenomas of 10mm or more. For those with large adenomas, 25% will develop carcinoma within a 20 year period. Only a small minority of those people who develop colorectal adenomas will progress to colorectal cancer, but very few colorectal cancers will develop in those who do not develop colorectal adenomas.

Once colorectal cancer has developed, there is a steadily-rising probability that distant spread of the disease will occur (although a precise quantitative estimate of this probability cannot be made from currently available sources because of the difficult of identifying the date of onset of the cancer). However, using the modified Dukes' grading system it is possible to roughly predict such probabilities (derived from the results of the randomised controlled trials of F.O.B.T. screening published in recent years[4-6].

Figure 7.1 Estimations of Survival from Stages of Colorectal Cancer



It can be seen from this that survival of people who have distant metastases at the time of diagnosis (Stage D) have a high probability of mortality within a short period of time (the majority of these deaths will be from colorectal cancer), but even for those in whom no distant metastases are detected at the time of diagnosis (Stage A) about 15% will die from their colorectal cancer. This is a measure of the limitation of our ability to detect the life-threatening components of the disease. It should be noted that in the screening trials, the survival of those in those screening with screening-detected Stage A colorectal cancer was better than for non screening detected Stage A cancers.

7.4 Summary of Screening for Colorectal Cancer

The rationale for screening for colorectal cancer is that many cancers have spread to distant sites before symptoms prompt the person to seek medical investigation and management. These cancers with metastases are extremely resistant to treatment, leading ultimately to death despite the best available therapy. There is some evidence that cancers diagnosed early are less likely to lead to

death. The cancers usually have been present for some considerable time before diagnosis following investigation of symptoms, and therefore would be available to be detected by screening in asymptomatic at-risk people.

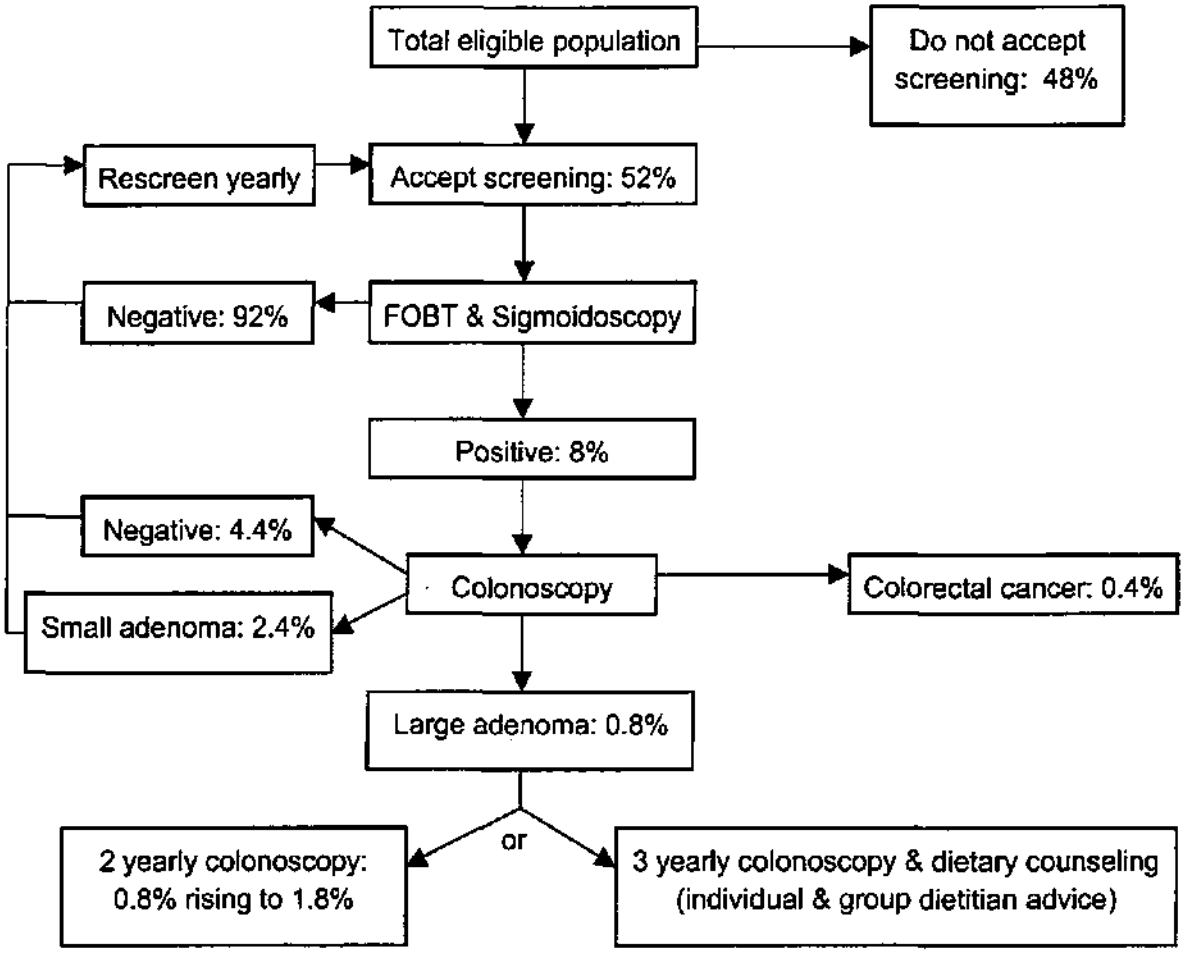
Current practice of screening for colorectal cancer usually involves a fecal occult blood screening test and / or sigmoidoscopy in the general population of people aged 50 - 75 years followed by definitive diagnosis using colonoscopy or less frequently double contrast barium enema. Fecal occult blood testing is used because colorectal cancers tend to lose small amounts of blood from their surface which can be detected by the sensitive but not specific test strips. Sigmoidoscopy will detect the less common rectal cancers which, although they bleed just as much, may be missed because of less complete mixing of faeces and blood.

Screening identifies not only a proportion of the colorectal cancers that may be present, but also a proportion of the colorectal adenomas. Although a smaller proportion of the adenomas are detected by the screening procedures compared to the cancers, because the absolute numbers of adenomas are much higher, adenomas form the majority of the lesions detected. These adenomas are usually removed by excision biopsy at the time they are seen during the colonoscopy or sigmoidoscopy, since their nature can only be determined under the microscope, and since they are regarded as pre-cancerous lesions. However, the underlying cellular changes are present in the non-excised adjacent areas, and the adenomas tend to recur relatively soon. As a result, people in whom an adenoma is found will often be invited to undergo regular (usually every 2 years) repeat colonoscopy as a colorectal cancer prevention measure, since it is believed that they have demonstrated that they have developed the genetic mutations that are capable of forming colorectal cancers.

Thus there are at least three outcome groups formed after colorectal cancer screening:

- those with colorectal cancer, who will be managed surgically and followed-up individually to detect metastatic and recurrent disease;
- those with no colorectal disease, who will continue in the standard colorectal cancer screening program, but will be regarded as disease-free;
- those in whom a colorectal adenoma is detected, and particularly those with large adenomas, who will receive enhanced screening in the form of regular colonoscopic examinations.

Figure 7.2 Costs of Screening for Colorectal Cancer with and without Dietary Advice



7.5 Annual Numbers of Colonoscopies Performed in Victoria

The population of Victoria in the age range 50 to 75 years is approximately 1,000,000. A 52% enrolment in this age group would thus include 520,000 in a colorectal cancer screening program, of whom 41,600 would provide positive initial screen results requiring colonoscopy each year. Of these, approximately 2,000 will have detected colorectal cancer in the first year, falling to approximately 1,400 per annum in subsequent years. 4,160 will be found to have large colorectal adenomas and 12,480 small adenomas, which will be excised. Current practice involves two yearly repeat colonoscopy in these patients to detect recurrence of the adenomas, which are regarded as pre-cancerous lesions. Thus each year there will be about 40,000 colonoscopies performed on those found to be screen positive, and either 4,000 rising to 9,000 colonoscopies for those with large adenomas or 16,000 rising to 20,000 colonoscopies for those with any adenoma for those on the biennial repeat colonoscopy program. Thus there would be between 42,000 and 50,000 colonoscopies performed each year as a result of the colorectal cancer screening program.

7.6 Prevention of Colorectal Cancer by Diet Changes

Although it has been demonstrated by observational epidemiological studies that diet and lifestyle changes may influence the incidence of colorectal cancer, it should be assumed that the size of any

benefit achieved would be dependent on the age at which people make those changes. The effects seen in the studies would reflect the effects of lifelong changes, whereas changes later in life should be assumed to produce smaller changes. The quoted benefits are derived from comparisons between the upper and lower quintiles (usually), so if the entire population changed its diet to that of the healthiest quintile, the benefit would be less than the difference between the upper and lower quintiles. Lesser degrees of change would produce proportionally less benefit. The interactions between different beneficial change are unknown: whether change is additive, synergistic or whether there is a fixed maximum benefit that can be achieved. Since there are so many imponderables, and no empirical evidence of benefit, no attempt will be made to estimate the effects of populations-wide primary prevention. *The question that will be addressed is whether there is benefit in adding a* dietary advice module to the colorectal cancer screening programs that are currently being considered.

7.7 Prevention of Colorectal Cancer by Diet Changes in a Screening Context

Two alternative programs are proposed to be compared for those demonstrated to have developed large adenomas, and are entered into a follow-up program. The standard management would be to perform 2 yearly repeat colonoscopy. This is contrasted with a program of 3 yearly repeat *colonoscopy with accompanying dietitian advice to achieve dietary change that would slow the* recurrence of the adenomas, thereby achieving the same outcome as the 2 yearly program. Such advice might aim to achieve a low-fat, high-fibre diet such as used in the Australian Polyp Prevention Project[2] . The program would involve one 45 minute consultation, followed by three 30 minute group education sessions, followed by one 20 minute individual consultation, in order to establish the person on the appropriate diet. This would then be followed by 6 monthly 20 minute individual consultations continued throughout the lifetime of the program, and a further 30 minute group session once every three years. The programs have been costed as if provided either in a public hospital, or in a private institution funded at Medicare payment rates, both discounted at 5% a year.

Item costs:	
Public hospital colonoscopy rate (day-case):	$ 800
Medicare rebate for private colonoscopy, including hospital and medical fees:	$1,500
Dietitian counseling in public hospital @ $48 per hour for 4.8 hours (over 3 yrs):	$ 230
Dietitian counseling in private hospital @ $60 per hour for 4.8 hours (over 3 yrs):	$ 288

Dietitian costs include:	1 x 1 hour individual session
	2 x 1 hour group (n=5) education sessions
	1 x 1/2 hour individual follow-up
	5 x 1/2 hour 6 monthly follow-up

Table 7.1 Costing of Alternative 1 (Public Hospital)

Public hospital 3 yearly colonoscopy and dietitian counseling: cost per person = $310 pa

Year	1	2	3	4	5	6	Total
Dietitian	$134	$46	$43	$70	$39	$37	$370
Colonoscopy	$800			$686			$1,486
							$1,855

Table 7.2 Costing of Alternative 2 (Public Hospital)

Public hospital 2 yearly colonoscopy: cost per person = $360 pa

Year	1	2	3	4	5	6	Total
Colonoscopy	$800		$722		$652		$2,174
							$2,174

Table 7.3 Costing of Alternative 3 (Private Hospital)

Private hospital 3 yearly colonoscopy and dietitian counseling: cost per person = $540 pa

Year	1	2	3	4	5	6	Total
Dietitian	$168	$57	$54	$93	$49	$46	$467
Colonoscopy	$1,500			$1,286			$2,786
							$3,253

Table 7.4 Costing of Alternative 4 (Private Hospital)

Private Hospital 2 yearly colonoscopy: cost per person = $680 pa

Year	1	2	3	4	5	6	Total
Colonoscopy	$1,500		$1,354		$1,222		$4,076
							$4,076

A comparison of Tables 7.1 and 7.2 indicates that there would be about 20% reduction in costs if a repeat colonoscopy program included dietary advice such that the two yearly repeat colonoscopy could be performed three yearly to produce the same benefits. It should be noted that there would be about a 2.5 times increased cost if these programs were performed in the private sector paid by Medicare compared with provision in public facilities.

Table 7.5 demonstrates for Victoria, the annual costs associated with the colonoscopic component and associated dietary management within the colorectal cancer screening program.

Table 7.5 Summary of Annual Costs for Program Alternatives 1 & 2: Victoria

	Program 1 3 yearly Colonoscopy and Diet		Program 2 2 yearly Colonoscopy	
	Public (a)	Private (b)	Public (a)	Private (b)
Screening colonoscopies	$ 28.0 M	$60.0 M	$ 28.0 M	$60.0 M
Repeat colonoscopies * (years 2 to 5)	$ 1.24 M	$ 2.16 M	$ 1.44 M	$ 2.72 M
Repeat colonoscopies ** (after 10 years)	$ 2.8 M	$ 4.9 M	$ 3.24 M	$ 6.12 M

* 4,000 per annum ** 9,000 per annum

The figures shown in Table 7.5 are premised on the assumption that the services: (a) are provided totally in the public hospitals when the costs would be borne by the state health budget, or (b) occur totally in Facilities where private services can be provided paid for by the Commonwealth via Medicare, health insurance funds and the patients themselves. The public service costs do not include or cover capital and training costs associated with establishing such a service, whereas the private costs must cover capital and training costs.

7.8 Conclusions

We have assumed in this analysis that the inclusion of dietary and lifestyle change advice as a component module of a program of follow-up of those found to have colorectal adenomas would allow the same benefits to be obtained from a three year period between repeat colonoscopies as would be obtained from a two year period without such advice. If this proposition were true, then this analysis demonstrates that inclusion of dietary advice is cost-saying. We believe that addition of this advice adds to the service the important values of patient autonomy and partnership, the patient being actively involved and responsible for the maintenance of their own health.

We do not know whether the two alternative are of equivalent effectiveness, or that one is better or worse than the other. There is no value in guessing which is best, because of the possibilities of bias influencing such guesswork. Thus there is a need for program development research to determine the mix of service that can achieve the best health value.

It is expected that screening for colorectal cancer by F.O.B.T. and/or sigmoidoscopy will be recommended in the near future. This carries the implication that these services will receive State/Commonwealth/health insurance funding. If this service is to be offered on a population-wide basis, then the costs in terms of just the colonoscopy component will be substantial. In Victoria, if this component is conducted in public hospitals, the funder costs would be about $28 million, whereas in the private facilities, the funder costs would be $60 million. This should be compared with the current expenditure in Victoria on all colorectal cancer hospital treatment of $45 million. The screening trials indicate that substantial benefits could be obtained by this level of investment.

The program would involve the performance of approximately 50,000 screening-related colonoscopies a year in Victoria. If a colonoscopist performs 1,200 colonoscopies a year, there would be the need for about 40 extra full-time equivalent specialist colonoscopists in the State. This increased demand for colonoscopists would require a substantial training program in order to supply the demand generated by the adoption of population screening. Since the new demand would appear immediately following commencement of the colorectal cancer screening program, demand would escalate dramatically. There is the possibility that this increase in demand for the services of specialist colonoscopists occurring, without a balancing increase in their supply, would lead to a shift of specialist colonoscopists from public to private practice. If this shift were to occur, there would be increased costs to the funders, since the higher costs of private services would have to be paid, rather than the lower public hospital costs. From the point of view of the Victorian State government, there would be a refer of costs to the Commonwealth, patients (co-payments), and possibly the health insurance funds. This effect needs to be carefully considered in the development of any planned service.

For the purposes of this analysis, the effect of a dietary advice module may allow a small reduction (about 3,000 out for 50,000 total colonoscopies a year) in the numbers of repeat colonoscopies in people found to have adenomas (which may eventually form 25% of the total colonoscopies performed).

Annex 7.1 References to Chapter 7

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8 Resource Implications of Drug Withdrawal and Lifestyle Advice for Management of Hypertension

8.1 Introduction

Hypertension is the most common problem treated by general practitioners in Australia (Bridges-Webb, 1992) and affects around 16% of all adults aged 20-69 years (National Heart Foundation, 1989). Although diet and sedentary lifestyle are known to be important risk factors for hypertension (MJA Suppl, 1994), the most common treatment for hypertension remains drug therapy. Furthermore, drug therapy for hypertension is typically a long term Cement for patients, even though it has been known for many years that some patients can be withdrawn from drug therapy for extended periods before rising blood pressure again indicates re-commencement of drug therapy. Lifestyle modification is known to increase the success of drug withdrawal.

Intermittent treatment of hypertension with drugs is obviously of lower pharmaceutical cost than continuous treatment. However, responsible patient management requires closer monitoring of patients during periods of drug withdrawal, particularly in the early stages and training in lifestyle change. Provided that blood pressure control results in the same final health outcomes, regardless of whether it is achieved by continuous drug therapy or intermittent therapy, the economic desirability of intermittent therapy is dependent upon the balance of savings from reduced drug consumption and the additional costs of monitoring and lifestyle advice. While a number of trials report on the effect of withdrawal of anti- hypertensive medication and of lifestyle advice on blood pressure control, we have been unable to identify any trials that establish the long term effects of intermittent therapy on final health outcomes. We thus have no evidence concerning the validity of the assumption of equivalent health outcomes. However, we note that modification of lifestyle behaviours to reduce blood pressure, may also improve other risk factors (such as weight and fitness). Thus it is plausible that achievement of equivalent blood pressure control through lifestyle change may be associated with improved health outcomes. Thus a presumption of equivalence is considered conservative given the potential for additional benefits from non drug management.

The approach to the economic analysis of hypertension adopted here addresses the consequences of including, for eligible patients only, (intermittent) drug withdrawal, supported by lifestyle advice in the existing protocol for managing hypertension. The evaluation draws in part upon the Hypertension Evaluation Action Trial (HEART) as well as the international literature.

8.2 Risks for Hypertension

Hypertension is a condition of raised blood pressure. It commonly has no clear cause but in a minority of cases, known as secondary hypertension, is due to endocrine or renal causes. It is hypothesised that hypertension is not just a condition of increased intra-arterial pressure, but is frequently part of a syndrome commonly associated with insulin resistance, dyslipidaemia, central obesity, renal abnormalities as well as abnormalities of smooth muscle (Houston, 1993, Franklin, 1996).

The modifiable risk factors for hypertension include smoking, poor nutrition resulting in dyslipidaemia and overweight, sedentary lifestyle and excessive alcohol intake. Some 30% of hypertension has been attributed to individuals being overweight and at least 60% of overweight individuals will become hypertensive over a 10 to 15 year period. A strong predictor of hypertension is abdominal

fat, measured by waist/hip ratio where upper limits are 0.9 for men and 0.8 for women. This suggest the possible role for lifestyle interventions, (Consensus Conference of Hypertension 1994).

As exercise increases blood pressure during the period of exercise, it is appropriate to ensure good blood pressure prior to commencement of an exercise program. Subject to this qualification, the benefits of exercise have been well documented. A meta-analysis of the impact of aerobic exercise on blood pressure found it resulted in reductions of 6 and 7 mmHg for systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively in borderline hypertensives, and a 10 and 8 mmHg reduction in hypertensives (Laragh, 1995).

8.3 Rationale for Selection of Case Study

The rationale for selecting hypertension management as the subject of an economic evaluation is based upon:

i) Disease burden

- the prevalence of hypertension in the Australian population is estimated at 16% of adults and 45% of person aged 60 to 65 (see Table 8.1),
- the management of hypertension consumes substantial health care resource, drug costs alone cost an estimated $400 million (or more depending on basis for the estimate), with total costs of management estimated at $812 million (see Table 8.7 and Section 2). Hypertension is responsible for an estimated 9.5%of all GP consultations (Bridges Webb 1994),
- significant long term health implications of high blood pressure and the beneficial impact of lowering blood pressure.

ii) Evidence of effectiveness of alternative management options

- there is evidence of the effectiveness of lifestyle management, which is a component of best practice management,
- the literature reports successful drug withdrawal for lengthy periods, particularly when supported by lifestyle/nutritional education.

iii) Consideration of health system issues

- the analysis in Section 4 suggests that non-medical modes of management, such as lifestyle interventions are likely to be underutilised, in comparison with medical therapies, such as drugs.

A number of these matters are explained further below. They suggest that the current management of hypertension, specifically the role for non-drug approaches, may well represent an area where the allocation of health resources may be sub-optimal. It thus was identified as an area of management which warrants further investigation. We have undertaken a preliminary review at this stage, which is reported here. We plan also to undertake further research on this matter, which will be reported on at a later date.

Table 8.1 The Prevalence of Hypertension in Australia

Sex/Hypertensive level	20-29	30-39	40-49	50-59	60-69	All 20-69
Men						
Hypertensives	3.5	8.5	16.8	31.2	40.4	18.3
Treated & Controlled [a]	0.5	1.1	3.5	8.8	14.9	5.0
Treated & Uncontrolled [b]	0.2	0.8	2.8	7.7	10.3	3.8
Undetected [c]	2.9	6.6	10.5	14.7	15.2	9.5
Normotensive [d]	96.5	91.5	86.3	68.8	59.6	81.7
Women						
Hypertensives	0.7	2.6	8.8	26.5	46.5	14.3
Treated & Controlled [a]	0.3	0.8	5.0	12.9	22.4	7.0
Treated & Uncontrolled [b]	0.2	0.3	1.4	5.2	10.7	2.9
Undetected [c]	0.3	1.6	2.4	8.4	13.4	4.4
Normotensive [d]	99.3	97.4	91.2	73.5	53.5	85.7

Source: National Heart Foundation Risk Factor Prevalence Study, 1989

Notes: (a) On medication for blood pressure and DBP <95 mmHg and SBP < 160 mmHg
(b) Not on medication for blood pressure and DBP ≥ 95 mmHg and SBP ≥160 mmHg
(c) Not on medication for blood pressure and DBP < 95 mmHg and SBP < 160 mmHg

8.4 Long Term Health Implications of Hypertension and the Beneficial Impact of Lowering Blood Pressure

As reported in Section 2, CVD remains the major contributor to mortality in Australia. Hypertension is a known risk factor for CVD. It has been estimated that hypertension accounts for between 20 and 25% of all coronary heart disease deaths (National Heart Foundation, 1996) with hypertension a greater risk for stroke (Neaton, 1993). The Framingham Study of the determinants of cardiovascular and cerebrovascular mortality and morbidity has shown that the risk of sudden death from all-causes was three fold higher for hypertensive patients (Dawber, 1980).

It is well documented through large international clinical trials that lowering of blood pressure through drug therapy yields beneficial health outcomes. The Systolic Hypertension in the Elderly Program (SHEP), in 1984 focused upon the impact of drug therapy for isolated systolic hypertension. Over 4,700 patients aged 62 years or older were recruited and randomised into initial treatment (low-dose diuretic) or placebo in a double blind trial. Dosage was adjusted with a second drug (atenolol or reserpine). Subjects were followed for an average of 4.5 years and a significant reduction in the relative risk of stroke to 0.64 (CI 0.5-0.82) was observed in the intervention group. The relative risk of coronary heart disease was also reduced to 0.75 (CI 0.6-0.94). The observed beneficial effect of treatment will understate the real benefit, as the analysis was done on the basis of 'intention to treat', and during the course of the trial some 44% of the control group were changed from placebo to active intervention.

The effects of anti-hypertensive therapy in mild hypertension show significant but smaller results. The Australian trial (Australian National Blood Committee, 1980)[i] showed a statistically significant 50% reduction in cardiovascular events and cardiovascular mortality. A meta-analysis of five studies including the Australian trial indicates a statistically significant ($p < 0.0001$) reduction in total strokes of 41% (+ 8%) and a non-significant reduction in coronary heart events of 10%.

The reduction in absolute risk (in terms of number of lives saved for instance), varies by initial risk. Such that those at higher initial risk, e.g. by virtue of age or co-morbidities will have the greatest absolute potential for benefit and for whom therefore therapy should be most cost-effective, as illustrated in Table 8.2.

Table 8.2 Mortality Rates (Per 100 Patients Years) in Hypertension Detection and Follow-up Program (Mild Hypertension)

	Stepped Care Group	Referred Care Group	Mortality Change
In patients with complications	15.6	20	-22%
In patients without complications	4.5	5.8	-22%

Source: Hypertension Detection and Follow-up Program Cooperative Group 1979

The epidemiological evidence available has been used to suggest that higher blood pressure, at any level, is linked to increased risk of cardiovascular disease. This issue is the subject of on-going research and clinical debate and, in the interim, the dividing line between the definitions of normotensive and hypertensive remain somewhat arbitrary.

The structural abnormalities of hyper tension in the heart and smooth muscle contribute to maintenance of hypertension (Adams, 1989). Drug therapy for at least 12 months can show a reversal of these structural abnormalities. This consequence of drug therapy is of importance to the rationale for focusing upon drug withdrawal as it suggests the possibility of a reduced need for anti-hypertensive drugs.

8.5 Drug Withdrawal – With and Without Lifestyle Education

The ability for a proportion of long term users of anti-hypertensive agents to cease drug use for extended periods has been established for over thirty years (Page, 1962). Details of a number of international studies that have trialed drug withdrawal are shown in Table 8.3. It can be seen that the proportion of patients who remain normotensive for extended periods, without alternative therapy is between 6% and 30%. International trials, involving drug withdrawal supported by lifestyle management education enables successful withdrawal from drug therapy of a greater proportion, reported at between 44-70% of patients a t 12 months or beyond. The results of the Australian HEART trial are consistent with the international literature.

While the conventional approach to the treatment of hypertension is long term drug therapy, clinical trial evidence demonstrates that many hypertensive patients can be withdrawn from drug therapy for extended periods. The period of withdrawal, without an increase in blood pressure indicating resumption of drug therapy, varies from a few months up to several years. The withdrawal of a patient from drug therapy offers savings in resource costs from lower drug consumption and a lower side effect profile, but possibly additional costs through increased monitoring by the general

practitioner. In addition, there may be quality of life gains from a reduction in drug induced side effects, from a greater sense of control over the patients own health through reduced reliance on medication and other quality of life advantages associated with lifestyle change.

8.6 Options for the Management of Hypertension

Whilst disease management can be undertaken in a variety of settings, the management of hypertension in Australia is primarily the responsibility of general practitioners. This reflects in large part the predominant role of the general practitioner as the primary care physician. This is reinforced by a number of the special privileges; their fees are rebatable under Medicare, only they can make a referral to a specialist whereby the specialist consult is reimbursable and only they (with other medical practitioners) have authority for prescribing.

For the delivery of lifestyle education programs allied health professionals, specifically dietitians, nurse educators, fitness experts, as well as the general practitioner, or a multi-disciplinary life style management program, represent some of the alternatives. In Australia" health system, given that the diagnosis and management of hypertension is primarily the responsibility of general practitioners and that 86% of the population see a general practitioner at least once per year (Deeble, 1990), and general practitioners are trained in the diagnosis of risk factors, general practitioners are a possible vehicle for the conduct of lifestyle education. Where other health professionals deliver life style advice/programs this would ideally be in cooperation with general practitioners to ensure appropriate drug therapy, and a consistent approach from all health professionals involved in the patients care.

The analysis here is based on a general practitioner based service, where drug withdrawal and lifestyle advice is provided by the GP. This reflects both the reality of Australia's funding arrangements but also access to pertinent studies which use the GP to deliver lifestyle advice.

The Hypertension Evaluation Action Research Trial (HEART) (Reid, 1993), an Australian trial designed to explore the effectiveness of lifestyle intervention in the control of blood pressure, and the capacity to reduce reliance on drugs, is based on general practitioner service delivery. Features of this trial form the basis for the model we have evaluated. It is thus briefly described here. HEART proceeded through the recruitment of GPs in Melbourne's western suburbs. Thirteen of the 38 'participating' GPs recruited patients into the trial. The trial identified a reluctance on the part of the GPs to remove drug therapy and explore an alternative approaches to management (Reid *et al*, 1993). Forty-five patients with uncomplicated hypertension were recruited through the 13 GPs who identified eligible and consenting patients. These patients were randomly allocated to control and intervention groups, with all patients in the intervention group being withdrawn from drug therapy.

Both groups received intensive lifestyle counseling based on behavioural change principles (Prochaska, 1983). (The behavioural modification of Prochaska and DiClemente recognised that the path to lifestyle change is usually characterised by periods of progress and regression requiring individualised support and re-setting of goals as appropriate). Patients were monitored for 9 months.

The stages of the intervention comprised:

- Recruitment of GP's into the trial and training of GPs in lifestyle advice/support and in identification of suitable patients,

- Identification of suitable patients for the Trial being long term users of anti-hypertensive agents, well controlled without complications who are prepared to participate,

- Negotiation of management plan by GP with the patient to reduce CVD risk. The role of drug therapy in control of hypertension and the possibility for achieving control through lifestyle adjustment is explained. The lifestyle changes needed are determined. For patient in the intervention group anti-hypertensive agents are withdrawn. Regular follow-up visits to the GP are part of the management plan.

- The GP assists the patient to make lifestyle changes through provision of advice, printed materials and encouragement. Over time risks are reassessed, blood pressure taken and further assistance offered to help patients achieve their targets. Anti-hypertensive agents are reintroduced if blood pressure becomes uncontrolled.

The printed materials supplied to the GPs and patients were developed under the HEART program and supported the behaviour change principles underpinning the program. An information booklet on the program was given to participating GPs. Participating patients received a patient information booklet on drug withdrawal which outlined the collaborative nature of the program (between patient and doctor) and the available support from the community. They also received two booklets on appropriate diet and exercises, specifically aimed at lowering blood pressure.

The results of the HEART program revealed that after 9 months, there was no significant difference between control and intervention groups in the mean blood pressure level. In the intervention group 71% remained off drug therapy and with good blood pressure control. it was additionally reported that the intervention group achieved a reduction in their body mass index of an average of 6%.

8.7 Description of Intervention Subject to Review

The design of the intervention program explored here is based on HEART but modified to take account of elements more appropriate to clinical practice. The program evaluated is designed around four main components: the set-up phase involving enlistment and training of GP's, followed by patient recruitment, negotiation of patient plan including withdrawal of anti-hypertensive drugs, and assistance with achievement of goals (through provision of written materials etc.) and goal revision.

Some elements of program costs have been estimated by reference to a CVD risk factor reduction trial, Heartwise undertaken by the Department of Community Medicine, Melbourne University. This trial was similar in scale and design to HEART. Although the aim of Heartwise was a reduction in multiple risk factors for CVD through behaviour modification, focused on management of cholesterol. Heartwise trained GPs in the use of the same behavioural change techniques as used in HEART, using the same printed materials.

It is envisaged that the program would be coordinated by a Department of Health or other central administrative unit and recruitment of GPs would be through Divisions of General Practice. Once recruited, GP's would attend training workshops to reinforce their risk identification skills and enhance their capacity to deliver an effective behavioural change intervention. it was assumed that GPs would recruit patients continuously over a 12 month period.

The potential subjects of drug withdrawal are those patients whose hypertension is under good control, based on conventional diagnostic values (DBP less than 95 mmHg and SBP less than 160

mmHg. Exclusion criteria in relation to complications would also be defined. Patients must have been on drug therapy for a least 12 months and with good control for at least the previous 6 months. Patients must be agreeable to termination of drug therapy and adoption of a more healthy lifestyle, and be prepared to re-attend for monitoring and re-setting of goals at 1 week, 2 weeks, and the 1, 3, 6 and 9 months.

8.8 Preliminary Cost-effectiveness

The alternative approaches to management of hypertension are evaluated essentially in terms of their differential impact on health care resource use. The analysis presumes that blood pressure is to be controlled at all times, with drug therapy when indicated. Equivalent health outcomes for both drug withdrawal and continuous therapy cohorts is assumed. That is satisfactory blood pressure control is presumed to be associated with equivalent outcomes, regardless of modality of management. This assumption is to be relaxed in an extension of this research.

The two alternative management options explored are;

i) maintenance of anti-hypertensive therapy,

ii) drug withdrawal accompanied by lifestyle education.

The primary study time frame is 12 months, for which outcomes can be derived from clinical trial results. A 15 year time frame during which eligible patients are treated by intermittent therapy, is also considered but this is more speculative.

To determine the resource implications of adoption of drug withdrawal protocol combined with lifestyle advice, as an alternative to normal care of maintenance of drug therapy, estimates are required of:

- cost of recruitment and training of GPs to implement protocol and deliver lifestyle advice,
- cost of patient recruitment,
- duration for which drug withdrawal can be sustained with lifestyle education, for 12 months and 15 years,
- the cost of managing hypertension with drugs.

Cost of GP Recruitment and Training

The cost of recruitment of GPs depends on recruitment methods and rate of recruitment achieved. Depending on the purpose for which GPs are being recruited recruitment rates and thus cost vary. It is difficult to extrapolate from a clinical trial as the requirements on GP participants are quite different to that associated with normal clinical practice. In the Heartwise trial, 114 GP's were identified in two Divisions of General Practice 32% declined to participate 53% were identified in two Divisions of General Practice 32% declined to participate 53% were identified as ineligible for the research trial, with 16% agreeing to participate, with active participation 12%. In discussion with GP divisions, recruitment rates can be far higher. Recruitment would be expected to be undertaken by the Divisions, through letter, other publicity, phone call and visit. Divisions suggest that the costs of recruiting GPs into programs varies from less than $100/GP to perhaps up to $1,000 or even higher

for very 'unattractive' programs. A figure of $1,150 per GP recruited is used in the analysis, which would cover the costs of a research officer for 2 months to recruit ~ 10 GPs, allowing for overheads and direct costs. Training cost is estimated at $350/GP, based on the experience of Heartwise (covering the cost of group training session and valuation of GP time for attendance at $95.41/hour). Total cost for recruitment and training of GPs is thus estimated at $1500/GP.

Patient 'Recruitment'

The management of hypertensive patients is one of the services offered by general practitioners. The intervention essentially involves educating GPs to offer drug withdrawal with lifestyle support as one of the management options. In that sense while patient recruitment is a legitimate cost in a clinical trial setting, it is not clear that it represents an identifiable cost in normal clinical practice. One might propose that the review of anti-hypertensive patients to establish and as necessary modify management is an integral component of normal clinical practice.

We have estimated the number of patients on drugs for high blood pressure who meet the criteria for drug withdrawal and would accept a trial off blood pressure medication supported by lifestyle change. The National Heart Foundation prevalence study estimates that 9.5% of adults (to age 75) are treated for hypertension. In relation to a typical GP practice of 1,000 patients (of ~ 750 adults) this suggest management of about 70 patients with hypertension (excluding those with undetected hypertension). The HEART and a much larger trial, Australian National Blood Pressure trial (ANBP2), report that 50% of hypertensive patients meet the criteria for drug withdrawal and are willing to participate. A single GP may have some 35 patients suitable and prepared to trial drug withdrawal with lifestyle support.

Duration of Drug Withdrawal with Lifestyle Education

There are a number of published reports of drug withdrawal without lifestyle support, as reported in Table 8.3. Fewer studies have investigated the effect of withdrawal of anti-hypertensive agents when accompanied by lifestyle intervention. A number are reported in Table 8.4. The findings of these trial document a wide range of outcomes, which perhaps not surprising given the wide range in entry criteria and study protocols. For studies of drug withdrawal without lifestyle advice, results at 12 months show the number of subjects remaining off anti-hypertensive medication at between 21% and 70%.

The most commonly reported result is around 40%. With the addition of lifestyle advice/support the proportion still off medication at 12 months is reported to be 44% (Stamler *et al.*, 1984), 60% (Blaufox *et al.*, 1984), 71% (Langford *et al.*, 1985) and 71% at 9 months (Reid *et al.*, 1995). Collectively the trials indicate that for many hypertensive patients who are well controlled on anti-hypertensive agents, drug therapy can be withdrawn and good blood pressure control maintained for extended periods, and that the period of withdrawal can be increased through lifestyle intervention.

On the basis of the literature it was assumed that over the first 12 months after drug withdrawal, with lifestyle advice, 10% of patients recommenced drug therapy within an average of 5 days, 80% achieved drug withdrawal for at least 6 months days and that 65% were still off drugs at the end of 12 months.

We also have undertaken a hypothetical analysis based on 15 year timeframe. In this case we assumed that 10% of patients recommenced drug therapy within 5 days, 80% of patients achieved

drug withdrawal for a least 6 months, 70% are off drugs at the end of 12 months, that a further 20% would recommence therapy by 24 months (50% still off drugs), with 40%* off drugs at 3 years and that 10% of all patients would still be off drugs at 15 years. For the 30% (off drugs at 3 years but not indefinitely) it is presumed they follow a five year cycle of intermittent therapy comprising 4 years on lifestyle management followed by 12 months of drug treatment. (*In the Trial by Stamler *et al.*, 1984, at 38 months, 44% of those given nutrition counseling were still well controlled without drugs at 36 months).

Table 8.3 Studies of Anti-hypertensive Drug Withdrawal (only)

Author	Study Group	Pre-treatment DBP (mmHg)	Duration of treatment (yrs)	DBP at withdrawal (mmHg)	Recommence therapy (mmHg)	Follow-up (months)	%normo-tensive at follow-up
Page, I.H. & Dunstan, H.P. 1962, 'Persistence of normal blood pressure after discontinuing treatment in hypertensive patients', *JAMA*, 253:433-436	Observational Study: 27 severe hypertensive 19 essential, 3 renal, 4 malignant	Not Provided	0.5 – 25	Not Provided	<95	6.60	33%
Thurm R.H. & Smith, W.M. 1967, 'On resetting the "Barostats" in hypertensive patients', *JAMA* 201: 301-304	Observational study: 69 mild moderate hypertensives	>90 mmHg	2	<90	>90	24	23%
Dunstan, H.P. *et al*, 1968, 'Arterial pressure responses to discontinuing anti-hypertensive drugs', *Circulation*, 27:370-379	Observational study: 60 severe hypertensive – 39 essential	>120	0.5 – 25	≤95	Not Provided	96	6%
Veterans Administration Cooperative Study Group on Anti-hypertensive Drugs 1975, 'Return of elevated blood pressure after withdrawal of anti-hypertensive drugs' *Circulation*, 51:1107-13.	Randomised double-blind placebo controlled study: 60 severe hypertensives	>110	5	≤95	1 visit>129 2 visits>99 3 visits>94	18	15%
Levinson, PD, Khatri, IM, Freis, E.D. 1982, 'Persistence of normal BP after withdrawal of drug treatment in mild hypertension', *Arch Intern Med, 142: 2265-68.*	Observational placebo controlled study: 24 mild hypertensive well controlled on diuretics alone	90 – 109	≥1 Mean = 3	≤90	1 visit>114 2 visits>114 3 visits>104 5 visits>94	6 12	46% 21%
Maland L.J., Lutz, L.J. & Castle, C.H. 1983, 'Effects of withdrawing diuretic therapy on blood pressure in mild hypertension', *Hypertension*, 5: 539-544.	Double blind placebo controlled study: 62 mild hypertensive patients on diuretic therapy	Mean = 99	1	<90 Mean = 78	1 visit>105 2 visits>95 3 visits>90	12	64%

Author	Study Group	Pre-treatment DBP (mmHg)	Duration of treatment (yrs)	DBP at withdrawal (mmHg)	Recommence therapy (mmHg)	Follow-up (months)	%normo-tensive at follow-up
Hansen, A.G., Jensen, H., Laugesen, LP & Petersen, A. 1983, 'Withdrawal of anti-hypertensive drugs in the elderly', *Acta Med Scand*', 676(S):178-185.	Observational study: 105 hypertensives > 60 yrs	Not Provided	Not Provided	<110	>110	12	41%
Finnerty, F.A. 1984, 'Step-down treatment of mild systemic hypertension', *Am J Cardiol* 53: 304-307.	Observational study: 67 mild hypertensives	>95	0.5	≤85	>85 mmHg	24 30 48	56% 54% 54%
Stamler, R. al, (1984) see Table 7.04							
Medical Research Council Working Party on Mild Hypertension, 1986, 'Course of blood pressure in mild hypertensives after withdrawal of long term anti-hypertensive treatment', *BMJ* 293: 988-992.	Randomised controlled trial – 2765 subjects from the MRC Phase 1 trial	90 – 1-9	6	≤90	>90	24	drug B: M=44%,F=54% Propanolol M=47%,F=27%
Alderman, M.H. *et al*, 1986, 'Anti-hypertensive drug therapy withdrawal in a general population', *Arch Intern Med* 146: 1309-1311.	Observational study: 66 hypertensive patients	>95	>0.5	Mean<85	2 visits>95	12 24	69.8% 54.5%
Fagefbeerg, B. *et al*, 1992, 'Withdrawal of anti-hypertensive drug treatment: time-course for redevelopment of hypertension and effects upon left ventricular mass', *J Hypertension*, 10:587–593.	Observational study: 32 men aged 56 years	>100	84s	Mean <85	≥ 105 mmHg	36	0%
Takala, Y. *et al*, 1992, 'Comparison of with-drawing anti-hypertensive therapy between diuretics and angiotensin converting enzyme inhibitors in essential hypertensives', *Am Heart J*, 124:1574–80.	Non-thiazide diuretics withdrawn n=35, ACE withdrawn – n=37, Continued therapy – n=41	≥90	Not Provided	≤90	≥105	12	Diuretic group 41% ACE group – 37%

Table 8.4 Studies of Anti-hypertensive Drug Withdrawal Accompanied by Lifestyle Education

Author	Study Group	Pre-treatment DBP (mmHg)	Duration of treatment (yrs)	Recommence therapy (mmHg)	Follow-up (months)	%normo-tensive at follow-up
# Blaufox, M.D. *et al*, 1984	Randomised controlled study: 496 mild hypertensives. Effect of ordinary intervention following drug withdrawal	>95	5	1 visit > 105	14	Placebo – 355 Weight loss group 60% Diet group 525
Reid *et al*, 1995abstract European Society for Hypertension Meeting	Randomised control study: 24 continued medication, 24 drug withdrawal, both groups received lifestyle support				9 months	Drug withdrawal group 71% also mean 6% reduced BMI
Darne B. *et al*, 1993	Randomised control trial of 54 obese subjects with mild to moderate hypertension	>90	5	1 visit > 115 2 visits > 90	10 months	Diet group: average 50% reduction in anti-hypertensive drugs
Stamler, R. *et al*, 1984	Randomised controlled study: Group 1 (n=97) drug withdrawal/nutrition counseling, Group 2 (n=44) drug withdrawal, Group 3 (n=48) continued medication	>90	5	1 visit > 115 2 visits > 90	38	Group 1 – 44% Group 2 – 15%

8.9 Differential Costs of Management

The impact of drug withdrawal on health service costs is determined from consideration of items of costs that will differ between the two modalities. These are:

- cost of recruitment/training of GPs for drug withdrawal and lifestyle advice,
- cost of drug therapy,
- cost of GP consultations.

All other times of cost of management of hypertension are expected to be equivalent between the two groups. The frequency of consultations for the drug withdrawal group was taken from HEART trial results. The cost of these consultations is based on the scheduled Fee (Commonwealth Medical Benefits Schedule, 1996), and taken at $22 for a standard consultation. Based on consultations at 1 and 2 weeks, e, 6, 9 and 12 months the total cost per patient over 12 months would be $132, (6 x $22.00).

Costing of Traditional Drug Management

Patient management of hypertension by general practitioners is not uniform but rather varies widely (Ruth, 1993), creating a difficulty in defining 'current practice'. Average or typical practice has been inferred from an analysis of national data on drug use, surveys of consultation frequencies and information on total medical services.

The costs to the health care system of managing hypertension could in theory include attribution of a proportion of in-patient costs. However, given the focus of this analysis on the direct management of hypertension and the presumption that health outcomes would be the same given equivalent blood pressure control, any costs for the management of complications are presumed to be equivalent between both groups.

The frequency of GP consultation for hypertension is identified in a number of surveys. (Bridges-Webb, 1992), Sayer G, 1994, Steven I, 1992). It was reported that 6.4% of all consultations (Sayer, 1994), and 9.5% of all 'management' encounters (Bridges-Webb, 1992), related to hypertension. It is also known that hypertensive patients who comply with their drug therapy would need to renew their prescriptions approximately every 3 months. The Health Insurance Commission records 188.1 million medical services in 1994/5 of which 98.56 million were unreferred services (largely GP services) with 17.5 million specialist attendances. If between 6.4% and 9.5% of GP consultations were related to hypertension this would represents perhaps 7.5 million GP consultations for hypertension. Based on the National Heart Foundation survey (modified in view of the absence from the survey of persons 70+), the number of diagnosed hypertensives in Australia is estimated at 1.4 million adults. This suggests 5.36 GP consultation per annum per patient for the management of hypertension. In the absence of data on length of consultation for management of hypertension, we have assumed 3 short consultations at $15 each plus 2 standard consultations at $22 each, at a total cost of $90.

The value of prescriptions for anti-hypertensive drugs on in the Pharmaceutical Benefits Scheme was obtained from the Federal Department of Health and Family Services for 1995/6. The drug classes

encompassed by the data are listed in Table 8.5 (for a complete list of the drugs contributing these aggregates, refer Annex 8.2).

Henry *et al*, 1994 reviewed the use of anti-hypertensive medications and reported the breakdown of use by indicator including hypertension. The proportions estimated by Henry *et al* are given in column 3 of Table 8.6. They have been applied to the Department of Health data to estimate the annual cost of prescriptions of hypertension at $397.2 million. When related to the estimated number of persons diagnosed and treated for hypertension of 1.4 million adults, this is equivalent to an average annual drug cost per person of $283.

The addition of assumed consultation costs to estimated drug use yields a combined average cost of hypertension, based on 'standard care' of $373 per patient, per annum.

Table 8.5 Anti-hypertensive Agents Consumed in Australia, 1995/6

Pharmaceutical Class	Characteristic			
	Prescriptions	Benefit ($)	Co-payment ($)	Costs ($)
ACE Inhibiters	8,270,940	222,537,697	52,556,206	275,093,903
Anti-hypertensives	1,047,800	14,056,856	1,030,176	15,087,032
Beta Blockers	3,523,607	31,453,835	8,883,555	40,337,390
Ca Channel Blockers	7,179,788	138,970,185	38,752,110	177,722,295
Diuretics	2,902,906	24,885,306	8,357,463	33,242,769
TOTAL	22,925,041	431,903,879	109,579,510	541,483,389

(a) Government subsidy through Pharmaceutical Benefit Scheme
(b) Co-payment
(c) Total cost comprising co-payment plus government subsidy

Table 8.6 Cost of Anti-hypertensive Drugs Adjusted for Primary Indication

Drug Category Aggregate Costs % attributed to hypertension			Total cost of drugs for hypertension
ACE Inhibiters	$275,093,903	79.1%	$217,599,277
Other Anti-hypertensives	$ 15,087,032	86.3%	$ 13,020,109
Beta Blockers	$ 40,337,390	76.7%	$ 30,938,778
Ca Channel blockers	$177,722,295	67.0%	$119,073,938
Diuretics	$ 33,242,769	50.0%	$ 16,621,385
TOTAL : all categories	$541,483,389		$397,253,486

8.10 Results

Based on the assumptions described above, which incorporate the available evidence from the literature and published data on prevalence of hypertension and cost of management, the relative cost of standard care, and drug withdrawal supported by lifestyle advice have been calculated. The results are shown in Tables 8.7 and 8.8. Our analysis suggests that a program to encourage withdrawal of anti-hypertensive drugs in a suitable population could result in savings in the first 12 months of $138 per participant. This means that for persons with well controlled blood pressure, and without serious co-morbidities, a program of drug withdrawal supported by lifestyle advice could reduce the total cost of management for blood pressure to around two thirds of the cost of traditional management which relies on continuous medication. As this alternative modality may be appropriate for perhaps 50% of those currently managed for high blood pressure, the potential savings are in the order of $92 million. However, as in reality it is unlikely all (or perhaps even most) GPs could be persuaded to revise their current management practice, it is unlikely that such savings would be realised.

Table 8.7 Indicative Results–12 Months

Cost Component	Annual cost of management Usual Care	Cost of management drug withdrawal with GP delivered lifestyle advice	Difference: withdrawal of drugs compared with usual care
GP recruitment and training	not applicable	$ 43*	+$ 43
GP consultations	$ 90	$132	(saving) $ 42
Healthy lifestyle materials	not applicable	$ 8	
Drug therapy	$283	$ 60#	(saving) $223
TOTAL dollars per head	$373	$243	(saving) $130

Source: see text
Notes: * $1500/GP allocated across 35 patients (see text)
10%x12 months + 10% x 9 months 15% x 3 months (65% off drugs for 12 months)

Table 8.8 Indicative results – Cost of Management for Hypertension Per Patient: 15 Years

Cost Component	Cost of management usual care	Cost of management drug withdrawal with GP delivered lifestyle advice	Difference: withdrawal of drugs compared with usual care
GP recruitment and training	not applicable	$ 43	$ 43
GP consultations	$ 966*	$1,133 ^	$ 167
Healthy lifestyle materials	not applicable	$ 8	$ 8
Drug therapy	$3,038*	$1,826#	(saving) $1,212
TOTAL	$4,004	$3,008	(saving) $ 994

Note: * $90/annum, and $283/annum for 15 years discounted at 5%/annum
^ after 2 years GP visits assumed to revert to 5 per annum, as per usual care
# 10% x 15 years, 10% x 14 years 9 months, 10% x 14 years, 20% x 13.5 years, 10% x 12.5 years, + 30% x 3 years, 10% no drugs

The twelve month analysis ignores the longer term evidence that for many patients still off drugs at 12 months, drug therapy will need to be resumed at some time. On the other hand over a longer period, the recruitment and training of GPs could be spread over more patients, reducing these costs on a per patient basis. We have therefore attempted an indicative costing of management over 15 years, for traditional drug based management and drug withdrawal with lifestyle advice. With future costs discounted at 5% per annum, savings are estimated at $994 present value cost per participant. This represents approximately 125% saving on the direct cost of management of high blood pressure.

8.11 Discussion

This analysis suggests that substantial saving in the cost of management of blood pressure are possible through a change in management involving a trial off blood pressure medication supported by lifestyle advice, for persons with well controlled uncomplicated hypertension. This will indicate a desirable resource shift, provide the assumption of at least equivalent health outcomes is valid. Given the requirement under both management modalities to maintain acceptable blood pressure control, it is not unreasonable to presume the assumption to be correct.

The estimated cost saving relies on a relatively small additional cost for GP consultations, for lifestyle materials and for the recruitment and training of GPs, being offset by a substantial reduction in drug costs. Of course if drug withdrawal is not maintained for the periods presumed the cost savings will not be realised. The literature is however, quite consistent in suggesting that a majority of patients can be withdrawn from anti-hypertensive medication for at least 12 months, with still a sizeable proportion off drugs at 3 years. Whether this also means that long term intermittent therapy is a viable option as assumed in our model is not known. The long term trials of this type have not been done. If drug therapy were to become far cheaper this would also limit the potential savings. In fact over the last decade the cost of managing hypertension has increased rapidly with a shift in prescribing to new agents such as the ACE inhibiters which are far more costly than the older drugs.

The analysis does suggest a possible inefficiency in the way hypertension is currently being managed, with the possibility of substantial resource savings through encouragement of a trial of drug withdrawal in suitable patents supported by lifestyle advice. The most critical assumption of the whole analysis is that of equivalence of health outcome. The drug withdrawal trials use blood pressure and numbers of participant still off drug therapy as their endpoints. They do not report CVD events or mortality. Given patient numbers and period of follow-up, they would not have the power to explore these end points. If there were to be a change in management to promote drug withdrawal, it would be desirable to gain direct evidence of the likely impact from large randomised trials to determine the clinical acceptability. It is of course possible that achievement of adequate blood pressure control through lifestyle modification may enhance health endpoints, due to the advantageous effect of lifestyle change on independent CVD risk factors. The issue of health outcomes is to be explored further in a follow up study.

Annex 8.1 Protocol for Hypertension Management

i) Diagnosis

Natural fluctuations in blood pressure are such that the diagnosis of hypertension is based upon an average of repeated readings, with classification of patients as nominated below.

Table 8.9 Classification of Hypertension by Blood Pressure Reading

	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)
Mild hypertension	140–180	and/or	90–105
Borderline Hypertension	140–160	and/or	90–95
Moderate/Severe Hypertension	≥ 180	and/or	≥105
Isolated Systolic Hypertension (ISH)	≥ 160	and	<90
Borderline ISH	140–160	and	<90

Source: MJA Vol. 160 [Suppl]. 21/3/94

Table 8.10 Follow-up Criteria for Adults Aged 18 Years and Over

	Recommended Follow-up
Diastolic	
<85	Recheck within 2 years
85–95	Recheck within 1 year
90–104	Confirm within 2 months
105–114	Evaluate or refer within 2 weeks
≥115	Evaluate of refer immediately
Systolic when diastolic is <90	
<140	Recheck within 2 years
140–190	Confirm within 2 months
≥200	Evaluate or refer within 2 weeks

Source: MJA Vol. 160 [Suppl]. 21/3/94.

ii) Managing Hypertension

The aim of management is to lower blood pressure management and prevent target organ damage (kidney, heart). The aim of therapy should be to reduce blood pressure to at least 140/90 mmHg, (MJA, 1994). Lifestyle change is acknowledged as an important part of treatment but, the focus of the Consensus statement is when and how to introduce drug therapy. The consensus group suggested β blockers and diuretics be used as first line drugs. In relation to monitoring and review, the guidelines state that the frequency should depend upon the extent of coexisting conditions. For uncomplicated hypertension, review every 3 to 6 months was considered appropriate (MJA Suppl, 1994, pS15).

Annex 8.2 Anti-Hypertensive Medications

Captopril
Cilazapril Monohydrate
Enalapril Maleate
Fosinopril Sodium
Lisinopril
Perindopril Erbumine
Quinapril Hydrochloride
Ranipril
Trandolapril
Clonidine
Diazoxide
Hydralazine Hydrochloride
Methyldopa
Minoxidil
Prazosin Hydrochloride
Sodium Nitroprusside
Alprenolol Hydrochloride
Atenolol
Labetalol Hydrochloride
Metoprolol Tartrate
Oxprenolol Hydrochloride
Pindolol
Propanolol Hydrochloride
Sotalol Hydrochloride
Timolol Maleate
Amlodipine Besylate
Dilitiazen Hydrochloride
Felodipine
Nifedipine
Perhexiline Mateate
Vermapil Hydrochloride
Amiloride Hydrochloride
Bendrofluazide
Bumetamide
Chlorothiazide
Chlorthalidone
Cyclopenthiazide
Ethacrynic Acid
Frusemide
Hydrochlorothiazide Amiloride
Hydrochlorothiazide Triamteren
Indapamide
Methyclothiazide
Metolazone
Quinethazone
Spironolactone
Triamterene

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APPENDIX 1

Table 1.1 CVD Expenditure: Australia 1989/90

	Expenditure ($mill) per health delivery setting						
	Hospital	Medical	Pharma-ceutical	Allied health	Nursing home	Total	% total
CVD (total)	1140	356	424	35	530	2485	
% of total	46	14	17	1	21		
Acute/chronic rheumatic disease	13	1	2	0.3	1	18	1
Hypertension	24	168	251	19	14	477	20
Ischaemic heart disease	424	56	66	4	35	585	24
acute myocardial infarction	131	2	1	0	14	148	
other acute/subacute	47	1	0.5	0	2	50	
other ischaemic disease	246	53	65	4	19	387	
Pulmonary circulation diseases	16	2	1	0.1	3	22	1
tobacco complication	3	0	0.5	0	0	4	
other	13	1	1		2	18	
Other Heart Disease	236	62	74	4	112	488	20
cardiac dysrrhythmias	74	23	18	1	11	128	
heart failure	115	32	53	3	97	301	
other	47	7	3	0	3	60	
Stroke	178	18	10	3	306	515	21
Diseases of arteries (1)	110	15	6	2	45	178	7
atherosclerosis	13	1	1	0	11	27	
peripheral artery disease	89	12	4	2	33	140	
diabetes complications. PAD	*38*	*5*	*2*	*1*	*23*	*69*	
other PAD	*51*	*7*	*2*	*1*	*10*	*71*	
other	8	2	1	0	1	12	
Diseases of veins (2)	138	33	14	2	14	201	8
diabetes complications	3	1	0	0	2	6	
other	134	33	13	2	13	195	
CHD	*563*	*256*	*371*	*26*	*146*	*1363*	*55*

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.2 Cancer Expenditure: Australia 1989/90

	Expenditure ($mill) per health delivery setting						
	Hospital	Medical	Pharma-ceutical	Allied health	Nursing home	Total	% total
Neoplasm (all)	**798**	**127**	**20**	**9**	**121**	**1076**	
% of total	74	12	2	1	11		
Cancer	**658**	**66**	**17**	**6**	**113**	**860**	**80**
Lip, Oral Cavity, Pharynx	**18**	**1**	**0**	**0**	**4**	**23**	**2**
Digestive Organs	**147**	**8**	**3**	**2**	**22**	**182**	**17**
Colorectal	***79***	***5***	***1***	***1***	***15***	***100***	***9***
Colon	44	3	1	1	8	57	
Rectal	35	2	0	0	6	44	
Other (1)	68	4	2	0	7	82	
Respiratory Organs	**74**	**5**	**3**	**1**	**12**	**95**	**8**
Lung	65	3	3	1	11	82	
Other (2)	10	1	0	0	1	12	
Bone, Connective Tissue, *Skin, Breast*	**135**	**37**	**3**	**2**	**17**	**194**	**18**
Skin melanoma	13	5	0	0	1	19	
Skin nonmelanoma	65	27	1	1	5	100	
Breast female	48	4	2	1	10	65	
Other	8	0	0	0	1	9	
Genitourinary Organs	**102**	**9**	**5**	**0.8**	**28**	**144**	**13**
Prostate	25	5	3	1	12	45	
Bladder	27	1	0	0	5	33	
Kidney	13	1	0	0	3	18	
Other (3)	39	3	0	0	7	47	
Other Unspecified Organs	**100**	**3**	**2**	**0**	**20**	**125**	**12**
Brain & Nerves	20	1	0	0	6	27	
Other	80	2	1	0	14	98	
Lymph & haemopoetic	**81**	**4**	**1**	**0**	**10**	**97**	**9**
Non-Hodgkin's	33	1	0	0	3	38	
Leukemia	31	2	0	0	4	37	
Other (4)	18	2	0	0	3	22	
Carcinoma in Situ (5)	**14**	**1**	**0**	**0**	**0**	**16**	**1**

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of oesophageal, stomach, liver & intrahepatic, pancreas and other GI organs
(2) inclusive of laryngeal, pleura and other cancers of the respiratory organs
(3) inclusive of uterus, cervix, ovary, urinary organs, testes & other GU organs
(4) inclusive of Hodgkin's and other diseases of lymphatic & haemopoetic tissue
(5) inclusive of respiratory, skin, breast, cervix & other forms of carcinoma in situ

Table 1.3 National Mortality & Morbidity: Heart Disease 1989/90

	Mortality		Morbidity				PYLL	
	Deaths		Admissions		Bed days		To age 75	
	1,000	% total	1,000	% total	1,000	% total	1,000	% total
CVD (total)	**57**		**284**		**2,769**		**200**	
Acute/chronic rheumatic	**0.4**	0.8	**2**	**1**	**18**	**1**	**3**	**2**
Hypertension	**1**	2	**9**	3	**76**	3	**3**	**2**
Ischaemic heart disease	**33**	57	**99**	35	**732**	26	**127**	64
acute myocardial infarction	22		29		292			
other acute/subacute IHD	0		15		97			
other IHD	11		54		344			
Pulmonary circulation	**0.2**	0	**4**	**1**	**43**	**2**	**2**	**1**
tobacco complication	0		1		6			
other	0		3		36			
Other heart disease	**6**	**11**	**53**	**19**	**591**	**21**	**22**	**13**
cardiac dysrhythmias	1		22		119			
heart failure	4		30		393		*8*	
other	2		8		79			
Stroke	**13**	**22**	**39**	**14**	**753**	**27**	**32**	**16**
Diseases of arteries (1)	**3**	**6**	**22**	**8**	**264**	**10**	**7**	**4**
atherosclerosis	1		2		33			
peripheral artery disease	2		18		211			
diabetes complic. PAD	*1*		*8*		*102*			
other PAD	*1*		*10*		*109*			
other	0		3		20			
Diseases of veins (2)	**0.2**	0	**48**	**17**	**291**	**11**	**2**	**1**
diabetes complications	0		1		8			
other	0.2		48		283			
CHD	*38*	*66*	*138*	*49*	*1,202*	*43*	*138*	*69*

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.4 National Mortality & Morbidity: Cancer 1989/90

	Mortality		Morbidity				PYLL	
	Deaths		Admissions		Bed days		To age 75	
	1,000	% total	1,000	% total	1,000	% total	1,000	% total
Neoplasm (all)	**31**		**239**		**1,761**		**237**	
Cancer	**30**	99	**165**	69	**1,504**	85	**235**	99
Lip, Oral Cavity, Pharynx	**1**	2	**4**	2	**39**	2	**6**	2
Digestive Organs	**9**	28	**26**	11	**336**	19	**55**	23
Colorectal	***4***	*14*	***14***	*6*	***197***	*11*	***27***	*11*
Colon	3		8		111			
Rectal	1		6		86			
Other (1)	4	0	11	0	140			
Respiratory Organs	**7**	22	**17**	7	177	10	**82**	34
Lung	6		15		154			
Other (2)	0		1		24			
Bone, Connective Tissue	**4**	12	**43**	18	**273**	15	**43**	18
Skin melanoma	1		4		26			
Skin nonmelanoma	0		23		102			
Breast female	2		14		127			
Breast Male	0		0		1			
Other	0		2		18			
Genitourinary Organs	**5**	15	**32**	14	**270**	15	**27**	11
Prostate	2		8		95			
Bladder	1		11		56			
Kidney	1		2		31			
Other (3)	*1*		*10*		*89*			
Other Unspecified Organs	**3**	9	**23**	10	**258**	15	**28**	12
Brain & Nervous	1		3		53			
Other	2		20		205			
Lymph & Haemopoietic Tissue	**3**	9	**20**	8	**151**	9	**29**	12
Non-Hodgkin's	1		8		62			
Leukemia	1		7		55			
Other (4)	1		5		34			
Benign Neoplasms	**0**	0	**60**	25	**200**	11	**1047**	0
Carcinoma in Situ (5)	**0**	0	**8**	0	**24**	0		
Neoplasm Unspec/uncert	**0**	1	**6**	3	**33**	2	**1**	1
Skin Cancers (6)	***1***	*3*	***45***	*19*	***156***	*9*	***12***	*5*
Breast Cancers (6)	***2***	*8*	***23***	*10*	***136***	*7*	***27***	*11*

Source: *AIHW Cost of Illness Data 1989/90*

Notes: (1) inclusive of oesophageal, stomach, liver & intrahepatic, pancreas and other GI organs
(2) inclusive of laryngeal, pleura and other cancers of the respiratory organs
(3) inclusive of cancers of the uterus, cervix, ovary, urinary organs, testes & other GU organs
(4) inclusive of Hodgkin's and other diseases of lymphatic & haemopoietic tissue
(5) inclusive of respiratory, skin, breast, cervix & other forms of carcinoma in situ
(6) compilation of malignant, benign & in-situ forms

Table 1.5 Life Years Lost to 75 (PYLL) & Annual Expenditure: CVD 1989/90

	PYLL to age 75		Expenditure	
	(1,000s)	% of total	($mill)	% of total
CVD (total)	**199**		**2485**	
Acute/chronic rheumatic	**3**	2	**18**	1
Hypertension	**3**	2	**477**	20
CHD	**138**	69	**1363**	55
Pulmonary circulation	**2**	1	**22**	1
Other heart disease	**22**	13	**488**	20
Stroke	**32**	16	**515**	21
Diseases of arteries (1)	**7**	4	**178**	7
Diseases of veins (2)	**2**	1	**201**	8

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.6 Life Years Lost to 75 (PYLL) & Annual Expenditure: Cancer 1989/90

	PYLL to age 75		Expenditure	
	(1,000s)	% of total	($Mill)	% of total
Cancer	**235**	99	**860**	80
Lip, Oral Cavity & Pharynx	**6**	2	**23**	2
Digestive Organs	**55**	23	**182**	17
Colorectal	*27*	*11*	*100*	*9*
Respiratory Organs	**82**	34	**95**	9
Bone, Connective Tissue	**43**	18	**194**	18
Genitourinary	**27**	11	**144**	13
Other & Unspecified	**28**	12	**125**	12
Lymphatic & Haemopoietic	**29**	12	**97**	9
Carcinoma in Situ	**35**	0	**16**	2
Skin Cancers (1)	*12*	*5*	*184*	*17*
Breast Cancers (1)	*27*	*11*	*73*	*7*
Lung Cancers (1)	*44*	*18*	*82*	*8*

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) compilation of malignant, benign & in-situ forms

Table 1.7 Life Years Lost to Age 75 (PYLL) & Expenditure: CVD & Cancer 1989/90

		PYLL to age 75	Expenditure
		(100s)	($mill)
1	**CVD (total)**	**1,991**	**2484.6**
2	**Acute/chronic rheumatic**	**30**	**18**
3	**Hypertension**	**31**	**476.77**
4	**Ischaemic heart disease**	**1,272**	**585.46**
5	**Pulmonary circulation**	**21**	**21.61**
6	**Other HD**	**224**	**488.13**
7	**Stroke**	**324**	**515.29**
8	**Diseases of arteries (1)**	**73**	**178.49**
9	**Diseases of veins (2)**	**16**	**200.85**
10	*CHD*	*1,382*	*1363*
11	**Neoplasms (all)**	**2,372**	**1076.5**
12	**Cancer**	**2,349**	**859.85**
13	**Lip, Oral Cavity & Pharynx**	**58**	**23.18**
14	**Digestive Organs**	**549**	**181.92**
15	*Colorectal*	*269*	*100.2*
16	**Bone, Connective Tissue**	**433**	**194.17**
17	**Genitourinary**	**269**	**144.34**
18	**Lymphatic & Haemopoietic**	**288**	**96.69**
19	**Carcinoma in Situ**	**0**	**15.72**
20	*Skin Cancers (3)*	*116*	*183.5*
21	*Breast Cancers (3)*	*269*	*72.77*
22	*Lung Cancers (3)*	*435*	*82.19*

Source: . AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

(3) compilation of malignant, benign & in-situ forms

Table 1.8 CVD Expenditure ($M) by Age Group: Australia 1989/90

	0-19	20-39	40-69	70+	n.s.	Total
CVD (all)	**14**	**104**	**1,080**	**1,288**	**1**	**2,485**
%	1	4	43	52	0	
Rheumatic disease	1	1	12	3	0	18
%	0	1	0	0	0	1
Pulmonary Circulation Disease	0	2	8	10	0	22
%	0	0	0	0	0	1
Heart Disease, other	4	14	89	80	0	187
%	0	1	4	3	0	8
Stroke	2	8	120	386	0	515
%	0	0	5	16	0	21
Diseases of arteries (1)	2	4	66	107	0	178
%	0	0	3	4	0	7
Diseases of veins (2)	3	43	103	52	0	201
%	0	2	4	2	0	8
CHD	*2*	*39*	*707*	*647*	*0*	*1363*
%	*0*	*2*	*28*	*26*	*0*	55

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.9 Cancer Expenditure ($M) by Age Group: Australia 1989/90

	0-19	20-39	40-69	70+	n.s.	Total
Cancer	22	54	440	344	0	860
%	2	5	41	32	0	80
Lip, Oral, Pharynx	0	1	15	7		23
%	0	0	1	1		2
Digestive & Peritoneum	1	5	89	87	0	182
%	*0*	*0*	*8*	*8*	*0*	*16*
colorectal	*0*	*2*	*50*	*48*	*0*	*100*
%	0	0	5	4	0	9
Respiratory	0	1	54	39	0	95
%	0	0	5	4	0	9
Bone, Connective Tissue	5	17	108	64	0	194
%	0	2	10	6	0	18
Genitourinary	1	8	46	75		144
%	0	1	4	7		13
Other & Unspecified	5	11	68	42	0	125
%	0	1	6	4	0	12
Lymphatic	10	11	45	31	0	97
%	1	1	4	3	0	9
Carcinoma in Situ	0	6	6	3		16
%	0	1	1	0		1
Neoplasm Uncertain	2	4	12	9	0	27
%	0	0	1	1	0	3
Skin cancers	*17*	*35*	*87*	*44*	*0*	*184*
%	2	3	8	4	0	17
Breast cancers	*1*	*40*	*176*	*22*	*0*	*234*
%	*0*	*4*	*16*	*2*	*0*	22
Lung cancers	*0*	*1*	*46*	*35*	*0*	*82*
%	*0*	*0*	*4*	*3*	*0*	*8*

Source: AIHW Cost of Illness Data 1989/90

Table 1.10 CVD & Cancer Expenditure by Gender & Health Delivery Setting: Australia 1989/90

	Expenditure ($mill) per health delivery setting						
	Hospital	Medical	Pharmac-eutical	Allied health	Nursing home	Total	% total CVD expenditure
CVD (total)	**1140**	**356**	**424**	**35**	**530**	**2485**	
% of total	*46*	*14*	*17*	*1*	*21*		
male	643	166	165	14	223	1213	49
female	497	189	290	20	306	1272	
Rheumatic Diseases	**13**	**1**	**2**	**0**	**1**	**18**	**1**
male	5	1	1	0	0	7	
female	8	1	1	0	1	11	
Pulmonary circulation	**16**	**2**	**1**	**0**	**3**	**22**	**1**
male	8	1	1	0	1	11	
female	8	1	1	0	1	11	
Heart Disease, other	**121**	**30**	**21**	**1**	**15**	**187**	**8**
male	70	15	10	1	5	100	
female	51	15	11	0	10	87	
Stroke	**178**	**18**	**10**	**3**	**306**	**515**	**21**
male	88	9	4	2	133	236	
female	90	9	6	2	173	280	
Diseases of arteries (1)	**110**	**15**	**6**	**2**	**45**	**178**	**7**
male	67	8	3	2	25	104	
female	44	7	3	1	20	74	
Diseases of veins (2)	**138**	**33**	**14**	**2**	**14**	**201**	**8**
male	60	15	5	1	7	88	
female	78	18	8	1	8	113	
CHD	**563**	**256**	**371**	**26**	**146**	**1363**	**55**
male	346	117	142	10	53	668	
female	217	139	229	17	94	696	
Hypertension	**24**	**168**	**251**	**19**	**14**	**477**	**19**
male	9	72	87	6	1	175	
female	15	97	164	13	13	302	
Ischaemic heart disease	**424**	**56**	**66**	**4**	**35**	**587**	**24**
male	284	31	33	3	15	366	
female	140	24	33	2	20	219	
Heart Failure	**115**	**32**	**53**	**3**	**97**	**301**	**12**
male	53	14	22	1	36	126	
female	62	18	31	2	61	175	

....continued over

Table 1.10 cont.	Expenditure ($mill) per health delivery setting						
	Hospital	Medical	Pharmac-eutical	Allied health	Nursing home	total	% total Cancer expenditure
Neoplasm (all)	**798**	**127**	**20**	**9**	**121**	**1076**	
% of total	74	12	2	1	12		
male	189	56	11	5	51	312	48
female	409	71	9	4	70	563	
Colorectal cancer	**80**	**5**	**1**	**1**	**15**	**100**	**9**
male	43	3	0	1	4	50	
female	37	2	1	0	11	50	
Lung cancers (3)	**65**	**4**	**3**	**1**	**11**	**82**	**8**
male	47	2	2	0	8	59	
female	18	2	1	0	3	24	
Skin cancers (3)	***105***	***67***	**2**	**4**	**6**	**184**	**17**
male	54	33	1	2	3	93	
female	54	34	1	1	4	94	
Breast cancers (3)	**53**	**7**	**2**	**1**	**10**	**73**	**7**
male	0	0	0	0	0	1	
female	52	6	2	1	10	72	

Source: AIHW Cost of Illness Data 1989/90

Notes: (1) inclusive of arteries, arterioles & capillaries
(2) inclusive of veins, lymphatics & other diseases of the circulatory system
(3) compilation of malignant, benign & in-situ forms

Table 1.11 CVD Expenditure: Australia 1993/94

	Expenditure ($mill) per health delivery setting							
	Hospital	Medical	Pharma ceutical	Allied health	Nursing home	Other (3)	Total	% total CVD expenditure
CVD (total)	1442	496	713	38	541	135	3365	
% of total	*42.9*	*14.7*	*21.2*	*1.1*	*16.1*	*4.0*		
Acute/chronic rheumatic	18	2	1	0	1	0	22	0.65
Hypertension	21	214	481	19	6	71	812	24.13
Ischaemic heart disease	547	87	110	5	68	15	832	24.73
Pulmonary circulation	20	3	2	0	5	1	31	0.92
Other Heart Disease	301	92	69	4	154	18	638	19
Heart failure	*133*	*46*	*39*	*4*	*124*	*9*	*355*	
Stroke	256	31	14	5	250	6	562	16.70
Diseases of arteries (1)	146	22	11	2	34	5	220	6.54
Diseases of veins (2)	134	46	25	2	23	15	245	7.28
CHD	*701*	*347*	*630*	*28*	*198*	*95*	1999	*59.41*

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of arteries, arterioles & capillaries
(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.12 Cancer Expenditure: Australia 1993/94

	Expenditure ($mill) per health delivery setting						
	Hospital	Medical	Pharma ceutical	Allied health	Nursing home	OPD	Total
Cancer	**789**	**121**	**42**	**9**	**29**	**76**	**1066**
Lip, Oral Cavity, Pharyngeal	**20**	**3**	**1**	**1**	**0**	**2**	**27**
Digestive Organs	**158**	**14**	**5**	**2**	**6**	**11**	**196**
Colon	58	5	1	0	2	4	**70**
Rectal	39	3	0	0	1	3	**46**
Other (1)	60	5	3	0	3	4	**135**
Respiratory Organs	**70**	**8**	**3**	**2**	**2**	**7**	**92**
Lung	*58*	*7*	*3*	*2*	*2*	*6*	**78**
Other (2)	12	1	0	0	0	0	**23**
Bone, Connective tissue	**139**	**70**	**16**	**3**	**7**	**21**	**256**
Skin melanoma	9	6	0	0	0	1	**16**
Skin nonmelanoma	72	58	3	2	5	13	**153**
Breast female	50	5	13	0	1	6	**75**
Genitourinary Organs	**122**	**15**	**12**	**1**	**5**	**14**	**169**
Prostate	45	8	8	1	2	6	**70**
Bladder	29	1	1	0	1	5	**37**
Kidney	14	2	2	0	0	1	**19**
Other (3)	31	2	3	0	0	3	**75**
Other Unspecified	**152**	**5**	**2**	**0**	**6**	**13**	**178**
Brain & Neural	21	1	0	0	1	1	**24**
Other	131	4	1	0	5	12	**153**
Lymphatic & Haemopoetic	**128**	**6**	**3**	**0**	**3**	**8**	**148**
Non-Hodgkins	42	2	2	0	1	3	**50**
Leukemia	68	3	2	0	1	4	**78**
Other (4)	18	1	0	0	1	1	**26**
Carcinoma in situ (5)	**22**	**1**	**2**	**0**	**0**	**5**	**30**
Neoplasm Unspecified	**23**	**9**	**1**	**0**	**1**	**3**	**37**
Skin cancers (6)	*112*	*112*	*5*	*2*	*5*	*21*	**257**
Breast cancers (6)	*62*	*9*	*17*	*1*	*1*	*9*	**99**
colorectal	*97*	*8*	*2*	*1*	*3*	*6*	**117**
Lung cancers (6)	*58*	*7*	*3*	*2*	*2*	*6*	**78**

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of oesophageal, stomach, liver & intrahepatic, pancreas and other digestive organs
(2) inclusive of laryngeal, pleura and other cancers of the respiratory organs
(3) inclusive of cancers of the uterus, cervix, ovary, urinary organs, testes & other genitourinary organs
(4) inclusive of hodgkins and other diseases of lymphatic & haemopoietic tissue
(5) inclusive of respiratory,skin, breast, cervix & other forms of carcinoma in situ
(6) compilation of malignant, benign & in-situ forms

Table 1.13 National Mortality & Morbidity: CVD 1993/94

	Mortality		Morbidity				PYLL to age 75	
	(No. deaths)		(No. admissions)		(Bed days)			
	(1000s)	%	*(1000s)*	%	*(1000s)*	%	*(1000s)*	%
CVD (total)	**50.8**		**365**		**2695**		**165**	
Acute/chronic rheumatic	0.3	0.6	2	0.6	17	0.6	2	1.2
Hypertension	1	2.0	9	2.5	55	2.0	3	1.8
Ischaemic heart disease	28	55.1	137	37.5	796	29.5	103	62.4
Pulmonary circ. disease	0.2	0.4	5	1.4	50	1.9	2	1.2
Other Heart Disease	6	11.8	83	22.7	633	23.5	21	12.7
Heart failure	*3*		*39*		*408*		*4*	
stroke	12	23.6	46	12.6	682	25.3	26	15.8
Diseases of arteries (1)	3	5.9	24	6.9	224	8.3	7	4.2
Diseases of veins (2)	0.3	0.6	59	16.2	238	8.8	1	0.6
All CHD	32	63.0	185	50.7	1259	46.7	110	66.7

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.14 National Mortality & Morbidity: Cancer 1993/94

	Mortality		Morbidity				PYLL to age 75	
	(No. deaths)		(No. admissions)		(Bed days)			
	(1000s)	%	(1000s)	%	(1000s)	%	(1000s)	%
Neoplasms (all)	32		310		1703		241	
Cancer	31	96.9	196	63.2	1424	83.6	239	99.2
Lip, Oral Cavity, Pharyngeal	1	3.1	4	1.3	34	2.00	6	2.5
Digestive Organs	9	28.1	29	9.4	308	18.1	56	23.2
Colorectal	*4.2*	*13.1*	*17*	*5.5*	*183*	*10.8*	*28*	*11.6*
Colon	3.2		10		106			
Rectal	1.1		7		77			
Other (1)	4		11		104		28	
Respiratory Organs	6	18.8	16	5.2	149	8.8	46	19.1
Lung	*6*	*18.8*	*14*	*4.5*	*128*	*7.5*	*42*	*17.4*
Other (2)	*0*		2		*21*		4	
Bone, Connective tissue	4	12.5	54	17.4	211	12.4	46	19.1
Skin melanoma	1		3		15		10	
Skin nonmelanoma	0		35		87		3	
Breast female	3		14		93		28	
Genitourinary Organs	**5**	**15.6**	**35**	**11.3**	**235**	13.8	26	10.8
Prostate	2		13		99		6	
Bladder	1		11		45		2	
Kidney	1		3		27		5	
Other (3)	1		8		64		43	
Other Unspec. Organs	**3**	**9.4**	**33**	**10.7**	**330**	**19.4**	**29**	**12.0**
Brain & Neural	1		3		42		14	
Other	2		30		288		14	
Lymphatic & Haemopoetic	**3**	**9.4**	**24**	**7.7**	**155**	**9.1**	**31**	**12.9**
Non-Hodgkins	1		9		64		12	
Leukemia	1		11		61		14	
Other (4)	1		4		30		5	
Carcinoma in situ (5)	**0**	**0.0**	**11**	**3.6**	**26**	**1.5**	**0**	**0.0**
Neoplasm Unspecified	**0**	**0.0**	**9**	**2.9**	**35**	**2.1**	**2**	**0.8**
Skin cancers (6)	*1*	*3.1*	*56*	*18.1*	*128*	*7.5*	*13*	*5.4*
Breast cancers (6)	*3*	*9.4*	*20*	*6.5*	*103*	*6.1*	*28*	*11.6*
colorectal	*4.2*	*13.1*	*17*	*5.5*	*183*	*10.8*	*28*	*11.6*
Lung cancers (6)	*6*	*18.8*	*14*	*4.5*	*128*	*7.5*	*42*	*17.4*

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of oesophageal, stomach, liver & intrahepatic, pancreas and other digestive organs
(2) inclusive of laryngeal, pleura and other cancers of the respiratory organs
(3) inclusive of cancers of the uterus, cervix, ovary, urinary organs, testes & other genitourinary organs
(4) inclusive of hodgkins and other diseases of lymphatic & haemopoietic tissue
(5) inclusive of respiratory,skin, breast, cervix & other forms of carcinoma in situ
(6) compilation of malignant, benign & in-situ forms

Table 1.15 Life Years Lost to 75 (PYLL) & Annual Expenditure: CVD 1993/94

	PYLL to age 75 (100s)	Expenditure ($M)
CVD (total)	**165**	3365
Acute/chronic rheumatic	2	22
Hypertension	3	812
Ischaemic heart disease	103	832
Pulmonary circulation	2	31
Other Heart Disease	21	638
Stroke	26	562
Diseases of arteries (1)	7	220
Diseases of veins (2)	1	245
CHD	110	1999

Source: AIHW Cost of Illness Data 1993/94
Notes: (1) inclusive of arteries, arterioles & capillaries
(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.16 Life Years Lost to 75 (PYLL) & Annual Expenditure: Cancer 1993/94

	PYLL to age 75 (100s)	Expenditure ($M)
Cancer	**239**	**1066**
Lip,Oral Cavity, Pharyngeal	**6**	**27**
Digestive Organs	**56**	**196**
Colorectal	*28*	*117*
Respiratory Organs	**46**	**92**
Bone, Connective tissue	**46**	**256**
Genitourinary Organs	**26**	**169**
Other Unspecified Organs	**29**	**178**
Lymphatic & Haemopoetic	**31**	**148**
Benign Neoplasm	1	**293**
Carcinoma in situ	0	**30**
Neoplasm Uncertain/benign	2	37
Skin cancers (1)	13	257
Breast cancers (1)	28	99
Lung cancers (1)	42	78

Source: AIHW Cost of Illness Data 1993/94
Notes: (1) compilation of malignant, benign & in-situ forms

Table 1.17 Life Years Lost to 75 (PYLL) & Annual Expenditure: CVD & Cancer 1993/94

		PYLL to age 75 (100s)	Expenditure ($M)
1	**CVD (total)**	1599	**1**
2	**Acute/chronic rheumatic**	23	**22**
3	**Hypertension**	29	**812**
4	**Ischaemic HD**	1033	**3**
5	**Pulmonary circ diseases**	16	**31**
6	**Other HD**	145	**638**
7	**Stroke**	261	**16**
8	**Diseases of arteries (1)**	79	**220**
9	**Diseases of veins (2)**	13	**245**
10	*CHD*	1107	1999
11	**Neoplasms (all)**	2413	**1431**
12	**Cancer**	2389	**1066**
13	**Lip,Oral Cavity, Pharyngeal**	64	**27**
14	**Digestive Organs**	558	**196**
15	*Colorectal*	278	**117**
16	**Bone, Connective tissue**	461	**256**
17	**Genitourinary Organs**	259	**169**
18	**Lymphatic & Haemopoetic**	306	**148**
19	**Carcinoma in situ**	31	**30**
20	*Skin cancers (3)*	126	257
21	*Breast cancers (3)*	284	99
22	*Lung cancers (3)*	415	78

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of arteries, arterioles & capillaries
(2) inclusive of veins, lymphatics & other diseases of the circulatory system
(3) compilation of malignant, benign & in-situ forms

Table 1.18 CVD Expenditure ($M) by Age Group: Australia 1993/94

	0-4	5-24	25-44	45-74	75+	n.s.	Total
CVD (all)	4	33	236	1932	1313	0	3517
%				54.93	37.33		
Acute/Chronic Rheumatic	1	2	3	15	3	0	24
Pulmonary Circulation	0	0	4	17	11	0	33
Heart Disease, Other	2	8	30	162	101	0	300
Stroke	0	4	14	210	368	0	595
%				35.3	61.8		
Diseases of Arteries (1)	0	3	10	127	98	0	240
Diseases of Veins (2)	0	10	63	129	52	0	254
CHD	*0*	*6*	*118*	*1271*	*677*	*0*	*2073*
%				61.3	32.7		

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) inclusive of arteries, arterioles & capillaries

(2) inclusive of veins, lymphatics & other diseases of the circulatory system

Table 1.19 Cancer Expenditure ($M) by Age Group: Australia 1993/94 (Abridged)

	0-4	5-24	25-44	45-74	75+	n.s.	Total
Neoplasm	14	74	216	860	331		1496

Source: AIHW Cost of Illness Data 1993/94

Notes: (1) compilation of malignant, benign & in-situ forms

Table 1.20 CVD & Cancer Expenditure by Gender & Health Setting: Australia 1993/94

	expenditure ($M) per health delivery setting						
	Hospital	Medical	Pharma-ceutical	Allied health	Nursing home	Out-patient	Total
Neoplasms (all)	1004	208	52	12	32	122	**1430**
% of total: male	497	98	23	6	14	59	**697**
female	507	110	29	6	18	64	**734**
Colorectal cancer	**97**	**8**	**3**	**1**	**3**	**7**	**119**
male	52	5	1	1	1	4	**64**
female	45	3	2	0	2	3	**55**
Lung cancers (3)	**57**	**7**	**3**	**2**	**2**	**6**	**77**
male	40	4	2	1	1	4	**52**
female	18	3	1	1	1	2	**26**
Skin cancers (3)	**36**	**6**	**0**	**4**	**6**	**20**	**200**
male	54	9	1	2	2	11	79
female	90	15	1	2	4	9	121
Breast cancers (3) (female)	**62**	**0**	**0**	**1**	**1**	**9**	**73**

continued over...

Table 1.20 continued

	expenditure ($M) per health delivery setting						
	Hospital	Medical	Pharma-ceutical	Allied health	Nursing home	Out-patient	Total
CVD (total)	1442	496	713	38	541	135	3365
male	825	243	302	20	213	70	1673
female	617	253	411	18	328	65	1692
Rheumatic Disease	**18**	**2**	**1**	**0**	**1**	**1**	**23**
male	6	1	1	0	0	0	**8**
female	11	1	1	0	0	0	**13**
Pulmonary circulation	**20**	**3**	**1**	**0**	**5**	**0**	**29**
male	9	1	1	0	2	0	**13**
female	**11**	1	1	0	3	0	**16**
Heart Disease, other	**301**	**92**	**69**	**4**	**154**	**30**	**650**
male	154	46	30	2	55	15	**302**
female	145	46	39	2	98	15	**345**
Stroke	**256**	**31**	**14**	**5**	**249**	**15**	**570**
male	123	17	6	3	101	3	**253**
female	133	14	8	1	148	3	**307**
Diseases of arteries (1)	**146**	**22**	**11**	**2**	**34**	**14**	**229**
male	92	13	6	1	16	9	**137**
female	53	9	6	0	18	4	**90**
Diseases of veins (2)	**134**	**46**	**25**	**2**	**23**	**13**	**243**
male	59	21	11	1	8	9	**109**
female	75	25	14	1	15	4	**134**
CHD	**703**	**348**	**631**	**28**	**198**	**98**	**2006**
male	441	168	264	15	72	49	1009
female	263	182	368	14	126	50	1003
Hypertension	**21**	**214**	**481**	**19**	**6**	**71**	**812**
male	8	94	191	9	1	34	**337**
female	13	121	290	11	5	37	**477**
Ischaemic Disease	**546**	**87**	**110**	**5**	**68**	**15**	**831**
male	371	52	56	4	28	9	**520**
female	176	36	54	1	40	6	**313**
Heart Failure	**136**	**47**	**40**	**4**	**124**	**12**	**363**
male	62	22	17	2	43	6	**152**
female	74	25	24	2	81	7	**213**

Notes: (1) inclusive of arteries, arterioles & capillaries
(2) inclusive of veins, lymphatics & other diseases of the circulatory system
(3) compilation of malignant, benign & in-situ forms

Table 1.21 Public Health Expenditure ($M) 1993/94

Community & Public Health:		
	Community Health Services	1362.20
	Health Promotion & Illness Prevention	205.80
		1568.00
Health Promotion & Illness Prevention:		
	Drug Abuse Reduction	34.50
	Environmental Health Standards	19.20
	Health Promotion & Disease Prevention	145.50
	Research	6.60
		205.80
CVD & Cancer Activities:		
	NCADA (1)	30.5
	Administration	10.25
	Public health education	8.9
	National health promotion program	4.72
	National women's health program	8.72
	Major longitudinal study into women's health	0.02
	Cervical screening	6.19
	Early detection of breast cancer	25.60
	Research	6.60
		101.50
Other Activities:		
	Influenza B	17.00
	Drug abuse reduction	3.00
	HIV/Aids	45.00
	Family planning	14.00
	Environmental health	19.20
	Other: administration	0.50
	road accidents	0.30
	quarantine	0.30
	mental health	3.00
	homelessness	2.00
		104.30
Health Promotion & Illness Prevention Total :		
	CVD & Cancer Activities	101.50
	Other Activities	104.30
		205.80

Source: Richardson *et al* Report 4: Tables A2.1 (pvii), A2.3 (px), A2.6 (pxxvi)
Notes: (1) National Council Against Drug Abuse

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