HEART DISEASE AND STROKE IN CANADA

1995*

* Heart Disease and Stroke in Canada is published by the Heart and Stroke Foundation of Canada periodically (approximately every two years).

HEART AND STROKE FOUNDATION OF CANADA
June 1995

ISBN 1-896242-12-X
ISSN 1201-9828

ACKNOWLEDGEMENTS

Special thanks are due to Ms. Lorraine Khachatourians, and the staff, Saskatchewan Heart and Stroke Epidemiology Unit, Department of Community Health and Epidemiology, University of Saskatchewan for the excellent preparation of materials for this publication.

Thanks are also due to Doug MacQuarrie, Director, Health Promotion, and Dominique Mongeon, Secretary, Health Promotion, Heart and Stroke Foundation of Canada for final proofreading and editing of this publication.

TABLE OF CONTENTS

LIST OF FIGURES

(All data for Canada unless indicated otherwise)

LIST OF TABLES

(All data for Canada unless indicated otherwise)

1. *INTRODUCTION*

In recent years, considerable progress has been made in identifying the multiple factors that place individuals at risk of developing heart disease and stroke. Successful programs of prevention have demonstrated that through the modification of these risk factors, death and illness from these diseases can be reduced. However, despite these numerous interventions, cardiovascular diseases remain the major cause of death, disability and illness in Canada. To address this burden, a number of partners are collaborating on a range of national and international efforts.

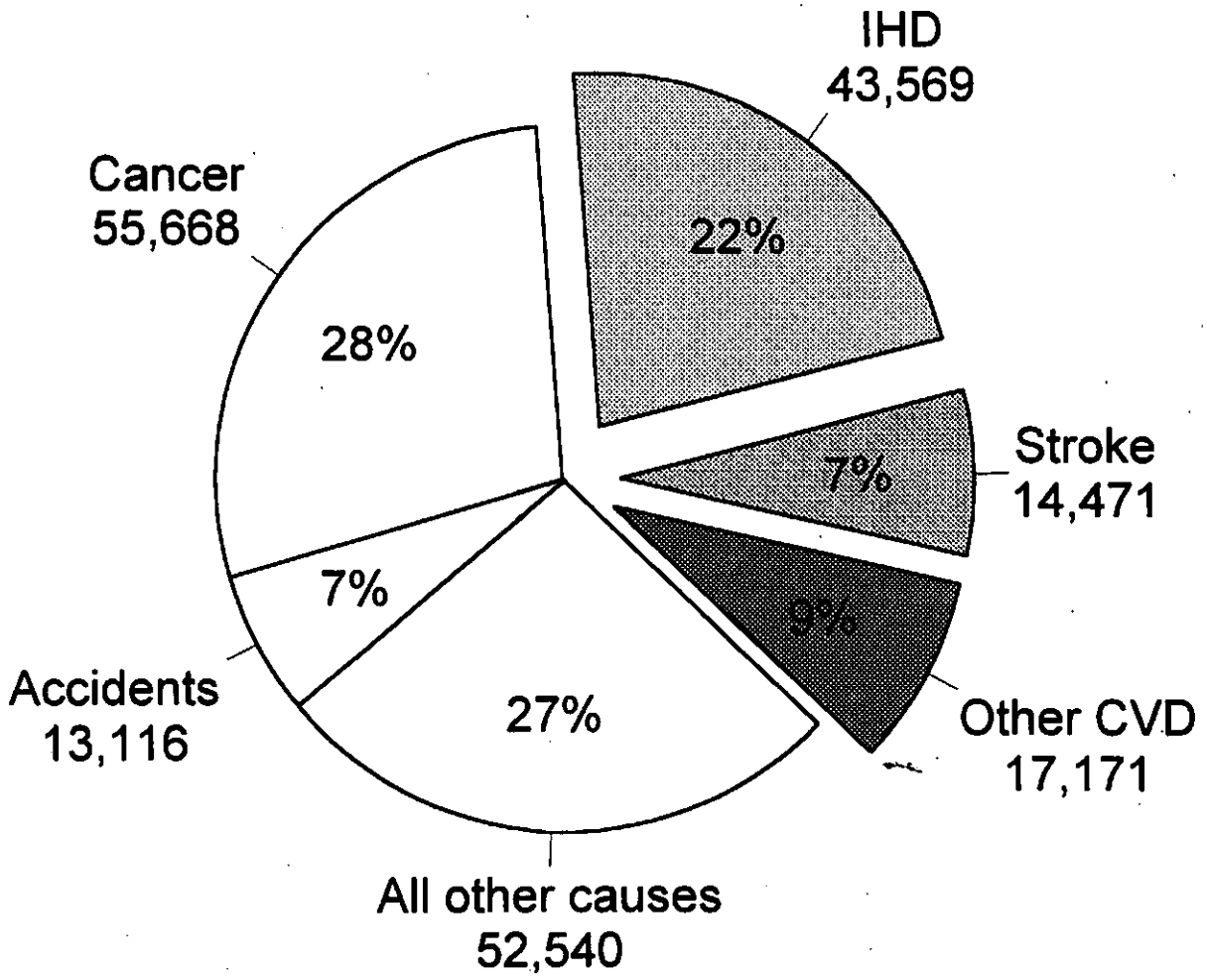
The Heart and Stroke Foundation of Canada and its affiliated provincial foundations play a major role. The Foundation provides the majority of funds for research into heart disease and stroke in Canada, and, in the domain of health promotion, the Foundation has a significant impact in the areas of nutrition, blood pressure control and physical activity. Emphasis has been placed on the prevention of sudden pre-hospital death through its cardiopulmonary resuscitation program and on healthy public policy in areas such as tobacco control. A current focus of the Foundation is on cardiovascular diseases in women and children.

Health Canada and the National Health Research and Development Program have also provided significant support and leadership in heart health promotion across Canada. The Canadian Heart Health Initiative is the result of collaboration between Health Canada, the provincial Ministries of Health and the Heart and Stroke Foundations. The Initiative stimulates cardiovascular disease prevention at the community level in each province. Furthermore, the 1992 Victoria Declaration on Heart Health established international partnerships in policy development and program implementation aimed at heart health promotion and cardiovascular disease prevention worldwide.

This publication is the third of a regular series that provides the public, health professionals and policy makers with an overview of the current trends of heart disease and stroke in Canada. It has drawn upon published literature, including that from the Canadian Heart Health Surveys as well as current unpublished data provided generously by the Health Statistics Division, Statistics Canada and the Laboratory Centre for Disease Control of Health Canada. It outlines the patterns of risk factors, mortality and disability produced by the cardiovascular diseases as well as their impact on the health care system. A discussion of risk factor distribution across Canada illustrates the scope for cardiovascular disease prevention. This issue, as well, contains a special section on women and cardiovascular diseases, a vital emerging area for prevention, treatment and research.

This document was prepared by the Heart and Stroke Foundation of Saskatchewan Epidemiology Unit at the University of Saskatchewan in collaboration with the Heart and Stroke Foundation of Canada, Health Canada and Statistics Canada.

Leading Causes of Death, Percentage and Number of Deaths Canada, 1992



SOURCE: Health Statistics Division, Statistics Canada

The term '**cardiovascular diseases**' used in this document refers to ischemic heart disease, stroke, as well as other heart and vascular diseases. Where appropriate, the patterns of the specific disease entities are highlighted. Age-standardization for international comparisons in this edition has been made to the 1993 European New Standard Population. This is a change from previous editions. As a result, age standardized mortality rates are higher than those shown in the past. Therefore, comparison of international rates with previous editions of this publication is not possible. Age-standardization for all Canadian comparisons is still based on the 1986 population of Canada, and therefore, comparisons for these data with previous editions are possible. A glossary of technical terms is included at the end of the document to facilitate use of this publication.

2. *DEATHS FROM CARDIOVASCULAR DISEASES*

2.1 *The Leading Causes of Death*

Thirty-eight percent (38%) of deaths in Canada in 1992 were due to cardiovascular diseases (Figure 1).[1] Ischemic heart disease accounts for 22% of deaths, of which more than half are attributable to acute myocardial infarction (Figure 2). Stroke and other cardiovascular diseases account for 7% and 9% of deaths respectively in Canada (Table 1). Since the first publication of this series in 1991 (data from 1988) to this current issue (data from 1992), deaths due to ischemic heart disease have decreased from 25% to 22% of total deaths; the percentage of deaths due to stroke and other cardiovascular diseases has remained unchanged.

Death from ischemic heart diseases may occur suddenly in the absence of or within one hour of the onset of symptoms. Such 'sudden death' may be the only manifestation in about 15% of individuals suffering from a first heart attack.[2,3] In individuals with known ischemic heart disease experiencing another heart attack, the risk of sudden death may be increased by four to five-fold.[2,3] About 50% of all ischemic heart disease deaths occur before the individuals reach the hospital. Further studies are required to decrease the burden of this manifestation of the disease.

For men and women suffering from an acute myocardial infarction admitted to hospital, it is estimated from the "Ontario experience" that the age- and gender-adjusted case fatality rate during the first 30 days has decreased from 22% in 1981 to 16% in 1991.[4] This decrease began before the utilization of beta-blocking agents, Aspirin® and thrombolytic therapy.[5]

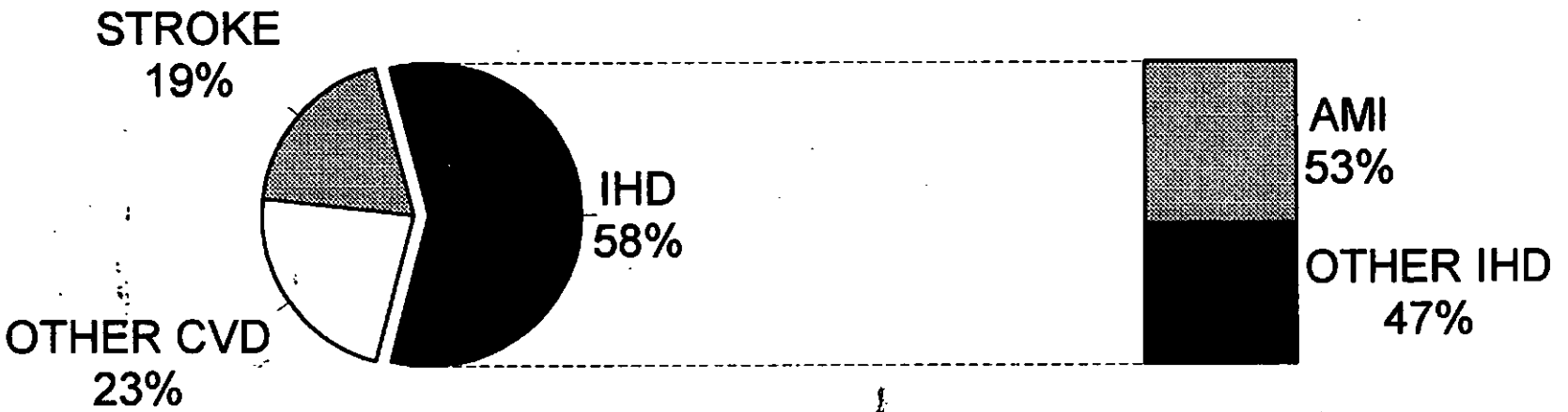
While there has been considerable debate on the mortality differences between leading thrombolytic agents, it is clear that regardless of the specific one used, a thrombolytic agent, when given within 12 hours after the onset of symptoms, can reduce mortality from myocardial infarction by 30 to 50% to overall levels of less than 7.5%. Unfortunately, thrombolytic therapy is used in only about 50% of eligible patients. Therefore strategies are needed to reduce delay, improve diagnosis and increase availability.[6,7,8,9]

2.2 *International Comparisons*

Cardiovascular diseases are the leading cause of death worldwide, but rates vary considerably among countries. In the early 1990's, age-standardized mortality rates for all cardiovascular

FIGURE 2

The Major Components of Cardiovascular Disease Mortality, Canada, 1992



SOURCE: Health Statistics Division, Statistics Canada

TABLE 1

Number and Percent of Deaths due to Cardiovascular Diseases, Males and Females, Canada 1992[1]

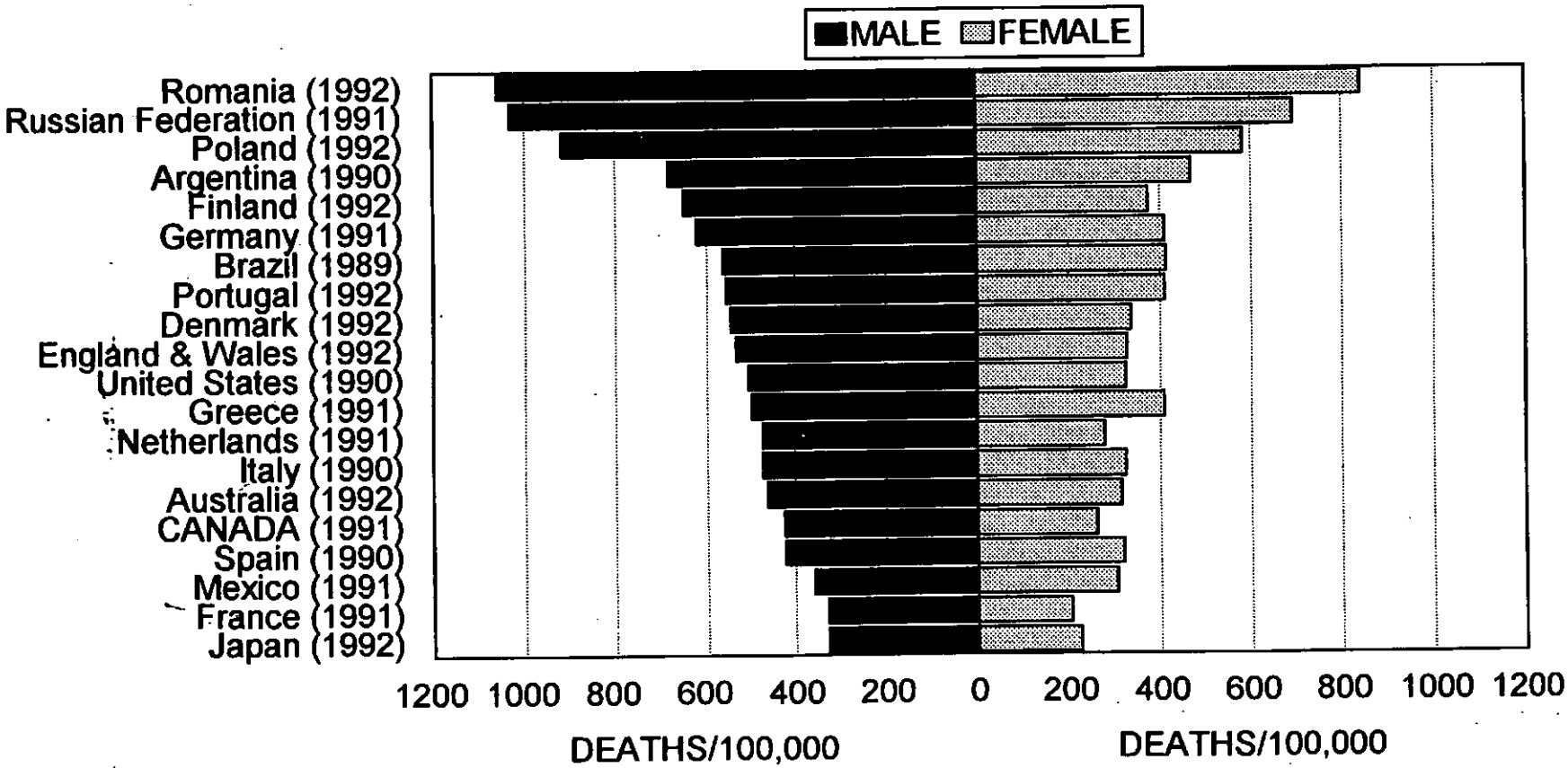
SEX	AGE	ALL CVDS[2]		AMI[3]		IHD[4]		STROKE	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
MALES	35-54	2737	7.0	1265	9.2	1926	7.9	280	4.6
	55-64	5208	13.2	2290	16.7	3736	15.2	513	8.5
	65-74	10573	26.9	4112	30.0	6980	28.5	1358	22.4
	75+	20526	52.2	5972	43.6	11776	48.1	3856	63.7
TOTAL[5]		39290		13685		24490		6052	
FEMALES	35-64	902	2.4	227	2.4	373	2.0	282	3.3
	55-64	1926	5.2	698	7.3	1116	5.8	349	4.1
	65-74	5991	16.2	2114	32.4	3449	18.1	1072	12.7
	75+	27939	75.6	6470	67.9	14118	74.0	6671	79.2
TOTAL[5]		36921		9525		19079		8419	

1. Standardized to 1986 Canadian population
2. CVDS = Cardiovascular diseases
3. AMI = Acute myocardial infarction (heart attack); AMI is a sub-category of IHD
4. IHD = Ischemic heart disease
5. Total includes all ages

SOURCE: Laboratory Centre for Disease Control, Health Canada; Health Statistics Division, Statistics Canada

FIGURE 3

Age-Standardized Mortality Rates*, Cardiovascular Diseases, World, Early-1990's



*Standardized to "New European Population"
SOURCE: Health Statistics Division. Statistics Canada

diseases in men ranged from 1058 deaths per 100,000 population in Romania, to a low of 328 deaths per 100,000 in Japan (Figure 3).[1] Canada's rates (1991) for men were 423 per 100,000 and for women were 261 per 100,000. If Canada were to attain the 1990 death rate of France (males: 330 per 100,000; females: 205 per 100,000), an estimated 8,000 deaths among men and 5,400 deaths among women might be avoided annually.[10]

Among the 20 selected countries, Canada's mortality rates from ischemic heart disease are in the middle range, whereas those from stroke are the second lowest (Figure 4). These relative positions have remained unchanged since the mid-1980s.

Many factors may account for international differences in death rates: genetic predisposition, diet, smoking habits, lack of physical exercise and the prevalence of high blood pressure in the population. Much of the difference, however, remains unexplained.

2.3 Age - and Gender - Specific Death Rates

Gender differences in cardiovascular diseases are well documented. Men experience almost twice the death rates of women in all categories of cardiovascular diseases except stroke, for which the rates are approximately equal for all ages (Table 2; Figure 5). However, in women over age 85, the death rate from stroke exceeds that in men (Table 2). Research suggests that normal estrogen levels in pre-menopausal women confer a protective benefit against the development of ischemic heart disease. In the decades following menopause, ischemic heart disease death rates in women approach those in men.

Although the age-standardized cardiovascular disease mortality rates in men are more than double those in women, in the final analysis, almost as many women die from cardiovascular diseases as men. In 1992 for example, 39,290 men and 36,921 women died from cardiovascular diseases (Table 1).[1] This apparent paradox is the result of the older average age of death of women and the high cardiovascular disease mortality rates in the older age groups.[11]

Forty-one percent (41%) of all deaths in women are due to cardiovascular diseases compared to 37% in men. In women, the proportion increases sharply after menopause while in men, the percentage increases steadily from age 35 to age 84 (Figure 6).

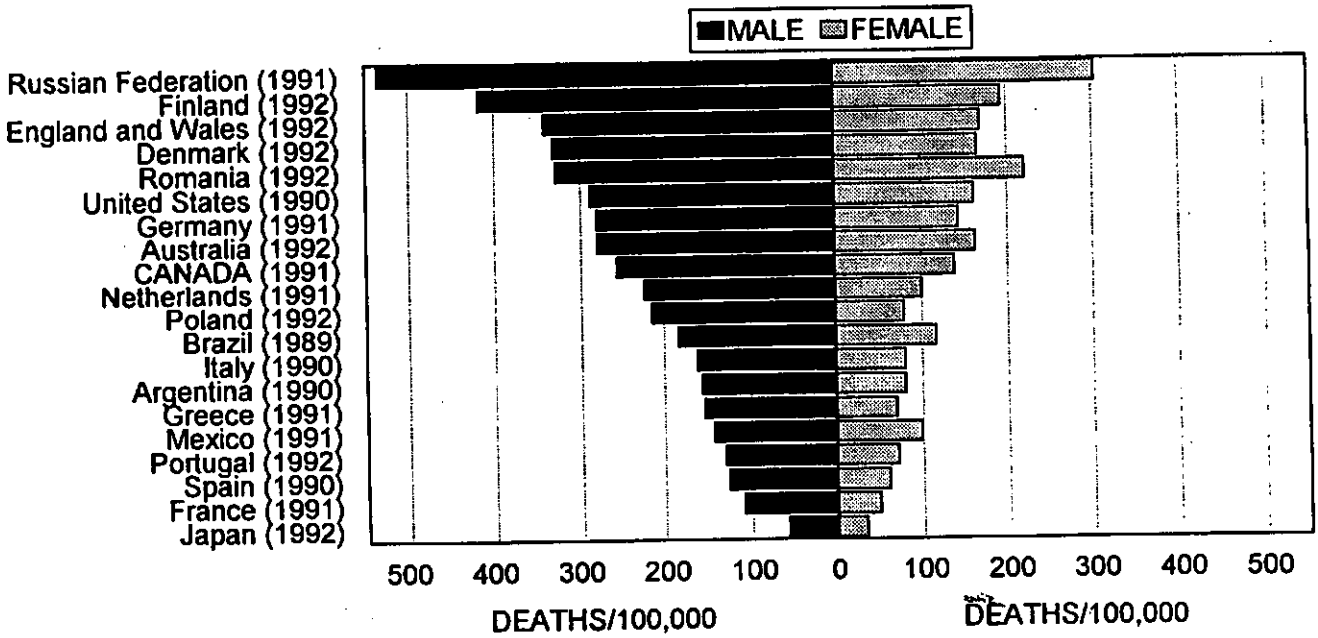
In both sexes, rates increase dramatically in the older age groups. During the coming decades as the proportion of elderly (over 65 years) within the population increases, the prevalence of, and the absolute number of deaths due to cardiovascular diseases may increase. The lower death rate in the 35-64 age group does not diminish the importance of cardiovascular diseases as a health problem; it is still the leading cause of death in this age group.

2.4 Regional Comparisons

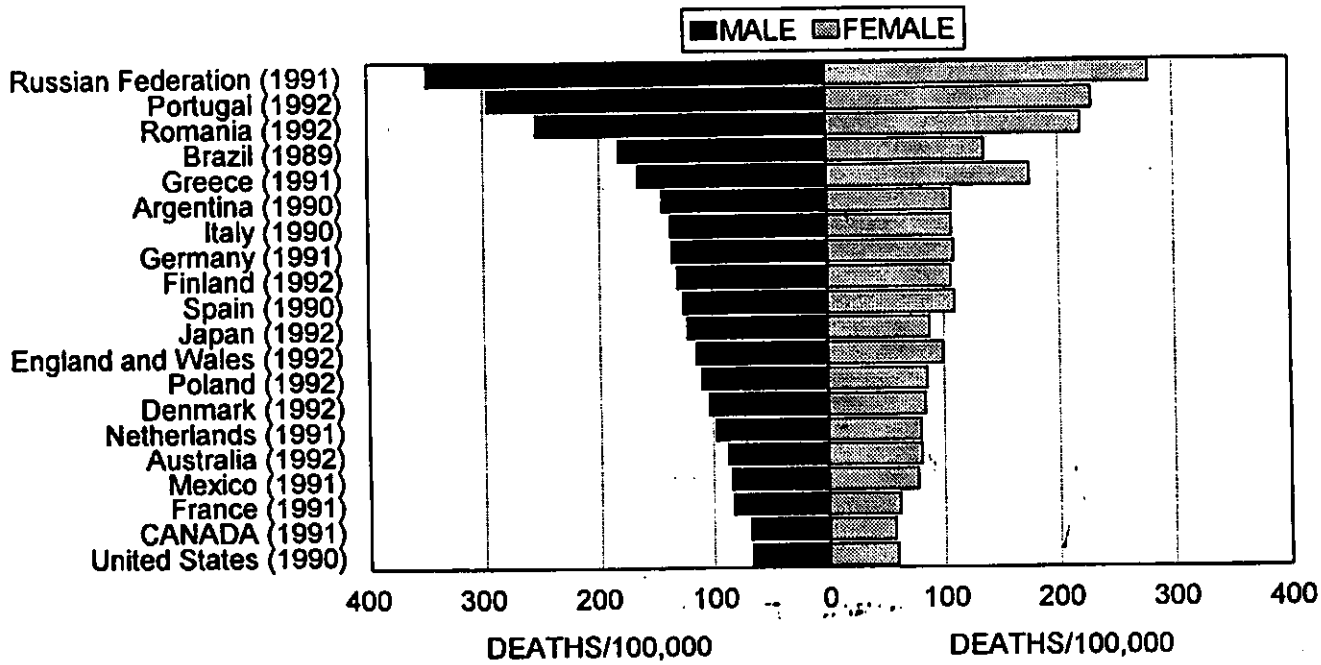
Within Canada there is an East-West gradient in cardiovascular disease death rates (Figure 7; Table 3). Atlantic Canada has consistently higher rates than Western Canada. Cardiovascular disease death rates in 1992 were highest for men and women in Newfoundland, 363 and 244 per 100,000 population, respectively. The rates were lowest for men in British Columbia (288 per

FIGURE 4

Age-Standardized Mortality Rates*
Ischemic Heart Disease, World, Early-1990's



Age-Standardized Mortality Rates*
Stroke, World, Early-1990's



***Standardized to "New European Population"**
SOURCE: Health Statistics Division, Statistics Canada

TABLE 2

Age-Standardized Mortality Rates[1], per 100,000
All Cardiovascular Diseases, Males and Females
Canada, 1992

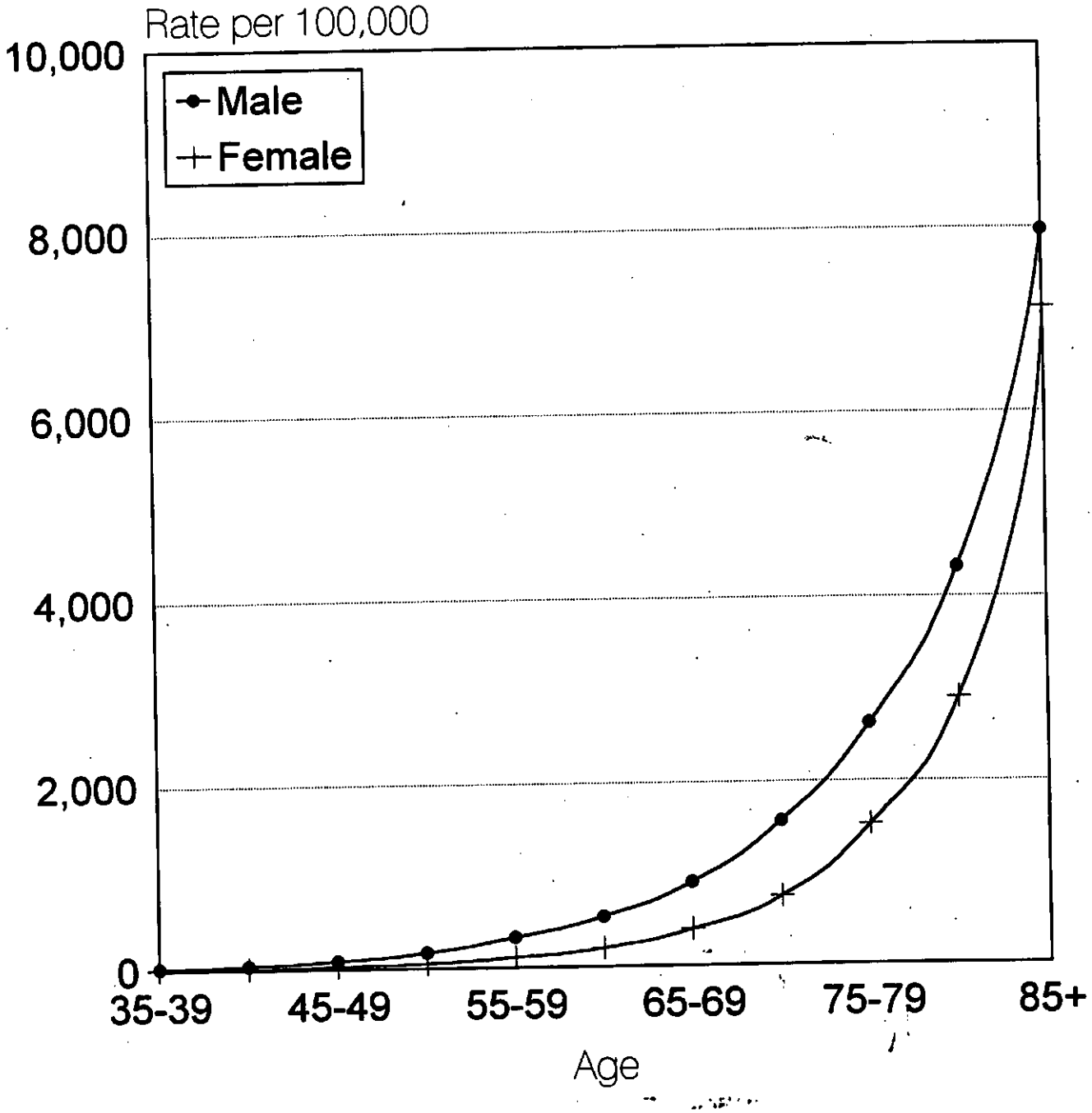
	35-54		55-64		65-74		75-84		85+		All ages	
	M	F	M	F	M	F	M	F	M	F	M	F
AMI[2]	33	6	191	56	467	195	1069	598	1784	1281	107	50
IHD[3]	50	10	310	90	794	318	1947	1092	4241	3431	194	98
Stroke	7	7	43	28	155	99	584	480	1631	1725	50	42
Other CVDS[4]	14	7	80	37	250	135	735	470	2098	1983	71	48
Total CVDS	72	24	432	155	1204	552	3265	2042	7970	7139	315	187

1. Standardized to 1986 Canadian population
2. AMI = Acute myocardial infarction (heart attack); AMI is a sub-category of IHD
3. IHD = Ischemic heart disease
4. CVDS = Cardiovascular diseases

SOURCE: Laboratory Centre for Disease Control, Health Canada; Health Statistics Division, Statistics Canada

FIGURE 5

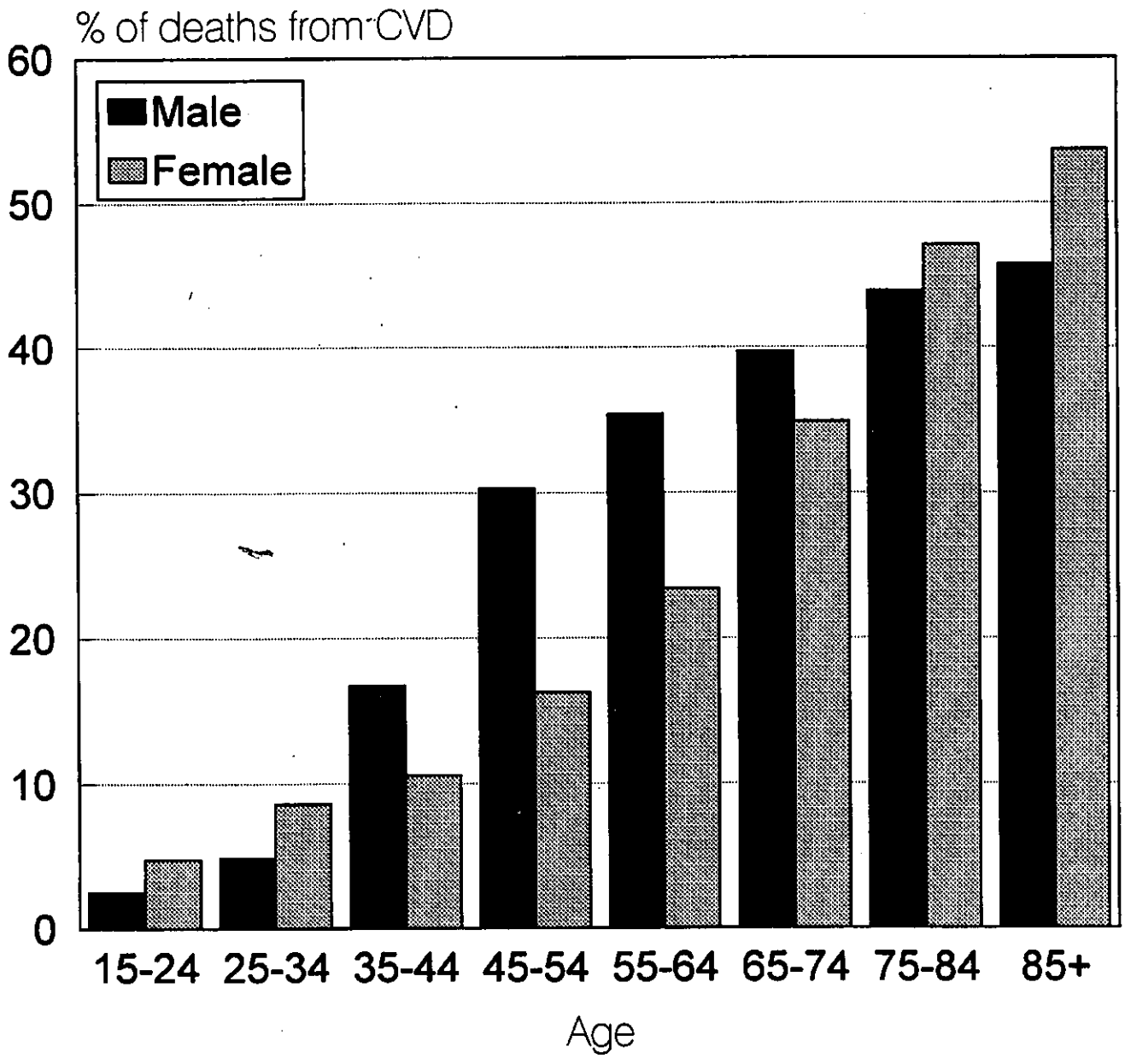
Age-Specific Cardiovascular Disease Mortality Rates, Canada, 1992



SOURCE: Health Statistics Division, Statistics Canada

FIGURE 6

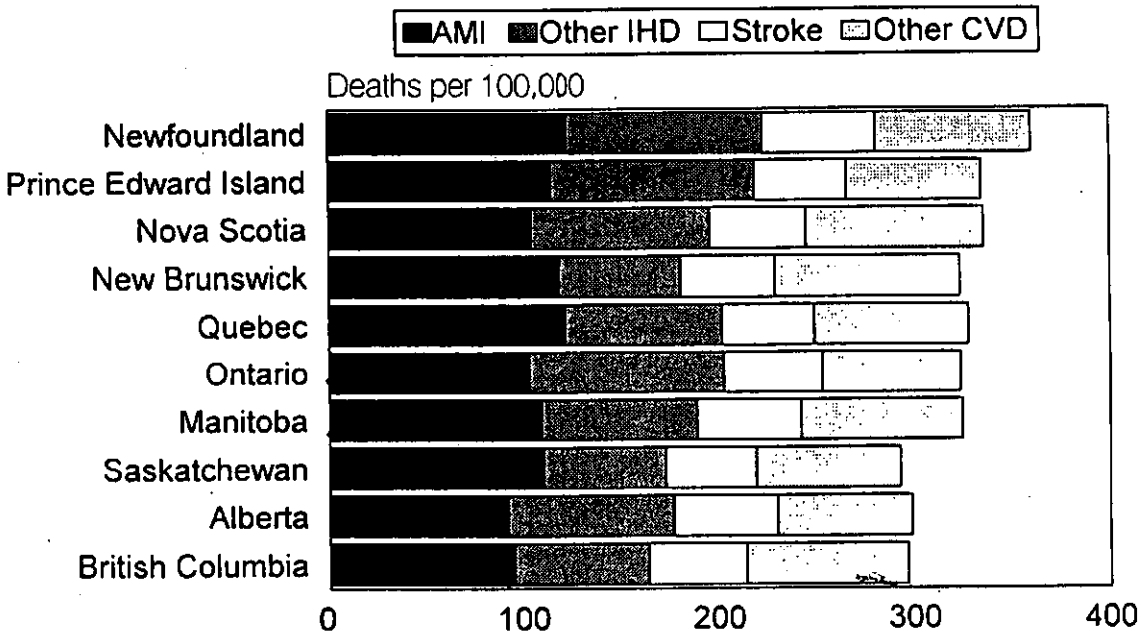
Percentage of Deaths due to Cardiovascular Diseases, by Age Group and Sex, Canada, 1992



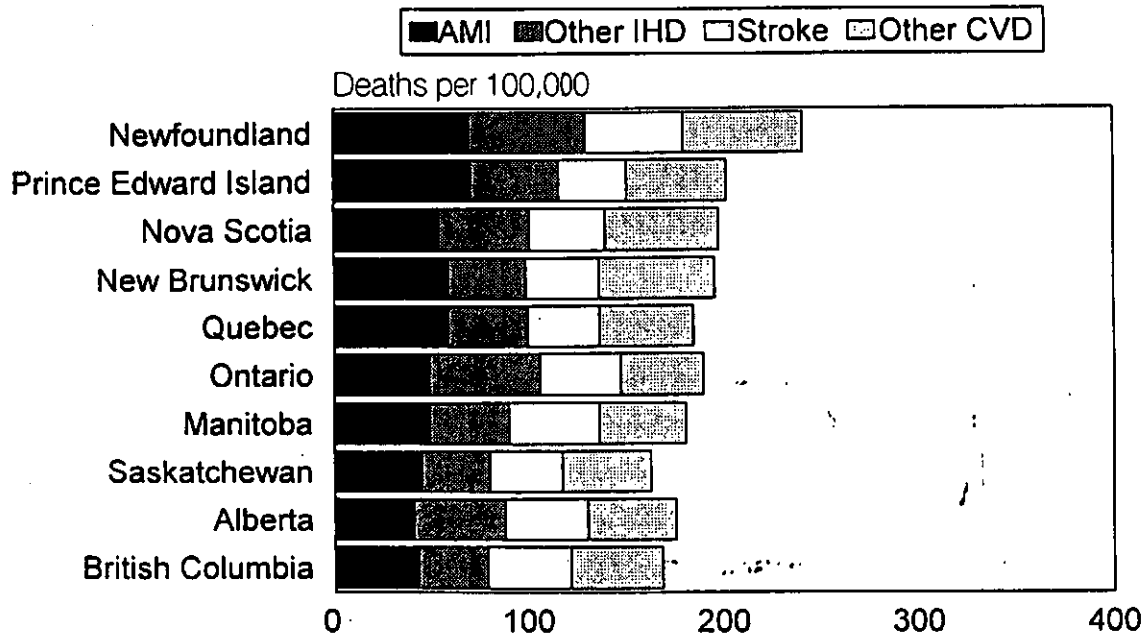
SOURCE: Health Statistics Division, Statistics Canada

FIGURE 7

Age-Standardized Mortality Rates*
All Cardiovascular Diseases, Males, 1992



Age-Standardized Mortality Rates*
All Cardiovascular Diseases, Females, 1992



***Standardized to 1986 Canadian Population**
SOURCE: Health Statistics Division, Statistics Canada

100,000 population) and for women in Saskatchewan (166 per 100,000 population).[10] Regional differences are more notable with respect to death rates from acute myocardial infarction and ischemic heart disease than to those from stroke. Mortality atlases (Figures 8, 9, 10 and 11) show overall disease patterns in Canada for ischemic heart disease and stroke; however the death rates given for specific census divisions should be interpreted cautiously due to the relatively small number of deaths from which they are derived.

Provincial prevalence rates of smoking, high blood pressure and obesity parallel the cardiovascular disease gradient (see Section 7, Risk Factors for Cardiovascular Disease). This would suggest that the variation in cardiovascular disease death rates in Canada is partly explained by differences in the prevalence of risk factors.

2.5 Aboriginal Populations

Aboriginal populations (both Inuit and Indian) in Canada have, until recent decades, experienced much lower cardiovascular disease death rates than the non-native population. Yet, during the past decade, aboriginal men have experienced a death rate for ischemic heart disease similar to that of the Canadian male population and also have experienced a comparable decline over time (Table 4).[12,13] Their age-standardized death rate from stroke is decreasing as is the relative difference between their death rates and those of the general Canadian population (expressed as the standardized mortality ratio). Aboriginal women experience higher death rates than the general Canadian female population for both ischemic heart disease and stroke. During the past decade, the difference between aboriginal women and the general female population with respect to stroke has decreased noticeably, whereas that for ischemic heart disease has remained the same. The higher prevalence of risk factors for cardiovascular diseases such as high blood pressure, diabetes, obesity, and smoking may account, in part, for this trend.[14,15,16]

2.6 Time Trends

Cardiovascular disease death rates have been declining steadily in Canada since the mid-1960's. The 1992 death rates are almost half those of 1969; this applies to all major categories of cardiovascular diseases, and to rates among both men and women (Figure 12).[1]

Ischemic heart disease rates peaked in Canada in the mid-1960's (Figure 12). Ontario's rates were the highest, reaching 447 deaths per 100,000 population (males) in 1970; whereas those in Saskatchewan were the lowest, at 318 deaths per 100,000 population (males) in 1969.[17] Since then, the decline has been steady at approximately 2% per year. The rate of decline has been greatest in Atlantic Canada and least in the Prairies, so that by 1992, considerably less regional variation is seen than two decades earlier. The decline may, like that in the United States, be explained partly by a reduction in the prevalence of smoking and consumption of dietary fat, improved identification and control of high blood pressure, and improved medical and surgical care of individuals who have developed cardiovascular diseases.[18]

The decline in the death rate from acute myocardial infarction is similar to that seen for ischemic heart disease (Figure 12). Statistics specific to acute myocardial infarction were not collected until 1969 and therefore death rates are not available prior to this time.

TABLE 3

Age-Standardized Mortality Rates,[1] per 100,000
All Cardiovascular Diseases, Males and Females
Provincial Comparisons, 1992

	MALES				FEMALES			
	AMI	IHD	STROKE	TOTAL CVDS	AMI	IHD	STROKE	TOTAL CVDS
Newfoundland	123	223	58	360	69	129	5	241
Prince Edward	113	219	47	334	70	115	36	202
Nova Scotia	103	196	49	336	53	100	40	199
New Brunswick	117	181	48	325	58	98	39	196
Quebec	122	202	47	327	58	98	38	184
Ontario	102	203	50	324	48	106	43	191
Manitoba	108	189	53	325	48	89	48	181
Saskatchewan	109	173	46	292	44	79	37	164
Alberta	91	177	53	300	40	873	44	175
British Columbia	94	164	50	297	42	78	44	168
CANADA	106	193	49	319	50	97	42	185

1. Standardized to 1986 Canadian population

SOURCE: Health Statistics Division, Statistics Canada

TABLE 4

Age-Standardized Mortality Rates and Standardized Mortality Ratios for Ischemic Heart Disease (IHD) and Stroke on Indian Reserves (IR) and in Canada, per 100,000 Ages 0-64, 1979-1991

	Age-Standardized Mortality Rates						Standardized Mortality Ratios		
	1979-82		1983-86		1987-91		1979-82	1983-86	1987-91
	IR	Canada	IR	Canada	IR	Canada			
Males									
IHD	85.5	88.0	74.1	72.4	51.4	55.3	0.97	1.03	0.94
Stroke	17.2	11.4	13.9	9.1	9.8	7.7	1.47	1.6	1.24
Females									
IHD	26.3	22.3	30.7	18.4	16.8	14.5	1.2	1.7	1.16
Stroke	25.6	9.2	14.9	7.2	11.5	5.9	2.84	1.97	1.86

Source: Laboratory Centre for Disease Control, Health Canada; Mao et al, 1992

Figure 8
Ischemic Heart Disease, Males
Ages 35-74, 1986-1992

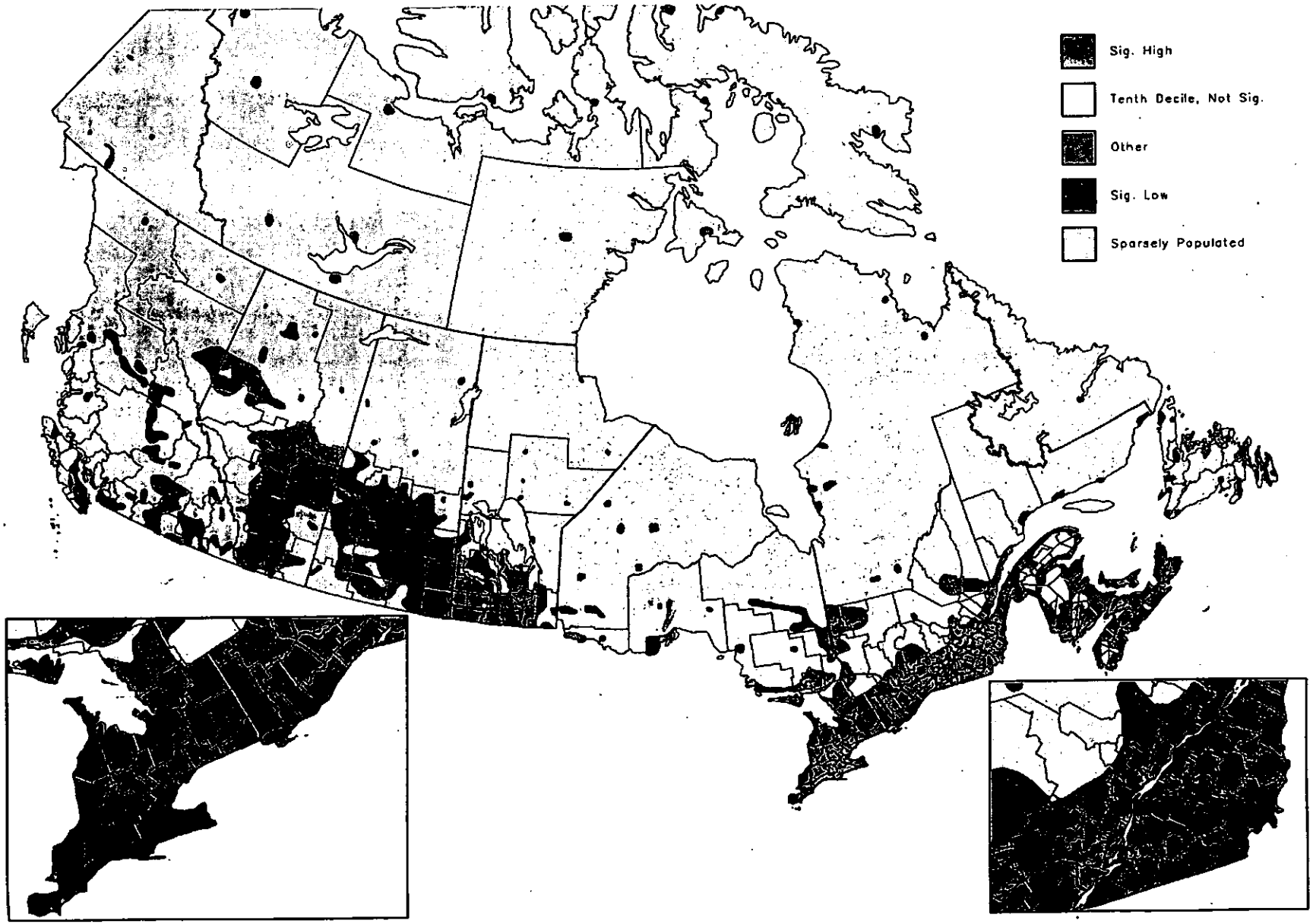


Figure 9
Ischemic Heart Disease, Females
Ages 35-74, 1986-1992

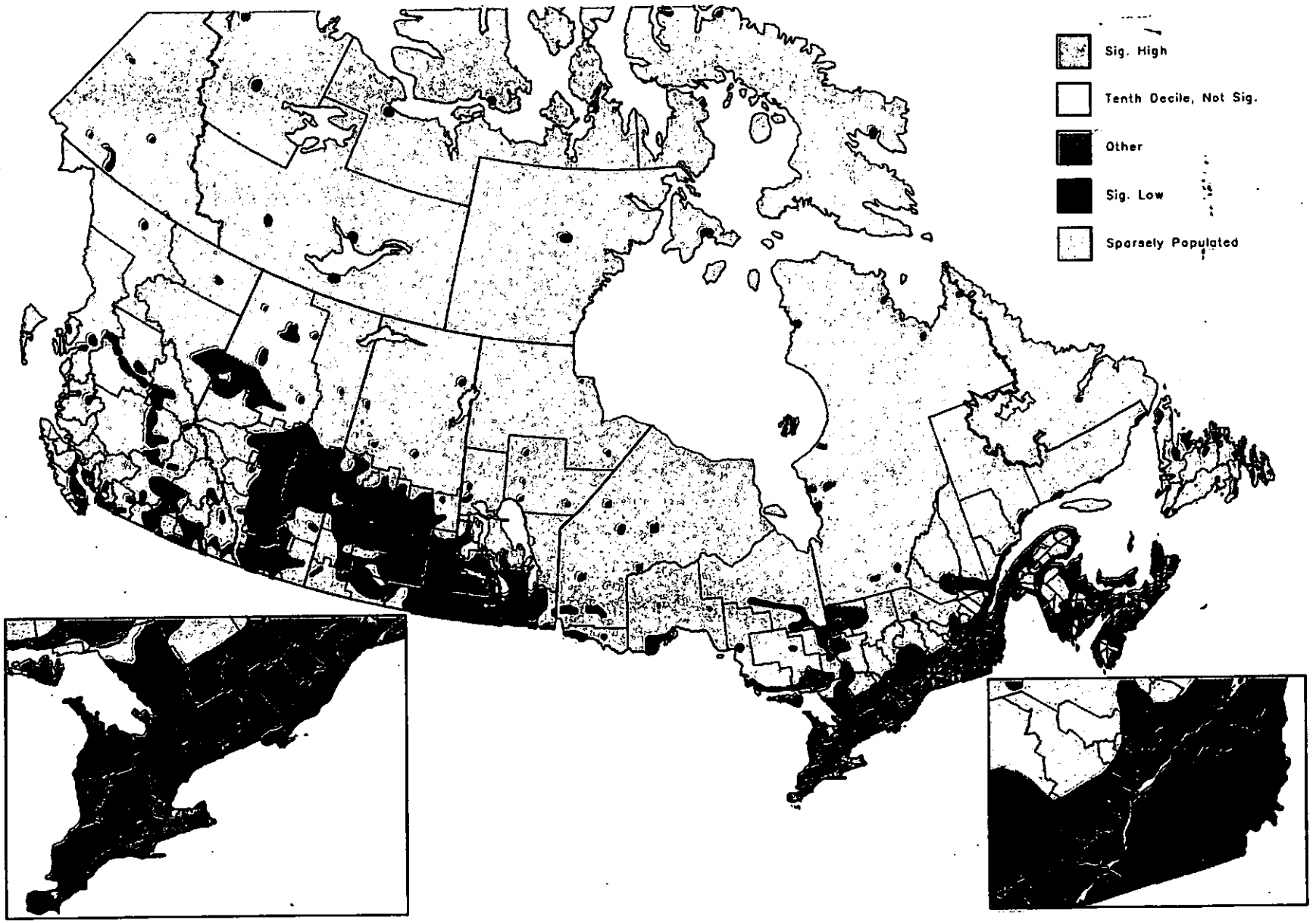


Figure 10
Stroke, Males
Ages 35-74, 1986-1992

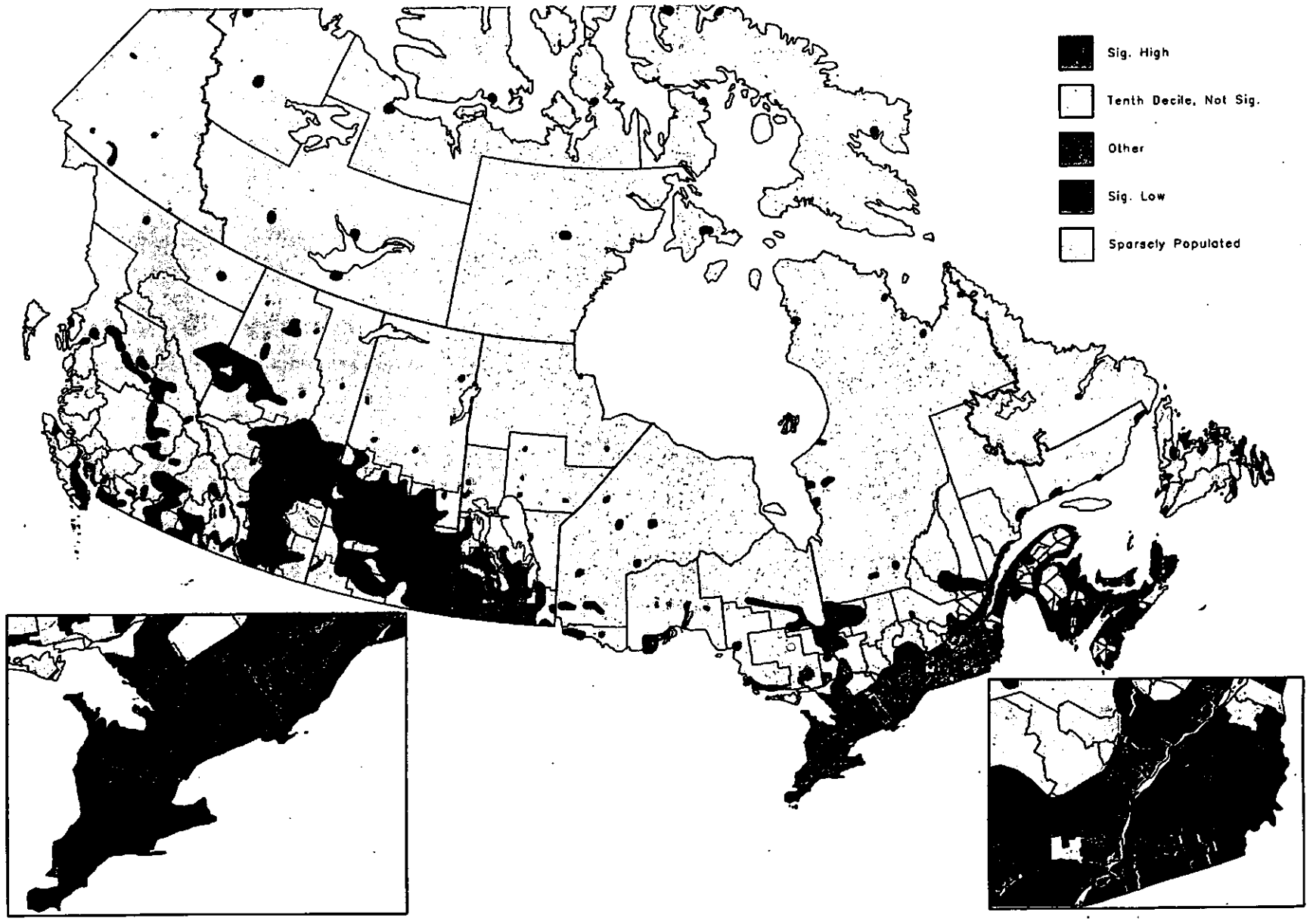


Figure 11
Stroke, Females
Ages 35-74, 1986-1992

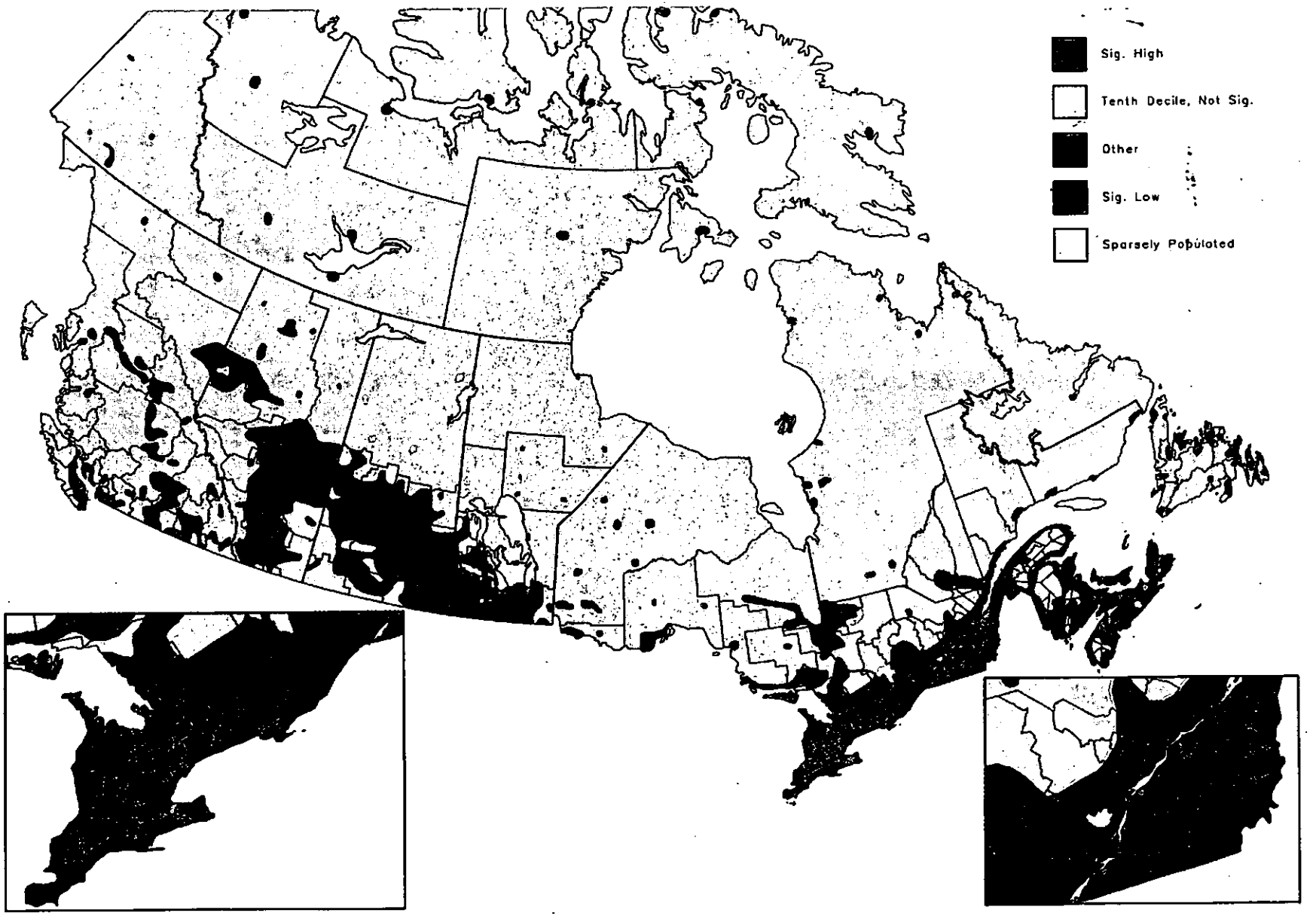
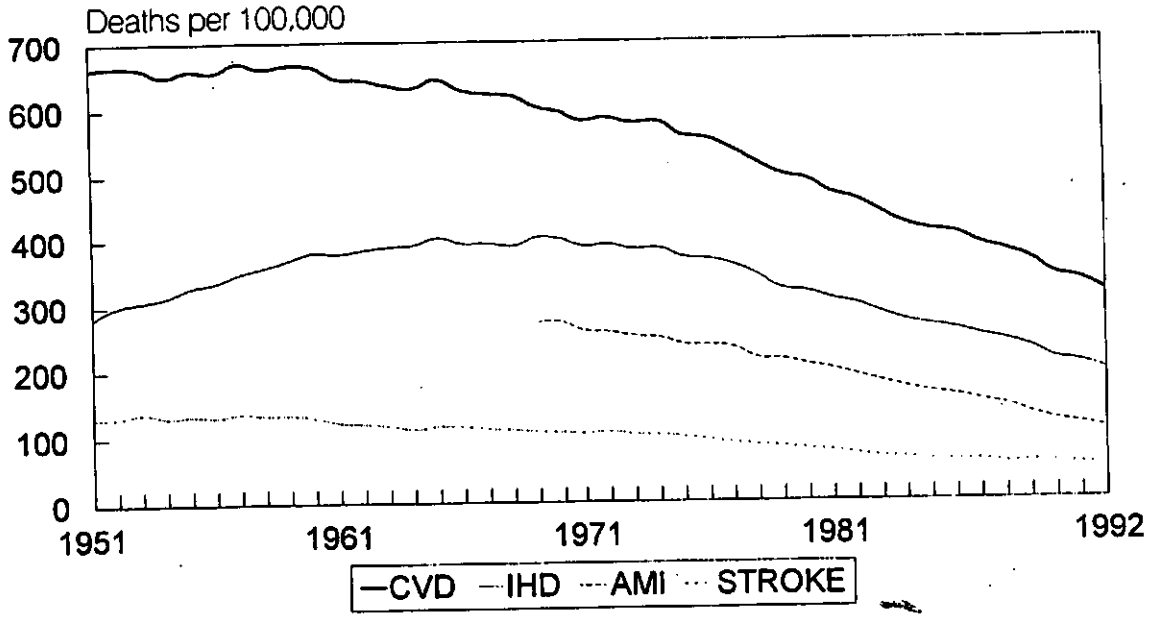
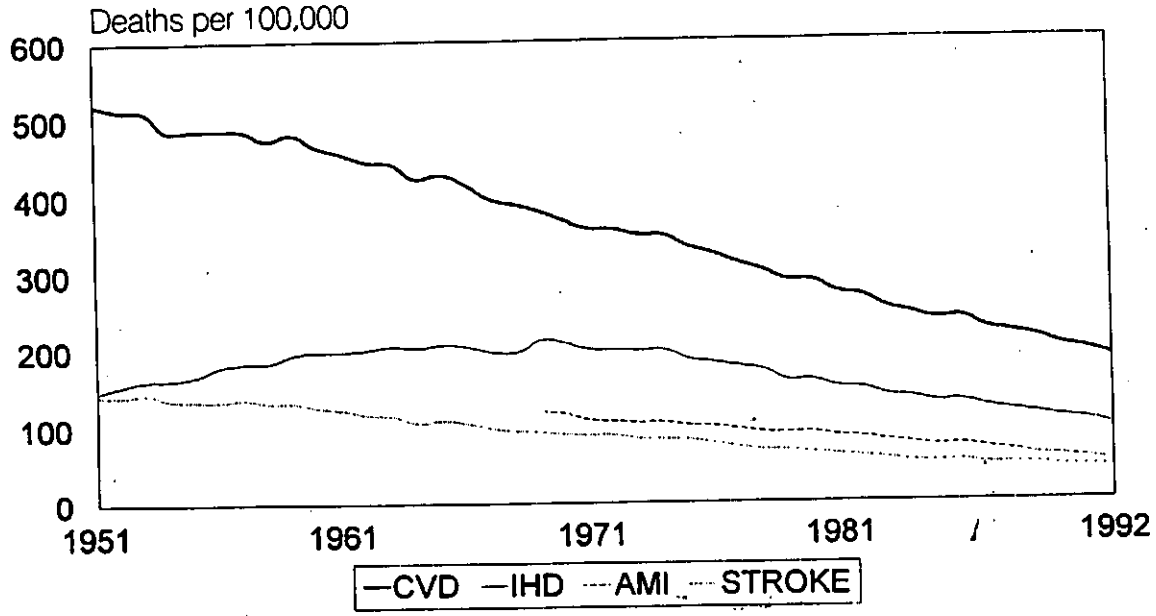


FIGURE 12

Age-Standardized Mortality Rate*, per 100,000, Males, 1951-1992



Age-Standardized Mortality Rate*, per 100,000, Females, 1951-1992



***Standardized to 1986 Canadian Population**
SOURCE: Health Statistics Division, Statistics Canada

Although stroke in Canada is responsible for 7% of all deaths, the death rate from stroke is among the lowest in the world. Death rates from stroke declined at approximately 2% per year since the 1950's; the percentage of deaths due to stroke has remained stable at 7% since 1988. The death rate from stroke is closely related to the prevalence of high blood pressure and smoking in the population. The decline in death rate from stroke may be related to an improved public awareness of high blood pressure and its earlier detection and treatment, and to a reduced prevalence of smoking.

2.7 Potential Years of Life Lost

An indication of the impact of premature death on society can be obtained from the calculation of potential years of life lost. This is the sum of the number of years of life that individual Canadians "lost", that is, did not live, due to premature death (considered arbitrarily as that prior to age 75). Premature death from cardiovascular diseases is responsible for an estimated 290,000 years of life lost, and is third after that from injuries and cancer (Figure 13).[10] This represents a significant social and economic loss to the nation and stresses the importance of preventive health programs to decrease the number of premature deaths from cardiovascular diseases.

3. INCIDENCE OF CARDIOVASCULAR DISEASES

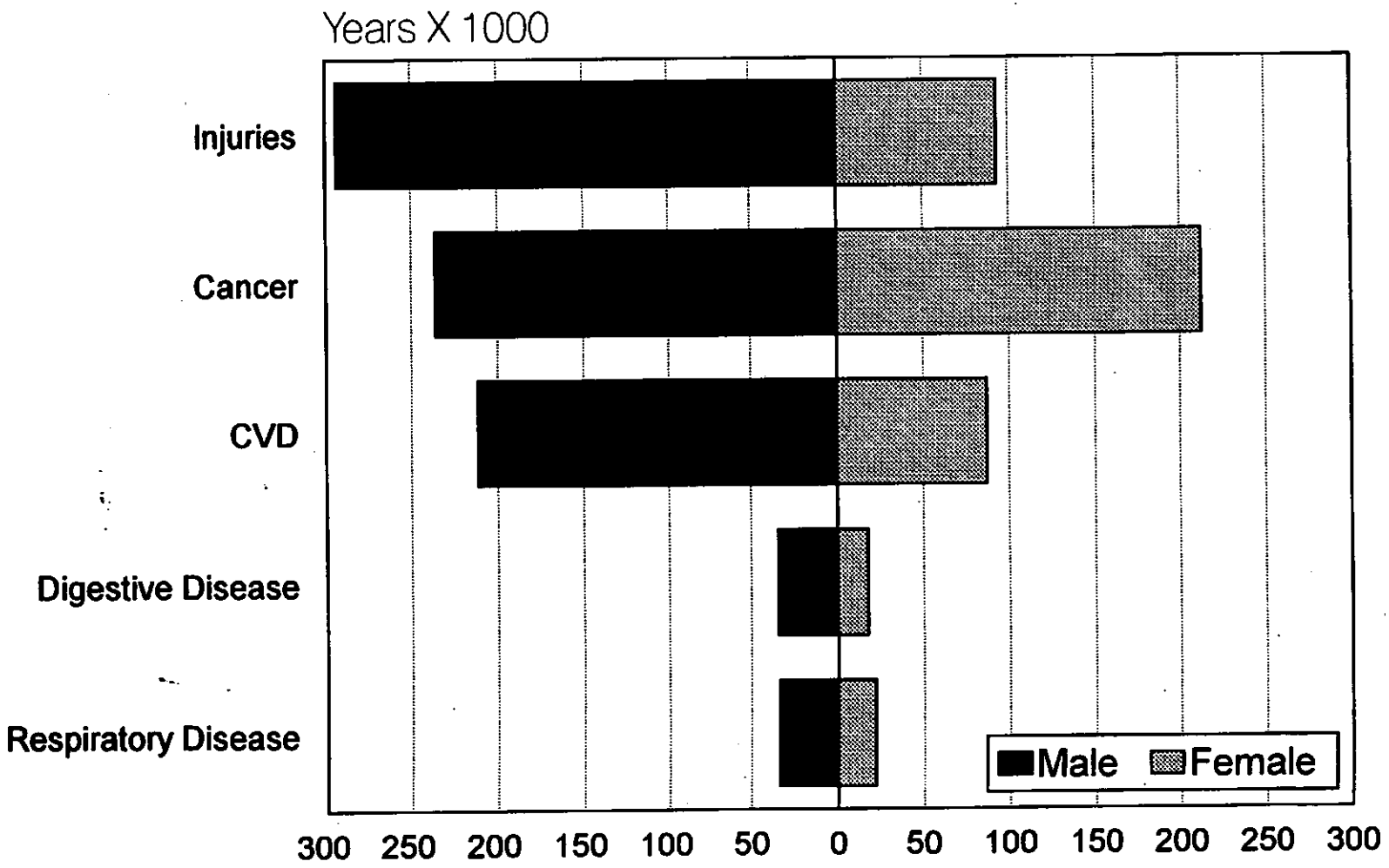
Declines in mortality from cardiovascular diseases may be attributable to a decreased incidence, improved survival or a combination of the two.[19,20] Through the determination of incidence rates, the impact of lifestyle changes and improvements in treatment may be identified. Furthermore, estimation of the incidence of cardiovascular diseases is of central importance to effective health care planning.[20]

To explain regional differences and time trends in death from cardiovascular diseases in Canada, the Nova Scotia - Saskatchewan Cardiovascular Disease Epidemiology Group examined the incidence of acute myocardial infarction in these two provinces.[19] Nova Scotia experiences one of the highest rates of ischemic heart disease death in Canada while Saskatchewan has one of the lowest. The incidence of fatal and non-fatal cases of acute myocardial infarction was estimated by linking hospital discharge records with the Canadian Mortality Database.[21] The study demonstrates a higher incidence rate and lower survival rate of acute myocardial infarction in Nova Scotia, which appears to account for the higher death rate in that province when compared with Saskatchewan (Figure 14; Table 5).[19] Incidence and mortality rates decreased and survival rates increased in both provinces between 1977-85.[22] The exception is the rate of fatal first acute myocardial infarction in men, which increased in this interval. To further explain changing mortality rates, data regarding cardiovascular disease incidence are needed from other provinces and for more recent periods.

The World Health Organization's ***Monitoring the Trends and Determinants of Cardiovascular Disease*** (MONICA) project is an international cardiovascular disease surveillance study covering a total population of more than 15 million people in 41 centres.[23] To explain international cardiovascular disease trends, data regarding death and incidence rates, risk factor profiles and medical care are being collected in each centre using a standardized methodology. The population of Halifax County, Nova Scotia is one of the population groups being studied.[24]

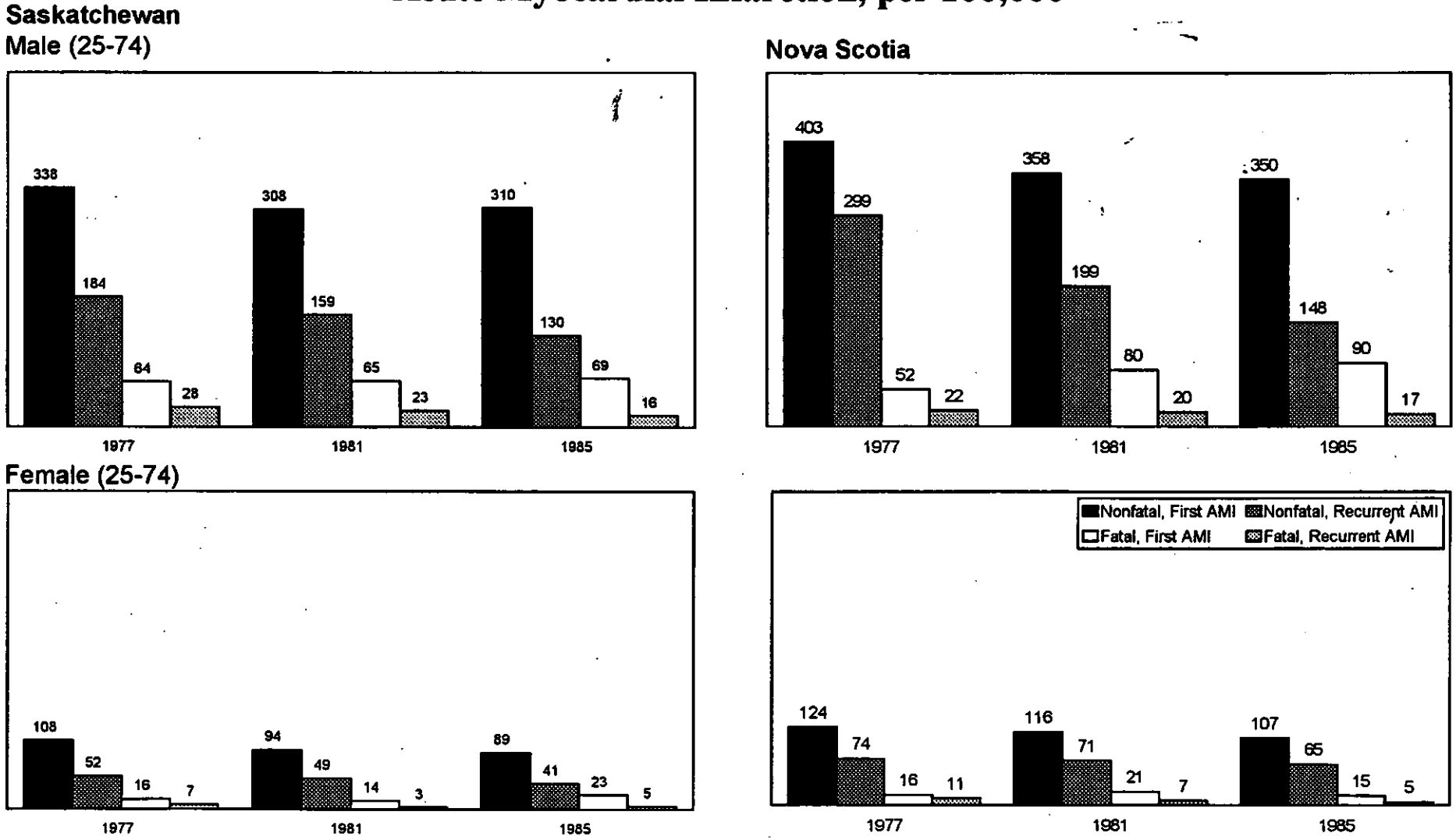
FIGURE 13

Potential Years of Life (in 1000's) Lost Prior to Age 75, by Disease Category, Canada, 1992



SOURCE: Laboratory Centre for Disease Control, Health Canada

FIGURE 14
Age-Standardized Rates* of Fatal and Nonfatal First and Recurrent Acute Myocardial Infarction, per 100,000



*Standardized to 1971 Canadian Population

SOURCE: The Nova Scotia-Saskatchewan Cardiovascular Epidemiology Group

TABLE 5

Survival Rates (Percentage) for Hospitalized Patients Experiencing an Acute Myocardial Infarction in 1981

	AGE GROUP	NUMBER	DAY(S) AFTER AMI[1] EPISODE		YEAR(S) AFTER AMI EPISODE	
			1	14	1	5
Nova Scotia						
Males	25-54	341	96.5	90.3	87.4	86.2
	55-74	805	97.0	86.0	78.6	74.3
Females	25-54	64	98.4	87.5	84.4	81.3
	55-74	370	86.3	82.4	74.3	71.9
Saskatchewan						
Males	25-54	295	94.9	89.8	92.9	89.8
	55-74	864	94.6	85.5	80.9	75.6
Females	25-54	57	91.2	84.2	84.2	84.2
	55-74	353	93.8	87.3	75.6	70.5

1. AMI = Acute Myocardial Infarction

SOURCE: The Nova Scotia-Saskatchewan Cardiovascular Disease Epidemiology Group, Can J Cardiol 1992;8:253-8[22]

Every fatal and non-fatal case of acute myocardial infarction is validated and documented in a registry.

4. *DISABILITY FROM CARDIOVASCULAR DISEASES*

About 20% of disability pensions paid by the Canada Pension Plan in 1992 to individuals up to age 65 were for cardiovascular diseases, second only to payments for musculoskeletal disability (34%).[1] This proportion has been decreasing by approximately 1% per year in recent years. Sixty percent (60%) of the cardiovascular diseases-related pensions are for ischemic heart disease, of which heart attack is only a small proportion (2.4%) while 20% of the cardiovascular diseases-related pensions are for stroke.[25]

5. *UTILIZATION OF HEALTH SERVICES*

5.1 Hospitalization

Cardiovascular diseases have a significant impact on Canada's health care system. In fiscal year 1991-92, they accounted for 455,000 (12%) hospital admissions which is an increase from 426,000 admissions in 1989-90 (Figure 15).[1] Of the admissions, 38% were for ischemic heart disease, including 12% for acute myocardial infarction, 15% for stroke and 47% for other cardiovascular diseases.[1]

More than 19% of all patient days in hospital, a total of 8 million in 1991-92, were for the treatment of cardiovascular diseases.[10] For men and women respectively, 40% and 46% of these cardiovascular disease patient days result from stroke, 27% and 20% from ischemic heart disease and 11% and 6% from heart attacks. Thus, although stroke is responsible for only 19% of cardiovascular disease mortality, it accounts for nearly half of the patient days in hospital attributable to cardiovascular diseases.

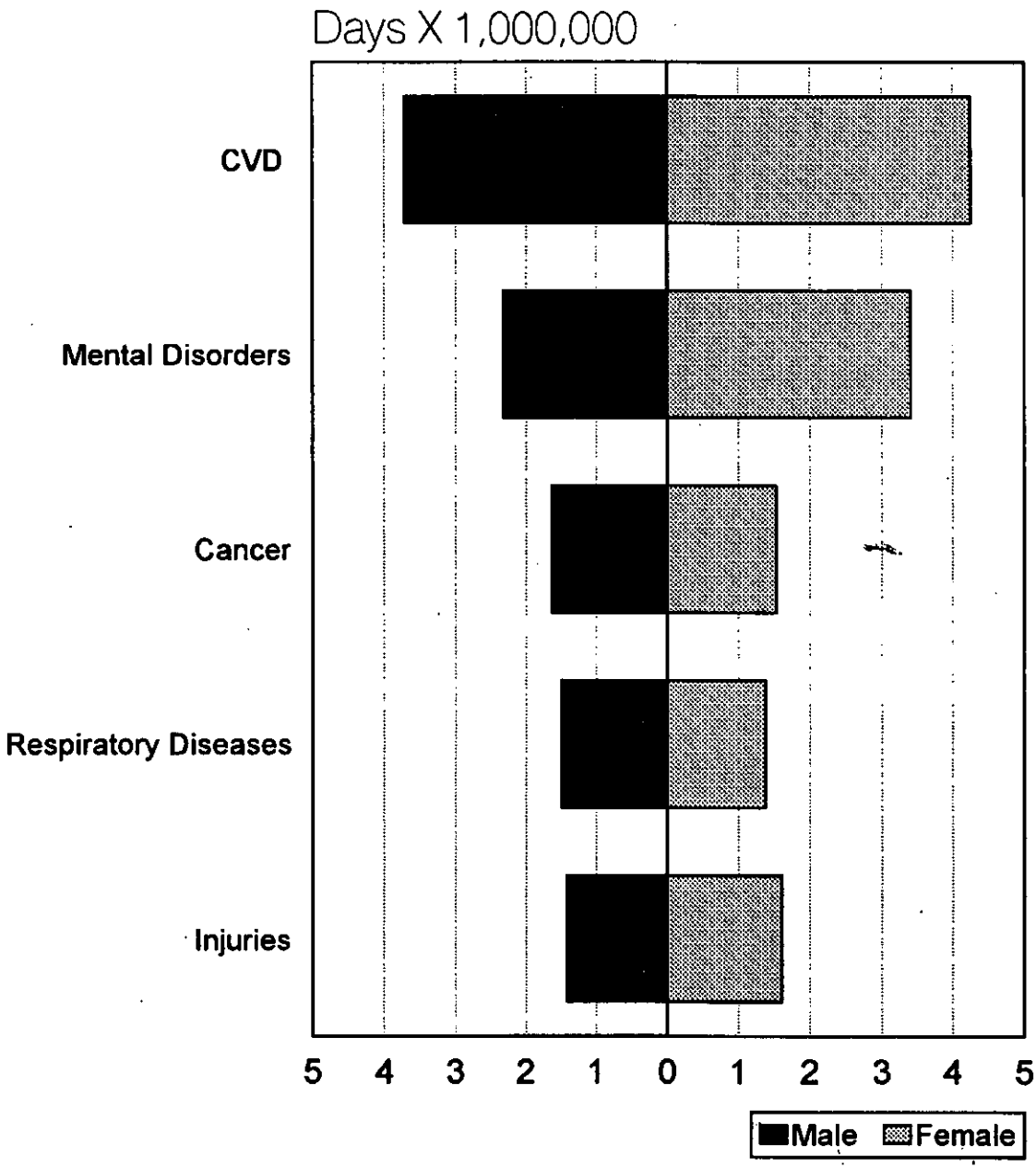
Patients with cardiovascular diseases have a longer length of stay (17.5 days) that the average for all causes (11.4 days) with striking differences between the young (35-64 years) and older (65+ years) age groups (10.0 days versus 22.4 days, respectively). The average length of hospital stay is 14.5 days for men and 21.3 days for women. This difference may reflect the older average age of women who experience cardiovascular diseases and the greater proportion of women suffering from stroke.[1]

5.2 Physician Consultation

It is estimated that in 1994 Canadians made 264 million visits to physicians.[26] Nearly ten percent (9.9%) of these visits were for cardiovascular diseases (Table 6). Of these cardiovascular disease-related visits, half (50%) are for the management of high blood pressure, 25% for ischemic heart disease, and 25% for other cardiovascular diseases.[26] Of those for ischemic heart disease, 59% of visits are for acute myocardial infarction and 41% for angina.

FIGURE 15

Hospital Days for Major Causes by Sex, Canada, 1991-92



SOURCE: Laboratory Centre for Disease Control, Health Canada

TABLE 6

Numbers and Percentage Physicians Visits per Diagnostic Category[1] Canada, 1994

Diagnostic Category (ICD-9)	Estimated Number (Millions)	Percentage
Respiratory Diseases (460-519)	36.5	13.8
Cardiovascular Diseases (390-459)	26.0	9.9
Central Nervous System Disorders (320-389)	21.2	8.0
Mental Disorders (290-319)	22.1	8.4
Musculoskeletal Disorders (710-39)	20.3	7.7
Injury & Poisoning (800-999)	15.5	5.9
Genito-Urinary Diseases (580-629)	15.5	5.9
Skin Diseases (680-709)	13.3	5.0
Digestive Diseases (520-79)	12.3	4.7
Endocrine/Immune Disorders (240-79)	14.1	5.3
Infective/Parasitic Diseases (001-139)	10.7	4.1
Neoplasms (140-239)	8.3	3.2
Other Categories	48.2	18.3
TOTAL	263.9	100

1. Percentage drawn from the Canadian Disease and Therapeutic Index of IMS Canada. The database is comprised of self-reported practice patterns of a representative sample of 652 office-based family physicians and specialists throughout Canada surveyed four times per year.

SOURCE: **Intercontinental Medical Statistics (IMS) Canada**
Canadian Disease and Therapeutic Index, Year Ending 1994

5.3 Ischemic Heart Disease-Related Procedures

The rates of both coronary artery bypass (CAB) surgery and angioplasty have increased substantially during the past decade (Figure 16). A total of 15,034 CAB surgical procedures (52.9 per 100,000 population) and 14,299 angioplasties (50.3 per 100,000 population) were performed in Canada in the 1992-93 fiscal year.[1] In Canada in January 1990, 4,495 patients were awaiting CAB surgery and 852 awaiting angioplasty. The average waiting time was 22.6 and 11.0 weeks respectively for these procedures.[27,28]

There is considerable variation in the cost for CAB surgery. For example, at the Vancouver General Hospital in 1989, total inpatient costs for CAB surgery were found to vary from $10,982 to $33,676 per case (mean $14,328). Costs tend to increase with the patient's age and the number of vessels grafted. The change in the mean age of CAB patients from 52.2 to 61.1 years between 1975 and 1985 may account, in part, for the cost increase observed in that decade.[29]

5.4 Utilization of Pharmaceuticals

Prescription drugs for the treatment of cardiovascular diseases are estimated to account for 12.6% of the total 220 million prescriptions dispensed in Canada in 1994 (Table 7).[26] Calcium channel blocking agents are the most frequently prescribed class of drug, comprising 26.7% of the estimated 27.8 million prescriptions dispensed for the treatment of cardiovascular diseases. This is followed by angiotensin converting enzyme inhibitors (22.5%), beta-blocking agents (22.3%), vasodilators (12.3%), digitalis preparations (8.4%), and other agents (6.5%). Diuretics, most of which are utilized in the treatment of cardiovascular diseases, account for a further small percentage (4.5%) of prescription drugs dispensed in Canada. During the past five years, the use of calcium channel blocking agents and angiotensin converting enzyme inhibitors has increased, whereas that of beta-blocking agents, vasodilators, digitalis preparations and diuretics has decreased.[26,30]

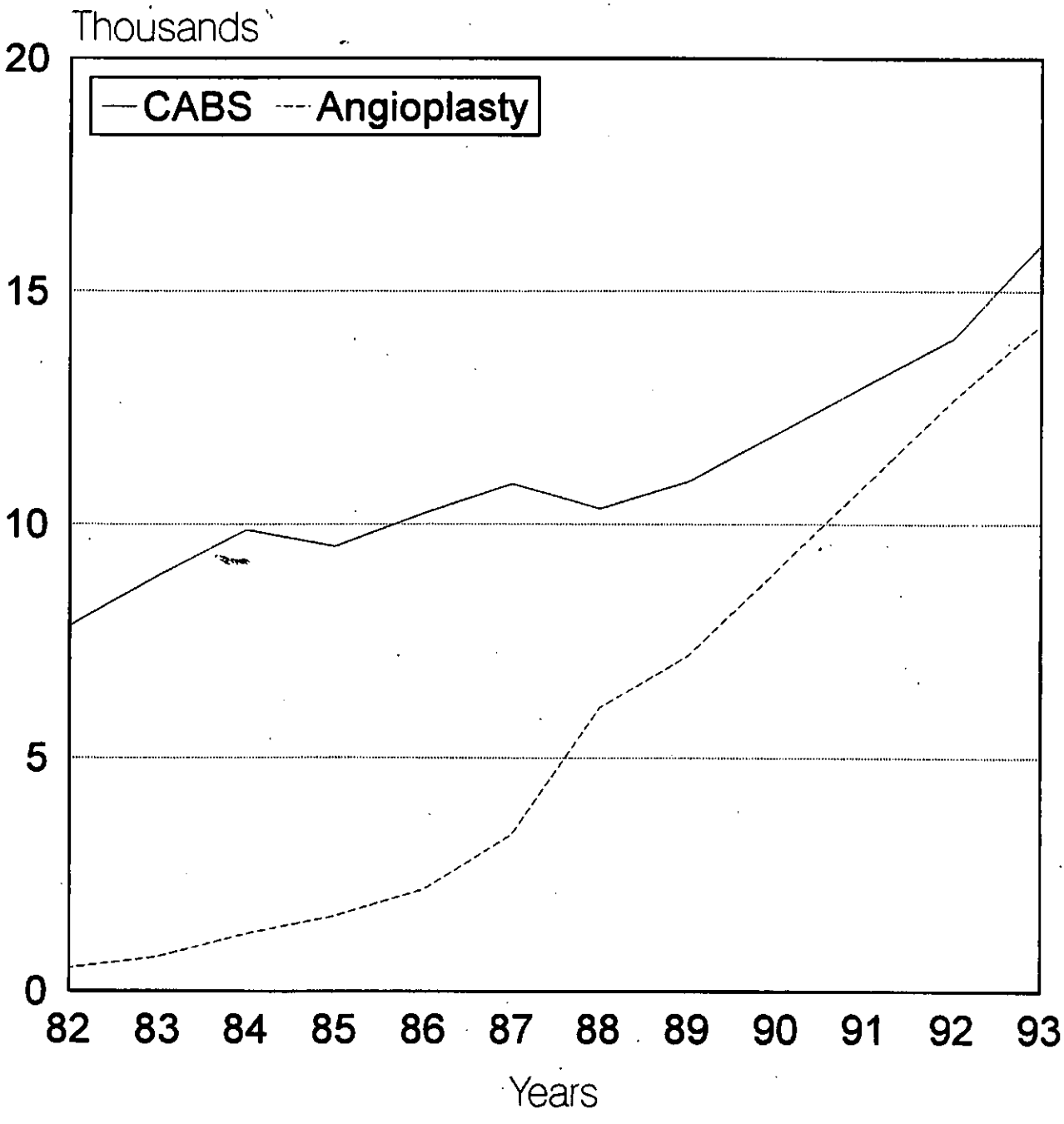
6. ECONOMIC IMPACT OF CARDIOVASCULAR DISEASES

Cardiovascular diseases have a significant economic impact in Canada as measured by direct costs.[31] Direct costs refer to the value of resources actually expended that could have been allocated elsewhere in the absence of disease.

Cardiovascular diseases were the most expensive disease category in 1993 accounting for $8.3 billion or 16% of the total direct costs of illness.[31] Figure 17 illustrates the total direct costs for each diagnostic category.

The sources of the direct costs of cardiovascular diseases are illustrated in Figure 18. Direct costs are comprised of those for hospital expenditures, medical care, drugs, research, and pensions and benefits. Hospital care was the most expensive direct cost component ($5.2 billion) for cardiovascular diseases. Cardiovascular diseases contributed 8.4% ($900 million) to the costs of medical services provided by physicians across Canada. About 22% of the total cost of drugs distributed to the Canadian consumer through drug stores and hospitals was spent on drugs for the treatment of cardiovascular diseases ($1.6 billion). Cardiovascular disease research accounted

FIGURE 16
Coronary Bypass Surgery (CABS) and Angioplasty, Age-Standardized Rates, per 100,000 Canada, 1982-1993*



Source: Canadian Centre for Health Information, Statistics Canada
***1993 refers to fiscal year 1993/94, etc.**

TABLE 7

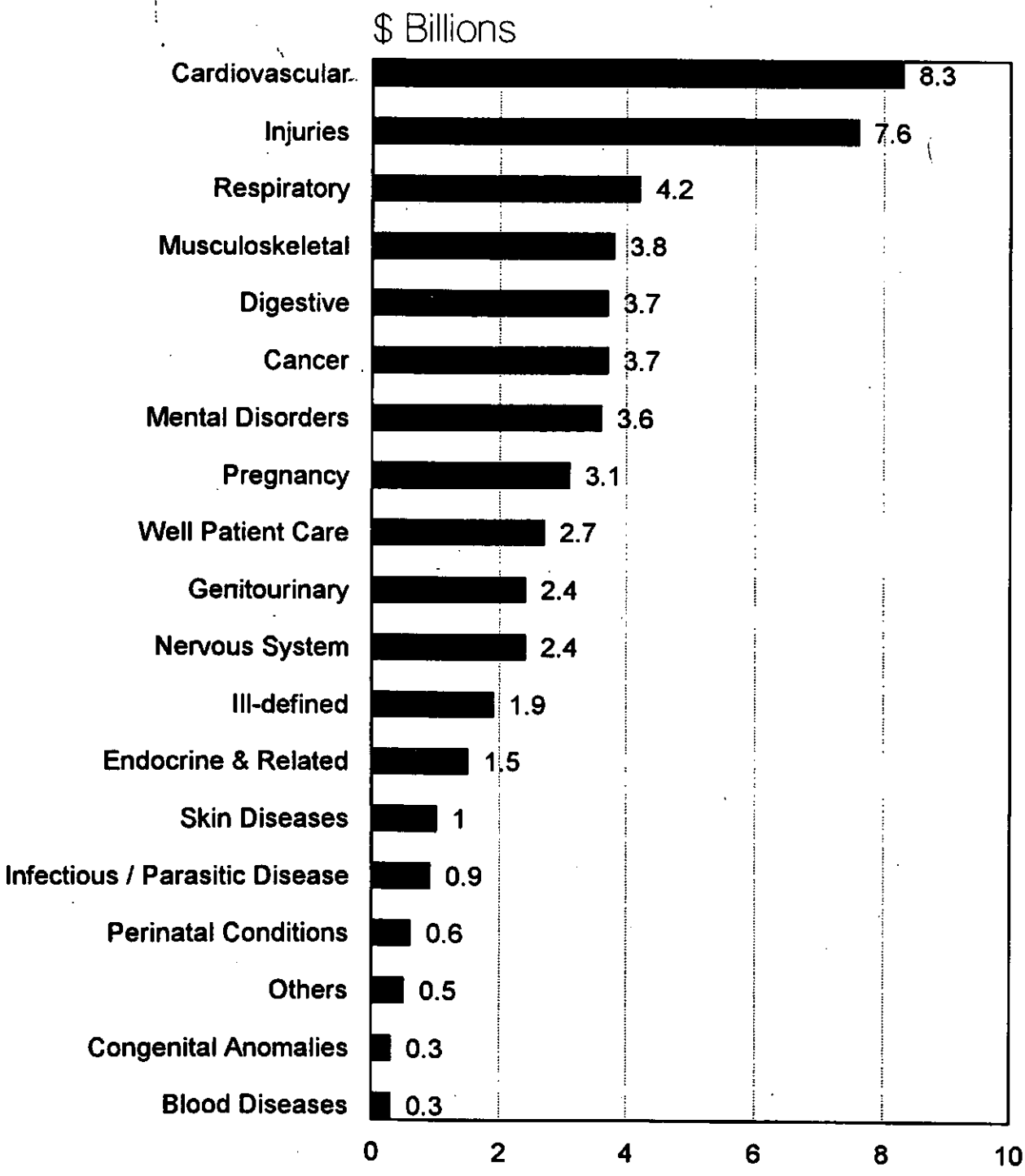
Pharmaceutical Prescriptions Dispensed by Type of Drug[1], Number and Percentage, Canada, 1994

Type of Drug	Estimated Number (Millions)	Percentage
Cardiovascular	27.8	12.6
Anti-infectives	26.7	12.2
Psychotherapeutics	21.6	9.8
Analgesics	18.9	8.6
Hormones	16.7	7.6
Contraceptives	9.1	4.2
Diuretics	8.5	3.9
Antiarthritics	9.8	4.5
Others	80.5	36.6
TOTAL	**220.0**	**100.0**

1. Data drawn from the Canadian Compuscript Audit of IMS Canada. The database is comprised of the dispensing patterns of a representative sample of 1500 retail pharmacies throughout Canada collected on a continual basis.

SOURCE: Intercontinential Medical Statistics (IMS) Canada
Canadian Compuscript, Year Ending December, 1994

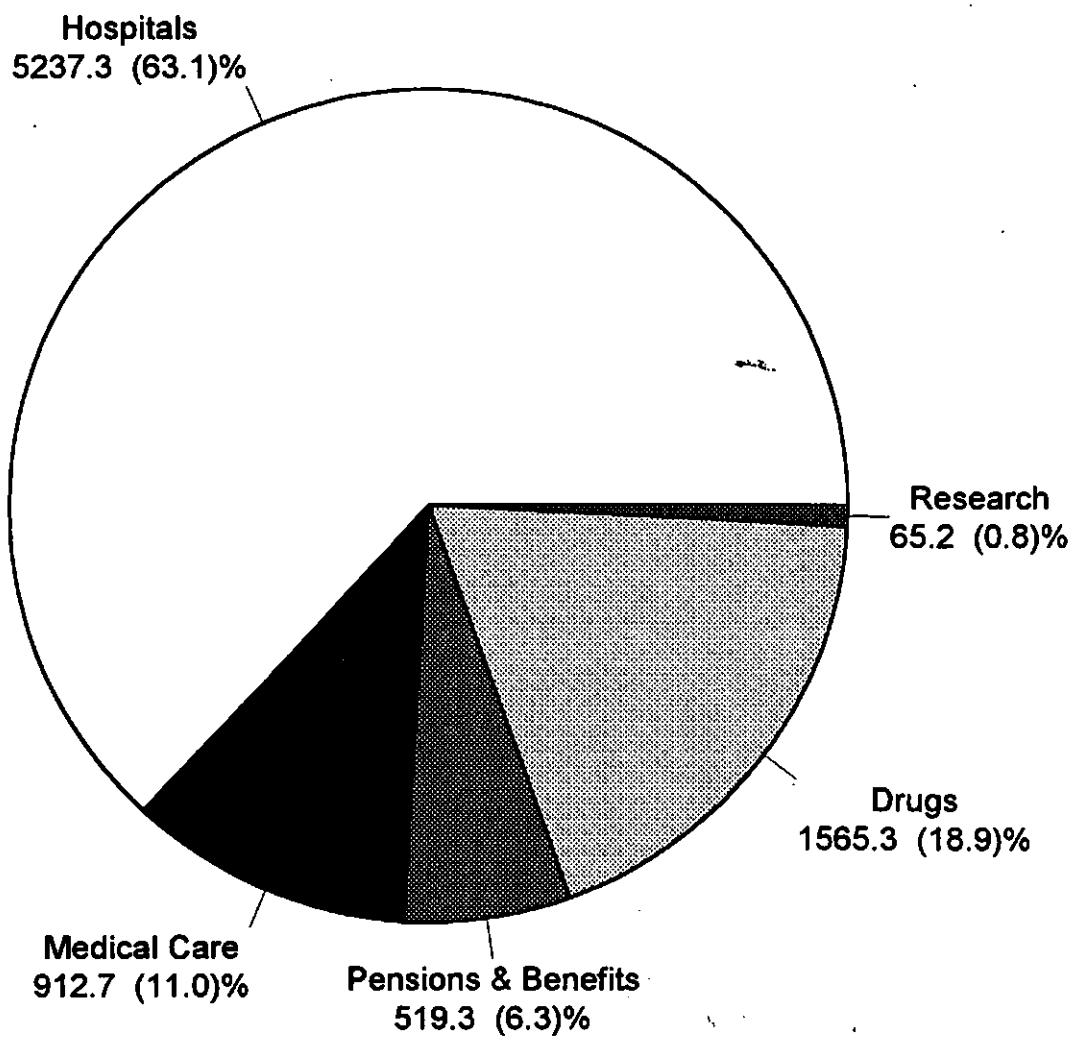
Figure 17
Direct Costs of Illness by Disease Category, Canada, 1993



SOURCE: Laboratory Centre for Disease Control, Health Canada

Figure 18

Direct Costs of Cardiovascular Diseases, $Millions (%) Canada, 1993



SOURCE: Laboratory Centre for Disease Control, Health Canada

for the expenditure of $65 million. Combined total net payments for disability pension and workers compensation payments for cardiovascular diseases were $519 million.

The categories of stroke and ischemic heart disease accounted for 40.9% of the total direct cost of cardiovascular diseases. They represent 11.4% of the total hospitalization expenditure for all disease categories, $35.5 million for pharmaceuticals; and more than one quarter ($16.7 million) of the cardiovascular disease research costs. Ischemic heart disease alone accounted for almost one third ($270 million) of the cardiovascular disease medical cost. Approximately 28 billion dollars of the total direct costs of illness in Canada for 1993 cannot be classified by disease category. As a result, these numbers may underestimate the true economic impact of cardiovascular diseases.

Other costs play a significant role in the economic burden of illness in Canada. Indirect costs include the value of lost productivity due to illness or disability, and the loss of future earnings due to premature death. Although indirect costs are currently not available, their impact on total costs is significant.

7. *RISK FACTORS FOR CARDIOVASCULAR DISEASES*

7.1 Risk Factors for Ischemic Heart Disease

Considerable research has identified the major risk factors for ischemic heart disease.[32] Some factors such as family history of premature ischemic heart disease, age and male sex are "non-modifiable". Others such as smoking, elevated blood cholesterol, high blood pressure, physical inactivity, diabetes and obesity are considered "modifiable" through individual behaviour change or treatment. There are other risk factors, not yet well defined, which may contribute to ischemic heart disease (Section 7.1.7).[33]

As part of the Canadian Heart Health Initiative,[34] the prevalence of risk factors in Canadian adults has been determined using a standardized methodology.[35] Survey data were obtained from 23,251 Canadians between the ages of 18 and 74 and the results from ten provinces have been reported.[36,37]

For the major risk factors of smoking and high blood pressure, there is a definite east to west gradient, with eastern provinces demonstrating a higher prevalence than western provinces (Table 8). The exceptions are high blood pressure in Quebec and smoking in Ontario, which have the lowest respective rates for these risk factors. There is a similar but less striking trend for sedentary life style and obesity, but relative uniformity of risk from elevated blood cholesterol.

7.1.1 Smoking

In the Canadian Heart Health Surveys,[37] the prevalence of smoking was highest in Atlantic Canada and Quebec. Ontario and Saskatchewan had the lowest rates for those aged 18 - 74 (Table 8). Smoking was highest in the 18 - 34 age group (Table 9).

TABLE 8
Percentage (%) of Population Aged 18-74 with Selected Risk Factors, by Province Canada, 1986-1992[1]

Risk Factors	PROVINCES[2]										
	BC (%)	AB (%)	SK (%)	MB (%)	ON (%)	PQ (%)	NB (%)	NS (%)	PE (%)	NF (%)	Canada[3] (%)
At least one major risk factor[4]	59	58	61	62	61	67	67	69	65	69	63
Major risk factors											
Regular smoking[5]	25	27	24	25	23	32	31	33	29	35	27
High blood pressure[6]	13	15	16	16	17	13	19	19	20	22	15
Elevated blood cholesterol[7]	43	37	43	44	40	48	46	44	45	43	43
Other risk factors											
Sedentary life style[8]	29	37	31	45	39	37	45	42	44	48	37
Obesity[9]	27	33	35	36	31	28	36	36	37	42	31
Diabetes[10]	4	5	5	5	4	5	5	-	4	6	4

1. Age and sex standardized to 1986 Canadian population
2. British Columbia (BC), Alberta (AB), Saskatchewan (SK), Manitoba (MB), Ontario (ON), Quebec (PQ), New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PE), Newfoundland (NF)
3. Excluding Yukon Territory and Northwest Territories
4. More than one of regular smoking, high blood pressure and elevated blood cholesterol
5. One or more cigarettes per day
6. Diastolic pressure $\geq$ 90 mm Hg or being treated with medication, a salt-restricted diet or weight-reduction program
7. Total plasm cholesterol level $\geq$ 5.2 mmol/L
8. Respondents not physically active during leisure time at least once a week during the month preceding the survey
9. Body Mass Index $\geq$ 27 or over (Body Mass Index = Weight in kg/(Height in m)^2
10. Self-reported; Diabetes information not collected for Nova Scotia

SOURCE: Canadians and Heart Health: Reducing the Risks; Health Canada 1995; Canadian Heart Health Surveys

TABLE 9

Prevalence of Cardiovascular Disease Risk Factors[1] (Percentage of Individuals)[2]

MALES	AGE GROUPS						
Risk Factor	**18-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**TOTAL**
Smoking[3]	33	35	32	31	22	16	30
High Blood Pressure[4]	2	9	15	25	33	27	16
Elevated Blood Cholesterol[5]	14	34	58	65	61	65	48
Obesity[6]	18	27	37	45	47	39	35
One or More Risk Factors[7]	39	57	72	80	79	80	64
Two or More Risk Factors[7]	5	17	28	34	30	24	22

FEMALES	AGE GROUPS						
Risk Factor	**18-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**TOTAL**
Smoking[3]	32	34	33	26	18	12	28
High Blood Pressure[4]	1	3	6	19	32	38	13
Elevated Blood Cholesterol[5]	18	23	31	60	81	80	43
Obesity[6]	13	19	27	32	42	45	27
One or More Risk Factors[7]	41	49	56	74	89	89	63
Two or More Risk Factors[7]	6	9	14	28	36	37	19

1. Age standardized to 1986 Canadian population
2. Prevalence in all Canadian provinces excluding Ontario
3. Regular cigarette smoker: one or more cigarettes per day
4. Diastolic blood pressure $\geq$ 90 mmHg and/or pharmacologic or non-pharmacologic treatment
5. Total plasma cholesterol $\geq$ 5.2 mmol/L
6. Body Mass Index $\geq$ 27; Body Mass Index = Weight in kg/(Height in meters)^2; data includes Ontario
7. Major risk factors: regular smoker, high blood pressure, elevated blood cholesterol

SOURCE: **Canadian Heart Health Surveys: A Profile of Cardiovascular Risk. Can Med Assoc J 1992;146:1969-2029.**[35,40,42,48,53]

Smoking is believed to account for up to 17% of deaths from cardiovascular diseases.[38] Thirty-one percent (31%) of Canadians over the age of 15 are regular cigarette smokers (one or more cigarettes per day). As reported in the *Survey on Smoking in Canada 1994*, there has been no real change in the overall prevalence of smoking since 1986.[39]

There is little difference in the overall smoking rates between the sexes (34% for men versus 32% for women).[40] In 1981, 40% of men in the age group 15-19 were smokers. This rate decreased to 20% in 1991. Similarly for young women, the rate declined from 42% in 1981 to 21% in 1990. Since then, the rates have increased steadily to 26% for men and 29% for women in 1994.[39] The number of cigarettes smoked, i.e. the consumption, but not the number of smokers has declined for young women, but not for young men.

7.1.2 Elevated Blood Cholesterol

A 2% decrease in ischemic heart disease has been associated with a 1% lowering of blood cholesterol in middle aged men.[41] Forty-eight and forty-three percent (48% and 43%) of men and women respectively, have elevated total plasma cholesterol ($\geq$ 5.2 mmol/L) (Table 9).[37,42] In men, there is a rapid increase in prevalence of elevated total cholesterol from age 18 to 44, whereas in women, the rise is more gradual until age 44 when it increases dramatically to exceed the rate of men at age 55.

Elevated low density lipoprotein cholesterol (LDL-C) and decreased high density lipoprotein cholesterol (HDL-C) are more precise indicators of ischemic heart disease risk than total blood cholesterol.[43] Measurement of these lipid fractions may identify additional people at risk and at the same time prevent the entry into treatment of individuals who have elevated total cholesterol but low LDL-C and high HDL-C. Forty percent (40%) of men and 32% of women have elevated LDL-C ($\geq$ 3.4 mmol/L) and 13% and 4% of men and women respectively, have depressed HDL-C levels (< 0.9 mmol/L).[42] While elevated LDL-C and low HDL-C are risk factors for ischemic heart disease in both men and women, a consistent association between high triglyceride levels and ischemic heart disease has been found only in women. In general, when HDL-C is taken into account, triglyceride levels do not improve the prediction of cardiovascular diseases. However in women with low levels of HDL-C, high triglyceride levels have been associated with increased risk of ischemic heart disease.[44,45,46]

7.1.3 High Blood Pressure

High blood pressure is an independent risk factor for cardiovascular diseases.[32,47] Fifteen percent (15%) of Canadians have high blood pressure, that is, have a diastolic blood pressure $\geq$ 90 mmHg and/or are undergoing treatment (Table 8).[37,48]

At age 18, 2% of men and 1% of women have high blood pressure (Table 9). From that age on among men, there is a steady increase in the prevalence of high blood pressure until age 64 after which a decrease is observed. Among women, the increase in prevalence is steady to age 74. After the age of 55, the prevalence of high blood pressure is greater among women than men.

Twenty-six percent (26%) of individuals with high blood pressure are unaware of their condition.

Of those aware, only 57% are treated and controlled, that is, have a diastolic blood pressure ≤ 90 mmHg. Women are generally more likely than men to be aware that they have high blood pressure, and more likely to have their blood pressure under control if it is treated.[37,48]

7.1.4 Physical Inactivity

Physical inactivity is recognized as a major risk factor for ischemic heart disease.[49] The *1988 Campbell's Survey of the Well-Being of Canadians* is part of a longitudinal study examining physical activity and health patterns of Canadians.[50] With regard to total energy expenditure, 43% of Canadians are considered inactive in their leisure time with women more likely to be inactive. There is a general decline in activity with age except for Canadians over 65 who are more active than those in the 45-64 age group. During the past 20 years, however, the Canadian population has become generally more active.[50,51,52]

The Canadian Heart Health Surveys show that sedentary lifestyle is an important risk factor (Table 8). Almost half of individuals aged 18 - 74 in Newfoundland have a sedentary lifestyle; over 40% of those in the other Maritime provinces also exhibit this risk factor. British Columbia has the lowest percentage (29%) of sedentary individuals.

7.1.5 Diabetes Mellitus

Overall, 4% of Canadian men and 5% of women report having diabetes mellitus.[37] This prevalence ranges from 1% in the youngest (15-34 years) to 12% in the oldest (55-74 years) age groups among men and from 3% to 9% among women respectively.[53]

7.1.6 Obesity

Obesity, especially abdominal obesity, is associated with an increased risk of ischemic heart disease.[54,55] Thirty-one percent (31%) of Canadian adults are obese (Body Mass Index - BMI ≥27) (Table 8) with the prevalence being greater among men than women (Table 9).[37,53] With age, the prevalence of obesity increases in both men and women. Yet, for men a decrease is observed following age 65 so that in the 65-74 age group there are more obese women than men.

With increasing obesity there is a rise in the prevalence of an abdominal distribution of fat as measured by waist-hip circumference ratio. A waist-hip ratio of 0.9 for men and 0.8 for women is an indication of abdominal obesity. More men (50%) than women (34%) have abdominal obesity with the prevalence also increasing with age.[37,53]

Obesity and an abdominal fat distribution are associated with an increased prevalence of diabetes, high blood pressure and elevated plasma cholesterol. The prevalence of high blood pressure, for example, is more than doubled among individuals with abdominal obesity.[53]

7.1.7 Other Factors

Recent research suggests that a number of other factors may play a role in the development of cardiovascular diseases. These factors include altered thrombogenic, inflammatory and

immunologic responses, dietary iron and psychosocial factors. Biological antioxidants such as beta carotene, ascorbic acid, vitamin E and selenium may have a protective effect. Further work is required before recommendations can be made regarding these factors.[33]

7.1.8 Multiple Risk Factors

The hallmark of cardiovascular disease risk is the synergistic effect of more than one cardiovascular disease risk factor on overall cardiovascular disease risk. Even moderate elevations in more than one risk factor may increase cardiovascular disease risk.[56]

Sixty-four percent (64%) of Canadian adults have one or more of the cardiovascular disease risk factors (high blood pressure, elevated blood cholesterol and regular smoking) (Tables 8 and 9).[37,57] The prevalence of at least one risk factor increases substantially with age until it reaches a plateau in men at age 45 and in women at age 55. Eighty-five percent (85%) of Canadian adults age 65-74 have at least one major risk factor. Men, aged 45-54 and women, aged 65-74 years of age have the highest occurrence of two or more risk factors (34% and 37% respectively) (Table 9).

7.1.9 Public Knowledge on Causes of Cardiovascular Diseases

More than 90% of Canadians recognize that cardiovascular diseases are preventable. However, the majority do not recognize the specific risk factors (Table 10).[40,57] Smoking was one of the most commonly reported risk factors associated with cardiovascular diseases and was reported more often by smokers than by non-smokers.[40]

7.1.10 Socioeconomic Status and Risk Factors

Prevalence and awareness of risk factors varies with socioeconomic status. Canadians with a lower level of education (a proxy measure of socioeconomic status) are more likely to have risk factors for cardiovascular diseases (Table 11)[57] yet are less likely to identify these as risk factors (Table 10). Lower and upper socioeconomic groups differ most noticeably in their awareness of high blood pressure and elevated blood cholesterol as risk factors.

7.2 Risk Factors for Stroke

Risk factors for stroke can be divided broadly into two categories: non-modifiable and modifiable. The non-modifiable risk factors include the patient's age and a family history of stroke. The presence of diabetes is associated with an increased risk of stroke, however it is not clear whether optimal diabetic control can result in a decrease in stroke incidence.

The important modifiable risk factors for stroke are high blood pressure, smoking, physical inactivity, presence of atrial fibrillation and a previous transient ischemic attack (TIA).[58]

TABLE 10

Percentage of Individuals Mentioning Selected Risk Factors as Causes of Heart Disease by Years of Education[1,2]

	YEARS OF EDUCATION						
	MEN			WOMEN			TOTAL
RISK FACTOR	≤ 6	7 - 12	≥ 12	≤ 6	7 - 12	≥ 12	
Smoking	34	48	48	32	46	49	47
High Blood Pressure	7	18	20	11	21	24	20
Elevated Blood Cholesterol	12	25	28	12	24	29	25
Obesity	20	28	31	18	35	36	31
Lack of Exercise	20	38	56	16	35	52	40
Stress	28	37	46	30	44	54	44

1. Data from all Canadian provinces excluding Ontario
2. Age standardized to 1986 Canadian population

SOURCE: MacDonald, *et al.* Can Med Assoc J 1992;146:2021-9[57]

TABLE 11

Percentage of Individuals with One or More Major Risk Factor[1] by Years of Education[2,3]

	YEARS OF EDUCATION					
	MEN			WOMEN		
Age (years)	≤ 6	7 - 12	≥ 12	≤ 6	7 - 12	≥ 12
18 - 24	69	50	28	48	48	35
24 - 34	79	67	48	55	56	42
35 - 44	75	76	68	84	59	48
45 - 54	78	84	77	92	75	67
55 - 64	76	79	82	90	89	89
65 - 74	78	80	82	86	89	92
TOTAL	77	72	58	86	67	53

1. Major risk factors: smoking, high blood pressure, elevated blood cholesterol
2. Data from all Canadian provinces excluding Ontario
3. Age standardized to the 1986 Canadian population

SOURCE: MacDonald *et al.* Can Med Assoc J. 1992;146:2021-9[57]

7.2.1 High Blood Pressure

High blood pressure remains the number one preventable risk factor for stroke with an estimated 56.4% (men) and 66.1% (women) of stroke attributable to this factor.[59] The overall age-adjusted risk of stroke among hypertensives compared to normotensives is 3.1 for men and 2.9 for women. The risk of stroke increases with both increasing systolic and diastolic pressures.

Recent evidence indicates that isolated systolic hypertension is a major risk factor for stroke in the elderly.[60] Isolated systolic hypertension is defined as a systolic blood pressure of 160 mmHg or over and a diastolic pressure of less than 90 mmHg. Isolated systolic hypertension may be present in approximately 30% of women and 10% of men over the age of 80. There is good clinical evidence that treating such isolated systolic hypertension in those 60 years of age and over will decrease the incidence of stroke. Therapy also slows progression of carotid artery narrowing secondary to atherosclerosis.[60]

7.2.2 Smoking

Cigarette smoking remains a common risk factor for both ischemic heart disease and stroke.[61,62] The Honolulu Heart Program showed that cigarette smoking significantly increased the risk of stroke, intracerebral and subarachnoid hemorrhage as an independent risk factor. The risk is dose related with smoking more than 25 cigarettes per day conferring the highest risk. A recent analysis of 32 separate studies showed smoking to be a significant independent contributor to stroke incidence in both sexes and at all ages.[63] The risk of stroke was approximately 50% higher in smokers than in non-smokers and rose substantially with the number of cigarettes smoked per day in both men and women.

Based on the data from the Nurses Health Study and Framingham Study, cessation of smoking is followed by a reduction in risk of stroke to baseline over a remarkably short time. The risk of stroke falls to approximately 50% within one year and reaches the levels of those who have never smoked within five years.[64] There appears to be no age related effects as there is a decrease in risk with smoking cessation in both young and older individuals.

7.2.3 Atrial Fibrillation

Heart disease is a common risk factor for stroke. The presence of atherosclerosis in the coronary arteries increases the risk of similar disease elsewhere, including the cerebral circulation. Unfortunately, there is no clear evidence that treating the cardiac condition aggressively leads to a decrease in risk of stroke.

Recently, several studies have shown conclusively that the risk of stroke in patients with untreated atrial fibrillation is very high.[65,66,67] This may reach 7% per year in patients who, in addition to atrial fibrillation, also have a previous history of embolic disease, hypertensive heart disease, a previous history of congestive heart failure or echocardiographic evidence of a left atrial abnormality. Atrial fibrillation is a common problem occurring in up to 10% of patients over the age of 75. Proper assessment and careful use of anticoagulants or antiplatelet agents can significantly decrease the risk of embolic stroke.

7.2.4 *Transient Ischemic Attack*

Patients who have had a recent TIA or a completed stroke are at a very high risk of a subsequent stroke.[68] This is dependent on the degree of carotid stenosis and the presence of associated risk factors. In patients with bilateral carotid stenosis, the risk may be as high as 39% in the first 18 months.[69] This risk is highest immediately after the event and then slowly decreases thereafter. In most patients, the stroke is secondary to thrombus formation in the carotid artery with subsequent distal embolization. Infrequently, an episode of hypotension in the presence of critical carotid stenosis may result in an infarction in the same arterial territory. Recognition of TIA is important because treatment can significantly decrease the risk of recurrence of stroke.[69,70,71]

7.2.5 *Physical Inactivity*

Leisure time activity and work-related vigorous physical activity have been shown to lower the incidence of cerebrovascular disease. Although most initial evidence was related to heart disease, there are now some data which show that increasing activity also leads to a decrease in the incidence of stroke.[72] Underlying mechanisms, though not fully understood, are likely multifactorial. Exercise has a beneficial influence on associated risk factors. Thus physical activity may help reduce elevated blood pressure and improve weight loss and the LDL-C to HDL-C ratio. Exercise is also associated with a better lifestyle that includes non-smoking, improved eating habits and maintenance of a healthy body weight.[73]

7.2.6 *Other Risk Factors*

Other risk factors for stroke include an increased hematocrit, fibrinogen, obesity, alcohol consumption and lipid abnormalities. The risk of stroke in these conditions may be increased although the exact relationship between such risk factors and stroke remains controversial. [58]

8. *PREVENTION OF CARDIOVASCULAR DISEASES*

8.1 *Opportunities for Prevention*

It has been estimated that 54% of the decline in ischemic heart disease mortality observed in North America in recent decades may be due to changes in lifestyle, 39.5% may be the result of medical intervention and the remainder (6.5%) unexplained.[18,38] Studies in Canada and the United States estimated that as much as 30% of cardiovascular disease mortality is attributable to high blood pressure, 19% to diabetes, 17% to smoking and 15% to elevated serum cholesterol.[38]

Optimal prevention requires the use of primary, secondary and tertiary prevention strategies. "Primary" prevention, by risk factor modification, can reduce disease incidence; "secondary" prevention, through early identification and management of the disease states, can increase survival; "tertiary" prevention, through the rehabilitation from established disease, can further reduce disability and suffering and so enhance individual quality of life.

Primary prevention of cardiovascular diseases involves a three-pronged strategy that includes: a general population approach; a targeting of those at high risk; and the management of

psychosocial determinants of cardiovascular diseases.[34,74] Within Canada, the differences in incidence and mortality rates that are observed between provinces leads one to believe that opportunities exist for enhanced prevention.[75] Internationally, the Stanford Five City, the North Karelia, Heartbeat Wales and other projects have demonstrated convincingly that effective cardiovascular disease prevention can result from programs that are community-based and are targeted at both the general population and to individuals at 'high risk' of cardiovascular diseases.[76,77,78,79]

8.2 The Role of Research

Although cardiovascular diseases constitute one of the major health problems in Canada, funding allocation for research ($65 million, 1993) does not reflect this, and lags behind that for endocrine disorders ($89 million) and cancer ($67 million).[80]

Death rates from cardiovascular diseases are declining, while the economic costs of cardiovascular diseases are increasing. The challenge is not only to improve the quality of care and quality of life of diseased individuals but also to reduce the incidence of the disease so as to minimize its social and economic costs.

8.3 The Canadian Heart Health Initiative

A national approach to heart health developed from the broad consultations carried out by the Federal-Provincial Working Group on Cardiovascular Disease during the mid-1980s is known as the Canadian Heart Health Initiative. With the collaboration of numerous interested health and non-health sectors, a consensus was developed on strategies for cardiovascular disease prevention in Canada. The report of the working group, *Promoting Heart Health in Canada*[81] recommended an integrated multi-factorial approach toward the prevention or control of risk factors by achieving environmental changes favourable to heart healthy lifestyles.

Promoting Heart Health in Canada serves as the policy blueprint for the Canadian Heart Health Initiative (CHHI). The report's strategic options - public health system leadership; community programs; intersectoral coordination; access to health services; public education and information; and monitoring, evaluation and research - have been adopted as CHHI strategies. This Initiative is a partnership between Health Canada and the provincial Ministries of Health, in collaboration with the Heart and Stroke Foundation of Canada.[34] The CHHI accommodates the fundamental principles of health promotion as described in *Achieving Health For All: A Framework for Health Promotion*.[82]

The main agents of the CHHI are coalitions at national, provincial and community levels. Four phases of the Initiative have been planned.

The first phase, a cardiovascular disease risk factor survey in all 10 provinces, has been completed.[37]

The second phase, currently in progress, involves the development of a national database and the implementation of demonstration heart health programs in each province. The national database

documents the Canadian and provincial risk factor profiles as well as the levels of knowledge and awareness of cardiovascular diseases. This database is proving to be instrumental in planning appropriate interventions that will meet the specific needs of Canadian communities. Programs underway include: public and professional education; worksite programs; school health and public policy development.

Evaluation of these programs and of the Initiative as a whole comprises the third phase. This will determine the effectiveness of these efforts and demonstrate health promotion opportunities to other Canadian communities.

Diffusion of interventions to communities across Canada is the fourth phase which is envisioned to start in a systematic manner after 1995.

The Heart and Stroke Foundation of Canada and its affiliated provincial foundations play a major role in the prevention of cardiovascular diseases in Canada through their substantial support for research, professional education and such public education programs as *Jump Rope for Heart, Know Your Blood Pressure by Heart,* and the *Heart Smart* restaurant and cooking programs.

8.4 International Heart Health

The Victoria Declaration on Heart Health, issued in May 1992 by the Advisory Board of the International Heart Health Conference, Victoria, British Columbia, calls upon all professionals, organizations, governmental agencies, communities and individuals to join in a partnership of policy development and program implementation towards heart health promotion and cardiovascular disease prevention.[74]

Using a public health approach to eliminate or reduce risk factors, the Declaration proposes a "four cornerstone approach" to heart health that would extend the benefits of prevention and treatment to all individuals and populations: the promotion of healthy dietary habits; a tobacco-free lifestyle; regular physical activity; and a supportive psychosocial environment.

The Declaration states that cardiovascular diseases are largely preventable. Through scientific knowledge and study ischemic heart disease and stroke can be reduced significantly.[74] This will necessitate achieving international support for heart health policies that create environments supportive of a healthy lifestyle. It will require education of the public, the involvement of communities in health promotion activities, the encouragement of employers to create healthy work environments and the creation of cardiovascular disease monitoring systems. The development and nurturing of partnerships will be essential to the achievement of these common goals.

9. *CARDIOVASCULAR DISEASES IN WOMEN*

Vicki Bernstein, MD, University of British Columbia
Michèlle Robitaille, MD, MPH, Hôpital Laval, Québec
Michèle Turek, MD, FRCPC, Ottawa General Hospital
Andreas Wielgosz, MD, PhD, FRCPC, Ottawa General Hospital

While it is becoming more appreciated that women are vulnerable to cardiovascular diseases, albeit with a later age of onset than men, it is not widely known that nearly as many women as men die each year from cardiovascular diseases in Canada (Table 1). Since the 1960s, mortality from cardiovascular diseases has been declining in women of all ages. However, the increase in smoking consumption by younger women raises concerns about an increased burden of disease, particularly of cardiovascular diseases in the years to come.[83]

9.1 Risk Factors in Women

9.1.1 Smoking

Smoking is an important preventable determinant of cardiovascular diseases in women. Although women in the age group 45 - 74 years smoke less than men, younger women (15 - 44 years) currently smoke as much as men did in the early 1990s.[39] Since 1991, cigarette smoking has increased by about 5%, most notably among young women. This effect is most evident in the Maritime provinces and Quebec.

9.1.2 High Blood Pressure

Mean levels of blood pressure increase with age in both men and women. While high blood pressure is more prevalent overall in men than in women, following the menopause, over a third of Canadian women are hypertensive.[48] The complication rate also increases with age but remains lower among women than men. Compared to normotensive women, the risk of complications is increased 5 to 6 fold among hypertensive women. Women have a higher prevalence of the white coat phenomenon, seek medical care more frequently and are more compliant with medication use. They also present a higher rate of weight fluctuation and are more likely to use over-the-counter non-steroidal anti-inflammatory drugs (NSAIDs) that interfere with blood pressure control.

The effect of treatment is based on only a few studies involving women. Women have been under-represented in studies of the effectiveness of anti-hypertensive medications. In those studies that have included women, treatment lowered the mortality in black women by 25% (special care versus usual care; Hypertension Detection and Follow-up Program).[84,85] No change however, was observed in Caucasian women. Women who participated in the Australian study (37% of all participants) experienced a 36% reduction in total events, however, this was not statistically significant.[86] In the 1985 British Medical Research Council study, the risk of stroke was reduced by 40% in treated women.[87] Most of the available data are based on use of diuretics and beta-blockers but not on newer treatment modalities such as angiotensin converting enzyme (ACE) inhibitors and calcium channel blockers.

9.1.3 Cholesterol

Total cholesterol above 5.2 mmol/L is less prevalent in women below 45 years of age than in men of this age group.[42] However, after menopause, women experience a rapid increase in total cholesterol, reaching levels that are higher than in men by age 55. HDL-C is high in premenopausal women and low thereafter. Hormonal replacement therapy following menopause can influence the lipid profile: estrogens decrease the ratios of total cholesterol/HDL-C and LDL-C/HDL-C while progestegens decrease HDL-C and increase LDL-C. This therapeutic approach is relatively recent so we do not have sufficient information on its influence on risk factor profiles in Canadian women. Furthermore, we are still awaiting the results of the first prospective randomized study examining the effect of hormone replacement therapy, especially the progestegens, on mortality from ischemic heart disease.

9.1.4 Diabetes Mellitus

The prevalence of diabetes mellitus (5%) in women is not as high as smoking (28%) or elevated blood cholesterol (43%), however, it is often associated with obesity (27%) and sedentary lifestyle (85%).[37,53]

The relative impact of diabetes on death from ischemic heart disease and acute myocardial infarction is greater in women than in men.[88] Diabetic women suffer from ischemic heart disease at rates similar to non-diabetic men. In studies of the prognosis following myocardial infarction, diabetic women have been observed to have a consistently worse outcome than diabetic men.[89]

9.1.5 Physical Inactivity

Physical activity has been examined in the *Campbell's Survey of the Well Being of Canadians*.[50] Regular aerobic activity (30 minutes or more every other day, at 50% of individual capacity or greater) is undertaken by only 10% of women aged 20 - 64 years of age. Thirty percent (30%) of women over 65 engaged in aerobic activity, most often walking. Only 41% of women in the Canadian Heart Health Surveys mentioned lack of exercise as a risk factor for cardiovascular diseases.[57] Even in women with a high degree of education, lack of exercise was mentioned by only 52% as a risk factor. Although regular physical activity is an important strategy for cardiovascular health, this has not yet been recognized by the majority of women nor included as part of their lifestyle.

9.1.6 Obesity

Obesity has a clear relationship to adverse cardiovascular health consequences.[53] Results from the Canadian Heart Health Surveys indicate that for women, mean BMI increases steadily to age 55 - 64 years of age, and then reaches a plateau. Obesity (BMI $\geq$ 27) was evident in 27% of women ages 18 - 74. Five percent (5%) of all women had a BMI $\geq$ 35 compared to 9% of women aged 55 - 64 and 8% of women aged 65 - 74. These results indicate that, although there have been extensive attempts to promote healthy weights for over nearly two decades, there has been little change in weight distribution of women.[90]

9.1.7 Hormonal Risk Factors

Oral contraceptive and estrogen replacement therapy are of special concern for women. In earlier studies with higher hormonal dosage, the use of oral contraceptives was shown to result in a two to four-fold increase in risk of both fatal and non-fatal myocardial infarction.[91,92,93,94] However, there is evidence that, with the use of lower dose preparations and a more careful selection of patients in recent years, the risk is negligible.[95,96,97] Since young, healthy women have a very low risk of myocardial infarction, the absolute increase in risk is small. The risk increases, however, with the simultaneous presence of other risk factors. Concurrent smoking and oral contraceptive use, for example, substantially elevate the risk of myocardial infarction.[98,99]

Although some evidence[100] suggests that there is a residual risk of myocardial infarction up to six years after stopping oral contraceptive use, most recent analyses fail to demonstrate a significant risk for past users.[93,111]

In contrast to oral contraceptives, postmenopausal estrogen replacement therapy seems to have a protective effect. Women who used estrogen for menopausal symptoms have one-third to one-half the risk of fatal and non-fatal heart attacks of those who do not.[112] However, since it is found that estrogen taken alone increases the risk of endometrial cancer, it has been recommended that estrogen be combined with low dose progestin to decrease that risk.[113]

Because of the high fatality rate attributable to ischemic heart disease, meta-analysis of several studies indicates that a relative risk of 0.5 translates into many lives saved among estrogen users. It is estimated that 5,250 lives are saved annually per 100,000 estrogen users in the age group 50 - 75 years or 333 lives annually for ischemic heart disease and stroke per 100,000 estrogen users in the age group 65 - 75 years. This improvement in mortality would appear to outweigh any deaths from other diseases potentially related to estrogens, including endometrial and breast cancers.[93,114,115]

9.2 Diagnosis of Ischemic Heart Disease in Women

Angina is the most common manifestation of ischemic heart disease in women. It appears to carry a better long term prognosis in women than that in men.[59] Angiographic studies have shown that 50% of women with angina have minimal or no obstructive coronary disease, thus explaining the relatively benign outcome.[116] Yet as angina becomes more typical (and especially in older women) the likelihood of disease increases.[117] Because of the lower over-all prevalence of ischemic heart disease in women, the predictive value of any diagnostic test is lower in women than in men. Exercise electrocardiography has a higher false positive rate in women overall,[118] however that improves when applied to women with a higher pre-test probability of disease (post-menopausal women, more typical angina or with resting ECG abnormalities) and can provide similar estimates of prognosis compared to men.[119] Other imaging techniques, such as thallium scintigraphy and echocardiography with exercise or pharmacologic stress, have shown higher specificity in women.[120,121]

9.3 *Management and Outcomes*

Women with established ischemic heart disease are more likely to be disabled and to have a less favourable outcome even correcting for increased age and other concurrent risk factors.[122,123,124] There are few data concerning specific pharmacologic therapies for ischemic heart disease in women. Fewer women are referred for coronary angiography than men, despite having positive diagnostic tests, acute myocardial infarction, or greater functional disability due to angina. There is controversy as to whether or not this represents a gender bias.[122,125,126,127,128] Both coronary angioplasty (PTCA) and CAB surgery have similar long term survival benefits for men and women. Earlier reports of the application of coronary angioplasty in women identified lower success rates, increased complications and procedural mortality, however, more recent studies indicate that this is no longer the case.[129,130] The frequency of restenosis appears to be less in women. CAB in women is associated with a higher operative mortality and a less favourable clinical response.[131] This excess operative mortality (approximately twice that of men) has been attributed to smaller coronary artery size in women and may also be confounded by other variables such as age and functional class. All told, women are less likely to undergo any of the above invasive procedures.[122,127,132]

Non-anginal manifestations of ischemic heart disease are less common in women. Sudden death, in particular, accounts for only 7% of all coronary events in women compared to 10% in men.[59] There is a paucity of data on silent ischemia in women despite the greater frequency of unrecognized infarction (35% versus 27% in men).[59] Survival after the development of heart failure is better in women and this advantage persists after controlling for age and cause of heart failure.[133]

Acute myocardial infarction is associated with a higher mortality rate in women across all age groups (overall case fatality rate of 32% versus 27% in the Framingham data; see also Table 6 for Canadian data).[59] Women are more likely to have non-Q wave infarctions, reinfarctions, peri-infarction strokes and congestive heart failure. Since women overall have better left ventricular function as measured by systolic contractility, there appears to be a higher prevalence of diastolic dysfunction.[123,124,134]

Even in the thrombolytic era, the one year mortality after acute myocardial infarction is higher in women (29% versus 15% in men).[135] Thrombolytics produce a comparable reduction in mortality for both men and women.[135,136,137] However, women are more likely to be excluded from thrombolytic therapy. This may be due to delays in presentation, other comorbid conditions or increased risk of bleeding complications, particularly haemorrhagic stroke.[138,139] The use of beta blockers after acute myocardial infarction has been shown to be beneficial in women as well as men.[140] ACE inhibitors used following myocardial infarction in women also have been shown to reduce mortality.[141,142] The routine use of Aspirin® post myocardial infarction has not been reported separately for women, however it is believed to be similarly effective and its use is recommended.

9.4 Stroke

Although overall stroke mortality has been declining in Canada for several decades, strokes remain a significant cause of death and disability especially for elderly women (Table 2). For women over age 75 years, the incidence of stroke may be increasing, assuming the results of a United States study are equally relevant in Canada.[143]

Of the various types of stroke, young women appear to experience an excess of subarachnoid hemorrhage, the least common type of stroke overall. Women are also at increased risk of stroke when exposed to unique risk factors such as toxaemia in pregnancy, oral contraceptive use and in the presence of conditions such as mitral valve prolapse and migraine headaches.[144]

High blood pressure is the most important risk factor for stroke both in men and women. Diabetes and smoking put women at greater risk of stroke than men. Female smokers have nearly twice the risk of stroke as nonsmokers. Hypertensive smokers are at even greater risk, however stopping smoking alone can reduce the risk by one third.

Women are more likely to survive a stroke than men thus increasing the burden of disability. Because more women survive into the latter decades of life, they account for the greater proportion of disabled stroke patients occupying nursing homes.

Although interventions including endarterectomy and treatment of atrial fibrillation with aspirin or warfarin are applied to women and presumed to be equally beneficial, their effects have been studied largely in men.

9.5 Environmental Factors

Several studies have found that working women are healthier overall, with fewer risk factors for cardiovascular diseases than nonemployed women. However, the issue is complicated by the fact that the demands of the job, the degree of personal control and social support may be more important than employment per se.[145] Although women generally fare better than men in organizing and availing themselves of social support, they appear to be more vulnerable to a lack of it. The stress of multiple roles, for example working more than 20 hours per week and being a homemaker with little or no spousal support increase the risk of cardiovascular diseases.[146] Hostility and depression aggravate the risk. The impact of social factors and how women react to stresses may vary by age. More attention and research support are being allocated to these issues in order to clarify the nature of the risk and to develop effective preventive interventions.[147] There remains a paucity of data specific for Canadian women.

9.6 Summary

Although cardiovascular mortality continues to decline, now placing Canada in the lowest quartile among industrialized nations, for Canadian women there is cause for concern. An increasing number of women are beginning their post-menopausal phase of life (one third of their life expectancy) when their risk of cardiovascular diseases increases. The increasing burden of disease and disability, compounded by the effect of aging, will place significant economic

demands on ever-straining health care and social budgets. Although cardiovascular diseases are being prevented to a large extent and the prevalence of risk factors appears to be changing favourably, the increase in smoking among young women cannot be ignored.

The purpose of focusing on women and cardiovascular diseases is to create an awareness of a problem that does not discriminate according to gender. In summarising the data that exist, we want to highlight gaps in knowledge and to identify priorities for further research. While focusing on matters specific to women, future research should also consider important aspects such as age, ethnicity and socio-economic factors. Evaluation of hormone replacement therapy is needed urgently. Likewise, there is a need for more information on the effect of cardiovascular pharmacotherapy in women, where this has not been studied adequately to date. Access to diagnostic services, therapy and rehabilitation appears to differ by gender. The reasons for this must be understood clearly and strategies have to be developed to ensure equitable utilization. Many additional issues merit attention. Only by further discussion and research will we begin to ask and probe the right questions.

10. GLOSSARY

ACUTE MYOCARDIAL INFARCTION: (ICD-9 410) A manifestation of ischemic heart disease, describing a severe sudden onset of myocardial necrosis due to the formation of a thrombus in the coronary arterial system obstructing arterial blood flow to that section of cardiac muscle.

AGE-STANDARDIZED RATES: The standardized rate represents what the crude rate would be if the population under study had the age distribution of the standard population. It is the weighted average of age-specific rates applied to a standard distribution of age.

ANGINA PECTORIS: (ICD-9 413) A symptomatic manifestation of ischemic heart disease, describing a severe squeezing or pressure-like thoracic pain, brought on by exertion or stress.

CARDIOVASCULAR DISEASES: All diseases of the circulatory system classified according to ICD-9 390-459. They include acute myocardial infarction, ischemic heart disease, valvular heart disease, peripheral vascular disease, arrhythmias, high blood pressure and stroke.

CASE FATALITY RATE: The proportion of persons contracting a disease, who die of that disease.

DIABETES: Diabetes mellitus is an illness associated with a disturbance of blood glucose control. In the provincial heart health surveys, individuals were considered to have diabetes if they reported ever having been so diagnosed by a physician.

ELEVATED SERUM CHOLESTEROL: Elevated serum cholesterol is here defined as a total serum cholesterol level greater than or equal to 5.2 mmol/litre.

HIGH BLOOD PRESSURE: High blood pressure is defined as diastolic blood pressure equal to or greater than 90 mm HG and.or on treatment, either pharmacologic or non-pharmacologic (weight control and/or salt restriction), for the purpose of lowering blood pressure.

ICD: International Classification of Diseases - 9th Revision 1977.

INCIDENCE: The number of instances of illness commencing, or of persons falling ill, during a given period in a specified population.

INCOME QUINTILES: Five approximately equal sized groups of census tracts ranked according to the percentage of population below Statistics Canada's low-income cut-off (See Wilkins, Adams and Brancker, Health Reports, 1(2):137-174, 1989).

INJURIES: The category "injuries" includes intentional (homicides, suicides, etc.) and unintentional (falls, motor vehicle accidents, poisonings, etc.) injuries. It is based upon ICD-9 (external causes of injury) E800-E999 and ICD-9 (nature of injury) 800-999.

ISCHEMIC HEART DISEASE: (ICD-9 410-414) Any condition in which heart muscle is damaged or works inefficiently because of an absence or relative deficiency of its blood supply; most often causes by atherosclerosis, it includes angina pectoris, acute myocardial infarction, chronic ischemic heart disease and sudden death.

OBESITY: Individuals are considered obese if they have a Body Mass Index [weight in kilograms/(height in metres)^2] greater than or equal to 27.

PHYSICAL INACTIVITY: In the Canada Fitness Survey, 1981, individuals were considered physically inactive or 'sedentary' if they reported a usual daily leisure-time energy expenditure of less than 1.5 kcal/kg/day.

POTENTIAL YEARS OF LIFE LOST: The sum of the number of years of life that individual Canadians 'lost' due to premature death. It is calculated with death prior to age 75 being considered premature. Since the average life expectancy for men is 75 years, and 81 years for women, death prior to age 75 can be considered an average for both men and women. The calcuation in this issue is based on age 75, and not 70 as in the previous issue. Therefore, direct comparisons are not possible.

PREVALENCE: The number of instances of a given disease or other condition in a given population at a designated time; the term usually refers to the situation at a specified point in time.

RELATIVE RISK: The ratio of the risk of disease or death among the exposed to the risk among the unexposed.

SMOKING: Individuals are considered to be smokers if they regularly smoke at least one cigarette per day.

STANDARD MORTALITY RATIO (SMR): The ratio of the number of events observed in the population to the number that would be expected if the population had the same specific rates as the standard population, multiplied by 100.

STROKE: (ICD-9 430-438) Sudden development of a focal neurologic deficit due to disease of one or more blood vessels of the brain.

TRANSIENT ISCHEMIC ATTACK: Reversible neurological or retinal deficits secondary to decrease in blood flow. Symptoms last for less than 24 hours, ususally less than half an hour. There is complete recovery of function within 24 hours.

WAIST-HIP RATIO: The ratio of waist circumference (cm) to hip circumference (cm).

11. REFERENCES

1. Health Statistics Division, Statistics Canada. Unpublished data.

2. Kannel, W.D., Gagnon, D.R., and Cupples, L.A. Epidemiology of sudden coronary death: Population at risk. Canadian Journal of Cardiology, 1990;6:439-444.

3. Wannamethee, G., Shaper, MacFarlane, P.W., and Walker, M. Risk factors for sudden cardiac death in middle-aged British men. Circulation, 1995;91:1749-1756.

4. Naylor, C.D., and Chen, E. Population-wide mortality trends among patients hospitalized for acute myocardial infarction: The Ontario experience, 1981-1991. Journal of the American College of Cardiology, 1994;24:1431-1438.

5. Rogers, W.J., Bowlby, L.J., Chandra, N.A., et al. Treatment of myocardial infarction in the United States (1990 to 1993): Observations from the national registry of myocardial infarction. Circulation, 1994;90:2103-2114.

6. Lee, K.L., Califf, R.M., Simes, J., et al. Holding GUSTO up to the light. Annals of Internal Medicine, 1994;120:876-881.

7. Ridker, P.M., O'Donnell, C.J., Marder, V., et al. A response to "Holding GUSTO up to the light". Annals of Internal Medicine, 1994;120:882-885.

8. Cairns, J., Armstrong, P., Belenkie, I. Canadian Consensus Conference on Coronary Thrombolysis - 1994 Update. Canadian Journal of Cardiology, 1994;10:517-521.

9. Canadian Consensus Conference on Coronary Thrombolysis - 1994 Recommendations. Canadian Journal of Cardiology, 1994;10:522-528.

10. Laboratory Centre for Disease Control, Health Canada. Unpublished data.

11. Johansen, H.L., Nargundkar, M., Nair, C., et al. Women and cardiovascular disease. Chronic Diseases in Canada, 1990;11(3):41-46.

12. Mao, Y., Morrison, H., Semenciew, R., and Wigle, D. Mortality on Canadian Indian Reserves - 1977-1982. Canadian Journal of Public Health, 1986;77:263-268.

13. Mao, Y., Moloughney, B.W., Semenciew, R., and Morrison, H. Indian Reserve and Registered Indian Mortality in Canada. Canadian Journal of Public Health, 1992;83:350-353.

14. Young, T.K. Cardiovascular Disease and Risk Factors Among North American Indians. Winnipeg, MB: Northern Health Research Unit, 1990.

15. Young, T.K. Self-perceived and clinically assessed health status of Indians in

northwestern Ontario: Analysis of a health survey. Canadian Journal of Public Health, 1982;73:272-277.

16. McIntyre, L., Shah, C.P. Prevalence of hypertension, obesity and smoking in three Indian communities in northwestern Ontario. Canadian Medical Association Journal, 1986;134:345-349.

17. Nair, C., and Nicholls, E. Cardiovascular Disease in Canada. Ottawa, ON, Canadian Centre for Health Information, Statistics Canada, 1990.

18. Goldman, L., and Cook, E.F. The decline in ischemic heart disease mortality rates. Annals of Internal Medicine, 1984;101:825-836.

19. Nova Scotia-Saskatchewan Cardiovascular Disease Epidemiology Group. Estimation of the incidence of acute myocardial infarction using record linkage. A feasibility study in Nova Scotia and Saskatchewan. Canadian Journal of Public Health, 1989;80(6):412-416.

20. Wielgosz, A.T., Establishing surveillance of cardiovascular disease incidence in Canada. Canadian Journal of Cardiology, 1992;8(3):249-251.

21. Statistics Canada. Surgical Procedures and Treatments. Catalogue 82-206; Ottawa, ON, Statistics Canada, 1988.

22. Nova Scotia-Saskatchewan Cardiovascular Disease Epidemiology Group Trends in incidence and mortality from acute myocardial infarction in Nova Scotia and Saskatchewan 1974 to 1985. Canadian Journal of Cardiology, 1992;8(3):253-258.

23. WHO MONICA Principal Investigators. The World Health Organization MONICA Project (monitoring trends and determinants in cardiovascular disease): A major international collaboration. Journal of Clinical Epidemiology, 1988;41:105-114.

24. Gregor, R.D., Guerensey, J.R., MacKenzie, B.R., et al. Prevalence of ischemic heart disease and its treatment in Halifax County; results of the MONICA survey. Nova Scotia Medical Journal, 1990;69:146-149.

25. Health Canada. Report of the Canadian Health and Disability Survey 1983-84. Ottawa, ON, Health Canada, 1988.

26. Intercontinental Medical Statistics Canada. Unpublished data.

27. Higginson, L.A.J., Cairns, J.A., Keon, W.J., and Smith, E.R. Rates of cardiac catheterization, coronary angioplasty and open-heart surgery in adults in Canada. Canadian Medical Association Journal, 1992;146(6):921-925.

28. Peters, S., Chagani, K., Paddon, P., and Nair, C. Coronary artery by-pass surgery in Canada. Health Reports, 1990;2(1):9-26.

29. Krueger, H., Goncalves, J.L., Caruth, F.M., and Hayden, R.I. Coronary artery bypass grafting: How much does it cost? Canadian Medical Association Journal, 1992;146(2):163-168.

30. Reeder, B.A., Lauzon, R., Mao, Y., et al. Cardiovascular Disease in Canada, 1991. Heart and Stroke Foundation. Canada, 1991.

31. Bureau of Chronic Disease Epidemiology, Laboratory Centre for Disease Control, Health Canada. Unpublished data.

32. Dawber, T.R. The Framingham Study: The Epidemiology of Atherosclerotic Disease. Cambridge, MA, Harvard University Press, 1980;257.

33. National Institutes of Health. Epidemiology and Prevention of Cardiovascular Diseases. U.S. Department of Health and Human Services, National Institutes of Health. 1994.

34. Health Canada. The Canadian Heart Health Initiative: A policy in action. Health Promotion, 1992;30(4):1-19 (insert).

35. MacLean, D.R., Petrasovits, A., Nargundkar, M., et al. Canadian heart health surveys; a profile of cardiovascular risk: Survey methods and data analysis. Canadian Medical Association Journal, 1992;146(11, suppl):1969-1974.

36. Canadian Heart Health Surveys Research Group. The Federal-Provincial Canadian Heart Health Initiative. Canadian Medical Association Journal, 1992;146(6):1-2.

37. Health Canada. Canadians and Heart Health: Reducing the Risks. Ottawa, ON, Health Canada, 1995.

38. White, C.C., Tolsma, D.D., Haynes, S.G., and McGee, D. Cardiovascular Disease. In Closing the Gap: The Burden of Unnecessary Illness, Amler, R. (Ed),. New York, NY, Oxford University Press, 1986: 43-53.

39. Health Canada. Survey on Smoking in Canada. Ottawa, ON, Health Canada, 1994.

40. Stachenko, S.J., Reeder, B.A., Lindsay, E., et al. Smoking prevalence and associated risk factors in Canadian adults, 1992. Canadian Medical Association Journal, 1992;146(11, suppl):1989-1996.

41. Lipid Research Clinic Program. The Lipid Research Clinics Coronary Primary Prevention Trial Results I: Reduction in incidence of coronary heart disease. Journal of the American Medical Association, 1984;251:351-364.

42. Connelly, P.W., MacLean, D.R., Horlick, L., et al. Plasma lipids and lipoproteins and the prevalence of risk for coronary heart disease in Canadian adults. Canadian Medical Association Journal, 1992;146(11, suppl):1977-1987.

43. Canadian Conference on Cholesterol: Final Report. Canadian Medical Association Journal, 1988;139:1-8.

44. Gordon, T., Castelli, W.P., et al. High density lipoproteins as a protective factor against coronary heart disease. American Journal of Medicine, 1977;62:707-714.

45. Criqui, M.H., Heiss, G., and Cohn, R. Triglycerides and coronary heart disease mortality: Lipid Research Clinics program follow-up study. American Heart Association 27th Conference on Cardiovascular Disease, 1987.

46. Austin, M.A. Plasma triglyceride as a risk factor for coronary heart disease: The epidemiologic evidence and beyond. American Journal of Epidemiology, 1989;129:249-259.

47. MacMahon, S., Peto, R., Cutler, J., et al. Blood pressure, stroke and coronary heart disease. Part 1, prolonged differences in blood pressure: prospective observational studies corrected for regression dilution bias. The Lancet, 1990;335:765-774.

48. Joffres, M.R., Hamet, P., Rabkin, S.W., et al. Prevalence, control and awareness of high blood pressure among Canadian adults. Canadian Medical Association Journal, 1992;146(11, suppl):1997-2005.

49. American Heart Association. The Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology. Benefits and recommendations for physical activity programs for all Americans. Circulation, 1992;86(1):340-344.

50. Stephens, T., and Craig, C.L. The Well-Being of Canadian: Highlights of the 1988 Campbell's Survey. Ottawa, ON, Canadian Fitness and Lifestyle Research Institute, 1990.

51. Caspersen, C.J., Merritt, R.K., and Stephens, T. International physical activity patterns: A methodological perspective. In Advances in Exercise Adherence, Dishman, R. K. (ed.). Human Kinetics, Champaign, IL, 1994.

52. Haskell, W.L., Montoye, H.J., and Orenstine, D. Physical activity and exercise to achieve health-related physical fitness components. Public health Reports, 1985;100:202-212.

53. Reeder, B.A., Angel, A., Ledoux, M., et al. Obesity and its relation to cardiovascular disease risk factors in Canadian adults. Canadian Medical Association Journal, 1992;146(11, suppl):2009-2019.

54. Hubert, A.B., Feinleib, M., McNamara, P.M., et al. Obesity as an independent risk factor for cardiovascular disease: A 26 year follow-up of participants in the Framingham Heart Study. Circulation, 1983;67:968-977.

55. Larsson, B., Svardsudd, K., Welin, L., et al. Abdominal adipose tissue distribution, obesity and risk of cardiovascular disease: 13-year follow-up of participants in the study of men born in 1913. British Medical Journal, 1984;288:1401-1404.

56. Wilhelmsen, L. Synergistic effects of risk factors. Clinical and Experimental Hypertension, part A, 1990;12:845-863.

57. MacDonald, S., Joffres, M.P., Stachenko, S.J., et al. Multiple cardiovascular risk factors in Canadian adults. Canadian Medical Association Journal, 1992;(11 suppl):2021-2029.

58. Wolf, P.A., Cobb, J.L., and D'Agostino, R.B. Epidemiology of stroke. In Stroke: Pathophysiology, diagnosis and management. Barnett, J.J., Mohr, J.P., Stein, B.M., Jatsu, F.M. (eds). New York, N.Y., Churchill Livingstone, 1992:3-29.

59. Lerner, D.J., and Kannel, W.B. Patterns of coronary heart disease morbidity and mortality in the sexes: A 26 year follow-up of the Framingham population. American Heart Journal, 1986;111:383-390.

60. SHEP Cooperative Research Group. Prevention of stroke by antihypertensive drug treatment in older persons with systolic hypertension. Journal of the American Medical Association, 1991;265:3255-3264.

61. Donnan, G.A., You, R., Thrift, A., and McNeil, J.J. Smoking as a risk factor for stroke. Cerebrovascular Disease, 1993;3:129-138.

62. Wolf, P.A., D'Agostino, R., Kannel, et al. Cigarette Smoking as a risk factor for stroke. The Framingham Study. Journal of the American Medical Association, 1988;259:1025-1029.

63. Shinton, R., and Beevers, G. Meta-analysis of relation between cigarette smoking and stroke. British Medical Journal, 1989;298:789-793.

64. Colditz, G.A., Bonita, R., and Stampfer, M.J. Cigarette smoking and the risk of stroke in middle aged women. New England Journal of Medicine, 1988;318:937-941.

65. Petersen, P., Boysen, G., Godtfredsen, J., et al. Placebo-controlled randomized trial of warfarin and aspirin for prevention of thromboembolic complications in atrial fibrillation. The Lancet, 1989;1:175-179.

66. The Boston Area Anticoagulation Trial for Atrial Fibrillation Investigations. The effect of low dose on the risk of stroke in patients with nonrheumatic atrial fibrillation. New England Journal of Medicine, 1990;323:1505-1511.

67. Anonymous. Preliminary report of the stroke prevention in atrial fibrillation study. New England Journal of Medicine, 1990;322:863-868.

68. Sorenson, P.S., Marquadsen, J., Pederson, J., et al. Long-term prognosis and quality of life after reversible cerebral ischemic attacks. Acta Neurologica Scandia, 1989;79:204-213.

69. North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effects of carotid endarterectomy in symptomatic patients with high-grade stenosis. New England Journal of Medicine, 1991;325:445-453.

70. Barnett, H.J.M. Drug and surgical issues in stroke prevention. Cerebrovascular Disease, 1994;1(4 suppl):16-25.

71. Feinberg, W.M., Albers, G.W., Barnett, H.J.M., et al. Guidelines for the management of transient ischemic attacks. From the Ad Hoc Committee on Guidelines for the Management of Transient Ischemic Attacks of the Stroke Council of the American Heart Association. Stroke, 1994;25:1320.

72. Wannamethee, G., and Shaper, A.B. Physical activity and stroke in British middle aged men. British Medical Journal, 1992;304:597-601.

73. Fletcher, G.F., Blair, S.N., Blumental, J., et al. Statement on exercise. Benefits and recommendations for the physical activity programs for all Americans. Circulation, 1992;86:340-344.

74. International Heart Health Conference, Victoria, Canada, Advisory Board. Victoria Declaration on Heart Health, May 28, 1992.

75. Wong, T., and Wilkins, K. How many deaths from major chronic disease could be prevented? Chronic Diseases in Canada, 1990;11:573-575.

76. Farquhar, J.W. Effects of community wide education on cardiovascular disease risk factors: The Stanford Five-City Project. Journal of the American Medical Association, 1990;264(3):359-365.

77. Puska, P., Tuomilehto, J., et al. The North Karelia Project: Evaluation of a comprehensive community programme for control of cardiovascular diseases in 1972-77 in North Karelia, Finland. Copenhagen, Denmark, World Health Organization/EURO Monograph Series, 1981.

78. Vartiainen, E., Puska, P., Pelckanen, J., et al. Changes in risk factors explain changes in mortality from ischemic heart disease in Finland. British Medical Journal, 1994;309:23-27.

79. Shea, S., and Basch, C.E. A review of the five major community based cardiovascular disease prevention programs. Part 1: Rationale, design, and theoretical framework. American Journal of Health Promotion, 1990;4(3):302-213.

80. Preliminary data. Personal communication, Rachel Moore, Laboratory Centre for Disease

Control, Health Canada.

81. Federal-Provincial Working Group on the Prevention and Control of Cardiovascular Disease. Promoting Heart Health in Canada: A Focus on Cholesterol. Ottawa, ON, 1992.

82. Health and Welfare Canada. Achieving Health for All: A Framework for Health Promotion. Ottawa, ON, Health and Welfare Canada, 1986.

83. Eaker, E.D., Parkard, B., and Thom, T.J. Epidemiology and risk factors for coronary heart diseases in women. Cardiovascular Clinics 19(3), 1989, in Heart Diseases in Women , Dans, F.A. (ed.). Philadelphia, PA.

84. Anastosos, K., Charney, P., Charon, R.A., et al. Hypertension in women, what is really known? The Women's Caucus, Working Group on Women's Health of the Society of General Internal Medicine. Annals of Internal Medicine, 1991;115(4):287-293.

85. Hypertension Detection and Follow-up Program Cooperative Group. Five-year findings of the Hypertension Detection and Follow-up Program. I. Reduction in mortality of persons with high blood pressure including mild hypertension. Journal of the American Medical Association, 1979;242:2562-2571.

86. Report by the Management Committee. The Australian Therapeutic Trial in Mild Hypertension. The Lancet, 1980;i:1261-1267.

87. Medical Research Council Working Party: MRC trial of treatment of mild hypertension: Principal results. British Medical Journal, 1985;291:97-104.

88. Barrett-Connor, and E., Wingard, D.L. Sex differential in ischemic heart disease mortality in diabetics: A Prospective population-based study. American Journal of Epidemiology, 1983;118:489-496.

89. Abbott, R.D., Donahue, R.P., et al. The impact of diabetes on survival following myocardial infarction in men vs women: The Framingham Study. Journal of the American Medical Association, 1988;260:3456-3460.

90. Health and Welfare Canada. The Health of Canadians: Report of the Canadian Health Survey, 1978. Ministry of Supply and Services, Ottawa, 1981.

91. Eaker, E.D., Kronmal, R., et al. Comparison of the long-term, postsurgical survival of women and men in the Coronary Artery Surgery Study (CASS). American Heart Journal, 1989;117:71-81.

92. Ockene, I.S., and Ockene, J.K. Prevention of Coronary Heart Disease. Little, Brown and Company, Boston, MA., 1992.

93. Stampfer, M.J., Willett, W.C., Colditz, G.A., et al. Past use of oral contraceptives and cardiovascular disease. A meta analysis in the context of the Nurses' Health Study. American Journal of Obstetrics and Gynecology, 1990;163:285-291.

94. Wynn, V. Oral contraceptives and coronary heart disease. Journal of Reproductive Medicine; 1991;36(3 suppl):219-225.

95. Thorogood, M., Mann, J., Murphy, M., and Vessey, M. Is oral contraceptive use still associated with an increased risk of fatal myocardial infarction? Report of a case-control study. Obstetrical and Gynecological Survey, 1991;46:512-514.

96 Mant, D., Villard-Mackintosh, L., Vessey, M.P., and Yeates, D. Myocardial infarction and angina pectoris in young women. Journal of Epidemiology and Community Health, 1987;41:215-219.

97. Baird, D.T., and Glasier, A.F. Drug therapy. Hormonal contraception. New England Journal of Medicine, 1993:328(21):1543-1549.

98. Croft, P., and Hannaford, P.C. Risk factors for acute myocardial infarction in women: Evidence from the Royal College of General Practitioners' oral contraceptive study. British Medical Journal, 1989;298:165-168.

99. Thorneycroft, I.H. Oral contraceptives and myocardial infarction. American Journal of Obstetrics and Gynecology, 1990;163(4):1393-1397.

100. Vessey, M.P., Villarad-Mackintosh, L., McPherson, K., et al. Mortality among oral contraceptive users: 20 year follow up of women in a cohort study. British Medical Journal, 1989;299:1487-1491.

111. Rosenberg, L., Palmer, J.R., Lesko, S.M. Shapiro, S. Oral contraceptive use and the risk of myocardial infarction. American Journal of Epidemiolgy, 1990;131(6):1009-1016.

112. Lipid Research Clinics. Lipid Research Clinics Program follow-up study. Circulation, 1987;75:1102-1109.

113. La Rosa, J.C. The varying effects of progestins on lipid levels and cardiovascular disease. American Journal of Obstetrics and Gynecology, 1988;158:1621-1629.

114. Bush, T. Noncontraceptive estrogen use and risk of cardiovascular disease: An overview and critique of the literature. In The Menopause: Biological and Clinical Consequences of Ovarian Failure. Evolution and Management. Lorenman, S.G. (ed.). Norwell, MA. Serono Symposium 1990:211.

115. Henderson, B.F., Ross, R.K., Paganini-Hill, A., et al. Estrogen use and cardiovascular disease. American Journal of Obstetrics and Gynecology, 1986;154:1181-1186.

116. Kennedy, J.W., Killip, T., Fisher, L.D., et al. The clinical spectrum of coronary heart disease and its surgical and medical management. 1974-1979 The Coronary Artery Surgery Study. Circulation, 1982;66(III suppl):III16-III23.

117. Chaitman, B.R., Bourassa, M.G., Davis, K., et al. Angiographic prevalence of high risk coronary artery disease in patient subsets (CASS). Circulation, 1981;64:360-366.

118. Osbakken, M.D. Exercise stress testing in women: Diagnostic dilemma. In Heart Disease in Women, Douglas, P.S. (ed.). Philadelphia, PA, Davis Co., 1989:187-194.

119. Mark, D.B., Shaw, L., Harrell, F.E., et al. Prognostic value of a treadmill exercise score in outpatients with suspected coronary artery disease. New England Journal of Medicine, 1991;325:849-853.

120. Sawada, S.G., Ryan, T., Fineberg, N.S., et al. Exercise echocardiographic detection of coronary artery disease in women. Journal of the American College of Cardiology, 1989;14:1440.

121. Hung, J., Chaitman, B.R., Lam, J., et al. Noninvasive diagnostic choices for the evaluation of coronary artery disease in women: A multivariate comparison of cardiac fluoroscopy, exercise electrocardiography and exercise thallium myocardial perfusion scintigraphy. Journal of the American College of Cardiology, 1984;4:8-16.

122. Ayanian, J.Z., and Epstein, M.A. Differences in the use of procedures between women and men hospitalized for coronary heart disease. New England Journal of Medicine, 1991;325:222-225.

123. Dittrich, H., Gilpin, E., Nicod, P., et al. Acute myocardial infarction in women; Influence of gender on mortality and prognostic variables. American Journal of Cardiology, 1988;62:1-7.

124. Tofler, G.H., Stone, P.H., Muller, J.E., et al. Effects of gender and race on prognosis after myocardial infarction: Adverse prognosis for women, particularly black women. Journal of the American College of Cardiology, 1987;9:473-482.

125. Bickell, N.A., Pieper, K.S., Lee, K.L., et al. Referral patterns for coronary artery disease treatment: Gender bias or good clinical judgement? Annals of Internal Medicine, 1992;116:791-797.

126. Mark, D.G., Shaw, L.K., Achong, E.R., et al. Absence of sex bias in the referral of patients for cardiac catheterization. New England Journal of Medicine, 1994;330:1101-1106.

127. Steingart, R.M., Packer, M., Hamm, P., et al. Sex differences in the management of coronary artery disease. New England Journal of Medicine, 1991;325:226-230.

128. Shaw, L.J., Miller, D.D., Romais, J.C., et al. Gender differences in the noninvasive evaluation and management of patients with suspected coronary artery disease. Annals of Internal Medicine, 1994;120:559-566.

129. Cowley, M.J., Mullin, S.M., Kelsey, S.F., et al. Sex differences in the early and long term results of coronary angioplasty in the NHLBI PTCA Registry. Circulation, 1985;71:90-97.

130. Holmes, D.R., Holubkov, R., Vliestra, R.F., et al. Comparison of complications during percutaneous transluminal coronary angioplasty from 1977 to 1981 and from 1985 to 1986: The National Heart, Lung and Blood Institute Percutaneous Transluminal coronary Angioplasty Registry. Journal of the American College of Cardiology, 1988;12:1149-1155.

131. Coronary Artery Surgery Study (CASS): A prospective randomized trial of coronary artery bypass surgery. Circulation, 1983;68:939-950.

132. Jaglal, S.B., Goel, V., and Naylor, C.D. Sex differences in the use of invasive coronary procedures in Ontario. Canadian Journal of Cardiology, 1994;10:239-244.

133. Ho, K.K., Anderson, K.M., Kannel, W.B., et al. Survival after the onset of congestive heart failure in Framingham Heart Study subjects. Circulation, 1993;88:107-115.

134. Greenland, P., Reicher-Reiss, H., Goldbourt, U., et al. In-hospital and one year mortality in 1,524 women after myocardial infarction. Circulation, 1991;83:484-491.

135. Gruppo Italiano per lo Studio della Streptochinasi nell Infarto Miocardico (GISSI). Long term effects of intravenous thrombolytics in acute myocardial infarction: Final report of the GISSI study. The Lancet, 1987;2:871.

136. Fibrinolytic Therapy Trialists (FTT) Collaborative Group. Indications for fibrinolytic therapy in suspected acute myocardial infarction: Collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients. The Lancet, 1994;343:311-322.

137. Weaver, W.D., Wilcox, R.G., Morris, D., et al. Women in GUSTO: Baseline characteristics and effect of treatment regimen on mortality and complication rates. Circulation, 1993;88(suppl):abstract 2738.

138. Ball, S., Carrao, J., Gore, J., et al. Patients ineligible for thrombolytic therapy: The GUSTO acute myocardial infarction census log. Circulation, 1993;88(suppl):abstract 0306.

139. Maggioni, A.P., Franzoni, M.G., Santoro, A.P., et al. The risk of stroke in patients with acute myocardial infarction after thrombolytic and anti-thrombotic treatment. New England Journal of Medicine, 1992;327:1-6.

140. Rodda, B.E. The Timolol Myocardial Infarction Study: An evaluation of selected variables. Circulation, 1983;677:1101-1106.

141. Pfeffer, M.A., Braunwald, E., Moye, L.A., et al. Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after myocardial infarction: Results of the Survival and Ventricular Enlargement Trial. New England Journal of Medicine, 1992;327:669-677.

142. AIRE Study Investigators. Effect of ramipril on mortality and morbidity of survivors of acute myocardial infarction with clinical evidence of heart failure. The Lancet, 1993;342:821-828.

143. Broderick, J.P., Phillips, S.J., Whisnant, J.P., et al. Incidence rates of stroke in the eighties: The end of the decline in stroke? Stroke, 1989;20:577-582.

144. Barnett, H.J.M. Stroke in women. Canadian Journal of Cardiology,1990;6(suppl B):11B-17B.

145. Haynes, S.G., and Czajkowski, S.M. Psychosocial and environmental correlates of heart disease. In Cardiovascular Health and Disease in Women, Douglas, P.S. (ed). Philadelphia, PA, Saunders, 1993.

146. Hall, E.M. Gender, work control and stress: A theoretical discussion and an empirical test. International Journal of Health Services,1989;19:725-745.

147. Johnson, J.V., and Stewart, W. Measuring work organization exposure over the life course with a job exposure matrix. Scandinavian Journal of Work Environment Health, 1993;19: 21-28.

148. Miller, W.J. Life tables: Canada and the provinces, 1990-1992. Cat. No. 84-537. Statistics Canada, Ottawa.

FOUNDATION ADDRESSES:

HEART AND STROKE FOUNDATION OF
B. C. & YUKON
1212 West Broadway
Vancouver, British Columbia
V6H 3V2
Phone: (604) 736-4404

HEART AND STROKE FOUNDATION OF ALBERTA
1825 Park Road S.E.
Calgary, Alberta
T2G 3Y6
Phone: (403) 264-5549

HEART AND STROKE FOUNDATION OF
SASKATCHEWAN
279 - 3rd Avenue North
Saskatoon, Saskatchewan
S7K 2H8
Phone: (306) 244-2124

HEART AND STROKE FOUNDATION OF MANITOBA
301 Canada Building
352 Donald Street
Winnipeg, Manitoba
R3B 2H8
Phone: (204) 949-2000

HEART AND STROKE FOUNDATION OF ONTARIO
477 Mount Pleasant Road
4th Floor
Toronto, Ontario
M4S 2L9
Phone: (416) 489-7100

HEART AND STROKE FOUNDATION OF QUÉBEC
465 René-Lévesque Blvd. West
3rd Floor
Montréal, Québec
H2Z 1A8
Phone: (514) 871-1551

HEART AND STROKE FOUNDATION OF
NEW BRUNSWICK
110 Crown Street
Suite 340
Saint John, New Brunswick
E2L 2X7
Phone: (506) 634-1620

HEART AND STROKE FOUNDATION OF
NOVA SCOTIA
5523 Spring Garden Road
Suite 204
Halifax, Nova Scotia
B3J 3T1
Phone: (902) 423-7530

HEART AND STROKE FOUNDATION OF
PRINCE EDWARD ISLAND
40 Queen Street
P.O. Box 279
Charlottetown, Prince Edward Island
C1A 7K4
Phone: (902) 892-7441

HEART AND STROKE FOUNDATION OF
NEWFOUNDLAND AND LABRADOR
169-173 Water Street
P.O. Box 5819
St. John's, Newfoundland
A1C 1B1
Phone: (709) 753-8521

HEART AND STROKE FOUNDATION OF CANADA
160 George Street
Suite 200
Ottawa, Ontario
K1N 9M2
Phone: (613) 241-4361

HEART
AND STROKE
FOUNDATION

This manual was produced in collaboration with:
Health Canada
Statistics Canada
University of Saskatchewan

CAT 10139522