SOCIOECONOMIC STATUS AND RISK FACTORS FOR CORONARY HEART DISEASE: CANADA, 1971-1985

Kathryn Wilkins
Department of Epidemiology and Biostatistics
McGill University, Montreal

December 1987

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements
for the degree of Master of Science

© Kathryn Wilkins 1987

Socioeconomic Status and Heart Disease Risk Factors: Canada, 1971-1985

ABSTRACT

Six Canadian health surveys from 1971 to 1985 were analyzed for the prevalence by educational attainment of selected risk factors for coronary heart disease. Where measures were similar among surveys, trends over time were examined. Adjustment to a standard reference population was used to control for aging effects on risk factor levels, differences in age distributions across education categories, and changes in population age structure. For both genders, physical inactivity and obesity were inversely related to education. Among men, smoking was inversely related to education, but no patterns by education emerged for hypertension or hypercholesterolemia. University-educated women were less likely to smoke, or to be hypercholesterolemic. Over time the prevalence of smoking and hypertension declined in both genders. Hypercholesterolemia increased slightly among men, but remained stable among women. Obesity remained stable for men, but declined for women. The social determinants of ill health among disadvantaged Canadians require more study.

RESUME

Nous avons analysé six sondages canadiens sur la santé réalisé de 1971 à 1985 afin d'établir la prévalance de certains facteurs de risque de coronorapathie en fonction du niveau de scolarité. Lorsque les mesures étaient semblables d'un sondage à l'autre, nous avons étudié les tendances en fonction du temps. Nous avons procédé à un ajustement selon l'âge à travers les diverses catégories d'éducation afin de controller pour les changements dans la structure d'âge de la population. Tant chez les hommes que chez les femmes, la sédentarité et l'obésité étaient inversement proportionnels au degré de scolarité. Chez les hommes, le tabagisme était inversement proportionnel au degré de scolarité, mais on n'a relevé aucun modèle de rapports éducation-hypertension ou éducation-hypercholestérolémie. Les femmes diplômées de l'université étaient peu enclines à fumer ou avaient peu tendance à l'hypercholestérolémie. La fréquence du tabagisme et de l'hypertension décroissait avec le temps tant chez les hommes que chez les femmes. L'hypercholestérolémie augmentait légèrement chez les hommes, mais demeurait stable chez les femmes. L'obésité demeurait stable chez les hommes, mais décroissait chez les femmes. Les déterminants sociaux de la maladie chez les Canadiens défavorisés exigent une étude plus approfondie.

ACKNOWLEDGEMENTS

My advisor, Dr. James Hanley, provided valuable guidance throughout my work on this project. Dr. Donald Wigle, from the Laboratory Centre for Disease Control, and Mr. Wayne Millar, from the Health Promotion Division, both of Health and Welfare Canada, provided me access to the survey data used in the study. Robert Semenciw, Janet Brooks, Prem Khosla and Bill Bradley were responsible for preparing special cross-tabulations of the data. I thank them all. Dr. Remy Guibert facilitated my Ottawa contacts. Dr. Katherine Gray-Donald encouraged me to pursue the project and has been supportive throughout. Dr. Wikke Walop read and commented on early drafts of this work. Finally, I thank Russell Wilkins, whose own work is my greatest inspiration.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1 -INTRODUCTION

Trends and distribution of coronary heart disease

For several decades, coronary heart disease (ICD-9 codes 410-414) has been the leading cause of death in Canada. Each year close to 50,000 Canadians die of coronary heart disease (Nicholls et al., 1986), and in 1982 this cause accounted for 28% of all Canadian deaths. By comparison, cancer was the cause of 24% of all deaths in Canada.

Since the mid-1960s, coronary heart disease mortality has declined dramatically in Canada and elsewhere (Nicholls et al., 1986). From 1965 to 1982 the standardized mortality rate for coronary heart disease in Canadian males decreased 27%, from 317 to 230 per 100,000 population. Similar declines have occurred in the United States, Japan, Australia, Finland, Belgium, Denmark, New Zealand, and Norway (Ku and Mao, 1986; Hardes et al., 1985; Feinleib et al., 1984; Pisa and Uemura, 1982). By contrast, Sweden and France have experienced slight increases in coronary heart disease mortality rates, and Poland, Yugoslavia, Romania and Bulgaria have experienced marked increases (Pisa and Uemura, 1982; Rose, 1984; Stamler, 1981; Nicholls et al., 1986). Table 1 shows age-standardized mortality rates for heart disease from 1968-1977. Table 2 shows the change in rates which occurred over those years.

There is growing consensus in the literature that declines in coronary heart disease mortality rates are due to a decrease in the in-

cidence or severity of the disease over time. If the etiologic model of risk factor contribution to heart disease is correct, reduced incidence of heart disease would presumably result from changes in lifestyles, reflected in lowered prevalence of coronary heart disease risk factors such as smoking, hypertension, hypercholesterolemia, obesity and physical inactivity.

Various investigators have examined coronary heart disease mortality rates in terms of risk factor prevalence at the national level. For example, in the United States Stallones (1980) studied the decline of coronary heart disease mortality in terms of trends in the prevalence of four risk factors, including smoking, hypertension, elevated cholesterol and physical inactivity. He found that of these risk factors, only smoking prevalence was concordant with both the rise and fall of coronary heart disease since 1900. In Australia, Dobson (1987) examined the decline in coronary heart disease mortality, which decreased 40% from 1965-67 to 1980-81, together with risk factor prevalence. She reported that decreases in the prevalence of cigarette smoking, levels of mean serum cholesterol and blood pressure accounted for half the decrease in mortality observed in Australian men and three quarters of the decline which was observed in the women.

Other investigators have examined regional variations in coronary heart disease mortality rates in conjunction with variations in risk factor prevalence by region. Hechter and Borhani (1965), Sauer et al. (1966) and Davis et al. (1985), among many others, have provided extensive evi-

dence of the spatial variation of the decline in heart disease mortality in the United States.

Less attention has focused on the socioeconomic aspects of coronary heart disease and its risk factors. Contrary to the popular notion that heart disease is an "executive's disease," epidemiological literature has shown that for several decades heart disease death rates in many industrialized nations have been higher in lower socioeconomic strata than in higher strata. Only recently, however, have studies been undertaken to describe the distribution of those conditions which might predispose socially disadvantaged population subgroups to heart disease. In Canada, findings have begun to emerge which indicate a striking inverse gradient in the distribution of some heart disease risk factors according to socioeconomic status (Millar and Wigle, 1986), but much further investigation in this area remains to be done.

Study Objectives

The first objective of this study is to describe the distribution of selected risk factors for coronary heart disease among Canadians by subgroups defined on the basis of age group, gender and socioeconomic status. The second objective of this study is to assess the feasibility of using the available cross-sectional survey data to examine trends in the distribution of risk factors over time in the Canadian population. There are important limitations to using survey data to estimate risk factor

prevalence, as well as obstacles to comparing findings from survey to survey using cross-sectional data. The third objective is to examine trends in the distribution of risk factors from the early 1970s up to the mid-1980s. Data from six national cross-sectional surveys carried out in Canada from 1971 to 1985 are analyzed.

The specific questions addressed by this study are as follows:

- Among Canadian adults aged 25 years and over, how were risk factors for coronary heart disease distributed according to age, gender, and level of education as estimated by the six national health surveys fielded in Canada from 1971 to 1985?
- Insofar as data from the various surveys are comparable, was the distribution of coronary heart disease risk factors according to socioeconomic status the same in each survey?
- From the early 1970s until the mid-1980s have there been any changes in the prevalence of the risk factors for coronary heart disease in Canada? If so, have the distributions of risk factors according to age, gender and educational attainment remained consistent?

CHAPTER 2 - REVIEW OF SELECTED LITERATURE

Although overall rates of coronary heart disease mortality have declined in many populations, the rates of decline have not been uniform across all subpopulations within individual countries. In the past few decades a number of studies, mostly from Britain and the United States, have identified substantial socioeconomic disparities in rates of coronary heart disease morbidity and mortality. The following section summarizes the more important North American and European studies which addressed the distribution of rates of heart disease mortality and morbidity by socioeconomic status.

CORONARY HEART DISEASE: THE HISTORY OF ITS SOCIAL DISTRIBUTION

Early case studies led to the conclusion that heart disease was more common among the affluent. Even before coronary heart disease was formally identified as a unique disease entity, William Osler (1912) observed that "angina pectoris" (a rubric which at that time included all heart diseases) was an "affection of the better classes." Osler's view of the class distribution of heart disease was reinforced, in the minds of many, by the international distribution of heart disease mortality. By the 1950s coronary heart disease had become extremely common in industrialized nations, while it was rare elsewhere.

Findings from Britain, Europe, Australia and New Zealand

In Britain, several studies of coronary heart disease mortality using 1930-32 data compiled by the British Registrar General also supported Osler's observation (Stocks, 1938; Pedley, 1942; Sutherland, 1947; Logan, 1954). All noted a very strong direct gradient in mortality rates from upper to lower social class. In an analysis of the same data, Ryle and Russell (1949) reported that the standardized mortality rate (SMR)[1] for the disease entity still designated only as "angina pectoris" was distinctly lower with decreasing social class. The SMRs ranged from 237 among men in social class I (professional and managerial occupations) to about 65 among men in social classes IV and V (laborers, unskilled workers)--a four-fold range.

Later, the British data from 1930-32 were compared with data from 1949-53 (Logan, 1954; Logan and Cushion, 1960). The same gradient in mortality rates for coronary heart disease by occupational class was maintained for men, although the range had narrowed 114 points to a high of 150 for occupational class I and a low of 89 for class V.[2]

During the 1950s, upper class British men were also subject to higher than average rates of coronary heart disease morbidity. Brown et al.

---

1 The SMR is an index which shows how far the mortality rate of a particular group differs from the general average mortality rate of 100.

2 However, the SMRs for married women aged 20 to 64 were by this time "graduated in the opposite direction" with the highest mortality rates for coronary heart disease in lower class women.

(1957) studied morbidity among all 1,164 male patients aged 60 to 69 who were on the 1956 National Health Insurance lists of 11 general practitioners in Birmingham, England. Although the authors found no consistent relationship between the prevalence of coronary heart disease and social class, they did note that "myocardial infarction seemed to increase in prevalence from men in class V (unskilled occupations) to those in professional occupations (class I)."

However, the pattern of a direct gradient of coronary heart disease by social class gradually underwent an interesting and important change. In an analysis of the social class distribution of heart disease in Britain since the 1920s, Marmot et al. (1978) noted that mortality from coronary heart disease became progressively more common in the working class than in the middle and upper classes. In fact, the direct gradient of coronary heart disease mortality by social class gradually flattened and by 1961 had reversed.

Since the early 1960s the inverse relationship between heart disease and social class first identified in Britain has become more pronounced (see Figure 1). Analyses of trends in coronary heart disease mortality by social class in England and Wales from 1931 to 1971 showed that coronary heart disease mortality in the lower socioeconomic classes (IV and V) increased more slowly than that in upper classes (I and II) until 1951, and more quickly thereafter (Rose and Marmot, 1981). Also, in a seven-year follow-up study of a sample of 17,530 London civil servants aged 40 to 64, Rose and Marmot (1981) demonstrated that the lowest occupational classes

had a 3.6 times higher rate of coronary heart disease mortality than did the highest occupational class. Even after controlling for age, smoking, systolic blood pressure, plasma cholesterol level, and blood glucose, the inverse association between coronary heart disease mortality rates and grade of employment persisted (Marmot et al., 1984).

British data from the early 1970s (Black et al., 1982) for adults aged 15 to 64 showed that the age-standardized mortality ratio (ASMR) for diseases of the circulatory system was inversely related to occupational status. ASMRs for females ranged from 150 in the lowest class to 60 in the highest class, and for males from 120 to 90.

Reporting on findings of the Oslo Study of coronary heart disease mortality in a cohort of 18,000 men, Holme et al. (1980) showed that four-year mortality from coronary heart disease among men aged 40 to 49 was much higher among the lowest social class than the other classes. Data from 1974-1978 for New Zealand men aged 45-64 (Pearce et al., 1985) also showed that the rate of coronary heart disease mortality in the lowest occupational class exceeded rates in higher classes, although the relationship was not linear. In Australia as well, lower coronary heart disease mortality rates were observed for men in upper socioeconomic occupational groups compared to men in lower socioeconomic groups (Hardes et al., 1985; Dobson et al., 1985). Men from the upper occupational strata also experienced the greatest decline in rates between 1969 and 1978.

Findings from the United States

Studies of coronary heart disease mortality during the 1950s in the United States revealed the same inverse gradient between socioeconomic class and heart disease as observed from 1961 onwards in Britain. For example, analysis of Chicago mortality data for 1951 (Stamler et al., 1960) showed the death rate from arteriosclerotic heart disease for white male laborers aged 45 to 54 to be more than twice the rates for professionals, technicians, managers, etc. A study by Lew (1957) corroborated these findings. He compared 1953 coronary disease mortality rates in blue-collar, lower-income men with that in white-collar, medium to high income men, all of whom were policy holders of the Metropolitan Life Insurance Company. An inverse relationship was found between coronary heart disease mortality rates and socioeconomic status among men aged 35 to 54; the highest mortality rates occurred among the blue collar group.

An examination of heart disease morbidity from 1958 to 1963 among 1,472 men employed by the Chicago Western Electric Company (Shekelle et al., 1969) showed that the five-year incidence of myocardial infarction was lowest in upper educational strata and was generally inversely correlated with level of education. The incidence of angina pectoris, however, was highest in the upper educational strata.

In the 1960s several relatively large-scale studies in the United States continued to show that mortality rates from coronary heart disease were higher in lower socioeconomic strata. Pell and D'Alonzo (1963)

carried out a longitudinal study of 90,000 male Dupont Company employees who were aged 17 to 64 in 1956. Employees were categorized into five classes reflecting economic status and level of job responsibility. In 1962, at the end of six years of observation, 1,356 cases of first myocardial infarction had accumulated. The annual age-adjusted incidence rates of myocardial infarction were inversely related to job level among salaried workers. The rate for executives, 2.2 per 1,000 per year, was about half that of a group of lower-level employees.

Kitagawa and Hauser (1973) matched 340,000 May to August 1960 death certificates with corresponding census records from April 1960 in order to obtain social and economic characteristics of the decedents. They found that among whites aged 25 to 64 there was an inverse gradient over educational attainment of deaths due to hypertensive disease (with and without cardiac involvement). In white males the relative mortality rate (where the average for all education groups was 1.0) ranged from 1.3 for men with fewer than eight years of schooling to 0.7 for men with one or more years of college. For white females the corresponding range was 1.2 to 0.5. For arteriosclerotic and degenerative heart disease, the pattern was less regular for white males, ranging from 1.0 for men with eight years or fewer of school, 1.1 for men with one to four years of high school to 0.8 among men with one or more years of college. For white females, the mortality ratios for degenerative heart disease followed a clear inverse gradient: rates ranged from 1.4 among women with the least education to 0.6 among women who had attended college.

In a longitudinal study of 270,000 ethnically homogeneous, American male career employees of the Bell Telephone System throughout the continental United States, Hinkle et al. (1968) compared the 22,000 employees who were college graduates to the rest of the cohort who were not. During the 1962 to 1966 study period, college graduates were found to have 30% lower age-specific rates of first events of coronary heart disease and coronary deaths than nongraduates. The difference in risk was not due to the educational process itself, the authors suggested, but rather was the result of biological differences related to social and economic backgrounds, including habits of eating and smoking.

Weinblatt et al. (1978) studied a group of 1,739 survivors of myocardial infarction in the United States. Over the three-year period from 1972 to 1975, they found that among survivors who had a particular arrhythmia, the risk of sudden coronary death was over three times as high in those with eight or fewer years of education as in those with nine or more years of education. In examining the data for possible bias, the investigators found that the effect associated with low education could not be accounted for by differences in work status, access to medical care, drug-treatment regimens, other coronary-disease risk factors (including smoking and weight/height ratios), electrocardiogram findings, history of cardiovascular disease, or combinations of these factors.

In 1968 Antonovsky published an exhaustive review of all studies published this century containing information on the relationship between some measure of socioeconomic status and cardiovascular disease. About

three quarters of such studies from the United States, spanning the period from 1910 until the mid-1960s, reported an inverse gradient between cardiovascular mortality or morbidity and social class. Although in several of the studies the relationship was reported to be curvilinear (most often "J"-shaped, as the rate of morbidity or mortality in the highest social class exceeded somewhat that in the second highest class), nevertheless the rate was consistently highest in the lowest social class. A few studies found no clear relationship, and a few, particularly earlier, studies found a direct gradient. Antonovsky concluded that the prevalent perception of a direct class gradient for coronary heart disease mortality was not supported by empirical data. Rather, he pointed out, study findings more frequently showed an inverse gradient. Antonovsky anticipated even wider increases in class differentials for cardiovascular disease in the future.

Changes over time by social class: United States

In a seven-year follow-up of 3,102 Evans County, Georgia residents, Cassel et al. (1971) studied the incidence of coronary heart disease by social class. They found that although the prevalence of coronary heart disease in the years 1960-62 had been greater among men of higher socioeconomic status, the rate of <u>incident</u> coronary heart disease was equivalent across social classes from 1962-1969. They attributed this finding to a secular change in incidence: the rate of disease among lower

social class men had changed to the level which previously had been characteristic of the more favored classes. The authors raised, but did not answer the question of whether the rates in the lower education group were increasing or those in the higher education group were declining.

Subsequent studies which focused on comparisons of changing rates of disease in population subgroups substantiated Antonovsky's prediction of a widening gap between socioeconomic strata in rates of heart disease. Pell and Fayerweather (1985) analyzed long-term trends in incidence of myocardial infarction and deaths from coronary heart disease occurring from 1957 through 1983 among 6,286 male Dupont plant workers. Initially, the average annual incidence rates in the two groups were nearly the same, at 3.1 per 1,000 for hourly-paid production workers and 3.3 per 1,000 for salaried white collar workers. During the study period there was an overall decline in incidence of 28%, but the rate of decline was nearly 38% among salaried white collar workers compared to 18% among hourly-paid production workers.

Using aggregate data, Lerner and Stutz (1977) compared cause-specific mortality rates for the ten highest income and ten lowest income American states for the periods 1959-61 and 1969-71. In 1959-61 the coronary heart disease death rates were lower in the low income states. Over that decade heart disease mortality declined 10.4% in the high income states (from 306 to 274 per 100,000 population) but it declined only 1.9% in the low income states (from 279 to 274 per 100,000). By 1971 the heart disease mortality rates for low income and high income states were virtually equal.

The results of another ecologic analysis of changes over time in heart disease death rates by socioeconomic status were less clear. Yeracaris and Kim (1978) studied mortality rates from heart diseases in relation to census tract characteristics in three metropolitan areas in the United States: Birmingham, Alabama; Buffalo, New York; and Indianapolis, Indiana. In all three cities in 1960, white mortality rates from heart disease were inversely associated with neighborhood socioeconomic status scores. In the ten years which followed, reductions in mortality rates from heart disease concentrated more in the lower than higher socioeconomic neighborhoods in Birmingham, but in Buffalo and Indianapolis reductions in heart disease mortality favored the higher more than the lower socioeconomic neighborhoods.

Findings from Canada

Although most studies focusing on the relationship of heart disease to socioeconomic status have been conducted in Great Britain and the United States, recent studies have emerged from several other industrialized countries which have also generally shown that the mortality rate from heart disease in the lower socioeconomic classes exceeds that of the higher classes.

In Canada, Wigle and Mao (1981) analyzed 1971 cause-specific mortality by neighborhood income in 21 census metropolitan areas. For ischemic heart disease, the adjusted standardized mortality ratio (ASMR) for

men aged 35 to 64 was 259 per 100,000 population in the highest income quintile, increasing steadily through the quintiles to 407 per 100,000 in the lowest income quintile. For women aged 35-64 the ischemic heart disease ASMR was 52 per 100,000 in the highest income quintile, increasing to 98 per 100,000 in the lowest income quintile.

In a case-referent study of deaths from selected causes in Canadian males aged 25-64 in 1974, Billette and Hill (1978) found no trend by occupational status in the proportion of deaths due to coronary heart disease. It is important to note that the focus of Billette and Hill's analysis was the proportion of all deaths which were due to coronary heart disease in each occupational category, whereas the Wigle and Mao study examined coronary heart disease death rates in each income category. When we multiplied the proportion of deaths due to heart disease by the relative mortality rates for all causes, as shown in the Billette and Hill study, it was clear that heart disease death rates were highest in the lowest occupational category.

In summary, studies in Britain, the United States, Canada and other countries in the last few decades have shown that the rates of mortality and morbidity from coronary heart disease are now generally higher among persons of lower socioeconomic status than among persons of higher socioeconomic status. In the United States findings also suggest that heart disease has declined at a faster rate among persons of upper socioeconomic status than among persons of lower socioeconomic status. Table 3 summarizes the findings from studies conducted in Britain and

other countries on coronary heart disease mortality and morbidity in relation to socioeconomic status. Table 4 summarizes the findings from studies conducted in Canada and the United States. In the next section, studies which offer possible explanations for the observed differences between socioeconomic strata in rates of decline of mortality rates will be reviewed.

THE DISTRIBUTION OF RISK FACTORS

The bulk of studies related to determinants of coronary heart disease have focused on relationships between the presence of physiological factors and the occurrence of disease. Some investigations, however, have also considered the broader social determinants to which variations in lifestyle and health behaviors can be largely attributed. For example, Stamler (1981), in a review of developments in primary prevention of coronary heart disease which had occurred over the previous two decades, noted that dietary changes, declines in smoking, adoption of leisure time exercise and lowered cholesterol levels had occurred more frequently in households of higher educational and income levels. An exception to this pattern was noted for programs of detection and treatment of hypertension, which involved all population strata equally. Clearly though, he observed, the upper classes had benefited most from the decline in mortality.

Etiological studies have established several risk factors for coronary heart disease. Some of these, such as male gender, age and familial history, are clearly not modifiable, while others, such as smoking, hypertension, hypercholesterolemia (non-familial), obesity and physical inactivity, are amenable to change. Over the past few decades, major observational studies have established a significant association between "lifestyle" risk factors and coronary heart disease (see Table 5 for a summary of these studies).

The following section includes findings from various countries where the relationship between social class and the distribution of the five modifiable risk factors for heart disease presented above has been studied.

Findings from Britain, Europe, Australia and New Zealand

Table 6 summarizes the findings on risk factors in various studies from Europe, Britain, Australia and New Zealand which are presented in this section.

Marmot et al. (1978) studied trends in the prevalence of lifestyle habits in an attempt to account for the reversal of the mortality gradient by occupational class which they noted had occurred by 1961 in Britain. They found that higher mortality rates in the lower occupational classes correlated with relatively higher rates of smoking in the lower classes, and with certain dietary changes (not including fat consumption).

More recent British data from the Black Report (Black et al., 1982) showed that class-related patterns in smoking behavior have persisted. Prevalence of cigarette smoking by occupational level among persons aged 16 and over in 1980 showed a clear gradient from 21% among both male and female professionals to 57% and 41% among unskilled working men and women, respectively. Furthermore, class differentials were apparent in smoking cessation rates. The prevalence of smoking among men and women in professional occupations had decreased by over a third (from 33% to 21%) between 1972 and 1980, whereas the prevalence of smoking among unskilled manual classes decreased by only 11% for men and by 2% for women.

Studies of risk factor distribution are also available from several European nations. Among the 14,677 men aged 40 to 49 screened for the Oslo Study in 1972-73, Holme et al. (1976) observed that men of low educational and income status had higher serum cholesterol and triglyceride levels, higher blood pressure, smoked more and had higher coronary heart disease risk scores than did men of high status.

Another Norwegian-based study (Arnesen and Forsdahl, 1985) focused on conditions in childhood which might give rise to cardiovascular disease risk factors in adulthood. For the Tromso Study, which covered the years 1979-80, investigators carried out historical reviews on a group of 14,652 Norwegian adults aged 20 to 54 in order to examine the relation between the prevalence of risk factors for cardiovascular disease and self-reported information about economic conditions during childhood. Among the men studied, but not among the women, significant positive associa-

tions were found between poverty during childhood, level of total cholesterol, and percentage of current smokers.

In a random sample of 1,951 adults in the Netherlands in 1978, Kok et al. (1982) studied characteristics of persons having three or four risk factors (N=246) including smoking, inadequate nutrition, obesity and physical inactivity compared to the characteristics of persons with no risk factors (N=387). They found that the high risk group included more men, of all ages, with low education and poorly paid occupations.

In North Karelia, a county in Eastern Finland distinguished in the early 1970s for having the world's highest known incidence rates of coronary heart disease, risk factors were studied among a random sample of 10,951 men and women (Tuomilehto et al., 1978). In 1972, high values of serum cholesterol (defined as greater than or equal to 270 mg/dl or under cholesterol-lowering drug treatment) were observed more often among both men and women of lower educational level. In men aged 30 and over smoking was more common in the lower education category, though this association did not hold for women. High blood pressure (defined as systolic pressure greater than or equal to 175 mmHg and/or diastolic pressure greater than or equal to 100 mmHg) was more prevalent among men and women with a lower educational level, though this pattern was more pronounced for women than for men.

Data on smoking among men aged 15-64 in New Zealand for 1976 (Pearce et al., 1985) showed a clear social class gradient for the percentage of current smokers. Rates ranged from 32% in the upper two occupational

classes to 53% in the lowest class. Furthermore, the percentage of ex-smokers was linearly related to social class. Twenty two percent of respondents in the highest classes reported they had quit smoking, compared to 16% in the lowest class.

In Australia, Dobson et al. (1985) compared risk factor levels among occupational groups for persons aged 25 to 64 in 1980. They found that mean diastolic blood pressure, mean plasma triglyceride values (and proportions of respondents with clinically elevated triglyceride measurements) were higher among men and women of low socioeconomic status than among those of higher status. Similar findings were reported for elevated blood pressure (greater than or equal to 95 mmHg diastolic or 160 mmHg systolic), obesity (measured by body mass index), physical inactivity and cigarette smoking among both men and women. However, for mean plasma cholesterol as well as for elevated cholesterol (greater than 250 mg/dl) there were no apparent patterns and no statistically significant differences among occupation groups for men or women.

Findings from the United States--hypertension

Table 7 summarizes the findings on risk factors in the studies from the United States and Canada which are presented in the following sections.

Data representative of the entire noninstitutionalized population of the United States are provided by several health surveys. The National

Health and Nutrition Examination Survey (NHANES-I) of 1971-75 (National Center for Health Statistics (NCHS), 1981) showed an inverse relationship between socioeconomic status and blood pressure levels among adults 25 to 74 years of age. For both men and women, age-adjusted means of both systolic and diastolic blood pressure were consistently and statistically significantly lower in each successively higher category of educational attainment and annual family income. The mean systolic blood pressure was 134 mmHg for whites with fewer than five years of schooling, compared to 130 for whites with some college education. Systolic blood pressure ranged from a mean of 153 for blacks with fewer than five years of schooling to 137 for blacks with some college education. For both races, the prevalence of "definite" hypertension (defined as either systolic pressure of greater than or equal to 160 mmHg, or diastolic pressure of greater than or equal to 95 mmHg) and "borderline" hypertension (defined as systolic pressure below 160 mmHg and diastolic pressure below 95 mmHg but not both below 140 mmHg systolic and 90 mmHg diastolic) was consistently lower at successively higher levels of education for women, but less consistently so for men. The age-adjusted prevalence for definite hypertension ranged from 31% of adults with fewer than five years of school to 17% among adults with 13 or more years of school.

Data from the 1976 Health Interview Survey (Pincus et al., 1987) showed a strong inverse gradient between reported hypertension and formal education. The age-adjusted percentages of persons with reported hypertension in the educational categories of one to eight, nine to 11, 12, and more than 12 years of schooling were 26%, 13%, 11% and 7%, respectively.

The 1973-74 Hypertension Detection and Followup Program (HDFP) (1977) in 14 communities in the United States corroborated the NHANES-I findings. Analysis of data from 151,668 adults indicated that the greater the number of years of school completed, the lower the prevalence of hypertension (defined as diastolic blood pressure greater than or equal to 95 mmHg, or less than 95 mmHg if currently using antihypertensive medication). The prevalence of hypertension was 23% among whites who had completed fewer than ten years of school and 14% among whites who had graduated from college. The prevalence was lower for each successively higher education level. The inverse association between educational level and hypertension was somewhat more pronounced in women than in men.

Data from the 1976-80 National Health and Nutrition Examination Survey II (NHANES-II) (NCHS, 1986a) showed that the inverse relationship between education and mean blood pressure was still present, and that in contrast to the NHANES-I findings, the differences across educational levels among women substantially exceeded the differences among men. The survey also found that a greater proportion of the United States population was receiving hypertensive medication than previously, and that a greater proportion of the population had normotensive blood pressure than in the surveys of 1960-62 and 1971-75.

Findings from the United States--cholesterol

Estimates from NHANES-I for 1971-74 (NCHS, 1980) showed that for whites of either sex and for black women aged 18 to 74, mean serum cholesterol was lower in successively higher levels of educational attain-

ment. Among white men with fewer than nine years of education, the mean serum cholesterol was 220 mg/dl, decreasing steadily to 208 mg/dl among white men with 13 or more years of schooling. A comparison of findings from the Health Examination Survey (HES) of 1960-62 with findings from NHANES-I of 1971-74 indicated that the greatest reduction in the mean serum cholesterol between the two surveys generally occurred at the highest level of income ($10,000 or more per year), and at the highest level of education (13 years or more).

A comparison of results from NHANES-I data from 1971-74 with those of NHANES-II for 1976-80 (NCHS, 1986b) showed that the distinct inverse gradients of mean serum cholesterol by level of education which were present in the former period had been maintained. By 1976-80 the unadjusted mean levels of cholesterol for men and women in the lowest education group were virtually the same as in 1971-74. Likewise in the highest education group, the levels were very nearly the same. It is important to note, however, that the data on mean values of serum cholesterol available from the HES and NHANES-I surveys were not age-adjusted. Age-adjustment of NHANES-II data completely eliminated the gradient by educational attainment observed in the unadjusted data. This is not surprising, given that both the education distribution for the population and mean cholesterol levels vary by age. The elderly tend to have fewer years of schooling, and mean cholesterol levels increase as one ages (NCHS, 1986b). The gradients observed in the unadjusted data thus resulted from confounding of age with education. It is expected that age-adjustment of the earlier survey data would also eliminate the gradient observed.

When subgroups of the NHANES-II Survey population for 1976-80 were examined on the basis of income, an inverse gradient was evident for levels of mean serum cholesterol. Higher income was associated with higher mean serum cholesterol. In each successive age category, men and women at or above the poverty line had consistently higher mean serum cholesterol than did persons below the poverty line. Furthermore, among men living in poverty, the prevalence of high risk levels of cholesterol (15%) was significantly lower than among men living above the poverty line (20%). Age-adjusted prevalences differed only slightly from the unadjusted ones.

Findings from the United States--smoking

Analysis of 1983 United States Health Interview Survey (HIS) data on smoking among American adults aged 18 years and older according to educational attainment (McGinnis et al., 1987) showed that the highest rates of smoking occurred among men and women in the second lowest educational category, that is to say, among persons with some high school education but no high school diploma. Rates of smoking were lower in each successively higher education category and ranged from 46% among men with some high school to 16% among men with post-college education and from 39% among women with some high school to 17% among women with post-college education.

Findings from the United States--various risk factors

Smaller, regionally-based studies have focused on risk factor distributions by social class in various sections of the United States. Pell and D'Alonzo (1961) investigated whether differences in the prevalence of risk factors by region could account for the lower incidence of myocardial infarction observed in the late 1950s and early 1960s among Dupont Company executives. They matched 489 male executives aged 40 to 64 with 1,096 non-executive workers. Age-adjusted comparisons of prevalence of hypertension, obesity, hypercholesterolemia and smoking revealed no significant differences between the groups. However, as was stated earlier, survival of the executives was much better than that of the workers.

Tyroler et al. (1980) conducted a longitudinal study in Georgia focusing on familial patterns of cholesterol levels over the period 1960-1967. They found that correlations of cholesterol levels over time were distinctly stronger among members of lower-class families than among members of higher-class families. In 1960, white men in upper occupational categories had significantly higher levels of serum cholesterol than did white men in lower class occupations. Seven years later, though, the difference in mean levels of serum cholesterol between upper and lower social classes had been eliminated. This was accounted for by greater increases in cholesterol in the lower class men than in the upper class men.

Data collected in 1974-75 on 19,141 employed men aged 35 to 57 in California (Kraus et al., 1980) showed that among Whites, Spanish Amer-

icans and Asian Americans, there was a higher prevalence of hypertension (defined as diastolic blood pressure greater than or equal to 95 mmHg) and smoking among persons of lower socioeconomic status (as measured by a composite index based on occupation and education). Hypercholesterolemia (defined as greater than or equal to 260 mg/dl) was inversely but only weakly associated with socioeconomic status in Whites, and was unevenly distributed over socioeconomic status in the other racial groups.

In a study of 1,255 adults and children in Ohio in 1973-75, Khoury et al. (1981), found an inverse association between socioeconomic status (defined by education and occupation of head of household) and the prevalence of smoking among both children and adults, and an inverse association between socioeconomic status and plasma triglyceride levels among women.

Hunter et al. (1979) studied the relationship of parental social status to selected cardiovascular disease risk factors among a group of 3,524 children aged 5 to 14 living in Bogalusa, Louisiana in 1973-74. Among the white families studied, a statistically significant U-shaped pattern emerged. Parents with the lowest as well as parents with the highest levels of education had children with the highest values of serum cholesterol and alpha-lipoproteins. The other variables which were considered, including blood pressure, pre-beta-lipoproteins, and triceps skinfold, did not appear to be associated with socioeconomic status among the children.

Findings from Canada

There has been relatively little study of the distribution of risk factors for coronary heart disease by socioeconomic class among Canadians. Robitaille et al. (1979) studied cardiovascular disease risk factor prevalence in 1974 among a random sample of 4,830 Quebec City-area men aged 35 to 64. The prevalence of hypertension (blood pressure greater than 160/95 mmHg) and cigarette smoking were inversely related to educational attainment, whereas hypercholesterolemia (greater than or equal to 240 mg/dl) was equally distributed across all educational categories. When Lupien et al. (1985) studied cholesterol in terms of lipid and lipoprotein levels in the same cohort of men a few years later, they again found no relationship to education.

Stephens et al. (1985) analyzed findings from eight surveys conducted in the United States and Canada between 1972 and 1983 which dealt with leisure time physical activity patterns in the population. These surveys indicated a positive association between exercise and socioeconomic status, whether measured by occupational status, income or educational attainment.

In a few Canadian communities, the World Health Organization recently initiated an ongoing registration system for cardiovascular disease events and deaths known as Project MONICA (Multinational Monitoring of Trends and Determinants in Cardiovascular Disease) (Pisa and Uemura, 1982). Although a longitudinal follow-up of a cohort would be the

preferred approach to studying risk factors in the selected communities, risk factors are to be assessed only cross-sectionally, by three population surveys during the period of surveillance. In Canada there is no ongoing surveillance program of national scope such as the NHANES in the United States. Several one-time surveys have been conducted in Canada which assessed some aspects of risk factor prevalence in the population. In a recent investigation, Millar and Wigle (1986) used data from several such surveys (the Canada Health Survey of 1978-79, the Canada Fitness Survey of 1981, and Labour Force Survey Supplements of 1975 and 1983) in order to study the social gradient of risk factor distribution. They also examined changes over time in the age- and sex-specific prevalence of smoking within the various categories of educational attainment.

They found that among university-educated women in Canada, the prevalence of high serum cholesterol (greater than or equal to 260 mg/dl) was about one quarter that found among Canadian women with secondary education or less. Among men the prevalence of elevated cholesterol was more even by education. Pronounced socioeconomic gradients were shown for obesity, smoking and physical inactivity among Canadians of both sexes aged 20 to 69. Also, the prevalence of elevated diastolic blood pressure (greater than 90 mmHg) among women aged 40 to 69 was 25% among women with elementary education compared to 16% among women with university education. Among men of different levels of educational attainment, however, there were no differences in the prevalence of high blood pressure.

SUMMARY

Literature Review

From the literature related to rates of heart disease by socioeconomic class and to the distribution of risk factors within socioeconomic strata, the major findings were as follows:

- From at least mid-century the distribution of coronary heart disease by socioeconomic status has assumed an inverse gradient in the United States and Britain and in some other industrialized countries as well.
- Studies of risk factor distribution by socioeconomic status in the United Kingdom, the United States, Canada and other industrially developed countries show that the prevalence of hypertension and smoking is higher among persons in lower socioeconomic strata than among person in upper socioeconomic strata.
- Several, but not all, studies which have focused on elevated serum cholesterol have indicated that there is an inverse gradient by socioeconomic status for this variable as well.
- The more scanty evidence available on the distribution of other risk factors, including obesity and physical inactivity, indicates a higher prevalence among persons in lower socioeconomic strata.

The perspective of the present study

Although the literature on social inequalities in health is vast, and although it has been shown repeatedly that the poor are less healthy, there have been relatively few Canadian studies on this subject, and even fewer which focus on risk factor distributions by social class. In a recent publication, federal health minister Jake Epp (1986) outlined key problem areas which his ministry has targeted for change. Topping the list of priorities to be addressed was the problem of social inequalities in health, which persist despite universal access to medical care.

In this context, the importance of the study of inequalities in the distribution of risk factors for ill health among Canadians is heightened. Inequalities in relation to the determinants of coronary heart disease are particularly relevant. Coronary heart disease is the leading cause of death in Canada, and despite universal access to health care services, the rates of coronary heart disease mortality are higher among persons of lower socioeconomic status. The prevalence of risk factors is also higher among the socially disadvantaged in Canada, as in many other countries. This study is intended to further investigate patterns of risk factor prevalence according to socioeconomic status, and to quantify changes in rates which have occurred during the period that universal medicare has been in effect.

The present study is intended to expand on the work of Millar and Wigle (1986) concerning risk factor distributions, and it uses a number of

the same conceptual and methodological approaches. For the present study, data from the surveys examined by Millar and Wigle (The Canada Health Survey of 1978-79, the Canada Fitness Survey of 1981 and the Labour Force Survey Smoking Supplements of 1975 and 1983) as well as from the Nutrition Canada Survey of 1971, the Health Promotion Survey of 1985, and the General Social Survey of 1985 are analyzed for the distribution of coronary heart disease risk factors by socioeconomic status. Socioeconomic status is operationalized as level of educational attainment.

The data span a period of nearly 15 years. Therefore, within the constraints imposed by changes in survey methodology, the data are examined for trends over time. It is important to note that differences in the objectives, content and methodology of the various surveys limit strict comparability of the data. Important, but not altogether insurmountable, obstacles to observation of trends over time are imposed, and these are discussed.

CHAPTER 3 - MATERIALS AND METHODS

This study was designed as an analytical investigation of selected coronary heart disease risk factors as obtained from several cross-sectional data sets: five Canadian population health surveys and one Labour Force Survey Smoking Supplement. Data were selected from questionnaire items, laboratory tests and physical measurements bearing on the risk factor variables of interest (see Appendix 1). Custom cross-tabulations on the selected variables were obtained from Statistics Canada and Health and Welfare Canada. Age, sex, and education-specific prevalence rates were calculated. Adjustment to a standard reference population was used to control for aging effects on risk factor levels, differences in age distributions across education categories, and changes in population age structure. Estimated standard errors of the prevalence rates were calculated.

EDUCATION AND RISK FACTOR VARIABLES

The variables selected for study were five potentially modifiable risk factors of coronary heart disease: cigarette smoking, elevated serum cholesterol, hypertension, obesity and physical inactivity. The positive association between all of these factors and heart disease has been well established in observational studies of populations over the past few decades.

Educational attainment

Educational attainment was selected as the most appropriate indicator of socioeconomic status. Probably the best argument for this choice was made by Kitagawa and Hauser (1973), who pointed out that educational attainment tends to stabilize after age 25, that educational attainment is a measure less affected by illness experience than other measures of socioeconomic status such as income or occupational status, and that educational attainment applies with equal validity to retired men and working men, and to all women. Holme et al. (1980), also showed that the inverse gradient of mortality by educational attainment is more stable than the gradient by income, and that even when adjusted for income, heart disease mortality rates steadily decline with increasing level of educational attainment.

Evaluation of the quality of education data from census sources in the United States (Spiegelman, 1968) has shown that about 5% of the population failed to report educational attainment, 16% reported a higher grade in the census than in a reinterview, and 10% a lower grade, leaving a net of 6% who overstated their educational attainment.

Details of the classification and groupings of the educational attainment levels are explained later in relation to each survey.

Smoking

Prevalence rates of reported current daily smoking were examined from the following five surveys: the Nutrition Canada Survey of 1971, the Labour Force Survey Smoking Supplement of 1975, the Canada Fitness Survey of 1981, the General Social Survey of 1985, and the Health Promotion Survey of 1985. Of those, only the 1975 Smoking Supplement allowed proxy responses in addition to self-reports.

Elevated serum cholesterol

In recent observational studies, various definitions of elevated serum cholesterol have been used. For example, Robitaille et al. (1979) defined the minimum level considered "high risk" as 240 mg/dl, Dobson et al. (1985) as 250 mg/dl, Kraus et al. (1980) and Millar and Wigle (1986) as 260 mg/dl, and Tuomilehto (1978) as 270 mg/dl.

Etiologic investigations have substantiated the risks associated with various levels of elevated serum cholesterol. Keys et al. (1963) presented data from the Framingham, Minnesota and Albany studies in regard to the relationship of coronary heart disease risk to predisease serum cholesterol. All data sets showed sharp rises in the incidence of coronary heart disease with successively higher predisease serum cholesterol levels. In the Minnesota and Framingham data for persons aged 30-49, when serum cholesterol was greater than or equal to 240 mg/dl, the

risk of new coronary heart disease substantially exceeded the average rate of the study group. In the Framingham data for persons aged 50-59, and in the Albany data, greater risk was associated with cholesterol levels of 260 mg/dl and above.

Martin et al. (1986) studied data from the Multiple Risk Factor Intervention Trial (MRFIT) cohort of 361,662 men initially aged 35-57 over a period of six years to determine risks associated with various levels of serum cholesterol. They found a relative risk of 3.8 in men whose cholesterol levels were above the 85th percentile, which was 253 mg/dl.

Guidelines from the National Institutes of Health (NCHS, 1986b) reflect an age factor in the risk threshold for serum cholesterol. The high risk cutpoints were specified as:

Age in years	High risk level of serum cholesterol
20-29	>227 mg/dl
30-39	>247 mg/dl
40+	>268 mg/dl

For the present study serum cholesterol was described as "elevated" when the level was greater than or equal to 250 mg/dl. The risk at this level to younger persons is well substantiated, as the MRFIT, Minnesota and Framingham (ages 30-49) data show. These studies also suggest that the risk threshold in older persons, say 60 and over, may be somewhat higher than 250 mg/dl. Although the choice of the 250 mg/dl cutpoint may result in underestimates of persons at risk in younger age groups, and slight overestimates of those at risk in older age groups, it is nevertheless a reasonable compromise.

Hypertension

For the present study blood pressure was defined as "elevated" if diastolic blood pressure (4th Korotkoff phase) was greater than or equal to 100 mmHg, and defined as "not elevated" otherwise. This definition was designed to ensure comparability with the Nutrition Canada Survey, which recorded diastolic but not systolic blood pressure, and only if the level was greater than or equal to 100 mmHg.

Obesity

Obesity was defined in terms of the Quetelet or Body Mass Index (BMI), which is calculated as follows:

$$BMI = \text{Weight (kg)}/\text{Height (m)}^2$$

Physical inactivity

Estimates of physical activity and inactivity were calculated in at least some fashion on four surveys, at three points in time: in the Canada Health Survey of 1978, in the Canada Fitness Survey of 1981, in the General Social Survey of 1985 and in the Health Promotion Survey of 1985. Because definitions of physical inactivity varied so widely, it was deemed infeasible to compare prevalence rates over time, across surveys.

SOURCES OF DATA AND MEASUREMENT OF VARIABLES

The surveys selected for study met the following eligibility criteria:

- they provided data on educational attainment of survey respondents and on one or more of the risk factor variables of interest;
- they were designed as probability samples to be representative of the noninstitutionalized Canadian population; and
- documentation was available on sampling and data collection procedures so that data quality could be assessed.

The surveys included were the Nutrition Canada Survey, conducted by Health and Welfare Canada in 1970-72; the Canada Health Survey, conducted by Health and Welfare Canada and Statistics Canada in 1978-79; the Canada Fitness Survey, conducted by Fitness and Amateur Sport Canada in 1981; the General Social Survey, conducted by Statistics Canada in 1985; the Health Promotion Survey, conducted by Statistics Canada for the Health Promotion Directorate of Health and Welfare Canada in 1985; and the August 1975 Smoking Supplement to the August 1985 Labour Force Survey, conducted by Statistics Canada for Health and Welfare Canada.

In the following sections the objectives and methods of each of these surveys will be summarized. Target populations, survey procedures, and the definitions and measurement of each variables of interest to the present study will be described in detail. See Table B for a capsule summary of each survey in terms of the aims of this study.

Nutrition Canada Survey

Objectives. The objectives of the Nutrition Canada Survey (Nutrition Canada, 1973) were to assess the nutritional status of the non-institutionalized population and to evaluate food enrichment policies. Specifically, the survey was designed to determine the prevalence of nutritional diseases, to estimate the types and quantities of food items consumed, and the consumption of food additives and pesticide residues.

Target population. The target population of this survey was all non-institutionalized residents of the ten provinces, including Indians on reserves as well as Eskimos in each of the provinces and territories. The survey sampled persons of all ages, using a multistage probability sampling strategy. A participation rate of 47% was achieved, and the total sample numbered 15,920, of whom 6,058 were aged 25 years or over.

Survey procedures. Survey procedures included initial contact by home visits, where basic demographic data and information on food buying and preparation were collected from persons who consented to be interviewed, and subsequent assessments at survey centres in each locality. These assessments included interviewer-administered questionnaires, physical examinations and anthropometric measures. Data collected included measures of dietary intake, clinical, dental, and anthropomorphic data; biochemical measures of blood and urine; demographic information; and information on food purchases and preparation. Of interest to the present study were data on serum cholesterol, blood pressure, smoking and obesity.

Smoking. Information on smoking habits was elicited from participants in the Health Review section of the Nutrition Canada Survey. Questions related to cigarette smoking, including frequency, number of cigarettes smoked per day, number of years of smoking, and past smoking habits were asked of all participants. Questions relating to pipe and cigar smoking were asked of men only. For the present study respondents were classified as "current smokers" if they gave a "yes" response to each of the two questions, "Do you smoke cigarettes?" and "Do you usually smoke them every day?" All others were classed as non-smokers.

Cholesterol. Serum cholesterol was measured from blood specimens of non-fasting persons which were collected during the physical examination section of the Nutrition Canada Survey. Determinations of cholesterol levels were carried out on automated analytical equipment and the methods of analysis were validated through collaboration with other laboratories in Canada and the United States. For the present study, serum cholesterol was described as "elevated" when the level was greater than or equal to 250 mg/dl.

Blood pressure. In the Nutrition Canada Survey, blood pressure was taken in one reading, by means of a mercury sphygmomanometer, with the participant sitting. Only diastolic blood pressure was recorded, and then only in cases where it was greater than or equal to 100 mmHg. For the present study blood pressure was defined as "elevated" if diastolic blood pressure (4th Korotkoff phase) was greater than or equal to 100 mmHg, and "not elevated" otherwise.

Obesity. In the Nutrition Canada Survey, body weight was measured to the nearest tenth of a kilogram and height was measured in millimeters. For the present study obesity was defined as a Quetelet or Body Mass Index of 30.0 or more for men, and 28.6 or more for women (Millar, 1985).

Education. All participants in the Nutrition Canada Survey were asked to state their level of educational attainment as "grades obtained." For the present study, four levels of educational attainment were defined as follows:

- Elementary: at most elementary schooling, from none through eight years.
- Secondary: some secondary schooling, from nine through 13 years (secondary incomplete or completed) but no post-secondary schooling.
- Post-secondary: beyond secondary school but no university.
- University: any schooling at the university level.[1]

Smoking Supplement to the Labour Force Survey

Objectives. The Labour Force Survey (Statistics Canada, 1979) is an ongoing survey of Canadian labour force activity and characteristics of nearly all persons aged 15 years and over in the household population. Health and Welfare Canada monitors the smoking behavior of Canadians through periodic supplements to the survey.

---

1 Because of the way in which educational attainment was recorded in the Nutrition Canada Survey, this definition differs from the "university" category used in the other surveys, where "university" education refers to a university degree or diploma.

Target population. The Labour Force Survey covers the civilian non-institutionalized population aged 15 years and over in the ten Canadian provinces. It excludes the Yukon and Northwest Territories, persons living on Indian reserves and Crown lands, inmates of institutions and active members of the armed forces.

Survey procedures. The Labour Force Survey is a multi-stage probability sample of dwellings (Statistics Canada, 1977). After an initial household contact in person, monthly interviews for the Labour Force Survey are conducted by telephone. For the August 1975 survey Supplement, 52,791 persons aged 25 years or older were living in the households sampled. Data were collected by proxy for approximately 50% of these people.

Smoking. Current smoking was determined by answers to two questions in the smoking supplement. To classify a person as a "current smoker," responses of "yes" and "regularly" were required to the questions: "At the present time, does _____ smoke cigarettes?" and, "At the present time, does _____ smoke cigarettes regularly (usually every day) or occasionally (not every day)?"

Education. An interviewer recorded the number of years of completed schooling for each household member. For the present study, levels of educational attainment were defined for the Labour Force Survey as follows:

- Elementary: eight or fewer years of school completed.
- Secondary: some secondary schooling completed.
- Post-secondary: some (incomplete) university, or other post-secondary education (completed or not).
- University: university diploma or degree.

Canada Health Survey

Objectives. The Canada Health Survey was conducted in 1978-79 by Health and Welfare Canada and Statistics Canada (1981). The overall objective of the survey was to assess health risk factors, health status, and the consequences of health problems among Canadians. Although the survey was designed to be ongoing, data collection was terminated after only nine months.

Target population. The target population of the survey was the non-institutionalized Canadian population, excluding residents of the territories, Indian reserves and remote areas. Approximately three per cent of the Canadian population was thus excluded. Households were sampled by multistage probability sampling.

Survey procedures. Survey procedures included an Interviewer Administered Questionnaire (IAQ), a self-administered, drop-off Lifestyle and Health Questionnaire (LHQ), and Physical Examinations and Measures (PEM) which were taken in the participant's home. Data collected in the various components of the survey included information on reported health, physical health, health care utilization, household characteristics, demographics, emotional health, lifestyle, environment and biomedical measures. Risk factors examined for the present study included data on cholesterol levels, blood pressure, obesity and physical activity.

Response rates. Response rates for the various components of the survey were as follows: IAQ (all ages), 86% (10,571 households); LHQ

(ages 15 and over), 89% (23,791 persons); PEM (ages 2 and over), 72% (6,131 persons); blood test (a subgroup of the PEM sample for persons aged three and over), 80% (4,829 persons).

Cholesterol. Serum cholesterol levels for 3,006 persons aged 25 and over were measured from blood samples collected as part of the Physical Examinations and Measures (PEM)component of the Canada Health Survey. Blood was collected for 80% of persons aged three years and over who responded to the PEM component. For the present study, serum cholesterol was considered "elevated" if it was greater than or equal to 250 mg/dl. Eighty four percent (84%) of those sampled complied with instructions to fast a minimum of two hours before blood was drawn. Laboratory quality control procedures included calibration of instruments before each run.

Blood pressure. Blood pressure was measured in a single determination made during the second household visit as a part of the Physical Examinations and Measures component of the Canada Health Survey, for a sample of 2,912 persons aged 25 and over. Arm girth was measured first, and appropriate cuff sizes were specified relative to arm size. Blood pressure was measured with the subject seated; examiners were instructed to "assure a five minute rest period with no postural change prior to measurement." To ensure comparability with the definitions used in the Nutrition Canada Survey, hypertension was defined for the present study as a diastolic blood pressure (fourth Korotkoff phase) of 100 mmHg or greater.

Obesity. Measures of height and weight were collected from 3,512 persons aged 25 and over. An examiner measured height and weight, and

subjects wore light clothing and stocking feet. Where measurement was infeasible, such as for persons confined to a wheelchair or persons with severe curvature of the spine, these data were collected as self-reports of the participant. Height was measured to the nearest 0.1 centimeter, and weight to the nearest 0.1 kilogram. For the present study, obesity was defined as a Quetelet or Body Mass Index of 30.0 or more for men, and 28.6 or more for women.

Physical activity. Data on participation in physical activity were collected in the self-administered Lifestyle and Health component of the Canada Health Survey. Data on this variable were collected from a sample of 12,953 persons aged 25 and over. Levels of physical activity were calculated using the "Physical Activity Index," a measure which sums the frequency of each activity reported in the previous two weeks multiplied by the average duration in minutes of each activity times the average metabolic output for that activity. Scores for the Physical Activity Index ranged from 0 to 5,500 points or more. Levels of physical activity were defined as "sedentary" (0-749 points), "moderately inactive" (750-1,749 points), " moderate" (1,750-2,999 points) "moderately active" (3,000-5,499 points), and "very active" (5,500 or more points). The present study used the same definition of physical inactivity, that is to say, 0-749 points. A person would be classified as "sedentary," for example, if his only physical activity in the last two weeks was walking 15 minutes each day. If he also jogged for 30 minutes on each of six occasions in the last two weeks, he would be categorized as "moderately active." If he also

shovelled snow for an hour, and swam for an hour on each of five occasions during the last two weeks, he would be categorized as "very active."

Education. Respondents to the Canada Health Survey were asked to report the highest level of education they had "reached," using the following response categories:

- o Some secondary or less.
- o Secondary diploma.
- o Some post-secondary.
- o Post-secondary certificate or diploma.
- o Bachelor's degree or equivalent.
- o One or more graduate degrees.

For the present study, levels of educational attainment were defined as follows:

- o Elementary: "some secondary or less," including persons with no education, or some elementary or secondary schooling short of a high school diploma.
- o Secondary: completed secondary diploma but no further schooling.
- o Post-secondary: some or completed post-secondary schooling including university short of a university degree or diploma.
- o University: at least one university degree or "the equivalent."

Canada Fitness Survey

Objectives. The objectives of the Canada Fitness Survey (Fitness and Amateur Sport Canada, 1983) were to describe the physical activity patterns, actual fitness levels, and relationship of fitness to other aspects of health among Canadians.

Target population. The target population for this survey included persons aged 7 or over in the household population of the ten provinces. Persons between the ages of 7 through 69 were eligible for fitness testing and the survey questionnaire was administered to persons aged 10 and over. Participants for the survey were selected through a multistage probability sampling strategy. Participation rates were 52% (N=16,000) for fitness testing and physical measures and 77% (N=23,500) for the questionnaire component. The sample of persons aged 25 and over who had height, weight and blood pressure measures taken was approximately 9,100. Approximately 15,000 persons aged 25 and over completed the questionnaires from which physical activity levels and smoking status were ascertained.

Survey procedures. Both fitness testing and self-administered questionnaires were completed during home visits. Fitness and anthropomorphic measures, information on health and participation in physical activity, and demographic data were recorded. Risk factor variables of interest in the Canada Fitness Survey included smoking, blood pressure, obesity and self-reports of physical activity.

Smoking. Smoking habits were elicited from participants in the "Lifestyle and Your Health" component of the Canada Fitness Survey. Questions related to tobacco smoking, including frequency, amount smoked per day, and cessation of smoking were asked. For the present study "current smokers" were defined as persons who indicated that they currently smoked "less than 1/2 pack of cigarettes daily," "about a pack of cigarettes daily," or "two or more packs of cigarettes daily." All others were classified as "non-smokers."

Blood pressure. In order for the Canada Fitness Survey data to be comparable with those of the Nutrition Canada Survey, hypertension was defined for the present study as diastolic blood pressure (fourth Korotkoff phase) greater than or equal to 100 mmHg.

Obesity. Height and weight were measured on regularly calibrated instruments by an examiner in the participant's home. Subjects were in stocking feet and light clothing. For the present study obesity was defined using the Quetelet Index as described for the Nutrition Canada Survey above.

Physical activity. For the present study three levels of physical activity were defined from the Canada Fitness Survey of 1981 as follows: "Active" = participation in a physical activity for an average of at least three hours per week for at least nine months of the year; "moderate" = less than three hours per week for at least nine months of the year or at least three hours per week for less than nine months per year; "sedentary" = less than three hours participation per week for less than nine months per year.

Duration of physical activity

Activity per year	Activity per week <3 hours	>3 hours
<9 months	Sedentary	Moderate
>9 months	Moderate	Active

Education. Educational attainment was elicited from respondents 15 years of age and older, who were asked the highest level of education they had reached.[2] Levels of educational attainment were defined for the present study as follows:

- Elementary: at most elementary schooling.
- Secondary: some secondary schooling (incomplete or completed) but no post-secondary.
- Post-secondary: any schooling beyond secondary, including community college (incomplete or completed) and incompleted university.
- University: one or more university degrees.

General Social Survey

Objectives. The objective of the General Social Survey (Statistics Canada, 1985) was to assess the health status and social support networks of Canadians aged 15 and over.

Target population. The target population for this survey was the entire noninstitutionalized population of Canada.

Survey procedures. Proxy responses were never accepted, but survey procedures differed by age group. Persons aged 15 through 64 were selected for interviews by random digit dialing. Face-to-face interviews were conducted with persons aged 65 and over who were selected from a

---

2 Response categories included: elementary or less; some secondary; secondary diploma; some post-secondary; post-secondary diploma or certificate; community college or CEGEP diploma; one or more university degrees.

quota sample of persons of that age who had rotated out of the Labour Force Survey in 1985. Response rates of 84% for the telephone interviews (N=8,150) and of 87% for the personal interviews (N=3,150) were achieved. The sample included 9,543 persons aged 25 and over. Data collected included information on health problems, two-week disability, health care services use, long term disability, height and weight, physical activity, smoking and alcohol use, satisfaction, social activities, help given to others, household activities, support networks, and demographic characteristics. Data collected on risk factors of interest to this study included self-reports of physical activity participation, presence of hypertension, height and weight (from which body mass index as a measure of obesity could be calculated), and smoking.

Smoking. Respondents to the General Social Survey were asked about current and past tobacco use, including frequency of smoking, age smoking had begun, number of cigarettes and brand smoked. For the present study, "current smokers" were defined as persons who responded "daily" to the question, "At the present time do you smoke cigarettes daily, occasionally or not at all?"

Blood pressure. Respondents were asked to recall when they had last had their blood pressure checked, whether they had ever been told by a doctor or nurse that they had high blood pressure, and whether any medication or treatment had ever been prescribed to them for high blood pressure. For the present study, hypertension was defined as a "yes" response to the questionnaire item, "Have you ever been told by a doctor or nurse that you have high blood pressure?"

Obesity. Respondents were asked their height and weight. Responses were recorded in feet and inches or centimetres, and pounds or kilograms according to the way they were reported. Obesity was defined for the present study by the Quetelet Index as described above.

Physical activity. Respondents were asked if they had in the last three months participated in active physical exercise ("exercise which made you perspire or breathe more heavily than normal"), and if so in what particular activities. They were asked how frequently (per week or per month) they participated in physical activities, and how much time was spent on each occasion. For this study, "sedentary" was defined as a "no" response to the questionnaire item: "Thinking back over the last three months did you participate in active physical exercise, that is, exercise which made you perspire or breathe more heavily than normal?"

Education. Respondents were asked how many years of elementary or secondary education they had completed, if they had graduated from secondary school, and if they had attended or completed any post secondary education (such as community college, CEGEP, nursing school, university, or teacher's college). Levels of educational attainment were defined for the present study as follows:

- Elementary: any schooling up to eight years but no more.
- Secondary: any secondary schooling from grades nine to 13 (incompleted or completed) but no post secondary schooling.
- Post Secondary: any community college, CEGEP, or nursing school or incompleted university.
- University: "Bachelor's or undergraduate degree or teacher's college (diploma)," or higher university degrees.

Health Promotion Survey

Objectives. The Health Promotion Survey was conducted in 1985 by Statistics Canada on behalf of the Health Promotion Directorate of Health and Welfare Canada. The objectives of the survey were to assess health status, quality of life, prevalence of risk factors for cardiovascular disease and other health problems, health-related behaviors, and related knowledge, beliefs, and attitudes (Health Division, Statistics Canada for the Working Group on Health Status Indicators, 1987).

Target population. The target population of this survey included non-institutionalized persons aged 15 and over in the ten provinces and the Yukon Territory.

Survey procedures. The survey used random digit dialing to contact a sample of approximately 1,000 households per province or territory across Canada. Following a listing of household members, one individual per household was selected as a respondent based upon pre-established selection criteria, and this person was then interviewed by telephone. The response rate was 81% for Canadians aged 15 and over. Respondents aged 25 and over numbered 9,168. Data collected included information on self-perceived health status, health knowledge and attitudes, preventive, health and lifestyle behaviour, and demographic information. Risk factor variables of interest in this study included smoking, blood pressure, obesity and level of physical activity.

Smoking. Current smoking was defined for the present study as a response of "yes" to the question: "At the present time do you smoke cigarettes?" and a response of "regularly" to the question, "Do you smoke cigarettes regularly, that is usually everyday or occasionally, not every day?"

Blood pressure. Participants were asked when they last had had their blood pressure measured, and if they knew whether their blood pressure was high. For the present study, hypertension was defined as a response of "yes" to the question, "As far as you know is your blood pressure high?"

Obesity. Participants were asked how tall they were "without shoes," and how much they weighed. Obesity was defined according to the Quetelet Index as described above for the Nutrition Canada Survey.

Physical activity. Participants were asked "How many times per week do you exercise for at least 15 minutes?" Response categories were:

- o daily;
- o five to six times a week;
- o three to four times a week;
- o one to two times a week;
- o less than once a week;
- o never;
- o don't know.

For the present study, "sedentary" was defined as a "never" response to the above question.

Education. Participants were asked the highest grade or level of education that they had completed. Response categories were:

- o no schooling;
- o elementary;
- o some secondary;
- o completed secondary;
- o some community college, technical college, CEGEP, or nurse's training;
- o completed community college, technical college, CEGEP, or nurse's training;
- o some university or teacher's college;
- o completed university or teacher's college;
- o other education or training.

For the present study, levels of educational attainment were defined as follows:

- o elementary: no schooling or elementary schooling only;
- o secondary: secondary schooling (complete or incomplete) but no further schooling;
- o post-secondary: some or completed community college, technical college, CEGEP, nurse's training, "Other education or training," or some university or teacher's college;
- o university: completed university or teacher's college.

Table 9 summarizes the methods used in all the surveys to measure the variables of interest in this study.

METHODS OF ANALYSIS

Goals of the analysis

The basic goals of the analysis were:

- to determine the prevalence of the risk factors for coronary heart disease in each survey population and in its subpopulations;
- to examine the prevalence estimates in terms of their distribution by educational attainment and age in each survey;
- where possible, to compare estimates across surveys, along education and age parameters, using appropriate adjustments to control for aging effects on risk factor levels, differences in age distributions across education categories, and changes in population age structure over time.

Comparability of education categories

Preliminary to analysis, the original survey education categories were collapsed when necessary in order to make comparable the educational attainment levels among the various surveys, as described for each survey above.

Calculation of age, sex and education-specific prevalence rates.

For each risk factor variable, numerator and denominator matrices were constructed as follows: The numerators were defined as the weighted estimates of the population aged 25 and over possessing the characteristic of interest, cross-tabulated by sex, age group and level of education attained. The denominators were defined as a cross-tabulation by sex, age group and education level of the weighted estimate of the corresponding Canadian household population aged 25 and over. The prevalence rates in each cell were calculated by dividing the numerator matrix by the denominator matrix. The resultant matrix comprised the estimated proportion of persons in each age and education group who possessed the variable of interest.

Adjustment for differences in population structures over time

The surveys spanned a 14-year period, during which time the distribution of the population across the various age groups and educational attainment categories changed. Furthermore, for several of the risk factor variables, as well as for education, there was an aging effect. For example, the prevalence of obesity, hypertension and physical inactivity was higher among older age groups, and the level of educational attainment was lower among older persons. Therefore, in order to adjust for differences in the population age and education structure and to control for the aging

effects of the variables (to avoid confounding by age, which was an extraneous variable in the consideration of the risk factors in relation to educational attainment), survey estimates were adjusted to a common age and educational attainment structure using the 1981 Canadian census population (by age, sex, and highest level of educational attainment) as the reference. The 1981 census was selected as the reference population because it was the most recent census for which data were available, and also because 1981 was an intermediate year among the survey years, which were 1971, 1975, 1978-79, 1981, and 1985.

First, educational categories in the census data were collapsed so that they corresponded to those used for the survey data. Then adjustment by direct standardization was performed by applying the specific prevalence rates for each variable in each age, sex and education group of each survey to the reference population.

Age-adjustment

Age-adjustment to a standard reference population was performed so that each education category would have the same age structure. A single age-adjusted prevalence estimate for each education category was calculated by summing the products of the crude prevalence estimate in each cell, multiplied by the corresponding weight for age adjustment. The weights for age-adjustment were calculated by dividing the total reference population by the sub-population in each age category.

Education-adjustment

Similarly, education adjustment to a standard reference population was performed so that each age group would have the same education structure. A single education-adjusted prevalence rate estimate for each age category was calculated by summing the products of the crude prevalence rate estimate in each cell times the corresponding weight for education adjustment. The weights for education-adjustment were calculated by dividing the total reference population by the sub-population in each education category.

Age and education-adjustment

Finally, an overall age and education-adjusted prevalence rate estimate for each variable in each survey was calculated by summing the products of each crude prevalence rate estimate times the corresponding weight for age and education-adjustment. The weights for age- and education-adjustment were calculated by dividing the total reference population by the subpopulation in each age- and education-category cell. (See worked example in Appendix 2.)

Calculation of estimated standard errors

In order to adjust for non-response and sampling fractions in population surveys, population estimates are produced by multiplying weighting factors (which differ for each sex- and age-group cell) by the count in each cell. Because the sample sizes of each sex- and age-group cell are inevitably different from each other, the variances of the estimated prevalence in each cell also differ. Basically, the lower the weight that must be applied to a count to produce a population estimate, the lower the contribution of this cell to the uncertainty of the overall estimate. Conversely, the smaller the cell sample is in relation to the actual population (and the higher the weight which must be applied to produce a population estimate), the greater is the contribution of the cell to the uncertainty. Thus, in order to calculate the standard error on an overall prevalence estimate, cell-specific standard errors must be taken into account. The following formula, which was used to calculate overall standard errors for all variables, does this by including the summed, weighted standard errors of each cell:

$$SE_{pop} = (\sum W_i^2 SE_i^2)^{1/2}$$

For a worked example of the calculation of such standard errors, see Appendix 2. It should be noted that calculations of standard errors were only approximate. The formulae used assume that the sample was a simple random one, while in fact the surveys were based on more complex multistage probability sampling.

Finally, ninety-five percent confidence limits were calculated, defined as:

$$CI = \hat{p} \pm 1.96(SE(p))$$

where p = estimated proportion of risk factor present.

CHAPTER 4 - RESULTS

In this section results of the analysis are presented as follows:

- Estimates of adjusted and age and education-specific prevalences of each risk factor are compared among surveys.
- Changes in prevalence of each risk factor over time are noted.
- Age-group "cohorts" are tracked across surveys, and changes in risk factor prevalence for the "cohorts" are noted.
- The prevalence of each risk factor by sex and educational level is then examined in each survey.
- Finally, the change over time (across surveys) in the distribution of each risk factor by education is presented.

SMOKING

Measures of smoking prevalence were examined from the following five surveys: the Nutrition Canada Survey of 1971, the Labour Force Survey Smoking Supplement of 1975, the Canada Fitness Survey of 1981, the General Social Survey of 1985, and the Health Promotion Survey of 1985. See Table 10 for an overview of results related to smoking.

Overall prevalence of smoking by sex, and changes over time

Among men, the overall age and education-adjusted prevalence of current smokers was nearly 45% in the Nutrition Canada Survey of 1971, decreasing to about 36% by the Health Promotion Survey of 1985. Among women, the overall age and education-adjusted prevalence was about 35% in 1971, decreasing to approximately 30% in 1985.

Prevalence of smoking by age and sex, and changes over time

For men, the lowest prevalence of smoking was in the oldest age group (65 years and over). This finding was constant across all surveys. In the other age groups smoking rates ranged from 43% to 55% in 1971 and from about 35% to 43% in 1985. There was a net decrease over time in the smoking rates in every age group, except for the 35-44 year old group. During the 14-year period 1971-1985, the largest decrease, from 55% to about 39%, occurred in the 45-54 year old group.

For women, the lowest rates of smoking were also in the oldest age group and the highest rates of smoking were consistently observed among women aged 25 to 34, although the rate in the latter age group did decline over time. Within each age group, smoking rates did not vary as much over time as for men.

Tracking age-group "cohorts"

If one tracks age-group data for "birth cohorts"[1] of men from the 1971 and 1981 surveys, one sees that the education-adjusted prevalence of smoking among the men aged 25-34 in 1971 (35-44 in 1981) and among men aged 35-44 in 1971 (45-54 in 1981) remained virtually the same over the decade, at about 50% and 43% for the respective cohorts. A marked decline occurred among men aged 45-54 in 1971 (55-64 in 1981). From 1971 to 1981, the education-adjusted prevalence of smoking in this cohort declined from 55% to 41%. Among men aged 55-64 in 1971, the education-adjusted prevalence of smoking was 41%, compared to 35% among men aged 65-69 in 1981.

Tracking the female birth cohorts over time showed that declines occurred more consistently for women over age groups than for men. For women aged 25-34 in 1971 and 35-44 in 1981, the education-adjusted prevalence of smoking declined from 46% in 1971 to 38% in 1981. For women aged 35-44 in 1971 and 45-54 in 1981, the decline was from 37% in 1971 to 33% in 1981, nearly the same as that for women aged 45-54 in 1971. Twenty eight percent of women aged 55-64 smoked in 1971, compared to 23% of women aged 65-69 in 1981.

---

1 It is important to note that it is not possible to follow a cohort, in the strict sense of the word, across the surveys because each survey did not follow a fixed panel of persons. Instead, the population studied in the various surveys was dynamic, due to factors such as immigration, death, emigration and the fact that a new sample of the population was drawn for each survey.

Prevalence of smoking by education, age and sex, and change over time

When the data were examined by education, the lowest age-adjusted prevalence of smoking for both men and women was for the university-educated. This finding was consistent across all surveys. In the 1971 Nutrition Canada Survey, the lowest age-adjusted prevalence of smoking was among persons with a university education, but no gradient was apparent across the other education categories. The 1975 Labour Force Survey, the 1981 Canada Fitness Survey, the 1985 General Social Survey and the 1985 Health Promotion Survey showed clear inverse gradients for the age-adjusted prevalence of smoking according to educational attainment. For men, the highest age-adjusted prevalence of smoking was generally for those who had no more than an elementary school education.

For women in all surveys, the age-adjusted prevalence of smoking was clearly lowest among the university educated, but the 1975 Labour Force Survey, and the 1981 Canada Fitness Survey showed the highest age-adjusted prevalence of smoking in the secondary education category.

In 1971 the age-adjusted prevalence of smoking was equivalent among persons with elementary, secondary, and post-secondary education. Starting from 1975, though, persons with the least education (elementary or less) were the most likely to smoke. From 1971 to 1985, age-adjusted smoking prevalence rates decreased within all four education levels, but the largest decrease was observed among persons with post-secondary educa-

tion (not including those with a university degree or diploma), among whom the rate dropped from 49% to about 32%.

For women with elementary or secondary education, no substantial change in age-adjusted smoking prevalence rates was observed over time, while among women with post-secondary education the age-adjusted prevalence rate dropped from 40% in 1971 to 26% in 1985. Among women university graduates, however, there may have been a net increase in smoking prevalence rates over those years: The two 1985 surveys showed age-adjusted smoking prevalence rates of 19% and 26%[2] among women university graduates, compared to 19% among women with at least some college in the 1971 survey.

ELEVATED SERUM CHOLESTEROL IN 1971 AND 1978

Measures of cholesterol were taken for only two of the surveys, the Nutrition Canada Survey of 1971, and the Canada Health Survey of 1978. See Table 11 for an overview of results related to elevated serum cholesterol.

The overall age and education-adjusted prevalence of elevated serum cholesterol, defined as greater than or equal to 250 mg/dl, was 10% for

---

2 Because of the uncertainty in the 1985 estimate, it would be important to examine data from the 1986 Labour Force Smoking Supplement when they become available. The larger sample in the Labour Force survey allows for greater precision in the estimate than the General Social Survey or Health Promotion Survey.

men in 1971, and 16% for males in 1978. For women the age and education-adjusted prevalence rates were virtually the same in 1971 and 1978 (14% and 15%, respectively).

Prevalence of elevated serum cholesterol by age and sex

Nutrition Canada Survey data for 1971 showed that for men the prevalence of elevated serum cholesterol was about 5% in the 25-34 year old group, increasing over the age groups to a high of 16% among men aged 65 and over. Canada Health Survey results for 1978 indicated increases in the prevalence of elevated cholesterol at most ages, but an exceptional decrease among men aged 65 and over. The prevalence rates for elevated serum cholesterol ranged from a low of 9% among men aged 25 to 34 years old to a high of 31% among men aged 45 to 54 years old. Among men 55 to 64, the prevalence rate was 18%, which was higher than the rate for men of that age in 1971. Among men aged 65 and over, the prevalence rate was 8% in 1978, compared to 16% in 1971.

Among women in 1971 the prevalence of high cholesterol ranged from about 7% among women aged 25 to 34 to 30% among women aged 65 and over. In 1978 prevalences rates were at virtually the same levels as in 1971, except among women aged 65 and over where the rate had increased to about 45%. Nevertheless, because persons aged 65 and over were a relatively small part of the total population, the age-standardized prevalence of elevated serum cholesterol among women of all ages did not change substantially over time.

Prevalence of elevated serum cholesterol by education and sex

For men, no pattern in the age-adjusted prevalence of elevated cholesterol was discernible by educational level in either the Nutrition Canada Survey of 1971 or the Canada Health Survey of 1978.

For women in both surveys, however, the age-adjusted prevalence of elevated cholesterol was lower for university graduates than for women with less education. The Nutrition Canada Survey showed that in 1971 the age-adjusted prevalence of elevated serum cholesterol was approximately 16% among women with elementary education or less, 18% among women with secondary education, 11% among women with post secondary education, and 9% among women university graduates.

From 1971 to 1978, the age-adjusted prevalence of elevated serum cholesterol increased for men in all educational categories, particularly for men with education beyond high school. In 1971 the age-adjusted rates for men with post-secondary education and university education were 12% and 10%, respectively. In 1978 the age-adjusted rates were 19% for men with post-secondary non-university education, and 16% for male university graduates--an increase in both cases. For women, the age-adjusted prevalence of elevated serum cholesterol increased from 30% in 1971 to 45% in 1978 among women aged 65 and over. Increases occurred among women with post-secondary and university education, but remained stable among women in the lower education categories.

HYPERTENSION

Blood pressure was measured in the Nutrition Canada Survey of 1971, the Canada Health Survey of 1978 and the Canada Fitness Survey of 1981. (See Table 12 for an overview of results related to hypertension.) The General Social Survey of 1985 and the Health Promotion Survey of 1985, however, simply asked respondents if they had (or had had, in the former case) high blood pressure.

The overall age and education-adjusted prevalence of measured hypertension for men was 9% in 1971, 11% in 1978, and 7% in 1981. In the General Social Survey of 1985, an age and education-adjusted 18% of men reported (ever having had) high blood pressure, and in the Health Promotion Survey of 1985, an age and education-adjusted 9% reported current high blood pressure.

The overall age and education-adjusted prevalence of measured hypertension for women declined from 10% in 1971, to 7% in 1978 and 3% in 1981. In the General Social Survey of 1985, an age and education-adjusted 21% of women reported that they had or had had high blood pressure, and in the Health Promotion Survey of 1985, an age and education-adjusted 11% of women reported currently high blood pressure.

Prevalence of hypertension by age and sex

In most of the surveys there was a clear positive relationship between the prevalence of hypertension and age, for both men and women. Between 1971 and 1981, the education-adjusted prevalence of high blood pressure remained fairly stable among men in the age groups 25-34, 35-44, 45-54 and 55-64. In 1981 the Canada Fitness Survey indicated that among men aged 65 to 69 years, the education-adjusted prevalence of hypertension was about 3%, considerably lower than the education-adjusted rates of 18% and 17% for men aged 65 and over in the surveys of 1971 and 1978, respectively. For women in every age group, the prevalence of hypertension decreased by at least half between 1971 and 1981.

Tracking age-group cohorts

For men aged 25-34 in 1971 and 35-44 in 1981, the education-adjusted prevalence of hypertension increased from 1% to 5%. For men aged 35-44 in 1971 and 45-54 in 1981, the education-adjusted prevalence of hypertension increased from 7% to 14%. For men aged 45-54 in 1971 and 55-64 in 1981, the education-adjusted prevalence of hypertension remained stable over the decade--at about 12%. Among men aged 55-64 in 1971 and 65-69 in 1981, the education-adjusted prevalence of hypertension decreased over the decade from 13% to 3%.

An examination of female birth cohorts showed a decline in the education-adjusted prevalence of hypertension in most age groups: from 8%

to 5% among women aged 35-44 in 1971 and 45-54 in 1981; from 13% to 7% among women aged 45-54 in 1971 and 55-64 in 1981; and from 17% to 6% among women aged 55-64 in 1971 and 65-69 in 1981.

Prevalence of hypertension by education and sex

In 1971 there was a distinct inverse gradient between educational attainment and the age-adjusted prevalence of hypertension among men, ranging from about 12% among men with elementary education to about 5% among men with a university degree. Among women, there was a similar inverse gradient by education, ranging from 13% among women with elementary education to 4% among women with post-secondary education and 7% (95% confidence interval of 3.3%-11.6%) among women university graduates.

Within educational categories between 1971 and 1981 the age-adjusted rates of hypertension among men remained fairly stable, except among men with elementary education, where the rate fell from 12% to about 5%. This decrease effectively flattened the inverse gradient between hypertension and educational attainment which had been present in 1971.

Among women in 1981 compared to 1971, the age-adjusted prevalence of hypertension was lower in two education categories. The 1971 age-adjusted rate among women with secondary education was 8% compared to 3% in 1981, and for women with post secondary education, the age-adjusted rate was 13% in 1971 compared to 2% ten years later. In 1971 and 1981 an inverse gradient between hypertension and educational attainment was present; the

age-adjusted prevalence rates of hypertension were lower among women with post secondary or university education than among women with secondary or less education.

Among men in the General Social Survey of 1985, the age-adjusted prevalence rates of hypertension (or history of hypertension) were nearly equal across all educational levels, at about 18%. Among men in the Health Promotion Survey of 1985, however, there was a partially positive gradient between hypertension and educational attainment; the age-adjusted prevalence of hypertension increased progressively from 6% among men with elementary education, and 10% among men with secondary education, to 15% among men with post-secondary education. The age-adjusted prevalence rate among male university graduates was about the same as that among men with elementary education.

For women in 1985, the General Social Survey showed an inverse gradient in the age-adjusted prevalence rate of hypertension (or history of hypertension) by educational attainment; from 23% among women with elementary education only to 16% among university educated women. In the Health Promotion Survey the age-adjusted prevalence of hypertension was nearly equivalent across educational categories.

OBESITY

Estimates of obesity were calculated using data from five surveys: the Nutrition Canada Survey of 1971, the Canada Health Survey of 1978, the Canada Fitness Survey of 1981, and the General Social Survey of 1985 and the Health Promotion Survey of 1985. See Table 13 an overview of results related to obesity. For the Nutrition Canada Survey, the Canada Health Survey, and the Canada Fitness Survey, actual measurements of height and weight were made from which estimates of obesity were calculated. For the General Social Survey and the Health Promotion Survey, estimates of obesity were calculated from self-reported height and weight as obtained in telephone interviews (except for persons aged 65 and over in the General Social Survey, who were interviewed in person).

Overall prevalence of obesity by age and sex

The overall age and education-adjusted estimates of the prevalence of obesity among men varied little across the five surveys. The estimates ranged from 8% in the Nutrition Canada Survey to 11% in the Canada Health Survey.

For women, the age and education-adjusted estimates of the prevalence of obesity varied somewhat more. In the surveys where measurements were taken, estimates ranged from 18% in the Canada Health Survey to 12% in the Canada Fitness Survey. In the two 1985 surveys where measure-

ments were not taken, estimates were 12% and 10%. The overall age and education-adjusted prevalence of obesity among women decreased from 17% in 1971 to 12% in 1981.

Prevalence of obesity by age and sex

For men, there was no consistent pattern in the education-adjusted prevalence of obesity by age within each survey. For women, there was a fairly consistent positive association between age and the education-adjusted prevalence of obesity in each survey, at least until the age of 55. In the surveys with measures, the education-adjusted prevalence of obesity ranged from 7% to 10% among women 25-34 years old, and from 17% to 34% among women aged 55 and over. Between 1971 and 1981, the education-adjusted prevalence of obesity in women remained fairly constant in the age groups from 25 to 54, while in the age groups 55-64 and 65 and over, obesity appeared to decrease somewhat (from 22% to 17% and 40% to 25% in the respective age groups). Between 1971 and 1981, the education-adjusted prevalence of obesity in men increased at ages 35-44, from 5% in 1971 to 13% in 1981. The education-adjusted prevalence of obesity also increased for men aged 45-54, from 6% in 1971 to 13% in 1981. In the other age groups the education-adjusted prevalence of obesity in men was stable.

Tracking age-group cohorts

Tracking male birth cohorts showed that increases in the education-adjusted prevalence of obesity were associated with aging. For men aged 25-34 in 1971 and 35-44 in 1981, the education-adjusted prevalence of obesity increased from 8% to 11%. Among men aged 35-44 in 1971, the education-adjusted prevalence of obesity increased from 5% to 13%. Among men aged 45-54 in 1971 and 55-64 in 1981, the education-adjusted prevalence of obesity increased from 6% to 14%. The education-adjusted prevalence of 12% among men aged 55-64 in 1971 compared with 10% among men aged 65-69 in 1981.

Tracking female birth cohorts from 1971 to 1981 showed that among women aged 25-34 in 1971 and 35-44 in 1981, the education-adjusted prevalence of obesity was virtually unchanged over the decade. Among women aged 35-44 in 1971 and 45-54 in 1981, the education-adjusted prevalence of obesity increased from 10% to 19%. Among women aged 45-54 in 1971 and 55-64 in 1981, the education-adjusted prevalence of obesity did not change appreciably over the ten-year period. The education-adjusted prevalence of 22% among women aged 55-64 in 1971 compared with 25% among women aged 65-69 in 1981.

Prevalence of obesity by education and sex

Among men, there was a fairly consistent inverse gradient between the age-adjusted prevalence of obesity and educational attainment. Among women the inverse gradient was quite strong and consistent across all surveys.

The age-adjusted prevalence of obesity among men with no more than an elementary education increased from 11% in 1971 to 14% in 1981. At the other end of the educational attainment scale, the 1971 age-adjusted estimate of 6% prevalence of obesity among men with at least some university education was quite close to the 1981 age-adjusted estimate of 4% for male university graduates. The difference in rates of obesity between the high and low education groups thus appeared to widen somewhat over the 10-year period.

Among women, however, the difference in the age-adjusted prevalence rates of obesity between women with elementary or less education and women with university education narrowed between 1971 and 1981. Among women with elementary education the age-adjusted prevalence rate of obesity fell from 27% in 1971 to 18% in 1981. The age-adjusted prevalence rates were 7% in 1971 for women with at least some university education, compared to 4% in 1981 for women university graduates. Among women with secondary education the age-adjusted prevalence rates of obesity fell from 17% to 12% between 1971 and 1981. Among women with post-secondary education the age-adjusted prevalence rates of obesity remained stable at about 10%.

PHYSICAL INACTIVITY

Estimates of physical activity were calculated in at least some fashion on four surveys, at three points in time: in the Canada Health Survey of 1978, in the Canada Fitness Survey of 1981, in the General Social Survey of 1985 and in the Health Promotion Survey of 1985. See Table 14 for an overview of survey results related to physical inactivity. Because definitions of physical inactivity varied so widely, it was deemed infeasible to compare prevalence rates over time, across surveys.

Overall prevalence of physical inactivity by sex

For men, estimates of the overall age and education-adjusted prevalence of physical inactivity (as defined in each survey) varied from 9% in the Canada Fitness Survey to 60% in the General Social Survey. For women, estimates of the overall age and education-adjusted prevalence of physical inactivity varied from 12% in the Canada Fitness Survey to 66% in the General Social Survey. These widely different estimates reflect the inconsistent way in which the physical activity variable was defined in each survey.

Prevalence of physical inactivity by age and sex

In each survey physical inactivity was generally more prevalent in successively older age groups for both men and women.

Prevalence of physical inactivity by education and sex

For both men and women, in most surveys there was a distinct inverse gradient between level of educational attainment and prevalence of physical inactivity. There was usually a greater range in the estimates of physical inactivity between persons with elementary education compared to persons with secondary education, relative to the range in rates of physical inactivity between persons with post-secondary and persons with university education.

SUMMARY OF RESULTS

Smoking. Overall age and education-adjusted prevalence rates of smoking decreased over time for both men and women.

Elevated serum cholesterol. From 1971 to 1978 (the only two points in time for which data were available), the overall age and education-adjusted prevalence of elevated serum cholesterol increased among men, but not among women.

Obesity and hypertension. The overall age and education-adjusted prevalence rates of obesity as well as of hypertension were fairly stable over time among men, but among women there was a slight decrease in both.

Physical inactivity. Methodological variations among surveys pre-

vented comparisons of changes over time in the prevalence of physical inactivity.

Aging effect. All of the risk factors considered were age-related except obesity among men. Smoking prevalence decreased with age while the other risk factors increased with age.

Education effect--men. Among men, the distributions of the risk factors by educational attainment varied. The age-adjusted prevalence rates of smoking, obesity and physical inactivity among men generally decreased as level of educational attainment increased. For elevated serum cholesterol and high blood pressure in men, there were no consistent patterns by level of education in the age-adjusted prevalence rates.

For men, the patterns of risk factor distributions by educational attainment changed somewhat over time. A relatively large decline in age-adjusted prevalence rates of smoking occurred among men with post-secondary education. The age-adjusted prevalence rates of elevated serum cholesterol increased markedly between 1971 and 1978 among men with post-secondary and university education. As well, the strong inverse gradient of 1971 between educational attainment and hypertension which was evident in 1971 had disappeared by 1981 due to substantially lower prevalence of high blood pressure among men with elementary and secondary education in 1981.

Education effect--women. Among women, the age-adjusted prevalence rates of obesity, physical inactivity and hypertension were generally lower among women with higher levels of educational attainment. The age-

adjusted prevalence rates of smoking were also lower among women of higher educational attainment in the 1985 surveys. A few changes over time in the pattern of risk factor distribution by education were observed among women. The range in rates of obesity between women with elementary education only and women with university education narrowed considerably between 1971 and 1981, due to decreases in the prevalence of obesity among women in the lower educational categories. The range in age-adjusted prevalence rates of smoking among women of different educational levels also decreased between 1971 and 1985, due to lower rates of smoking among women in the lower education categories, together with a stable rate among women with university education.

CHAPTER 5 - DISCUSSION

In this chapter the findings on each risk factor variable are presented and discussed. Particular difficulties encountered in the analysis of each variable and measures taken to remedy these difficulties are considered. Finally, limitations of the study are presented and issues related to the feasibility of analyzing pre-collected survey data bases are discussed.

Smoking

It is interesting to consider the results of the present study related to smoking in the perspective of recent data from other countries. The Canadian data from 1975 onward showed the highest rates of smoking to be among men and women in the lowest education category, which was consistent with British data showing that smoking prevalence was highest among the lowest occupational class. For example, the General Household Survey of 1984 (McGinnis, 1987) showed that in England and Wales the prevalence of cigarette smoking ranged from 17% among professionals to 49% among unskilled manual workers, with a consistent inverse gradient by occupational class. Among women, the gradient by occupational class was not perfectly linear; rates of smoking ranged from 15% among professionals to 29% among employers and managers and intermediate nonmanual groups, to 37% among manual workers.

Although occupational status rather than educational attainment was used as the indicator of socioeconomic status in the British analyses, some similarities emerge between the British and Canadian data. The range of rates of smoking by socioeconomic status was wider among men than women in both countries. It is reasonable to expect that if Canadian smoking data were analyzed by occupational class, the pattern would assume a similar distribution.

Data from the United States in 1983 (McGinnis et al., 1987) showed a somewhat different pattern from that observed for Canada in 1981. The highest rates of smoking occurred among persons with some high school education but no high school diploma. Only among persons whose education went beyond high school, the United States data suggest, does the inverse relationship emerge between educational attainment and likelihood of smoking.

From 1971 to 1985, the greatest declines in age-adjusted prevalence rates of smoking among Canadians occurred among men with post-secondary and university education, and among women with post-secondary education. Among university educated women, the stability of the age-adjusted prevalence rates of smoking over time was notable. Nonetheless, in all surveys the lowest age-adjusted prevalence rates of smoking occurred consistently among men and women with university education.

Although questionnaire items related to smoking were fairly standard among the various surveys, inconsistencies in methods of data gathering slightly diminished the comparability of findings. For example, proxy

respondents were permitted for the Labour Force Survey Smoking Supplement of 1975, but not for other surveys. Among persons aged 15 to 24, great underestimates of smoking behaviour result from proxy responses, and smaller underestimates are observed in other age groups (Millar, 1985b, Collishaw, 1983). However since the present study examined results only for persons aged 25 years and over, the effect of proxy responses on reliability of the estimates was probably minimal.

Other differences in data gathering strategies may also have affected the validity of estimated rates of smoking prevalence. For example, face-to-face interviews were conducted for the Nutrition Canada Survey, and for persons aged 65 years and over in the General Social Survey. Telephone interviews were conducted for the Health Promotion Survey and for persons under 65 years of age in the General Social Survey. Self-administered questionnaires were utilized in the Canada Fitness Survey--with survey personnel present. Both face-to-face and telephone interviews were carried out for the Labour Force Survey.

It is reassuring to note that estimates of smoking prevalence rates in the Health Promotion Survey of 1985 agreed generally with those of the General Social Survey of the same year. Although different in their objectives, and somewhat different in methodology, the similarity of results reflects the robustness of the estimates as well as the strength of the inverse relationship between educational attainment and smoking.

Results from the Canada Fitness Survey reflect the consequences of truncating the oldest age group at 69 years. For persons aged 65-69 in

the Labour Force Survey, the education-adjusted prevalence rate of smoking was 35% for men, and 23% for women--considerably higher than the education-adjusted prevalence rates of smoking for all persons aged 65 and over in any of the other surveys examined. It is reasonable to expect that the negative association between smoking and age observed in all surveys would have continued among persons aged 70 and over, and thus the prevalence of smoking among persons aged 65 to 69 would have been higher than that for all persons aged 65 and over.

Elevated serum cholesterol

Only two surveys--the Nutrition Canada Survey and the Canada Health Survey--provided data on elevated serum cholesterol. This severely limited the possibility of time-trend observations. Also, because of small sample sizes, confidence intervals around the prevalence estimates are relatively wide. Thus, comparisons among estimates within and between surveys were sometimes difficult to make. Yet another obstacle to comparability was the low response rate for the Nutrition Canada Survey. Only 46% of persons selected for the Nutrition Canada Survey actually reported to the survey clinics, and because there is no documentation on the characteristics of the non-respondents, it is not known to what extent respondents may have differed from non-respondents. Measurement issues were also of some concern: for each of the two surveys, specimens were collected, stored and analyzed by different teams of technicians, in different laboratories.

Bearing these problems in mind, the similarity between the results of the Nutrition Canada Survey and the Canada Health Survey in estimates of the adjusted prevalence rates of elevated serum cholesterol among women in most age and education groups is remarkable. The education-adjusted rates changed significantly in two age groups, decreasing from 7% to 3% in women aged 25 to 34, and increasing from 30% (95% confidence interval 26%-34%) to 45% (95% confidence interval 35%-55%) in women aged 65 and over. For men, there was a significant overall increase in the age and education-adjusted prevalence of elevated serum cholesterol, accounted for by increases in men aged 45 to 54 and 65 and over. The magnitude of the increase over time in men aged 45-54, from 14% to 31% seems implausible since the change in all other age groups was considerably smaller. Also, the difference in the 1978 survey between the rate of 13% for men aged 35-44 and the rate of 31% for men aged 45-54 is inconsistent with the other increments by age observed between the two data sets. These estimates may well reflect statistical artifact or the effects of non-response. Yet another probable aberration was that the prevalence of elevated serum cholesterol appeared to fall somewhat (from 16% to 8%, with 95% confidence intervals of 12%-21% and 3%-12%) among men aged 65 and over, and yet to rise among women in this age group, from 30% to 45% (95% confidence intervals of 26%-34% and 35%-55%). As indicated by the standard errors, however, the real magnitude of these changes may have been very small.

The nearly even distribution of the age-adjusted prevalence rates of elevated serum cholesterol by educational attainment among men shown in

both the Nutrition Canada Survey and the Canada Health Survey was corroborated by findings from other studies. A 1974 study (Robitaille et al., 1979) of Quebec City men also found no pattern in the distribution of elevated serum cholesterol by education. In the United States, age-adjusted data from the 1976-80 HANES-II (NCHS, 1986b) showed that for men, the frequency of high-risk cholesterol levels[1] was statistically no different for men with 12 years of education compared to men with less than 12 years of education. Mean values of serum cholesterol were also virtually the same across all education categories.

For women, the Nutrition Canada Survey showed lower age-adjusted prevalence rates of elevated serum cholesterol among women with post secondary and university education than for women in lower education categories. The Canada Health Survey showed that although there were no differences in the age-adjusted prevalence rates of elevated serum cholesterol among women who had no more than an elementary, secondary or non-university post-secondary education, the age-adjusted prevalence rates were lower among women university graduates. HANES-II data from the United States corroborate the Canada Health Survey findings, showing the frequency of high risk levels of cholesterol to be the same across all education categories for women, as they were for men. In the United States data, the mean value of serum cholesterol was identical in all education

1 Risk cutpoints were: greater than 220 mg/dl for persons aged 20-29 years, greater than 240 mg/dl for persons aged 30-39 years, and greater than 260 mg/dl for persons aged 40 years and over.

categories except in women with 13 or more years of education, where the mean value was lower.

Lupien et al. (1985) noted that serum lipoproteins, in particular a low level of high-density lipoprotein, has been shown to be an even more powerful risk factor for coronary heart disease than serum cholesterol. It would be of interest in future surveys to examine the relationship between this risk factor and educational attainment among Canadians.

Hypertension

Although hypertension has been defined by the World Health Organization as blood pressure greater than or equal to 160 mmHg systolic, or greater than or equal to 95 mmHg diastolic (WHO, 1978a), the definition of hypertension used for the present study was a diastolic pressure greater than or equal to 100 mmHg. There were two reasons for this choice: First, it was felt that this relatively conservative criterion would improve sensitivity, that is to say, it would capture more persons whose high blood pressure reflects true hypertension rather than those with a slight transient elevation in blood pressure due to nervous reaction to the measurement procedure. Second, the higher cutoff was chosen so that findings from the Nutrition Canada Survey, where blood pressure was recorded only if diastolic pressure was 100 mmHg or higher, could be compared to findings from the other surveys where all levels of blood pressure were recorded.

Findings from the Canadian surveys with regard to the relationship between educational attainment and hypertension were inconsistent. In the Nutrition Canada Survey of 1971 there was a distinct inverse gradient between hypertension and education among men. In subsequent surveys no patterns by education were discernible. For women the Nutrition Canada Survey showed an inverse relationship between education and hypertension, as did the Canada Fitness Survey and the General Social Survey, and as was suggested in the Health Promotion Survey. No pattern with regard to hypertension and education was discernible for women in the Canada Health Survey.

In Chapter 3 it was pointed out that United States survey data from the HANES-I and HANES-II and HDFP studies in the 1970s showed consistently negative relationships between level of formal education and hypertension, and that this relationship was usually more pronounced among women than men. The Canadian data partially bear out these same relationships. For Canadian men, although an inverse gradient by education was apparent in 1971, it was not present in subsequent surveys. For women, however, four of the five surveys suggested an inverse relationship between hypertension and level of education.

The Nutrition Canada Survey indicated that 9% of men and 10% of women were hypertensive in 1971. However, both the Canada Health Survey of 1978 and the Canada Fitness Survey of 1981 indicated that the prevalence of high blood pressure was substantially higher among men than women. By contrast, in the Health Promotion Survey of 1985 and in the

General Social Survey of 1985, women were more likely than men to report high blood pressure as a problem.

In The Health of Canadians (Health and Welfare Canada and Statistics Canada, 1981), high blood pressure reported in the Chronic Health Problems section of the Canada Health Survey was compared to high blood pressure measured in the Physical Measures Section. Although measured high blood pressure[2] was more common in men (9%) than in women (7%), self-reported hypertension was more common in women (9%) than in men (6%). The sensitivity of self-report of high blood pressure was found to be only 24% for men and 48% for women. That is, 76% of the men and 52% of the women who were classified as hypertensive by measurement reported that they did not have high blood pressure. The specificity of self-report was 97%. That is, high blood pressure was reported by 3% of people in whom it was measured to be normal. As the authors of the Health of Canadians pointed out, the criterion for hypertension in the Canada Health Survey did not necessarily correspond with the level of blood pressure which merits treatment, a factor which probably accounts in part for the discrepancies between measured and reported hypertension.

The education-adjusted prevalence rates of hypertension increased with age for both men and women in most surveys. In the Canada Fitness Survey, however, the prevalence rate of hypertension in the truncated 65-69 year age category was lower than the prevalence rates for younger age groups.

---

2 Defined as diastolic blood pressure greater than or equal to 95 mmHg or systolic blood pressure greater than or equal to 160 mmHg.

Moreover, estimates of hypertension for the oldest age groups in the Canada Fitness Survey are lower than would be expected from other surveys. In the Nutrition Canada Survey, the education-adjusted prevalence rate of high blood pressure among men aged 65 and over was 18%, in the Canada Health Survey it was 17%, but in the Canada Fitness Survey, the education-adjusted prevalence rate of high blood pressure among men aged 65-69 was only 3%. Similarly, the Nutrition Canada Survey showed a 15% prevalence of hypertension among women aged 65-69, the Canada Health Survey showed a prevalence of 13%, while the Canada Fitness Survey showed a prevalence of hypertension of only 6% among women aged 65-69.

It is doubtful that truncation of the upper age groups alone accounts for the lower prevalence of hypertension in the Canada Fitness Survey. Another possible explanation is sampling bias which might have occurred if subjects who opted to participate in the Canada Fitness Survey self-selected on the basis of their relatively good state of health. However, no evidence of sampling bias in the Canada Fitness Survey occurs in the prevalence estimates of obesity and smoking, which are reasonably similar to those of the other surveys.

Between the Nutrition Canada Survey of 1971 and the Canada Fitness Survey of 1981, statistically significant decreases were observed in the overall age and education-adjusted prevalence rates of hypertension among men (from 9% to 7%), and among women (from 10% to 3%). These changes were due to substantially lower prevalence rates of hypertension among men with only an elementary education, and for women with elementary, secondary and

university education. The result of these declines was a leveling of the gradient among men and a less steep gradient among women in the previous inverse gradient between high blood pressure and educational attainment.

In the two surveys of 1985 blood pressure was self-reported, but not measured. Furthermore, differences in questionnaire items related to high blood pressure in the two 1985 surveys rendered the estimates incomparable. The General Social Survey asked, "Have you ever been told by a doctor or nurse that you have high blood pressure?" while the Health Promotion Survey asked, "As far as you know is your blood pressure high?" The Health Promotion Survey question thus ascertained prevalence of (current) high blood pressure, whereas the General Social Survey ascertained a history of perhaps even transient high blood pressure in addition to current high blood pressure. As might have been expected, estimates of prevalence of hypertension from the General Social Survey were consistently nearly twice as high as those of the Health Promotion Survey in practically all age and education categories for both sexes.

Obesity

The Quetelet Index was used to calculate obesity from height and weight data (Millar, 1985). Although this index is a simple way of assessing the prevalence of overweight and obesity, it lacks the precision of direct measurements of obesity such as skinfold measures.

A recent study compared estimates of relative weight between the Canada Fitness Survey, for which height and weight measures were taken by

trained personnel, and the Health Promotion Survey, where height and weight were reported by respondents. Findings suggested that in self-reported data there was a slight tendency to underestimate weight in certain age-sex groups but that there was a systematic tendency to overestimate height. The resulting effect was a bias toward the "underweight" or "acceptable" end of the relative weight variable (Millar, 1986b). In the present study, comparisons were drawn only between obesity estimates which were based on measured height and weight, (from the Nutrition Canada Survey, Canada Health Survey and the Canada Fitness Survey). Estimates which were based on self-reports of height and weight (from the General Social Survey and the Health Promotion Survey) were not compared to estimates based on measured height and weight.

Over time (or at least over surveys), changes in the adjusted prevalence rates of obesity were different for men and women. According to the estimates based on measures, among men no clear changes occurred by educational level from 1971 to 1981, and there was no net change in the overall prevalence of obesity. In contrast, for women between 1971 and 1981, the overall age and education-adjusted prevalence of obesity fell from 17% to 12%. The largest decreases occurred among women with elementary education and among women aged 65 and over. Over the period 1971 to 1978, as measured in the Nutrition Canada Survey and the Canada Health Survey, a significant decrease in education-adjusted prevalence rates of obesity occurred among women aged 65 years and over. Although explanations of these findings are only speculative, it is possible that

they reflect a responsiveness to social and cultural pressure against obesity which is stronger among women than men.

Millar (1986a) examined individual data from the Health Promotion Survey of 1985 to compare self-reported weight with preferred weight. Preferred weight was consistently lower than self-reported weight for both men and women in all age groups studied, but the discrepancies between preferred weight and self-reported weight were notably greater for women than for men.

It is perhaps not surprising that reductions in the age and education-adjusted prevalence rates of obesity among women from 1971 to 1981 correspond to decreases in the prevalence of hypertension during this period. Significant reductions in the prevalence of obesity and hypertension occurred among women, and the greatest decreases for both risk factors occurred in the oldest age group of women.

Physical activity

Variation in definitions of activity level made it impossible to compare estimates of physical inactivity across surveys. Within each survey, however, the prevalence of physical inactivity was slightly lower for men than for women. For both men and women in every survey there was a clear and strong indirect gradient between physical inactivity and educational attainment. Physical inactivity also increased with age for both sexes in each survey. The consistency with which these patterns appeared,

despite great inconsistencies in definitions and measurement of the variable, substantiated the robustness of the relationships. Clearly, in Canada from 1971 to 1985, physical inactivity was more likely to occur among older than younger persons, and among persons with less education compared to those with more education.

To put the Canadian findings into perspective, it is worth noting that the General Household Survey of 1977 (Black et al., 1982) showed that in England and Wales the degree of participation in active outdoor sports was also directly related to socioeconomic status among both men and women. Rates of active participation among men ranged from 15% among unskilled manual workers to 42% among professionals. Among women the rates ranged from 11% among unskilled manual workers to 30% among professionals.

Socioeconomic status

The concept of socioeconomic status is a theoretical representation of a person's position in society. The construct of socioeconomic status is social class. Classification of persons into social strata has proven to be a valuable analytical tool in epidemiologic research, as social class is frequently a strong and consistent predictor of health experience and behavior.

Conventionally, socioeconomic status has been operationalized by examining income, employment status or educational attainment, either singly or by some algorithm combining two or three of these indicators. There

are several limitations to defining socioeconomic status by level of income. First, income usually decreases markedly after retirement and thus does not necessarily reflect the earning pattern of the individual during his period of employment. Second, current income may be unrelated to one's assets. Third, there is inconsistency in the way in which income is analysed in relation to family size and household composition.[3] Fourth, income is an unstable indicator at times of economic recession. Fifth, the response rate in reporting income is usually relatively low (Statistics Canada and Department of National Health and Welfare, 1981).

A more fundamental problem with the use of income as an indicator of socioeconomic status in cross-sectional surveys is that it raises the question of reverse causality. If low income were found to be associated with high blood pressure, in the absence of knowledge concerning the temporal sequencing of events, it would not be known whether high blood pressure had led to reduced income, or whether reduced income had led to high blood pressure. Employment status as an indicator is also problematic when one is trying to categorize housewives and retired persons. Housewives are sometimes coded according to their husband's occupation, as in Britain, and retired persons according to their "usual" occupation during their working life, assuming that information is available. In both

---

3 In some cases, the income of the "head of the household" may be used for all family members, without regard to family size or to other family members who may be working. Even when total family income is the measure, family size is usually not considered. An income adequacy measure which would incorporate family size, as well as whether one lived in a rural or urban area would be more valid as a measure of income adequacy, but even that would not take assets into account.

cases occupational status is an indicator of only one dimension of socioeconomic status.

As discussed in Chapter 3, there are important advantages to using educational attainment rather than income as the primary indicator of socioeconomic status. It is relatively more stable in adulthood than is income and evidence shows that it has a more direct bearing on health-related behaviors.

The relationship of socioeconomic status to risk of coronary heart disease

This study has examined the relationship between educational attainment and modifiable risk factors for heart disease, but the mechanism of the interaction has not been explained. Several theories have been advanced in the literature to account for the inverse relationship usually observed between socioeconomic status and risk factor levels. One such theory is based on the assumption that the most important determinant of an individual's health status is his behavior. Community-based longitudinal studies such as Framingham have convincingly established the impact of such behaviors as smoking, obesity and physical inactivity on one's health status. The effect of social forces on health behavior is illustrated in the example of smoking. The social movement influencing smoking is class-based. Both the motivation to begin smoking, considered stylish in North America in the 1940s and 1950s, as well as the motivation for reducing and quitting smoking has come from the better-educated. How-

ever, the social dynamics of this behaviour are more complex than simply following a stylish behavior. As Slater and Carlton (1985) have observed, "we should expect change (in this case decreased smoking) to be slower than in the other classes simply because the poorer classes have fewer resources to develop substitutes for smoking. These groups' lack of education and vulnerability to the advertising media combine with poverty in many instances to sustain their health-damaging behaviors."

However, individual choices of lifestyle behavior do not appear to account for all the variation in health status. For example, Marmot et al. (1984) reported that in the Whitehall study of London civil servants there was a strong inverse association between heart disease mortality and employment grade. But even after controlling for important variables which were presumed to affect cardiac health status, including age, smoking status, systolic blood pressure, cholesterol and blood sugar, a two-fold difference in mortality remained between the lowest and highest employment grades. Similarly, Weinblatt et al. (1978) found that in a group of myocardial infarction survivors the inverse relationship between education and risk of sudden death persisted even after controlling for smoking, relative weight, access to medical care, drug-treatment regimens and electrocardiogram findings.

Berkman and Syme (1979) and Cassel (1976) have proposed that psychosocial factors (stress) influence susceptibility to various disorders. Ruberman et al. (1984) studied the three-year mortality risk among 2,320 male survivors of acute myocardial infarction. They found

that even after controlling for prognostic factors, the patients classified as being socially isolated and having a high degree of life stress had more than four times the risk of death compared to the patients with low levels of stress and isolation. High levels of stress and social isolation were most prevalent among the least-educated men and least prevalent among the best-educated. The work of Lown et al. (1980), who have described experimental evidence that environmental stresses can lower the threshold of cardiac vulnerability to ventricular fibrillation, perhaps sheds light on the physiological mechanism which is involved.

The importance of educational attainment as an indicator of risk status was substantiated in all of the above studies. In addition to the association of low education with higher levels of 'behavioral' risk factors, evidence suggests that low education also serves as a marker for the presence of stress, another apparently powerful, though difficult to measure, risk factor for heart disease. Research into the social causes of differences in environment and personal behavior should be pursued.

Feasibility of using survey data bases--comparability of data

Because the data analyzed in this study came from several separate surveys, comparability of the data was limited by methodological and other factors which differed from survey to survey. Sampling strategies, sample sizes, age-group exclusions and data gathering techniques varied, as did several definitions of variables and their measures. Strategies for

ensuring quality control, for data editing and for calibration of instruments also differed from survey to survey. As well, technical aspects of physical measurements and biological specimen collection and analysis differed.

Although a number of measures were undertaken for the present study to enhance the comparability of data across the surveys, interpretations of time trends were nevertheless undertaken only with caution and where appropriate. For the present study, definitions of hypertension, elevated serum cholesterol, obesity, current smoking, and levels of educational attainment were standardized as much as possible across all surveys. When methods of data ascertainment or variable definitions differed markedly, such as estimates of hypertension and obesity which were derived from physical measurements in some surveys, and from self-reports in other surveys, no attempt was made to draw comparisons between them.

Because the surveys were conducted over a period of 14 years, during which time the age and educational attainment distribution of the population changed, and because the age distributions in education categories also varied, standardization to a common reference population was performed. Since there were substantial differences in the sample sizes from which the weighted population estimates were projected, standard errors were computed on each prevalence rate estimate in order to better assess the significance of differences among rates.

Some of the discrepancies among surveys were more difficult to compensate for. As has been discussed, truncation of the oldest age group in

the Canada Fitness Survey had particular bearing on the interpretation of risk factor levels in this study because the latter were all to some degree correlated with age. For those risk factors which become more prevalent with age, for example, the prevalence rates in the population aged 65-69 would have been less than the rate in the population aged 65 and over.

It is also important to note that in all surveys except the Canada Health Survey, the lowest category of educational attainment was "no schooling" or "elementary schooling." The Canada Health Survey questionnaire, however, grouped persons who had had some secondary education (but had not received a diploma) with those who had had no schooling or elementary schooling only. Therefore, estimates from the Canada Health Survey for the lowest educational category ("elementary") were for persons who had elementary schooling or less as well as for persons who had some (but not completed) secondary schooling. The "secondary" schooling category on the Canada Health Survey also differed from the other surveys. On the Canada Health Survey the "secondary" category included only persons who had completed secondary school, whereas on the other surveys persons who had attended but not necessary completed secondary school were included in this category. The expected effect of these categorization differences would be that for risk factors which were inversely related to educational attainment, the level for the Canada Health Survey in the "elementary" category would be underestimated relative to the other surveys because of the presence in that category of persons with some secondary education.

Definitions of educational categories also differed for the Nutrition Canada Survey. The "university" category included persons who had completed any years of "college" (or university), whereas in the other surveys the "university" category included only persons who had graduated with a degree or diploma from university. The "post-secondary" category in the Nutrition Canada Survey included persons who had only non-university schooling beyond high school, unlike the other surveys in which post-secondary schooling also included schooling at the university level short of a degree. The expected effect of this difference would be that for risk factors which were inversely related to educational attainment, the level in the "university" category would be overestimated because of the presence in that category of persons without university degrees. The observed gradient would thus tend to be flattened.

The effective use of existing survey data bases clearly presents a challenge to the researcher. Furthermore, attempts to interpret trends from several unrelated surveys are particularly fraught with difficulty. However, this study has shown that by carefully attending to inconsistencies in methodology, definitions, measures, and response rates, it is possible to arrive at results from which reasonable interpretations can be drawn. Assessment of population health status and of its correlates is certainly a necessary first step in rational planning of health care. Existing data bases which have measured aspects of population health at particular points in time are a valuable and economical, but often underutilized, resource for health research.

CHAPTER 6 - CONCLUSIONS

The primary objectives of this study were: to assess the feasibility of using existing survey data bases to study the distribution of risk factors for coronary heart disease; to describe the distribution of selected risk factors for coronary heart disease among Canadians by age, gender and educational attainment; and, after adjustment to a standard reference population, to note trends over time in the prevalence rates and distribution of risk factors by age, gender and educational attainment.

The main findings of the study were that among men, rates of current smoking, hypertension, obesity and physical inactivity were inversely related to educational attainment at least once, and usually several times in the period 1971 to 1985. Of all the risk factors examined, only elevated serum cholesterol was not inversely related to education in men. Among women, all of the risk factors examined, including elevated serum cholesterol, were inversely related to educational attainment in at least one and more often in several surveys during the period 1971 to 1985.

Although time trends could be interpreted only cautiously, it appeared that the age and education-adjusted prevalence rates of smoking and hypertension in men and women, and of obesity in women decreased from 1971 to 1985. The age and education-adjusted prevalence rates of hypercholesterolemia, however, appeared to increase in men and women over the period. Some of the inverse gradients between educational attainment and risk factor prevalence observed in the earlier surveys, particularly in

the Nutrition Canada Survey, tended to flatten out over time. Distributions of elevated serum cholesterol and hypertension among men and of obesity, smoking and hypertension among women displayed this leveling trend. However, after age-adjustment, a strong inverse gradient between physical inactivity and education persisted from 1978 to 1985 in the four surveys from which the variable was available.

Some difficulties in the interpretation of trends over time were imposed by methodological differences among the surveys. For one of the variables considered in this study, physical activity, drastic variations in definitions of activity rendered any inter-survey prevalence comparisons impossible. For other variables, however, where methods of data collection and measurement were similar, comparisons among surveys appear to have more validity.

The suggested trends or changing patterns in the distribution of risk factors which do emerge from the present study emphasize the importance of ongoing surveillance of the health status of Canadians in a methodologically consistent fashion. Although the mechanisms of action of known biological risk factors for heart disease are fairly well documented, the role of social and economic determinants is less well understood.

In closing, here are a few of my personal opinions concerning the policy implications of this study: A major issue confronting health policy makers today concerns how to reduce inequalities in the health status of Canadians of different socioeconomic strata. The social condi-

tions which promote ill health may have to be corrected primarily by basic economic and social changes such as income redistribution--a strategy promoted by the authors of the Black Report. Political action is also required to diffuse through all social classes the benefits of modifying individual behavior to improve personal health status. In the case of clearly destructive behaviors such as smoking, the responsibility of government goes beyond that of health promotion campaigns to legislative action which would curtail the production, sale and use of tobacco. A major challenge for policymakers and health professionals is to become sensitive to the difficulties which Canadians from lower socioeconomic strata face in their daily lives, and then to implement appropriate measures to improve their opportunities for good health. An important task facing researchers, in the meantime, is understanding and documenting social class influences on health outcomes.

REFERENCES

Antonovsky, A. (1967). Social class and the major cardiovascular diseases. **Journal of Chronic Diseases** 21:65-106.

Arnesen, E. and Forsdahl, A. (1985). The Tromso heart study: coronary risk factors and their association with living conditions during childhood. **Journal of Epidemiology and Community Health** 39:210-214.

Berkman, L. and Syme, L. (1979). Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. **American Journal of Epidemiology** 109:186-204.

Billette, A. and Hill, G.B. (1978). Risque relatif de mortalite masculine et les classes sociales au Canada 1974. **Union Medicale du Canada** 107:583-590.

Black, D., Morris, J. N., Smith, C. and Townsend, P. (1982). **Inequalities in Health: The Black Report.** Townsend, P., Davidson, N. (eds), Toronto: Penguin Books.

Borhani, N.O., Hechter, H.H., and Breslow, L. (1963). Report of a ten-year follow-up study of the San Francisco longshoremen. **Journal of Chronic Diseases** 16:1251-1266.

Brown, R.G., Davidson, L.A.G. McKeown, J., and Whitfield, A.G.W. (1957) Coronary-artery disease: Influences affecting its incidence in males in the seventh decade. **Lancet** 2:1073-1077.

Cassel, J. (1976). The contribution of the social environment to host resistance. **American Journal of Epidemiology** 104:107-123.

Cassel, J., Heyden, S., Bartel, A.G., Kaplan, B.H., Tyroler, H.A., Cornoni, J.C., and Hames, C.G. (1971). Incidence of coronary heart disease by ethnic group, social class, and sex. **Archives of Internal Medicine** 128:901-906.

Collishaw, N.E. (1983). Is Cigarette Consumption Declining in Canada? In **Proceedings of the Fifth World Conference on Smoking and Health.** Winnipeg, Manitoba: Canadian Council on Smoking and Health, July.

Davis, W.B., Hayes, C.G., Knowles, M., Riggan, W.B., van Bruggen, J., and Tyroler, H.A. (1985). Geographic variation in declining ischemic heart disease mortality in the United States, 1968-78. **American Journal of Epidemiology** 122:657-672.

Dobson, A.J. (1987). Trends in cardiovascular risk factors in Australia, 1966-1983: Evidence from prevalence surveys. **Community Health Studies** 11(1):2-14.

Dobson, A.J., Gibberd, R.W., Leeder, S.R. and O'Connell, D.L. (1985). Occupational differences in ischemic heart disease mortality and risk factors in Australia. **American Journal of Epidemiology** 122(2):283-290.

Epp, Jake (1986). **Achieving Health for All: A Framework for Health Promotion.** Ottawa: Health & Welfare Canada.

Fitness and Amateur Sport Canada (1983). **Canada Fitness Survey--Fitness and Lifestyle in Canada.** Ottawa: Fitness and Amateur Sport Canada.

Hardes, G.R., Dobson, A.J., Lloyd, D.M., and Leeder, S.R. (1985). Coronary heart disease mortality trends and related factors in Australia. **Cardiology** 72:23-28.

Health Promotion Directorate (1987). **The Active Health Report.** Ottawa: Health and Welfare Canada.

Hechter, H.H., and Borhani, N.O. (1965). Mortality and geographic distribution of arteriosclerotic heart disease. **Public Health Reports** 80:11-24.

Hinkle, L.E., Whitney, L.H., Lehman, E.W., Dunn, J., Benjamin, B., King, R., Plakun, A., and Flehinger, B. (1968). Occupation, education and coronary heart disease. **Science** 161:238-246.

Holme, I., Helgeland, A., Hjermann, I., Leren, P. and Lund-Larsen, P.G. (1980). Four-year mortality by some socioeconomic indicators: the Oslo study. **Journal of Epidemiology and Community Health** 34(1):48-52.

Holme, I., Solberg, L.A., Weissfeld, L., Helgeland, A., Hjermann, I., Leren, P., Strong, J.P. and Williams, O.D. (1985). Coronary risk factors and their pathway of action through coronary raised lesions, coronary stenoses and coronary death. Multivariate statistical analysis of an autopsy series: the Oslo Study. **American Journal of Cardiology** 55(1):40-47.

Hubert, H.B., Feinleib, M.F., McNamara, P.M. and Castelli, W.P. (1983). Obesity as an independent risk factor for cardiovascular disease: A 26-year follow-up of participants in the Framingham Heart Study. **Circulation** 67(5):968-977.

Hunter, A.S. MacD., Frerichs, R.R., Webber, L.S. and Berenson, G.S. (1979). Social status and cardiovascular disease risk factor variables in children: The Bogalusa heart study. **Journal of Chronic Diseases** 32:441-449.

Hypertension Detection and Follow-up Program Cooperative Group (1977). Race, education and prevalence of hypertension. **American Journal of Epidemiology** 106:351-361.

Keys, A.(ed.) (1970). Coronary heart disease in seven countries. American Heart Association Monograph no. 29. **Circulation**, Suppl. I, vols. 41, 42, 1-211.

Keys, A., Menotti, A., Aravanis, C., Blackburn, H., Djordevic, B.S., Buzina, R., Dontas, A.S., Fidanza, F., Karvonen, M.J., Kimura, N. et al. (1984). The seven countries study: 2,289 deaths in 15 years. **Preventive Medicine** 13(2):141-154.

Keys, A., Taylor, H.L., Blackburn, H., Brozek, J., Anderson, J.T., and Simonson, E. (1963). Coronary heart disease among Minnesota business and professional men followed fifteen years. **Circulation** 28:381-395.

Khoury, P.R., Morrison, J.A., Laskarzewski, P., Kelly, K., Mellies, M.J., King, P., Larsen, R., and Glueck, C.J. (1981). Relationship of education and occupation to coronary heart disease risk factors in school children and adults: The Princeton School District Study. **American Journal of Epidemiology** 113:378-395.

Kitagawa, E. and Hauser, P.M. (1973). **Differential mortality in the United States. A study in socio-economic epidemiology.** Cambridge, Mass.: Harvard University Press.

Kok, F.J., Matroos, A.W., van den Ban, A.W., and Hautvast, J.G.A.J. (1982). Characteristics of individuals with multiple behavioral risk factors for coronary heart disease: The Netherlands. **American Journal of Public Health** 72(9):986-991.

Kraus, J.F., Borhani, N.O., and Franti, C.E. (1980). Socioeconomic status, ethnicity, and risk of coronary heart disease. **American Journal of Epidemiology** 111(4):407-414.

Last, J.M. (ed.) (1983). **A Dictionary of Epidemiology.** New York: International Epidemiological Association.

Leren, P., Helgeland, A., Hjermann, I., and Holme, I. (1983). The Oslo study: CHD risk factors, socioeconomic influences, and intervention. **American Heart Journal** 106:1200-1206.

Lerner, M. and Stutz, R.N. (1977). Have we narrowed the gaps between the poor and the nonpoor? Part II. Narrowing the gaps, 1959-1961 to 1969-1971: Mortality. **Medical Care** 15(8):620-635.

Lew, E.A. (1957). Some implications of mortality statistics relating to coronary artery disease. **Journal of Chronic Diseases** 6:192-209.

Logan, W.P.D. (1954). Social class variations in mortality. **Public Health Reports** 69:1217.

Logan, W.P.D. and Cushion, A.A. (1960). **Morbidity Statistics from General Practice.** London: Her Majesty's Stationery Office (HMSO).

Lown, B., DeSilva, R.L., Reich, P. and Murawski B.J. (1980) Psychophysiologic factors in sudden cardiac death. **American Journal of Psychiatry** 137:1325-1335.

Lupien, P.-J., Moorjani, S., Rochon, J., Dagenais, G.-R., Fleury, L.-A., Jobin, J., and Robitaille, N.-M. (1985). Lipid profile of a French-Canadian population: 1. Association of plasma lipid and lipoprotein levels with age, relative body weight and education. **Canadian Medical Association Journal** 133:1127-1133.

Marmot, M.G., Adelstein, A.M., Robinson, N. and Rose, G.A. (1978). Changing social-class distribution of heart disease. **British Medical Journal** 2:1109-1112.

Marmot, M.G., Shipley, M.J. and Rose, G. (1984). Inequalities in death--specific explanations of a general pattern? **Lancet** 1:1003-1006.

Martin, M.J., Hulley, A.B., Browner, W.S., Kuller, L.H. and Wentworth, D. (1986). Serum cholesterol, blood pressure, and mortality: implications from a cohort of 361,662 men. **Lancet** 25 October:933-936.

McGinnis, J.M., Shopland, D. and Brown, C. (1987). Tobacco and Health: Trends in Smoking and Smokeless Tobacco Consumption in the United States. **Annual Review of Public Health** 8:441-467.

Millar, W.J. (1985a). Population estimates of overweight and hypertension in Canada, 1981. **Canadian Journal of Public Health**, November-December:398-403.

Millar, W.J. (1985b). Smoking prevalence among Canadian adolescents: A comparison of survey estimates. **Canadian Journal of Public Health** 76:33-37.

Millar, W.J. (1986a). "A comparison of self-reported weight and preferred body weight." Unpublished manuscript obtained from the author, November 1986.

Millar, W.J. (1986b). Distribution of body weight and height: comparison of estimates based on self-reported and observed measures. **Journal of Epidemiology and Community Health** 40(4):319-323.

Millar, W.J. and Wigle, D.T. (1986). Socioeconomic disparities in risk factors for cardiovascular disease. **Canadian Medical Association Journal** 134:127-132.

Monitoring the incidence and determinants of cardiovascular diseases in the population--new WHO project ("MONICA"). **Chronic Diseases in Canada** 2(4):41-42, March 1982.

Moses, L.E. (1987). Graphical methods in statistical analysis. **Annual Review of Public Health** 8:309-353.

Multiple Risk Factor Intervention Trial Research Group (1986). Relationship between baseline risk factors and coronary heart disease and total mortality in the Multiple Risk Factor Intervention Trial. **Preventive Medicine** 15:254-273.

National Center for Health Statistics (1967). Serum cholesterol levels of adults, United States, 1960-62, by F.E. Moore and T. Gordon. **Vital and Health Statistics.** Series 11-No. 22. DHEW Pub. No. (HRA) 77-1283. Health Resources Administration. Washington, D.C.: United States Government Printing Office.

National Center for Health Statistics (1980): Serum cholesterol levels of persons 4-74 years of age by socioeconomic characteristics, United States, 1971-74, by R. Fulwood, S. Abraham, and C.L. Johnson. **Vital and Health Statistics.** Series 11-No. 217. DHEW Pub. No. (PHS) 80-1667. Public Health Service. Washington,D.C.: United States Government Printing Office.

National Center for Health Statistics (1981). Hypertension in adults 25-74 years of age, United States, 1971-75, by J. Roberts and M. Rowland. **Vital and Health Statistics.** Series 11-No. 221. DHHS Pub. (PHS) 81-1671. Hyattsville, Maryland.: National Center for Health Statistics.

National Center for Health Statistics (1982). Blood pressure levels and hypertension in persons aged 6-74 years: United States, 1976-80, by M. Rowland and J. Roberts . **Advance data from Vital and Health Statistics** no. 84. DHHS Pub. No. (PHS) 82-1250. Hyattsville, Maryland: National Center for Health Statistics.

National Center for Health Statistics (1986). Blood pressure levels in persons 18-74 years of age in 1976-80, and trends in blood pressure from 1960 to 1980 in the United States. **Vital and Health Statistics.** Series 11-No. 234. DHEW Pub. No. (PHS) 86-1684. Hyattsville, Maryland: National Center for Health Statistics.

National Center for Health Statistics (1986). Total serum cholesterol levels of the adults 20-74 years of age, United States, 1976-80. **Vital and Health Statistics.** Series 11-No. 236. DHHS Pub. (PHS) 86-1686. Hyattsville, Maryland: National Center for Health Statistics.

Nicholls, E., Nair, C., MacWilliam, L., Moen, J. and Mao, Y. (1986). **Cardiovascular Disease in Canada.** Ottawa: Minister of Supply and Services Canada.

Nicholls, E.S., Jung, J., and Davies, J.W. (1981). Cardiovascular disease mortality in Canada. **Canadian Medical Association Journal** 125:981-992.

Nutrition Canada (1973). **Nutrition: A National Priority.** Ottawa: Department of National Health and Welfare, Information Canada.

Osler, W. (1910). The Lumleian lectures on angina pectoris. **Lancet** 1, 12.

Paffenbarger, R.S., Hyde, R.T., Wing, A.L., and Chung-cheng H. (1986). Physical activity, all-cause mortality, and longevity of college alumni. **New England Journal of Medicine** 314:605-613.

Paul, O., Lepper, M.H., Phelan, W.H., Dupertuis, G.W., MacMillan, A., McKean, H., and Park H. (1963). A longitudinal study of coronary heart disease. **Circulation** 228:20-31.

Pearce, N.E., Davis, P.B., Smith, A.H., and Foster, F.H. (1985). Social class, ethnic group, and male mortality in New Zealand, 1974-8. **Journal of Epidemiology and Community Health** 39:9-14.

Pell, S, and D'Alonzo, C.A. (1963). Acute myocardial infarction in a large industrial population. **Journal of the American Medical Association** 185(11):117-126.

Pell, S. and Fayerweather, W.E. (1985). Trends in the incidence of myocardial infarction and in associated mortality and morbidity in a large employed population, 1957-83. **New England Journal of Medicine** 312(16):1005-1011.

Pincus, T., Callahan, L.F. and Burkhauser, R.V. (1987). Most chronic diseases are reported more frequently by individuals with fewer than 12 years of formal education in the age 18-64 United States population. **Journal of Chronic Diseases** 40:865-874.

Pisa, A. and Uemura, K. (1982). Trends in mortality from ischemic heart disease and other cardiovascular diseases in 27 countries, 1968-77. **World Health Statistics Quarterly** 35:11-47.

Powell, K.E., Thompson, P.D., Caspersen, C.J. and Kendrick, J.S. (1987). Physical activity and the incidence of coronary heart disease. **Annual Review of Public Health** 8:253-287.

Rabkin, S.W., Mathewson, F.A.L. and Hsu, P.-W. (1977). Relation of body weight to development of ischemic heart disease in a cohort of young North American men after a 26 year observation period: The Manitoba Study. **American Journal of Cardiology** 39:452-458.

Robitaille, N.M., Christien, A., Dagenais, G.R., Lupien, P.J., and Rochon, J. (1979). Prévalence des facteurs de risque de la maladie coronarienne dans la région de Québec. **Clinical and Investigative Medicine** 2:13-16.

Rose, G. (1984). International trends in cardiovascular disease--implications for prevention and treatment. **Australian and New Zealand Journal of Medicine** 14:375-380.

Rose, G. (1985). Sick individuals and sick populations. **International Journal of Epidemiology** 14(1):32-38.

Rose, G. and Marmot, M.G. (1981) Social class and coronary heart disease. **British Heart Journal** 45:13-19.

Ruberman, W., Weinblatt, A.B., Goldberg, J.D., and Chaudhary, B.S. (1984). Psychosocial influences on mortality after myocardial infarction. **New England Journal of Medicine** 311:552-559.

Sauer, H., Payne, G., and Council, B. (1966). Cardiovascular disease mortality patterns in Georgia and Northa Carolina. **Public Health Reports** 75:841-851.

Shaper, A.G., Pocock, S.J., Walker, M., Phillips, A.N., Whitehead, T.P. and MacFarlane, P.W. (1985). Risk factors for ischaemic heart disease: the prospective phase of the British Regional Heart Study. **Journal of Epidemiology and Community Health** 39:197-209.

Shekelle, R.B., Ostfeld, A.M. and Paul, O. Social status and the incidence of coronary heart disease. **Journal of Chronic Diseases** 22:381-391.

Shekelle, R.B., Shryock, A.M., Paul, O., Lepper, M., Stamler, J., Liu, S., and Raynor, W.J. (1981). Diet, serum cholesterol, and death from coronary heart disease: The Western Electric Study. **New England Journal of Medicine** 304(2):65-70.

Slater, C. and Carlton, B.(1985). Behavior, lifestyle, and socioeconomic variables as determinants of health status: implications for health policy development. **American Journal of Preventive Medicine** 1(5):25-33.

Spiegelman, M. (1968). Introduction to Demography. Cambridge, Mass.: Harvard University Press.

Stallones, R.A. (1980). The rise and fall of ischemic heart disease. Scientific American 243:53-59.

Stamler, J. (1981). Primary prevention of coronary heart disease: The last 20 years. American Journal of Cardiology 47:722-735.

Stamler, J. (1979). Research related to risk factors. Circulation 60(7):1575-1587.

Stamler, J., Berkson, D.M., Mojonnier, L., Lindberg, H.A., Hall, Y., Levinson, M., Burkey, F., Miller, W., Epstein, M.B. and Andelman, S.L. (1968). Epidemiological studies on atherosclerotic coronary heart doseases: causative factors and consequent preventive approaches. Progress Biochemical Pharmacology 4:30-49.

Stamler, J., Kjelsberg, M. and Hall, Y. (1960). Epidemiologic studies on cardiovascular-renal diseases. I. Analysis of mortality by age-race-sex-occupation. Journal of Chronic Diseases 12:440.

Statistics Canada (1977). Methodology of the Canadian Labour Force Survey, 1976. Catalogue 71-526 occasional. Ottawa: Minister of Industry Trade and Commerce.

Statistics Canada (1979). Guide to labour force survey data. Catalogue 71-528 occasional. Ottawa: Minister of Supply and Services Canada.

Statistics Canada (1981). 1981 Census of Canada, Population, School attendance and level of schooling, Table 3. Population 15 Years and Over by Age Groups and Sex, Showing Highest Level of Schooling, for Canada and Provinces. Catalogue 92-914. Ottawa: Minister of Supply and Services Canada.

Statistics Canada and Department of National Health and Welfare (1981). The Health of Canadians: Report of the Canada Health Survey. Catalogue 82-538. Ottawa: Minister of Supply and Services.

Statistics Canada (1985). "General Social Survey: Cycle One Questionnaire Package" (mimeographed documentation). Ottawa: Housing, Family and Social Statistics Division, Statistics Canada.

Stephens, T., Jacobs, D.R. and White, C.C. (1985). A descriptive epidemiology of leisure-time physcial activity. Public Health Reports 100(2):147-158.

Sutherland, I. (1947). Variations in occupational mortality between and within social classes. British Journal of Social Medicine 1:126-134.

Tibblin, G., Wilhelmsen, L. and Werko, L. (1975). Risk factors for myocardial infarction and death due to ischemic heart disease and other causes. American Journal of Cardiology 35:514-522.

Tuomilehto, J., Puska, P., Virtamo, J., Nettaanmake, L., and Koskela, K. (1978). Coronary risk factors and socioeconomic status in Eastern Finland. Preventive Medicine 7:539-549.

Tyroler, H.A., Heiss, G., Heyden, S. and Hames, C.G. (1980). Family follow-up study of serum cholesterol in Evans County, Georgia. Journal of Chronic Diseases 33:323-330.

Weinblatt, E., Ruberman, W., Goldberg, J., Frank, C.W., Shapiro, S. and Chaudhary, B.S. (1978). Relation of education to sudden death after myocardial infarction. New England Journal of Medicine 299:60-65.

Wigle, D.T. and Mao, Y. (1980). Mortality by income level in urban Canada. Ottawa: Health Protection Branch, Department of National Health and Welfare.

Wilhelmsen, L., Wedel, H. and Tibblin, G. (1973). Multivariate analysis of risk factors for coronary heart disease. Circulation 48:950-958.

World Health Organization (1978a). Arterial Hypertension: Report of a WHO Expert Committee. Geneva: World Health Organization Technical Report Series.

World Health Organisation (1978b). International Classification of Diseases, 9th revision (ICD-9). Geneva: World Health Organisation, 1978.

Wynder, E.L., Mushinski, M.H., Stellman, S.D., and Choay, P. (1981). Tobacco usage in France: An epidemiological study. Preventive Medicine 10:301-315.

Yano, K., Reed, D.M. and McGee, D.L. (1984). Ten-year incidence of coronary heart disease in the Honolulu Heart Program. American Journal of Epidemiology 119(5):653-666.

Yeracaris, C.A. and Kim, J.H. (1978). Socioeconomic differentials in selected causes of death. American Journal of Public Health 68(4):342-351.

Table 1. Mortality from ischemic heart disease (ICD 410-414) by sex in various countries: age-standardized mortality rates per 100,000 population aged 40-69 years, 1975, and annual change (%) of ischemic heart disease mortality from 1968 to 1977.

Males			Females		
	Rate	Change		Rate	Change
Country	1975	68-77	Country	1975	68-77
Finland	673	-1.8	Scotland	202	+0.5
Scotland	615	+0.1	Israel	193	--
Northern Ireland	614	+1.3	Northern Ireland	189	-0.2
New Zealand	545	-1.2	Australia	180	-1.0
Australia	534	-2.1	United States	171	-3.6
United States	528	-3.0	Ireland	168	-0.4
Ireland	508	+2.6	New Zealand	167	-1.6
England & Wales	498	+0.3	Canada	143	-0.9
Canada	473	-1.6	Finland	142	-1.6
Czechoslovakia	410	+0.6	England & Wales	138	+1.1
Denmark	400	-1.7	Czechoslovakia	129	0.0
Norway	398	-1.1	Hungary	125	+2.0
Israel*	370	--	Denmark	114	+0.7
Sweden	368	+2.0	Bulgaria	110	+2.5
Netherlands	363	-0.9	Sweden	102	+1.8
Hungary	328	+2.6	Austria	89	+0.3
West Germany	325	+0.4	Netherlands	87	+0.8
Belgium	312	-1.7	Norway	86	-0.3
Austria	308	+0.6	Belgium	84	-1.1
Bulgaria	237	+5.6	West Germany	81	+0.5
Poland	229	+6.4	Yugoslavia	70	+4.1
Italy	226	-0.1	Romania	64	+3.8
Switzerland	226	+0.2	Italy	63	-2.0
Yugoslavia	180	+0.6	Poland	56	+5.2
France	152	+1.1	Switzerland	50	-3.5
Romania	146	+4.3	France	37	-1.4
Japan	69	-2.6	Japan	29	-4.7

Source: Pisa and Uemura, 1982

Note: -- Indicates insufficient data for analysis.

* Standardized to composition of European population aged 40-69 years.

Table 2. Annual change (%) in age-standardized mortality rates from ischemic heart disease at ages 40-69 years, by sex, various countries, 1968 to 1977.

Change	Males		Females	
Decreasing	United States	-3.0	Japan	-4.7
	Japan	-2.6	United States	-3.6
	Australia	-2.1	Switzerland	-3.5
	Finland	-1.8	Italy	-2.0
	Belgium	-1.7	Finland	-1.6
	Denmark	-1.7	New Zealand	-1.6
	Canada	-1.6	France	-1.4
	New Zealand	-1.2	Belgium	-1.1
	Norway	-1.1	Australia	-1.0
Increasing	Poland	+6.4	Poland	+5.2
	Bulgaria	+5.6	Yugoslavia	+4.1
	Romania	+4.3	Romania	+3.8
	Hungary	+2.6	Bulgaria	+2.5
	Ireland	+2.6	Hungary	+2.0
	Sweden	+2.0	Sweden	+1.8
	Northern Ireland	+1.3	England & Wales	+1.1
	France	+1.1		
	Yugoslavia	+0.6		
No change	Austria		Austria	
	Czechoslovakia		Canada	
	West Germany		Czechoslovakia	
	Netherlands		Denmark	
	Italy		West Germany	
	Switzerland		Netherlands	
	England & Wales		Ireland	
	Scotland		Norway	
			Northern Ireland	
			Scotland	

Source: Pisa and Uemura, 1982.

Table 3. Selected studies of occurrence of coronary heart disease by social class, Britain and other countries, 1930-1980

Study	Population	SES variable	Endpoint	Relationship of outcome to SES
Logan (1954)	UK 1930-32	Occupational class	"Angina pectoris"	Positive
Logan (1954)	UK 1949-53	Occupational class	"Angina pectoris"	Positive (males) Negative (females)
Brown et al. (1957)	England 1956	Occupational class	Prevalent CHD	Inconsistent (positive?)
Marmot et al. (1978)	UK males 1961	Occupational class	CHD mortality	Negative
Black et al. (1982)	UK 1971-4	Occupational class	Mortality from diseases of circulatory system	Negative
Pearce et al. (1985)	New Zealand males 15-64 1974-1978	Occupational class	CHD mortality	Negative (but not linear)
Holme et al. (1980)	Oslo males 40-49 1972-77	Education	CHD mortality	Negative
Hardes et al. (1985), Dobson et al. (1985)	Australia males 1969-78	Occupational class	CHD mortality	Negative
Marmot et al. (1984)	London, England males 1967-79	Occupational class	CHD mortality	Negative

Table 4. Selected studies of occurrence of coronary heart disease by social class, United States and Canada, 1951 to 1983

Study	Population	SES variable	Endpoint	Relationship of outcome to SES
Stamler et al. (1968)	Males 45-64 1958-62	Occupational class	CHD mortality	Negative
Lew (1957)	Males 35-54 1953	Occupational class	CHD mortaltiy	Negative
Kitagawa & Hauser (1973)	White adults 25-64 1960	Education, occupational class	Hypertensive mortality (with & without coronary involvement)	Negative
Pell & D'Alonzo (1963)	Dupont employees 17-64 1956-61	Occupational class	CHD mortality	Negative
Weinblatt et al. (1978)	Male MI survivors with arrhythmia 1972-75	Education	Sudden coronary death	Negative
Shekelle et al. (1969)	Male Chicago W. Electric employees 1958-63	Education	CHD death Incident angina	Negative Positive
Hinkle et al. (1968)	Male Bell employees 1962-66	Education	1st event CHD CHD death	Negative
Cassel et al. (1971)	Evans Cy., Georgia residents 1960-69	Occupational class education	Prevalent CHD (1960-62) incident CHD (1962-69)	Positive None

Table 4. (cont.) Selected studies of occurrence of coronary heart disease by social class, United States and Canada, 1951 to 1983

Study	Population	SES variable	Endpoint	Relationship of outcome to SES
Pell & Fayerweather (1985)	Dupont employees 1957-83	Occupational class	Incident MI (1957--)	None
			CHD mortality (1983--)	Negative
Lerner & Stutz (1977)	Pop. of 10 highest & 10 lowest US states 1959-61 1969-71	Per capita income (state average)	Rate of decline of CHD mortality	Positive (rate of decline higher in higher income states).
Yeracaris & Kim (1978)	Pop. of 3 US cities 1960-70	SES composite score applied to census tract	CHD mortality	1960: Negative
			CHD: rate of decline	Negative in 1 city Positive in 2 cities
Wigle & Mao (1980)	Pop. of 21 Canadian cities 1971	Average income of census tract	CHD mortality	Negative
Brillette & Hill (1978)	Canada 1974	occupational status	CHD mortality	None (proportional)

Table 5. Major observational studies of coronary heart disease: Findings on modifiable risk factors (univariate analysis)

Study (Investigators)	Entry	Risk factors SM	CH	BP	OB	SED
Framingham (Dawber et al., 1963; Hubert et al., 1983)	1948	+	+	+	+	+
Manitoba (Rabkin et al., 1977)	1948	?	?	+	+	?
San Francisco Longshoremen (Borhani et al., 1963, Brand et al., 1979)	1951	+	+	+	+	+
Chicago Western Electric (Paul et al., 1963)	1957	+	+	+	+	+
Peoples Gas (Stamler et al., 1968)	1958	+	+	+	+	?
Men Born in 1913 (Tibblin et al., 1975)	1963	+	+	+	0	0
Seven Countries (Keys et al., 1984)	1958-64	+	+	+	0	*
Honolulu Heart Program (Yano et al., 1984)	1965-8	+	+	+	+	+
Oslo (Holme et al., 1985)	1972-3	0	+	+	?	0
British Regional Heart (Shaper et al., 1985)	1978-80	+	+	+	+	?
Harvard Alumni (Paffenbarger et al., 1986)	1962	+	?	+	0	+

Notes: Findings are shown as follows:
- \+ positive association with coronary heart disease;
- 0 no association with coronary heart disease found;
- ? risk factor not investigated, or not reported;
- * positive association with coronary heart disease in Southern Europe only.

Risk factors are abbreviated as follows:
- SM regular current cigarette smoking;
- CH hypercholesterolemia (various definitions);
- BP hypertension (various definitions);
- OB obesity or increased skinfold thickness (various definitions);
- SED physical inactivity (various difinitions).

Table 6. Occurrence of risk factors for coronary heart disease by social class: Selected studies from Europe, Britain, Australia and New Zealand, 1976-1985.

Investigators	Location & (years)	N	Measure of SES	Smoking	Elevated cholesterol	Hypertension	Obesity	Physical inactivity
Pearce et al. (1985)	New Zealand 1974-78	10% pop males 15-64	Occupation	↗ Males	na	na	na	na
Tuomilehto et al. (1978)	Finland 1972	10,951	Education	↗ Males	↗	↗	na	na
Marmot et al. (1984)	Britain 1967-77	18,403 males	Occupation	↗ Males	na	na	na	na
Holme et al. (1980) and Larem et al. (1983)	Norway 1972-77	14,677 males	Occupation & education	↗	↗	↗	---	↗
Kok et al. (1982)	Netherlands 1978	1,951	Education & occupation	↗	na	na	↗	↗
Arnesen & Forsdahl (1985)	Norway 1979-80	14,652 20-49	Poverty in childhood	↗ Males	↗	na	na	na
Dobson et al. (1985)	Australia 1980	5,617 25-64	Occupation	↗	---	↗	↗	↗

Notes: ↗ Higher prevalence in lower socioeconomic strata.
--- Risk factor measured, but no pattern of distribution by socioeconomic status discerned.
na Risk factor not measured.

Table 7. Occurrence of risk factors for coronary heart disease by social class: selected studies from United States and Canada, 1961-1986.

Investigators	Location & years	N	Measure of SES	Smoking	Elevated cholesterol	Hypertension	Obesity	Physical inactivity
Pell & D'Alonzo (1963)	USA 1956-61	1,585 males	Occupation	---	---	---	---	na
Shekelle et al. (1981)	Chicago 1958-65	2,017 males 40-55	Education	↗	---	↗	↗	na
HANES I (1980)	USA 1971-75	6,913 25-74	Education Occupation	000	000	↗	000	000
HANES II (1982, 1986)	USA 1976-80	11,754 20-74	Education Occupation	↗	↗	↗	000	000
HDFP (1977)	USA 1973-74	151,668	Education	na	na	↗	na	na
Hunter et al. (1979)	Louisiana 1973-74	3,524 5-24	Education Occupation	na	U	na	na	na
Robitaille et al. (1979) and Lupien et al. (1985)	Quebec 1974 1981	4,830	Education	↗	---	↗	na	na
Tyroler et al. (1980)	Georgia 1960, 1967	3,102	Occupation	↗	↗ ---(1967)	na	na	na
Kraus et al. (1980)	California 1974-75	19,141 males	Education & Occupation	↗	↗ (weak)	↗	na	na
Khoury et al. (1981)	Ohio 1973-75	1,255 6-19 & adults	Education & Occupation	↗	na	---	---	na
Stephens et al. (1985)	USA & Canada 1972-83	8 surveys	Occupation & education	na	na	na	na	↗
Millar & Nigle (1986)	Canada 1978-83	4 pop. surveys	Education	↗	---	↗ Females	↗	↗
	Females							

Notes: ↗ Higher prevalence in lower socioeconomic strata.
--- Risk factor measured, but no pattern of distribution by socioeconomic status discerned.
na Risk factor not measured.
000 Risk factor not presented here.
U U-shaped distribution: highest prevalence in highest and lowest strata.

Table 8: Objectives and methodology of surveys related to coronary heart disease risk factors, Canada, 1971-1985

SURVEY	OBJECTIVES	SAMPLE DESIGN, POPULATION	SURVEY PROCEDURES	MEASURES OF RISK FACTORS OF INTEREST
Nutrition Canada Survey, 1970-72 (Health & Welfare Canada)	To assess the nutritional status of the population; to determine the prevalence of nutritional diseases; to determine the quantity of food items consumed; to evaluate food enrichment policies; to estimate consumption of food additives, pesticide residue.	Multistage probability sample of the non-institutionalized residents of 10 provinces, Indians on reserves, Eskimos in provinces & territories. All ages. Response rate: 47% N=15,920	Home visits, survey centre assessments, interviewer-administered questionnaire, physical examination, anthropometric measures	Blood pressure: Measured by examiner at survey clinic, subject seated. (Recorded only if DBP>100 mmHg) Serum cholesterol: non-fasting specimen.
Canada Fitness Survey, 1981 (Fitness and Amateur Sport Canada)	To describe the physical activity patterns, actual fitness levels, and relationship of fitness to other aspects of health among Canadians.	Multistage probability sample of the household population of 10 provinces, aged 7 through 69 (fitness test and clinical measures), aged 10+ (questionnaire). Response rate: 52%, N=16,000 (fitness test and clinical measures); 77%, N=23,500 (questionnaire).	Home visits: fitness testing, self-administered questionnaire	Blood pressure: Measured by examiner in subject's home, subject seated.
Canada Health Survey, 1978-79, (Health and Welfare Canada and Statistics Canada)	To assess:--risk factors to health, health status, consequences of health problems.	Multistage probability sample of noninstitutionalized Canadian population, excluding: residents of territories, Indian reserves, remote areas (=3% excluded). Response rates: Household health interview (all ages): 86% (N=10,571 dwell-	Interviewer administered questionnaire, instrumented measures, self-administered questionnaire	Blood pressure: measured by examiner in subject's home during 2nd household visit, subject seated. Serum cholesterol: fasting specimen.

Table B: Objectives and methodology of surveys related to coronary heart disease risk factors, Canada, 1971-1985

SURVEY	OBJECTIVES	SAMPLE DESIGN, POPULATION	SURVEY PROCEDURES	MEASURES OF RISK FACTORS OF INTEREST
		ings, 30,000 persons); Lifestyle & health questionnaire : 89% (23,791 persons); Physical examinations/ measures: 72% (6,131 persons).		
Smoking Supplement to the Labour Force Survey (Health & Welfare Canada; Statistics Canada)	To monitor the smoking behavior of Canadians.	Stratified, multistage probability sample of household population, aged 15 +. Exclusions: populations of Yukon, Northwest Territories, residents of Indian Reserves, full-time members of Armed Forces, inmates of institutions.	Personal interview for first time, telephone interviews for subsequent. Proxy responses=51% of data collected.	Smoking: frequency, amount, duration, inhalation, brand.
General Social Survey, September-October 1985 (Statistics Canada)	To assess health status and social support networks of Canadians 15+.	Random sample (random digit dialing) of household population aged 15-64, and quota sample from groups, aged 65 & over which rotated out of the Labour Force Survey in 1985. Response rate: 84% (telephone interviews): N=8150; 87% (personal interviews): N=3150.	Telephone interviews (over age 65), face-to-face interviews 15-64). No proxy interviews.	Smoking: frequency Blood pressure: Ever been told they had high blood pressure? Obesity: height and weight. Activity: frequency of active physical exercise.
Health Promotion Survey of 1985 (Health & Welfare Canada)	To assess health status, quality of life, prevalence of risk factors for cardiovascular disease & other health problems, prevention-related behaviors, related knowledge, beliefs, attitudes.	Random sample (random digit dialing) of about 1000 persons over the age of 15 in each province and the 2 territories. N=approx 11,000	Telephone interviews	Smoking: frequency Blood pressure: Is blood pressure high? Obesity: height and weight. Activity: frequency of exercise of "at least 15 minutes."

Table 9. Measurement of survey variables related to risk factors for coronary heart disease, Canada, 1971-1985

SURVEY	HYPERTENSION	OBESITY	ACTIVITY LEVEL	CHOLESTEROL	SMOKING	EDUCATION
NCS 1971	Subject seated. BP measured at Survey Clinic. Recorded only if diastolic = or >100 mm Hg.	Measured by examiner.	------	Subject non-fasting	Asked (face-to-face) by interviewers "Do you smoke cigarettes?" "Do you usually smoke them everyday?".	Highest grade completed (0-13), 0 years post-high school, any "college".
CHS 1978	One reading. BP measured during 2nd household visit; subject seated. Appropriate cuff size.	Measured by examiner	"During last 2 wks, how many times did you do. . ." (sports, home activities); time spent on ea. occasion.	Subject fasting 2 hrs. prior to venipuncture.	XXX	Highest level reached of: 1. Some secondary or less 2.Secondary diploma 3. Some post secondary 4. Post secondary certificate or diploma 5. Bachelor's degree or equivalent 6. One or more graduate degrees.
CFS 1981	BP measured in subject's home; subject seated. Appropriate cuff size.	Measured by examiner	Time spent active at work, school, housework; leisure activities, frequency performed.		Self-administered questionnaire: "I haven't smoked," "I currently smoke. . . cigarettes occasionally. . . daily. . ."	"Highest level reached" of categories: 1. Elementary or less, 2. Some secondary, 3.Secondary diploma 4. Some post secondary, 5. Post secondary diploma, certificate 6. Community college or CEGEP diploma 7. One or more university degrees.
GSS 1985	Telephone interviews: "Have you ever been told by a MD or nurse that you have high blood pressure?"	Ages 15-64: telephone report; ages 65+: face-to-face report: "What is your height/ weight?"	"In last 3 mos. did you participate in active physical exercise?" "How frequently?" (per wk, per/ mo).	------	"At the present time do you smoke cigarettes daily, occasionally or not at all?"	"How many years of elementary or secondary education have you completed?" (0-13) "Have you graduated from secondary school?" "Any further schooling?" "Highest level": 1.Some community college, CEGEP, nursing school, 2. Diploma or certificate from 01 3. Some university 4.Degree 5. Masters 6. Other.

HPS 1985	"As far as you know is your blood pressure high?"	Phone: "How tall are you without shoes?" "How much do you weigh?"	Times/wk exercise for at least 15 min. (Daily, 5-6/wk, 3-4/wk, 1-2/wk, (1/wk, never)	-----	"At present time do you smoke cigarettes?" "Do you smoke cigarettes regularly, i.e. usually everyday or occasionally, not every day?"	Highest grade or level of education completed: 1. none 2. elementary 3. Some sec. 4. Completed sec. 5. some Community coll, tech. coll, CEGEP, nurse's training 6. completed 05, 7. Some university of teacher's coll. 8. completed 07. 9. Other
LFS 1975	----	----	----	----	Telephone interviews (51% by proxy): Presently smoke cigarettes regularly (usually every day)?	Highest level of schooling completed: 1.1-8 yrs, 2. some high school 3. completed h.s. 4. some univ. 5. completed univ. diploma 6. univ. completed degree 7. other ed conn 8. other completed

Notes: ----- Variable not measured.
XXXXX Variable not examined in present study.
NCS Nutrition Canad Survey
CHS Canada Health Survey
CFS Canada Fitness Survey
GSS General Social Survey
HPS Health Promotion Survey
LFS Labour Force Survey

Table 10: Prevalence of current smokers by age and educational attainment, by sex, persons aged 25 years and over, Canada 1971-1985 (percentage of population; estimated standard errors in parentheses)

Sex / Education / Age	Survey: Nutrition Canada (1971)	Labour Force (1975)	Canada Fitness (1981)	General Social (1985)	Health Promotion (1985)
Males, total(a)	44.7 (1.2)	43.3 (0.3)	41.9 (0.6)(d)	36.6 (0.8)	35.5 (0.8)
Education(b)					
Elementary	49.1 (1.9)	52.7 (0.6)	49.5 (2.2)	45.8 (2.8)	44.2 (3.4)
Secondary	47.1 (1.6)	48.3 (0.5)	46.2 (0.9)	43.3 (1.5)	42.2 (1.1)
Post secondary	49.1 (3.5)	41.2 (0.8)	38.8 (1.3)	32.6 (1.6)	30.6 (1.7)
University	27.9 (2.7)	26.8 (0.9)	30.1 (1.5)	21.5 (1.5)	22.5 (1.9)
Age(c)					
25-34	49.7 (2.4)	49.2 (0.6)	50.7 (1.7)	43.6 (2.1)	42.8 (2.3)
35-44	42.7 (2.3)	47.4 (0.7)	49.4 (1.5)	42.7 (2.0)	38.6 (2.1)
45-54	55.0 (2.9)	44.8 (0.7)	43.6 (1.6)	37.3 (2.2)	38.8 (2.2)
55-64	41.1 (3.0)	42.2 (0.9)	41.2 (1.7)	33.9 (2.4)	34.5 (2.4)
65+	28.0 (2.6)	28.5 (1.0)	35.0 (2.6)(d)	21.6 (1.2)	19.7 (1.9)
Females, total(a)	34.5 (0.9)	29.9 (0.3)	32.1 (0.5)(d)	27.8 (0.7)	31.2 (0.7)
Education(b)					
Elementary	37.6 (1.5)	30.6 (0.6)	33.9 (1.8)	32.6 (2.3)	37.5 (2.8)
Secondary	36.6 (1.3)	33.3 (0.4)	35.3 (0.7)	31.4 (1.1)	34.7 (0.9)
Post secondary	40.0 (2.5)	28.9 (0.7)	31.4 (1.0)	26.1 (1.2)	25.5 (1.4)
University	18.9 (2.7)	22.9 (1.0)	22.0 (1.6)	19.4 (1.6)	25.5 (1.8)
Age(c)					
25-34	46.2 (1.9)	38.3 (0.6)	42.6 (1.5)	38.1 (1.9)	40.4 (2.0)
35-44	37.1 (2.0)	34.0 (0.7)	38.2 (1.4)	28.9 (1.8)	35.8 (2.0)
45-54	37.2 (2.1)	33.6 (0.7)	32.6 (1.3)	31.1 (1.9)	33.2 (2.0)
55-64	28.3 (2.4)	27.5 (0.8)	32.4 (1.4)	25.9 (1.7)	26.8 (1.8)
65+	20.2 (1.8)	11.9 (0.6)	23.4 (2.0)(d)	14.8 (1.0)	18.0 (1.3)

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Table 11: Elevated serum cholesterol (greater than or equal to 250 mg/dL) by age and educational attainment, by sex, persons aged 25 years and over, Canada, 1971-1978 (percentage of population; estimated standard errors in parentheses)

Sex / Education / Age	Survey: Nutrition Canada (1971)	Survey: Canada Health (1978)
Males, total(a)	10.1 (0.7)	15.6 (1.1)
Education(b)		
Elementary	9.6 (1.0)	13.6 (1.3)(d)
Secondary	12.3 (1.0)	13.7 (2.1)(e)
Post secondary	11.9 (2.3)	18.9 (2.8)
University	9.8 (1.8)	15.9 (2.9)
Age(c)		
25-34	5.3 (0.9)	9.4 (1.5)
35-44	11.5 (1.5)	12.6 (2.3)
45-54	14.3 (2.2)	31.4 (3.9)
55-64	13.9 (2.3)	18.4 (3.3)
65+	16.2 (2.4)	7.7 (2.2)
Females, total(a)	14.3 (0.6)	15.1 (1.0)
Education(b)		
Elementary	16.3 (1.1)	15.8 (1.1)(d)
Secondary	17.6 (1.0)	16.4 (2.1)(e)
Post secondary	10.5 (1.5)	16.2 (2.2)
University	9.2 (2.4)	12.6 (4.9)
Age(c)		
25-34	6.8 (0.9)	2.5 (0.8)
35-44	3.6 (0.7)	2.5 (1.0)
45-54	16.6 (1.5)	17.0 (2.7)
55-64	24.9 (2.3)	24.7 (3.5)
65+	30.0 (2.2)	44.7 (5.1)

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) includes incompleted secondary
(e) secondary completed

Table 12: Prevalence of measured or reported hypertension (as defined in each survey) by age and educational attainment, by sex, persons aged 25 years and over, Canada, 1971-1985
(percentage of population; estimated standard errors in parentheses)

Sex Education Age	Blood pressure measured*			Hypertension reported**	
	Nutrition Canada Survey (1971)	Canada Health Survey (1978)	Canada Fitness Survey (1981)	General Social Survey (1985)	Health Promotion Survey (1985)
Males, total(a)	8.8 (0.5)	11.2 (1.0)	6.7 (0.4)(d)	18.3 (0.6)	9.0 (0.5)
Education(b)					
Elementary	12.4 (0.9)	12.6 (1.2)(e)	5.2 (0.8)	18.9 (1.9)	6.1 (1.5)
Secondary	8.9 (0.8)	11.8 (2.3)(f)	7.6 (0.6)	17.8 (1.1)	9.9 (0.7)
Post secondary	6.0 (1.7)	12.0 (2.0)	5.8 (0.8)	19.8 (1.4)	15.3 (1.4)
University	5.3 (1.5)	4.3 (1.6)	6.9 (1.1)	17.3 (1.3)	6.8 (1.2)
Age(c)					
25-34	1.1 (0.4)	6.3 (1.3)	2.6 (0.4)	8.6 (1.2)	4.9 (1.0)
35-44	6.7 (0.9)	10.8 (1.9)	5.4 (0.8)	14.4 (1.4)	8.7 (1.0)
45-54	11.5 (1.9)	9.4 (2.2)	14.0 (1.3)	20.7 (1.9)	10.3 (1.4)
55-64	12.9 (1.9)	16.3 (2.7)	11.6 (1.5)	27.4 (2.2)	12.1 (1.5)
65+	18.3 (2.2)	16.5 (4.4)	3.3 (1.3)(d)	33.6 (1.5)	18.5 (2.0)
Females, total(a)	9.9 (0.5)	6.8 (0.7)	3.2 (0.3)(d)	21.3 (0.6)	11.2 (0.5)
Education(b)					
Elementary	13.5 (0.9)	9.0 (0.8)(e)	4.4 (0.7)	23.3 (1.6)	12.1 (1.3)
Secondary	10.8 (0.8)	4.8 (1.2)(f)	3.0 (0.3)	22.6 (1.0)	10.5 (0.6)
Post secondary	3.8 (1.0)	6.2 (1.4)	1.9 (0.4)	18.5 (1.1)	9.6 (1.0)
University	7.5 (2.1)	10.3 (3.5)	1.9 (0.8)	16.2 (1.5)	11.7 (1.4)
Age(c)					
25-34	1.4 (0.5)	1.5 (0.6)	0.5 (0.2)	8.2 (1.1)	3.5 (0.6)
35-44	8.0 (1.0)	7.5 (1.5)	2.2 (0.6)	13.8 (1.4)	5.8 (0.9)
45-54	12.6 (1.3)	9.1 (1.8)	5.3 (0.8)	22.1 (1.8)	12.8 (1.4)
55-64	16.9 (1.9)	6.8 (1.8)	7.3 (1.0)	30.7 (1.7)	13.3 (1.4)
65+	15.4 (1.6)	12.9 (2.9)	5.7 (1.5)(d)	42.0 (1.3)	25.5 (1.5)

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) upper age group truncated at age 69
(e) includes incompleted secondary
(f) secondary completed
* diastolic blood pressure greater than or equal to 100 mmHg
** General Social Survey asked, "Have you ever been told by a doctor or nurse that you have high blood pressure?" Health Promotion Survey asked, "As far as you know, is your blood pressure high?"

Table 13: Prevalence of obesity* by age and educational attainment, by sex, persons aged 25 years and over, Canada, 1971-1985 (percentage of population; estimated standard errors in parentheses)

Sex / Education / Age	Height & weight measured			Height & weight reported	
	Nutrition Canada Survey (1971)	Canada Health Survey (1978)	Canada Fitness Survey (1981)	General Social Survey (1985)	Health Promotion Survey (1985)
Males, total(a)	8.0 (0.6)	11.4 (1.0)	9.6 (0.5)(d)	7.5 (0.5)	6.8 (0.5)
Education(b)					
Elementary	9.8 (1.1)	13.8 (1.3)(e)	14.2 (1.8)	11.2 (1.5)	13.0 (2.4)
Secondary	9.1 (0.9)	9.8 (1.9)(f)	10.4 (0.7)	7.1 (0.8)	6.9 (0.6)
Post secondary	5.0 (1.5)	12.6 (2.2)	7.8 (0.9)	5.6 (0.8)	4.6 (0.8)
University	5.1 (1.2)	8.6 (2.2)	4.2 (0.8)	4.4 (0.8)	3.4 (0.9)
Age(c)					
25-34	8.0 (1.3)	11.5 (1.8)	7.1 (1.2)	4.6 (0.9)	6.2 (1.6)
35-44	5.1 (0.8)	12.7 (2.1)	11.4 (1.2)	9.7 (1.3)	6.9 (1.2)
45-54	6.3 (1.1)	11.9 (2.4)	12.5 (1.2)	9.9 (1.4)	11.9 (1.5)
55-64	12.5 (2.0)	11.4 (2.5)	14.1 (1.5)	6.8 (1.2)	7.3 (1.2)
65+	7.3 (1.2)	7.2 (2.4)	9.7 (2.3)(d)	6.5 (0.7)	4.1 (0.9)
Females, total(a)	16.9 (0.6)	18.5 (1.0)	12.2 (0.5)(d)	11.7 (0.5)	9.9 (0.5)
Education(b)					
Elementary	26.7 (1.3)	26.8 (1.3)(e)	18.0 (1.7)	15.3 (1.5)	18.0 (2.1)
Secondary	16.8 (1.0)	15.8 (2.1)(f)	11.7 (0.6)	11.8 (0.8)	8.7 (0.5)
Post secondary	10.2 (1.5)	16.1 (2.1)	9.8 (0.9)	8.1 (0.8)	5.5 (0.7)
University	7.3 (2.2)	8.7 (3.1)	3.7 (0.9)	6.6 (1.0)	5.5 (1.0)
Age(c)					
25-34	10.0 (1.2)	7.2 (1.2)	7.4 (1.2)	6.8 (1.0)	7.6 (1.3)
35-44	10.0 (1.0)	14.3 (1.9)	10.9 (1.0)	9.9 (1.2)	9.4 (1.4)
45-54	18.6 (1.6)	20.3 (2.7)	19.4 (1.4)	13.7 (1.4)	11.8 (1.4)
55-64	21.9 (1.9)	33.7 (3.8)	17.0 (1.4)	15.5 (1.4)	14.2 (1.4)
65+	39.5 (2.1)	23.2 (3.2)	24.7 (2.8)(d)	14.1 (0.9)	9.1 (0.9)

Note: * Obesity defined as Quetelet index greater than or equal to 30 for males; greater than or equal to 28.6 for females.

(a) age- and education-adjusted to 1981 census population

(b) age-adjusted to 1981 census population

(c) education-adjusted to 1981 census population

(d) upper age group truncated at age 69

(e) includes incompleted secondary

(f) secondary completed

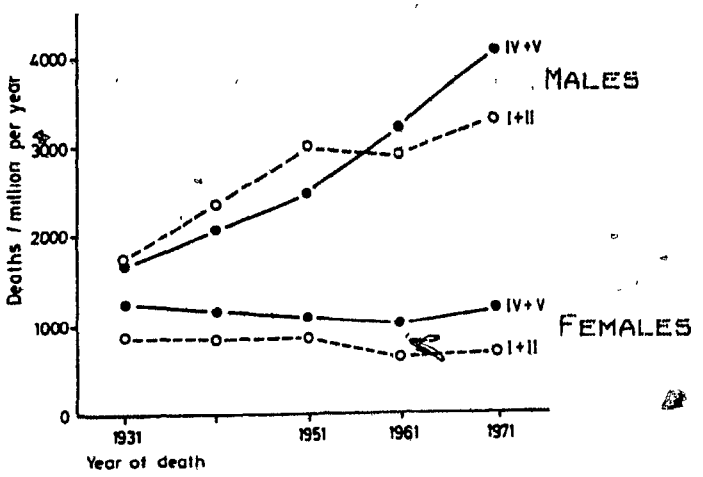
Table 14: Prevalence of physical inactivity (as defined in each survey), by age and educational attainment, and sex, persons 25 years and over, Canada 1971-1985 (percentage of population; estimated standard errors in parentheses)

Sex / Education / Age	Survey: Canada Health (1978)	Canada Fitness (1981)	General Social (1985)	Health Promotion (1985)
Males, total(a)	40.4 (0.8)	9.1 (0.4)(d)	59.8 (0.7)	25.7 (0.8)
Education(b)				
Elementary	51.4 (0.9)(e)	17.8 (1.8)	79.0 (2.5)	39.4 (3.2)
Secondary	39.5 (1.6)(f)	8.9 (0.5)	65.6 (1.4)	26.8 (1.0)
Post secondary	37.4 (1.7)	5.7 (0.7)	52.2 (1.6)	17.4 (1.5)
University	30.6 (1.9)	4.7 (0.7)	36.9 (1.6)	18.4 (1.8)
Age(c)				
25-34	35.5 (1.2)	9.8 (1.3)	40.6 (2.1)	18.6 (2.1)
35-44	39.7 (1.6)	9.6 (0.9)	59.7 (1.6)	22.9 (1.9)
45-54	40.8 (1.8)	9.5 (0.9)	74.0 (2.0)	33.5 (2.2)
55-64	44.9 (2.2)	13.4 (1.2)	74.4 (2.2)	37.5 (2.3)
65+	46.7 (3.1)	12.6 (1.5)(d)	75.2 (1.4)	26.6 (2.0)
Females, total(a)	41.9 (0.7)	12.1 (0.4)(d)	65.8 (0.7)	29.2 (0.7)
Education(b)				
Elementary	47.0 (0.8)(e)	23.9 (1.7)	85.3 (1.8)	37.2 (2.6)
Secondary	42.7 (1.4)(f)	11.6 (0.5)	67.4 (1.1)	28.5 (0.8)
Post secondary	34.7 (1.4)	7.6 (0.6)	55.4 (1.4)	22.2 (1.3)
University	38.4 (2.5)	5.1 (0.8)	52.3 (1.9)	17.4 (1.6)
Age(c)				
25-34	37.1 (1.1)	13.9 (1.3)	52.7 (1.7)	20.7 (1.7)
35-44	32.8 (1.4)	14.0 (1.0)	65.6 (1.5)	28.5 (1.9)
45-54	41.3 (1.7)	15.3 (1.0)	69.8 (1.9)	26.8 (1.9)
55-64	40.0 (2.0)	15.9 (1.0)	72.5 (1.7)	31.5 (1.7)
65+	60.8 (2.3)	16.5 (1.7)(d)	87.8 (0.9)	37.8 (1.6)

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) upper age group truncated at age 69
(e) includes incompleted secondary
(f) secondary completed

Definitions:
CHS: Physical Activity Index of 0-749 points (e.g. only activity in past 2 weeks was walking 15 minutes each day)
CFS: <3 hours/week participation in a physical activity for <9 months per year
GSS: No participation in active physical activity in past 3 months
HPS: Never exercise for at least 15 minutes

FIGURE 1: MORTALITY FROM NON-VALVULAR HEART DISEASE DURING 1931-71 IN MEN AND MARRIED WOMEN IN ENGLAND AND WALES, AGES 35 TO 64, ACCORDING TO SOCIAL CLASS (I+II VERSUS IV+V)



SOURCE: MARMOT ET AL., 1978.

FIGURE 2: AGE-ADJUSTED PREVALENCE OF CURRENT SMOKERS BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1985 (ORDERED BY EDUCATION, BY SURVEY)

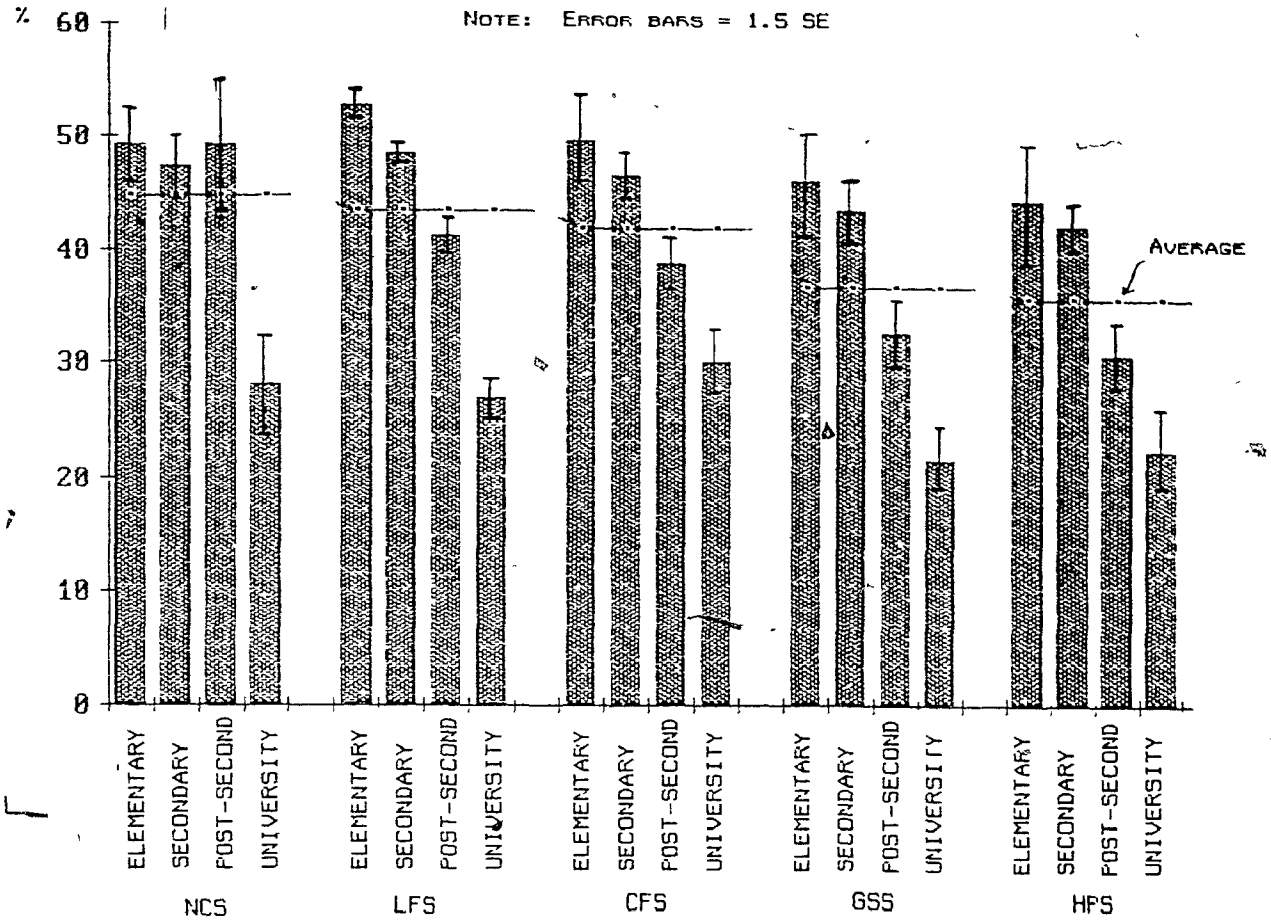


FIGURE 3: AGE-ADJUSTED PREVALENCE OF CURRENT SMOKERS BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1985 (ORDERED BY EDUCATION, BY SURVEY)

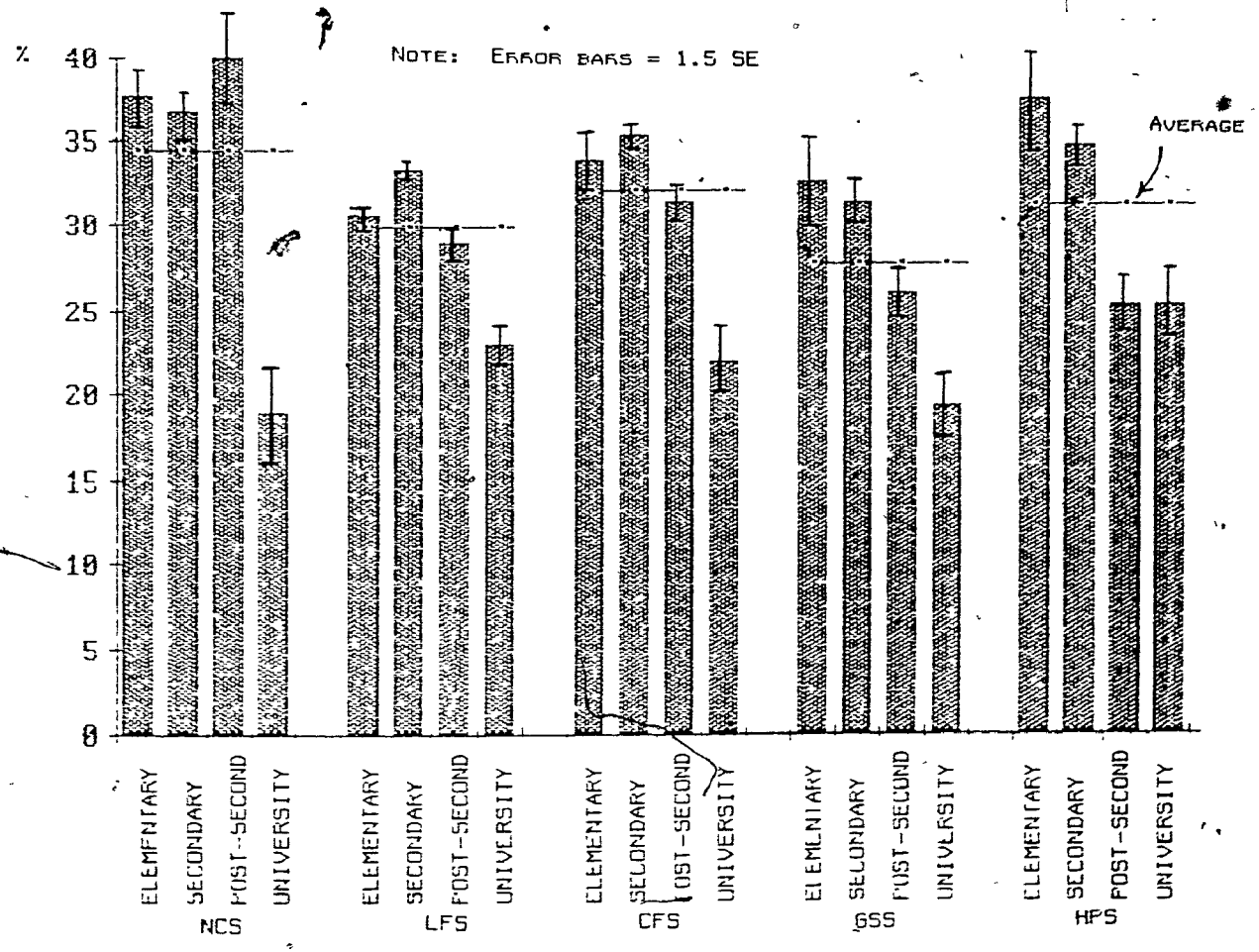


FIGURE 4: AGE-ADJUSTED PREVALENCE OF CURRENT SMOKERS BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1985 (ORDERED BY SURVEY, BY EDUCATION)

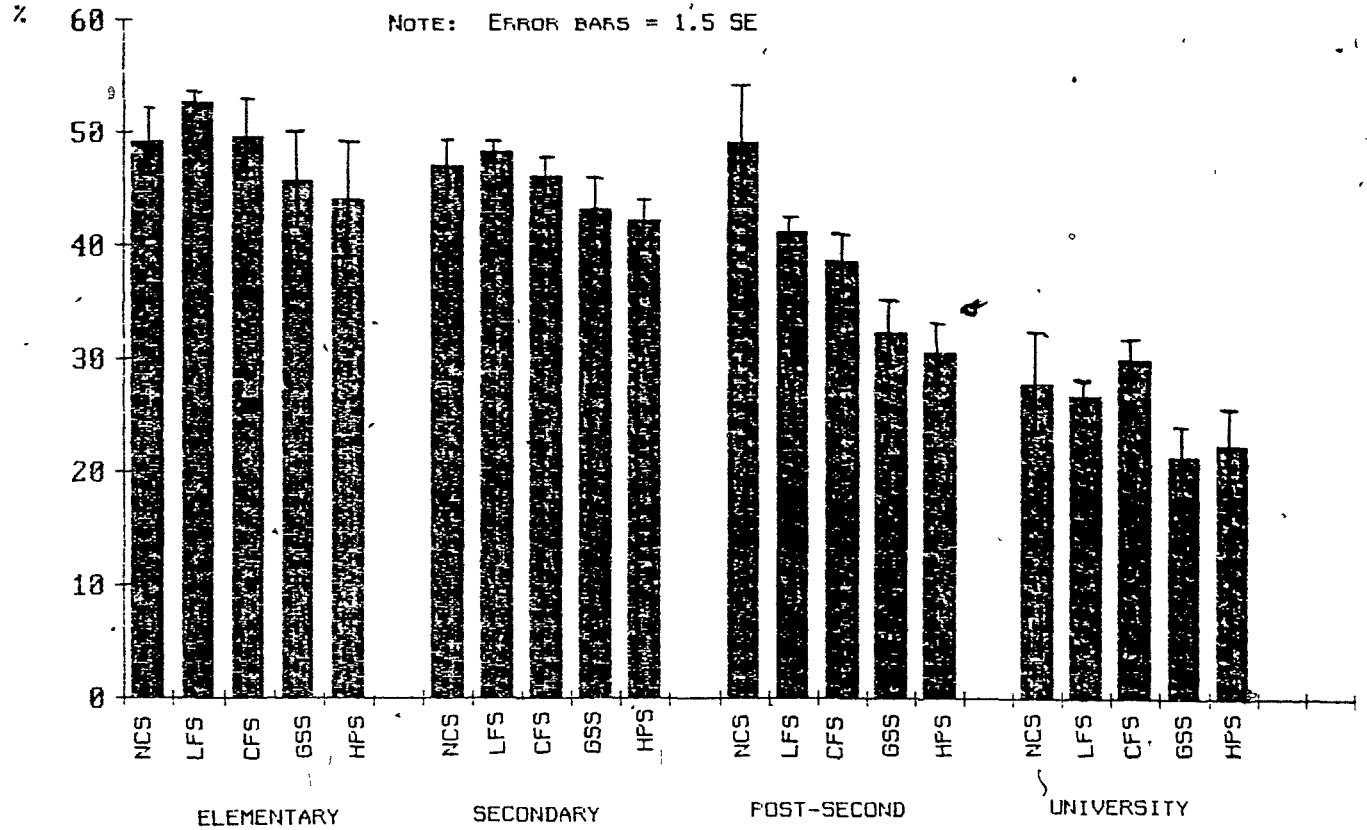


FIGURE 5: AGE-ADJUSTED PREVALENCE OF CURRENT SMOKERS BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1985 (ORDERED BY SURVEY, BY EDUCATION)

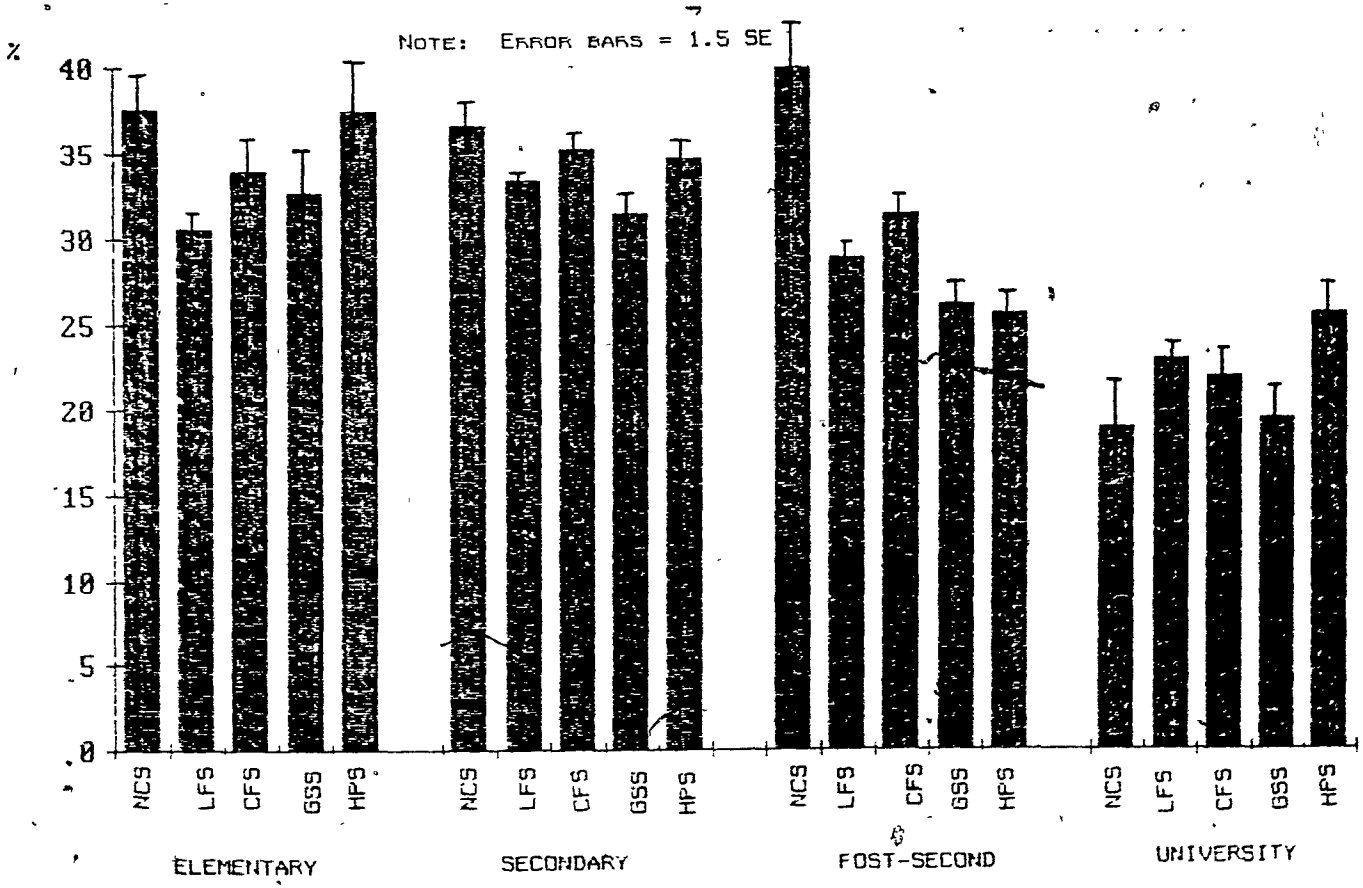


FIGURE 6: AGE-ADJUSTED PREVALENCE OF ELEVATED SERUM CHOLESTEROL BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1978 (ORDERED BY EDUCATION, BY SURVEY)

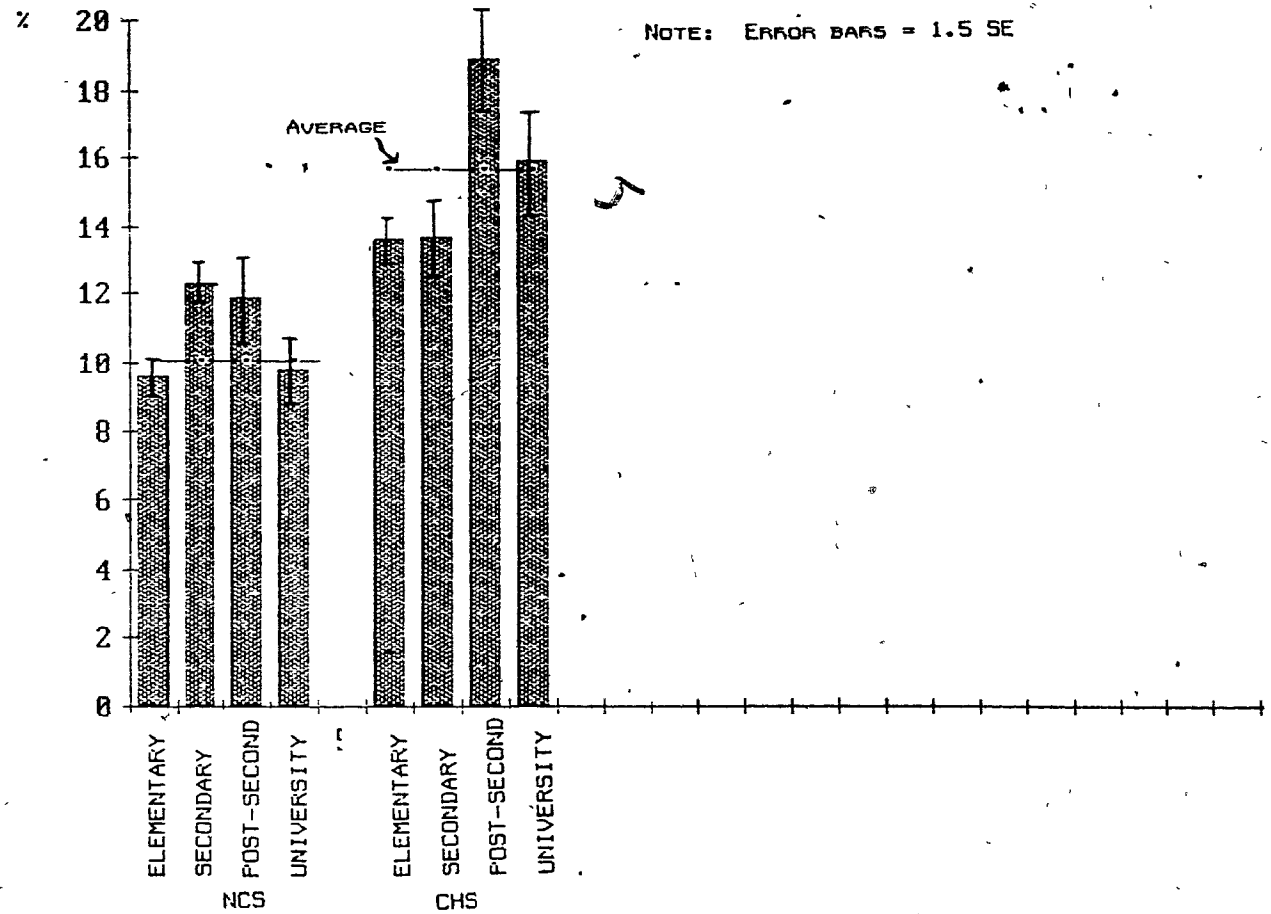
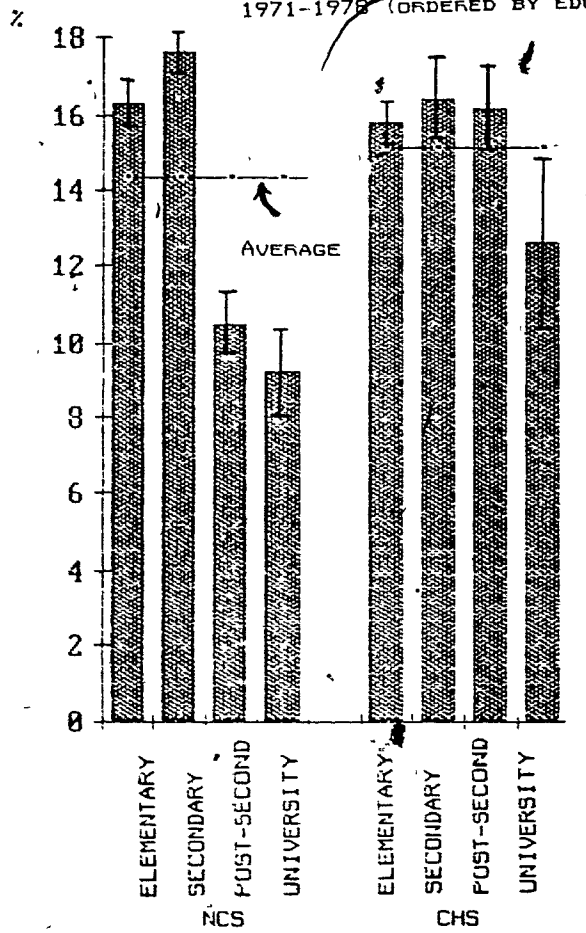


FIGURE 7: AGE-ADJUSTED PREVALENCE OF ELEVATED SERUM CHOLESTEROL BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1978 (ORDERED BY EDUCATION, BY SURVEY)



NOTE: ERROR BARS = ±1.5 SE

FIGURE 8: AGE-ADJUSTED PREVALENCE OF ELEVATED SERUM CHOLESTEROL BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1978 (ORDERED BY SURVEY, BY EDUCATION)

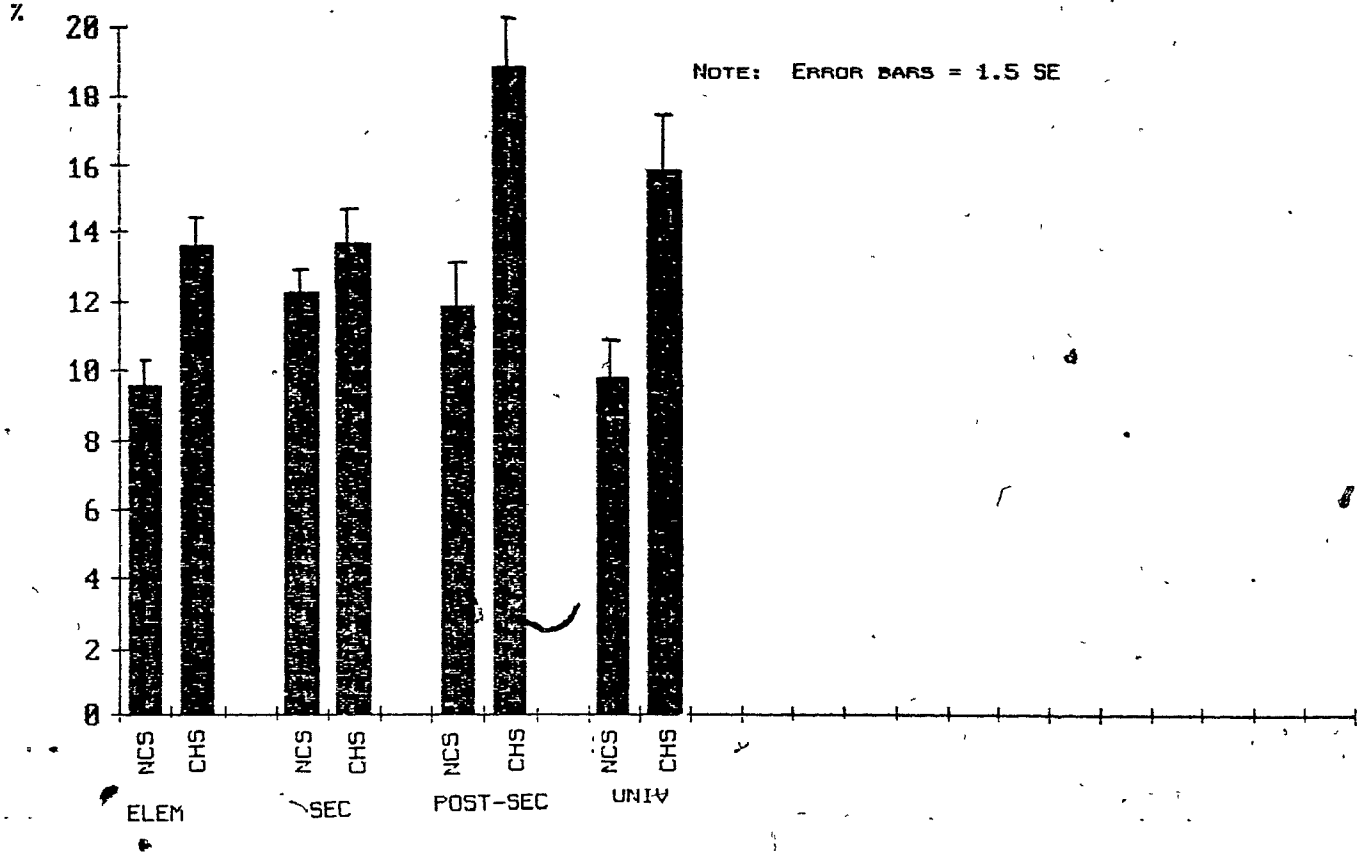


FIGURE 9: AGE-ADJUSTED PREVALENCE OF ELEVATED SERUM CHOLESTEROL BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1978 (ORDERED BY SURVEY, BY EDUCATION)

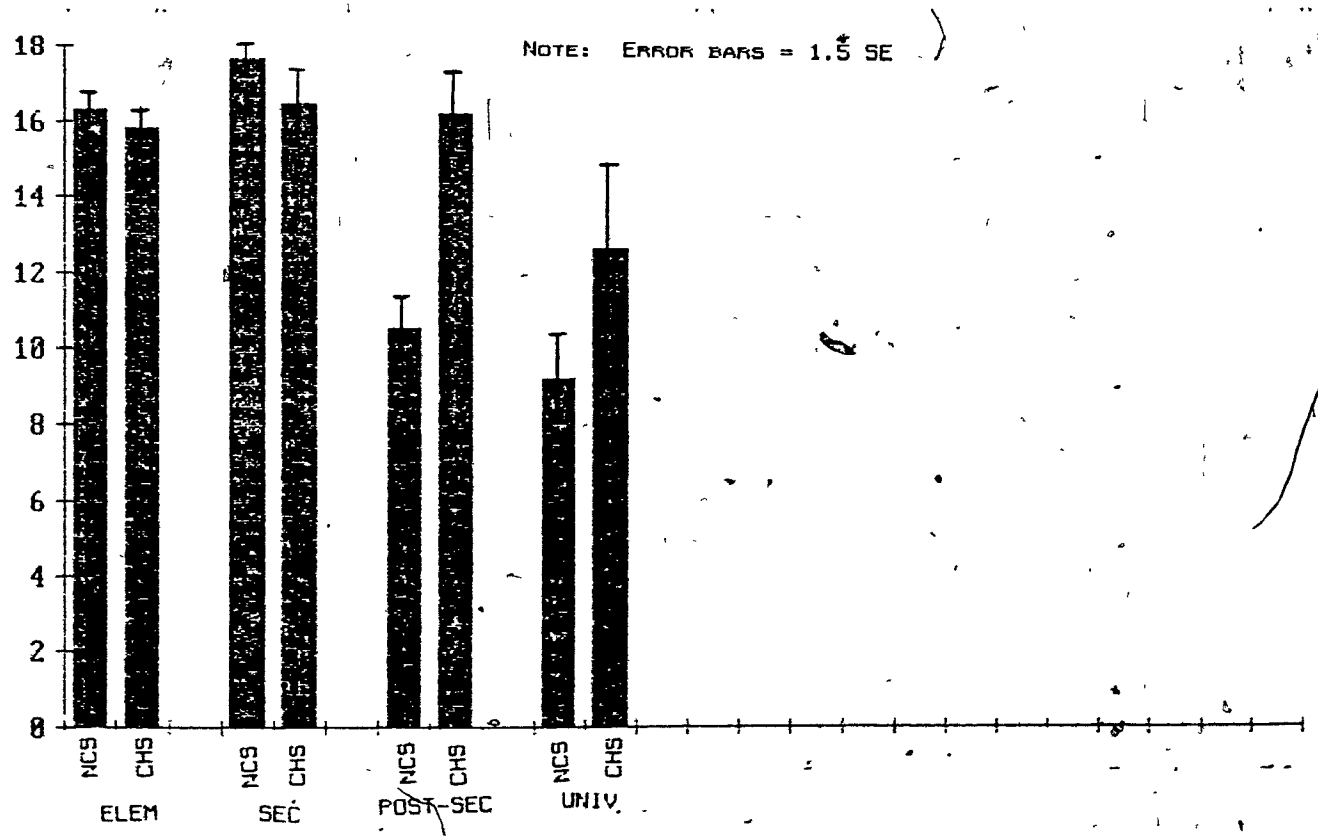


FIGURE 10: AGE-ADJUSTED PREVALENCE OF HYPERTENSION BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1981
(ORDERED BY EDUCATION, BY SURVEY)

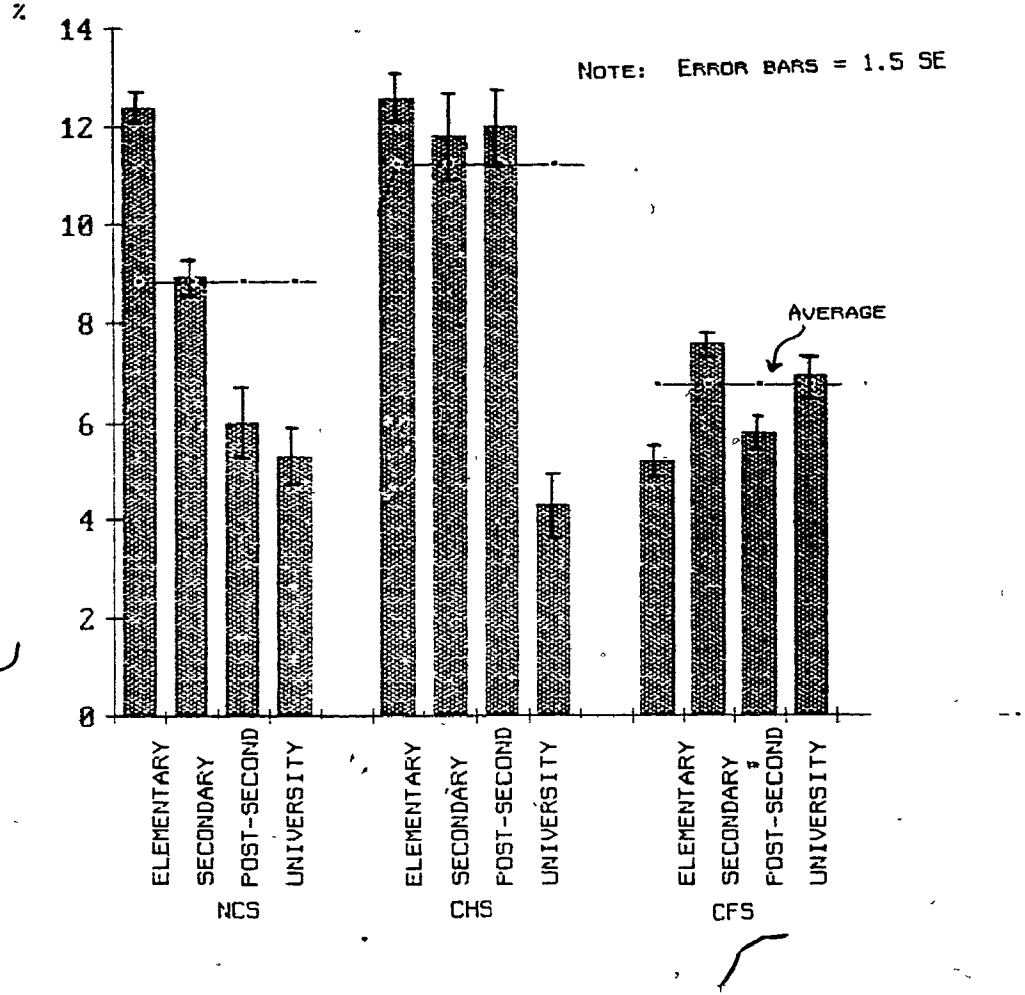


FIGURE 11: AGE-ADJUSTED PREVALENCE OF HYPERTENSION BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY EDUCATION, BY SURVEY)

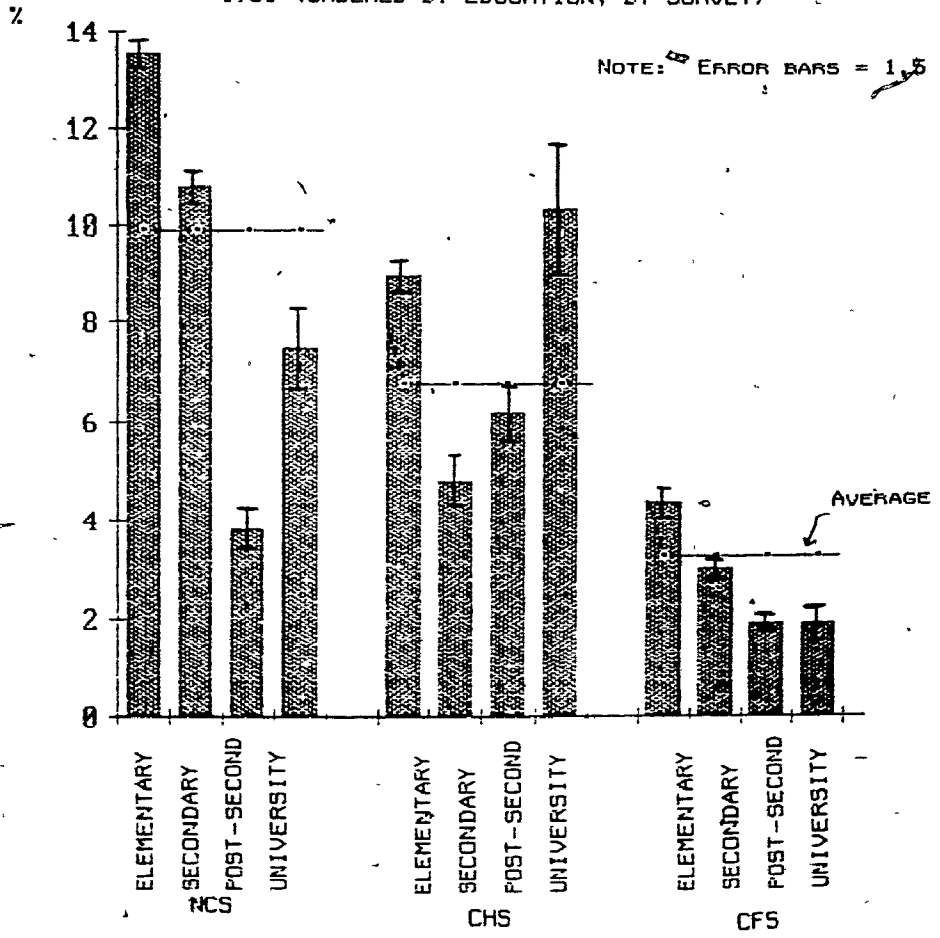


FIGURE 12: AGE-ADJUSTED PREVALENCE OF HYPERTENSION BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY SURVEY, BY EDUCATION)

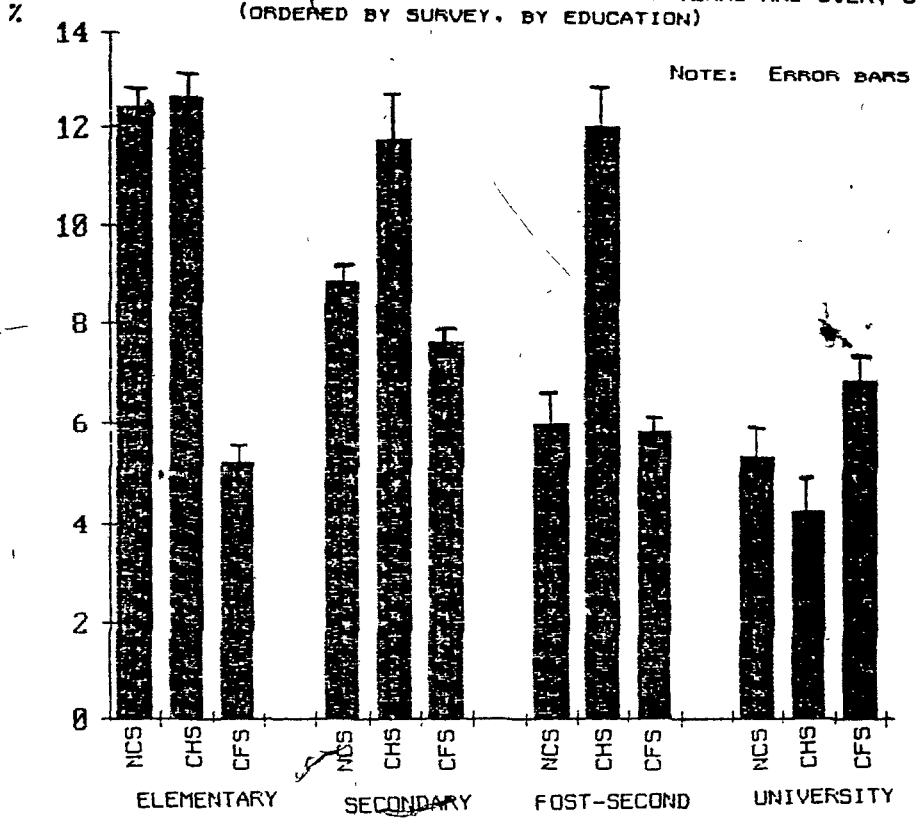


FIGURE 13: AGE-ADJUSTED PREVALENCE OF HYPERTENSION BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY SURVEY, BY EDUCATION)

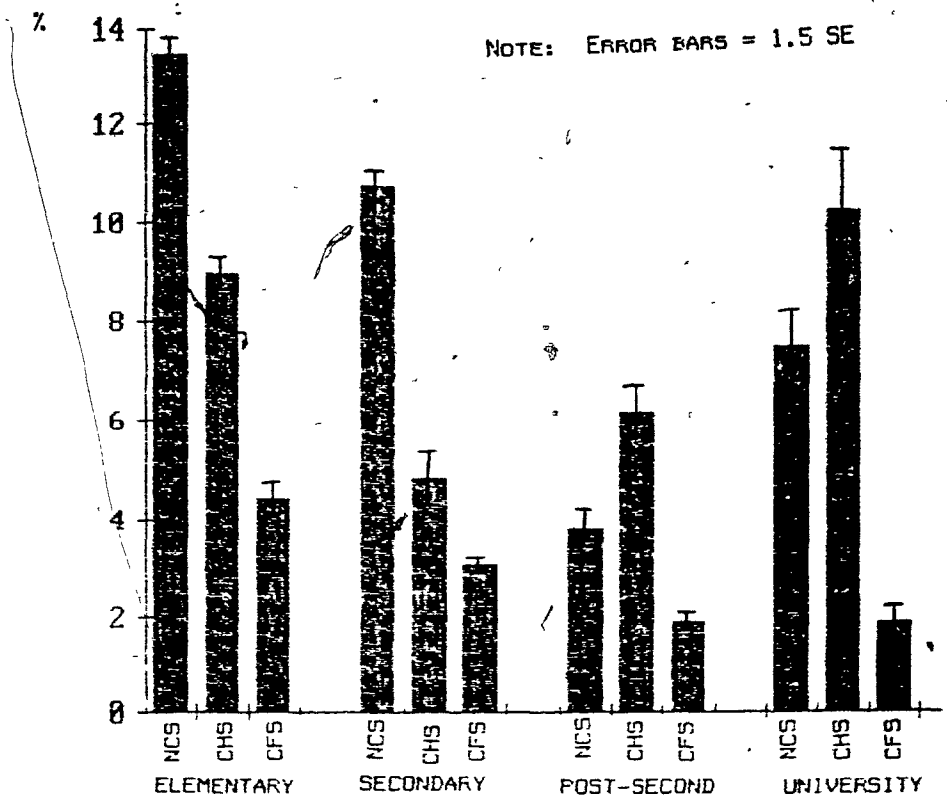


FIGURE 14: AGE-ADJUSTED PREVALENCE OF REPORTED HYPERTENSION BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1981

NOTE: ERROR BARS = 1.5 SE

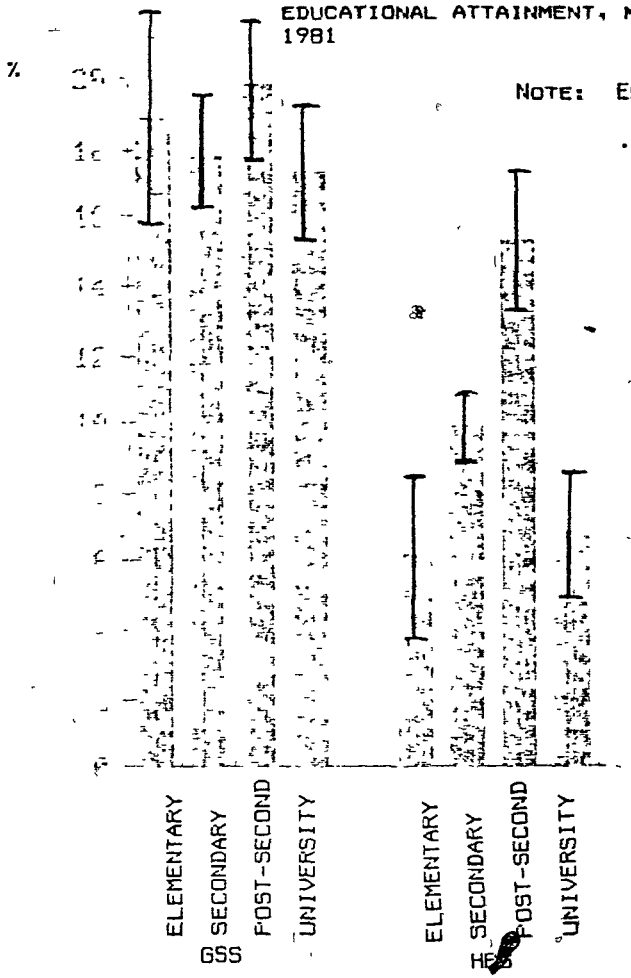


FIGURE 15: AGE-ADJUSTED PREVALENCE OF REPORTED HYPERTENSION BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1981

NOTE: ERROR BARS = 1.5 SE

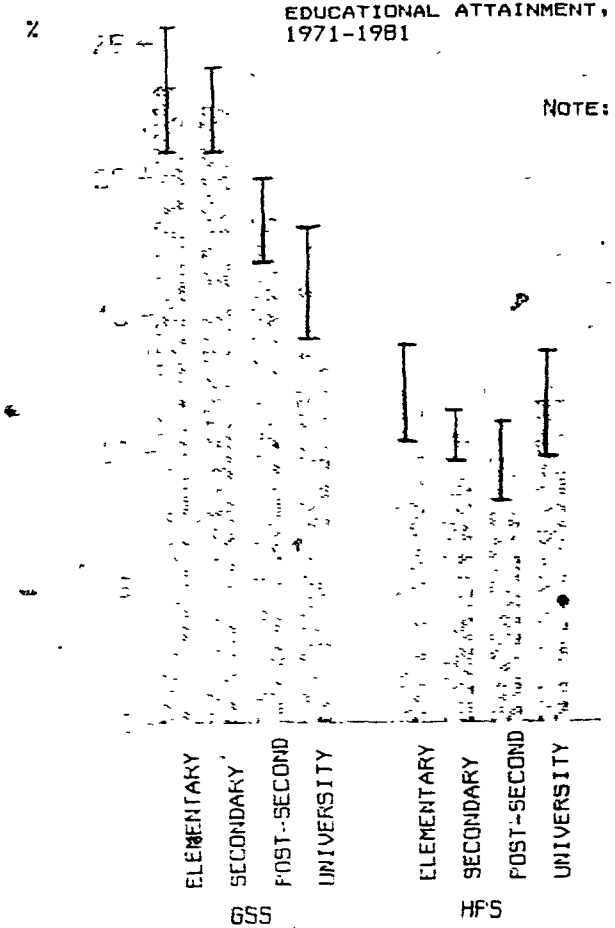


FIGURE 16: AGE-ADJUSTED PREVALENCE OF OBESITY BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY EDUCATION, BY SURVEY)

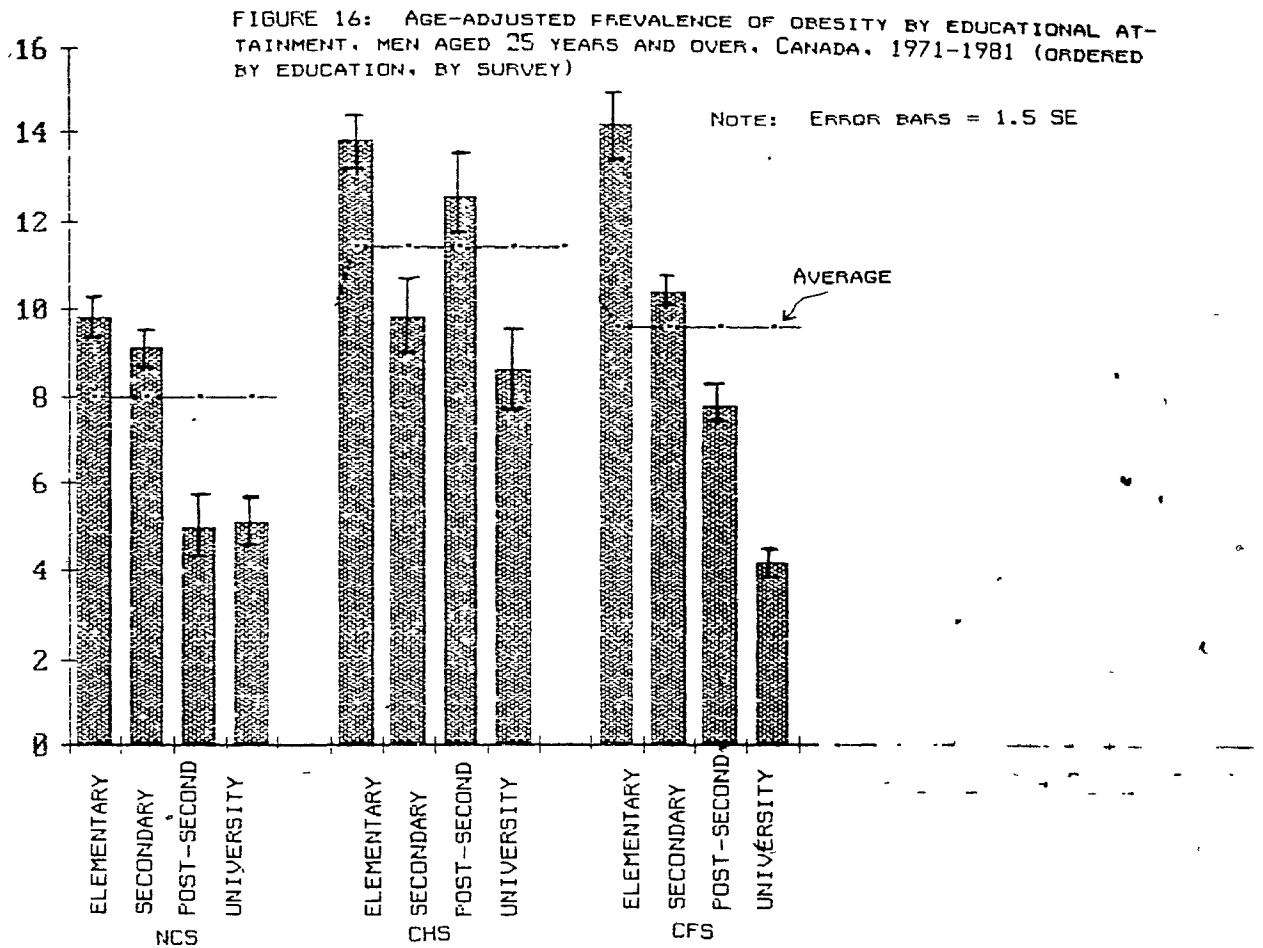


FIGURE 17: AGE-ADJUSTED PREVALENCE OF OBESITY BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY EDUCATION, BY SURVEY)

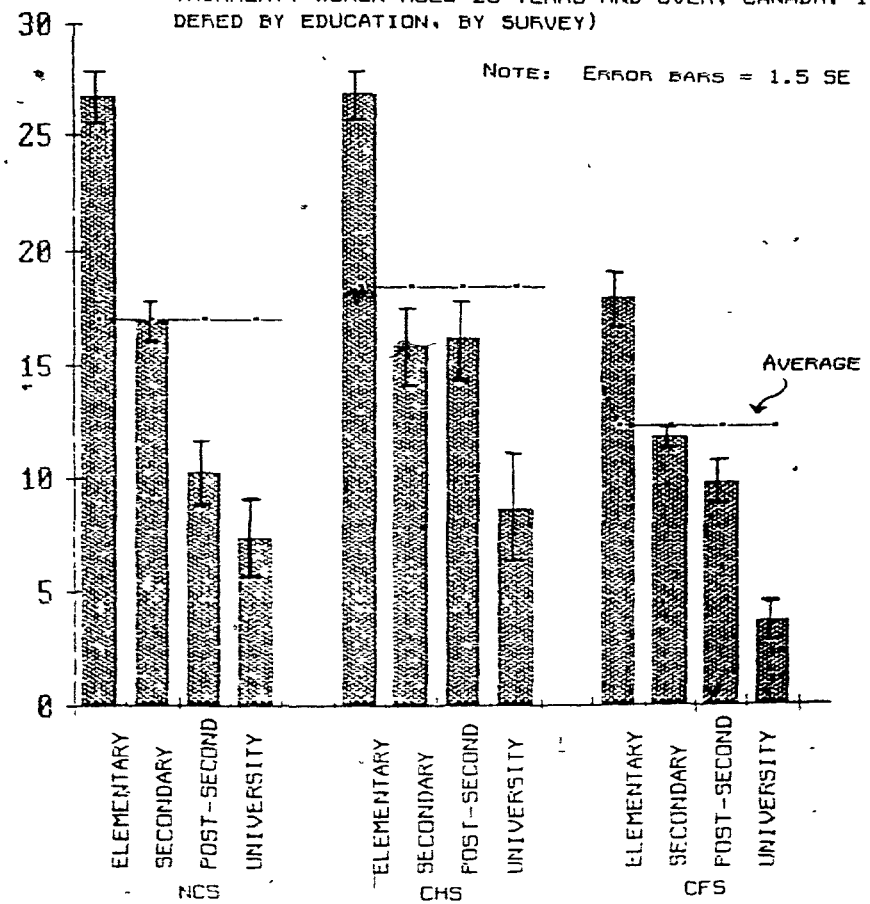


FIGURE 18: AGE-ADJUSTED PREVALENCE OF OBESITY BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY SURVEY, BY EDUCATION)

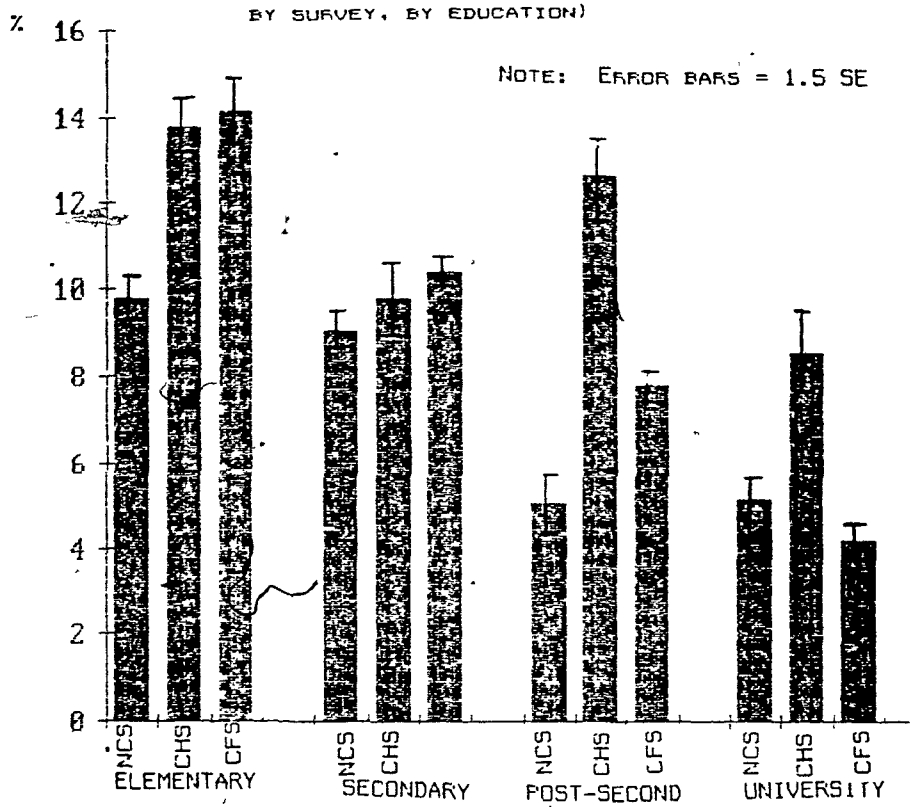


FIGURE 19: AGE-ADJUSTED PREVALENCE OF OBESITY BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1971-1981 (ORDERED BY SURVEY, BY EDUCATION)

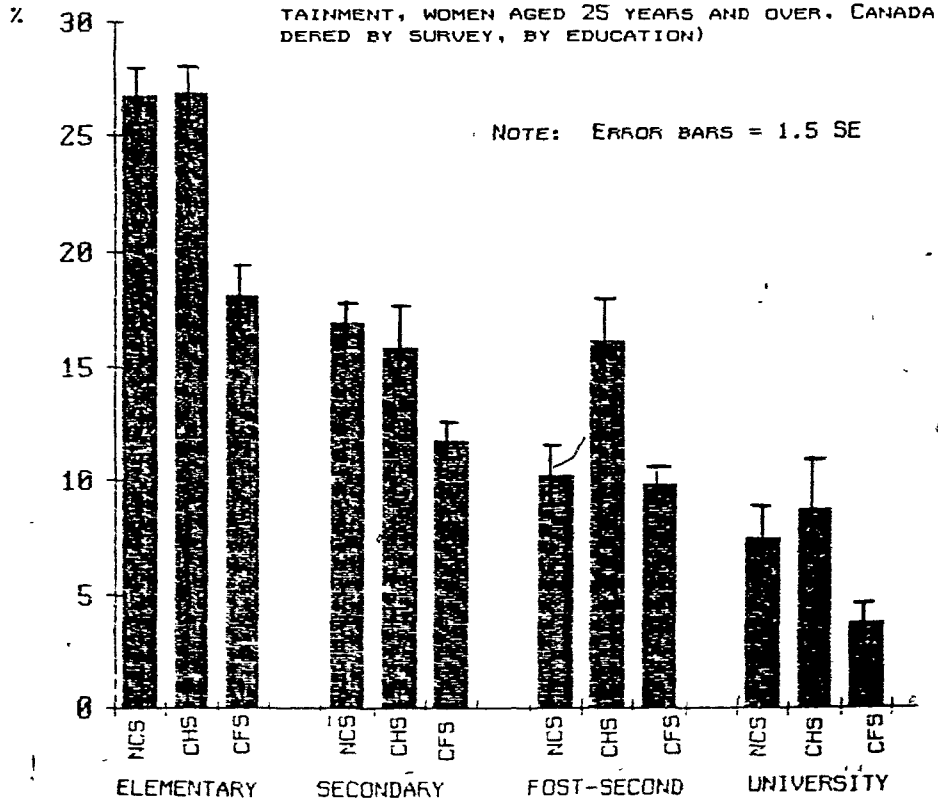


FIGURE 20: AGE-ADJUSTED PREVALENCE OF OBESITY (FROM SELF-REPORTED HEIGHT AND WEIGHT) BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1985 (ORDERED BY EDUCATION, BY SURVEY)

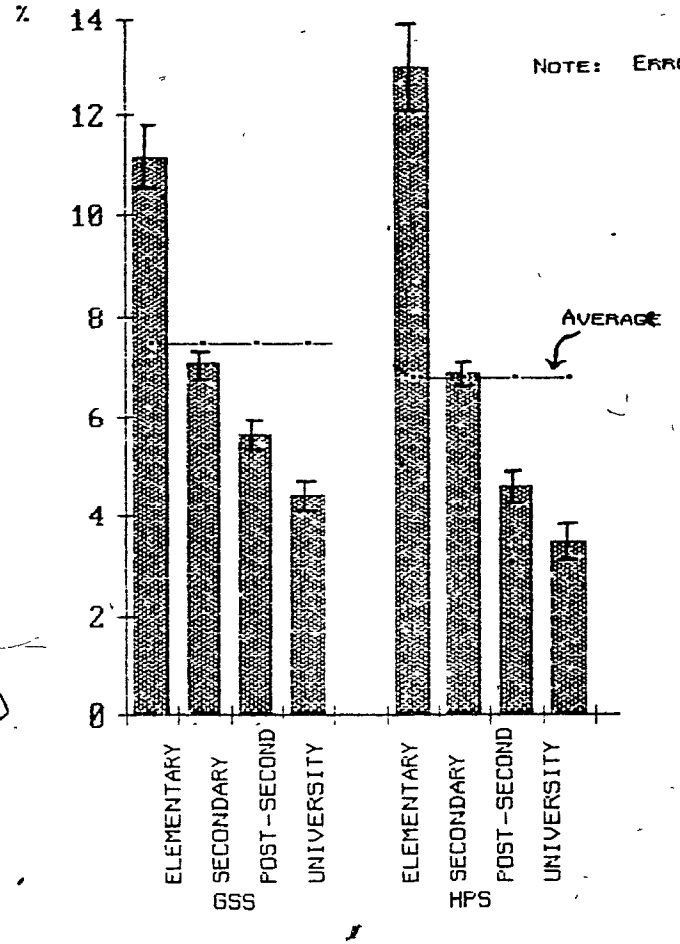


FIGURE 21: AGE-ADJUSTED PREVALENCE OF OBESITY (FROM SELF-REPORTED HEIGHT AND WEIGHT) BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1985 (ORDERED BY EDUCATION, BY SURVEY)

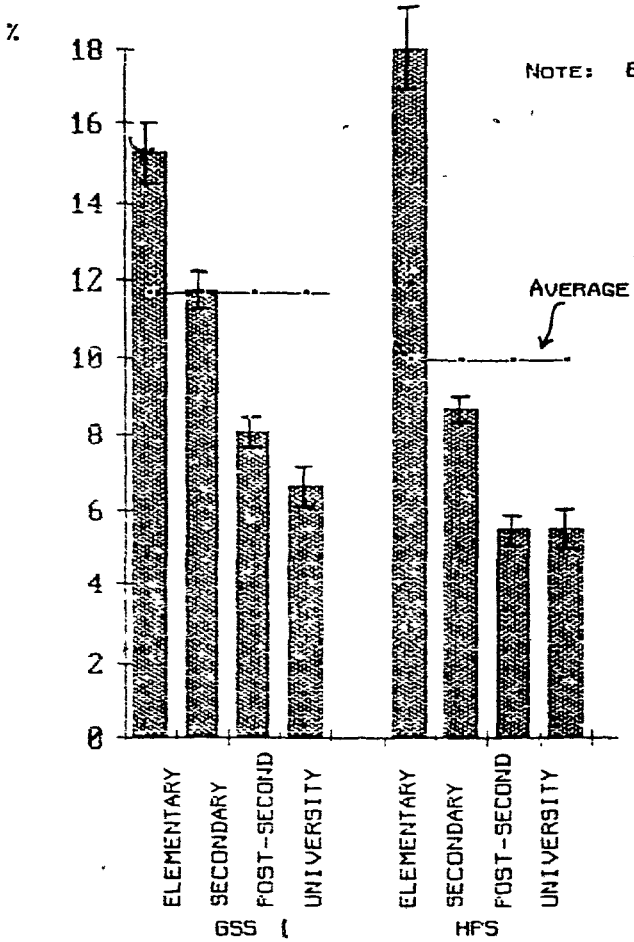


FIGURE 22: AGE-ADJUSTED PREVALENCE OF OBESITY (FROM SELF-REPORTED HEIGHT AND WEIGHT) BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1985 (ORDERED BY SURVEY, BY EDUCATION)

NOTE: ERROR BARS = 1.5 SE

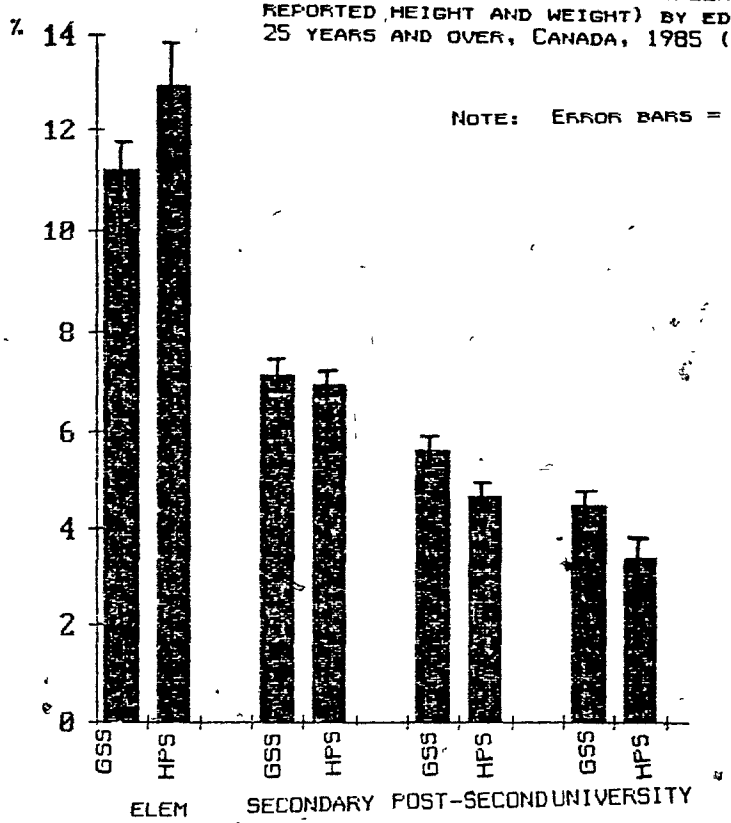


FIGURE 23: AGE-ADJUSTED PREVALENCE OF OBESITY (FROM SELF-REPORTED HEIGHT AND WEIGHT) BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1985 (ORDERED BY SURVEY, BY EDUCATION)

NOTE: ERROR BARS = 1.5 SE

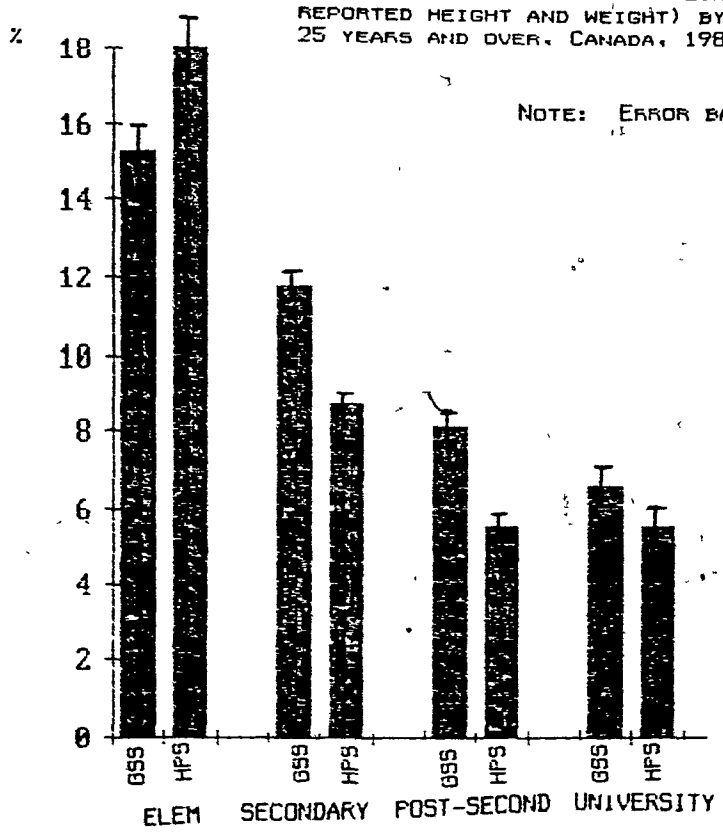


FIGURE 24: AGE-ADJUSTED PREVALENCE OF PHYSICAL INACTIVITY BY EDUCATIONAL ATTAINMENT, MEN AGED 25 YEARS AND OVER, CANADA, 1978-1985

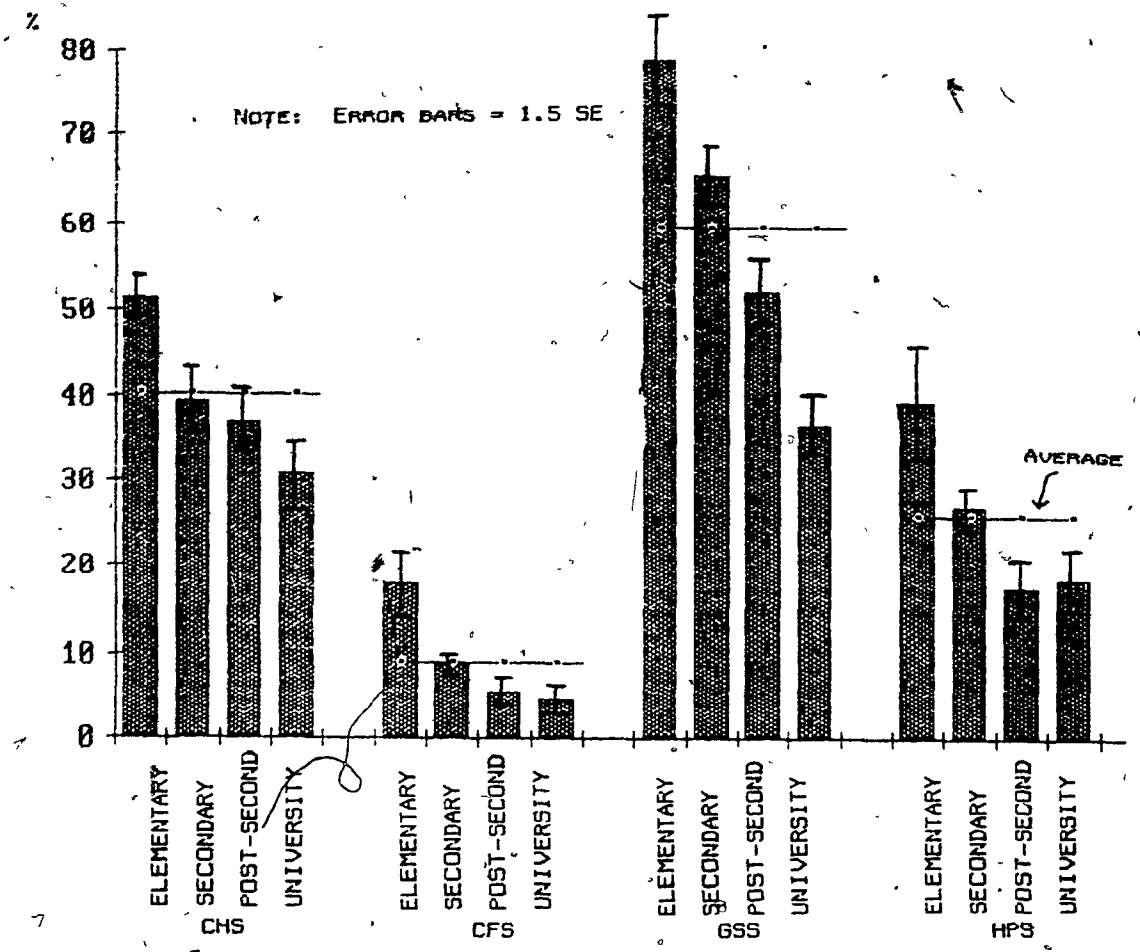
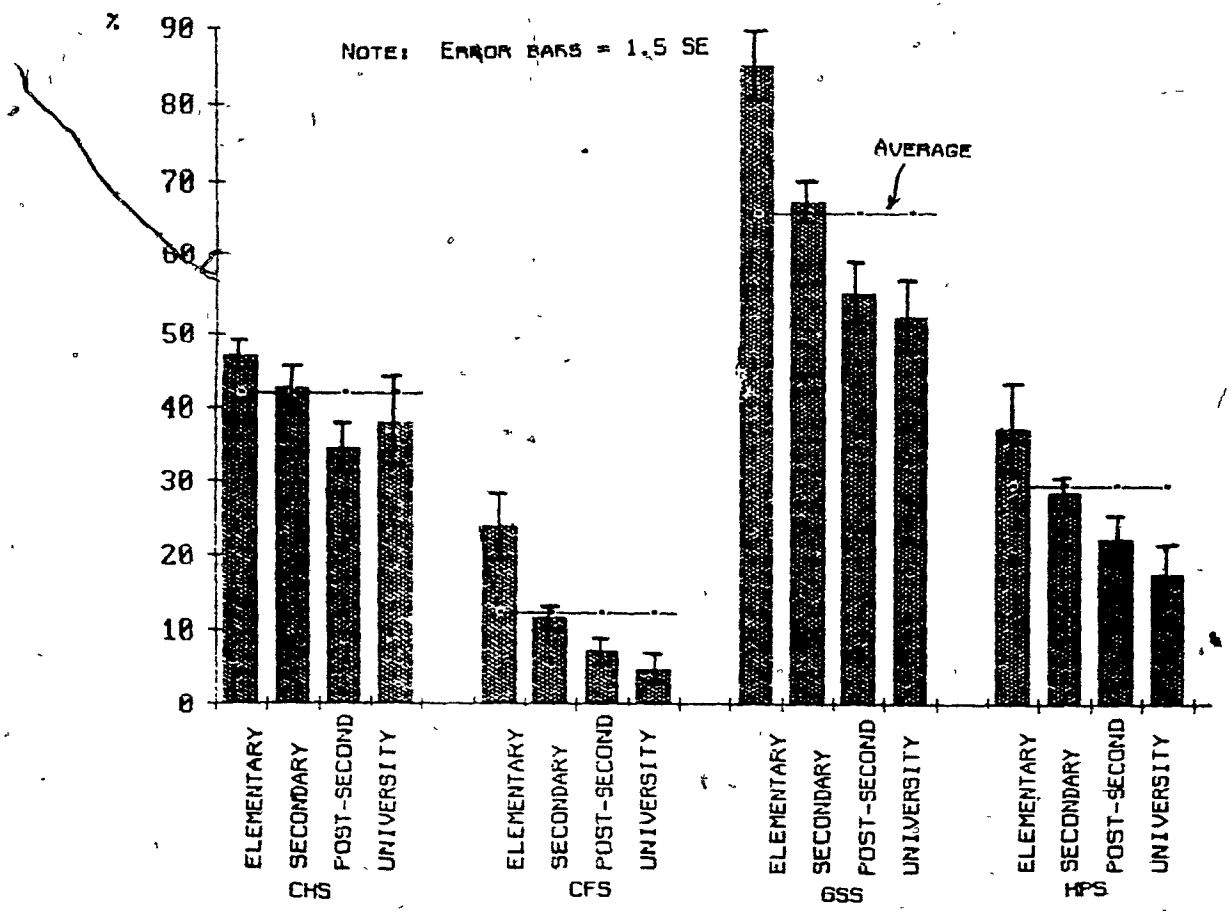


FIGURE 25: AGE-ADJUSTED PREVALENCE OF PHYSICAL INACTIVITY BY EDUCATIONAL ATTAINMENT, WOMEN AGED 25 YEARS AND OVER, CANADA, 1978-1985



APPENDIX 1:
QUESTIONNAIRE ITEMS
RELATED TO RISK FACTOR VARIABLES

QUESTIONNAIRE ITEMS RELATED TO (CURRENT) CIGARETTE SMOKING

Nutrition Canada Survey
Health Review (6 years and over)

J. Do you smoke cigarettes?
-Yes -No

If "yes"-do you usually smoke them every day?
-Yes -No

How many cigarettes do you smoke each day?

_____

For how long? (No. of years):

_____

If you do not now usually smoke cigarettes every day, did you ever do so in the past?
-Yes -No
How many per day?

_____
For how long (No. of Years):

_____
When did you last smoke cigarettes regularly?
Month_____ Year_____

Canada Fitness Survey
Lifestyle and your Health Section

24. Which of the following best describes your experience with tobacco? Check all that apply.
- -I haven't smoked
- -I currently smoke:
  - -cigarettes occasionally
  - -less than 1/2 pack of cigarettes daily
  - -about a pack of cigarettes daily
  - -two or more packs of cigarettes daily
  - -a pipe, cigar or cigarillo occasionally
  - -a pipe, cigar or cigarillo daily
- -I stopped smoking:
  - -cigarettes recently
  - -cigarettes over a year ago
  - -a pipe, cigars or cigarillos recently
  - -a pipe, cigars or cigarillos over a year ago

General Social Survey
Health and Social Support Questionnaire
Section G

53. At the present time do you smoke cigarettes daily, occasionally or not at all?
--Daily
--Occasionally
--Not at all

54. At what age did you start smoking cigarettes daily?

Don't know

55. About how many cigarettes do you smoke each day?
------

56. What brand of cigarettes do you usually smoke?

Health Promotion Survey

27. At the present time do you smoke cigarettes?
Yes
No

28. Do you smoke cigarettes regularly, that is usually everyday or occasionally, not every day?
Regularly_____
Occasionally_____

Labour Force Survey Smoking Supplement

10. Has _____ever smoked cigarettes, cigars or a pipe?
    Yes
    No

15. At the present time does _____smoke cigarettes?
    Yes
    No

16. At the present time does _____smoke cigarettes regularly (usually every day) or occasionally (not every day)?
    Regularly
    Occasionally

17. At what age did _____start smoking?
    _____

18. How many cigarettes does _____ usually smoke per day?
    _____

19. Does _____usually inhale the smoke?
    Yes
    No

20. What kind of cigarettes does _____usually smoke? (Brand, size, filter, non-filter)
    _____

21. Is this the same kind of cigarette that _____was smoking 12 months ago?
    Yes
    No

22. Compared to 12 months ago, is ____ now smoking more, less or smoking about the same amount?
    ___Smokes more
    ___Smokes less
    ___Smokes about the same

QUESTIONNAIRE ITEMS RELATED TO HYPERTENSION

Nutrition Canada Survey
Form #9
Page 1

Item N. Chest and Cardiovascular System:
Diastolic Blood Pressure:
(Record only if over 100) Sitting: __ __ __

Canada Health Survey
Physical Measures Questionnaire

Item 8. Blood Pressure
Assure 5 minute rest period with no postural change prior to measurement

A. Arm girth __.__ cm
B. Cuff size
Child (24.0 cm or smaller)
Regular (24.1 cm to 35.0 cm)
Large (35.1 cm or larger)
C. Was blood pressure taken on right arm?
D. Record 3 phases
__ __ __ mmHg.
__ __ __ mmHg
__ __ __ mmHg

Canada Fitness Survey
Physical Measures Questionnaire

(Same as Canada Health Survey)

General Social Survey
Health and Social Support Questionnaire
Section A

Item 3. Have you ever been told by a doctor or nurse that you have high blood pressure?
Yes ___
No ___
Don't know ___

Health Promotion Survey

Item 18. When did you last have your blood pressure checked?

Last 6 months ___
6-12 months ___
one to two years ___
more than 2 years ___
never ___

SURVEY QUESTIONS RELATED TO OBESITY

Nutrition Canada Survey
Form #6: Anthropometry

Item D. Body Weight (kg) to nearest tenth of kg ___.__
Item E. Height Standing (mm) ___.__

Canada Health Survey
Physical Measures Questionnaire

Item 5. Height
A. Measurement to the hearest 0.1 cm ___.__ cm
If unable to measure:
B. Ask respondent to state height in inches ____ in
Weight
C. Measurement to the nearest 0.1 kg ____.__ kg
If unable to measure:
D. Ask respondent to state weight in pounds ____ lbs

Canada Fitness Survey
Physical Measures Questionnaire

(Same as Canada Health Survey)

General Social Survey
Health and Social Support Questionnaire
Section E.

38. What is your height?
feet_____ inches_____ or centimetres_____
Don't know

39. What is your weight?
lbs_____ or kilograms_____

Health Promotion Survey

13. How tall are you without shoes?
feet/inches_____ or centimetres_____

14. How much do you weight?
pounds_____ or kilograms_____ don't know ___

QUESTIONNAIRE ITEMS RELATED TO PHYSICAL ACTIVITY

Canada Health Survey
"Lifestyle and Your Health" Component, page 6

2. During the last two weeks how many times did you do any of the following exercises, sports or recreational activities?

Walking (including to and from work or school)
Jogging or running
Calisthenics
Bicycling (including to and from work or school)
Bowling
Vigorous dancing
Skating
Skiing (downhill, cross country)
Curling
Racquet sports (tennis, badminton, squash, racquetball)
Baseball/Softball
Other team sports (hockey, basketball, football, soccer, volleyball)
Golf
Swimming
Other (please specify)

2a. About how much time did you spend on each occasion?
Minutes usually spent:

1 to 15
16 to 30
31 to 60
More than 60

3. During the last two weeks, how many times did you do the following tasks around your home?

Mowing the grass
Shoveling snow
Cleaning floors
Raking leaves
Gardening
Making beds
Carpentry
Handyman work, painting
Ironing
Other (please specify)

OR: I did nothing like this in the last two weeks.

3a. About how much time did you spend on each occasion?
Minutes usually spent:

1 to 15
16 to 30
31 to 60
More than 60

4. Which of the following choices best describes the work or other activity which you usually do? Check one only.

1. I am usually sitting during the day and do not walk about very much.
2. I stand or walk about quite a lot during my day, but I do not have to carry or lift things very often.
3. I usually lift or carry light loads, or I have to climb stairs or hills often.
4. I do heavy work or carry very heavy loads.

Canada Fitness Survey
Physical Activities Section

1. Daily Activities

For those activities which you do most days of the week (such as work, school and housework), how much time do you spend...

Sitting
Standing
Walking
Walking up stairs
Lifting or carrying heavy objects

(Response categories): Almost all of the time
About 3/4 of the time
About 1/2 of the time
About 1/4 of the time
Almost none of the time

2. Weekly Activities

Please refer to the reference card for a list of activities. Answer the following for the physical activities you do each week.

-Light housework and handywork: washing dishes, ironing, making beds, mowing lawn, etc.

-Heavy housework and handywork: washing and waxing floors, painting, etc.

-(Other activities).

(Responses): Number of occasions each month_____
Average time actually spent on each occasion_____

Intensity: Light: slight change from normal
Medium: Some perspiration; Above normal breathing
Medium: Heavy perspiration; Heavy breathing

3. Activities in the last Month

Please refer to the reference card for a list of activities. Answer the following for the physical activities you have done at least once in the last month. (Do not include activities already listed in Weekly Activities.)

-Gardening and cultivating such as spading, digging, weeding

-Shovelling snow

-Mowing the lawn

-(Other activities)

(Responses as in #2)

4. Activities in the last year
Please refer to the reference card for a list of activities. Answer the following for the physical activities you have done in the last 12 months. (Do not include activities you have already listed.)
-Walking for exercise
-Jogging (using short strides)
-Running (using long strides)
-Bicycling
-Home exercise (push-ups, sit-ups)
-Exercise classes
-Weight training
-Yoga
-Golf (walking and carrying clubs)
-Racquetball
-Squash
-Tennis
-Baseball
-Softball
-Ice hockey
-Curling
-Swimming at a pool
-Cross country skiing
-Alpine/Downhill skiing
-Ice skating
-(Other activities)

Responses: Number of occasions in last 12 months.
Average number of minutes spent on each occasion.

General Social Survey
Health and Social Support Questionnaire
Section F

41. Thinking back over the last 3 months did you participate in active physical exercise, that is exercise which made you perspire or breathe more heavily than normal?
Yes
No

42. What did you do? Anything else? (Mark all that apply.)
-Running or jogging
-Bicycling
-Tennis
-Exercise in a class or at home
-Swimming
-Racquetball or squash
-Other (specify)_____

43. Over the last 3 months which did you do most frequently?
-Running or jogging
-Bicycling
-Tennis
-Exercise in a class or at home
-Swimming
-Racquetball or squash
-Other (specify)_____

44. How frequently did you participate in this activity?
_____times per week
OR
_____times per month

Less than once a month
Don't know

45. About how much time did you spend on each occasion?
-More than one hour
-46 minutes to one hour
-31 minutes to 45 minutes
-16 minutes to 30 minutes
-15 minutes or less
-Don't know

Health Promotion Survey

24. How many times per week do you exercise for at least 15 minutes?
-Daily
-5-6 times a week
-3-4 times a week
-1-2 times a week
-Less than once a week
-Never
-Don't know

APPENDIX 2:

EXAMPLE SHOWING AGE-ADJUSTMENT PROCEDURE ON ESTIMATED PREVALENCE OF ELEVATED SERUM CHOLESTEROL, MALES 25 AND OVER, CANADA HEALTH SURVEY, 1978

$$\text{Prevalence} = \frac{\text{estimated number of persons with elevated serum cholesterol}}{\text{population}}$$

NUMERATOR: Estimated number of persons with elevated serum cholesterol

Age	Total	Education			
		Elem.	Sec.	Post-sec.	Univ.
Total	948000	433000	181000	187000	141000
25-34	195000	56000	13000	56000	64000
35-44	159000	52000	41000	31000	35000
45-54	299000	108000	103000	68000	21000
55-64	167000	101000	24000	25000	17000
65+	128000	116000	0	7000	4000

DENOMINATOR: Population

Age	Total	Education			
		Elem.	Sec.	Post-sec.	Univ.
Total	6212000	2943000	1165000	1197000	884000
25-34	1881000	528000	417000	628000	295000
35-44	1318000	478000	289000	249000	294000
45-54	1199000	675000	271000	151000	103000
55-64	949000	575000	138000	101000	134000
65+	865000	687000	50000	68000	58000

NUMERATOR/DENOMINATOR: Estimated prevalence (p) of elevated serum cholesterol

		Education			
Age	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.1526	.1471	.1554	.1562	.1595
25-34	.1037	.1061	.0312	.0892	.2169
35-44	.1206	.1088	.1419	.1245	.1190
45-54	.2494	.1600	.3801	.4503	.2039
55-64	.1760	.1757	.1739	.2475	.1269
65+	.1480	.1689	.0000	.1029	.0690

Reference population: Census Canada 1981

		Education			
Age	Total	Elem.	Sec.	Post-sec.	Univ.
Total	6809635	1649385	2414570	1596350	1149340
25-34	2094235	150935	781545	681340	480415
35-44	1489645	252885	527210	392810	316745
45-54	1249655	370275	458175	252230	168975
55-64	1021430	378820	364395	165080	113140
65+	954670	496470	283245	104890	70065

Weights in the reference population for education-adjustment (total in each education category divided by total pop)

		Education			
Age	Total	Elem.	Sec.	Post-sec.	Univ.
Total	0000	0000	0000	0000	0000
25-34	0000	.2422	.3546	.2344	.1688
35-44	0000	.2422	.3546	.2344	.1688
45-54	0000	.2422	.3546	.2344	.1688
55-64	0000	.2422	.3546	.2344	.1688
65+	0000	.2422	.3546	.2344	.1688

Crude rates multiplied by weights for education-adjustment and education-adjusted rates (left marginals).

Age	Total	Education Elem.	Sec.	Post-sec.	Univ.
Total					
25-34	.0943	.0257	.0111	.0209	.0366
35-44	.1259	.0263	.0503	.0292	.0201
45-54	.3135	.0388	.1348	.1056	.0344
55-64	.1837	.0425	.0617	.0580	.0214
65+	.0767	.0409	.0000	.0241	.0116

Weights in the reference population for **age-adjustment** (total in each age group divided by total pop)

Age	Total	Education Elem.	Sec.	Post-sec.	Univ.
Total	0000	0000	0000	0000	0000
25-34	0000	.3075	.3075	.3075	.3075
35-44	0000	.2188	.2188	.2188	.2188
45-54	0000	.1835	.1835	.1835	.1835
55-64	0000	.1500	.1500	.1500	.1500
65+	0000	.1402	.1402	.1402	.1402

Crude rates multiplied by weights for age-adjustment and age-adjusted rates (top marginals).

Age	Total	Education Elem.	Sec.	Post-sec.	Univ.
Total		.1358	.1365	.1889	.1589
25-34		.0326	.0096	.0274	.0667
35-44		.0238	.0310	.0272	.0260
45-54		.0294	.0697	.0826	.0374
55-64		.0263	.0261	.0371	.0190
65+		.0237	.0000	.0144	.0097

Weights in the reference population for age- and education-adjustment (total in each cell divided by total population)

	Education				
Age	Total	Elem.	Sec.	Post-sec.	Univ.
Total	0000	0000	0000	0000	0000
25-34	0000	.0222	.1148	.1001	.0705
35-44	0000	.0371	.0774	.0577	.0465
45-54	0000	.0544	.0673	.0370	.0248
55-64	0000	.0556	.0535	.0242	.0166
65+	0000	.0729	.0416	.0154	.0103

Crude rates multiplied by weights for age- and education-adjustment; age- and education-adjusted rate (grand total of sum of all weights multiplied by corresponding cells)

	Education				
Age	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.1556	.0372	.0495	.0404	.0287
25-34	.0301	.0024	.0036	.0089	.0153
35-44	.0277	.0040	.0110	.0072	.0055
45-54	.0560	.0087	.0256	.0167	.0051
55-64	.0272	.0098	.0093	.0060	.0021
65+	.0146	.0123	.0000	.0016	.0007

CALCULATION OF AGE- AND EDUCATION-ADJUSTED STANDARD ERRORS:

Basic formula for standard error: $SE=((p)(1-p)/n)^{1/2}$

Matrix of (p)(1-p)

Age	Education				
	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.1315	.1174	.1178	.1532	.1336
25-34	.0854	.0948	.0302	.0812	.1699
35-44	.1101	.0970	.1217	.1090	.1049
45-54	.2152	.1344	.2356	.2475	.1623
55-64	.1499	.1448	.1437	.1863	.1108
65+	.0708	.1403	.0000	.0923	.0642

Matrix of counts (n): estimated sample sizes in survey*

Age	Education				
	Total	Elem.	Sec.	Post-sec.	Univ.
Total	1383	795	210	210	163
25-34	365	136	68	92	66
35-44	269	126	51	48	42
45-54	238	151	41	27	19
55-64	252	165	37	27	23
65+	259	217	13	16	13

Matrix of $\frac{(p)(1-p)}{n}$

	Education				
	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.0001	.0001	.0006	.0007	.0008
25-34	.0002	.0007	.0004	.0009	.0026
35-44	.0004	.0008	.0024	.0023	.0025
45-54	.0009	.0009	.0057	.0092	.0085
55-64	.0006	.0009	.0039	.0069	.0048
65+	.0003	.0006	.0000	.0058	.0049

---

* Assuming simple random sampling. In fact, the sampling was multi-staged.

Matrix of $((p)(1-p)/n)^{1/2}=SE$

Age	Total	Education: Elem.	Sec.	Post-sec.	Univ.
Total	.0113	.0129	.0209	.0277	.0293
25-34	.0148	.0264	.0211	.0297	.0507
35-44	.0233	.0277	.0489	.0477	.0500
45-54	.0390	.0298	.0758	.0957	.0924
55-64	.0325	.0296	.0623	.0831	.0694
65+	.0223	.0254	.0000	.0760	.0703

STEPS IN CALCULATING EDUCATION-ADJUSTED STANDARD ERROR: $(SWE2SE2)^{1/2}$

Matrix of squared weights for education-adjustment $(WE)^2$

Age	Total	Education: Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0587	.1257	.0550	.0285
35-44	.0000	.0587	.1257	.0550	.0285
45-54	.0000	.0587	.1257	.0550	.0285
55-64	.0000	.0587	.1257	.0550	.0285
65+	.0000	.0587	.1257	.0550	.0285

Matrix of squared standard errors $(XSE)^2$

Age	Total	Education: Elem.	Sec.	Post-sec.	Univ.
Total	.0001	.0002	.0004	.0008	.0009
25-34	.0002	.0007	.0004	.0009	.0026
35-44	.0005	.0008	.0024	.0023	.0025
45-54	.0015	.0009	.0057	.0092	.0085
55-64	.0011	.0009	.0039	.0069	.0048
65+	.0005	.0006	.0000	.0058	.0049

Matrix of $(WE)^2 \times (SE)^2$

Age	Education				
	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0000	.0001	.0000	.0001
35-44	.0000	.0000	.0003	.0001	.0001
45-54	.0000	.0001	.0007	.0005	.0002
55-64	.0000	.0001	.0005	.0004	.0001
65+	.0000	.0000	.0000	.0003	.0001

Row sum of $(WE)^2 \times (SE)^2$

Total	25-34	35-44	45-54	55-64	65+
.0000	.0002	.0005	.0015	.0011	.0005

Education-adjusted standard errors: $(\Sigma WE^2SE^2)^{1/2}$:
Square-root of row sum of $(WE)^2 \times (SE)^2$

Total	25-34	35-44	45-54	55-64	65+
.0113	.0148	.0233	.0390	.0325	.0223

STEPS IN CALCULATING AGE-ADJUSTED STANDARD ERROR: $(\Sigma WA^2SE^2)^{1/2}$

Matrix of squared weights for age-adjustment $(WA)^2$

	Education				
	Total	Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0946	.0946	.0946	.0946
35-44	.0000	.0479	.0479	.0479	.0479
45-54	.0000	.0337	.0337	.0337	.0337
55-64	.0000	.0225	.0225	.0225	.0225
65+	.0000	.0197	.0197	.0197	.0197

Matrix of $(WA)^2 \times (SE)^2$

Age	Education: Total	Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0001	.0000	.0001	.0002
35-44	.0000	.0000	.0001	.0001	.0001
45-54	.0000	.0000	.0002	.0003	.0003
55-64	.0000	.0000	.0001	.0002	.0001
65+	.0000	.0000	.0000	.0001	.0001

Age-adjusted standard error: $(\Sigma WA^2SE^2)^{1/2}$
Column sum of $(WA)^2 \times (SE)^2$

Total	Elem.	Sec.	Post-sec.	Univ.
.0000	.0002	.0004	.0008	.0009

Square-root of row sum of $(WA)^2 \times (SE)^2$:

Total	Elem.	Sec.	Post-sec.	Univ.
.0113	.0129	.0209	.0277	.0293

Education- and age-adjusted standard error: $(\Sigma WT^2SE^2)^{1/2}$
Matrix of squared weights for age- and education-adjustment $(WT)^2$

Age	Education: Total	Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0005	.0132	.0100	.0050
35-44	.0000	.0014	.0060	.0033	.0022
45-54	.0000	.0030	.0045	.0014	.0006
55-64	.0000	.0031	.0029	.0006	.0003
65+	.0000	.0053	.0017	.0002	.0001

Matrix of $(WT)^2 \times (SE)^2$

Age	Total	Education: Elem.	Sec.	Post-sec.	Univ.
Total	.0000	.0000	.0000	.0000	.0000
25-34	.0000	.0000	.0000	.0000	.0000
35-44	.0000	.0000	.0000	.0000	.0000
45-54	.0000	.0000	.0000	.0000	.0000
55-64	.0000	.0000	.0000	.0000	.0000
65+	.0000	.0000	.0000	.0000	.0000

Grand sum of $(WT)^2 \times (SE)^2 = .0001$

Education- and age-adjusted standard error: $(\Sigma WT^2 SE^2)^{1/2}$

Square root of grand sum of $(WT)^2 \times (SE)^2 = .0113$

APPENDIX 3.

RISK FACTORS FOR CORONARY HEART DISEASE, VARIOUS SURVEYS, CANADA, 1971-1985: DETAILED TABLES OF NUMERATORS, DENOMINATORS, RATES, COUNTS, ADJUSTED RATES, STANDARD ERRORS, ADJUSTED STANDARD ERRORS, AND 95% CONFIDENCE INTERVALS,

Current smokers, Nutrition Canada Survey, 1971, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	10663249	2871	4722418	1271	.443	.447	.0119	.423--.470
Education(b)								
Elementary	4106599	1357	1961793	648	.478	.491	.0193	.453--.529
Secondary	3995418	1056	1934993	511	.484	.471	.0155	.441--.501
Post-secondary	879954	183	425346	88	.483	.491	.0354	.422--.561
University	1314440	275	400285	84	.305	.279	.0270	.226--.332
Age(c)								
25-34	2618036	506	1238843	239	.473	.497	.0241	.450--.545
35-44	2620011	583	1240819	276	.474	.427	.0231	.381--.472
45-54	2057571	500	1101238	268	.535	.550	.0285	.495--.606
55-64	1855034	428	775244	179	.418	.411	.0302	.352--.470
65+	1512597	854	366274	207	.242	.280	.0260	.229--.331
Females, total(a)	11520529	3357	4024406	1173	.349	.345	.0093	.327--.363
Education(b)								
Elementary	4010008	1430	1343827	479	.335	.376	.0153	.346--.406
Secondary	4878701	1364	1863544	521	.382	.366	.0126	.341--.391
Post-secondary	1595523	384	644832	155	.404	.400	.0252	.350--.449
University	764936	179	172203	40	.225	.189	.0274	.135--.243
Age(c)								
25-34	2826215	706	1348453	337	.477	.462	.0193	.424--.500
35-44	2691133	713	977490	259	.363	.371	.0196	.332--.409
45-54	2541156	664	937770	245	.369	.372	.0205	.332--.413
55-64	1626897	479	438273	129	.269	.283	.0236	.237--.329
65+	1835129	795	322421	140	.176	.202	.0178	.167--.236

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Diastolic blood pressure >100 mmHg, Nutrition Canada Survey, 1971, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	10663249	2871	1114522	300	.105	.088	.0052	.078--.098
Education(b)								
Elementary	4106599	1357	657281	217	.160	.123	.0085	.107--.140
Secondary	3995418	1056	322767	85	.081	.089	.0084	.072--.105
Post secondary	879954	183	38431	8	.044	.060	.0170	.027--.093
University	1314440	275	48887	10	.037	.053	.0145	.025--.081
Age(c)								
25-34	2618036	506	37853	7	.014	.011	.0041	.003--.019
35-44	2620011	583	227337	51	.087	.067	.0092	.049--.085
45-54	2057571	500	245621	60	.119	.115	.0191	.078--.153
55-64	1855034	428	267343	62	.144	.129	.0186	.093--.166
65+	1512597	854	336368	190	.222	.183	.0216	.141--.225
Females, total(a)	11520529	3357	1305151	380	.113	.098	.0048	.089--.108
Education(b)								
Elementary	4010008	1430	661597	236	.165	.135	.0087	.118--.152
Secondary	4878701	1364	464358	130	.095	.108	.0084	.092--.124
Post-secondar	1595523	384	60609	15	.038	.038	.0097	.019--.057
University	764936	179	41381	10	.054	.075	.0213	.033--.116
Age(c)								
25-34	2826215	706	36556	9	.013	.014	.0045	.005--.022
35-44	2691133	713	242367	64	.090	.080	.0101	.060--.099
45-54	2541156	664	371754	97	.146	.126	.0127	.101--.151
55-64	1626897	479	303404	89	.186	.169	.0188	.132--.206
65+	1835129	795	351070	152	.191	.154	.0164	.122--.186

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Obesity, Nutrition Canada Survey, 1971, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total (a)	10663249	2871	956203	257	.090	.080	.0057	.069--.092
Education (b)								
Elementary	4106599	1357	449281	148	.109	.098	.0110	.076--.119
Secondary	3995418	1056	364450	96	.091	.091	.0089	.073--.108
Post-secondary	879954	183	44664	9	.051	.050	.0152	.021--.080
University	1314440	275	84736	18	.064	.051	.0121	.027--.075
Age (c)								
25-34	2618036	506	221818	43	.085	.080	.0125	.055--.104
35-44	2620011	583	167353	37	.064	.051	.0082	.035--.067
45-54	2057571	500	146693	36	.071	.063	.0112	.041--.085
55-64	1855034	428	261140	60	.141	.125	.0201	.086--.165
65+	1512597	854	159199	90	.105	.073	.0115	.051--.096
Females, total (a)	11520529	3357	2205131	643	.191	.169	.0062	.156--.181
Education (b)								
Elementary	4010008	1430	1178935	420	.294	.267	.0130	.242--.293
Secondary	4878701	1364	707960	198	.145	.168	.0101	.148--.188
Post-secondary	1595523	384	167115	40	.105	.102	.0148	.073--.131
University	764936	179	35635	8	.047	.073	.0217	.031--.116
Age (c)								
25-34	2826215	706	277335	69	.098	.100	.0115	.078--.123
35-44	2691133	713	341515	90	.127	.100	.0101	.081--.120
45-54	2541156	[illegible]4	516339	135	.203	.186	.0158	.155--.217
55-64	1626897	479	428636	126	.263	.219	.0189	.182--.256
65+	1835129	795	641306	278	.349	.295	.0214	.253--.337

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Elevated serum cholesterol ()250mg/dl), Nutrition Canada Survey, 1971, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	10663249	2871	1112900	300	.104	.101	.0066	.089--.114
Education(b)								
Elementary	4106599	1357	426507	141	.104	.096	.0096	.077--.115
Secondary	3995418	1056	482551	128	.121	.123	.0103	.103--.143
Post-secondary	879954	183	88009	18	.100	.119	.0228	.074--.164
University	1314440	275	98535	21	.075	.098	.0184	.062--.134
Age(c)								
25-34	2618036	506	165920	32	.063	.053	.0090	.035--.070
35-44	2620011	583	328551	73	.125	.115	.0148	.086--.144
45-54	2057571	500	255658	62	.124	.143	.0218	.100--.185
55-64	1855034	428	200624	46	.108	.139	.0226	.095--.183
65+	1512597	854	162147	92	.107	.162	.0239	.115--.209
Females, total(a)	11520529	3357	1707840	498	.148	.143	.0058	.132--.154
Education(b)								
Elementary	4010008	1430	734960	262	.183	.163	.0106	.142--.184
Secondary	4878701	1364	725349	203	.149	.176	.0101	.156--.195
Post-secondary	1595523	384	164435	40	.103	.105	.0151	.075--.135
University	764936	179	35619	8	.047	.092	.0235	.046--.138
Age(c)								
25-34	2826215	706	198537	50	.070	.067	.0093	.049--.086
35-44	2691133	713	104841	28	.039	.036	.0071	.022--.050
45-54	2541156	664	449851	118	.177	.166	.0147	.137--.195
55-64	1626897	479	421762	124	.259	.249	.0229	.204--.294
65+	1835129	795	532848	231	.290	.299	.0218	.257--.342

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Elevated serum cholesterol (>250 mg/dl), Canada Health Survey, 1978, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	6212000	1383	948000	211	.153	.156	.0113	.134--.178
Education(b)								
Elementary	2943000	795	433000	117	.147	.136	.0129	.111--.161
Secondary	1165000	210	181000	33	.155	.136	.0209	.095--.177
Post-secondary	1197000	210	187000	33	.156	.189	.0277	.134--.243
University	884000	163	141000	26	.160	.159	.0293	.102--.216
Age(c)								
25-34	1881000	365	195000	38	.104	.094	.0148	.065--.123
35-44	1318000	269	159000	32	.121	.126	.0233	.080--.172
45-54	1199000	238	299000	59	.249	.314	.0390	.237--.390
55-64	949000	252	167000	44	.176	.184	.0325	.120--.247
65+	865000	259	128000	38	.148	.077	.0223	.033--.120
Females, total(a)	6534000	1623	1001000	249	.153	.151	.0098	.132--.170
Education(b)								
Elementary	3546000	932	670000	176	.189	.158	.0105	.137--.178
Secondary	1373000	282	165000	34	.120	.164	.0212	.122--.205
Post-secondary	1073000	294	142000	39	.132	.162	.0224	.118--.206
University	520000	106	23000	5	.044	.126	.0486	.031--.222
Age								
25-34	1889000	443	49000	11	.026	.025	.0078	.010--.040
35-44	1327000	332	32000	8	.024	.025	.0097	.006--.044
45-54	1202000	306	42000	62	.201	.170	.0267	.118--.223
55-64	1020000	263	312000	80	.306	.247	.0351	.179--.316
65+	1096000	279	366000	93	.334	.447	.0512	.347--.547

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Obesity, Canada Health Survey, 1978, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	6277000	1568	769000	192	.123	.114	.0096	.095--.133
Education(b)								
Elementary	3010000	903	420000	126	.140	.138	.0125	.114--.163
Secondary	1185000	242	126000	26	.106	.098	.0186	.061--.134
Post-secondary	1149000	232	153000	31	.133	.126	.0222	.082--.170
University	908000	184	70000	14	.077	.086	.0224	.042--.130
Age(c)								
25-34	1889000	412	214000	47	.113	.115	.0175	.081--.149
35-44	1331000	307	176000	41	.132	.127	.0208	.087--.168
45-54	1210000	270	171000	38	.141	.119	.0239	.072--.166
55-64	960000	280	114000	33	.119	.114	.0250	.064--.163
65+	887000	299	94000	32	.106	.072	.0238	.025--.118
Females, total(a)	6629000	1944	1478000	433	.223	.185	.0100	.166--.205
Education(b)								
Elementary	3688000	1134	1101000	339	.299	.268	.0126	.244--.293
Secondary	1334000	327	181000	44	.136	.158	.0208	.117--.198
Post-secondary	1074000	345	156000	50	.145	.161	.0206	.120--.201
University	502000	128	30000	8	.060	.087	.0313	.026--.149
Age(c)								
25-34	1902000	519	146000	40	.077	.072	.0120	.049--.096
35-44	1329000	390	237000	70	.178	.143	.0186	.106--.179
45-54	1217000	366	324000	97	.266	.203	.0265	.151--.255
55-64	1050000	325	416000	129	.396	.337	.0382	.262--.411
65+	1131000	344	355000	108	.314	.232	.0323	.169--.296

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Physical inactivity, Canada Health Survey, 1978, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	5354000	6067	2323000	2632	.434	.404	.0076	.389--.419
Education(b)								
Elementary	2611000	3303	1369000	1732	.524	.514	.0092	.496--.533
Secondary	990000	1046	375000	396	.379	.395	.0163	.363--.427
Post-secondary	930000	930	324000	324	.348	.374	.0170	.340--.407
University	796000	752	242000	229	.304	.306	.0189	.269--.343
Age(c)								
25-34	1711000	1766	621000	641	.363	.355	.0116	.332--.377
35-44	1171000	1299	483000	536	.412	.397	.0155	.367--.428
45-54	1016000	1186	471000	550	.464	.408	.0179	.373--.444
55-64	773000	970	365000	458	.472	.449	.0216	.407--.491
65+	683000	846	383000	474	.561	.467	.0310	.407--.528
Females, total(a)	5643000	6886	2414000	2946	.428	.418	.0069	.405--.432
Education(b)								
Elementary	2824000	3655	1371000	1774	.485	.470	.0084	.454--.487
Secondary	1301000	1398	535000	575	.411	.427	.0137	.400--.454
Post-secondary	1026000	1286	342000	429	.333	.347	.0141	.319--.375
University	458000	506	155000	171	.338	.384	.0250	.335--.433
Age(c)								
25-34	1750000	2046	639000	747	.365	.371	.0111	.349--.393
35-44	1176000	1461	405000	503	.344	.328	.0139	.301--.356
45-54	1026000	1319	423000	544	.412	.413	.0171	.379--.446
55-64	826000	1015	377000	463	.456	.400	.0202	.360--.439
65+	865000	1045	570000	689	.659	.608	.0234	.562--.653

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Diastolic blood pressure>100 mmHg, Canada Health Survey, 1978, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	6277000	1511	713000	172	.114	.112	.0098	.093--.131
Education(b)								
Elementary	3010000	841	421000	118	.140	.126	.0121	.103--.150
Secondary	1185000	240	111000	23	.094	.118	.0229	.074--.163
Post-secondary	1149000	248	134000	29	.117	.120	.0203	.080--.159
University	908000	176	41000	8	.045	.043	.0157	.012--.074
Age(c)								
25-34	1889000	346	139000	25	.074	.063	.0130	.038--.088
35-44	1331000	315	146000	35	.110	.108	.0192	.071--.146
45-54	1210000	252	123000	26	.102	.094	.0218	.051--.136
55-64	960000	303	151000	48	.157	.163	.0265	.111--.215
65+	887000	278	154000	48	.174	.165	.0444	.078--.252
Females, total(a)	6629000	2003	520000	157	.078	.067	.0065	.055--.080
Education(b)								
Elementary	3688000	1196	371000	120	.101	.090	.0080	.074--.105
Secondary	1334000	382	59000	17	.044	.048	.0117	.025--.071
Post-secondary	1074000	347	55000	18	.051	.061	.0139	.034--.089
University	502000	81	34000	5	.068	.103	.0353	.034--.173
Age(c)								
25-34	1902000	462	34000	8	.018	.015	.0058	.004--.026
35-44	1329000	353	118000	31	.089	.075	.0146	.046--.103
45-54	1217000	392	118000	38	.097	.091	.0183	.055--.127
55-64	1050000	363	95000	33	.090	.068	.0176	.033--.102
65+	1131000	355	155000	49	.137	.129	.0287	.072--.185

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Physical inactivity, Health Promotion Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7419000	3791	1846000	943	.249	.257	.0078	.242--.272
Education(b)								
Elementary	1051000	464	432000	191	.411	.394	.0323	.330--.457
Secondary	3486000	1869	917000	492	.263	.268	.0103	.248--.289
Post-secondary	1629000	811	255000	127	.157	.174	.0150	.144--.203
University	1214000	614	224000	113	.185	.184	.0178	.149--.219
Age(c)								
25-34	2225000	1327	311000	185	.140	.186	.0213	.144--.228
35-44	1769000	917	377000	195	.213	.228	.0186	.192--.265
45-54	1263000	541	410000	176	.325	.335	.0217	.293--.378
55-64	1108000	465	437000	183	.394	.375	.0234	.329--.421
65+	1054000	541	311000	160	.295	.266	.0201	.226--.305
Females, total(a)	7858000	5377	2231000	1527	.284	.292	.0070	.278--.306
Education(b)								
Elementary	1220000	578	546000	259	.448	.372	.0255	.322--.422
Secondary	4088000	2864	1163000	815	.284	.285	.0084	.269--.302
Post-secondary	1668000	1185	378000	269	.227	.222	.0129	.197--.248
University	803000	687	132000	113	.164	.174	.0158	.143--.205
Age(c)								
25-34	2250000	1788	438000	348	.195	.207	.0172	.174--.241
35-44	1760000	1159	467000	308	.265	.285	.0192	.247--.322
45-54	1257000	706	340000	191	.270	.268	.0185	.232--.304
55-64	1199000	729	424000	258	354	.315	.0170	.281--.348
65+	1392000	995	562000	402	.404	.378	.0159	.347--.409

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

High blood pressure, Health Promotion Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7419000	3791	705000	360	.095	.090	.0049	.080--.099
Education(b)								
Elementary	1051000	464	80000	35	.076	.061	.0146	.032--.089
Secondary	3486000	1869	343000	184	.098	.099	.0070	.085--.112
Post-secondary	1629000	811	203000	101	.125	.153	.0140	.126--.181
University	1214000	614	74000	37	.061	.068	.0122	.044--.092
Age(c)								
25-34	2225000	1327	113000	67	.051	.049	.0101	.029--.069
35-44	1769000	917	169000	88	.096	.087	.0096	.068--.106
45-54	1263000	541	129000	55	.102	.103	.0144	.075--.131
55-64	1108000	465	145000	61	.131	.121	.0150	.092--.151
65+	1054000	541	149000	76	.141	.185	.0197	.146--.224
Females, total(a	7858000	5377	867000	593	.110	.112	.0050	.102--.122
Education(b)								
Elementary	1220000	578	233000	110	.191	.121	.0131	.096--.147
Secondary	4088000	2864	413000	289	.101	.105	.0057	.094--.116
Post-secondary	1668000	1185	136000	97	.082	.096	.0097	.077--.115
University	803000	687	68000	58	.085	.117	.0140	.090--.145
Age								
25-34	2250000	1788	88000	70	.039	.035	.0062	.023--.047
35-44	1760000	1159	100000	66	.057	.058	.0092	.040--.076
45-54	1257000	706	164000	92	.130	.128	.0141	.100--.155
55-64	1199000	729	165000	100	.138	.132	.0135	.106--.159
65+	1392000	995	350000	250	.251	.255	.0150	.225--.284

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Current smokers, Health Promotion Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7419000	379	2662000	1360	.359	.355	.0083	.339--.371
Education(b)								
Elementary	1051000	464	377000	166	.359	.442	.0335	.377--.508
Secondary	3486000	1869	1494000	801	.429	.422	.0111	.400--.444
Post-secondary	1629000	811	515000	256	.316	.306	.0169	.273--.339
University	1214000	614	267000	135	.220	.225	.0191	.187--.262
Age(c)								
25-34	2225000	132	942000	562	.423	.428	.0231	.382--.473
35-44	1769000	917	661000	343	.374	.386	.0208	.345--.426
45-54	1263000	541	484000	207	.383	.388	.0222	.345--.432
55-64	1108000	465	368000	154	.332	.345	.0236	.299--.391
65+	1054000	541	207000	106	.196	.197	.0190	.160--.234
Females, total(a)	7858000	5377	2443000	1672	.311	.312	.0071	.298 .326
Education(b)								
Elementary	1220000	578	359000	170	.294	.375	.0276	.321--.429
Secondary	4088000	2864	1429000	1001	.350	.347	.0087	.330--.364
Post-secondary	1668000	1185	432000	307	.259	.255	.0135	.229--.281
University	803000	687	214000	183	.267	.255	.0183	.219--.291
Age(c)								
25-34	2250000	1788	839000	667	.373	.404	.0201	.365--.444
35-44	1760000	1159	617000	406	.351	.358	.0199	.319--.397
45-54	1257000	706	416000	234	.331	.332	.0196	.293--.370
55-64	1199000	729	321000	195	.268	.267	.0178	.233--.302
65+	1392000	995	250000	179	.180	.180	.0131	.155--.206

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

High blood pressure, General Social Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total (a)	7463000	4332	1354000	786	.181	.183	.0064	.170--.198
Education (b)								
Elementary	1424000	1141	374000	300	.263	.189	.0185	.152--.225
Secondary	2317000	1280	401000	222	.173	.178	.0110	.156--.199
Post-secondary	2055000	1037	330000	167	.161	.198	.0140	.170--.225
University	1628000	856	245000	129	.150	.173	.0134	.147--.199
Age (c)								
25-34	2239000	1163	189000	98	.084	.086	.0122	.062--.110
35-44	1782000	813	253000	115	.142	.144	.0141	.116--.172
45-54	1267000	472	256000	95	.202	.207	.0190	.170--.244
55-64	1109000	420	307000	116	.277	.274	.0221	.230--.317
65+	1066000	1464	349000	479	.327	.336	.0147	.307--.365
Females, total (a)	7909000	5211	1649000	1086	.208	.213	.0058	.202--.224
Education (b)								
Elementary	1589000	1271	531000	425	.334	.233	.0160	.202--.264
Secondary	3012000	1865	663000	411	.220	.226	.0096	.207--.245
Post-secondary	2108000	1315	302000	188	.143	.185	.0105	.165--.206
University	1160000	735	142000	90	.122	.162	.0145	.134--.191
Age (c)								
25-34	2263000	1348	172000	102	.076	.082	.0110	.061--.104
35-44	1777000	902	224000	114	.126	.137	.0135	.111--.164
45-54	1260000	581	276000	127	.219	.221	.0175	.187--.255
55-64	1202000	714	375000	223	.312	.307	.0174	.273--.341
65+	1407000	1666	602000	713	.428	.420	.0132	.394--.446

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Obesity, General Social Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7380595	4332	519003	305	.070	.075	.0047	.066--.084
Education(b)								
Elementary	1408454	1141	172999	140	.123	.112	.0154	.082--.143
Secondary	2284608	1280	163847	92	.072	.071	.0077	.056--.086
Post-secondary	2043463	1037	107808	55	.053	.055	.0079	.040--.071
University	1613806	856	72507	38	.045	.044	.0076	.029--.059
Age(c)								
25-34	2220300	1163	96413	51	.043	.046	.0091	.028--.064
35-44	1765748	843	138200	64	.078	.097	.0129	.072--.122
45-54	1247219	472	119291	45	.096	.099	.0139	.071--.126
55-64	1097239	420	85236	33	.078	.068	.0119	.044--.091
65+	1050088	1464	79863	111	.076	.065	.0072	.051--.079
Females, total(a)	7718674	5211	855961	578	.111	.117	.0049	.107--.126
Education(b)								
Elementary	1543009	1271	288943	238	.187	.153	.0148	.124--.182
Secondary	2958914	1865	345560	218	.117	.118	.0077	.103--.134
Post-secondary	2049596	1315	153309	98	.075	.081	.0078	.065--.096
University	1143758	735	66018	42	.058	.066	.0095	.047--.084
Age(c)								
25-34	2243865	1348	140071	84	.062	.068	.0101	.048--.088
35-44	1746569	902	153555	79	.088	.099	.0123	.075--.123
45-54	1195881	581	162801	79	.136	.137	.0144	.108--.165
55-64	1161583	714	188835	116	.163	.155	.0135	.129--.182
65+	1370777	1666	210698	256	.154	.141	.0090	.123--.159

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Current smokers, General Social Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7462860	4332	2618211	1520	.351	.366	.0083	.350--.383
Education(b)								
Elementary	1424396	1141	514338	412	.361	.458	.0283	.403--.514
Secondary	2316721	1280	1012563	559	.437	.433	.0147	.404--.461
Post-secondary	2055524	1037	714833	361	.348	.326	.0158	.295--.357
University	1628271	856	361108	190	.222	.215	.0147	.186--.244
Age(c)								
25-34	2238887	1163	839015	436	.375	.436	.0213	.394--.478
35-44	1782435	813	689717	315	.387	.426	.0197	.388--.465
45-54	1267144	472	460602	172	.363	.373	.0224	.329--.417
55-64	1109091	420	386882	147	.349	.339	.0235	.293--.385
65+	1065303	1464	241997	333	.227	.216	.0124	.192--.240
Females, total(a)	7908034	5211	2149713	1417	.272	.278	.0068	.264--.291
Education(b)								
Elementary	1590399	1271	377753	302	.238	.326	.0228	.281--.370
Secondary	3012449	1865	956152	592	.317	.314	.0111	.292--.336
Post-secondary	2110473	1315	578908	361	.274	.261	.0124	.237--.285
University	1160590	735	224956	142	.194	.194	.0159	.163--.226
Age(c)								
25-34	2262837	1348	737290	439	.326	.381	.0190	.343--.418
35-44	1776632	902	501290	255	.282	.289	.0176	.254--.323
45-54	1259630	581	394179	182	.313	.311	.0194	.273--.349
55-64	1201827	714	308678	183	.257	.259	.0167	.227--.292
65+	1407109	1666	208275	247	.148	.148	.0095	.129--.166

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Current smokers, Canada Fitness Survey, 1981, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	6263000	5718	2831000	2585	.452	.419	.0062	.406--.431
Education(b)								
Elementary	890000	876	444000	437	.499	.495	.0216	.453--.537
Secondary	2583000	2454	1299000	1234	.503	.462	.0092	.444--.480
Post-secondary	1462000	1272	634000	552	.434	.388	.0133	.362--.415
University	1178000	976	390000	323	.331	.301	.0146	.272--.330
Age(c)								
25-34	2098000	1967	1014000	951	.483	.507	.0166	.475--.540
35-44	1493000	1383	693000	642	.464	.493	.0146	.465--.522
45-54	1253000	1039	559000	464	.446	.436	.0158	.405--.467
55-64	1029000	905	429000	377	.417	.412	.0174	.378--.447
65-69	390000	424	136000	148	.349	.350	.0263	.299--.402
Females, total(a)	6391000	7484	2312000	2707	.362	.321	.0051	.311--.331
Education(b)								
Elementary	876000	995	304000	345	.347	.339	.0180	.304--.374
Secondary	3058000	3664	1209000	1449	.395	.352	.0071	.339--.366
Post-secondary	1586000	1895	577000	689	.364	.314	.0099	.295--.334
University	715000	738	177000	183	.248	.220	.0161	.188--.251
Age(c)								
25-34	2104000	2583	881000	1082	.419	.426	.0147	.397--.455
35-44	1467000	1725	546000	642	.372	.382	.0135	.356--.409
45-54	1240000	1385	409000	457	.330	.326	.0133	.300--.352
55-64	1127000	1265	376000	422	.334	.324	.0143	.296--.353
65-69	453000	526	100000	116	.221	.234	.0196	.196--.273

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Diastolic blood pressure >100 mmHg, Canada Fitness Survey, 1981, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	5999000	4094	441000	301	.074	.067	.0039	.059--.074
Education(b)								
Elementary	770000	552	66000	47	.086	.052	.0078	.037--.068
Secondary	2415000	1728	207000	148	.086	.076	.0061	.064--.088
Post-secondary	1490000	969	84000	55	.056	.058	.0084	.041--.074
University	1217000	762	82000	51	.067	.069	.0105	.049--.090
Age(c)								
25-34	2028000	1534	68000	51	.034	.026	.0037	.019--.034
35-44	1435000	1090	76000	58	.053	.054	.0078	.039--.070
45-54	1178000	736	169000	106	.143	.140	.0129	.114--.165
55-64	994000	533	113000	61	.114	.116	.0149	.086--.145
65-69	364000	201	15000	8	.041	.032	.0126	.008--.057
Females, total(a)	6185000	4811	205000	159	.033	.031	.0027	.026--.037
Education(b)								
Elementary	754000	560	57000	42	.076	.044	.0070	.030--.057
Secondary	2879000	2301	102000	82	.035	.030	.0034	.024--.037
Post-secondary	1682000	1311	32000	25	.019	.019	.0043	.011--.028
University	743000	536	11000	8	.015	.019	.0081	.003--.035
Age(c)								
25-34	2040000	1792	16000	14	.008	.005	.0015	.002--.008
35-44	1407000	1200	22000	19	.016	.022	.0062	.010--.034
45-54	1189000	887	64000	48	.054	.053	.0077	.038--.068
55-64	1105000	691	79000	49	.071	.072	.0102	.053--.092
65-69	444000	241	24000	13	.054	.057	.0152	.027--.087

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Physical inactivity, Canada Fitness Survey, 1981, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total (a)	6263000	5718	617000	563	.099	.091	.0038	.084--.099
Education (b)								
Elementary	890000	876	172000	169	.193	.178	.0175	.143--.212
Secondary	2583000	2454	251000	238	.097	.089	.0054	.078--.099
Post-secondary	1462000	1272	87000	76	.060	.057	.0067	.044--.070
University	1178000	976	58000	48	.049	.047	.0070	.033--.060
Age (c)								
25-34	2098000	1967	140000	131	.067	.098	.0125	.073--.122
35-44	1493000	1383	128000	119	.086	.096	.0094	.078--.115
45-54	1253000	1039	134000	111	.107	.095	.0093	.077--.113
55-64	1029000	905	150000	132	.146	.134	.0116	.111--.157
65-69	390000	424	65000	71	.167	.126	.0145	.098--.155
Females, total (a)	6391000	7484	850000	995	.133	.121	.0038	.114--.128
Education (b)								
Elementary	876000	995	224000	254	.256	.239	.0166	.206--.271
Secondary	3058000	3664	401000	480	.131	.116	.0049	.106--.125
Post-secondary	1586000	1895	126000	151	.079	.076	.0061	.064--.088
University	715000	738	43000	44	.060	.051	.0078	.036--.066
Age (c)								
25-34	2104000	2583	188000	231	.089	.139	.0126	.115--.164
35-44	1467000	1725	186000	219	.127	.140	.0103	.120--.160
45-54	1240000	1385	199000	222	.160	.153	.0101	.133--.172
55-64	1127000	1265	200000	224	.177	.159	.0100	.139--.178
65+	453000	526	77000	89	.170	.165	.0165	.133--.198

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Physical inactivity, General Social Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7462860	4332	4239539	2461	.568	.598	.0074	.584--.613
Education(b)								
Elementary	1424396	1141	1222787	980	.858	.790	.0252	.740--.839
Secondary	2316721	1280	1511907	835	.653	.656	.0135	.630--.683
Post-secondary	2055524	1037	945277	477	.460	.522	.0159	.490--.553
University	1628271	856	535551	282	.329	.369	.0164	.336--.401
Age(c)								
25-34	2238887	1163	730121	379	.326	.406	.0211	.365--.448
35-44	1782435	813	904618	413	.508	.597	.0163	.565--.629
45-54	1267144	472	911035	339	.719	.740	.0195	.702--.778
55-64	1109091	420	846224	320	.763	.744	.0215	.701--.786
65+	1065303	1464	847541	1165	.796	.752	.0138	.725--.779
Females, total(a)	7908034	5211	5061871	3336	.640	.658	.0066	.645--.671
Education(b)								
Elementary	1590399	1271	1403560	1122	.883	.853	.0181	.817--.888
Secondary	3012449	1865	2014341	1247	.669	.674	.0110	.653--.696
Post-secondary	2110473	1315	1070309	667	.507	.554	.0135	.527--.580
University	1160590	735	547074	346	.471	.523	.0186	.487--.559
Age(c)								
25-34	2262837	1348	1005642	599	.444	.527	.0171	.494--.561
35-44	1776632	902	1033763	525	.582	.656	.0153	.626--.686
45-54	1259630	581	875428	404	.695	.698	.0188	.662--.735
55-64	1201827	714	889056	528	.740	.725	.0167	.692--.757
65+	1407109	1666	1257983	1489	.894	.878	.0091	.860--.896

Note:
(a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Current smokers, Labour Force Survey, 1975, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	5975633	25838	2696856	11661	.451	.433	.0032	.427--.439
Education(b)								
Elementary	1790018	8817	866492	4268	.484	.527	.0062	.514--.539
Secondary	2465658	10313	1216523	5088	.493	.483	.0049	.473--.493
Post-secondary	945835	3920	400170	1658	.423	.412	.0081	.396--.428
University	774082	2788	213669	770	.276	.268	.0089	.251--.286
Age(c)								
25-34	1745215	7107	838060	3413	.480	.492	.0060	.480--.504
35-44	1296013	5342	631343	2602	.487	.474	.0069	.461--.488
45-54	1216057	5258	580788	2511	.478	.448	.0074	.434--.463
55-64	919692	4147	412390	1860	.448	.422	.0088	.405--.439
65+	798656	3984	234275	1169	.293	.285	.0096	.266--.304
Females, total(a)	6286470	26952	1943383	8332	.309	.299	.0029	.293--.305
Education(b)								
Elementary	1871592	8286	494491	2189	.264	.306	.0059	.295--.318
Secondary	3002705	12719	1049424	4445	.349	.333	.0041	.325--.341
Post-secondary	890627	3834	273380	1177	.307	.289	.0072	.275--.303
University	521546	2113	125996	510	.242	.229	.0095	.210--.248
Age(c)								
25-34	1767232	7342	678088	2817	.384	.383	.0060	.371--.395
35-44	1281728	5361	448630	1876	.350	.340	.0067	.327--.353
45-54	1242959	5484	433197	1911	.349	.335	.0068	.322--.349
55-64	976561	4272	273210	1195	.280	.275	.0075	.260--.290
65+	1017990	4493	110258	487	.108	.119	.0060	.107--.130

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Obesity, Canada Fitness Survey, 1981, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	5999000	4094	607000	414	.101	.096	.0047	.087--.106
Education(b)								
Elementary	770000	552	135000	97	.175	.142	.0180	.106--.177
Secondary	2415000	1728	277000	198	.115	.104	.0071	.090--.118
Post-secondary	1490000	969	121000	79	.081	.078	.0094	.060--.096
University	1217000	762	52000	33	.043	.042	.0080	.026--.057
Age(c)								
25-34	2028000	1534	124000	94	.061	.071	.0121	.047--.094
35-44	1435000	1090	151000	115	.105	.114	.0116	.092--.137
45-54	1178000	736	150000	94	.127	.125	.0123	.101--.149
55-64	994000	533	143000	77	.144	.141	.0147	.113--.170
65+	364000	201	39000	22	.107	.097	.0231	.052--.143
Females, total(a)	6185000	4811	820000	638	.133	.122	.0048	.113--.132
Education(b)								
Elementary	754000	560	202000	150	.268	.180	.0168	.147--.212
Secondary	2879000	2301	381000	305	.132	.117	.0063	.104--.129
Post-secondary	1682000	1311	185000	144	.110	.098	.0085	.081--.115
University	743000	536	28000	20	.038	.037	.0093	.019--.056
Age(c)								
25-34	2040000	1792	118000	104	.058	.074	.0118	.051--.097
35-44	1407000	1200	158000	135	.112	.109	.0104	.089--.130
45-54	1189000	887	232000	173	.195	.194	.0137	.168--.221
55-64	1105000	691	201000	126	.182	.170	.0139	.143--.197
65+	444000	241	111000	60	.250	.247	.0275	.193--.301

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey

Obesity, Health Promotion Survey, 1985, males and females.

	Denominator		Numerator		Crude rate	Adjusted rate	Adjusted SE	95% Confidence interval
	Population	Count	Population	Count				
Males, total(a)	7419000	3791	472000	241	.064	.068	.0049	.059--.078
Education(b)								
Elementary	1051000	464	118000	52	.112	.130	.0238	.084--.177
Secondary	3486000	1869	241000	129	.069	.069	.0060	.058--.081
Post-secondary	1629000	811	73000	36	.045	.046	.0082	.030--.062
University	1214000	614	41000	21	.034	.034	.0086	.017--.051
Age(c)								
25-34	2225000	1327	74000	44	.033	.062	.0161	.031--.094
35-44	1769000	917	111000	58	.063	.069	.0115	.046--.091
45-54	1260003	541	145000	62	.115	.119	.0154	.089--.149
55-64	1108000	465	90000	38	.081	.073	.0121	.050--.097
65+	1054000	541	52000	27	.049	.041	.0088	.023--.058
Females, total(a)	7858000	5377	719000	492	.091	.099	.0051	.089--.109
Education(b)								
Elementary	1220000	578	230000	109	.189	.180	.0208	.139--.220
Secondary	4088000	2864	357000	250	.087	.087	.0053	.077--.098
Post-secondary	1668000	1185	85000	60	.051	.055	.0073	.041--.070
University	803000	687	37000	32	.046	.055	.0103	.035--.075
Age(c)								
25-34	2250000	1788	124000	99	.055	.076	.0134	.049--.102
35-44	1760000	1159	141000	93	.080	.094	.0140	.067--.121
45-54	1257000	706	146000	82	.116	.118	.0141	.090--.145
55-64	1199000	729	168000	102	.140	.142	.0141	.114--.170
65+	1392000	995	140000	100	.101	.090	.0091	.073--.108

Note: (a) age- and education-adjusted to 1981 census population
(b) age-adjusted to 1981 census population
(c) education-adjusted to 1981 census population
(d) age group truncated at 69 years for Canada Fitness Survey