An Exploration of the Socioeconomic Status--Health Status Gradient in Ontario: Results from the 1990 and 1996 Ontario Health Surveys

by

Susan E. Schultz

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Graduate Department of Community Health

University of Toronto

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Abstract

Data from the 1990 and 1996 Ontario Health Surveys are used to model the association between SES (income and education) and health status (the Health Utilities Index, Self-rated Health Status and Activity Restriction) in 1990 and 1996. The associations are first examined for each year separately and then an interaction analysis is done to determine whether there was a change in the overall association over time. The study found a positive association between SES and health status – health status increased with increasing SES – overall and for most subgroups. Results of the interaction analysis varied among health status measures. Significant interaction was found between year, income and the HUI, indicating that the slope of the gradient in the HUI by income changed from 1990 to 1996. This is primarily due to a drop in HUI among those with low incomes, and may be related to the recession of 1991-93.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1: Introduction

I. Rationale

The years 1990-1996 were a period of major economic and social change for the people of Ontario. In the early 1990s, from 1990 to 1993, the changes were primarily the result of the severe economic recession sweeping the country. The official unemployment rate for Ontario soared from 6.3% in 1990 to 10.8% in 1992 as businesses "downsized" in an effort to cut costs (Ontario Ministry of Finance, 1999). The average duration of unemployment also increased from just under 15 weeks in 1990 to 26 weeks by 1993. The proportion of people working less than 30 hours per week rose from 16% of those employed in 1990 to 19% in 1993. By 1994, the economy (as measured by GDP) had begun to recover. However, few new jobs were created, so unemployment remained high at 9.6%. During this same period, social policy changes were occurring at the federal level which included the tightening of Unemployment Insurance (UI) criteria and deep cuts in transfer payments to the provinces. The UI changes forced many people onto welfare. The cuts in transfer payments in turn prompted the province to cut welfare payment rates.

Evidence of the widespread negative impact of this restructuring can be found using a number of indicators. Overall household incomes decreased, while the proportion of Ontario families living in poverty increased (Canadian Council on Social Development, 1997; Statistics Canada, 1996). Multivariate indices designed to measure quality of life or "social health" also indicate that things got worse for most Ontarians in the 1990s. This prompted the questions--has there also been a negative impact on the

health status of the people of Ontario? And, have these negative effects differed from one socioeconomic group to another?

In this thesis, these questions are explored within the framework of the relationship between socioeconomic status and health. It has been known for some time that socioeconomic status (SES) and health are linked (Antonovsky, 1967; Pamuk, 1985; Wilkinson, 1996; Marmot et al., 1987, 1994; Adler et al., 1993). It is also widely acknowledged that this doesn't consist merely of a health gap between the richest and poorest segments of the population but that, regardless of how one measures either health or SES, successively higher SES groups tend also to have successively better health status (Hertzman et al., 1994). This association has come to be known as the SES-health status gradient.

Research into the gradient has established that it can change over time, and that, in some countries, its slope became steeper (indicative of an increase in health inequalities) in the 1970s and 1980s (Pamuk, 1985; Pappas et al., 1993). However, the extent to which the gradient changes as a result of societal economic events such as recession and restructuring is not well understood.

II. Research Questions

Comparing the results of the 1990 and 1996 Ontario Health Surveys, this thesis proposes to address the following questions:

1. How does health status vary among different socioeconomic/sociodemographic groups in Ontario?

2. When comparing the health status of different socioeconomic/sociodemographic groups in 1990 and 1996, are there significant differences?

3. Has the pattern of health inequalities changed between 1990 and 1996? That is, have the differences in health status between various groups become wider, narrowed or have there been changes in rank order?

III. Hypothesis

This thesis proposes to test the hypothesis that there have been significant changes in the distribution of health inequalities in Ontario in 1996 compared with 1990. The null hypothesis is that there has been no change.

IV. Review of the Literature

The following section provides a review of the literature pertaining to the association between socioeconomic status and health status, as this is the fundamental question explored in this thesis. Also reviewed is the recent literature dealing with the measurement of health status and socioeconomic status as well as the socioeconomic context of Ontario in the years 1990 and 1996.

A. The Socioeconomic Status-Health Status Gradient

Evidence from the International Literature

The topic of socioeconomic status and health inequalities became a major field of public health inquiry approximately twenty years ago following the publication of the final report of the British Research Working Group on Health Inequalities chaired by Sir Douglas Black (Black et al., 1988). The Black Report, as it has since become known, served to both stimulate and focus discussion on the pattern, nature and causes of the observed differential in health status between social classes.

While the Black Report certainly galvanized researchers around the world to begin looking at the issue of SES and health in their own countries, it was not the first report of its kind. Indeed, "The Black Report is part of a long tradition in Britain of public health interest in socio-economic conditions and health, and of competing explanations for observed differences" (MacIntyre, 1997). Britain has been reporting mortality statistics by social class on a regular basis at least since 1842, when Edwin Chadwick published his *Report on an Enquiry into the Sanitary Conditions of the Labouring Population*. Beginning in 1913, when Stevenson, Britain's Registrar General,

devised the five-level occupational classification system, occupational information has been recorded on both birth and death certificates. Linking this mortality data with census records has allowed for the calculation of standardized mortality ratios by social class with each decenniel census (Fein, 1995).

Early studies of social class and mortality consistently found a marked inverse gradient – as social class increased, mortality decreased. Titmuss (1943), when he examined the mortality-social class gradients over time, concluded that social inequalities in 1931 were as great, if not greater than in 1911, due to the fact that, while mortality rates had declined across all social strata during this time, the declines had been steeper in the higher status occupational groups than the lower. Antonovsky (1967), in his review of studies of life expectancy, overall mortality and social class dating back to the 12th century, also found evidence of differential rates of mortality decline among classes. He reasoned that the upper classes would be the first to benefit from improvements in such areas as nutrition, housing and immunization, after which these benefits would "trickle down" to the lower classes. This would produce lags in the resulting mortality rate declines, which would show up in cross-sectional studies as mortality rate differentials. He further hypothesized that as mortality rates reached very low levels, these differentials should disappear.

Interest in the social class-health gradient waned in Britain during the 1950s and 1960s, as the focus of research shifted to the transition from infectious to chronic disease as the main cause of illness and death (MacIntyre, 1997). However, the SES-health gradient once again came to the fore when policy-makers realized that infant mortality rates in Britain in the 1960s and 1970s were not declining as quickly as in many other

countries (Black et al., 1988). In 1960, Britain ranked eighth in the world in infant mortality rate (IMR). By the late 70s the country had fallen to 15th in IMR, behind both Hong Kong and Singapore. There was a feeling that the persistence of health inequalities might be playing a role, and the Working Group on Inequalities was convened to examine the evidence regarding the patterns of health inequalities, hypotheses as to their cause and implications for public policy.

The Working Group (authors of the Black Report) found marked social class gradients for most of their health status and health service utilization indicators. They also found that, in general, health inequalities between occupational classes had increased in the post-war period, in spite of the fact that overall mortality rates had fallen to a very low rate by 1971. This countered Antonovsky's hypothesis that social class differentials would disappear when mortality rates reached a low level. The Black Report also examined the evidence surrounding four theoretical explanations for the social class-health gradient, which they divided into four general areas: artefact, natural/social selection, materialist/structural and cultural/behavioural. They then produced a number of general and specific recommendations for both policy and research. The Report recommended health sector policy changes aimed at giving children a better start in life, providing better services for the disabled and increasing preventive and health education programs to promote good health. For wider policy, they recommended a broad anti-poverty strategy and improvements to education in general (Black et al., 1988; MacIntyre, 1997).

The Black Report "unleashed a vigorous and, at times, acrimonious debate" (Frank and Mustard, 1994), in both Britain and in North America. Criticisms of the

report focused on several issues. The first of these was its use of occupational classifications as a measure of social class, with critics arguing that the social status of an occupation can and does change over time. Also, the results over time were difficult to interpret because there was no index of inequality that could be used to judge whether the health inequalities were increasing or decreasing. Pamuk (1985), addressed these criticisms in a more refined analysis of the same data that controlled for changes in occupational status, misclassification and also included an index of inequality. She found that health inequalities decreased through the thirties but then began to increase in the post-war period and continued to do so into the seventies.

Another criticism levelled at the Black Report focused on the fact that it was based on an analysis of a series of cross-sectional studies and was not truly a longitudinal study. While this is true, subsequent longitudinal analyses have tended to corroborate the findings of Black and his colleagues. In a landmark longitudinal study of the association between socioeconomic status and health, Marmot and colleagues (Marmot et al., 1978; 1984) followed 17,530 British civil servants for more than ten years, periodically examining the relationships between employment grade and various types of mortality. In their first analysis, conducted after seven and a half years of follow-up, they found a clear and unambiguous inverse gradient between risk of death from coronary heart disease (CHD) and employment grade. The lower the grade, the higher the risk, with the risk of death from CHD in the lowest grade 3.6 times that of the highest. This association remained strong even after controlling for risk factors such as smoking, lack of physical activity, Body Mass Index (BMI) and hypertension.

A final criticism of the Black Report was its reliance on mortality data as its measure of population health status (Fein, 1995). Subsequent studies have used not only mortality, but also functional measures of health status such as the SF-36 (Hemingway et al., 1997), prevalence of disability (Wilkins and Adams, 1983) and the Health Utilities Index (Roberge et al., 1995a) in their examination of the association between socioeconomic status and health status. Again, these studies have tended to show that the conclusions of the Black Report hold for other outcomes.

In North America, studies of socioeconomic status or social class and mortality were rare prior to the publication of the Black Report. This was due in part to the fact that information about socioeconomic status, either using income or occupation, was not routinely collected in a way that could be linked to mortality data (Last, 1982; Krieger and Fee, 1994). Deciding on an appropriate classification system for social class has also been identified as a problem both here in Canada (Williams, 1971) and in the United States (U.S.) (Krieger and Fee, 1994). When socioeconomic data were included in public health analyses, often they were "primarily used by researchers to "control" for, rather than study the effects of, socioeconomic position on health" (Krieger, Moss and Williams, 1997: 342). As well, researchers and policy-makers in the U.S. were more concerned with health and mortality differentials between racial groups, rather than social classes. Apart from racial differences, the U.S. perceived itself to be a largely classless society, with mobility up the socioeconomic scale freely available to anyone willing to 'pull himself up by his bootstraps' (Krieger et. al., 1997; MacIntyre, 1997).

Despite these difficulties, there have been studies of SES and health in the U.S. The earliest of these was an ecological analysis of mortality in Chicago between 1928

and 1932 by census tract, with each tract assigned one of five SES levels based on median monthly rental payments (Fein, 1995). It found a smooth inverse gradient between mortality and median rent – the higher the rent, the lower the mortality. The first study which linked death certificates with actual individual SES data was Kitagawa and Hauser's Matched Records study (Kitagawa and Hauser, 1973). They found an inverse gradient between mortality and three measures of SES: income, education and occupation. Pappas and colleagues recently updated Kitagawa and Hauser's study using data from the National Mortality Followback Survey and the National Health Interview Survey. They found that not only is there still an inverse relationship between SES and mortality, but that the gradient steepened during the intervening 26 years (Pappas et al., 1993).

Since the publication of The Black Report and the Whitehall Study, there has been a "deluge of studies" (Frank and Mustard, 1994) conducted around the world. Reviews of this body of research (Marmot et al., 1987; Haan et al., 1989; Williams, 1990; McGrail et al., 1998; Adler et al., 1993, 1994; Anderson and Armstead, 1995) reveal the following: 1) Despite marked heterogeneity in measures of both SES (e.g. income, occupation, education, residential area) and health (e.g. life expectancy, mortality rates, morbidity or functional limitations), the gradient persists. Or, as Hertzman et al. (1994) put it, "higher socioeconomic status, however measured, seems to be associated with better health, however measured" (p.79). 2) The gradient shows remarkable consistency over time and across a variety of cultures, countries and economic systems. According to Haan et al., (1989) "the gradient, the persistence over the life span and over time, and the international consistency of the association are basic to our understanding of SES and

health." Recent studies in both the U.K. and the U.S. have suggested not only that the gradient persists, but also that it might have increased in recent years. Pamuk (1985) found that health inequalities decreased in the 20s and 30s and increased again in the Post-War period. Pappas et al. (1993) estimated that between 1960 and 1986 the index of inequality doubled for men, while for women the increase was 23 percent. Feldman et al. (1989) found an increase in educational differentials in mortality between 1960 and 1984 for men, with the gradient for women remaining about the same. In another study dealing only with poverty and mortality, Hahn et al. (1995) determined that poverty-attributed mortality in the U.S. increased between the period 1971-1984 and 1991 by 10%. In the early 1970s the poverty-attributed mortality in the U.S. was 16.1%; in 1991 it was 17.7%. They also examined the directionality of this relationship and concluded that "ill-health contributes relatively little to poverty; the direction of causation is primarily from poverty to poor health to mortality." (p.495).

Canadian studies of SES and health

The SES-health status gradient is also evident in Canadian studies. One of the earliest studies was an ecological study of mortality by census tract in the metropolitan areas of Canada (Wigle and Yao, 1980) that found an association between life expectancy and income status. Following on this work, and still examining mortality and income on the ecological level in urban areas only, Wilkins et al. (1989) examined changes in mortality differences by income between 1971 and 1986. They showed three measures of population health – life expectancy, disability-free life expectancy and quality-adjusted life expectancy – to be associated with income. All three population health measures increased with increasing income. However, they also found that differences between income groups had decreased from 1971 to 1986. They caution that because their

analysis is based on neighbourhood income variables rather than individual or household level income, their results probably represent the "minimum rather than the maximum estimate of income-related disparities in mortality" (p 165). As well, they advise caution in interpreting the changes over time, as they may reflect an increasing neighbourhood heterogeneity, with the poor scattered more widely within each community, rather than a change in the actual income-mortality relationship itself.

Wilkins and Adams (1983) in an analysis of individual level data from the 1978 Canada Health Survey, found both life expectancy and health adjusted life expectancy to decrease with decreasing income:

> Although comprehensive government-administered health insurance plans have made medical and hospital care available as a right to all Canadians since the late 1960s, this does not mean that socioeconomic-based disparities in health status have been eliminated. Healthfulness of life was directly related to income whether the measure was overall life expectancy, disability-free life or quality-adjusted life expectancy. Moreover, income-related disparities in health status were compounded, rather than diminished, when disability was taken into account as well as overall life years. (p. 1078)

Subsequent studies have confirmed the findings of an association between SES and health status in Canada (Hay, 1988; Roberge et al., 1995a; Badley and Ibanez, 1994). Mustard et al. (1997) examined data on mortality and hospital treatment rates (as a proxy for morbidity) in the province of Manitoba and found socioeconomic differences similar to previous studies. They also found that such differences are greatest in the mid-adult years, lessening into older age.

The SES-health status gradient in Ontario

In 1990, the Province of Ontario conducted a comprehensive survey of the health of its citizens. A multistage, stratified cluster design, was used to survey 61,239

individuals in 35,479 households. Information collected in the survey included health status, health behaviour, health care utilization as well as socioeconomic and demographic information. Evidence from analyses of these data indicates that a clear socioeconomic gradient with health status and other health-related measures also exists in Ontario.

An important feature of the Ontario Health Survey was the inclusion of questions to be used in the construction of an individual Health Utilities Index (HUI). The HUI is a generic health status index that synthesizes both qualitative and quantitative measures of health status. The quantitative component comprises measures on eight aspects of health and functioning: vision, hearing, speech, cognition, mobility, dexterity, emotion and pain. The qualitative component consists of a series of weights applied to these measures which are based on societal preferences concerning the various functional levels. The weighted scores are then combined into an index with perfect health scoring 1.0.

Roberge et al. (1995a) conducted an analysis of HUI scores by socioeconomic status, specifically by income, educational attainment, marital status, occupation and an SES measure combining education and income. Each analysis was stratified by age group and sex. Their results tend to confirm other studies of SES and health status. Looking at measures of SES such as income (adjusted for family size and type), education and occupation, there is a gradient of increasing HUI with increasing SES for nearly every group between ages 35 and 64 for both men and women. Below age 35 and above 64 the association is not consistent. The results also show that HUI decreases with age, although the slope of the gradient changes with SES level and differs between men and women. It is interesting to note that the association between income and education, either

alone or together, appears to be stronger than the association between occupation and SES, based on the consistency of the gradients across age-sex groupings. With respect to marital status, there is no consistent pattern across age-sex subgroups. Below age 45, both men and women show a similar pattern of increasing HUI from separated/divorced to single to married. After age 44 for women, being single is associated with the highest HUI, while the pattern for men changes with each age category.

While this study is interesting because it uses functional health status rather than the more commonly used mortality as the outcome measure, it has a number of significant limitations. The first are the weights used to compute the HUI. Although the weights are intended to reflect societal preferences with respect to functional limitations, those used in this study were derived from a relatively small sample of the population. As well, except for stratification by age and sex, there was no adjustment for confounding. Thus, for example, the relationship between high HUI and being a single woman may be a result of single women's educational or income levels, not her marital status per se. Finally, because the study was cross-sectional, one cannot draw any conclusions regarding directionality.

A number of studies used the results from the 1990 OHS to examine factors associated with specific health problems (Badley et al., 1993). However, in most cases SES was simply treated as a possible confounder to be controlled for rather than a potential risk factor in and of itself. An exception was an analysis by Liira et al. (1996), focusing on long-term back problems. With respect to simple prevalence, a gradient was found with both income (increasing prevalence of back problems with decreasing income) and education (prevalence was significantly higher among those without a

secondary diploma than those who had secondary or greater). However, of the SES variables only occupation (white or blue-collar) was included in the logistic regression model, and was no longer significant once physical exposure was controlled for. While certain types of physical exposure (bending and lifting, operating vibrating machinery and working with the back in an awkward position) proved to be the best predictors of long term back pain, the authors did not take their analysis one step further and examine possible predictors of such exposure.

Other investigations into the association between SES and health have focused on either health behaviour or health-care utilization. Pomerleau et al. (1997) focused on the association between SES and the likelihood of meeting current recommendations for four health behaviours: smoking, alcohol consumption, fat intake and physical activity. Jaglal and Goel (1994), using data from the Ontario Heart Health Survey, looked at risk behaviour for coronary artery disease such as smoking, blood cholesterol, blood pressure and BMI and found higher risk behaviour to be associated with lower SES as measured by education level. Allison (1996) studied the predictors of physical inactivity using OHS data and found income to be a strong predictor. Ostbye et al. (1995) found the odds of being overweight or obese (defined using BMI) to be related to education and occupation, among other factors. And Keller et al. (1997) discovered that levels of income and education were associated with diet quality in seniors for both men and women.

With respect to health care utilization and socioeconomic status, Katz et al. (1996a, 1996b) found that in Ontario, utilization of physician and hospital services decreased with increasing income. As well, within income groups, utilization rates

increased with declining health status. They compared this to patterns in the U.S., which were much more mixed, with utilization among those in fair/poor health increasing with income. A similar study by Iron and Goel (1998), who looked separately at men and women, found need for health care, defined using health status and number of reported health problems, to be the most important predictor of hospital utilization. SES (income) was associated with utilization for women but not for men. MacIsaac et al. (1997) also looked at physician use and found that SES was not associated with seeing a general practitioner once in the past 12 months, but it was associated with six or more physician visits in the same period. While it is generally lower levels of income and education that are associated with higher frequency of utilization, the probability of having seen a specialist increased with income and education. Brown and Goel (1994) found that those with less than a high school education were more likely to have made two or more visits to the Emergency Room in the previous 12 months.

Socioeconomic status is also related to utilization of preventive services, with women in higher SES groups more likely to have had a Pap smear (Goel, 1994), and to have undergone mammography (Mercer and Goel, 1997), although in the latter study, the effect of the specific SES variable (income or education) varied with age group. Katz et al. (1994) also found that the probability of receiving a screening test for breast cancer or cervical cancer increased with both income and education.

Explanations for the SES-health gradients

If the fact of the SES-health status gradient is not in dispute, there continues to be a lively debate regarding the possible explanations for this association. In 1980, the Black Report divided the theoretical explanations of the association between health and socioeconomic status into four categories: artefact, natural or social selection,

cultural/behavioural factors and materialist/structural explanation. Other possible explanations have emerged since. The following is an outline of the main explanations for the gradient that have been put forth in the past two decades.

Artefact

This explanation argues that the SES-health gradient is an artefact of the data, and it does not reflect a causal relationship. Proponents of this view argue that, while the gap between classes may not have closed, the proportion of people in the lower classes has been shrinking, so that there has, in fact, been a lessening of inequalities. This is not borne out by the data, which show that, depending on the time frame involved, the proportion of the population in the lower SES groups (certainly the lower income groups) has tended to either remain the same or increase (Black et al., 1988).

Differential access to health care

Along with poorer nutrition and sanitation, lack of access to health care was also often cited as an explanation for the SES-health gradient. However, this explanation does not stand up under closer scrutiny, for two reasons. In the first place, the gradient persists even in places where access to health care is based on need and not on financial resources, as illustrated by studies from Ontario. Studies of utilization patterns in Ontario found that need was the greatest predictor of use of both hospital and physician services (Iron and Goel, 1997; MacIsaac et al., 1998), and that low income Ontarians had the highest utilization rates (Katz et al., 1996a, 1996b). However, in spite of this, Roberge et al. (1995a) still found clear SES-health status gradients among the Ontario population.

A number of researchers have also looked at the impact of health/medical care on mortality or life expectancy and found it to be small. McKeown et al. (1975), analysed death rates from various infectious diseases over time and concluded that the

contributions of modern medicine to the decline in mortality from such diseases have been small. Bunker et al. (1994) estimate that modern medical advancements in this century account for only about 5 years additional life expectancy, or about 20 percent of the actual improvement that has occurred. One can only conclude that barriers to care do not appear to be a sufficient explanation for the gradient, nor does access appear to be a solution.

Natural or social selection

This explanation is known by a number of titles – selection (Black et al., 1988), social mobility (Wilkinson, 1996) or reverse causation (Hertzman et al., 1994). Essentially, this theory suggests that the relationship between SES and health is being interpreted in reverse order. Rather than lower SES "causing" relatively poorer health, it is the poorer health that is "causing" the lower SES. Two studies (Power et al., 1990; Wadsworth, 1986) investigated this possibility and concluded that health does affect social mobility, but the size of the effect is small and cannot account for overall health differences. In addition, Wilkinson (1996) quotes from an unpublished study by Bartley and Plewis, who report that the effects of social mobility would likely be to decrease differences between SES groups.

Cultural/behavioural factors

This takes the approach that differences in health status between SES groups can be accounted for by differing levels of high risk behaviour such as smoking, alcohol consumption, diet and other lifestyle factors. While it is certainly true that risk behaviours such as smoking (Pomerleau et al., 1997), obesity (Ostbye et al., 1995) and physical activity (Allison, 1996) are related to both SES and health status, work by Slater and colleagues (Slater and Charlton, 1985; Slater et al., 1985) as well as evidence from

the Whitehall Study (Marmot et al., 1978) indicate that the effects of SES and health behaviour on health status operate independently of one another.

The lifestyle/behaviour explanation tends to assume that an individual behaves in a certain way of his or her own free will, and chooses to engage in high risk behaviour out of a lack of knowledge of the consequences. It then follows that the solution to the problem lies in education – once a person realizes the risk, he or she will cease the behaviour. However, the authors of the Black Report point out that this view fails to take into account the context, or "culture", in which people live and make choices. They cite Bernstein (1971), who argues that different patterns of child-rearing and socialization in working and middle class families produce children with very different linguistic and intellectual approaches to the social world. According to Evans and Stoddart (1994), who used the example of smoking, "the observation that smoking behaviour is sharply graded by socioeconomic class undercuts the argument that it represents an individual choice, and indicates instead a powerful form of social conditioning" (p. 44). This view sounds more like the materialist/structural argument (discussed in the next section) in that it implies that culture differs between social classes, and thus, that at least certain aspects of culture are determined by economic factors. This illustrates one of the difficulties with the search for an explanation for the association between health and SES – the lines between explanations are often blurred and may not be mutually exclusive.

Materialist/structural explanations

This approach emphasizes the role of economic and associated socio-structural factors in the distribution of health and well-being (Black et al., 1988:106). Traditionally, this has tended to focus on the *direct* link between poverty and ill-health, which are obvious when one considers conditions among the urban poor of Britain's

cities in Victorian or Edwardian times, or in the slums of the megacities of the developing world today. The health risks resulting from a lack of basic necessities such as proper food, housing, clean water, etc. are clear.

However, how does the materialist/structural explanation apply in today's industrialized societies, where food is relatively inexpensive and the vast majority have access to basic needs such as safe water and housing? In the Black Report, the authors, who confessed to preferring this explanation above others, theorize that economic class may be playing an indirect rather than a direct role, through the *relative* inequalities that continue to exist. "Poverty is also a relative concept, and those who are unable to share the amenities or facilities provided within a rich society, or who are unable to fulfil the social and occupational obligations placed upon them by virtue of their limited resources, can properly be regarded as poor." (Black et al., 1988:107). Being at the lower end of the economic scale, even though the bottom of the scale might be higher in absolute terms than a generation ago, still may confer disadvantages such as exposure to emerging new hazards, increased geographical isolation or lack of access to new information about health risks.

Income inequality

The idea that relative inequalities can have a detrimental effect on health is a theme that has been explored by a number of investigators. They argue that it is income distribution that has the negative effect on health, and they have taken an ecological approach to explore this relationship at the aggregate level (Wilkinson, 1992, 1996; Kennedy et al., 1996; Kawachi and Kennedy, 1997; Lynch et al., 1998). All have found that mortality rates increased as income disparity increased.

Wilkinson (1996), in an examination of health and income inequalities in a variety of countries, found that even if the absolute level of incomes was relatively low (although adequate to meet basic needs), if the spread from the lowest to the highest income percentile was relatively narrow, the country would show a flatter income-health gradient than a country with higher absolute levels of income but a broader range of income levels.

Kennedy, Kawachi and Prothrow-Stith (1996) examined the association between income distribution and mortality using two measures of inequality -- the Gini coefficient and the Robin Hood Index. The Robin Hood Index is a measure of the proportion of total income that is "maldistributed" – that is, the proportion of total income earned by the segment of the population whose income proportion exceeds its population proportion. For example, if 40% of the population earn 70.26% of the income, the Robin Hood Index is 30.26%. They found a strong correlation between the Robin Hood Index and total mortality as well as treatable causes of mortality such as infectious disease, hypertensive disease and tuberculosis. This relationship persisted even after controlling for poverty level, smoking, median household income and household size. In a similar analysis, that used the proportion of total household income earned by the least well-off 50% of the population, Kaplan et al. (1996), using as their measure of inequality the proportion of total household income earned by the poorest 50% of the population, found it to be correlated with total age adjusted mortality, homicide rates, violent crime rates, per capital expenditure on medical care and percentage low birth weight infants.

Kaplan and colleagues then took their analysis one step further and examined possible pathways which would account for the link between income inequality and

mortality. Looking at a variety of social indicators, they found correlations between the level of income inequality and the proportion of the population unemployed, incarcerated, receiving welfare, food stamps and without health insurance. Income inequality was also correlated with educational outcomes such as the proportion of the population with no or incomplete high school education.

A valuable analysis by Duncan (1996) sheds some light on a possible individual-level mechanism for this increasing disparity. He looked longitudinally at individual incomes over twenty years, tracing average incomes at the 10^{th}, 50^{th} and 90^{th} percentiles. He also tracked inflation-adjusted incomes for each group relative to the base year of 1969. The results are a dramatic illlustration of the differential effects of recessional and post-recessional periods on those at different income levels. While all groups saw their incomes decline during recessions, the declines became larger as the percentile decreased. As well, the ability for income levels to recover decreased as the percentile decreased. The result was that at the end of twenty years, average income in the 90^{th} percentile had increased 18%, had stayed the same for the 50^{th} percentile group and had dropped about 22% in the 10^{th} percentile group. If the association between income and health is causal, the health status of the lower group would drop and that of the highest group would rise, changing the slope of the gradient.

The fact that studies of the correlation between health and income inequality have used a variety of different measures has been the subject of criticism. Judge (1995) suggested that researchers in this area choose to use a certain measure because it yields the expected outcome. Such criticism was refuted in a study by Lynch et al. (1998), who examined the correlation between income inequality, measured nine different ways, and

total mortality in 283 metropolitan areas of the United States. They found a consistent, highly significant ($p<.001$) correlation between the two in every case. The relationship remained significant when they controlled for per capita income and average household size. Interestingly, however, they also found per capita income to be significantly associated with mortality, although the relationship was weaker than that of income inequality. Their findings suggest a series of parallel gradients both by income inequality quartile and by per capita income quartile.

Social Cohesion

A number of possible pathways have been suggested for the interaction between SES and health. Kawachi and Kennedy (1997) and Kawachi et al. (1997) tested the hypothesis that one of the pathways by which income inequality leads to health inequality as measured by mortality is via reduced investment in social capital and resulting damage to the social fabric. Following on the work of Putnam (1993), who, in his pioneering work in Italy, equated social capital with social cohesion – a sense of solidarity and integration among community members, they identified four indicators of social cohesion: participation in social organizations; level of perceived fairness; degree of mistrust of others and perceived lack of helpfulness. They then examined the associations between age-adjusted mortality, income inequality as measured by the Robin Hood Index and the four social capital measures. Income inequality was found to be highly correlated with mortality as well as with the social capital variables. In a path analysis they found that the relationship between income inequality and mortality is mediated through the social capital variables, especially perceived fairness. The authors conclude that "disinvestment in social capital appears to be one of the pathways through which growing income inequality exerts its effects on population-level mortality". They

caution, however, that the effect may also go in the opposite direction, or that there may be other variables underlying both social capital and income inequality and urge further investigation.

Lynch et al. (1998), proposed a 2-strand hypothesis as to how inequality is linked to health. The first strand suggests that income inequality is associated with a set of social processes and economic policies that systematically underinvest in physical and social infrastructure such as education, which may affect health. The second strand comprises the consequences of people's perceptions of their relative place in the social environment, leading to behavioural and cognitive states that influence health. Corin (1994) and others have suggested that the intervening factor here is stress. He argues that the dissonance created when one is unable to meet either one's own or one's community's expectations, results in great stress. This stress then increases one's susceptibility to a variety of conditions and illnesses. The idea that social inequalities can affect host resistance and increase susceptibility was first proposed in 1976 (Syme and Berkman, 1976; Cassel, 1976). It continues to be an attractive explanation for two reasons: 1) it describes a physiological mechanism through which an aggregate level variable such as income inequality can act on health at the individual level and 2) it offers a possible explanation for the striking diversity of pathological conditions associated with SES differentials. Marmot reports that in the Whitehall study, investigators found being lower on the job hierarchy to be associated with deaths from lung cancer, other cancers, coronary heart disease, cerebrovascular disease, respiratory diseases, genitourinary disease, accidents and violence (1994). The Whitehall II study also found an association with a variety of morbid and functional conditions (Hemingway et al., 1997).

Summary

In summary, the literature surrounding the association between SES and health suggests several things. First, that the association is ubiquitous. In this review of literature, no studies emerged that looked for an association between SES and health status and failed to find one. On the contrary, the association persists across cultures, across segments of the population and over time.

Secondly, the current variation in the lines of inquiry into the association suggest that there may be a number of possible explanations for the association, all of which are partially correct. All of this points to an association that is quite complex, with a variety of factors and determinants playing a role.

B. Measurement of Health Status

The relationship between SES and health status is complex, in part, because health itself is complex with respect to both its definition and measurement. With respect to definition, health was traditionally defined in terms of pathological conditions – if one was alive and had no diagnosed pathologies, then one was healthy. In the past few decades the emphasis has shifted from defining how sick someone is, to how *well* they are. This is often described as general health status, quality of life or well-being (Ware, 1995; Bergner, 1989). Patrick and Bergner (1990), prefer the term *health-related quality of life*, which encompasses a broad range of concepts, from death and duration of life to opportunity, and have developed a useful framework for delineating the various domains or concepts of health that fall within the health-related quality of life definition (see Table 1).

Along with variation in the concepts or domains of health underlying a particular choice of indicator, there are wide variations in the types of health measures. Health measures may be generic or disease specific, preference-weighted or non-preference-weighted, global or have a series of components and yield either an overall index or a profile. Generic measures generally measure health concepts that are universally valued and relevant to functional status and well-being, but are not specific to any one age, sex, disease or treatment group (Ware, 1991, 1995; Patrick and Deyo, 1989). Disease-specific measures, on the other hand, are designed to assess specific populations with specific conditions or diagnoses. The concepts measured range from overall measures of well-being to a single concept such as nausea and vomiting (Patrick and Deyo, 1989). The relative advantages and disadvantages depend to large degree on the objectives of the research and application of the measurement. For large, population-based studies of health status, generic measures are the most appropriate, as they allow comparability across ages, different diseases and conditions and sexes.

Table 1.1 Concepts and domains of health-related quality of life

CONCEPTS AND DOMAINS	DEFINITIONS/INDICATORS
OPPORTUNITY	
Social or cultural handicap	Disadvantage because of health
Individual resiliance	Capacity for health; ability to withstand stress; reserve
HEALTH PERCEPTIONS	
Satisfaction with health	Physical, psychological, social function
General health perceptions	Self-rating of health; health concern/ worry
FUNCTIONAL STATUS	
Social	
Limitations in usual roles	Acute or chronic limitations in social roles of student, worker, parent, household member
Integration	Participation in the community
Contact	Interaction with others
Intimacy	Perceived feelings of closeness; sexual
Psychological	
Affective	Psychological attitudes and behaviours, including distress and general well-being or happiness
Cognitive	Alertness; disorientation; problems in reasoning
Physical	
Activity restrictions	Acute or chronic limitation in physical activity mobility, self-care, sleep, communication
Fitness	Performance of activity with vigor and without excessive fatigue
IMPAIRMENT	
Subjective complaints	Reports of physical and psychological symptoms, sensations, pain, health problems or feelings not directly observable
Signs	Physical examination: observable evidence of defect of abnormality
Self-reported disease	Patient listing of medical conditions or impairments
Physiologic measures	Laboratory data, records and their clinical interpretation
Tissue alterations	Pathological evidence
Diagnoses	Clinical judgments "after all the evidence"
DEATH AND DURATION OF LIFE	Mortality; survival; longevity

Adapted by Patrick and Bergner (1990:167).

Measures may also be preference-weighted or non-preference-weighted. Non-preference weighted measures include health classification systems, in which respondents are assigned to different categories according to their responses to one or more questions. Classification measures may use a Likert-type scale where each item (category) is given equal weight. Or they may use an ordinal scale to which numeric values such as 0, 1, 2, 3, etc. may be assigned. In the latter case, the numbers assigned do not have any relative value, i.e. category 2 is not necessarily twice as bad/good as category 1, but simply indicate relative positions on the scale.

Preference-weighted measures, on the other hand, are one type of measure that attaches a numeric value to a health state. Preference weighting arose out of the conception of health status and quality of life as a value (Patrick and Bergner, 1990). Preference or utility values are assigned to states of health and quality of life according the certain rules and procedures. Utility-theory based measures such as the Health Utilities Index generally use techniques such as standard gamble, time trade-off or rating scales to determine health state preferences. As Mulley (1989) points out, there is an on-going debate over the use of preference-based measures, primarily around the validity of the preference weights themselves. He identifies as the source of this debate evidence that suggests preferences vary not only across individuals, as is to be expected, but according to the methodology used to derive the preference weights and the context in which the questions are asked. He also suggests that societal preferences in general are not static but may change over time, so preferences elicited at one point in time may no longer be valid at a future date.

Health status measurements may also be global, single-attribute or multi-attribute. Self-rated health is an example of a global measure of health. It asks the respondent to describe his or her health status in one overall term: excellent, very good, good, fair or poor. Other measures, such as the HUI, measure specific components of health – vision, hearing, mobility etc. and then combine them into a single measure. The difference is that in the latter case the components are explicit, while in the former the respondent is free to form his or her own evaluation criteria.

The information gathered from generic health measurement instruments may be summarized in one of two ways: as a single index score or as a profile that comprises measures of several different health components (McDowell and Newell, 1996). Examples of general health status surveys that yield a single index score are the European Quality of Life survey (EuroQOL), the HUI and Quality of Well-being Scale. Health status surveys that give a profile include the Nottingham Health Profile, the Short-Form 36 and the Duke Health Profile (Ware, 1995). Those who advocate the profile approach argue that health is inherently multidimensional and must be presented as such. Those who support the single index take the view that tradeoffs between dimensions are a part of everyday reality, and that a single score is more useful when deciding between two types of treatment, for example (McDowell and Newell, 1996).

Three measures of overall health status were examined in this thesis. The table below summarizes their characteristics based on the foregoing discussion.

Table 1.2 Characteristics of Health Status Measures Used in this Thesis

Health Status Measure	Concept or Domain of Health	Type of Measurement
Self-rated Health Status	General health perceptions	Global, unweighted, single score
Health Utilities Index	Physical activity restrictions; self-reported impairments	Preference-weighted single index
Activity Restriction	Role limitations	Unweighted, single score

Self-rated Health Status

Self-rated health status has been used since the 1950s in health and gerontological research (Jylha et al., 1998). It is attractive to researchers because it is both simple and global. There is a growing body of evidence of its validity and reliability. Idler and Benyamini (1997) reviewed 27 community studies of self-rated health and mortality and concluded that it is a consistent independent predictor of mortality. It has also been found to be predictive of hip fracture (Cummings et al., 1995), coronary heart disease (Moller et al., 1996), disability requiring the need for assistance with activities of daily living (Kaplan et al., 1993) and the use of physician services (Miilunpalo et al., 1997). Its robustness as a predictor of a variety of health outcomes suggests strong predictive validity. Its correlation with a number of more complex health indices indicates that it also has construct validity (Cousins, 1996). Lundberg and Manderbacka (1996) re-interviewed a sample of respondents from the Swedish Level of Living Study and found self-rated health to have high test-retest reliability as well (kappa=.723).

Studies have also explored the criteria, and thus the underlying construct of health, used by individuals to rate their health. Shadbolt (1997), examining the correlates

of self-rated health in a population of Australian women, and Manderbacka (1998) using qualitative interview techniques, generally found that "self-rated health reflects a complex process of internalized calculations that encompass both lived experience and knowledge of disease causes and consequences" (Shadbolt, 1997:951). Manderbacka (1998) also found that individuals who rate their health at the lower end of the spectrum tend to focus on illness and disability, while those who rate their health at the higher end also focus on health behaviour and feelings of fitness. Both concluded that people rate their health based on their understanding of what is important to health. Further to this, work by Jylha suggests that the construct of health used within a population is likely to be similar, but that cultural differences may exist, and that cross-cultural comparisons should be made with caution.

There are often differences in the wording of self-rated health questions on population-based health surveys over time and from survey to survey. In some cases, the respondent is asked simply, "In general, how would you rate your health?". In others, the respondent is asked explicitly to remove the effects of aging: "In general, compared with people your age, how would you rate your health". The phrase "in general" is sometimes worded "overall" or "all-in-all", while the category choices vary from 'excellent, very good, good, fair and poor' in the National Population Health Survey (Canada) and the National Health Interview Survey (U.S.) , to 'very good, fairly good, average, fairly poor and poor' in the European Longitudinal Study on Aging (ELSA) (Jylha et al., 1998) and 'very good, good, fair, bad and very bad' in the European Health Interview Survey (WHO EUROHIS). While Idler and Benyamini (1997) concluded that the strength of the association between self-rated health and subsequent mortality was such that it was

unaffected by differences in question wording, Manderbacka (1998) suggests that question wording may affect have an effect on other associations. Further research is needed into this question.

In summary, the high correlation shown between self-rated health and more complex health indices, coupled with the research into the health constructs which underlie respondent's evaluations, provide evidence to support a growing consensus that self-rated health is both a valid (Greiner et al., 1996; Cousins, 1997; Manderbacka et al., 1998) and reliable measure of an individual's health status (Lundberg and Manderbacka, 1996; Cousins, 1997).

The Health Utilities Index

One of the limitations of self-rated health as a measure of health status is its lack of discrimination. As Gold et al. (1996) point out, "Sixty-six percent of the US population reports itself as being in either excellent or very good health, therefore providing little information about gradations of health in a majority of Americans" (p. 164). This has been the impetus for the development of more detailed health-related quality of life (HRQOL) measures. The measure included in the Ontario Health Surveys is the Health Utilities Index.

The Health Utilities Index is a generic, multi-attribute, preference-based system for assessing health-related quality of life (Torrance et al, 1996). There have been three versions of the Health Utilities Index. The first, HUI Mark I, was developed for use in evaluating outcomes for low birthweight children in neonatal intensive care. It consisted of four domains, each having from four to eight attribute levels: physical function, role

function, social-emotional function and health problems. The second version, HUI Mark II, was developed for use in evaluating long-term outcomes of childhood cancer. It comprised seven domains: sensory and communication, happiness, self-care, pain or discomfort, learning and school ability, physical activity ability and fertility (Torrance et al., 1996). A third version, which is intended for use in the general adult population to measure overall health states, has been developed which includes eight domains: vision, hearing, speech, mobility, dexterity, emotion, cognition and pain, each having between four and seven attribute levels.

The utility index itself consists of a combination of the utility weights assigned to the attribute level of each domain. The utility weights themselves were determined by using Standard Gamble techniques to quantify individual preferences for the various health states (Roberge et al., 1995a). (For more information on utility theory and Standard Gamble, see von Neumann and Morgenstern, 1947).

In the version of the Health Utilities Index used in the 1990 and 1996 Ontario Health Surveys, the domains (and associated survey questions) for the population-based HUI:Mark III were mapped onto the weights and attribute levels for the HUI:Mark II. This has become known as the "provisional" HUI:Mark III (Mittman, et al. 1999).

Since 1990, the Health Utilities Index has become increasingly widely used as a measure of health status, both in Canada and elsewhere. In Canada, this is facilitated by the fact that the HUI has been included in several large, population-based surveys: the 1990 Ontario Health Survey, cycle 6 of the General Social Survey, the National Population Health Survey and the National Longitudinal Study of Children and Youth (Boyle et al., 1995). It has been used both as a direct measure of health status (Roberge

et al., 1995a) and as a weighting factor in measures of health-related quality of life (Manuel, 1997; Berthelot et al., 1993; Martel and Belanger, 1998). It is attractive because it provides a single, continuous, numerical measure of health status across a wide variety of health states. One caution noted by researchers in the past is the fact that the utility weights used in the provisional Mark III version were developed using a sample of parents of children with cancer, rather than a sample from the population at large. New weights, developed using a general population sample, have recently become available, but will not be incorporated into the NPHS surveys until the 1998 cycle. A few studies have examined the validity and reliability of the HUI. Gold et al. (1996), assessed the predictive validity of an adapted version of the HUI: Mark I and found it able to predict "the health related outcomes of vital statistics, hospitalization and decline in health perception over a 3- to 5-year time frame." (p. 170). However, they also found that beliefs about health behaviour were not incorporated, nor did the measure show any differentiation between those who had had cancer and those who had not. On the positive side, the constructed HUI retained predictive validity for those with excellent or very good Self-rated Health, who form a large portion of the general adult population, particularly at younger ages. Beaton et al. (1997) examined the test-retest reliability and responsiveness of the pain component of the HUI and found the reliability of the measure to be adequate, while the tests of responsiveness were somewhat inconclusive. Boyle et al. (1995) also examined the test-retest reliability of the HUI: Mark III as a whole and found it to have good reliability. As there is still work to be done in evaluating the HUI for construct validity, especially in how to interpret changes of various magnitudes, the

developers of the measure themselves caution that it is best interpreted in relative or comparative terms, rather than in absolute terms (Torrance et al., 1992).

Activity Restriction

Functional status is one of the domains of health defined in Table 1. Physical functioning, which is the main focus of the Health Utilities Index, is one aspect of functional status. Another is role functioning, which is measured as the presence or absence of limitations to role function as a student, householder, worker or participant in leisure activities. If a survey participant responds that they have a limitation in any of the above roles, they are flagged as having some type of activity restriction. Although no formal evaluations of either the validity or reliability of self-reported activity restriction exist in the literature, it is relatively widely used in general reports of population health status. For example, Williams et al. (1998) used activity restriction as one of their indicators of the burden of disability attributable to arthritis. It is also one of the indicators of disability used in a recent report on the health status of people living in Ontario (PHRED, 2000) and in Canada (ACPH, 1999).

C. The Ontario Context 1990 and 1996

The early 1990s saw the global economy experience another severe economic recession. In Canada, this recession hit particularly hard in the industrial heartland of Ontario. Plant closures, "downsizing" and retrenchment were all familiar features of the employment landscape. What made the 1990s recession different from others was the fact that it also involved major shifts in the labour market itself. Many traditional industrial jobs disappeared forever, replaced by new jobs in the computer and high tech industries. This shift has particularly affected older workers, for whom retraining is often not an option for a variety of reasons.

As well, this recession was accompanied by significant social policy changes, including cuts in transfer payments through Unemployment Insurance and Social Assistance. Finally, the recession lasted much longer than had originally been predicted and even when the recovery began, it was often referred to as "jobless".

The result has been a pattern of growing inequality in Ontario. A background paper released by the Canadian Council on Social Development in November 1995 outlines some of this inequality. Using data from Statistics Canada, they point to polarization in at least two areas: 1) work hours: the proportion of people working either 1-29 hours per week or over 50 hours per week has increased, while the proportion working 30-49 hours decreased; 2) the shrinking middle class: among Ontario men, for example, the proportion earning between $15,368 (the average low-income cutoff) and $50,000 decreased by nearly 8%, with the proportion earning less than $15,368 increasing 5% and the proportion earning more than $50,000 increasing by nearly 3%. (CCSD, 1995)

Poverty rates tell a similar story. The family poverty rate in Ontario rose from 9.6% in 1990 to 12.6% in 1995. Looking at selected non-elderly family types, the poverty rate for 2-parent families rose from 9.8% in 1990 to 12.8% in 1995; for single-parent, female-headed families it remained relatively constant at a very high rate, fluctuating between about 60% and 56%; the most dramatic change was in single-parent, male-headed families - the poverty rate in this group initially dropped from 25.5% in 1990 to 18.9% in 1992 but then increased to over 30% the following year, where it has remained. (CCSD, 1997) Overall, average family income dropped 6.4%, with male lone-parent family income dropping 11.3% and female lone-parent family income dropping

8.2%. It is important to note that while male lone-parent families may have had the largest proportional decrease in income, in 1995 they were still earning, on average, $44,318 per year compared with and average of $30,182 for female lone parent families.

Finally, two multivariate indexes, each constructed by combining data on a variety of social, health, economic and environmental indicators, also show a negative change during the 1990s. The Index of Social Health was developed in the mid-1980s at Fordham University (Fordham University, 1995). It is composed of the following indicators: Children- infant mortality, child abuse, children in poverty; Adolescents - teen suicide, drug abuse, high school drop-out rate; Adults - adult unemployment, average weekly earnings, health insurance coverage (US); Seniors - poverty among those 65 and over, out-of-pocket health costs for those 65 and over; All ages – homicides, alcohol-related traffic fatalities, Social Assistance beneficiaries (Canada), access to affordable housing, gap between rich and poor. When the Index was calculated for Canada for the period 1970 to 1995 (Human Resources Development Canada, 1997) the results showed that after peaking in 1979, the Index scores have been in general decline ever since. The score for 1995 was lowest since 1974. As well, the Index score dropped 12% between 1990 and 1995.

The Quality of Life Index for Ontario (Shookner, 1997), is another multi-indicator index that attempts to measure overall societal quality of life. It comprises the following indicators, each recorded as a rate per 10,000 population: children taken into care of Children's Aid Societies, Social Assistance beneficiaries, people waiting for public housing, labour force working, labour force unemployed, number of bankruptcies reported, deaths from suicide, long term care waiting list, low birth weight births, number

of hours of moderate/poor air quality, number of effluent discharge spills, tonnes of waste diverted to blue boxes. The overall composite index fell 13.6% from 1990 to 1997.

It is quite clear that the early to mid 1990s represent a period of economic hardship for many Ontarians. Involuntary unemployment, shrinking income, and even job insecurity tend to increase stress levels and have been found to have negative effects on health. A number of researchers have examined the impact of economic recession on the health of individuals and populations. The focus of many of these studies has been the central feature of recession – unemployment (here meaning those who wish to work but can't find a job). Jones, in his review of this body of literature, states that "Unemployment has been demonstrated to be a stressful life event with severe health consequences." (Jones, 1997:49). Brenner, (1984) who pioneered work in this area in the 1970s and 1980s, correlated an increasing unemployment rate and other changes in the labour market with increases in such things as cardiovascular problems, cirrhosis, suicide, infant mortality, homicide, motor vehicle accidents, child abuse and psychiatric admissions (Shortt, 1996). However, Brenner's work has been criticized because it uses aggregate data and so is subject to the "ecological fallacy". Subsequent studies of individuals during plant closings etc. have since substantiated many of Brenner's findings and have shed light on some of the intervening variables that account for the relationship between unemployment and poor health outcomes. Studies have found that the unemployed take more medication, visit physicians more often, have higher blood pressure and are admitted to the hospital more often than the employed (Jones, 1997). This is true even in studies that have controlled for possible selection bias. In an

interesting study in Ontario, Burke et al. (1993) found that employment status was strongly associated with health status outcomes for men, but not for women.

Lynch et al. (1997) also found a consistent and graded association between economic hardship and physical, psychological and cognitive functioning, although their work had a followup time of 30 years. In his review of the literature, Jones (1997) found that many longitudinal studies of workers who became unemployed experienced increased health problems during the first year after they became unemployed and some studies even found increased health risks during the anticipatory period – that is, between the time when workers find out that a plant/company will be closing/laying people off, and the point at which the layoff/closure takes effect.

While it may be that recessions can cause unemployment, which in turn can have a deleterious effect on health, is there any reason to expect that the effect would be different for people in different socioeconomic groups? A study by Duncan (1996) suggests that this might be so. In his work on income dynamics and health he begins by quoting evidence suggesting a differential impact of income on mortality. In the study proper, he showed that 1) recessions tend to have a greater impact on the incomes of people in the lowest income groups, whose incomes fall proportionately farther than those at higher levels and 2) that after a recession, those is the lowest income groups also tend not to make up the ground they lost, leading to a widening gap between those at the lowest levels and those at the top.

V. Summary

In summary, this review of the literature cites evidence that the recessionary early 1990s was a time of increasing income inequality in Ontario, as a greater proportion of

the population dropped below the low-income cutoff (CCSD, 1995, 1997). As well, there is evidence to suggest that the negative effects of recessions on income are much worse for those at the bottom end of the economic scale (Duncan, 1996). Based on the literature on the association between SES and health status, it is reasonable to expect that the early 1990s would also see increasing disparity in health status across socioeconomic groups and that this increased disparity will be evident as a change in the SES-health status gradient.

Chapter 2: Methods

I. Research Design

This thesis compares data from two cross-sectional population-based surveys, carried out in 1990 and 1996/97, with respect to the associations between the variables of interest – in this case the relationship between measures of socioeconomic status and measures of health status. Cross-sectional surveys, as the name implies, take a snapshot of a population, including various outcomes, exposures, social and demographic co-variables etc., at a single point or during a narrow window of time. Such studies have two main advantages: they are relatively inexpensive, because they don't involve long periods of follow-up, and they are often based on a sample of the general population, increasing the generalizability of their findings. The main disadvantage of cross-sectional studies is the fact that, because exposures and outcomes are measured at the same time, it is difficult to determine which came first and so nearly impossible to determine causality. Cross-sectional studies, then, are usually used to explore relationships and associations between variables (Kelsey et al., 1996), and are generally used for hypothesis generating rather than hypothesis testing.

Series of cross-sectional studies are often used to trace changes in relationships between variables over time. A well-known example of this type of study is the Black Report (Black et al., 1988), which used a cross-sectional series to trace the relationship between socioeconomic status and mortality from the 1920s into the 1970s.

Because one of the independent variables was education, the analysis was limited to those individuals 25 years of age and older, an age at which the majority of the

population have attained their highest level of education (the analysis does not distinguish between undergraduate and graduate university education).

II. Data Sources

Data sources for this thesis were the 1990 Ontario Health Survey (OHS90), which used a multi-stage, random sample design to survey some 35,000 households (61,239 individuals) (Ontario Ministry of Health, 1992), and the Ontario portion of the 1996/97 National Population Health Survey (now known as the OHS96) which surveyed approximately 36,000 households as part of a national survey (Statistics Canada, 1998).

III. Data Collection Methods

Data for the OHS90 were collected between January and November 1990 using a combination of face-to-face interviews, during which information was collected on all household members with one member acting as proxy for the others, and self-completed questionnaires which were completed by all members of the household over age 12. In a small number of cases interviews were conducted over the phone rather than face-to-face. The OHS96 data, were all collected between June 1996 and August 1997 via telephone using CATI (computer assisted telephone interviewing). The 1996/97 survey also has two sections, one of which was completed for all household members using one member as proxy. The other section was non-proxy and was completed only for one selected member of the household over 12 years of age. Both surveys were designed and implemented by Statistics Canada.

IV. Variable Definition and Comparability

Dependent Variables: Health Status

The Health Utilities Index

Definition: The Health Utilities Index (HUI) is an aggregate measure based on the presence or absence of difficulty with a variety of functions, weighted by the perceived utility of that function/limitation. The HUI was initially developed by Torrance and colleagues at McMaster University (Torrance et. al., 1996) to study neonatal intensive care outcomes for very low birth weight infants and included four attributes: (1) physical function, (2) role function, (3) social-emotional function, and (4) health problems (HUI Mark I). The Mark II instrument was expanded to 7 attributes and used to describe the long-term outcomes of childhood cancer. This Mark II instrument was then adapted for general use with adults and included as part of both the 1990 Ontario Health Survey and the National Population Health Survey (Mark III). This adult HUI Mark III comprises eight attributes: (1) vision, (2) hearing, (3) speech, (4) mobility, (5) dexterity, (6) emotion, (7) cognition and (8) pain. However, because utility weights were not yet available for use with these surveys, "provisional" index scores were calculated by mapping the responses from the Mark III questions onto the Mark II preference weights (Boyle et al., 1995). The final index scores were calculated using the formula: HUI= 1.06*(u1*u2*u3*u4*u5*u6)-.06, where u1-u6 are the utility weights for each attribute level.

Comparability: In the 1996 survey, the HUI was included in the dataset as a derived variable. With the 1990 survey data, it was necessary to compute the index from the individual question responses. As it was important that the HUI scores be computed in an identical way in the two years, the initial step was to compare the questions

included in the 1990 and 1996 survey instruments. This revealed that the question "Are you able to speak at all?" was included in 1990 but omitted in 1996. Otherwise, the questions were identical. The algorithms were also found to be identical, with the exception of the "Speech" section. Based on this, a decision was made to apply the 1996 algorithm to the 1990 survey, to ensure comparability. The 1996 algorithm was provided by Statistics Canada and converted for use with the 1990 questions. The overall impact of this change was small, as only 6 respondents out of the total 1990 sample (age 25 and over) of 38,818 were reported to be unable to speak at all.

Self-rated Health Status

Definition: Health status was also measured using the self-reported health or global health rating scale. This measure asks respondents to rate their own health on a 5-point rating scale: Excellent, Very Good, Good, Fair and Poor. Such a "subjective" measure of health status, "which in effect cedes control over its exact meaning to the respondent" (Idler and Benyamini, 1997:34), may, at first glance, appear to have little reliability. However, it has been found to be a powerful predictor of both mortality and hospitalization (Idler and Benyamini, 1997; Verbrugge, 1989). People seem to be able to evaluate their own health better than professionals, perhaps sensing conditions that are still in the subclinical stage, perhaps with a better understanding of severity in terms of their own physiological resources, prompting some researchers to argue that "the global rating represents an irreplaceable dimension of health status and in fact that an individual's health status cannot be assessed without it" (Idler and Benyamini, 1997:34).

Comparability: It is clear that self-reported health is an important measure of health status. Unfortunately, however, there is some question of variable comparability in this case due to important differences in the wording of the question in 1990 and 1996. In 1990, respondents were asked, "In general, compared with others your age, how would you rate your health?". In 1996, the question was phrased, "In general, how would you rate your health?". Thus, in 1990 respondents were asked to evaluate their health in relative terms -- relative to others in the same age group. In 1996, this explicit relativity has been removed and respondents were free to define for themselves the five levels of health. It is difficult to gauge what the impact of this change might be. To circumvent this problem, the analysis focuses on the risk ratios for Fair/Poor Health in each SES group compared with the highest SES group in 1990 and 1996, rather than the actual proportions in each group reporting Fair/Poor Health. Thus, while the overall proportion reporting Fair/Poor Health might have changed as a result of changes in the wording of the question, it is not likely that it will have changed differently for different SES groups and so the relative proportions should be comparable.

Activity Restriction

Definition – The third measure of health status used in this analysis is activity restriction. This is also often called activity limitation, and has become increasingly popular internationally as a measure of disability in the population. Respondents are asked whether they find it necessary to limit their activities at home, work, school, etc. because of a long term health problem.

Comparability – Unfortunately, once again, there is not an exact match between the 1990 and 1996 questions. To begin with, the 1996 dataset contains a variable called the "Restriction of Activity Flag". A respondent is flagged as having an activity

restriction if they respond 'YES' to any of the " ....do you restrict your activities at home, ...school etc." questions OR if they respond 'YES' to the question "Do you have a long term disability or handicap?". This latter question was not included as part of the 1990 survey. This problem was solved by creating a new variable for the 1996 sample that did not include the long-term disability question.

The second comparability problem is similar to that for self-rated health. In 1990 respondents were asked, "Compared to other people of the same age in good health, are you limited in the kind or amount of activity you can do because of a long-term physical or mental condition or health problem?". In 1996/97, on the other hand, respondents were asked simply, "Because of a long-term physical or mental condition or a health problem, are you limited in the kind or amount of activity you can do: [as separate questions] at home, at school, at work or in other activities such as transportation to or from work or leisure time activities?" Once again, the impact of this difference is difficult to gauge, but it would be likely to result in an underestimation of activity restriction in 1990 compared with 1996.

As with self-rated health, this problem was addressed by using the risk ratio for Activity Restriction as the measure of effect, rather than the absolute proportions.

Independent variables: Socioeconomic Status

Definition: One of the challenges of studies involving socioeconomic status is that there is no "gold standard" of measurement. In this study, SES was conceptualized in terms of socioeconomic position rather than social class, to use a distinction proposed by Krieger et al. (1997). They define social class as "referring to social groups forged by interdependent economic and legal relationships". Socioeconomic position, on the

other hand, refers to an aggregate concept that encompasses one's material and social resource assets as well as access to and consumption of goods, services and knowledge.

The most commonly used indicators of SES are income, education and occupation. While they are sometimes thought of as interchangeable, some authors have suggested that they may be measuring different determinants of health (Winkleby et al., 1992). For example, income measures spending power and housing, occupation measures physical and environmental work exposures and education measures knowledge and prestige. Occupation was not used as a measure of SES in this study for two main reasons. The first is that the social status of an occupation is not always stable over time (Pamuk, 1985), raising the possibility of misclassification bias. Second, and perhaps even more importantly, those who are not currently employed for wages are difficult to classify and must often be excluded. For these reasons, only income and education were examined in this study.

Income

Comparability: Both surveys collected data about income using income categories rather than asking respondents for an actual estimate. These categories, which were defined by Statistics Canada, differed slightly at the lowest level. This was resolved by turning to Statistics Canada's low income cutoffs for 1990 and 1996. The low income cutoffs, which take into account household size and urbanization, are used to define the population living in "straitened circumstance" relative to the average (see http://www.statcan.ca/english/Pgdb/People/Families/def/deffamil60a.htm) The low income cutoff for 1-2 person households in 1990 was close to $12,000 and in 1996 it was just over $15,000, so it was felt that these two figures could be used to define comparable low income groups for the two years. Once the cutoffs for the lowest income group were

defined, the following matrix was developed based on the categories developed by Statistics Canada for the 1996/97 NPHS:

Table 2.1 Adjusted Income Category Matrix

	Low		Lower Middle		Upper Middle		Upper	
Household Size	1990	1996	1990	1996	1990	1996	1990	1996
1-2	<$12,000	<$15,000	$12,000-$29,999	$15,000-$29,999	$30,000-$59,999	$30,000-$59,999	$60,000+	$60,000+
3-4	<$20,000	<$20,000	$20,000-$39,999	$20,000-$39,999	$40,000-$79,999	$40,000-$79,999	$80,000+	$80,000+
5+	<$30,000	<$30,000	$30,000-$59,999	$30,000-$59,999	$60,000-$79,999	$60,000-$79,999	$80,000+	$80,000+

Education

Education was defined as the highest level of education the respondent had attained. It was used as a categorical variable, with the cutpoints based on credentials as recommended by Liberatos et al. (1988) and Krieger et al. (1997). The cutpoints in this case were: 1. Less than secondary graduation, 2. Secondary graduation/some post-secondary, 3. Post-secondary graduation.

Confounders and co-variables

A review of the literature identified the following as important potential confounders of the association between SES and health status: age, sex, household type (which, in a sense, is a combination of family structure and marital status) and behaviour. Studies have shown that the relationship between SES and health is confounded by both age (House et al., 1990) and sex (Winkleby et al., 1992). The confounding by age consists of an association between age and health (health generally decreases with age), age and education (education levels have increased with each age cohort throughout this century) and age and income (income often decreases after retirement). The confounding

with sex has to do with the fact that the returns from increased education with respect to income and occupation are different for women and men (Krieger et al., 1997; Winkleby et al., 1992). Evidence from the Whitehall II study (Hemingway et al., 1997) also suggests that SES level has a differential impact on women compared to men.

The association between health status and SES can also be confounded by health behaviour, as behaviour is associated with both SES and health status. People in lower SES groups tend to smoke more, exercise less and be more overweight. Alcohol use, on the other hand, tends to be higher in the higher socioeconomic groups (Pomerleau et al., 1997). The health effects of behaviours such as smoking and alcohol abuse are well documented. It is therefore important to control for behaviour in order to properly estimate the independent effect of SES on health status.

After the important potential confounders were identified from the literature, they were entered one by one into the model. All were found to be significant and so were included in the final model.

Definitions: Below are the definitions/categorizations of the confounders/co-variables used in this analysis:

Age - as a continuous variable in the regression analyses. An age-stratified analysis was also carried out on the combined dataset.

Sex - as a categorical variable.

Household type - The type of household was divided into 5 categories: single individuals, couples without dependent children, couples with dependent children, single parents with dependent children and other.

Behaviour - The effect of health behaviour was controlled for by including variables for physical activity, smoking and alcohol consumption. Physical activity was measured using the Physical Activity Index, a three-level derived variable categorizing a person's activity level as Active, Moderate or Inactive. Smoking was measured using the "type of smoker" variable. This variable has four levels: current daily smoker, current occasional smoker, former smoker, never smoked. Alcohol consumption was included as "type of drinker". This variable also had four levels: regular drinker, occasional drinker, former drinker, abstainer.

Comparability: The 1990 and 1996 surveys use different categories for some of the co-variables. Discrepancies were dealt with by recoding .

V. Data Analysis Methods

The data were first examined for missing values. For most variables, the proportion of observations with missing values was quite small. However, there were a few variables that had missing proportions in at least one of the two years large enough to be cause for concern (i.e. greater than 5%). These were the risk behaviour variables (smoking, drinking, physical activity) and income. The proportion missing for each variable in 1990 and 1996/97 respectively were: smoking 7.3% and 0.3%; drinking 7.1% and 1.0%; physical activity 20.5% and 2.4%; income 14.7% and 25.1%. Because the proportions were so large, a decision was made to create an 'unknown' category for each of these variables, to allow the observations to be included and thus ensure that the other

information was not lost. The total number of observations included in the study was 38,028 in 1990 and 30,327 in 1996/97.

Another issue which had to be considered was the question of how to control for the effect of sampling and the differences in sampling design between the two years. Data from both years came from sample surveys, but the sampling designs differed rather substantially. In 1990, the data were collected using a stratified, cluster design. In 1996, on the other hand, the 'core' sample (that which is part of the national longitudinal sample) was selected using a stratified methodology, while the additional 'buy-in' sample of about 30,000 was selected using Random Digit Dialing techniques which very nearly yields a simple random sample. Also, while detailed DEFF (design effect) estimates are available for 1990, the only estimates available for 1996 were overall for the province. One method which has been suggested to deal with differences in sampling methodologies when combining two or more surveys is to 'down-weight' each sample by its respective DEFF (Frankel, 1983). Using this method, the actual sample size is divided by the average design effect, generating an 'effective sample size' (Aday, 1996:164). In addition, to obtain population estimates without inflating the variance, the sampling weights were normed (each weight divided by the mean weight). Down-weighting for the DEFF, coupled with the normed sampling weights, yielded approximately correct variance estimates for use with in statistical tests that otherwise assume a simple random sample (Frankel, 1983:46).

After the initial examination of the data, a separate analysis for each year was carried out. This included a series of bivariate analyses, looking at each of the outcome variables with the independent and possible confounding variables. This was done using

simple cross-tabulations. Following this, multivariate analyses were conducted using regression to permit control for potential confounders. The confounders or potential confounders listed above were entered into the regression models one by one and all were found to be significant at the .05 level after adjusting for all other variables, with the exception of sex, which was not significant in the full model but was included in spite of this. In addition, each full model was also adjusted for the other SES measure.

The association between mean HUI (a continuous measure) and socioeconomic status was analyzed using linear regression.

With respect to the multivariate analysis of the dichotomous outcome variables: HUI <.83, Self-rated Health and Activity Restriction, the standard approach to this type of analysis has generally been to model the logit using logistic regression, yielding a series of adjusted conditional odds ratios. A number of articles in the past decade have pointed out that this is inappropriate (Wacholder, 1986; Lee, 1994; Davies et al, 1998). According to Lee (1994) the odds ratio in and of itself is "incomprehensible" to most readers, but is useful as a proxy for the more easily understood relative risk. However, if the outcome of interest is not rare, as is often the case in cross-sectional population-based studies, the odds ratio does not approximate the relative risk and may lead to misunderstandings in interpreting the data (Schwartz et al., 1999). As Davies et al. (1998) showed, the farther an odds ratio moves from unity, the more it over- (if the OR is >1) or under (OR <1) estimates the relative risk. Lee (1994) maintains that the more appropriate measure is the relative risk, and suggests that relative risk adjusted for multiple covariates may be estimated using Cox's proportional hazard model. The basis for Lee's suggestion is work by Breslow (1974), who showed that by assuming a constant

risk period, the hazard ratio = the risk ratio. Based on this, the risk ratio in this study was estimated using the SAS procedure PHREG (Allison, 1995), which uses Cox's regression to model the conditional hazard (risk) of the outcome of interest. Time was set equal to 1 for every observation and those without the outcome of interest were censored. PHREG then modeled the proportions with and without the exposure of interest and calculated the adjusted hazard ratio which is equivalent to the risk ratio.

The models (with the interaction term included) were as follows:

$$\text{Linear model: } HS = \beta_1 \text{Year} + \beta_2 \text{SES} + \beta_i \text{ Covariates} + \beta_j \text{ Year X SES}$$

$$\text{Cox model: } \text{time*HS(cens)} = \beta_1 \text{Year} + \beta_2 \text{SES} + \beta_i \text{ Covariates} + \beta_j \text{ Year X SES}$$

In both models "HS" is the particular health status measure, "Year" is the survey year, "SES" is either education or income and "Covariates" are the possible confounders being controlled for such as age. The interaction term of Year x SES was used to assess whether there had been a significant change in the health status gradients from 1990 to 1996/97. In the Cox model, time=1 for all observations and "cens" defined which outcomes were to be treated as censored (usually 0 or 1).

Significance of the interaction was assessed as follows: For the linear regression analysis, the interaction term itself was used to determine whether there was significant interaction. If the p-value from the F-test for the Type III Sum of Squares was less than .05, even after controlling for all other variables, then the effect of the interaction term was considered significant. In this case it was concluded that there was a significant interaction between year and the SES variable. In the case of the dichotomous outcome variables, significance of the interaction was assessed by comparing models. Two

models were fit, one with the interaction variables and one without. The difference in the –2Log Likelihood scores for the two models follows a chi-squared distribution with the degrees of freedom equal to the difference in the number of variables from one model to the other. This chi-squared value was then compared to the cutpoint at the .05 level. For example, the chi-squared for 4 df, .95 is 9.49. Thus, in the income analysis, if the difference in the –2 Log Likelihood between the models with and without the income x year interaction terms was equal to or greater than 9.49, there was significant interaction between year and income. As well, the individual variable categories were examined for changes in the relationship between them and the reference category from 1990 to 1996/97.

A note about analysis of the Health Utilities Index

To date, no standard methodology for multivariate analysis of the HUI has been described in the literature. For this reason, the analysis of the association between health status as measured by the HUI and SES was carried out in two different ways. The first analysis was carried out using linear regression, with the HUI as a continuous variable. However, it must be acknowledged that this approach violates the normality assumption for linear regression, as the HUI is not normally distributed but has an upper threshold of 1.0. This may lead to biased variance estimates, and one must be cautious about drawing conclusions regarding statistical significance. The second approach dichotomized the HUI and then used the proportional hazards model to examine the association between the HUI and SES. The difficulty with this approach is the fact that there is no "gold standard" cutpoint for dichotomizing the HUI. For example, Manuel (1997) used .95 as a cutpoint to distinguish "near-perfect" health. Roberge et al. (1995b), on the other hand,

suggested that an HUI score of .8 or higher indicated "a high level of health". Williams et al. (1998) took a somewhat different approach. Rather than defining perfect or near-perfect health, they estimated .83 to be a cutpoint that could be expected to indicate physical disability based on responses to other items. In this thesis, the latter cutpoint, .83, was used to dichotomize the HUI.

Stratified Analysis

In addition to the overall multivariate analyses, analyses were carried out for separate age and sex groups. The age strata were: 25-44 years, 45-64 years, 65-74 years and 75+. The purpose of this stratified analysis was to determine if the SES-health gradient changes were similar for men and women and for different age groups, or if some groups were affected more than others.

VI. Ethical Considerations

The data used in this analysis is secondary survey data which has been made available by Statistics Canada and the Ontario Ministry of Health to researchers through universities and other institutions. In accordance with the guidelines covering the use and release of data from Statistics Canada surveys, only weighted, aggregate results are included and no results have been reported where the unweighted cell count was less than 30.

Chapter 3: Results

This chapter is organized into four general sections. The first section comprises the general descriptive analysis. In the second section the relationship between the two SES variables (income and education) and the four health status variables (the continuous HUI, dichotomous HUI, Self-rated Health and Activity Restriction) are examined separately for the two years, 1990 and 1996. Income is examined first for the two years and then education. All analyses are carried out for the population as a whole, then by sex and finally by four age groups.

The third section contains the interaction analyses. In these analyses the two years are examined together, to determine if the pattern of the association between SES and health status changed from one year to the next. The final section contains several additional analyses – an in-depth look at the component attributes of the HUI and a brief examination of the association between employment status and health status.

I. Descriptive Analysis

Univariate analyses were done to compare the weighted and unweighted samples from 1990 and 1996. Table 3.1a shows the univariate analysis for the variables which were included in the model. The analysis was limited to respondents 25 years of age and over, which yielded sample sizes of 38,309 for 1990 and 30,742 for 1996. The overall Health Utilities Index scores are very similar -- .91 for both years when rounded to two decimal places. The proportion reporting themselves to be in Fair or Poor health was 12.1% in 1990, 11.5% in 1996, a difference which might be explained by the changes in

Table 3.1a. Univariate Analysis of Variables Included in the Model, 1990 and 1996

(age 25 and over)

Variable	N (Unweighted) 1990	N (Unweighted) 1996	Unweighted 1990	Unweighted 1996	Weighted 1990	Weighted 1996
Dependent Variables						
Health Utility Index (mean)	38309	30742	0.906	0.905	0.909	0.912
Self-rated Health Status (%)						
Excellent	7752	7292	20.1	23.6	20.4	24.2
Very Good	14571	11635	37.9	37.6	38.1	38.1
Good	11452	8052	29.8	26.0	29.4	26.1
Fair	3788	2906	9.8	9.4	9.6	8.4
Poor	916	1054	2.4	3.4	2.5	3.1
Activity Restriction (%)						
Yes	4116	4750	10.6	15.4	9.7	13.2
No	34603	26189	89.4	84.6	90.3	86.8
Independent Variables						
Income (%)						
Low	3432	3373	8.8	10.9	7.5	8.9
Lower-Middle	10818	6485	27.9	21.0	24.6	19.8
Upper-Middle	13683	9228	35.2	29.8	35.7	29.8
High	5174	4097	13.3	13.2	17.7	15.2
Unknown	5711	7756	14.7	25.1	14.5	26.3
Education (%)						
Less than sec. graduation	14930	6922	38.8	22.7	34.3	20.5
Sec. Grad/Some post-sec.	13919	12179	36.1	39.9	37.1	40.1
Post-Sec Grad	9669	11411	25.1	37.4	28.7	39.1
Co-variables						
Age (%)						
25-44	19289	14713	49.7	47.6	51.3	50.2
45-64	12417	9591	32.0	31.0	30.8	32.2
65-74	4614	4042	11.9	13.1	11.6	11.2
75+	2498	2593	6.4	8.4	6.3	6.4
Sex (%)						
Male	17949	14208	46.2	45.9	48.0	48.5
Female	20869	16731	53.8	54.1	52.0	51.5

Table 3.1a. Univariate Analysis of Variables Included in the Model, 1990 and 1996

(age 25 and over)

Variable	N (Unweighted) 1990	N (Unweighted) 1996	Unweighted 1990	Unweighted 1996	Weighted 1990	Weighted 1996
Household Type (%)						
Single Individual	4927	8413	12.7	27.2	14.3	16.4
Couple, no dep. children	15929	10064	41.0	32.5	40.5	33.6
Couple, dep. children	15212	9834	39.2	31.8	37.5	41.3
Single parent, w/ & w/o dep.	1176	2400	3.0	7.8	2.9	7.6
Other	1574	223	4.1	0.7	4.9	1.0
Type of Smoker (%)						
Current daily	9885	7325	25.5	23.7	24.2	22.0
Current occ.	1610	1056	4.1	3.4	4.5	3.7
Former	9760	9575	25.1	30.9	23.8	29.8
Never smoked	14720	12875	37.9	41.6	40.0	44.2
Unknown	2843	108	7.3	0.3	7.4	0.4
Alcohol Use (%)						
Regular	22117	17047	57.0	55.1	58.3	55.0
Occasional	7158	6412	18.4	20.7	17.3	20.0
Former	3362	4505	8.7	14.6	7.4	13.3
Abstainer	3410	2637	8.8	8.5	9.4	10.6
Unknown	2771	338	7.1	1.1	7.5	1.2
Physical Activity Index (%)						
Active	2881	5212	7.4	16.8	7.7	16.3
Moderate	4592	6936	11.8	22.4	12.3	22.1
Inactive	23402	18042	60.3	58.3	59.7	58.4
Unknown	7943	749	20.5	2.4	20.4	3.1

the way the question was worded. Activity restriction, on the other hand, rose from 9.7% in 1990 to 13.2% in 96/7.

Moving on to the independent variables, one obvious difference is the change in the proportion of respondents who did not report their income (listed here as "Unknown"). In 1990, 14.5% of respondents were classified as "Unknown". In 1996, this rose to 26.3%. While it is impossible to know exactly what caused this increase, it is likely that the change in mode of administration of the survey from face-to-face to telephone interview played some role. Because the proportions for both 1990 and 1996 are both relatively high and quite different from each other, this group was included in all analyses as a separate category.

With respect to education, we see a large shift from 1990 to 1996, with the proportion reporting less than a secondary graduation diploma dropping from 34.3% to 20.5% and the proportion who have completed some type of post-secondary training rising from 28.7% to 39.1%.

There are only slight shifts in the age-sex distribution. The proportion of respondents in single parent households more than doubled from 1990 to 1996, but two-parent households, either with or without dependent children, still make up the greatest proportion of the sample in 1996. There also appear to be some changes in risk behaviour, with prevalence of current daily smoking and regular drinking both down in 1996 compared with 1990 and physical activity on the increase. However, once again it is important to note the change in proportions of "unknown" for the risk behaviour categories. Once again, this may be the result of the mode of administration – in 1990

Table 3.1b Additional Unvariate Comparisons, Variables Not Included in the Model

(Age 25 and over)

Variable	N (Unweighted) 1990	N (Unweighted) 1996	% (Unweighted) 1990	% (Unweighted) 1996	% (Weighted) 1990	% (Weighted) 1996
Health Planning Region						
Ottawa-Carleton	809	2056	2.1	6.6	7.0	7.0
P-R/S/D/G/G/Renfrew	1919	930	4.9	3.0	2.6	2.5
L/L/G/H/PE/F/L/A	2516	1578	6.5	5.1	4.6	4.5
N'umberlnd/V/H/Peterboro	1726	1214	4.4	3.9	2.6	2.8
Durham	1138	1245	2.9	4.0	3.8	4.1
Peel	720	1290	1.9	4.2	6.6	7.8
Toronto	4479	3267	11.5	10.6	25.2	22.9
York	768	1208	2.0	3.9	4.3	5.4
Simcoe	976	1325	2.5	4.3	2.6	3.1
Halton	978	1211	2.5	3.9	2.9	3.2
Niagara	1100	1201	2.8	3.9	3.9	3.8
Hamilton-Wentwth	1036	1263	2.7	4.1	4.6	4.4
Brant/Hald-Norfolk	2063	1203	5.3	3.9	2.0	2.0
Well./Dufferin	881	1205	2.3	3.9	1.8	2.0
Waterloo	1208	1200	3.1	3.9	3.6	3.7
Essex	916	1180	2.4	3.8	3.3	3.1
Lambtion/Kent	2110	1169	5.4	3.8	2.4	2.1
Elgin/Mddlsx/Oxford	3012	1333	7.8	4.3	5.2	5.3
Bruce/Grey/Huron/Perth	3396	1262	8.7	4.1	2.6	2.6
Algoma/Cochrane	1647	1157	4.2	3.7	2.2	2.0
Manit/Sudbury	920	1157	2.4	3.7	1.8	1.8
Tim/Musk/ParrSnd/Nipp	2698	1184	7.0	3.8	2.0	2.0
Thunder Bay/Ken/RR	1802	1101	4.6	3.6	2.4	2.1
Place of Birth						
Canada	30293	23837	78.0	77.0	69.1	69.0
US	534	406	1.4	1.3	1.4	1.2
UK	2071	1664	5.3	5.4	6.0	5.3
Europe	3256	1977	8.4	6.4	11.1	8.3
Caribbean/L. America	370	336	1.0	1.1	2.0	1.9
Asia	668	705	1.7	2.3	3.8	4.7
Other	1547	1953	4.0	6.3	6.3	9.3
Unknown	79	61	0.2	0.2	0.3	0.3
Total	38818	30939	100.0	100.0	100.0	100.0
Years Since Immigration						
Less than 10 yrs	1044	1141	12.8	16.6	17.6	21.7
More than 10 yrs	7094	5735	87.2	83.4	82.4	78.3
Total	8138	6876	100.0	100.0	100.0	100.0

Table 3.1b Additional Unvariate Comparisons, Variables Not Included in the Model

(Age 25 and over)

Variable	N (Unweighted) 1990	N (Unweighted) 1996	% (Unweighted) 1990	% (Unweighted) 1996	% (Weighted) 1990	% (Weighted) 1996
Number of GP Consultations prev. 12 months						
0	7001	5384	18.0	18.1	17.9	18.7
1-4	21453	18037	55.3	60.6	56.5	61.5
5+	9701	6158	25.0	20.7	23.9	19.1
Unknown	663	178	1.7	0.6	1.8	0.7
Total	38818	29757	100.0	100.0	100.1	100.0
Unemployed for 12 months prior to survey (age 25-64 only)	5885	5501	18.6	22.6	16.4	20.9
Sources of Income						
Wages and salaries	28770	18971	74.1	61.3	76.4	66.9
Self-employment	8134	4472	21.0	14.5	19.5	15.2
Investments	13202	4466	34.0	14.4	34.0	14.1
Pensions	11310	9226	29.1	29.8	27.6	25.6
Family allowance (90) or child tax credit (96)	15191	3011	39.1	9.7	36.8	10.5
UIC	4531	1621	11.7	5.2	10.0	5.3
Worker's Comp	1923	753	5.0	2.4	4.6	2.3
Social Assistance	1630	1469	4.2	4.7	3.7	4.5
Refused to answer	244	1588	0.6	5.1	0.6	5.5
Number of sources of income						
1	8842	16758	22.9	58.0	25.2	56.8
2	15044	8296	39.0	28.7	39.0	28.6
3	10201	2887	26.4	10.0	25.2	10.8
>3	4487	954	11.6	3.3	10.6	3.8
Total	38574	28895	100.0	100.0	100.0	100.0

the risk behaviour questions were part of the self-completed questionnaire, while in 96/7 they were asked by the interviewer.

Tables 3.1b compared the two surveys on a range of variables not included in the regression model. These included geographic, demographic, health care utilization and socioeconomic variables. The geographic variation in the unweighted samples is expected, as certain areas were intentionally oversampled. As the geographic region was one of the variables included in the weighting, most of the differences disappeared after weighting. With respect to the birthplace and immigration status of the two samples, the weighted proportion for those born in Canada did not change, but the distribution of those born outside Canada did. The weighted 1996 result has a smaller proportion from the UK, US and Europe and more from Asia, the Caribbean and elsewhere. Of the 30% or so who had been born outside Canada, the proportion who said they had immigrated within the last 10 years rose from 17.6 to 21.7 percent. Health care utilization was compared by looking at the number of GP consultations (either by visit or phone) reported. There was a slight shift to fewer visits, with the proportion reporting five or more visits falling and the proportion reporting either no visits or 1-4 visits rising. Economic factors were also examined, which, although they were not included in the analytical model, are still related to the study topic. The proportion of respondents who had been unemployed for at least the previous 12 months rose from 16 to 20 percent (weighted). The final comparison looked at sources of income. The first analysis, which examined the proportion who reported receiving income from various sources (more than one source was allowed), was somewhat puzzling at first, because there was a decline in the proportion receiving each source of income except pensions. Particularly dramatic was

Table 3.1c Bivariate Analyses: Health Status by Co-variables

Weighted proportions only, unadjusted for other variables

	Mean HUI		% with HUI <.83		% with Fair/Poor Self-rated Health		% with Activity Restriction	
Variables	**1990**	**1996**	1990	1996	**1990**	**1996**	**1990**	**1996**
Income								
Low	0.854	0.851	30.4	32.0	26.9	26.5	17.2	26.0
Low-middle	0.896	0.898	19.6	18.9	15.6	15.1	10.6	16.7
Upper-middle	0.921	0.923	13.3	12.9	8.4	8.3	6.6	11.1
High	0.936	0.940	9.6	8.5	6.0	5.5	4.7	7.9
Unknown	0.897	0.915	19.6	15.6	14.8	11.0	9.6	11.6
Education								
Less than secondary graduation	0.875	0.869	24.3	26.8	20.9	22.5	13.3	20.9
Secondary grad./Some post-sec.	0.920	0.917	13.3	14.7	8.8	10.1	6.9	12.6
Post-secondary graduation	0.934	0.931	10.8	10.9	5.7	7.0	4.9	9.6
Age								
25-44	0.939	0.941	10.0	9.3	6.9	6.7	5.4	8.1
45-64	0.893	0.899	19.1	18.1	14.3	12.9	10.4	14.1
65-74	0.864	0.876	26.7	24.4	21.6	20.1	13.2	20.1
75+	0.827	0.811	36.6	40.9	25.9	27.6	15.4	35.8
Sex								
Male	0.913	0.919	15.9	13.9	11.7	10.8	8.2	12.0
Female	0.906	0.906	16.9	17.6	12.4	12.2	8.7	14.3
Household Type								
Single Individual	0.886	0.887	22.4	22.5	14.2	16.5	11.1	19.7
Couple, no dep. children	0.896	0.901	19.2	17.8	15.3	13.6	9.8	14.9
Couple, dep. children	0.934	0.935	10.5	10.4	7.4	7.2	5.9	8.4
Single parent, w/ & w/o dep. children	0.898	0.892	19.6	21.8	11.7	15.2	8.5	16.8
Other	0.901	0.910	18.5	15.2	14.7	13.0	9.5	17.1
Type of Smoker								
Current daily	0.902	0.904	18.1	17.4	13.5	13.8	10.2	14.4
Current occ.	0.924	0.918	12.1	13.9	11.3	11.9	6.3	11.5
Former	0.903	0.905	18.1	16.9	12.1	12.0	9.7	15.5
Never smoked	0.918	0.921	14.4	14.4	10.1	9.9	6.8	11.1
Unknown	0.895	0.840	19.1	33.9	18.7	25.5	9.4	21.4
Alcohol Use								
Regular	0.921	0.927	13.5	11.5	8.3	7.4	6.4	10.0
Occasional	0.906	0.905	16.4	17.7	12.5	12.6	9.3	15.0
Former	0.871	0.866	26.3	27.8	22.7	23.2	16.7	22.7
Abstainer	0.887	0.904	21.8	19.1	20.8	15.6	10.8	14.0
Unknown	0.889	0.913	22.1	19.1	19.0	16.6	12.0	15.3
Physical Activity Index								
Active	0.936	0.939	12.1	9.1	4.6	6.1	5.2	9.1
Moderate	0.927	0.930	12.5	11.3	6.3	7.4	6.3	10.2
Inactive	0.909	0.906	16.2	17.5	12.3	13.3	8.7	14.0
Unknown	0.887	0.762	21.0	51.6	17.8	34.9	10.5	39.6

the drop in the proportion reporting income from investments (from 34% in 1990 to 14.4% in 1996, unweighted) and family allowance/child tax credit (from 36.8% to 10.5%). The situation became clearer with the next analysis, which looked at the number of reported sources of income. In 1990 only 22.9% (unweighted) of respondents reported only one source of income and 11.6% reported more than 3. In 1996, the proportion with only one source of income more than doubled to 58% of respondents, while the proportion with more than three dropped to 3.8%. The mean number of income sources for the entire population over 25 was 2.2 in 1990 and 1.5 in 1996.

The final descriptive table is Table 3.1c. This is a bivariate analysis of the health status variables by the co-variables/potential confounders. These results d not control for age, sex or any other variables.

II. Single Year Analysis

The association between socioeconomic status and health status was first examined for each year separately. This was done for the population as a whole, stratified by sex and stratified by age group with both sexes together. Separate analyses were carried out for adjusted income and highest level of education.

The Pattern of Health Inequalities by Income - 1990

Overall

The mean HUI analysis for 1990 shows a clear, almost linear, gradient of increasing HUI with increasing income (Table 3.2). The mean HUI for each successive income level is significantly higher than the one before, with the largest gap between the low and low-middle income groups. The mean HUI scores range from .868 (95% Confidence Limits - .863, .872) for the low income group, to .920 (.916, .924) for the high income group.

Similar results are evident from the analysis of the dichotomous HUI, Self-rated Health and Activity Restriction. In all three cases an association was seen in which the risk of a poorer health status (either HUI <.83, Fair/Poor Self-rated Health or some type of Activity Restriction) relative to those in the High income category increased as one moved down the income scale. It is also interesting to note the similarity in risk ratio estimates across the three outcome variables. Generally speaking, being in the Upper-middle income category increases one's risk of negative health status by about 25%; having a low-middle income increases it by about 50-60% and those in the low income group have a risk of poor health at least twice that of their high income counterparts. The exception to this similar pattern across outcomes is the fact that the risk for reporting

Table 3.2. Health Status Outcomes by Income, adjusted and unadjusted, 1990

Age 25 years and over

Mean HUI by Income (LSMeans)

	Unadjusted		Adjusted (full model**)	
	Mean HUI	Mean HUI	(95% Confidence Limits)	p-value*
Low	0.854	0.868	(0.863, 0.872)	0.0001
Low-middle	0.896	0.900	(0.896, 0.903)	0.0001
Upper-middle	0.921	0.910	(0.907, 0.913)	0.0001
High	0.936	0.920	(0.916, 0.924)	ref.
Unknown	0.897	0.902	(0.898, 0.906)	0.0001

*t-test for difference in means, reference category=High income level

Risk Ratio for Mean HUI <.83 by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	3.18	2.01	(1.67, 2.43)
Low-middle	2.05	1.52	(1.3, 1.78)
Upper-middle	1.39	1.27	(1.09, 1.48)
High	1.00	1.00	----
Unknown	2.05	1.50	(1.26, 1.77)

Risk Ratio for Fair/Poor Health by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	4.47	2.39	(1.92, 2.99)
Low-middle	2.58	1.62	(1.34, 1.97)
Upper-middle	1.40	1.18	(0.98, 1.43)
High	1.00	1.00	----
Unknown	2.46	1.56	(1.27, 1.92)

Risk Ratio for Activity Restriction by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	3.43	2.13	(1.67, 2.72)
Low-middle	2.22	1.57	(1.27, 1.93)
Upper-middle	1.43	1.26	(1.03, 1.54)
High	1.00	1.00	----
Unknown	2.00	1.43	(1.14, 1.8)

**full model adjusts for age, sex, household type, behaviour (smoking, alcohol use, physical activity) and education.

Fair/Poor health status was no different for those in the upper-middle income group compared with the high income group.

Sex-stratified - 1990

The pattern of health status inequalities in 1990 was then examined for men and women separately. Table 3.3 reports the results by adjusted income. In 1990, the gradient is clear for both sexes, although the slopes differ somewhat. The mean HUI for low income men in 1990 is 0.865 (0.857, 0.874) compared with 0.928 (0.921, 0.934) for high income. The mean scores for women, on the other hand, range from 0.870 (Low) to 0.913 (High). While the mean HUIs for men and women at the lowest end of the SES scale are similar, they diverge substantially as one moves up, indicating at greater range and steeper gradient for men compared with women.

With respect to the dichotomous HUI, all income groups show a significantly higher risk of an HUI <.83 compared with the high income group, and the relative risk for low income men is higher than for low income women, which is consistent with the mean HUI results which showed a larger gap from low to high income among men than among women. The results for activity restriction are again similar to those for the dichotomous HUI, with the difference being no significant difference in risk of activity restriction between the upper-middle income group and the high income group.

The pattern was slightly different with respect to Self-rated Health, with the RR for low income women higher than for low income men. Still, in both cases the risk of reporting Fair/Poor health for low income was more than twice that of high income.

Table 3.3 Health Status by Adjusted Income and Sex, 1990
Age 25+
Mean HUI by Income (LSMeans)

1990

	Men			Women		
	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*
Low	0.865	(0.857, 0.874)	0.0001	0.870	(0.864, 0.876)	0.0001
Low-middle	0.903	(0.897, 0.908)	0.0001	0.899	(0.895, 0.903)	0.0001
Upper-middle	0.917	(0.911, 0.922)	0.0001	0.905	(0.901, 0.910)	0.0022
High	0.928	(0.921, 0.934)	ref.	0.913	(0.908, 0.918)	ref.
Unknown	0.907	(0.900, 0.913)	0.0001	0.900	(0.895, 0.905)	0.0001

*t-test for difference in means, High income as reference category

Risk Ratio for HUI <.83 by Income, 1990

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.28	(1.74, 3)	1.78	(1.38, 2.31)
Low-middle	1.63	(1.3, 2.04)	1.39	(1.12, 1.74)
Upper-middle	1.28	(1.03, 1.58)	1.25	(1.01, 1.55)
High	1.00	----	1.00	----
Unknown	1.33	(1.28, 2.08)	1.38	(1.08, 1.75)

Risk Ratio for Fair/Poor Health by Income, 1990

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.18	(1.6, 2.97)	2.67	(1.94, 3.69)
Low-middle	1.42	(1.09, 1.85)	1.85	(1.39, 2.47)
Upper-middle	1.03	(0.79, 1.33)	1.37	(1.03, 1.83)
High	1.00	----	1.00	----
Unknown	1.40	(1.05, 1.86)	1.76	(1.3, 2.4)

Risk Ratio for Activity Restriction by Income, 1990

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.30	(1.62, 3.27)	1.95	(1.39, 2.74)
Low-middle	1.62	(1.21, 2.17)	1.49	(1.11, 1.99)
Upper-middle	1.28	(0.96, 1.7)	1.23	(0.92, 1.64)
High	1.00	----	1.00	----
Unknown	1.45	(1.05, 2.01)	1.40	(1.02, 1.92)

**full model adjusts for age, household type, behaviour (smoking, alcohol use, physical activity) and education.

Age stratified – 1990

The data were also stratified into age groups: 25-44 (young working age), 45-64 (older workers) 65-74 (young seniors) and 75+ (older seniors). The results of the analysis of health status by income and age group are reported in Table 3.4. From the HUI results two features emerge. The first is, as one might expect, most SES groups show a general decline in HUI with age. The second is that, while there is a clear gradient with income in the 25-44, 45-64 and 65-74 age groups, the relationship shows evidence of change with increasing age. In the 25-44 age group, the gradient is clear and the mean HUIs for each group are significantly different from the groups above and below. In the next group, the HUI for the lowest group has dropped significantly but the mean scores for the two highest groups are quite similar. In the 65-74 age group, while there is still a gradient in the mean values, the differences are no longer statistically significant. Over age 75 there are not statistically significant differences, nor is there a gradient in the mean values. Caution must be used when interpreting the results for those in the older age groups, keeping in mind that the survey does not include anyone living in institutions, and also that more of these responses may be proxy than at the younger ages. Mean HUI appears to rise, or at least level off, after age 65 in the low income group. Overall, the greatest inequality in health status appears to be in the 45-64 year age group, with very little difference in the mean HUI scores of the top two groups and then successively larger drops in health status as one moves down the income scale.

With respect to Self-rated Health, the relative risk of Fair/Poor health for low income 25-44 year-olds is just under twice that of high income. This increases in the 45-

Table 3.4. Health status by Adjusted Income and Age Group, sexes together, 1990
Age 25+
Mean HUI by Income (LSMeans)

	25-44			45-64			65-74			75+		
	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*
Low	0.898	(0.892, 0.904)	0.0001	0.817	(0.806, 0.827)	0.0001	0.836	(0.816, 0.855)	0.0005	0.806	(0.779, 0.834)	0.8424
Low-middle	0.926	(0.922, 0.930)	0.0001	0.878	(0.871, 0.885)	0.0001	0.852	(0.836, 0.868)	0.0108	0.833	(0.808, 0.858)	0.0814
Upper-middle	0.932	(0.928, 0.936)	0.0001	0.905	(0.899, 0.912)	0.3007	0.863	(0.847, 0.879)	0.2003	0.833	(0.806, 0.860)	0.0978
High	0.947	(0.943, 0.951)	ref.	0.908	(0.901, 0.916)	ref.	0.875	(0.854, 0.897)	ref.	0.803	(0.767, 0.838)	ref.
Unknown	0.931	(0.926, 0.936)	0.0001	0.889	(0.882, 0.896)	0.0001	0.850	(0.833, 0.867)	0.0105	0.824	(0.799, 0.849)	0.2305

*t-test for difference in means, High income as reference category

Risk Ratio for Mean HUI <.83 by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.87	(2.08, 3.98)	2.61	(1.94, 3.53)	1.62	(0.93, 2.82)	0.81	(0.46, 1.42)
Low-middle	1.83	(1.38, 2.43)	1.64	(1.28, 2.09)	1.30	(0.80, 2.11)	0.82	(0.49, 1.40)
Upper-middle	1.51	(1.16, 1.96)	1.15	(0.92, 1.44)	1.25	(0.76, 2.05)	0.78	(0.44, 1.37)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	1.66	(1.21, 2.28)	1.48	(1.15, 1.92)	1.41	(0.84, 2.34)	0.85	(0.50, 1.46)

Risk Ratio for Fair/Poor Health by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	1.96	(1.34, 2.87)	3.23	(2.28, 4.60)	2.87	(1.39, 5.93)	2.24	(0.92, 5.49)
Low-middle	1.36	(0.98, 1.87)	1.88	(1.39, 2.53)	2.11	(1.07, 4.15)	1.42	(0.59, 3.42)
Upper-middle	1.04	(0.77, 1.41)	1.22	(0.91, 1.63)	1.66	(0.83, 3.34)	1.01	(0.39, 2.59)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	1.26	(0.88, 1.81)	1.66	(1.21, 2.28)	2.13	(1.06, 4.31)	1.72	(0.71, 4.19)

Risk Ratio for Activity Restriction by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.74	(1.82, 4.13)	3.55	(2.42, 5.21)	1.35	(0.64, 2.82)	0.54	(0.26, 1.10)
Low-middle	1.60	(1.12, 2.29)	2.08	(1.51, 2.87)	1.28	(0.67, 2.44)	0.52	(0.26, 1.00)
Upper-middle	1.49	(1.07, 2.07)	1.19	(0.87, 1.62)	1.22	(0.63, 2.37)	0.51	(0.24, 1.05)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	1.36	(0.90, 2.05)	1.70	(1.21, 2.40)	1.35	(0.68, 2.65)	0.53	(0.27, 1.06)

**full model adjusts for sex, household type, behaviour (smoking, alcohol use, physical activity) and education.

64 year old group such that older workers who are low income are more than three times more likely to rate their health as Fair or Poor compared to their high income counterparts. The gradient persists into early retirement, with the relative risk of Fair/Poor health for those 65-74 years of age with low income still nearly three times that of high income. In the oldest age group there is no difference in relative risk of reporting Fair/Poor health across income groups.

Looking at activity restriction and HUI <.83, the risk of negative health status for the low income group age 25-44 is nearly 3 times that of the high income group. In the 45-64 year age group this RR drops for HUI <.83 but rises to 3.6 for Activity Restriction. After age 64 there is little difference in risk of either Activity Restriction or HUI <.83 across income groups.

The Pattern of Health Inequalities by income - 1996

Overall

Looking at Table 3.5, the pattern of health inequalities as measured by the HUI appears similar in 1996. The greatest gap in mean HUI exists between the low income and low-middle income groups, with smaller differences between the upper three groups. However, it is interesting to note that the mean HUIs for all groups are lower in 1996 compared with 1990.

With respect to the other health status measures, the overall pattern is similar in 1996 to 1990. Compared with the highest income group, the relative risk of a poor health status outcome is approximately 20-30% higher for the upper-middle income group, between 40% and 60% higher for the low-middle income group and from 98% to 150% higher for the low income group.

Table 3.5. Health Status Outcomes by Income, adjusted and unadjusted, 1996
Age 25+

Mean HUI by Income (LSMeans)

	Unadjusted	Adjusted (full model**)		
	Mean HUI	Mean HUI	(95% Confidence Limits)	p-value*
Low	0.851	0.823	(0.816, 0.831)	0.0001
Low-middle	0.898	0.864	(0.857, 0.871)	0.0001
Upper-middle	0.923	0.872	(0.866, 0.879)	0.0003
High	0.940	0.880	(0.873, 0.887)	ref.
Unknown	0.915	0.880	(0.873, 0.886)	0.736

*t-test for difference in means, reference category=High income level

Risk Ratio for Mean HUI <.83 by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	3.78	2.22	(1.93, 2.54)
Low-middle	2.23	1.44	(1.27, 1.64)
Upper-middle	1.53	1.29	(1.14, 1.46)
High	1.00	1.00	----
Unknown	1.84	1.23	(1.08, 1.39)

Risk Ratio for Fair/Poor Health by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	4.86	2.53	(2.15, 2.98)
Low-middle	2.76	1.63	(1.40, 1.90)
Upper-middle	1.52	1.22	(1.05, 1.43)
High	1.00	1.00	----
Unknown	2.02	1.26	(1.08, 1.47)

Risk Ratio for Activity Restriction by Income

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Low	3.30	1.98	(1.71, 2.29)
Low-middle	2.11	1.40	(1.22, 1.60)
Upper-middle	1.41	1.19	(1.05, 1.36)
High	1.00	1.00	----
Unknown	1.47	1.01	(0.89, 1.15)

**full model adjusts for age, sex, household type, behaviour (smoking, alcohol use, physical activity) and education.

Table 3.6 Health Status by Adjusted Income and Sex, 1996
Age 25+
Mean HUI by Income (LSMeans)

	Men			Women		
	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*
Low	0.828	(0.817, 0.839)	0.0001	0.817	(0.807, 0.827)	0.0001
Low-middle	0.867	(0.858, 0.877)	0.0001	0.859	(0.850, 0.868)	0.0956
Upper-middle	0.882	(0.873, 0.892)	0.0001	0.862	(0.853, 0.871)	0.3619
High	0.895	(0.885, 0.905)	ref.	0.865	(0.855, 0.874)	ref.
Unknown	0.891	(0.882, 0.900)	0.2088	0.868	(0.860, 0.877)	0.279

*t-test for difference in means, High income as reference category

Risk Ratio for HUI <.83 by Income, 1996

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.89	(2.35, 3.56)	1.80	(1.50, 2.16)
Low-middle	1.80	(1.49, 2.17)	1.19	(1.00, 1.41)
Upper-middle	1.48	(1.23, 1.78)	1.14	(0.97, 1.34)
High	1.00	----	1.00	----
Unknown	1.35	(1.12, 1.63)	1.11	(0.94, 1.31)

Risk Ratio for Fair/Poor Health by Income, 1996

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	3.02	(2.39, 3.82)	2.17	(1.73, 2.73)
Low-middle	1.75	(1.41, 2.18)	1.49	(1.20, 1.86)
Upper-middle	1.25	(1.01, 1.56)	1.18	(0.95, 1.46)
High	1.00	----		----
Unknown	1.35	(1.09, 1.68)	1.16	(0.94, 1.44)

Risk Ratio for Activity Restriction by Income, 1996

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.62	(2.11, 3.24)	1.64	(1.34, 2.00)
Low-middle	1.64	(1.35, 1.99)	1.22	(1.01, 1.46)
Upper-middle	1.27	(1.05, 1.53)	1.13	(0.94, 1.34)
High	1.00	----	1.00	----
Unknown	1.03	(0.85, 1.26)	0.97	(0.81, 1.16)

**full model adjusts for age, household type, behaviour (smoking, alcohol use, physical activity) and education.

Stratified by sex - 1996

The 1996 sex-stratified results are found in Table 3.6. In the mean HUI analysis for women there is a noticeable narrowing of the gaps between the upper three groups and a widening of the gap between these and the lowest income group. For men, the pattern remained largely the same as in 1990, but again, the mean HUI scores for all groups dropped relative to 1990.

Looking at the other three health status variables, it appears as though there is greater inequality across income groups for men than for women. Although low income women are still significantly more likely to report lower health status (HUI <.83, Fair/Poor health or some type of Activity Restriction) the relative risks range from 1.64 for Activity Restriction to 2.17 for Self-rated Health. Also, there is no evidence of elevated risk for those in the upper-middle income group. In contrast, the relative risks for low income men range from 2.62 for activity restriction to 3.02 for self-rated health, and all income groups show significantly higher risk compared with the high income group.

Stratified by age – 1996

Table 3.7 lists the results of the analysis by age group for 1996. Once again, the mean HUIs for all groups are lower in 1996 relative to 1990. Both the 25-44 and 45-64 year age groups show clear gradients with income. As in 1990, the 45-64 group once more exhibits the greatest health inequalities by income. Over age 64 there is no significant difference between income groups.

In the analysis of the dichotomous HUI, the highest relative risk is found among those age 25-44 with low incomes. Their RR of a low HUI is 3.22 compared with their high income counterparts. This drops to 2.74 among those 45-64. In contrast, the highest

Table 3.7. Health status by Adjusted Income and Age Group, sexes together, 1996

Mean HUI by Income (LSMeans)

	25-44			45-64			65-74			75+		
	Adjusted** Mean HUI	Confidence Limits	p-value	Adjusted** Mean HUI	Confidence Limits	p-value	Adjusted** Mean HUI	Confidence Limits	p-value	Adjusted** Mean HUI	Confidence Limits	p-value
Low	0.868	(0.859, 0.878)	0.0001	0.802	(0.786, 0.817)	0.0001	0.818	(0.796, 0.839)	0.7616	0.753	(0.723, 0.782)	0.0112
Low-middle	0.909	(0.900, 0.918)	0.0001	0.864	(0.851, 0.878)	0.0001	0.827	(0.803, 0.851)	0.5850	0.785	(0.758, 0.811)	0.2775
Upper-middle	0.920	(0.911, 0.928)	0.0143	0.877	(0.864, 0.890)	0.0001	0.835	(0.813, 0.858)	0.1655	0.776	(0.741, 0.810)	0.1191
High	0.926	(0.917, 0.935)	ref.	0.894	(0.880, 0.908)	ref.	0.821	(0.799, 0.844)	ref.	0.806	(0.766, 0.845)	ref.
Unknown	0.920	(0.912, 0.928)	0.0246	0.894	(0.881, 0.907)	0.9688	0.833	(0.806, 0.860)	0.2467	0.799	(0.773, 0.824)	0.7153

*t-test for difference in means, High income as reference category

Risk Ratio for Mean HUI <.83 by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	3.22	(2.55, 4.06)	2.74	(2.22, 3.38)	1.17	(0.77, 1.78)	1.27	(0.80, 1.99)
Low-middle	1.65	(1.32, 2.07)	1.65	(1.36, 2.00)	1.05	(0.72, 1.54)	1.11	(0.72, 1.70)
Upper-middle	1.33	(1.07, 1.65)	1.40	(1.17, 1.67)	1.03	(0.70, 1.52)	1.14	(0.74, 1.75)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	1.39	(1.11, 1.73)	1.22	(1.01, 1.47)	0.96	(0.66, 1.4)	1.04	(0.68, 1.58)

Risk Ratio for Fair/Poor Health by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.79	(2.13, 3.66)	3.44	(2.66, 4.44)	1.33	(0.86, 2.06)	1.93	(0.97, 3.82)
Low-middle	1.46	(1.12, 1.90)	2.09	(1.64, 2.67)	0.96	(0.64, 1.44)	1.82	(0.95, 3.51)
Upper-middle	1.15	(0.89, 1.48)	1.38	(1.09, 1.74)	0.67	(0.44, 1.02)	1.83	(0.94, 3.53)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	1.22	(0.94, 1.58)	1.31	(1.03, 1.66)	0.85	(0.57, 1.27)	1.58	(0.82, 3.03)

Risk Ratio for Activity Restriction by Income

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Low	2.25	(1.78, 2.84)	2.73	(2.17, 3.45)	1.13	(0.71, 1.81)	1.37	(0.84, 2.25)
Low-middle	1.34	(1.08, 1.66)	1.75	(1.41, 2.17)	1.11	(0.73, 1.69)	1.18	(0.74, 1.88)
Upper-middle	1.03	(0.84, 1.27)	1.30	(1.06, 1.59)	1.13	(0.74, 1.72)	1.26	(0.79, 2.00)
High	1.00	---	1.00	---	1.00	---	1.00	---
Unknown	0.87	(0.70, 1.09)	1.04	(0.84, 1.28)	0.92	(0.60, 1.40)	1.10	(0.70, 1.74)

**full model adjusts for sex, household type, behaviour (smoking, alcohol use, physical activity) and education.

relative risks for Fair/Poor health and Activity Restriction are found in the 45-64 year old age group, with slightly lower RRs for the 25-44 age group. Still, there is a clear association between risk of lowered health status and income group for those under 65. Over age 64 there are no significant differences across groups.

Pattern of Health Inequalities by Highest Level of Education – 1990

Overall

The pattern of health inequalities by SES, when education is used as the SES measure, differs from that of income in that the gradient is less clear (Table 3.8). In fact, in many cases it appears to be more of a threshold effect than a gradient. For example, mean HUI scores by highest level of education indicates a significantly lower HUI for those with less than a high school diploma, but virtually no difference in HUI between those with a high school diploma and those with a post-secondary degree or diploma.

The pattern is similar for both the dichotomous HUI and activity restriction. If one does not have a high school diploma, the relative risk of scoring less than .83 on the HUI or reporting some type of Activity Restriction in 1990 were 1.32 (1.17, 1.49) and 1.56 (1.32, 1.83) respectively. However, there was no significantly higher risk of either low HUI or Activity Restriction for those with a high school diploma but no post-secondary diploma or degree. The exception to this is Self-rated Health. In this case, there was a significantly higher risk of reporting Fair/Poor health for both those with less than a secondary diploma and those with a secondary diploma but no college or university. However, in the latter case the result was barely significant.

Stratified by sex - – 1990

Comparing mean HUI scores by highest level of education for men and women in 1990 (Table 3.9), once again there is no difference between the upper two groups for men, although there is a significant difference in mean HUI for women in these two groups. For both sexes, mean HUI scores for those with less than a secondary education are much lower than the other two groups. As well, the mean HUI scores for women in all groups tend to be lower than those for men.

Table 3.8. Health Status Outcomes by Highest Level of Education, adjusted and unadjusted, 1990
Age 25+
Mean HUI by Education

	Unadjusted	Adjusted (full model**)	(95% Confidence Limits)	p-value*
Less than secondary graduation	0.875	0.886	(.883, .889)	0.0001
Secondary graduation/ Some post-secondary	0.920	0.905	(.903, .909)	0.1951
Post-secondary graduation	0.934	0.908	(.904, .911)	ref.

*t-test for difference in means, reference category=Post-secondary graduation

Risk Ratio for Mean HUI <.83 by Education

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	2.18	1.32	(1.17, 1.49)
Secondary graduation/ Some post-secondary	1.19	1.00	(0.89, 1.13)
Post-secondary graduation	1.00	1.00	---

Risk Ratio for Fair/Poor Health by Education

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	3.50	1.88	(1.62, 2.20)
Secondary graduation/ Some post-secondary	1.47	1.18	(1.01, 1.39)
Post-secondary graduation	1.00	1.00	---

Risk Ratio for Activity Restriction by Education

	Unadjusted	Adjusted (full model**)	
	Risk Ratio	Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	2.53	1.56	(1.32, 1.83)
Secondary graduation/ Some post-secondary	1.39	1.16	(0.99, 1.37)
Post-secondary graduation	1.00	1.00	---

**full model adjusts for age, sex, household type, behaviour (smoking, alcohol use, physical activity) and income.

Table 3.9. Health Status by Education and Sex, 1990
Age 25+
Mean HUI by Education (LS Means)

	Men			Women		
	Adj.** mea HUI	95% Confidence Limits	p-value*	Adj.** mea HUI	95% Confidence Limits	p-value*
Less than secondary graduation	0.890	(0.884, 0.895)	0.0001	0.884	(.880, .888)	0.0001
Secondary graduation/ Some post-secondary	0.912	(0.906, 0.917)	0.5445	0.901	(.897, .905)	0.0097
Post-secondary graduation	0.910	(0.904, 0.916)	ref.	0.907	(.902, .911)	ref.

*t-test for difference in means, reference category=Post-secondary graduation

Risk Ratio for HUI <.83 by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.30	(1.09, 1.54)	1.36	(1.14, 1.61)
Secondary graduation/ Some post-secondary	0.99	(0.83, 1.18)	1.03	(0.87, 1.22)
Post-secondary graduation	1.00	---	1.00	---

Risk Ratio for Fair/Poor Health by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.96	(1.57, 2.44)	1.80	(1.45, 2.23)
Secondary graduation/ Some post-secondary	1.23	(0.98, 1.56)	1.14	(0.92, 1.43)
Post-secondary graduation	1.00	---	1.00	---

Risk Ratio for Activity Restriction by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.60	(1.27, 2.02)	1.51	(1.2, 1.9)
Secondary graduation/ Some post-secondary	1.08	(0.85, 1.38)	1.23	(0.98, 1.54)
Post-secondary graduation	1.00	---	1.00	---

**full model adjusts for age, household type, behaviour (smoking, alcohol use, physical activity) and income.

Table 3.10. Health Status by Education and Age Group, sexes together, 1990, Age 25+

Mean HUI by Education (LS Means)

	25-44			45-64			65-74			75+		
	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*	Adj.** Mean HUI	95% Confidence Limits	p-value*
Less than secondary graduation	0.914	(0.910, 0.918)	0.0001	0.862	(0.856, 0.868)	0.0001	0.852	(0.837, 0.867)	0.2997	0.798	(0.775, 0.821)	0.0001
Secondary grad./ some post-secondary	0.932	(0.929, 0.936)	0.1658	0.887	(0.880, 0.893)	0.3577	0.854	(0.838, 0.870)	0.4376	0.820	(0.796, 0.844)	0.0532
Post-secondary graduation	0.934	(0.931, 0.938)	ref.	0.890	(0.883, 0.897)	ref.	0.859	(0.841, 0.877)	ref.	0.842	(0.813, 0.870)	ref.

t-test for difference in means, reference category is Post-secondary graduation

Risk Ratio for HUI <.83 by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.57	(1.28, 1.92)	1.37	(1.12, 1.69)	0.98	(0.73, 1.33)	1.26	(0.88, 1.79)
Secondary grad./ some post-secondary	1.00	(0.83, 1.21)	1.00	(0.80, 1.24)	0.94	(0.69, 1.29)	1.04	(0.70, 1.54)
Post-secondary graduation	1.00	---	1.00	---	1.00	---	1.00	---

Risk Ratio for Fair/Poor Health by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	2.18	(1.70, 2.81)	2.07	(1.58, 2.73)	1.43	(0.97, 2.11)	1.31	(0.84, 2.06)
Secondary grad./ some post-secondary	1.20	(0.94, 1.52)	1.30	(0.97, 1.74)	1.13	(0.75, 1.71)	0.88	(0.52, 1.48)
Post-secondary graduation	1.00	---	1.00	---	1.00	---	1.00	---

Risk Ratio for Activity Restriction by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.72	(1.33, 2.24)	1.70	(1.28, 2.25)	0.74	(0.74, 1.70)	1.21	(0.72, 2.05)
Secondary grad./ some post-secondary	1.14	(0.90, 1.46)	1.15	(0.85, 1.55)	0.74	(0.74, 1.71)	1.17	(0.66, 2.05)
Post-secondary graduation	1.00	---	1.00	---	1.00	---	1.00	---

**full model adjusts for sex, household type, behaviour (smoking, alcohol use, physical activity) and income

Looking at the results for the dichotomous health status measures, in no case is there a significant difference in risk between the highest two education levels. This is the same for both men and women. Having less than a secondary education, however, does significantly increase one's risk of reporting a lower health status compared with those with a post-secondary diploma or degree. The relative risks for the lowest education group ranged from 1.3 for the relative risk of an HUI score less than .83, to 1.96 for the relative risk of reporting one's health as Fair or Poor.

Stratified by age - 1990

Results for the analysis of health status by highest level of education and age group in 1990 are found in Table 3.10. For each education level group, mean HUI declines steadily with age. As well, at no age is there a significant difference between the top two education level groups. Those with less than a high school diploma, however, have significantly lower mean HUI scores in all age groups except 65-74. Again, the greatest inequality is found in the 45-64 year old age group.

Looking at the other health status variables, in the 25-44 and 45-64 year age groups those with less than a high school diploma have a significantly higher risk of low HUI, Fair/Poor health and Activity Restriction compared with those who have completed post-secondary. However, there is no evidence of a significantly higher risk among those with less education over the age of 64.

Pattern of Health Inequalities by Highest Level of Education – 1996

Overall

While the overall pattern of mean HUI scores by education level shows virtually no change between 1990 and 1996 (Table 3.11), again the mean HUI scores for each

Table 3.11. Health Status Outcomes by Highest Level of Education, adjusted and unadjusted, 1996

Mean HUI by Education

	Unadjusted	Adjusted (full model**)	(95% Confidence Limits)	p-value*
Less than secondary graduation	0.869	0.853	(.847, .860)	0.0001
Secondary graduation/ Some post-secondary	0.917	0.869	(.863, .875)	0.6699
Post-secondary graduation	0.931	0.870	(.863, .876)	ref.

*t-test for difference in means, reference category=Post-secondary graduation

Risk Ratio for Mean HUI <.83 by Education

	Unadjusted Risk Ratio	Adjusted (full model**) Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	2.34	1.28	(1.18, 1.39)
Secondary graduation/ Some post-secondary	1.28	1.07	(0.99, 1.15)
Post-secondary graduation	1.00	1.00	---

Risk Ratio for Fair/Poor Health by Education

	Unadjusted Risk Ratio	Adjusted (full model**) Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	3.01	1.53	(1.39, 1.69)
Secondary graduation/ Some post-secondary	1.36	1.10	(1.00, 1.21)
Post-secondary graduation	1.00	1.00	---

Risk Ratio for Activity Restriction by Education

	Unadjusted Risk Ratio	Adjusted (full model**) Risk Ratio	(95% Confidence Limits)
Less than secondary graduation	2.13	1.17	(1.02, 1.33)
Secondary graduation/ Some post-secondary	1.29	1.03	(0.91, 1.16)
Post-secondary graduation	1.00	1.00	---

**full model adjusts for age, sex, household type, behaviour (smoking, alcohol use, physical activity) and income.

Table 3.12. Health Status by Education and Sex, 1996
Age 25+
Mean HUI by Education (LS Means)

	Men			Women		
	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*
Less than secondary graduation	0.866	(0.856, 0.875)	0.0002	0.840	(0.831, 0.849)	0.0001
Secondary graduation/ Some post-secondary	0.876	(0.867, 0.885)	0.8411	0.861	(0.852, 0.869)	0.8191
Post-secondary graduation	0.876	(0.867, 0.886)	ref.	0.861	(0.853, 0.870)	ref.

*t-test for difference in means, reference category=Post-secondary graduation

Risk Ratio for HUI <.83 by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.24	(1.10, 1.41)	1.29	(1.16, 1.44)
Secondary graduation/ Some post-secondary	1.07	(0.95, 1.19)	1.06	(0.96, 1.17)
Post-secondary graduation	1.00	---	1.00	---

Risk Ratio for Fair/Poor Health by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.52	(1.32, 1.74)	1.53	(1.34, 1.75)
Secondary graduation/ Some post-secondary	1.15	(1.00, 1.30)	1.05	(0.92, 1.19)
Post-secondary graduation	1.00	---	1.00	---

Risk Ratio for Activity Restriction by Education

	Men		Women	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.17	(1.02, 1.33)	1.17	(1.03, 1.33)
Secondary graduation/ Some post-secondary	1.03	(0.91, 1.16)	1.11	(0.99, 1.23)
Post-secondary graduation	1.00	---	1.00	---

**full model adjusts for age, household type, behaviour (smoking, alcohol use, physical activity) and income.

group are lower in 1996 compared with 1990. The adjusted risk ratios have also dropped, suggesting a reduction in inequalities across education categories.

Stratified by sex – 1996

The pattern of mean HUI by education for men and women in 1996 was nearly identical, with significantly lower scores in those without a high school education but no difference between the top two groups (Table 3.12). The main difference between the men's and women's results was the fact that the women's scores were lower than the men's across the board. As well, all scores dropped in 1996 relative to 1990.

The relative risks for HUI <.83, Fair/Poor health and Activity Restriction for those with less than a high school diploma were nearly identical for men and women, ranging from 1.17 (1.02, 1.33) for activity restriction to 1.52 (1.32, 1.74) for Self-rated Health. As before, there were no significant differences in risk between the top two groups.

Stratified by age – 1996

The pattern of mean HUI by age and education shows little change from 1990 (Table 3.13). As in 1990, we again see no difference between the high school graduates and the post-secondary graduates. The only group that differs significantly from the highest group is the group with less than high school graduation. Scores for this group are lower than their higher education counterparts across all age groups. As well, 1996 scores are generally lower than those for 1990 across all age and education groups.

For the other outcome variables, the pattern for those under age 64 is much like that of 1990 – no difference between the top two groups, but significantly higher risk of the negative outcomes among those with less than high school graduation. The difference between the 1996 results and 1990 come in the upper age groups. Unlike

Table 3.13. Health Status by Education and Age Group, sexes together, 1996

Mean HUI by Education

	25-44			45-64			65-74			75+		
	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*	Adj.** mean HUI	95% Confidence Limits	p-value*
Less than secondary graduation	0.899	(0.890, 0.908)	0.0001	0.857	(0.844, 0.870)	0.0003	0.817	(0.795, 0.838)	0.0013	0.764	(0.740, 0.788)	0.0035
Secondary graduation/ Some post-secondary	0.913	(0.905, 0.922)	0.6986	0.871	(0.858, 0.884)	0.9416	0.829	(0.807, 0.851)	0.287	0.794	(0.769, 0.819)	0.8744
Post-secondary graduation	0.914	(0.906, 0.922)	ref.	0.871	(0.858, 0.883)	ref.	0.835	(0.813, 0.858)	ref.	0.793	(0.765, 0.820)	ref.

*t-test for difference in means, reference category is Post-secondary graduation

Risk Ratio for HUI <.83 by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.29	(1.09, 1.52)	1.22	(1.07, 1.39)	1.42	(1.16, 1.75)	1.31	(1.07, 1.61)
Secondary grad./ some post-secondary	1.05	(0.93, 1.20)	1.01	(0.89, 1.14)	1.23	(0.99, 1.52)	1.08	(0.87, 1.33)
College/university graduation	1.00	---	1.00	---	1.00	---	1.00	---

Risk Ratio for Fair/Poor Health by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.82	(1.51, 2.18)	1.54	(1.32, 1.80)	1.25	(1.01, 1.56)	1.49	(1.15, 1.94)
Secondary grad./ some post-secondary	1.10	(0.95, 1.29)	1.05	(0.90, 1.23)	1.04	(0.82, 1.31)	1.23	(0.94, 1.62)
College/university graduation	1.00	---	1.00	---	1.00	---	1.00	---

Risk Ratio for Activity Restriction by Education

	25-44		45-64		65-74		75+	
	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits	Adj.** Risk Ratio	95% Confidence Limits
Less than secondary graduation	1.34	(1.11, 1.60)	1.22	(1.05, 1.42)	1.05	(0.85, 1.30)	1.01	(0.82, 1.25)
Secondary grad./ some post-secondary	1.15	(1.01, 1.32)	1.06	(0.92, 1.22)	0.97	(0.78, 1.21)	0.97	(0.78, 1.21)
College/university graduation	1.00	---	1.00	---	1.00	---	1.00	---

**full model adjusts for sex, household type, behaviour (smoking, alcohol use, physical activity) and income

1990, where there was no difference between groups after age 64, in 1996 the lowest education group exhibits significantly higher risk of both low HUI and Fair/Poor health in both older age groups. Only in the case of Activity Restriction is there no difference after age 64.

III. Interaction Analysis – combined 1990 and 1996

After examining the relationships between health status outcomes and SES for each year individually, an analysis was carried out that looked for interaction and, as such, for significant changes in the association between SES and health status between 1990 and 1996.

Overall interaction analysis by income

Table 3.14 contains the results of the interaction analysis for the population as a whole, controlled, as always, for age, sex, household type, behaviour and highest level of education. The purpose of the interaction analysis was to determine if there has been a significant change in the relationships between the groups from 1990 to 1996, a change in the pattern of inequalities, as it were. From Table 3.14 we can see that there has been a significant change using mean HUI as the measure of health status. The F-test for the interaction term is significant at 7.43, $p<.0001$.

Looking at the individual categories, we find that while the mean HUIs of all groups appear to have declined, the drop was greater for the lowest income group (Figure 3.1).

There is also a significant interaction between year and the risk of an HUI score less than .83. The relative risk ratio for the dichotomous HUI exceeded 1 for all income groups, although only the low income group showed a significantly higher relative risk. Figure 3.2 displays graphically the changes in relative risk for the three dichotomous measures.

For Self-rated Health, the relative risks for 1996 compared with 1990 also exceed 1.0, but are not significant for any individual group. The overall chi-squared test for

Table 3.14. Interaction Analysis - Health Status and Adjusted Income
Combined analysis of 1990 and 1996 OHS
Age 25+, both sexes together

Mean HUI	Adjusted** mean HUI				
	1990	95% Confidence	1996	95% Confidence	p-value
Income Category		Limits		Limits	interaction
Low	0.871	(0.865, 0.877)	0.853	(0.849, 0.858)	0.0021
Lower-middle	0.901	(0.897, 0.904)	0.894	(0.891, 0.897)	0.476
Upper-Middle	0.908	(0.905, 0.911)	0.904	(0.901, 0.907)	0.9273
High	0.916	(0.912, 0.920)	0.911	(0.908, 0.915)	ref.
Unknown	0.904	(0.900, 0.909)	0.908	(0.905, 0.911)	0.0072

F-test for interaction term, full model: F=7.43, p<.0001

Adjusted Risk Ratio for HUI <.83 in 1996 compared with 1990**

Income Category	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	1.74	2.26	1.30	(1.05, 1.61)
Lower-middle	1.38	1.48	1.07	(0.88, 1.3)
Upper-Middle	1.22	1.29	1.06	(0.87, 1.29)
High	1.00	1.00	1.00	---
Unknown	1.33	1.27	0.95	(0.78, 1.17)

Chi-squared test for interaction: 12.462, 4df, p = 0.014

Adjusted Risk Ratio for Fair/Poor health in 1996 compared with 1990**

Income Category	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	2.18	2.58	1.18	(0.92, 1.53)
Lower-middle	1.56	1.64	1.05	(0.83, 1.34)
Upper-Middle	1.18	1.22	1.04	(0.81, 1.33)
High	1.00	1.00	1.00	---
Unknown	1.47	1.28	0.87	(0.68, 1.13)

Chi-squared test for interaction: 9.168, 4df, p = 0.057

Adjusted Risk Ratio for Activity Restriction in 1996 compared with 1990**

Income Category	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	2.03	1.97	0.97	(0.74, 1.28)
Lower-middle	1.53	1.40	0.91	(0.71, 1.17)
Upper-Middle	1.24	1.19	0.96	(0.74, 1.23)
High	1.00	1.00	1.00	---
Unknown	1.33	1.03	0.77	(0.59, 1.01)

Chi-squared test for interaction: 5.80, 4df, p = 0.215

**Full model adjusts for age, sex, household type, behaviour (smoking, alcohol use and physical activity) and education

Figure 3.1 Mean HUI Scores for Men, Women and Total Population, 1990 and 1996, by Income Group

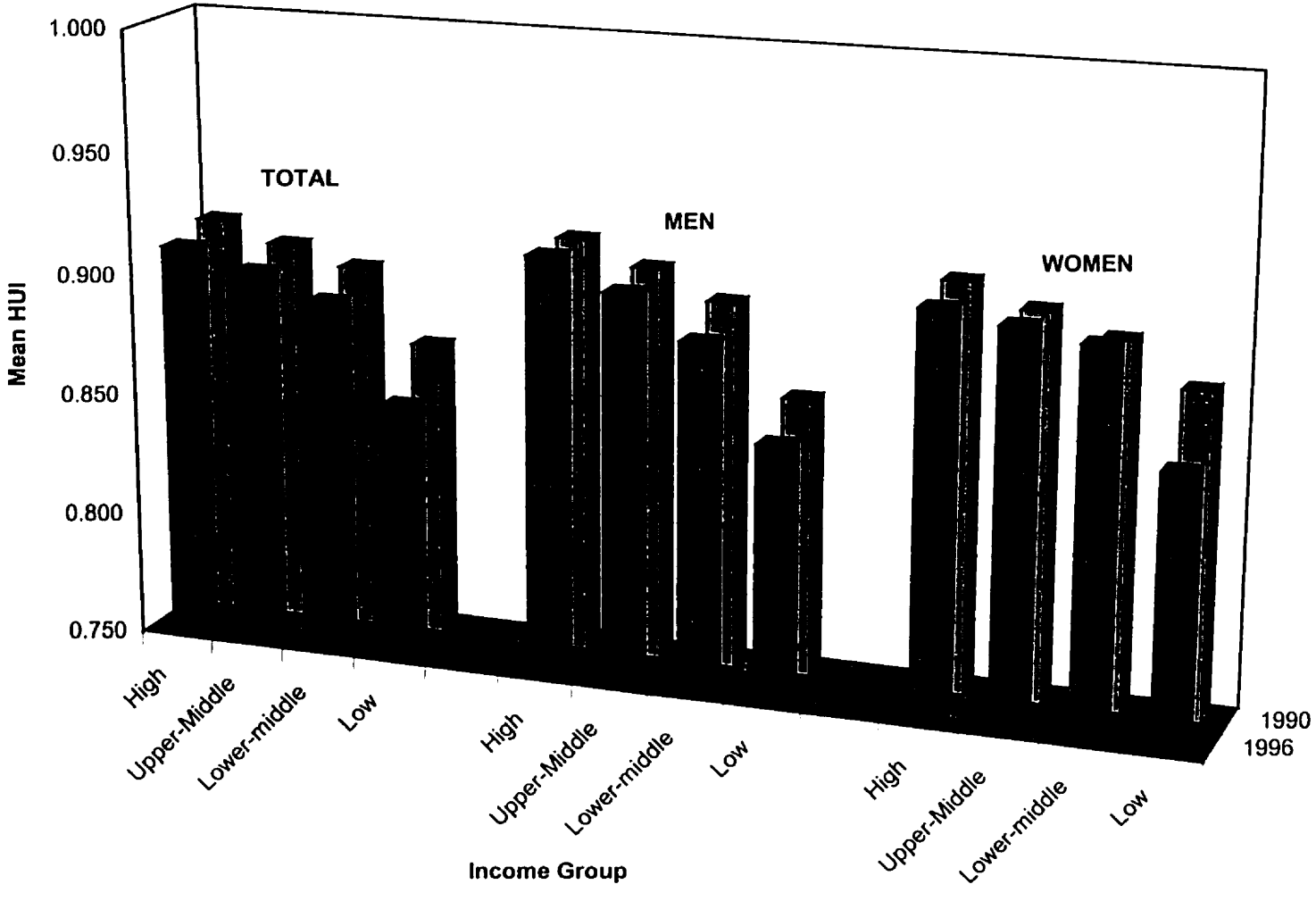
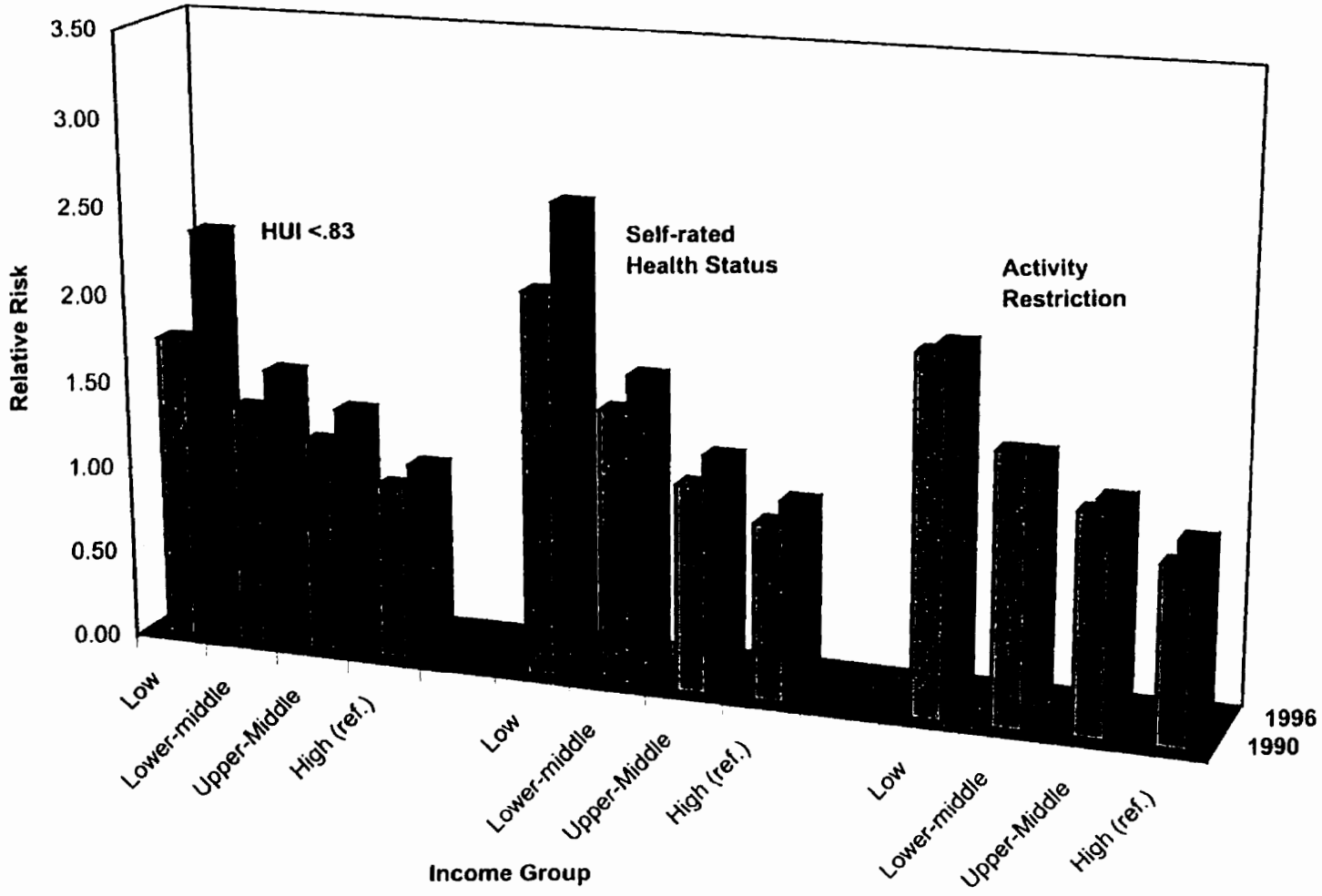


Figure 3.2 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996 by Income Group



interaction was 0.057, just missing significance at the .05 cutpoint. There was no evidence of an interaction for Activity Restriction.

Overall interaction analysis by education

From Table 3.15, there appears to be no interaction between mean HUI, education and time (F=1.75, p=.1734). Nor is there any evidence of a change in the association between either the dichotomous HUI or Self-rated Health and education from 1990 to 1996. However, the chi-squared test for interaction for Activity Restriction was significant, and it appears as though there may have been a reduction in inequality in Activity Restriction by education level between 1990 and 1996.

Stratified by sex - income

Table 3.16 shows the interaction between income, health status and time separately for men and women. For mean HUI, both sexes show overall significant interactions and a similar pattern of changes. All groups saw their HUIs drop, but the drops get larger descending the income scale, leading to an increase in inequality.

The interaction analysis of the dichotomous HUI also shows a significant overall interaction for men, although not for women (see Figures 3.3 and 3.4). The adjusted relative risk of an HUI less than .83 was more than 50% higher in 1996 compared with 1990. Low income men also had a significantly higher relative risk of reporting their health as Fair or Poor in 1996 compared with 1990, although the overall interaction test for Fair/Poor health was not significant. There was no significant difference in the relative risk of Activity Restriction among low income men in 1996 compared with 1990. Nor was there any evidence of a change in the association between income and any of the dichotomous outcome variables for women.

Table 3.15. Interaction Analysis - Health Status and Highest Level of Education
Combined analysis of 1990 and 1996 OHS
Age 25+, both sexes together

Mean HUI **Adjusted* mean HUI**

Highest level of education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than secondary graduation	0.889	(0.885, 0.892)	0.881	(0.878, 0.884)	0.0618
Secondary graduation/ Some post-secondary	0.905	(0.901, 0.908)	0.900	(0.897, 0.903)	0.3991
Post-secondary graduation	0.904	(0.901, 0.908)	0.902	(0.899, 0.904)	ref.

F-test for interaction term, full model: F=1.75, p = 0.1734

Adjusted* Risk Ratio for HUI <.83 in 1996 compared with 1990

Highest level of education	Adj.** RR 1990	Adj.** RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95%Confidence Limits
Less than secondary graduation	1.21	1.34	1.11	(0.97, 1.27)
Secondary graduation/ Some post-secondary	0.97	1.08	1.12	(0.97, 1.29)
Post-secondary graduation	1.00	1.00	1.00	---

Chi-squared test for interaction: Chi-sq = 2.788, 2df, p = 0.248

Adjusted* Risk Ratio for Fair/Poor health in 1996 compared with 1990

Highest level of education	Adj.** RR 1990	Adj.** RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95%Confidence Limits
Less than secondary graduation	1.76	1.59	0.91	(0.76, 1.07)
Secondary graduation/ Some post-secondary	1.16	1.11	0.96	(0.80, 1.15)
Post-secondary graduation	1.00	1.00	1.00	---

Chi-squared test for interaction: Chi-sq.=1.545, 2df, p = 0.462

Adjusted* Risk Ratio for Activity Restriction in 1996 compared with 1990

Highest level of education	Adj.** RR 1990	Adj.** RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95%Confidence Limits
Less than secondary graduation	1.48	1.21	0.82	(0.68, 0.98)
Secondary graduation/ Some post-secondary	1.14	1.08	0.95	(0.78, 1.15)
Post-secondary graduation	1.00	1.00	1.00	---

Chi-squared test for interaction: Chi-sq.=6.199, 2df, p = 0.045

**Full model adjusts for age, sex, household type, behaviour (smoking, alcohol use and physical activity) and income

Table 3.16. Interaction Analysis by Sex - Health Status and Income
Combined analysis of 1990 and 1996 OHS

	Men					Women				
Mean HUI	**Adjusted* mean HUI**									
	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Income Category										
Low	0.863	(0.856, 0.870)	0.852	(0.848, 0.857)	0.0954	0.881	(0.875, 0.887)	0.857	(0.852, 0.863)	0.0003
Lower-middle	0.899	(0.890, 0.909)	0.891	(0.884, 0.898)	0.9062	0.898	(0.890, 0.906)	0.904	(0.899, 0.908)	0.0329
Upper-Middle	0.911	(0.905, 0.916)	0.908	(0.903, 0.913)	0.8334	0.907	(0.902, 0.912)	0.908	(0.904, 0.912)	0.2372
High	0.920	(0.915, 0.925)	0.920	(0.916, 0.924)	ref.	0.916	(0.911, 0.920)	0.912	(0.907, 0.917)	ref.
Unknown	0.904	(0.898, 0.910)	0.914	(0.909, 0.920)	0.0607	0.901	(0.895, 0.908)	0.911	(0.907, 0.915)	0.0043
F-test for interaction, full model: F=4.66, p=0.0009						F-test for interaction, full model: F=3.99, p= 0.0031				

Adjusted* Risk Ratio for Mean HUI <.83 in 1996 compared with 1990

	Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence		Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence	
Income Category	RR 1990	RR 1996	1996/1990)	Limits		RR 1990	RR 1996	1996/1990)	Limits	
Low	1.97	3.00	1.53	(1.10, 2.11)		1.63	1.78	1.10	(0.82, 1.46)	
Lower-middle	1.47	1.87	1.28	(0.96, 1.70)		1.30	1.19	0.91	(0.70, 1.20)	
Upper-Middle	1.22	1.48	1.21	(0.91, 1.61)		1.21	1.13	0.94	(0.72, 1.23)	
High	1.00	1.00	1.00	---		1.00	1.00	1.00	---	
Unknown	1.45	1.41	0.97	(0.72, 1.32)		1.25	1.13	0.90	(0.68, 1.20)	
Chisq test for interaction: 13.01, 4df, p = 0.011						Chisq test for interaction: Chisq=3.69, 4df, p= 0.45				

Adjusted* Risk Ratio for Fair/Poor health in 1996 compared with 1990

	Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence		Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence	
Income Category	RR 1990	RR 1996	1996/1990)	Limits		RR 1990	RR 1996	1996/1990)	Limits	
Low	2.07	3.07	1.48	(1.03, 2.14)		2.36	2.20	0.93	(0.65, 1.35)	
Lower-middle	1.39	1.76	1.27	(0.91, 1.76)		1.75	1.50	0.86	(0.60, 1.22)	
Upper-Middle	1.04	1.25	1.21	(0.86, 1.69)		1.34	1.17	0.88	(0.61, 1.26)	
High	1.00	1.00	1.00	---		1.00	1.00	1.00	---	
Unknown	1.34	1.38	1.03	(0.73, 1.47)		1.63	1.17	0.72	(0.50, 1.04)	
Chisq test for interaction: Chisq=7.246, 4df, p = 0.123						Chisq test for interaction: Chisq=5.133, 4df, p= 0.274				

Adjusted* Risk Ratio for Activity Restriction in 1996 compared with 1990

	Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence		Adj.	Adj.	Interaction Effect (Ratio	Interaction Effect 95%Confidence	
Income Category	RR 1990	RR 1996	1996/1990)	Limits		RR 1990	RR 1996	1996/1990)	Limits	
Low	2.37	2.58	1.09	(0.72, 1.64)		1.83	1.61	0.88	(0.61, 1.28)	
Lower-middle	1.67	1.64	0.98	(0.69, 1.41)		1.41	1.21	0.85	(0.60, 1.21)	
Upper-Middle	1.30	1.26	0.97	(0.67, 1.39)		1.18	1.12	0.95	(0.67, 1.35)	
High	1.00	1.00	1.00	---		1.00	1.00	1.00	---	
Unknown	1.44	1.05	0.73	(0.49, 1.08)		1.25	0.98	0.78	(0.54, 1.14)	
Chisq test for interaction: Chisq=5.534, 4df, p = 0.237						Chisq test for interaction: Chisq=2.56, 4df, p= 0.634				

*Full model adjusts for age, household type, behaviour (smoking, alcohol use and physical activity) and education

Figure 3.3 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Men only

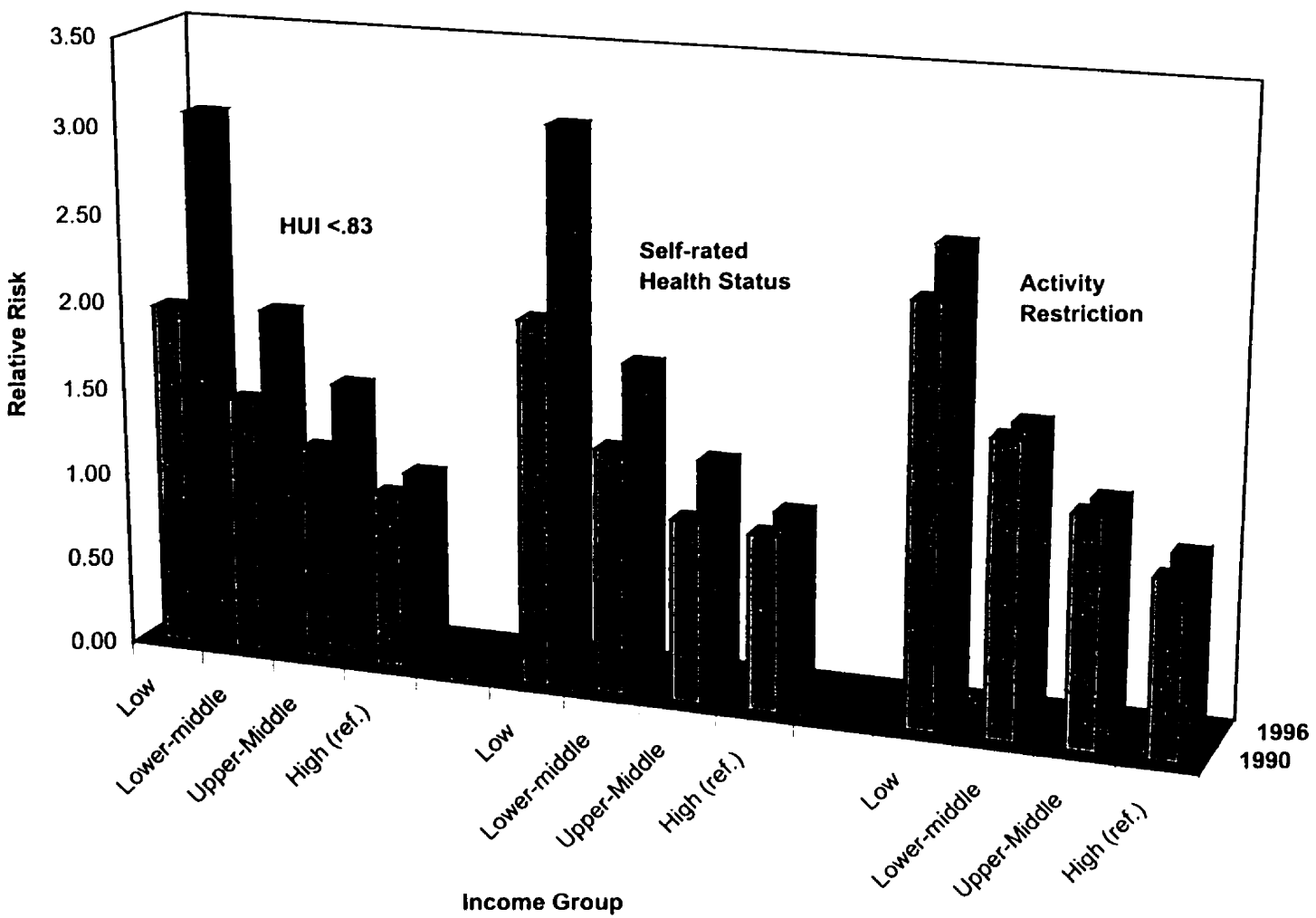
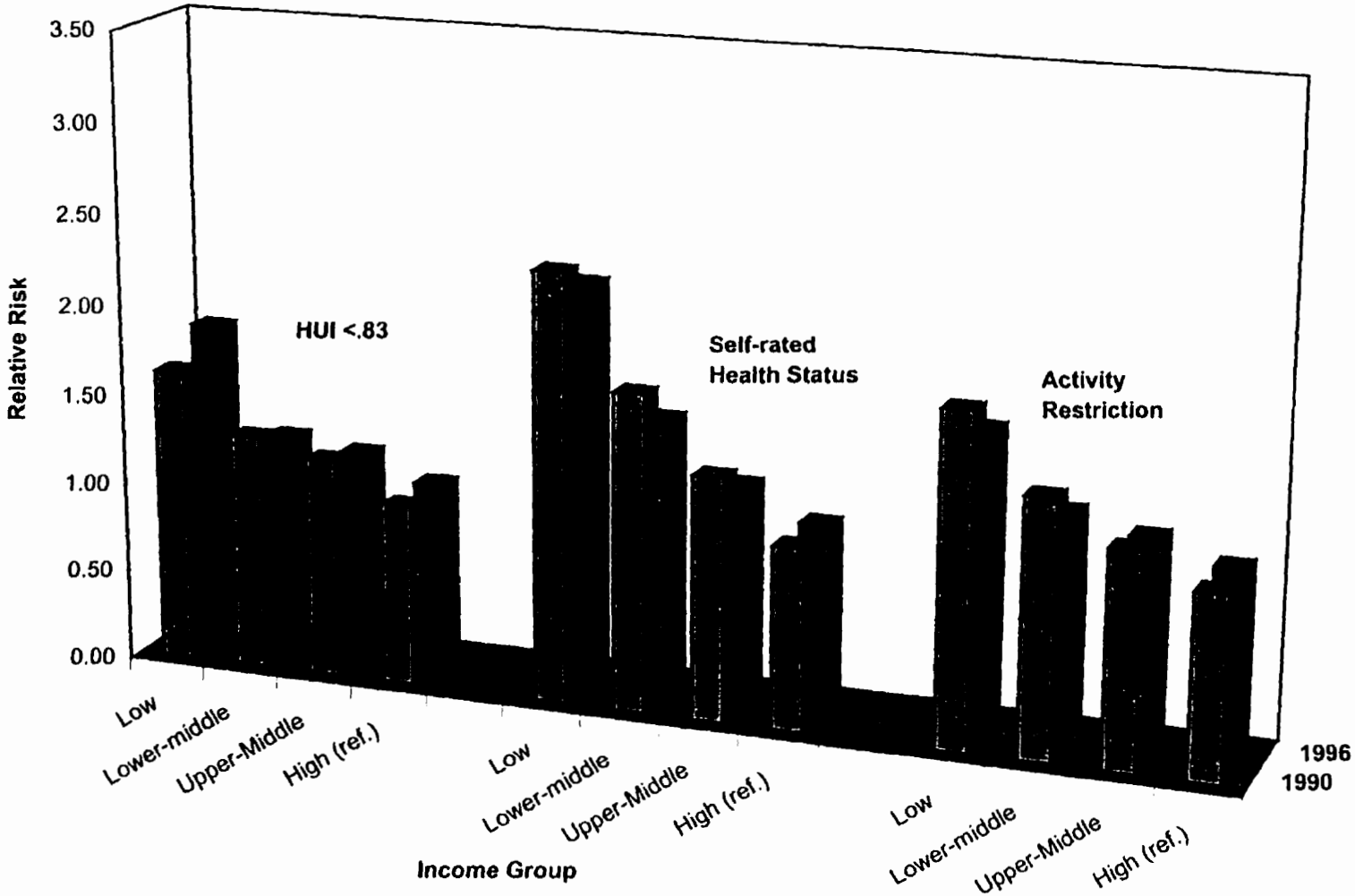


Figure 3.4 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Women only



Stratified by sex – education

When education is used as the measure of socioeconomic status, a somewhat different picture emerges. Results of the interaction analysis for education, health status and time are shown in Table 3.17. For mean HUI, there is no significant interaction evident for men, but there is for women. The mean HUIs for men without a high school diploma showed almost no change, while women in this group saw their HUIs drop significantly.

In the case of the dichotomous HUI, Self-rated Health and Activity Restriction, no significant change in the pattern of inequalities by education level is evident.

Stratified by age – income

Interaction analysis of the mean HUI by income and age group is shown in Table 3.18. There is a significant interaction with time at age 25-44 and 45-64, indicating a change in the pattern of inequalities in these age groups (Figure 3.5).

From Table 3.19, there is no evidence of interaction between the dichotomous HUI, income and time, nor with Self-rated Health Status (see Figures 3.6 to 3.9). However, the chi-squared test for interaction for Activity Restriction was significant for both the 45-64 age group and the over 75 year age group. In the former, there appears to be a general reduction in the risk ratios for Activity Restriction. However, in the latter age group, those over age 75, the risk ratio for Activity Restriction was much higher in 1996 compared with 1990.

Table 3.17. Interaction Analysis by sex - Health Status and Education
Combined analysis of 1990 and 1996 OHS

Mean HUI **Adjusted* Mean HUI**

	Men					Women				
Highest level of education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than sec. Grad.	0.889	(0.884, 0.894)	0.888	(0.883, 0.892)	0.6049	0.887	(0.883, 0.891)	0.875	(0.870, 0.879)	0.1006
Sec. grad., some post-secondary	0.906	(0.901, 0.911)	0.901	(0.897, 0.906)	0.0968	0.902	(0.897, 0.906)	0.898	(0.894, 0.902)	0.4101
Post-secondary graduation	0.902	(0.897, 0.908)	0.903	(0.899, 0.907)	ref.	0.905	(0.900, 0.910)	0.899	(0.895, 0.903)	ref.
F-test for interaction, full model:	F=1.43, p=0.2384					F-test for interaction, full model: F=3.35, p= 0.0349				

Adjusted* Risk Ratio for Mean HUI <.83 in 1996 compared with 1990

	Men				Women			
Highest level of education	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than sec. Grad.	1.13	1.33	1.17	(0.86, 1.26)	1.28	1.33	1.04	(0.86, 1.26)
Sec. grad., some post-secondary	0.94	1.09	1.16	(0.86, 1.28)	1.02	1.06	1.05	(0.86, 1.28)
Post-secondary graduation	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq=2.751, 2df, p= 0.253				Chisq test for interaction:	Chisq=0.239, 2df, p= 0.887		

Adjusted* Risk Ratio for Fair/Poor health in 1996 compared with 1990

	Men				Women			
Highest level of education	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than sec. Grad.	1.75	1.61	0.92	(0.72, 1.17)	1.76	1.56	0.88	(0.7, 1.12)
Sec. grad., some post-secondary	1.19	1.17	0.98	(0.75, 1.29)	1.14	1.05	0.92	(0.71, 1.19)
Post-secondary graduation	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq=0.644, 2df, p= 0.725				Chisq test for interaction:	Chisq=1.082, 2df, p= 0.582		

Adjusted* Risk Ratio for Activity Restriction in 1996 compared with 1990

	Men				Women			
Highest level of education	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj. RR 1990	Adj. RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than sec. Grad.	1.49	1.21	0.82	(0.63, 1.06)	1.49	1.20	0.81	(0.63, 1.04)
Sec. grad., some post-secondary	1.07	1.04	0.96	(0.72, 1.28)	1.20	1.10	0.92	(0.7, 1.2)
Post-secondary graduation	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq=3.132, 2df, p= 0.209				Chisq test for interaction:	Chisq=3.154, 2df, p= 0.207		

*Full model adjusts for age, household type, behaviour (smoking, alcohol and physical activity) and income

Table 3.18. Interaction Analysis by Age Group - Mean HUI by Income Combined analysis of 1990 and 1996 OHS

Adjusted* mean HUI

Age 25-44

Income Category	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Low	0.898	(0.890, 0.905)	0.883	(0.878, 0.888)	0.0391
Lower-middle	0.926	(0.921, 0.930)	0.924	(0.919, 0.929)	0.5460
Upper-Middle	0.931	(0.927, 0.935)	0.935	(0.931, 0.939)	0.0098
High	0.946	(0.941, 0.951)	0.942	(0.938, 0.945)	ref.
Unknown	0.930	(0.925, 0.936)	0.935	(0.930, 0.939)	0.0393

F-test for interaction, full model: F=5.51, p= 0.0002

Age 45-64

Income Category	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Low	0.820	(0.806, 0.833)	0.814	(0.805, 0.822)	0.4829
Lower-middle	0.879	(0.872, 0.887)	0.876	(0.870, 0.883)	0.5756
Upper-Middle	0.904	(0.897, 0.910)	0.890	(0.885, 0.896)	0.0060
High	0.907	(0.899, 0.914)	0.907	(0.900, 0.913)	ref.
Unknown	0.890	(0.881, 0.898)	0.905	(0.900, 0.911)	0.0084

F-test for interaction, full model: F=7.71, p= 0.0001

Age 65-74

Income Category	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Low	0.861	(0.843, 0.879)	0.857	(0.843, 0.871)	0.1208
Lower-middle	0.872	(0.861, 0.883)	0.866	(0.856, 0.877)	0.0907
Upper-Middle	0.878	(0.865, 0.891)	0.876	(0.865, 0.887)	0.0587
High	0.889	(0.868, 0.910)	0.860	(0.842, 0.877)	ref.
Unknown	0.871	(0.856, 0.885)	0.870	(0.860, 0.880)	0.0524

F-test for interaction, full model: F=1.04, p= 0.3872

Age 75+

Income Category	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Low	0.831	(0.807, 0.855)	0.776	(0.754, 0.797)	0.0439
Lower-middle	0.849	(0.829, 0.870)	0.805	(0.787, 0.822)	0.0866
Upper-Middle	0.838	(0.813, 0.862)	0.802	(0.784, 0.821)	0.1862
High	0.810	(0.769, 0.851)	0.812	(0.780, 0.844)	ref.
Unknown	0.847	(0.826, 0.869)	0.819	(0.802, 0.835)	0.2591

F-test for interaction, full model: F=1.42, p= 0.2254

*Full model adjusts for sex, household type, behaviour and education

Figure 3.5 Mean HUI by Income and Age Group, 1990 and 1996

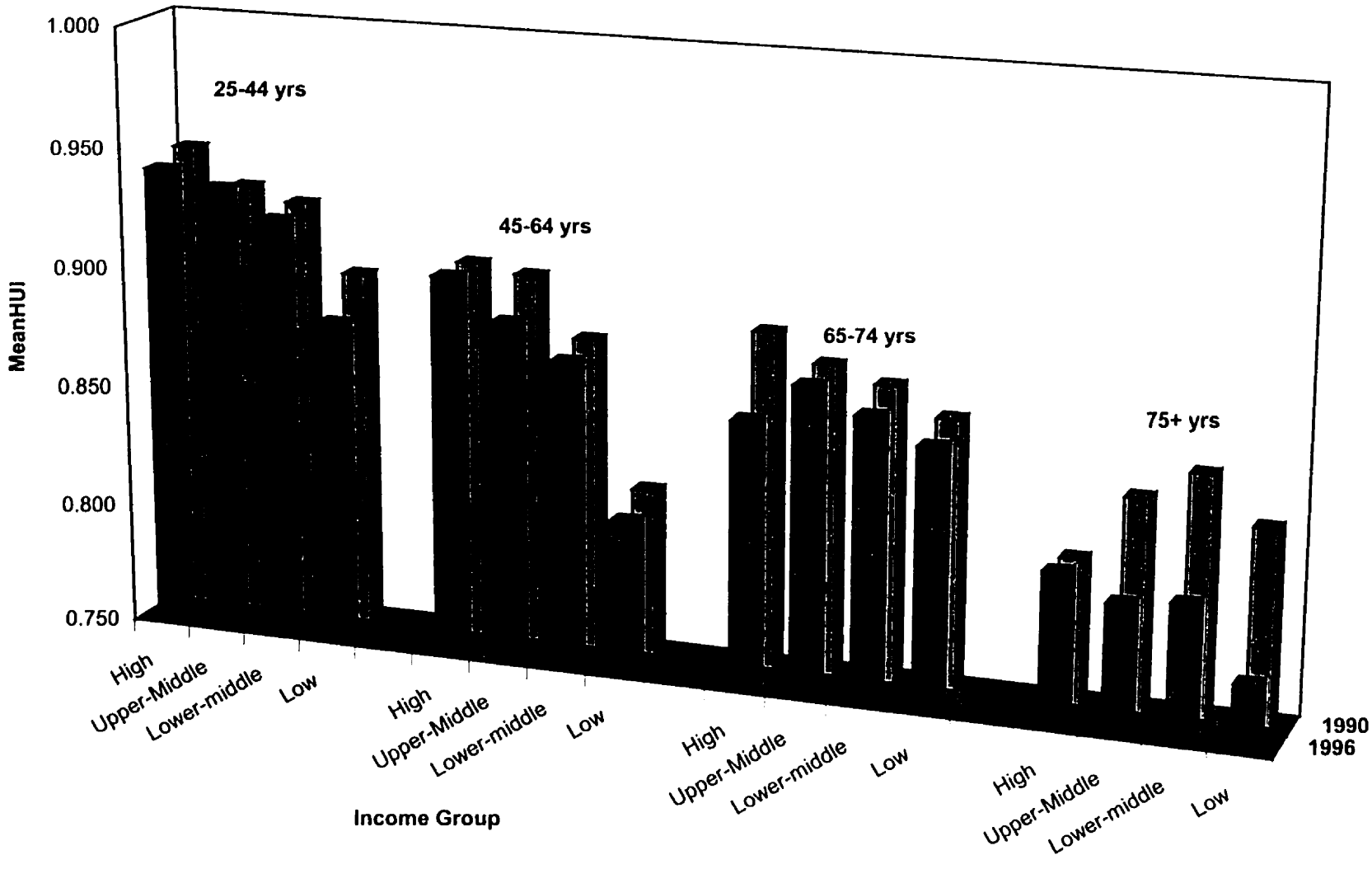


Table 3.19. Interaction Analysis by Age Group - Dichotomous Measures and Income Combined analysis of 1990 and 1996

Age 25-44

	Mean HUI <.83				Self-rated Health Status			
Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	2.63	3.34	1.27	(0.87, 1.85)	1.83	2.84	1.55	(1.00, 2.39)
Lower-middle	1.75	1.72	0.98	(0.69, 1.39)	1.33	1.48	1.11	(0.75, 1.65)
Upper-Middle	1.47	1.34	0.91	(0.65, 1.27)	1.04	1.15	1.11	(0.75, 1.63)
High	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Unknown	1.58	1.44	0.91	(0.62, 1.33)	1.24	1.23	0.99	(0.64, 1.53)
Chisq test for interaction:	Chisq = 5.985, 4df, p = 0.200				Chisq = 6.331, 4df, p = 0.176			

Age 45-64

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	2.35	2.80	1.19	(0.85, 1.67)	3.06	3.52	1.15	(0.77, 1.72)
Lower-middle	1.50	1.69	1.13	(0.84, 1.51)	1.83	2.11	1.16	(0.80, 1.67)
Upper-Middle	1.12	1.40	1.25	(0.94, 1.66)	1.23	1.37	1.11	(0.77, 1.61)
High	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Unknown	1.37	1.26	0.92	(0.67, 1.25)	1.62	1.33	0.82	(0.55, 1.21)
Chisq test for interaction:	Chisq = 6.69, 4df, p = 0.153				Chisq = 6.276, 4df, p = 0.179			

Age 65-74

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	1.33	1.20	0.90	(0.47, 1.75)	2.73	1.35	0.50	(0.22, 1.12)
Lower-middle	1.19	1.05	0.89	(0.48, 1.63)	2.09	0.95	0.45	(0.21, 0.99)
Upper-Middle	1.25	1.01	0.80	(0.43, 1.51)	1.67	0.66	0.40	(0.17, 0.90)
High	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Unknown	1.28	0.98	0.77	(0.41, 1.44)	2.04	0.86	0.42	(0.19, 0.95)
Chisq test for interaction:	Chisq = 1.417, 4df, p =0.841				Chisq = 5.975, 4df, p = 0.201			

Age 75+

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	0.72	1.22	1.69	(0.85, 3.37)	2.00	1.91	0.96	(0.32, 2.87)
Lower-middle	0.77	1.06	1.38	(0.72, 2.68)	1.36	1.74	1.28	(0.43, 3.78)
Upper-Middle	0.78	1.06	1.36	(0.68, 2.73)	0.98	1.68	1.72	(0.55, 5.39)
High	1.00	1.00	1.00	---	1.00	1.00	1.00	---
Unknown	0.76	1.01	1.33	(0.68, 2.57)	1.51	1.52	1.01	(0.34, 3.00)
Chisq test for interaction:	Chisq = 2.829, 4df, p = 0.587				Chisq = 5.339, 4df, p = 0.254			

*Full model adjusts for sex, household type, behaviour and education

Table 3.19. Interaction Analysis by Age Group - Dichotomous Measures and Income Combined analysis of 1990 and 1996

Activity Restriction

Age 25-44

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	2.81	2.23	0.79	(0.50, 1.26)
Lower-middle	1.62	1.34	0.83	(0.55, 1.27)
Upper-Middle	1.42	1.03	0.72	(0.48, 1.09)
High	1.00	1.00	1.00	---
Unknown	1.40	0.88	0.63	(0.39, 1.01)
Chisq test for interaction:	Chisq = 4.478, 4df, p = 0.345			

Age 45-64

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	3.88	2.73	0.70	(0.46, 1.09)
Lower-middle	2.29	1.75	0.76	(0.52, 1.13)
Upper-Middle	1.33	1.29	0.97	(0.65, 1.44)
High	1.00	1.00	1.00	---
Unknown	1.78	1.04	0.59	(0.38, 0.90)
Chisq test for interaction:	Chisq = 10.926, 4df, p = 0.027			

Age 65-74

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	1.26	1.10	0.87	(0.37, 2.06)
Lower-middle	1.20	1.08	0.90	(0.41, 1.96)
Upper-Middle	1.10	1.11	1.01	(0.45, 2.27)
High	1.00	1.00	1.00	---
Unknown	1.25	0.91	0.74	(0.33, 1.66)
Chisq test for interaction:	Chisq = 1.751, 4df, p = 0.781			

Age 75+

Income Category	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Low	0.44	1.33	3.03	(1.33, 6.92)
Lower-middle	0.45	1.12	2.48	(1.13, 5.44)
Upper-Middle	0.43	1.17	2.72	(1.16, 6.38)
High	1.00	1.00	1.00	---
Unknown	0.39	1.06	2.73	(1.22, 6.09)
Chisq test for interaction:	Chisq = 6.923, 4df, p = 0.14			

*Full model adjusts for age, sex, household type and behaviour

Figure 3.6 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Age 25-44 only

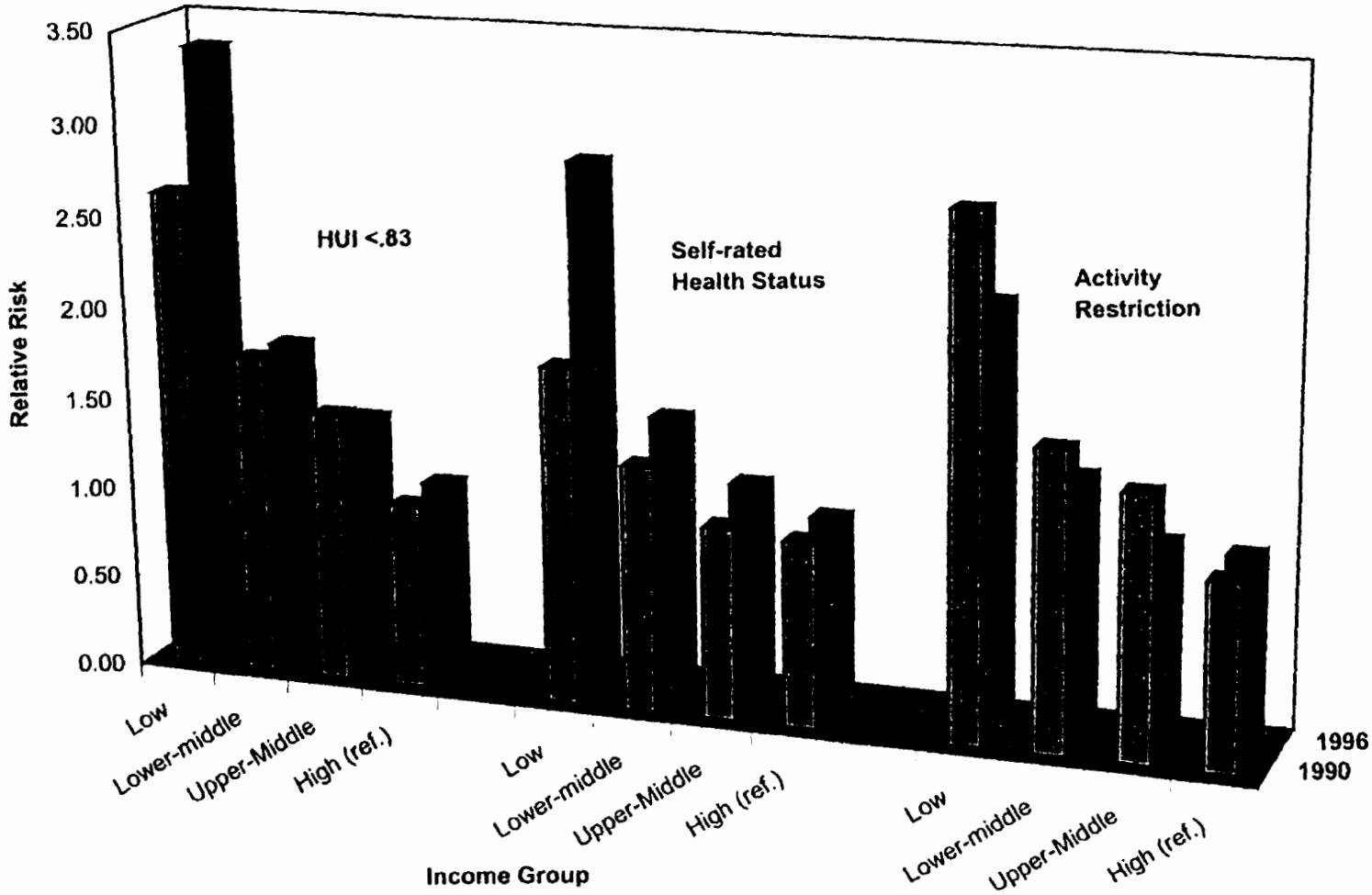


Figure 3.7 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Age 45-64 only

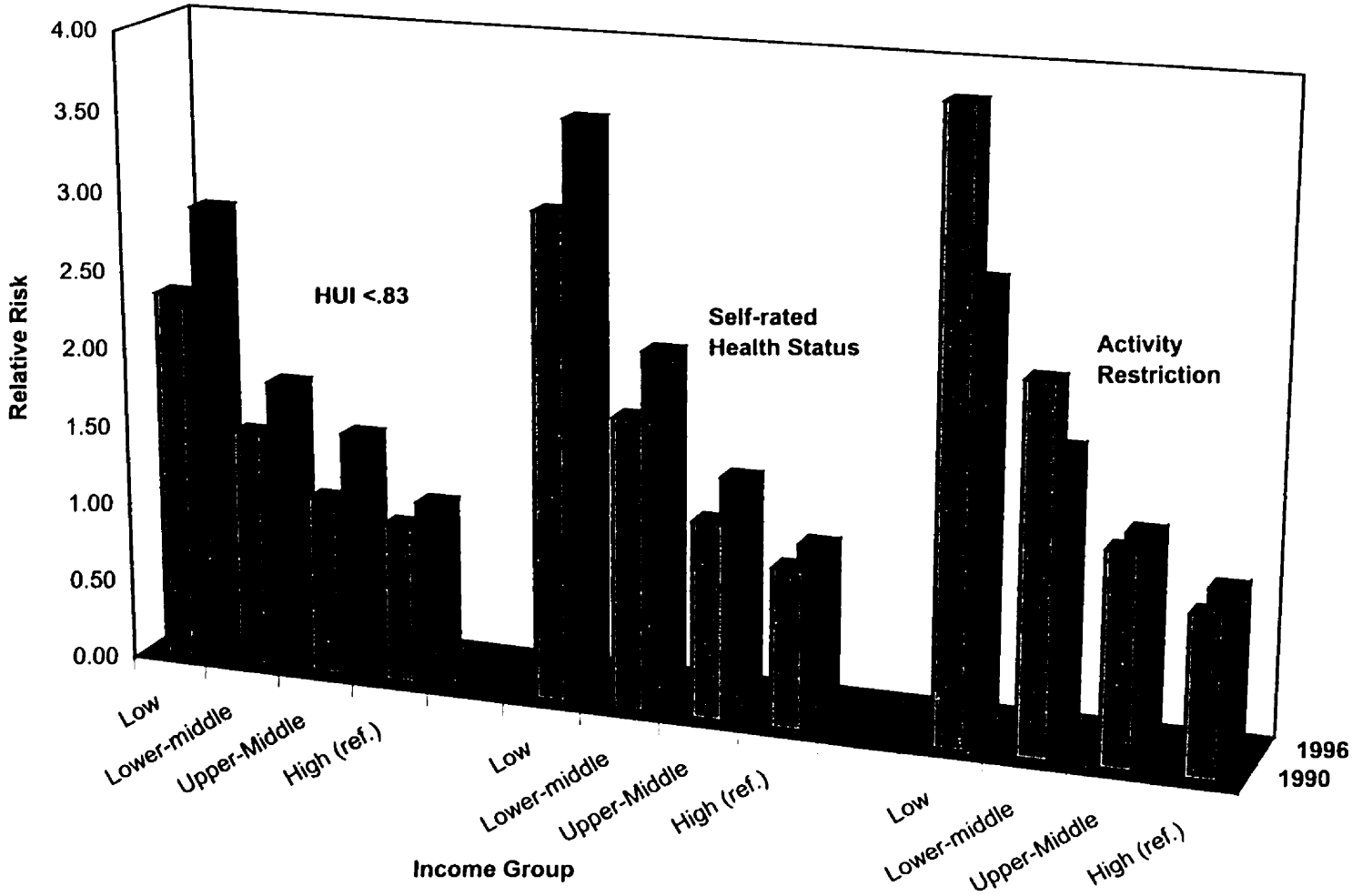


Figure 3.8 Relative Risks for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Age 65-74 only

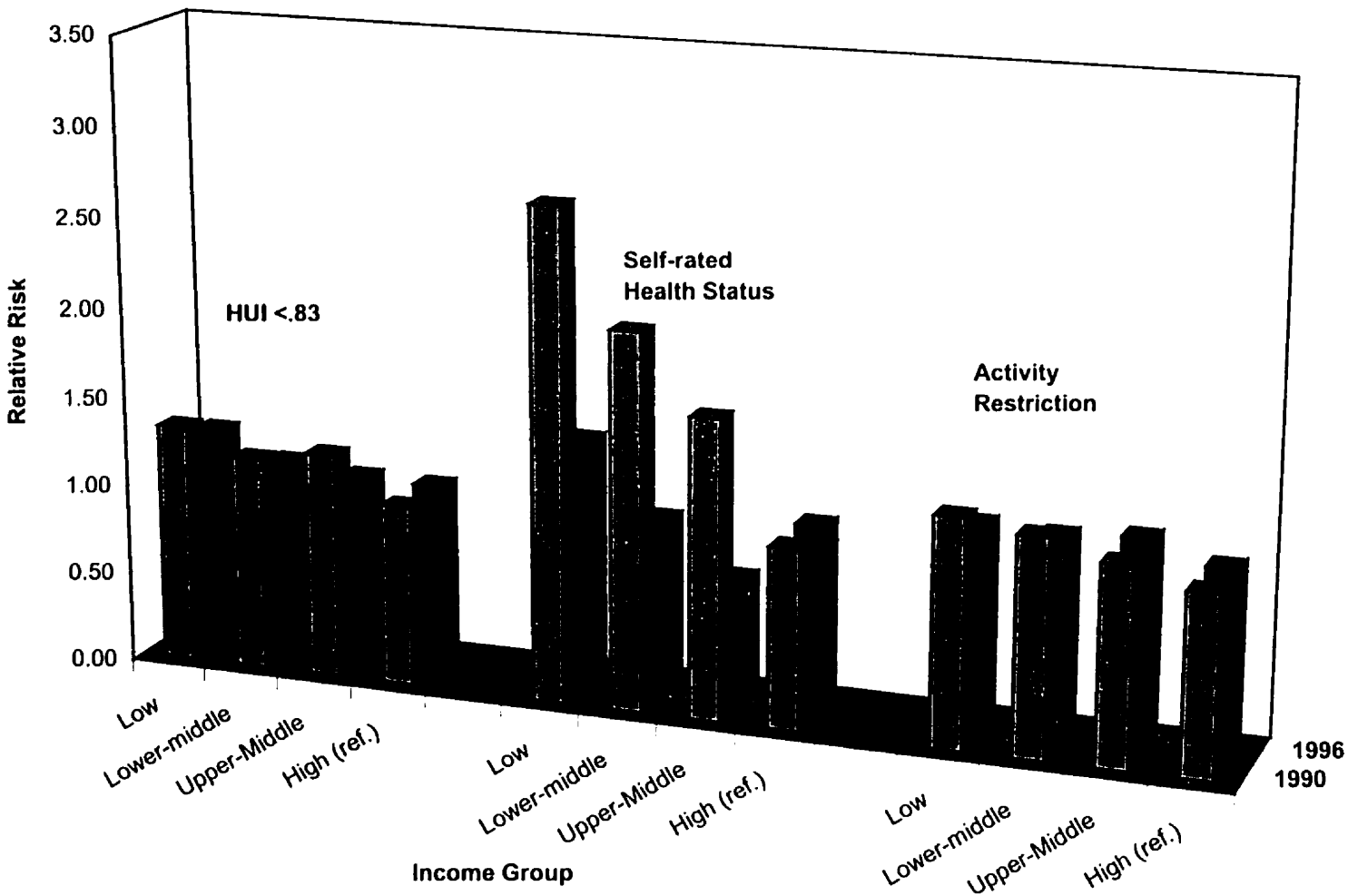


Figure 3.9 Relative Risk for HUI <.83, Fair/Poor Health Status and Activity Restriction, 1990 and 1996, by Income Group, Age 75+ only

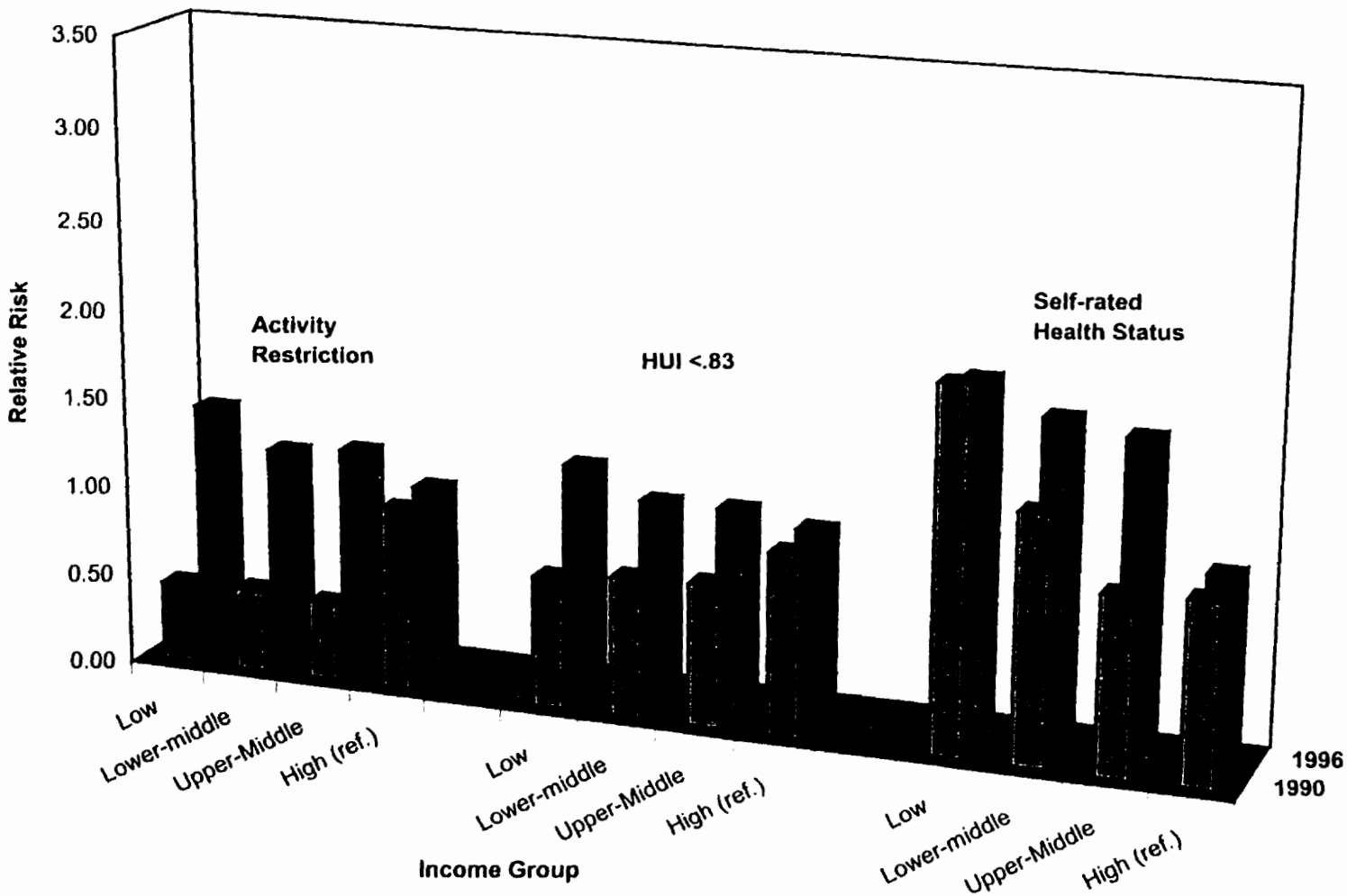


Table 3.20. Interaction Analysis by Age Group - Mean HUI and Education Combined analysis of 1990 and 1996 OHS

Adjusted* Mean HUI

Age 25-44

Highest Level of Education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than secondary graduation	0.914	(0.909, 0.919)	0.913	(0.908, 0.918)	0.6375
Sec. grad., some post-secondary	0.930	(0.926, 0.933)	0.929	(0.926, 0.933)	0.7556
Post-secondary graduation	0.930	(0.926, 0.934)	0.931	(0.927, 0.934)	ref.

F-test for interaction, full model: F = 0.12, p = 0.8865

Age 45-64

Highest Level of Education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than secondary graduation	0.866	(0.860, 0.872)	0.868	(0.862, 0.874)	0.1508
Sec. grad., some post-secondary	0.889	(0.883, 0.895)	0.883	(0.877, 0.888)	0.7471
Post-secondary graduation	0.889	(0.882, 0.896)	0.884	(0.879, 0.890)	ref.

F-test for interaction, full model: F =1.98, p = 0.1377

Age 65-74

Highest Level of Education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than secondary graduation	0.868	(0.858, 0.879)	0.854	(0.845, 0.864)	0.0473
Sec. grad., some post-secondary	0.867	(0.855, 0.879)	0.869	(0.859, 0.880)	0.8512
Post-secondary graduation	0.873	(0.857, 0.889)	0.877	(0.866, 0.888)	ref.

F-test for interaction, full model: F = 3.43, p = 0.0326

Age 75+

Highest Level of Education	1990	95% Confidence Limits	1996	95% Confidence Limits	p-value interaction
Less than secondary graduation	0.820	(0.803, 0.837)	0.776	(0.760, 0.792)	0.8472
Sec. grad., some post-secondary	0.837	(0.816, 0.858)	0.813	(0.797, 0.830)	0.1830
Post-secondary graduation	0.860	(0.833, 0.887)	0.814	(0.794, 0.833)	ref.

F-test for interaction, full model: F =1.50, p = 0.2238

*Full model adjusts for sex, household type, behaviour and income

Table 3.21 Interaction Analysis by Age Group - Dichotomous Measures and Education Combined analysis of 1990 and 1996

Age 25-44

Highest level of education	Mean HUI <.83				Self-rated Health Status			
	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.35	1.39	1.03	(0.81, 1.32)	1.93	1.92	1.00	(0.75, 1.34)
Secondary graduation/ Some post-secondary	0.94	1.08	1.15	(0.92, 1.44)	1.13	1.13	1.00	(0.75, 1.33)
Post-secondary graduation	1.00	1.00	1.00	—	1.00	1.00	1.00	—
Chisq test for interaction:	Chisq =1.773, 2df, p = 0.412				Chisq = 0.0, 2df, p = 1.0			

Age 45-64

Highest level of education	Mean HUI <.83				Self-rated Health Status			
	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.29	1.07	0.98	(0.78, 1.24)	1.98	1.60	0.81	(0.60, 1.09)
Secondary graduation/ Some post-secondary	0.96	1.04	1.08	(0.84, 1.38)	1.27	1.07	0.84	(0.61, 1.17)
Post-secondary graduation	1.00	1.00	1.00	—	1.00	1.00	1.00	—
Chisq test for interaction:	Chisq = 0.809, 2df, p = 0.667				Chisq = 2.005, 2df, p = 0.367			

Age 65-74

Highest level of education	Mean HUI <.83				Self-rated Health Status			
	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	0.94	1.48	1.58	(1.11, 2.24)	1.43	1.27	0.89	(0.58, 1.38)
Secondary graduation/ Some post-secondary	0.95	1.23	1.30	(0.89, 1.91)	1.14	1.04	0.91	(0.57, 1.47)
Post-secondary graduation	1.00	1.00	1.00	—	1.00	1.00	1.00	—
Chisq test for interaction:	Chisq = 6.669, 2df, p = 0.0356				Chisq = 0.263, 2df, p = 0.877			

Age 75+

Highest level of education	Mean HUI <.83				Self-rated Health Status			
	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.23	1.33	1.08	(0.73, 1.61)	1.47	1.46	1.00	(0.60, 1.66)
Secondary graduation/ Some post-secondary	1.04	1.07	1.03	(0.66, 1.61)	0.91	1.40	1.33	(0.74, 2.41)
Post-secondary graduation	1.00	1.00	1.00	—	1.00	1.00	1.00	—
Chisq test for interaction:	Chisq = 0.187, 2df, p = 0.911				Chisq = 2.011, 2df, p = 0.366			

*Full model adjusts for sex, household type, behaviour and income

Table 3.21 Interaction Analysis by Age Group - Dichotomous Measures and Education Combined analysis of 1990 and 1996

Activity Restriction

Age 25-44

Highest level of education	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.82	1.37	0.76	(0.55, 1.03)
Secondary graduation/ Some post-secondary	1.12	1.16	1.04	(0.77, 1.39)
Post-secondary graduation	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq = 5.111, 2df, p = 0.078			

Age 45-64

Highest level of education	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.76	1.24	0.70	(0.51, 0.97)
Secondary graduation/ Some post-secondary	1.12	1.08	0.96	(0.68, 1.36)
Post-secondary graduation	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq = 7.861, 2df, p = 0.019			

Age 65-74

Highest level of education	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.21	1.05	0.87	(0.53, 1.43)
Secondary graduation/ Some post-secondary	1.25	0.97	0.78	(0.46, 1.33)
Post-secondary graduation	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq = 0.89, 2df, p = 0.641			

Age 75+

Highest level of education	Adj.* RR 1990	Adj.* RR 1996	Interaction Effect (Ratio 1996/1990)	Interaction Effect 95% Confidence Limits
Less than secondary graduation	1.11	1.01	0.92	(0.52, 1.62)
Secondary graduation/ Some post-secondary	1.18	0.96	0.82	(0.44, 1.52)
Post-secondary graduation	1.00	1.00	1.00	---
Chisq test for interaction:	Chisq = 0.473, 2df, p = 0.789			

*Full model adjusts for sex, household type, behaviour and income

Stratified by age – education

Table 3.20 shows the results of the age-stratified analysis for the mean HUI. The only significant interaction appears in the 65-74 year age group. A similar interaction is evident in this age group for the dichotomous HUI (Table 3.21). Both HUI analyses indicate a decrease in the HUI in the lowest education group relative to the highest education group.

Also from Tables 3.21, there is no evidence of interaction for Self-rated Health Status in any age group. The 45-64 year age group does show interaction for Activity Restriction. Once again, there appears to be a decrease in education-related inequality in Activity Restriction.

IV. Summary of Interaction Analyses

Table 3.22 is a summary of all the interaction results. It clearly shows the variation across both health status and SES measures. The interaction analysis with income showed the most consistency. Across health status measures, the interaction result was most consistent for the HUI, with much less evidence of interaction for either Self-rated Health or Activity Restriction. Figures 3.10 to 3.13 provide a graphic illustration of the differences in the mean HUI between 1990 and 1996. Figure 3.10 shows how the differences in both the magnitude of the change in mean HUI and its direction vary across income groups and also between men and women. Figure 3.11 shows the same thing across age groups. A comparison of Figures 3.12 and 3.13 with Figures 3.10 and 3.11, which are all graphed on the same scale, reveals how much smaller the changes in mean HUI are for the various education groups and how much less variation there is.

Table 3.22 Summary of Interaction Analysis Results

	All	Men	Women	Age 25-44	Age 45-64	Age 65-74	Age 75+
HUI x Income	**F=7.43 p=.0001**	**F=4.66 p=.0009**	**F=3.99 p=.0031**	**F=5.51 p=.0002**	**F=7.71 p=.0001**	F=1.04 NS	F=1.42 NS
Dichotomous HUI x income	**X^2=12.46 p = 0.014**	**X^2=13.01 p = 0.011**	X^2=3.69 NS	X^2=5.99 NS	X^2=6.69 NS	X^2=1.42 NS	X^2=2.83 NS
Self-rated health x income	X^2=9.17 p = 0.057	X^2=7.25 NS	X^2=5.13 NS	X^2=6.33 NS	X^2=6.28 NS	X^2=5.98 NS	X^2=5.34 NS
Activity Restriction x income	X^2=5.80 NS	X^2=5.53 NS	X^2=2.56 NS	X^2=4.48 NS	**X^2=10.93 p = 0.027**	X^2=1.751 NS	X^2=6.923 NS (but all individ. signif.)
HUI x education	F=1.75 NS	F=1.43 NS	**F=3.35 p=.0349**	F=0.12 NS	F=1.98 NS	**F=3.43 p=.0326**	F=1.5 NS
Dichotomous HUI x income	X^2=2.788 NS	X^2=2.757 NS	X^2=0.239 NS	X^2=1.773 NS	X^2=0.809 NS	**X^2=6.669 p = 0.036**	X^2=0.187 NS
Self-rated health x education	X^2=1.545 NS	X^2=0.644 NS	X^2=1.082 NS	X^2=0.0 NS	X^2=2.005 NS	X^2=0.263 NS	X^2=2.011 NS
Activity Restriction x education	**X^2=6.199 p = 0.045**	X^2=3.132 NS	X^2=3.154 NS	X^2=5.11 p = 0.078	**X^2=7.861 p = 0.019**	X^2=0.89 NS	X^2=0.473 NS

Figure 3.10 Difference in mean HUI 1990 and1996 by income group, All Ontario, Men and Women

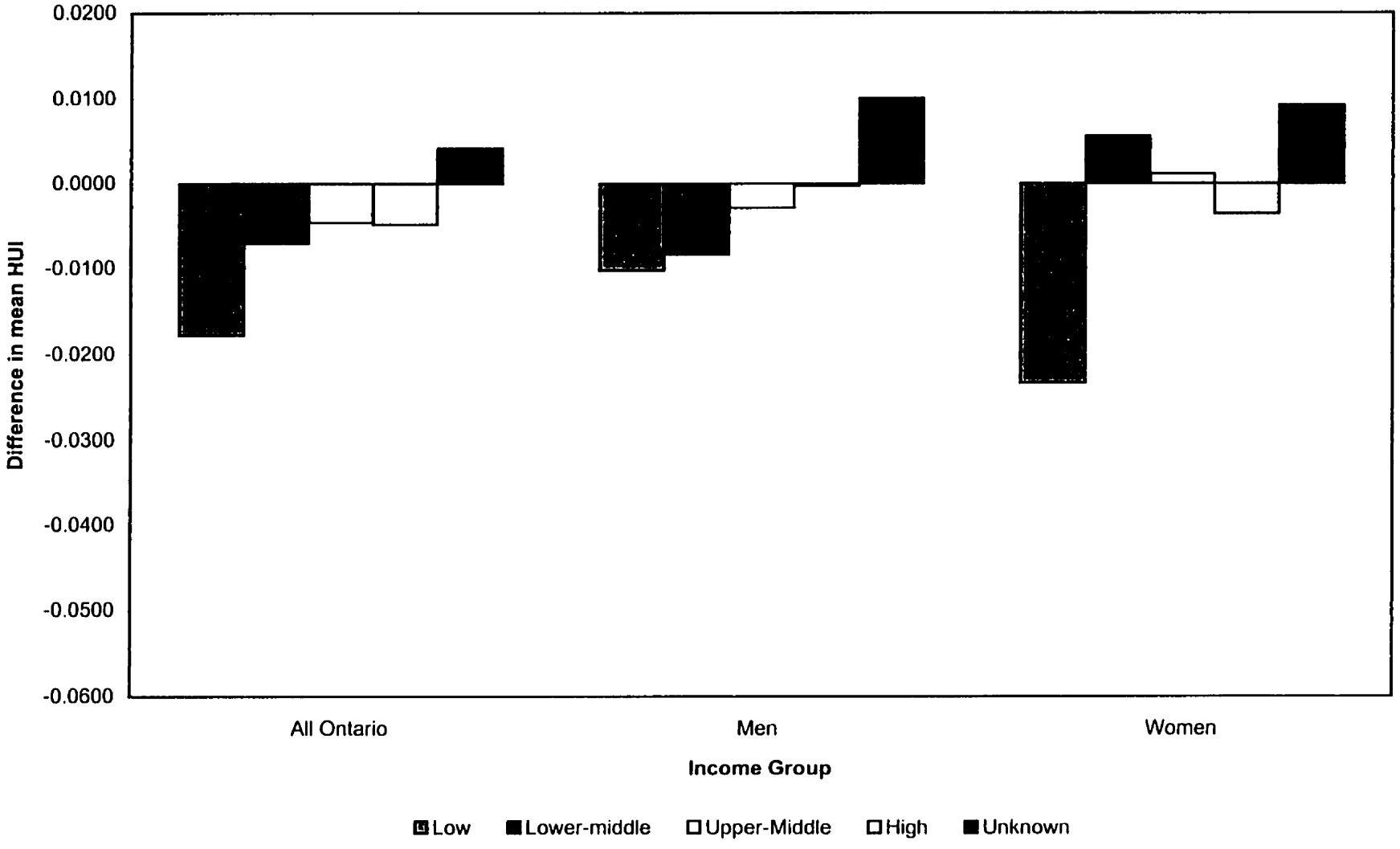


Figure 3.11 Difference in mean HUI 1990 and 1996, by Income and Age Group

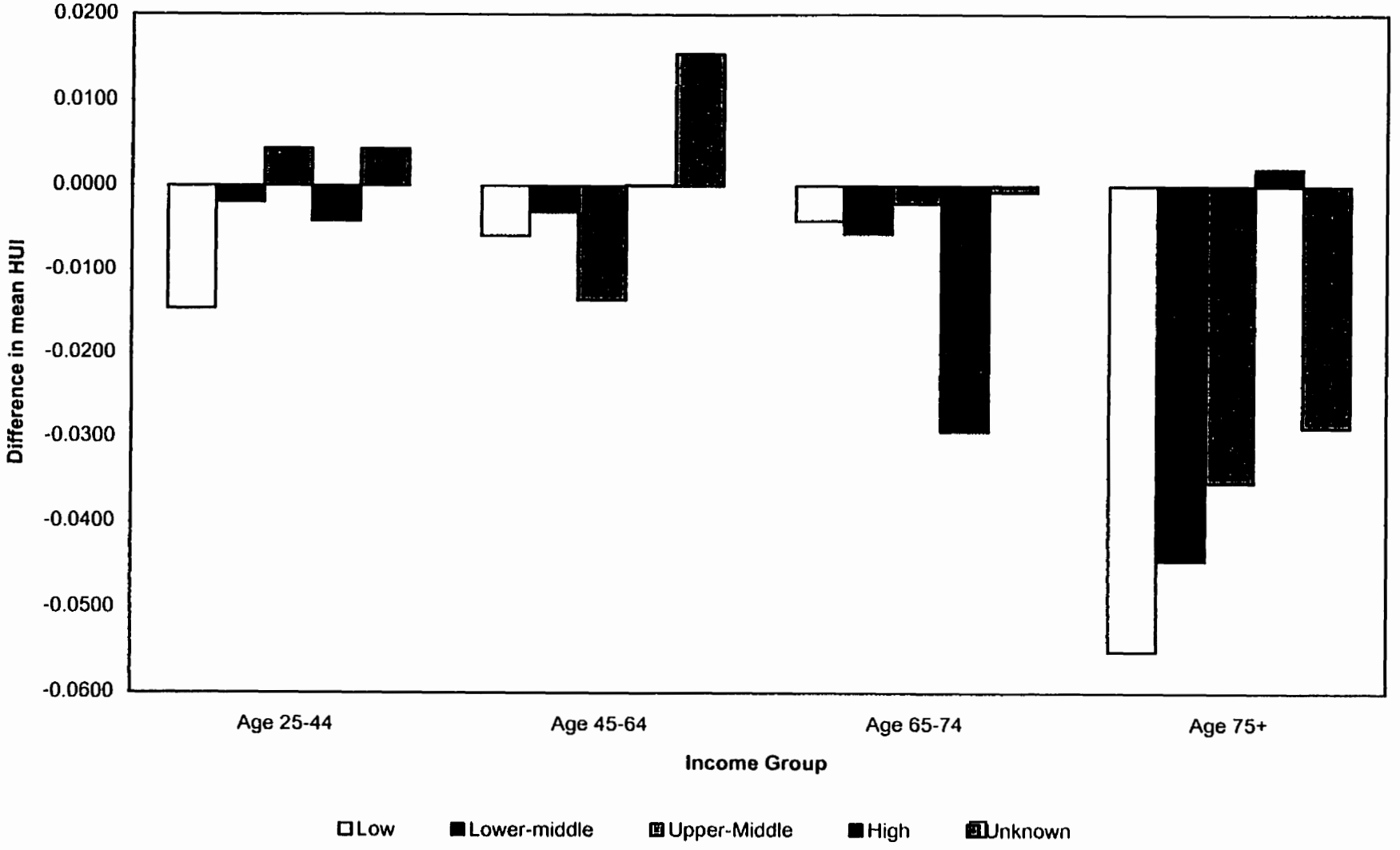


Figure 3.12 Difference in mean HUI 1990 and 1996 by highest level of education, All Ontario, Men and Women

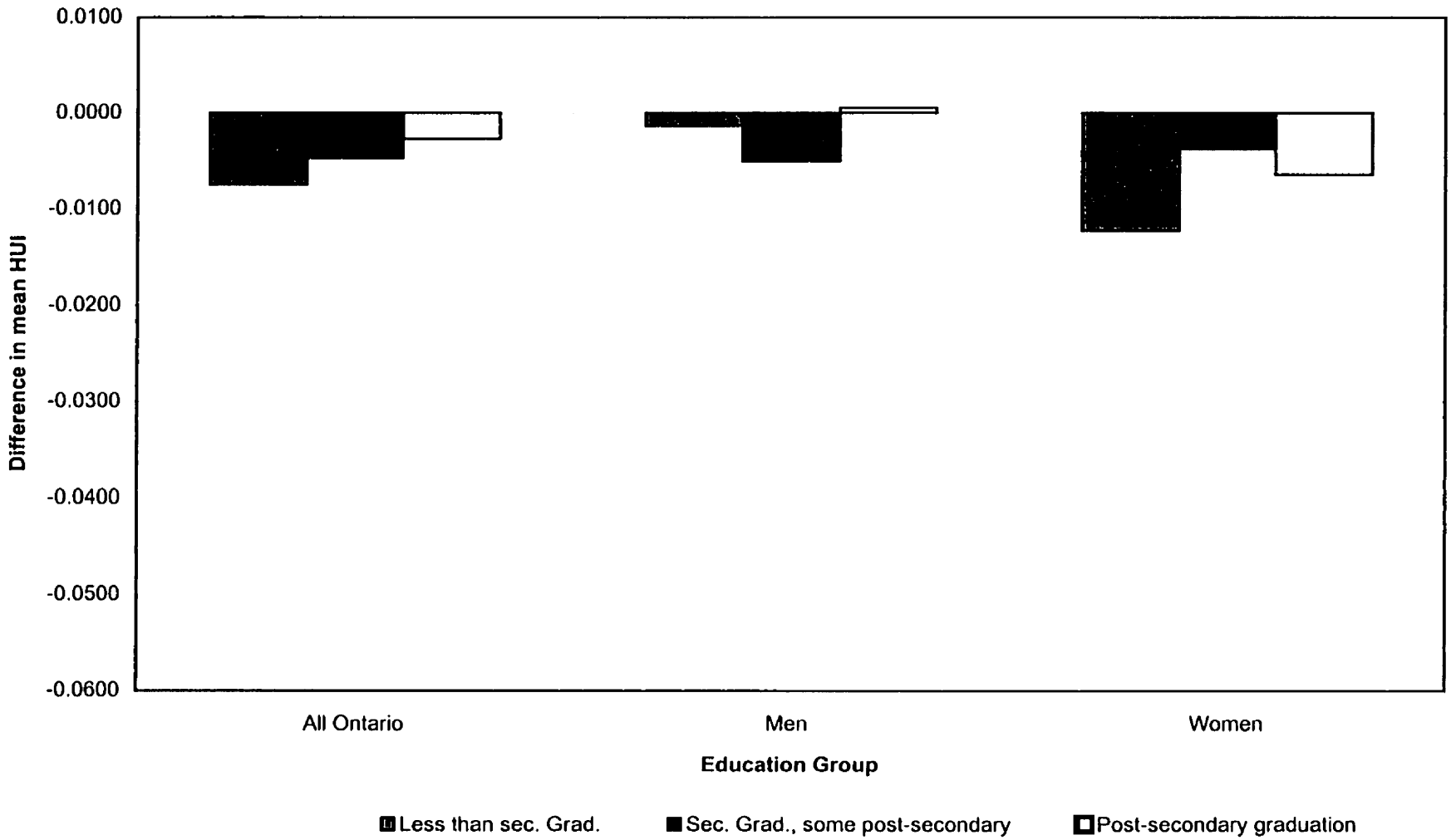
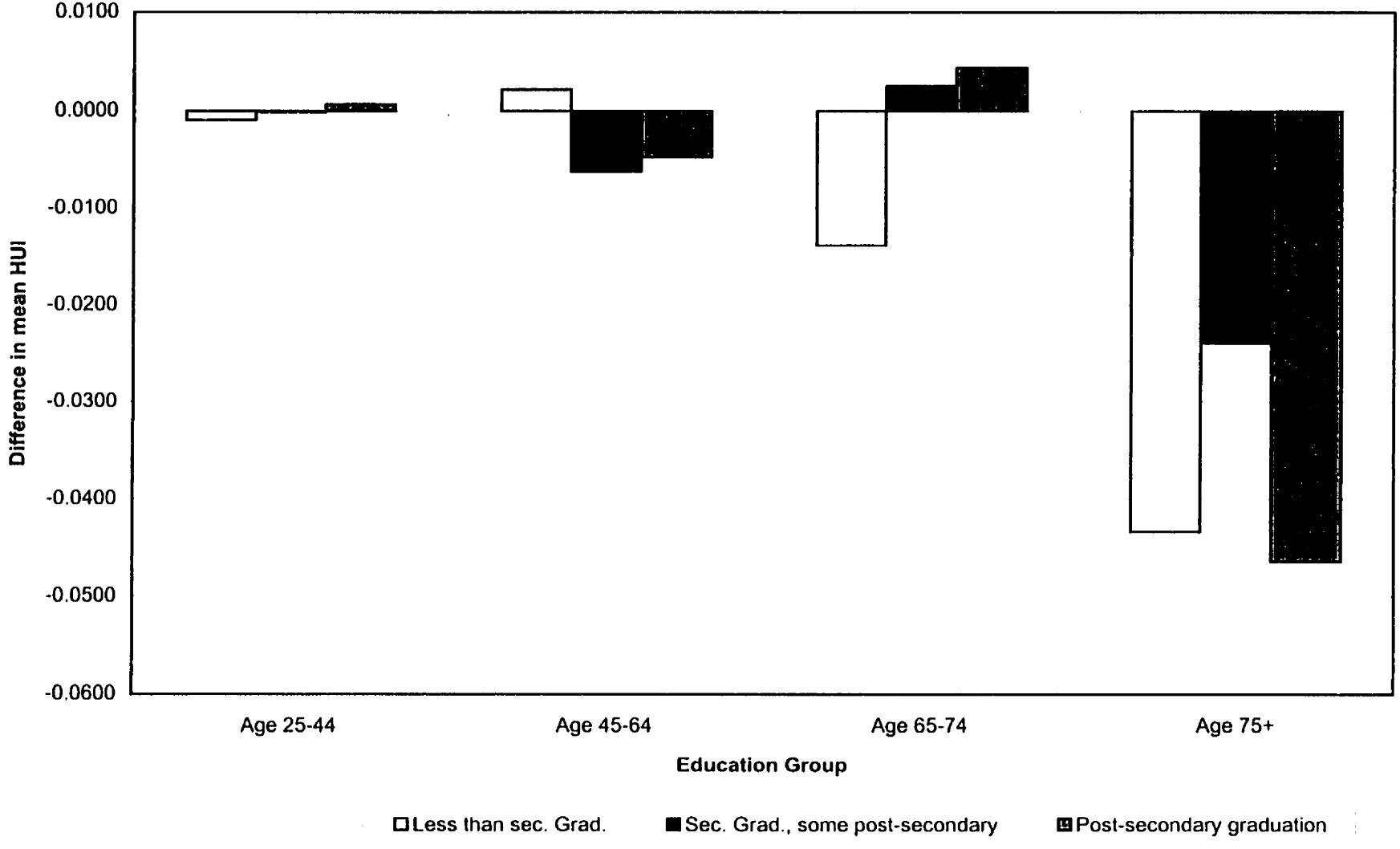


Figure 3.13 Difference in mean HUI 1990 and 1996, by Education and Age Group



V. Additional Analyses

Two additional analyses were carried out in an attempt to better understand the association between SES and health status. The first of these analyses looked at the individual components of the Health Utilities Index, testing for interaction between income and year for each component. The results of this analysis can be found in Figure 3.14. It is clear from Figure 3.14 that the large decline in HUI seen in the low income group is the result of large drops in the scores for emotion, pain and mobility.

Finally, the discussion of health status and SES, particularly during times of recession, has alluded to employment status as one possible intervening factor or mechanism acting on this association. The last analysis took a cross-sectional look at the relationship between employment status and mean HUI. In the 1996 OHS, respondents were categorized in the following employment status groups: those who were currently working, those who were not currently working but who had worked for part of the previous 12 months and those who had not worked at all in the previous 12 months. Respondents who reported some type of activity restriction or long term disability were excluded, and the analysis only included those of standard working age (25-64, early retirement notwithstanding). From Figure 3.15 we can see two things: the first is that there appears to be an association between employment status and health status. Overall, the mean HUI dropped significantly with each category. The other feature of this graph is that the result is different for men and women. Men who had worked in the previous 12 months but were not currently working had a significantly lower HUI than those who were currently working. This was not the case for women, but in both sexes, those who

Figure 3.14 Difference in Mean HUI Component Scores, by Income Group, 1990 to 1996

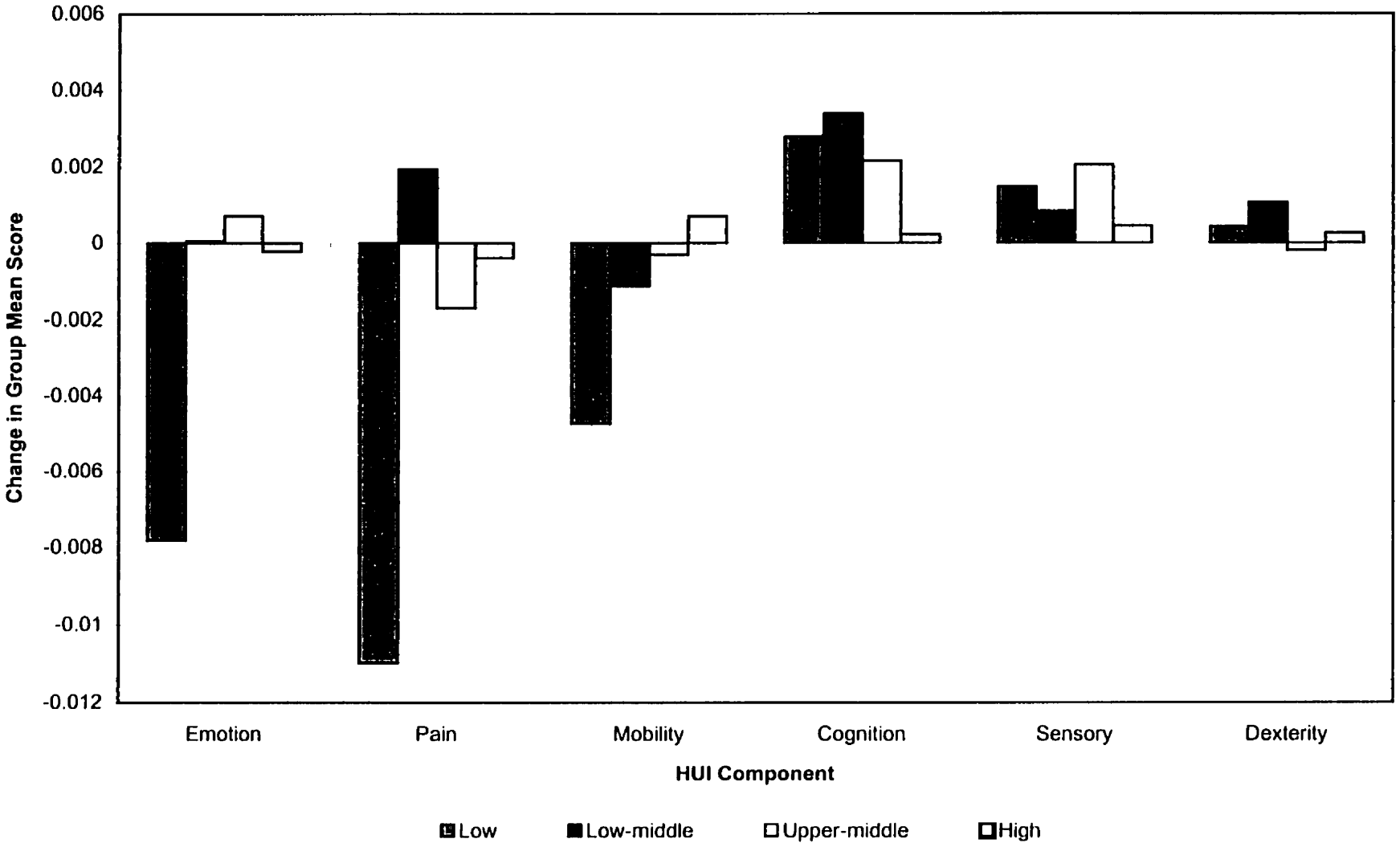
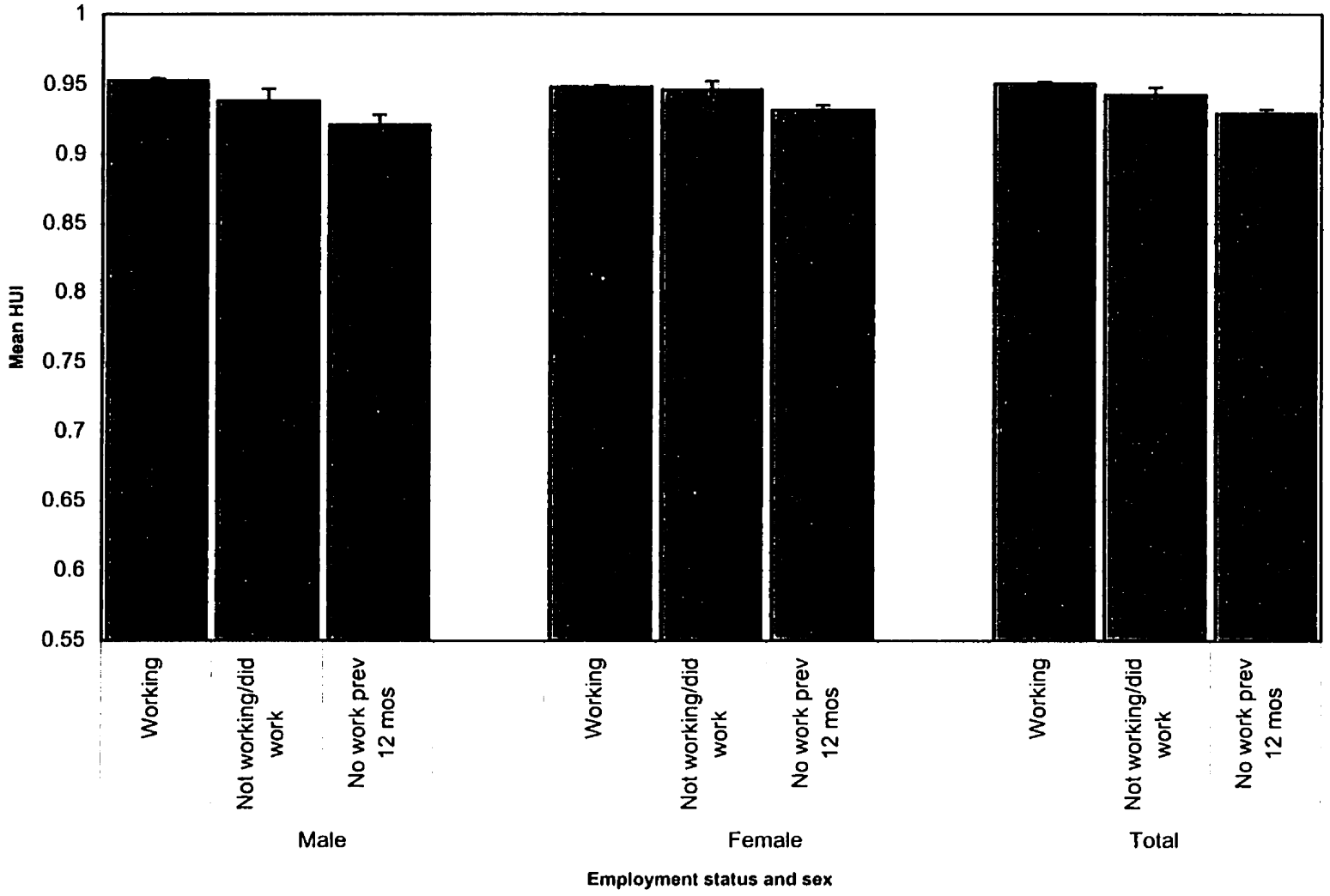


Figure 3.15 Mean HUI by employment status, those age 25-64 with no activity restriction, by sex, 1996



had been unemployed for at least 12 months had lower HUIs than either of the other group.

VI. Summary

To summarize, the results show that a significant health status-income gradient existed in both 1990 and 1996. Health status increased significantly as income increased. However, it also appears as though there was a decline in health status as measured by the Health Utilities Index in all income groups between 1990 and 1996, with the size of the decline increasing as one goes down the income scale. This suggests an increase in income-related inequalities in health, particularly if one compares the lowest income group to the rest.

The pattern of health inequalities by education appears to suggest a threshold at high school graduation. Those with less than a high school education have a much lower health status than the rest of the population, but further credentials beyond high school graduation did not appear, from this analysis, to convey additional benefit in terms of health status.

Chapter 4 Discussion

The purpose of this thesis was twofold: 1) to examine the pattern of health inequalities by socioeconomic status in Ontario during the 1990s and 2) to see if there was any significant change in this association from 1990 to 1996. This particular time period was chosen because it was a time of significant restructuring within Ontario, from both an economic and from a social policy point of view, which could conceivably have had an impact on the association between SES and health status. The data came from two independent, cross-sectional, population-based surveys, the 1990 Ontario Health Survey and the 1996/97 Ontario Health Survey.

The analyses carried out were unique in two ways: 1) it is the first study which looked at the SES-health status relationship in Ontario at more than one point in time and 2) it went beyond many Canadian studies of health status and SES in not only controlling for demographic variables such as age and sex, but also, through the use of multivariate analysis techniques, controlling for household type and behaviour.

I. Health Status and Income

As expected, a positive association was found between health status and income – as income increases, so does health status. This association is often referred to as the SES-health gradient. The health status-SES gradient as it existed in 1990 was previously described by Stephens and Graham (1993), Warren (1994) and Roberge et al. (1995). The results of this study demonstrate that the gradient persists even after controlling for household type and health behaviour.

In the literature on the SES-health gradient reviewed in Chapter 1, two characteristics of this association were repeatedly mentioned. The first is the consistency of the relationship, the second is its ubiquity. These characteristics were also found to be generally true of the association between income and health status in Ontario in both 1990 and 1996. It was nearly ubiquitous in the sense that it was evident for the population as a whole, for the sexes separately and for the age groups 25-44 and 45-64, although no significant association was found among Ontarians over the age of 64. This latter finding may be due, in part, to a lack of power to detect differences among groups over age 64, as the sample sizes for these groups was much smaller than for the younger age groups. However, as this finding is consistent with other research, there may be other explanations as well. Other possible reasons for a finding of no significant association between SES and health status over age 64 are discussed below.

The consistency of the relationship was evident in the very similar results obtained using the different health status measures. In all of the above groups, and for nearly all health status measures, as one moved up the income scale the health status of each group was significantly higher than the one that preceded it. The only deviation from this pattern was that in certain groups there was no significant ($p=.05$) difference in health status between the highest two income groups.

While there was general consistency to the pattern across groups and health status measures, the results were not identical. For instance, the health status gradients tended to be different for men and women, and some of the largest risk ratios were seen in the 45-64 year age group. With respect to the former, men tended to have higher HUI scores, indicating higher health status, but the relative risks of Fair/Poor health status or Activity

Restriction also tended to be higher for men than women in the same SES group, suggesting that inequality across SES groups was greater for men than for women.

Possible explanations for such sex-related differences in the SES-health gradient have emerged from a number of recent studies attempting to delineate the exact nature of the relationship between income and health status (Backlund et al., 1996; Ettner, 1996; Ecob and Davey Smith, 1999). Using mortality as their health status measure and a continuous measure of income, Backlund et al. found that income-mortality gradients tended to be steeper overall for men than for women, but women showed the steeper gradients at the lowest income levels. They suggest a number of possible explanations for their finding, including sex-related differences in environmental or workplace exposures at different income levels or perhaps being low income represents a more permanent or long-term situation for men than for women. This latter explanation raises an important point that must be kept in mind when considering the relationship between income and health status – the fact that income is rarely stable across a person's life span, but can vary considerably. If the association between income and health status is causal, as some recent studies have suggested (Ettner, 1999), then the effect of income on a person's life will be the cumulative exposure across that life span. The more movement there is between income groups, then, the smaller the differences between groups will be. The ideal income measure, then, would be some type of "lifetime average income" and any measure that relies only on measures at one or two points in an individual's life is bound to be subject to a certain amount of measurement error, although the magnitude of such error is difficult to judge. This point will be discussed further in the section on study limitations.

With respect to age differences, both Backlund et al. (1999) and House et al. (1990) also found the largest health status-income differentials in the 45-64 age group and a lack of difference in the upper years (75+). House et al. theorized that this increased disparity in health status in the middle years may result from a postponement of morbidity among those in the higher SES groups at an age when serious health problems are beginning to emerge. They also suggested that the lack of difference in health status across income groups in the upper years (75+) is the result of the effects of early mortality in the lower SES groups and of the onset of health problems previously delayed among the higher SES groups. The possible measurement error inherent in measuring income data at only one point in time mentioned above may also play a role here, as income at older ages may be less important than accumulated wealth.

Along with changes in slope among age and sex groups, Backlund et al. (1996) and Ecob and Davey Smith (1999) have also looked into how the the shape of the relationship between income and mortality changed across the income spectrum itself. They demonstrated that the slope tended to be steeper at lower income levels, flattening out at higher levels. The results from this thesis cannot be directly compared with those from the abovementioned studies because the latter were using income as a continuous variable with equal increments and this analysis has income grouped into categories. However, the impact of an increase in income does appear to diminish higher up the income scale. The greatest absolute differences in mean HUI between groups, for example, tend to be between the Low and the Low-middle income groups. Conversely, there is often no statistically significant difference between the Upper-middle and High

income groups. This certainly suggests that increases in income have a greater impact at the low end of the spectrum compared with the higher end.

The second question this thesis sought to answer was whether or not there was any significant change in health status within SES groups from 1990 to 1996 or any change in the overall pattern of health-SES inequalities from one year to the other. The latter was measured by testing for interaction between the SES variable (either income or education) and year. Table 3.22 summarizes the results of the tests for interaction.

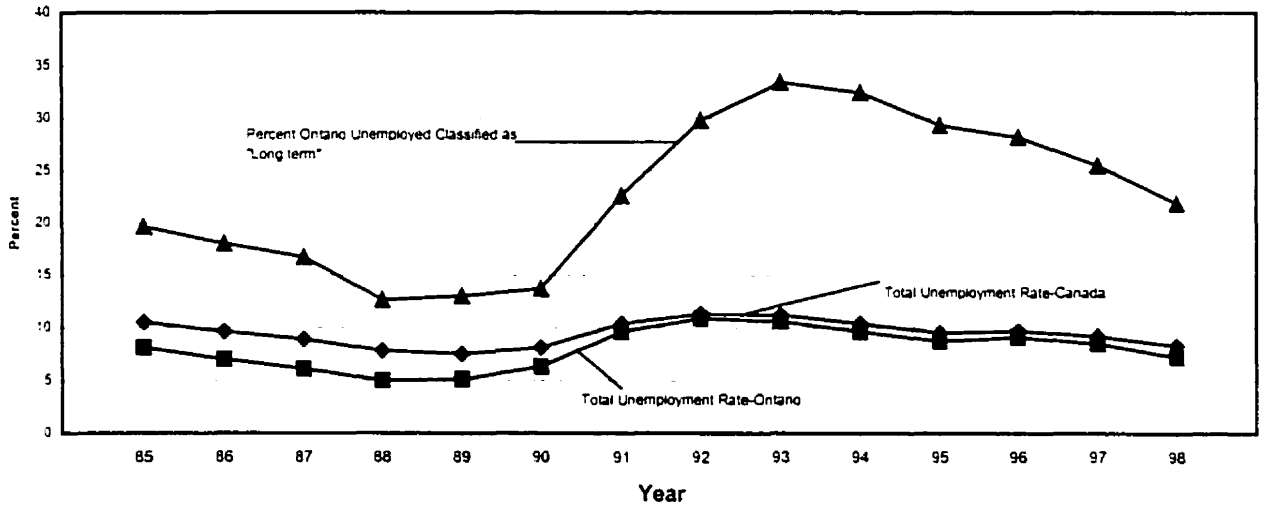
Looking only at the top half of the table, which summarizes the interaction results for health status and income, there is strong evidence of an interaction between year and income for the mean HUI. The interaction is also evident for the dichotomized HUI, but is not particularly strong with respect to Self-Rated Health and Activity Restriction. These results raise a number of interesting issues – one of which is the variability of results across the different measures of health status and in particular the very strong result for the mean HUI. In addressing this issue, it may be useful to first examine more closely changes in other social and economic indicators during the period 1990 to 1996.

For Ontario and most of North America, the year 1990 marked the end of a significant economic expansion. Between 1984 and 1989, the number employed grew by an average of 3.5% per year and payrolls for all industries combined grew an average of 8.7%. In 1990 this trend came to an abrupt halt, with the number employed actually decreasing by about one quarter of one percent and payroll growth slowing to only 4% per year (Statistics Canada, 1995).

By 1991 the economy was in full recession, with changes to wages, payrolls and employment numbers all in the negative range (Statistics Canada, 1995). Unemployment

jumped from 6.3% in 1990 to 9.6% in 1991 (Ontario Ministry of Finance, 1999) as many workers lost their jobs to "downsizing" and "right-sizing" and those looking to enter the workforce were unable to do so. Periods of unemployment were also longer in the early 90s. Between 1985-90, an average of 15.6% of those unemployed were classified as long-term unemployed, meaning they were unemployed 27 weeks or more.

Figure 4.1 Total Unemployment Rates, Ontario and Canada and Ontario Long-term Unemployment Rate, 1985-1998



Source: Ontario Ministry of Finance, 1999

Between 1991 and 1995 that figure nearly doubled, to an average of 29.5% (Ontario Ministry of Finance, 1999). Family poverty rates also increased during this time, rising from 9.6% in 1990 to a high of 13.3% in 1993. Working life during the early nineties was also difficult for those who remained employed, as they were asked to take

on more responsibility and work longer hours. In short, the early 1990s, from late 1990 until 1994 were stressful economic times for many, if not most, Ontarians.

Both poverty and unemployment are associated with a variety of negative health outcomes (Lynch et al., 1997; Shortt, 1996; Jones, 1997). The low health status of those at the lowest end of the SES-health gradient is indicative of the impact of poverty on health status. The Caledon Institute for Social Policy, a social policy think tank based in Ottawa, has documented that people in the lower income categories often experience food insecurity, substandard housing and difficulties meeting the medical needs of themselves and their children (Noce and O'Connell, 1998; Bezanson and McMurray, 2000).

Employment status, too, can have an impact on health status. Figure 3.15 shows how the mean HUI varied across employment status groups in 1996. For those between 25 and 64 without activity restriction, the mean HUI was significantly associated with employment status. Those who were currently working had the highest mean HUI, with those who were not working currently but who had worked during the previous 12 months significantly lower than the first group, and those who had not worked for at least 12 months showing the lowest mean HUI of the three. This association held true even after controlling for age, sex and behaviour (results not shown).

Given the nature and extent of the changes that occurred in Ontario in the early 90s, it is certainly reasonable to expect some impact on health status. But why did that impact appear to differ across health status measures? Part of the answer to this lies in the conceptual differences between the three health status measures. Social and economic changes certainly have an impact on health, but the impact varies in both

magnitude and rate across different aspects or domains of health. The following section examines each health status measure in turn, beginning with Activity Restriction, then Self-rated Health and finally the HUI, looking at the concepts and domains of health that each encompasses (based on Table 1.1) and extrapolating this to changes in health status that might be expected, given the social changes outlined above.

The first health status measure, Activity Restriction, is the narrowest of the three. From Table 1.1, it primarily encompasses that portion of the "Functional Status" section involving limitations in social roles. A change in this domain would likely take the longest to manifest, as it requires a change in physical health, leading to a change in physical functioning finally leading to a change in social role functioning. It is not surprising, then, that any gradients in Activity Restriction showed less change from 1990 to 1996 (see Figure 3.2) than the other two measures.

Self-rated Health Status, the next measure, comprises "General Health Perceptions" from Table 1.1. The criteria for the various levels of health are left to the respondent to define. As mentioned early in the review of the literature, studies of Self-rated Health suggest that its underlying health construct is complex, including both the respondent's experience of physical health and his or her knowledge and beliefs about preventive medicine, risk behaviours and health promotion (Manderbacka, 1998; Shadbolt, 1997). However, there is also evidence that the underlying construct may differ by culture, gender and age (Jylha et al., 1998; Shadbolt, 1997). For example, Shadbolt found that only older women took psychological aspects into account when evaluating their health. In addition, Smith et al. (1994) found evidence to suggest that individuals may use different criteria when rating their health as Fair or Poor compared

with Good-Excellent. Their results suggested that a rating of Fair or Poor was based almost exclusively on the respondent's experience of ill-health, while ratings of Good, Very Good or Excellent took into account not only the absence of ill-health, but also optimum weight, fitness and other factors. As well, a study by Goldstein et al. (1984) found that changes in perceived health status tend not to be associated with short-term changes in physical health but mainly with long-term chronic illness. A recent study of the responsiveness of the HUI and Self-rated Health to the development of chronic conditions found that Self-rated Health was indeed responsive (Kopec et al., under review). Another feature of Self-rated Health to bear in mind is that it only has five levels to begin with, which were then dichotomized into two – Fair/Poor and Good/Very Good/Excellent.

In light of this, what impact could the changes of the early 90s be expected to have on Self-rated Health? The answer is: probably not very much, for two reasons. In the first place, the fact that the five levels were dichotomized into two means within-category changes (such as Fair to Poor or from Very Good or Excellent to Good) would not be captured. Secondly, the work of Smith et al. (1994) and Goldstein et al. (1984), suggest that it would require a major shift in health status, such as the development of serious chronic illness, to cause someone to lower their self-rating from Good/Very Good/Excellent to Fair/Poor. Such a change would likely need a longer lag time. Based on this, one might expect to see relatively little overall change in Self-rated Health, which is what this study found, with only men in the lowest-income category showing a significant increase in their relative risk of Fair/Poor health.

The final measure, the Health Utilities Index, is a multi-attribute index rather than a measure based on a single question, which makes it the most complex of the three. It encompasses the broadest range of concepts from Table 1.1 – including aspects of physical health status, psychological health status and impairment. It is also the measure that showed a consistently significant result in the interaction analysis. The reason for this may be the fact that the HUI includes not only physical functioning, but emotional and cognitive function as well. From the analysis of the individual components of the HUI (Figure 3.14) it is clear that emotion plays a major role, along with pain and mobility, in the decrease in HUI among the lowest income group. There was also a marked increase in pain and a loss of mobility among the lowest income group. Because the questions on which the HUI is based ask about pain in general, rather than just pain associated with a long term illness, it is also possible that this measure is picking up acute problems (such as short-term work-related injuries) as well as chronic ones. Thus, the fact that the HUI includes emotion as an explicit component, as well as the suggestion that it may be sensitive to both acute and long term chronic conditions, may make it particularly sensitive to negative life events such as involuntary unemployment, loss of income or economic uncertainty. It certainly appeared to be the most sensitive of the measures used here.

In comparing the results of the interaction analysis across health status measures, it is also important to note that the nature of the associations being modeled differed between the mean HUI analysis and the other analyses. The mean HUI analysis used linear risk modeling, which assumes additive (parallel) relations among the variables (Rothman and Greenland, 1998). In this case the test for interaction looks for nonparallel

slopes in the regression lines. The exponential model, which was used to model the association between SES and the dichotomous health status variables, uses a multiplicative risk model which assumes proportional relations between variables. The test for interaction tests for nonproportional differences in the regression lines. Any interaction must be greater than multiplicative, thus making the test much more stringent.

The preceding section outlined reasons why the impact of negative social and economic changes varied from one health status measure to another. However, there was also variability from one income group to another. As Figures 3.10 and 3.11 show, the magnitude of the change in HUI often increased as income decreased. Those in the lowest income group, who started out with the lowest health status, also tended to experience the greatest drop in health status from 1990 to 1996. This appears to be consistent with work by Duncan (1996) who showed that while incomes in general decline during a recession, incomes of the those at the bottom of the economic scale fall proportionately faster and farther than those in middle or at the upper end of the scale. They also recover more slowly, often not recovering fully before the onset of the next recession, leading to a stepwise, downward progression and increasing income inequality within the population. If the relationship between income and health is causal as some suggest (Ettner, 1996), then we could expect a concomitant decline in health status during recessions that is farther and faster for those in the lowest income group, and a slower improvement post-recession. And even if the drop in income among the lower income group was the same in absolute terms as that of the other income groups, the work of Backlund et al. (1999), outlined above, suggests that income drops of similar absolute value have a greater health impact at the lower than the upper end of the scale. Although

the studies by Duncan and Backlund et al. used data from the U.S. and work by Wolfson (1998) suggests that Canada experiences less income inequality than the U.S., the results of this analysis do appear to be consistent with the scenario described by Duncan.

While the decline in health status was generally larger in the low income group compared with the other groups, another interesting result was the finding that the HUI did not only decline in the lowest group, but in most other groups as well. It can be argued, based on the information about the general context of the early 1990s presented earlier, that no group was immune to the stresses that accompanied the social and economic changes of the time. Even those who did not experience a loss of employment or decline in income directly, were faced with the stresses of increased workload, increased expectations and having to do "more with less", which may have contributed to a general lowering of health status. Another factor which wasn't examined directly but should be mentioned is the independent impact of increased inequality at the societal level. Coburn (2000) argues that the shift in government policy at both the federal and provincial level during the 1990s from a "Keynesian welfare state" to an emphasis on competition and letting markets allocate resources, which he calls "neo-liberalism", has led to an erosion of the 'social safety net' and an increase in income inequality. Wilkinson (1996) and others (Lynch et al., 1998; Kawachi et al., 1997) posit that an increase in inequality leads to a decline in health status through decreased social cohesion and increased mistrust and insecurity.

II. Health Status and Education

This study also examined the relationship between health status and education. Many studies of SES and health status have used education as their SES measure because

it is easy to collect, relatively stable (unlike income) and it has generally been assumed that education is so closely related to income and occupation (the other two most common measures of SES) that it can easily serve as a proxy for the other two. The results of this study raise questions about the validity of this latter assumption. While the association between health status and income took the form of a non-linear but still measurable gradient, the results with respect to education clearly suggest a threshold effect. In virtually every case, whether for the population as a whole or stratified by age or sex, there was virtually no difference in health status between the top two education groups (those with a high school diploma and those with some type of post-secondary credential), but a large gap between these two highest groups and the lowest education group (in this case less than a high school diploma).

This represents a divergence from previously published work, in which a clear gradient has almost always been found with education (House et al., 1990; Winkleby, 1992; Slater et al., 1985). In fact, House et al. found the relationship between education and health status to be the more linear, with the pattern of inequality by income tended to be nonlinear. Winkleby concluded that "the univariate relationship between SES and risk factors [for cardiovascular disease] was strongest and most consistent for education, showing higher risk associated with lower levels of education" (p 818).

One possible explanation for this divergence from previous work might be the additional control for confounding in this study. Winkleby, for example, only controlled for age and sex; House et al., controlled for a number of sociodemographic variables (age, sex, race, marital status) but were not able to control for behaviour. Slater et al.

did control for a variety of health behaviours, but used slightly different cutpoints at the upper end of the education scale.

It is also possible that the differences represent real changes in the relationship between education and health status. Educational attainment has been evolving in the population and some of the data used in the previous studies cited was from the late 1970s and early 1980s. The studies cited were also all based on U.S. data, and there may be national differences at work here as well.

Explanations for why the pattern of inequality should be so different for education compared with income in the same population may lie with the role of educational attainment within the population and how it has changed in recent years. To begin with, the relationship between education and health is complex, acting as it does in the realm of both social class and social status (Liberatos, 1988). The level of education a person attains can affect his or her behaviour, lifestyle and social networks, which are part of social status, but it can also influence income and occupation, aspects of social class. As well, as Liberatos et al., (1988) and Krieger et al. (1997) point out, significant changes have been occurring in North America with respect to education. The first of these is the strong cohort effect. Throughout the 20th century the average level of educational attainment increased with each successive cohort. More recently, there has also been an increasing homogeneity in educational attainment, as a greater and greater proportion of the population have the opportunity to earn post-secondary degrees and diplomas (generally the highest level of education measured). Finally, the economic changes of the past decade or so have blurred the lines of income and opportunity for those with varying levels of education past high school graduation. For example, a person with "only" a

high school diploma is no longer automatically relegated to a low socioeconomic group, either in terms of social class or social status, if he or she has strong creative or entrepreneurial skills. Conversely, a post-secondary degree or diploma is no longer a guarantee of higher social position, either in terms of occupation and income or even in terms of social status. This evolving situation may offer some explanation for the apparent change in the relationship between education and health status.

Looking at the education-health status results for the sexes separately, the threshold effect is evident for men for all four health status measures and for women with respect to the dichotomous HUI, self-rated health and activity restriction. The exception to this pattern was the mean HUI analysis for women, which did show a clear gradient with educational attainment.

In the age-stratified analysis, there was a general threshold pattern for those under age 65, with the lowest education group having much lower health status than the other two groups. Over age 65 there was no difference between the groups in 1990, but the threshold effect was again evident for those over 65 for the dichotomous HUI and for Self-rated Health Status.

Changes in health status within education groups and overall changes in the pattern of health inequalities from 1990 to 1996 across education groups were also examined. The income-health status analysis revealed both a general decline in health status as measured by the HUI and a significant change in the pattern of inequalities, due in large part to the fact that the decline in HUI was much larger for the lower income group than the higher ones. The situation was somewhat different with respect to education. While the mean HUI again dropped for all education groups in the population

as a whole, there was not the same consistent pattern evident across subgroups that one saw in the case of income. The population as a whole and women show the pattern of general decline in health status and increasing magnitude of the decline with decreasing education. However, of these two, only women showed a significant interaction. The age group 65-74 also showed a significant change in the pattern of inequalities, but in this case the mean HUI of the upper two education groups rose, while that of the lowest group fell.

There was no significant change in the association with education for either the dichotomous HUI or Self-rated Health. Activity Restriction, on the other hand, did show a significant interaction both overall and for the 45-64 year age group. However, it appears as though this interaction is the result of a decrease in inequality among groups from 1990 to 1996, rather than an increase in inequality as was evident for income.

III. Study Limitations

There are a number of limitations to this thesis that must be acknowledged. The first of these is the fact that the study was using two cross-sectional surveys to examine longitudinal trends. The use of cross-sectional data precludes the drawing of conclusions with respect to causality and limits such conclusions to general patterns. Ideally, a similar study should be conducted using longitudinal data, which would give a more accurate picture of the nature of the relationships between the variables being studied.

Secondly, as outlined in the Methods chapter, the data collection methodologies differed in important ways from one survey to the other. It is difficult to gauge the total impact of the fact that the first survey used a combination of face-to-face interviews and self-completed survey while the other was carried out completely by telephone using

Computer Assisted Telephone Interviewing (CATI). One noticeable effect was on response rates to certain questions. Response rates differed substantially on a few questions such as those dealing with physical activity, for which the response rate was much higher in 1996 than in 1990, and for income, which had a much higher response rate in 1990 than in 1996. There are several ways of dealing with item missing values. One option is simply to exclude incomplete observations. Another is to create a separate category called "missing" and treat it as a distinct group. A third method that is often used is imputation, in which the missing value is assigned or "imputed" based on other respondent characteristics. The benefit of imputation is that it permits all observations to be used. The downside to imputation is that it requires the analyst to make assumptions about the relationships and associations between variables when choosing imputation categories. As well, it has been suggested that the cell mean method of imputation will distort the relationship between imputed and nonimputed variables, thus leading to incorrect significance test results (Andersen et al., 1979).

In this study, for the questions which had a large proportion of missing values (more than 2%), missing was included as a separate category. This allowed the rest of the information from the respondent to be used, even if no useful information was provided on the question with the missing value, thus avoiding the loss of power that results from excluding observations. Still, the non-responses on these represent an unfortunate loss of information and greater efforts should be made in the future to ensure that the information provided by the respondent is complete.

Another cause for concern with respect to data quality is its representativeness, particularly with regard to education. Statistics Canada reports in the

results from the 1991 Census that 34.7% of the population over age 25 had less than a high school diploma. In the 1990 OHS sample the proportion in this group was 34.3%, very close to the census figure. In 1996, based on the 1996 Census, the proportion with less than a high school diploma was 30.6%. However, the figure from the 1996 OHS was only 20.6% unweighted, 20.1% when the sampling weights were applied. An analysis of the distribution of the population with less than a high school diploma across age groups revealed the greatest differences in the 25-44 and 55-64 year age groups. Those in the 25-44 year group without a high school diploma were oversampled in the OHS96 compared with the 96 Census, while those in the 55-64 year age group were substantially underrepresented. Since younger people generally have higher levels of health status than older, the effect of this would probably be to overestimate the health of those with less than a high school education. The reality may be that the differences in health status between those with and without a high school diploma are actually larger than shown in this analysis.

The data in Table 3.1b also demonstrates certain differences between the two survey samples, but in this case there is reason to believe that these may be the result of real changes occurring in the province of Ontario rather than some type of systematic sampling bias. The samples do not differ substantially with respect to age or sex and the geographic difference is intentional and is accounted for by weighting. The other differences in the variables shown in Table 3.1b may be the result of Ontario becoming more ethnoculturally diverse (which it is); having reduced access to health care, including family physicians; and the drop in sources of income may be the result of the disappearance of thousands of jobs in the early 90s. Rather than being an indication of

bias, the results of this comparison may be part of the changes in the Ontario situation that this thesis was intended to study.

Finally, there are the differences in the Self-rated Health and Activity Restriction questions from 1990 survey to the 1996/97 one. In 1990, respondents were asked to compare their health or their activity restriction with others their age. In 1996 they were simply asked, "How would you rate your health?" or "Are you forced to limit your activities at home, school etc." It is difficult to gauge exactly what the impact of this difference might be. However, one can imagine that the age qualification might cause people in the younger age groups to evaluate their health more critically, as the general expectation would be for perfect or near-perfect health. On the other hand, at older ages, where overall health expectations are lower, the tendency might be in the other direction, with even someone with mild or moderate health conditions thinking along the lines of, "I think I'm doing pretty well for someone my age". The impact of this on the comparison between the two years would then be as follows: At the younger ages, in 1990 one would find people reporting Fair/Poor health at a higher functional level compared to 1996. At the older ages, in 1990 people would tend to report higher levels of health at lower functional levels. This expectation was tested in a very rudimentary fashion using the Health Utilities Index as a measure of functional status. It revealed that, among the age group 25-44, the mean HUI for those reporting Fair or Poor health was higher in 1990 than 1996. Among the group 65 years and over, those reporting Excellent or Very Good health had lower mean HUIs in 1990 compared with 1996. This tends to support the theory outlined above. To get around these differences, only relative risks were compared between the two years.

IV. Implications for Health and Social Policy and Research

When government-funded health and hospital insurance was introduced in Ontario, there was an expectation that the elimination of financial barriers to access to medical care would also eventually lead to the elimination of income-related differences in health status. The results of this thesis have demonstrated that this has not happened. Significant income and education-related differences in health status continue to exist in Ontario. These results also suggest that the gap between those at the lowest end of the SES spectrum and the rest of the population may be getting wider. The question now is, what suggestion do these findings have for future research.

Beginning with an issue that has surfaced throughout this thesis, there is a need for population-based information about health status and its determinants that is both consistent and long term. While cross-sectional health-related surveys have been conducted in Canada since the late 1970s, attempts to use them to track trends over time face problems related to variable incompatibility and differences in sampling and administration methodologies that make such research difficult. The Canadian Community Health Survey, a series of national and provincial cross-sectional surveys to be conducted biennially starting in 2000, was designed to provide such data. One hopes that it will not only provide data on a consistent and long-term basis, but that efforts will be made to minimize the occurrence of missing values, another problem with available survey data identified in this study.

Moving beyond data issues, there is a general need for more Ontario-based research into this association between socioeconomic status and health status. To give an example, one important area of current research in this area in the U.S. is into causal

mechanisms. Within this field of inquiry, one question being examined is the role of social and physical environments. Adler (2000) recently cited research conducted in the U.K. and the U.S. which has shown that neighbourhoods that have a relatively low mean income also tend to be poorer with respect to the services and choices available to their residents. This included fewer physicians, pharmacies, recreational facilities and supermarkets, the latter leading to more expensive 'healthy' food. The question for researchers and policy makers in Ontario is whether the same situation hold true for Ontario. Do individuals with lower incomes in Ontario also experience disadvantaged social environments? How widespread is this and what can be done to ameliorate the situation?

There is also a need for more research into the measurement of health status. This is prompted by the finding in this study of a difference in the association between SES and health status over time, depending on which measure of health status was used. This thesis has also raised questions about the measurement properties of the Health Utilties Index, particularly the emotion component.

There is a need for more research into the dynamics of the association between health status and income. The results of this analysis indicate that health status increases with income, cross-sectionally. However, there is a need for a better understanding of how this relationship works longitudinally. For example, it is easy to imagine how someone's health can drop if their income suddenly drops due to unemployment etc., but is the reverse true – can you raise someone's health by increasing their income? How long are the lag times in each case. Information such as this would be valuable, for

example, if policymakers were to seek ways to mitigate the negative health effects of recessionary periods.

Finally, there is a need for research into ways to reduce the SES-related disparities in health evident in Ontario. So-called 'agendas for action' have been or are in the process of being developed in countries such as the U.K. (Acheson, 1998; Tarlov, 1999) and the U.S. (Moss, 2000). There is a need for researchers to identify, based on existing and emerging information about factors influencing the SES-health status association in Ontario, strategies that could be implemented as part of a plan to reduce SES-related health disparities in this province.

V. Summary and Conclusions

This thesis sought to explore the association between socioeconomic status and health status in Ontario in 1990 and 1996. As expected, a positive association was found between SES, as measured by income and education, and health status as measured by all three measures – the Health Utilities Index, Self-rated Health and Activity Restriction. This was true for both years, even after controlling for potential confounders.

Health status in 1990 and 1996 within SES groups was compared using the Health Utilities Index. The adjusted mean HUI values for most groups fell from 1990 to 1996, with the largest declines evident in the lowest SES group. Finally, an interaction analysis was carried out to determine if the pattern of SES-related health inequality had changed from 1990 to 1996. It showed a significant interaction between year, income and the HUI, which was interpreted to mean that inequality in health status as measured by the HUI increased from one time to the other. The other measures of health status did not show the same degree of change over the time period.

The results of these analyses indicate, first of all, that socioeconomic status has a significant impact on the health of Ontarians, even though there are no financial barriers to accessing required medical care. Being "poor" in Ontario (in the lowest income category) or not having a high school diploma approximately doubles one's risk of poor health when compared with those in the highest category, even after adjusting for age, sex, household type, and health-related behaviour.

These results also suggest that serious recessionary periods can have relatively broad negative health effects (at least as measured by the Health Utilities Index), and that those at the lowest end of the SES spectrum, whose health is already poorer relative to the rest of the population, are the most vulnerable to such effects, as shown by their greater declines in health. More research is needed, not only into the causal mechanisms involved in this association, but into ways to reduce the health risks faced by those at the lower end of the SES scale.

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Appendix A

Health Utilities Index Mark III: Health Status Classification System

Vision

1 Able to see well enough to read ordinary newsprint and recognize a friend on the other side of the street, without glasses or contact lenses
2 Able to see well enough to read ordinary newsprint and recognize a friend on the other side of the street, but with glasses
3 Able to read ordinary newsprint with or without glasses, but unable to recognize a friend on the other side of the street, even with glasses
4 Able to recognize a friend on the other side of the street with or without glasses, but unable to read ordinary newsprint, even with glasses
5 Unable to read ordinary newsprint and unable to recognize a friend on the other side of the street, even with glasses
6 Unable to see at all

Hearing

1 Able to hear what is said in a group conversation with at least three other people, without a hearing aid
2 Able to hear what is said in a conversation with one other person in a quiet room without a hearing aid, but requires a hearing aid to hear what is said in a group conversation with at least three other people
3 Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid and able to hear what is said in a group conversation with at least three other people with a hearing aid
4 Able to hear what is said in a conversation with one other person in a quiet room without a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid
5 Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid
6 Unable to hear at all

Speech

1 Able to be understood completely when speaking with strangers or friends
2 Able to be understood partially when speaking with strangers, but able to understood completely when speaking with people who know the respondent well
3 Able to understood partially when speaking with strangers or people who know the respondent well
4 Unable to be understood when speaking with strangers but able to be understood partially by people who know the respondent well
5 Unable to be understood when speaking to other people (or unable to speak at all)

Ambulation

1 Able to walk around the neighbourhood without difficulty, and without walking equipment
2 Able to walk around the neighbourhood with difficulty, but does not require walking equipment or the help of another person
3 Able to walk around the neighbourhood with walking equipment, but without the help of another person
4 Able to walk only short distances with walking equipment and requires a wheelchair to get around the neighbourhood
5 Unable to walk alone, even with walking equipment; able to walk short distances with the help of another person and requires a wheelchair to get around the neighbourhood
6 Cannot walk at all

Dexterity

1 Full use of two hands and ten fingers
2 Limitations in the use of hands or fingers, but does not require special tools or the help of another person
3 Limitations in the use of hands or fingers, is independent with use of special tools (does not require the help of another person)
4 Limitations in the use of hands or fingers, requires the help of another person for some tasks (not independent even with the use of special tools)
5 Limitations in the use of hands or fingers, requires the help of another person for most tasks (not independent even with the use of special tools)
6 Limitations in the use of hands or fingers, requires the help of another person for all tasks (not independent even with the use of special tools)

Emotion

1 Happy and interested in life
2 Somewhat happy
3 Somewhat unhappy
4 Very unhappy
5 So unhappy that life is not worthwhile

Cognition

1 Able to remember most things, think clearly and solve day to day problems
2 Able to remember most things, but have a little difficulty when trying to think and solve day to day problems
3 Somewhat forgetful, but able to think clearly and solve day to day problems
4 Somewhat forgetful and have a little difficulty when trying to think and solve day to day problems
5 Very forgetful and have great difficulty when trying to think and solve day to day problems

6 Unable to remember anything at all, and unable to think and solve day to day problems

Pain

1 Free of pain and discomfort
2 Mild to moderate pain that prevents no activities
3 Moderate pain that prevents a few activities
4 Moderate to severe pain that prevents some activities
5 Severe pain that prevents most activities

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