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THE HEALTH STATUS OF MOTHERS AND CHILDREN

By

LORI CURTIS, B.Sc., M.A.

A Thesis

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ABSTRACT

This is an investigation of the relationship between family structure, socioeconomic status and the health status of mothers and children. A population health framework underlies the analysis. The first essay uses three population health surveys to study the differences in the health status of mothers from two-parent families with those from one-parent families. Lone mothers have, on average, lower unconditional health status than married mothers. However, lone mothers are, on average, younger, poorer, less educated, have fewer children and smoke more. Controlling for these factors, a negative relationship between lone motherhood and health status (compared with married mothers) can be rejected.

The second and fourth essays investigate the relationship between family structure and socioeconomic status and child health. The second essay uses the Ontario Child Health Survey (OCHS), 1983 and 1987. Health status is measured by the HUI2 scores. The results indicate that lone-mother status has a strong negative relationship with child health as does low-permanent income (long term poverty), even after controlling for low birth-weight. However, no consistent relationship with current income is found. The National Longitudinal Survey of Children and Youth (NLSCY) is employed in the fourth essay. The findings are similar to those obtained from the OCHS study. Lone-mother status has a strong, robust, negative relationship with child health status; current income does not.

The third essay presents the development of the algorithm used to map the OCHS responses into the Health Utilities Index Mark 2 (HUI2) attribute levels used in the second essay. The mapping system is compared to others. While a major difference is seen when applying two different algorithms to the same data, there seems to be little difference when applying the different algorithms to similar populations from different data sets.

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The final essay of the thesis was prepared with the intention of joint publication with three other members of my thesis committee, Professors Martin Dooley, David Feeny and Dr. Ellen Lipman. I had primary responsibility for data preparation and empirical analysis, and played a major role in the writing of the paper.

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1. Introduction

This thesis is composed of four essays investigating the relationship between family structure, socioeconomic status and the health status of mothers and children. The nature of this relationship has important implications for the health, social, and economic policy agendas in Canada and other developed countries. Better knowledge of the factors affecting morbidity can help to inform decisions about the relative roles of health care, social support, and educational expenditures in achieving important social goals such as the improvement of child and maternal physical, social and economic welfare.

A population health framework underlies the analysis. The population health framework indicates complex inter-relationships between health and its determinants. An individual's genetic endowment, social and physical environment and the way the individual reacts to those environments are associated with the individual's health. At an aggregate level the productivity and wealth of the nation will influence the social and physical environments of individuals and will also play a role in determining the resources available to devote to the health care system. The formal health care system is but one factor in the determination of the individual's and the population's health status. The available data make it necessary to concentrate on the relationships at the individual level. There are no measures for genetic endowment in these data except for low birth-weight which is used as a rough proxy in the second essay. The availability of longitudinal health data sets will eventually make it possible to address heterogeneity in individual's health endowments and the aggregate issues.

The first essay investigates the health status of mothers. The investigation is based on three population health surveys by Statistics Canada: the 1985 and 1991 General Social Survey (GSS) and the 1994 National Population Health Survey (NPHS). The surveys use similar methodologies and contain similar information. The sample size is smaller in the two General Social Surveys than in the NPHS. The NPHS is also intended to be a longitudinal survey. Results from all three surveys are included to

investigate the robustness of results across different time periods. Several different measures of health status are used including the presence of a diagnosed illness, self-reported health status and the Health Utilities Index Mark 2.

The second and third essays use the only panel survey available to date in Canada that has detailed information on the health status of children, the Ontario Child Health Survey (OCHS) of 1983 and 1987. The primary objective of the OCHS was to obtain precise unbiased estimates of the prevalence of psychiatric disorder among Ontario children 4 to 16 years of age. Statistics Canada surveyed a total of 1,869 families and 3,294 children in 1983 with a follow-up in 1987. In addition to information on emotional and behavioural problems, data were collected on physical health, cognitive abilities and functional limitations in activities of daily living. A limited amount of information was also collected concerning the socioeconomic characteristics of the family.

The second essay investigates the impact of socioeconomic status, particularly family structure and poverty on the health status of children. Three interesting and novel features in this study are the following: the use of a proxy for permanent income; the inclusion of a long-term measure of lone-mother family status; and the use of the Health Utility Index Mark 2 (HUI2) as an indicator of health status. We have limited our efforts to single equation models with a small set of independent variables. This is due in part to the limitations of the OCHS data. We realize that the causal relations among child health, family income and parental status are much more complex than the picture portrayed in this essay. The findings are best viewed as attempts to summarize the joint distribution of the HUI2 measures of health status and key socioeconomic variables from the OCHS.

The HUI2 is a system composed of a categorical method of describing health status and a multi-attribute utility function to assess health-related quality of life. This allows researchers to investigate single dimensional problems by looking at individual attributes and multiple dimensional problems by studying the health status vectors and global health-related quality of life on a conventional dead=0.00, perfect health=1.00 scale using a multi-attribute utility function to obtain a utility score. (Torrance et al. 1992, 1995, 1996). The third essay documents the mapping of the survey responses in the OCHS into the

levels of the attributes in the HUI2 System. It then presents the results obtained from the mapping system used in essay two to the results obtained using alternative mapping systems on the same data and on different data.

The final essay extends the work done in the Ontario Child Health Study to the entire Canadian population with the National Longitudinal Survey of Children and Youth (NLSCY). The National Longitudinal Survey of Children and Youth (NLSCY) is a relatively new survey that offers major improvements in the data available to investigate the relationships between family structure, socioeconomic status and child health. The first cycle of the NLSCY collected comprehensive information on 22,831 children who were newborn to 11 years old in 1994-1995. The topics surveyed include child health, temperament, behaviour, school readiness/progress and other activities. Data were also collected on family functioning and the socioeconomic characteristics of the child's family and neighbourhood. The survey is intended to be longitudinal; the long term goal is to conduct reinterviews every two years until the children are adults.

There are two objectives for the fourth essay. First, to use the NLSCY sample to assess the association between a variety of psychiatric, academic and social difficulties and a range of socioeconomic variables including the number, age, income, education and market work of parents, and the sex, number and age of children. The second objective is to compare findings with NLSCY data to those provided by what previously was Canada's best survey of child health and development, the OCHS.

2. Lone Motherhood and Health Status

2.1 Introduction

One of the implications of the research on the determinants of population health (see CIAR, 1991 and Stoddart, 1995) is that there are some characteristics that persist in their association with, and differences in, the health status of populations. Income or income inequality, education, occupational status and marital status are some examples consistently found in the literature (Anson, 1989, Smith, Bartley and Blaine, 1990, Smith, Shipley and Rose, 1990, Trovato and Lauris, 1989, Wyke and Ford, 1992). Hertzman, Frank and Evans (1994) indicate that sub-groups within specific populations, however, may react differently to specified "determinants of health." The purpose of this paper is to investigate a sub-set of the Canadian population, female parents, to examine the role which family structure plays in explaining the health status of these women and to detect whether the relationships reported in the literature hold for this group.

The structure of Canadian families has changed substantially over the last two decades. In 1976 approximately 10% of all families with children 18 years of age or younger were parented by one person. In 1991 more than 14% of families fell into this category; eighty-two percent of these lone parents were female. Lone-parent families make up approximately 14% of all families with children yet they account for 45.4% of families with children that live in poverty[1]. (Dooley, 1993)

Initially, the differences in health and socioeconomic status of female parents from one and two parent families with children living at home will be described. Next, multivariate regression analysis will be used to determine whether, after controlling for socioeconomic, biological, lifestyle, and social factors, the marital status of the female parent has an independent effect on health status. The hypothesis is that, after controlling for recognized determinants of health, marital status will be an independent determinant of health status. An explanation of why this may be the case is that the lone parent must allocate her time

between employment, leisure and family responsibilities. The absence of a spouse with whom to share family responsibilities decreases the time she has available to devote to the production of health (Grossman, 1972, 1972a). The lone parent is "time poor." This "time poverty" may lead to more stress. Avison (1996) indicates that lone mothers suffer more one time and ongoing stressors and strains resulting in lower health status.

Lone parenthood may be a result of divorce, birth of a child outside of legal or common-law marriage or, to a lesser extent, widowhood. The number of individuals affected by the state of lone parenthood is large and the majority of them are children. It is important in and of itself that we consider the health of the head of these families. Furthermore, the head of the family's health status will tend to affect the child's health status. Cadman et al. (1991) indicate that parents with chronic psycho-social dysfunction have a higher percentage of children with chronic health problems than do healthy parents. The vast majority of lone parents are females. Thus the research into the social and economic circumstances (including health) of lone parents is one component of research into gender inequalities. Finally, research into the health status of lone parents and their families is relevant to those planning health and social services such as day care, family drop in centres and family health clinics. (Popay and Jones, 1990)

There is little research available on the health of lone parents. The existing research has tended to concentrate on the differences in physical and psychological well-being of the children in one and two parent families (See Cadman et al., 1991, Dooley and Lipman, 1996, Dooley et al., 1996, Curtis et al. 1997, Dawson, 1991, Semchuck and Eakin, 1989) or differences in health of lone mothers related to earnings and welfare participation (Wolfe and Hill, 1992). To my knowledge this study is the only population health study done on the health status of female parents for the whole of Canada.

The main findings in this study are that lone mothers have, on average, consistently lower unconditional health status. However, lone mothers are also younger, poorer, less educated, have fewer children and smoke more. Once age, income, education, life-style factors, the presence of children and other recognised determinants of health are controlled for, lone mothers are no worse off than married

mothers when it comes to health status and for some health indicators may be better off.

Section 2.2 reviews the literature relevant to this topic, Section 2.3 discusses the conceptual model used. Section 2.4 examines the data. Section 2.5 explains the methods used to investigate the hypothesis. Section 2.6 presents the empirical results and finally Section 2.7 discusses the findings and conclusions.

2.2 Literature Review

Researchers have been studying the effects of marriage on mortality for more than a century . In 1859 William Farr, the Registrar General for England and Wales, analysed age-adjusted mortality rates for single, married and widowed men and women in France in 1853. Mortality rates were found to be lower for married individuals. He concluded: "Marriage is a healthy state. The single individual is more likely to be wrecked on his voyage than the lives joined together in matrimony." (Farr, W., 1859) Studies done in the late nineteenth century, relying on mortality rates caused by suicides, cirrhosis of the liver and diseases associated with mental illness, confirmed Farr's work (MacIntyre, 1992).

A more recent study of marital status and mortality in Canada supports Farr's work (Trovato and Lauris, 1989). The authors exploited data on females over the age of 35 from Statistics Canada's Mortality Data Base to investigate the relationship between marital status and mortality (death from all causes, death from cardiovascular disease and death from malignant neoplasm) for 1951, 1961, 1971 and 1981. The rationale for selecting individuals aged 35 and over was that the medical conditions studied tended to occur later in life. Controlling for age and sex, Trovato and Lauris found that marital status has a significant correlation with cause-specific, as well as general mortality rates. The study did not control for income or other socioeconomic factors. Females who were married had the lowest mortality rates for all time periods and causes of death. In general they found that never-married women had lower mortality rates than divorced or widowed females. Widowed females had the highest rates of death, divorced women the second highest.

Wyke and Ford (1992) suggested that two models are offered in the literature as explanations for the

difference in health status between the married and unmarried. One is the "health selection" model, postulating that marital status is dependent upon health status. Unhealthy or disabled individuals are less likely to marry and, if they do marry, there is a higher probability that the relationship will end in divorce. As well, those who become ill while married are more likely to suffer a dissolution of the relationship.

The second is the "social causation" model which hypothesizes that health status is dependent upon marital status. Four explanations are given for this: 1) Divorced or widowed individuals are left financially worse off when the relationship ends; 2) Married individuals have less stress because of their well defined, socially acceptable role. Losing a partner or change in circumstance are also stressors that married individuals do not have; 3) Marriage enhances an "orderly lifestyle" ie. regular healthy meals, regular sleep and exercise. It also decreases negative health behaviours such as smoking, excessive drinking and risky activities like fast driving; and 4) Married individuals benefit from the availability of social support in both quantity and quality.

Wyke and Ford tested the social causation hypothesis using data from the West of Scotland Twenty-07 Study, an investigation of health and everyday life. They studied females in their mid-fifties. The authors believed that this group was the most likely to have had marital relationships and dissolutions. The data indicated that no-longer-married women had statistically significantly more limiting chronic conditions, lower self-reported health status and worse mental health than married females. The authors found that after controlling for each of the following in separate regressions, stress, the intimacy of relationships, and material wealth (measured by ownership of a car), marital status was no longer a significantly associated with health status. Tobacco consumption significantly affected health; after controlling for tobacco consumption marital status remained significant. Alcohol consumption and quantity of social supports were poor predictors of health for both married and no-longer-married females. The authors concluded that they found support for three of the "social causation" explanations. The higher wealth, lower stress levels and higher quality social supports associated with marriage seemed to explain the difference between the health status of married and no-longer-married women. They found that orderly

lifestyle does not explain the difference, although cigarette consumption did significantly affect health status.

Zick and Smith (1991) tested the hypothesis that health determines marital status. They postulated that if healthier individuals were "selected" into marriage then, after controlling for age, race, education, employment, and poverty, there should be a significant difference in the probability of mortality between married and never married individuals. Evidence from the U.S. Panel Survey of Income Dynamics from 1968 to 1984 indicated that married individuals were not healthier than never-married individuals after confounding factors were controlled for. The evidence did not support the hypothesis that healthy individuals are selected into marriage. The selection of unhealthy individuals out of marriage (individuals separate or divorce due to ill health) was not tested.

After controlling for marital status, the recent dissolution of a marriage, age, race and employment, Zick and Smith also found that poor women had a higher probability of death than non-poor. They postulate that the major risk reduction of marriage for females is likely to be economic. Other research has shown that lone-female heads of families are more likely to suffer chronic stress from low income and low levels of social support than females from two parent families (McLanahan, 1983).

Few studies have been completed that delve specifically into the health status of female parents. Of those that do, the evidence is mixed as to the contribution lone parenthood has on health status. Weissman et al. (1987) investigate utilization of health and mental health services and the prevalence of psychiatric disorders in female parents, 18 to 44 years of age, in the greater New Haven community. Lone parents were more often black, less educated and poorer than married parents. The rates of health problems for black-lone parents were twice that of other parents. Lone-female parents had a higher probability of suffering from poorer over-all health but this relationship did not hold once race was controlled for. The percentage of lone parents reporting only fair to poor mental health was 3 times that of married parents and this did not dissipate after controlling for race. However, there was no significant difference between the six-month prevalence of major psychiatric disorders (such as major depression, bipolar disorder, phobias,

alcohol or drug abuse) between the married and unmarried mothers studied. Six-month prevalence rates of dysthymia (chronic, mild depression) were twice as high for lone parents and the difference remained significant after controlling for race or income. On the other hand, the rate for compulsive-obsessive disorder was significantly greater for married mothers after controlling for race. Unmarried mothers with less than college education were significantly more likely to suffer dysthymia, 2.5 to 3 times that of the other marital status and education categories. The authors interpret their results as suggesting "that enhancing the educational, occupational, and earning capacity of lone-parent women might improve their sense of well-being and that of their children" (page 35).

Anson (1989) examined women's health and marital status in the United States. The author postulates that the presence of a "proximate adult", an individual other than a child, 18 or over, in the household would alleviate the health differences between married and unmarried females. To test this theory data on white females between the ages 18 and 55 from the 1979 National Health Interview Survey were used. The measures for health status included self-reported health status, chronic and acute morbidity. Anson found that never-married females were substantially younger and widowed females considerably older than married or divorced women. Married females had more children and family income almost twice that of the other groups. Ninety-nine percent of married women, 76%, 23% and 11% of never-married, divorced and widowed women, respectively, had proximate adults present. There is no indication as to whether or not these differences are statistically significant.

After controlling for age, income, the number of children and the presence of a proximate adult, Anson found that only never-married females had significantly lower self-reported health status than married ones. Separated or divorced women had significantly more acute or chronic conditions before controlling for proximate adult but there was no statistically significant difference in health status across marital statuses after it was controlled for. She concludes that her study supports the theory that the proximate adult may be an adequate substitute for a spouse in supplying needed social support.

Wolfe and Hill (1992) investigate the health status of lone mothers in relation to earnings capacity

and poverty. They use the Current Population Survey from the United States (March, 1989). The authors controlled for age, education, income, the number and age of children, race, and geographic area. They found that both lone mothers and single females, without children, have a higher probability of self-reported disability or health problems that limits work than the base case (married females without children). There is no significance difference between the health status of married mothers and the base case.

A British study of women's health (Macran et al, 1996) investigates the relationship between health status (measured by self-reported health status, the presence of long standing disease or disability, psycho-social well-being, the presence of illness (or physical symptom such as headache, backache or cold) in the last month and fitness (blood pressure, lung function and body mass index (bmi)) and socioeconomic status which they refer to as social groups.

The social groups were measured by occupational status, labour force participation, marital status and the presence of children. The authors controlled for income and age but not education. Occupational status may act at least in part as a control for education. Marital status was measured by dummy variables for the following six living arrangements: couple without children (base group); couple with dependent children; lone mother with dependent children, single person; single person and others; and finally couple and others. The consistent finding in the paper concerning marital status is that mothers, including lone mothers, who reside with dependent children are relatively healthier than those without children after controlling for the factors mentioned. The coefficients on the variables single living with others or married females living with others were not significant for any of the health status measures. Married mothers with children had significantly higher self-reported health status than married females without children and single females living alone had significantly lower. The lone mother coefficient was not significant in the self-reported health status regression. Lone mothers fared poorly on psycho-social well-being. They had significantly lower mental health status, on average, than women who had spouses and no children. The coefficient on married mother was the same in magnitude and opposite in sign for psycho-social problems

as the one on lone parent. Single women living alone also had significantly lower psycho-social health status, on average, than couples without children but higher than lone mothers. Lone mothers had significantly less long-term disease and disability than couples without children. The authors interpreted this as evidence against the hypothesis of selection out of marriage due to poor health. There were no significant differences between lone mothers and the base group for the remaining measures of health status.

To test the theory that lone mothers have more mental health problems because they must cope with both the domestic and employment demands without the financial or emotional support of a spouse, Macran et al. interacted lone mother and labour force participation (described by full-time (base), part-time, unemployed and not in the labour force) when using the measure of psycho-social illness. After adding controls for labour force participation lone motherhood continues to predict a lower psycho-social health status when compared to married women with no children. Married females with dependent children have significantly higher and single females have significantly lower health status than couples without children. Worthy of mention is the fact that lone mothers who were employed full-time had the worst health when measured by psycho-social status while lone mothers employed part-time had significantly higher health status than those employed full-time. Lone mothers not in the labour force had the next best health status but only significantly different from the base case (lone mother, employed full-time) at the 10% level and unemployed lone mothers' mental health status was not significantly different than those employed full-time. The lower psycho-social health status of lone mothers in full-time employment supports the theory of time constraints and excess demands leading to poor health. Part-time employment may offer social contact outside the home as well as increased income while leaving time for family duties.

A similar picture was encountered when the health of lone female parents from Ontario was studied. Lipman et al. (1997) employed the Ontario Health Survey Supplement to investigate the sociodemographic, physical and mental health characteristics of lone mothers in Ontario. Women in the sample ranged from 16 to 66 years of age. Lone mothers had significantly fewer children under the age of 16 and were

significantly more likely to have low income than married mothers. There were no significant differences in the age or prevalence of physical health problems between lone and married mothers but lone female parents did have significantly more mental-health problems.

The investigation included several dummy variables to measure of mental health: i)dissatisfaction with four or more of the following: main activity; family; friends; leisure activities; current housing; income; or life in general; ii) affective and/or anxiety disorder present if the individual ever had an affective disorder (dysthymia or depression) or anxiety disorder (social phobia, simple phobia, panic disorder, agoraphobia or generalized anxiety disorder). iii)one or more disorders present if the individual had ever suffered one or more of the following: anxiety disorder; affective disorder; antisocial behaviour; or substance abuse; iv) outpatient utilization if any outpatient services for mental health were used in the last year; v) total utilization if any mental health treatment had been used in the last year. The authors found that after controlling for income, education, the presence of young children and maternal age, lone mothers had significantly higher prevalence ratios for all measures of mental health except affective or anxiety disorder.

The odds of lone mothers suffering from dissatisfaction, having one or more disorders, outpatient utilization or any utilization were 2.5, 1.9, 2.9, and 2.6 times that of married mothers, respectively. The odds of lone mothers suffering from anxiety/affect disorder were 1.8 times that of a married mother but this was not significant at the 5% level. The authors are careful to note that it cannot be determined whether lone motherhood predates morbidity or conversely that morbidity is the cause of marital dissolution.

In a case comparison study of lone mothers and mothers from two-parent families in the city of London, Ontario, Avison (1996) found that lone mothers were less educated, had fewer children, had a lower probability of being in full- or part-time employment and had less than half the family income of mothers in two-parent families. Lone mothers had, on average, significantly higher scores on the Center for Epidemiological-Depression Scale (CES-D) and Anxiety index scores. The higher scores indicate lower outcomes. The probability of suffering from major depression or substance abuse was

approximately four times higher for lone mothers than married mothers.

The exposure to stressful life events was also significantly higher for lone mothers. They suffered more strain from financial problems, care-giving problems and conflicts between home and work-life. After controlling for age, income, education, the number of children and employment the CES-D scores of lone mothers remained significantly higher than that of married mothers. There were no longer any significant differences in CES-D scores by marital status after the previously discussed life-stressors were controlled for. This led the author to conclude that it is the exposure to one time and ongoing stressors and strains, not lower coping abilities of lone mothers, that leads to lower mental health status.

Morgenhagen et al, 1985 noted that some of the differences in mortality rates between married and lone parents have decreased over the last few generations. The argument is that it has become more socially acceptable to be a lone parent. It is possible that older lone parents have been socialized to the fact that marriage is the "normal" situation in which to raise a family, while the younger generation of lone parents may not feel this way. This could lead to higher levels of stress and morbidity in older lone parents when compared to younger ones.

Many studies, including those mentioned previously, have shown a consistent relationship among income, education, age, social class, social relationships and health status using both measures of morbidity and mortality. Income, education, social class, and social relationships have positive associations with health status, while age has a negative correlation (see Anson 1989, Berkman (1984), House et al. (1988), Koskenvuo et al. (1980), McLanahan (1983), and Wolfson et al. (1993)). Macran et al. (1996) found unemployed females to have significantly lower self-reported and psycho-social health status than those who were employed. However, when they included an interaction term for the employment status of lone mothers there were no significant differences between the health status of lone mothers who were employed full-time and who were unemployed. Occupational classification is expected to have a positive correlation with health status (Macran et al. (1996), Smith Bartley and Blane, (1990), Smith, Shipley and Rose, (1990)).

There is overwhelming evidence that excessive consumption of alcohol and consumption of tobacco is deleterious to ones health. Obesity and sedentary lifestyle increase the risk of coronary and respiratory diseases and other circulatory conditions. Positive health habits, such as getting sufficient exercise are hypothesized to increase the health status through its "investment effect" on health (Slater et al, 1985).

The evidence on the association between marital status and health status is somewhat less than overwhelming for female parents. The literature fairly consistently indicates an inability to detect differences in "physical health" and marital status of mothers, after controlling for confounding determinants of health. The studies, although not unanimously, do imply a negative relationship between self-reported health status or mental health status and lone parenthood.

The central question addressed in this paper is whether lone motherhood remains an independent determinant of health status, after controlling for other social, economic, biological and psychological factors.

2.3 MODEL

Zick and Smith (1991) follow the Grossman (1972) model of a health production framework as a guide to an estimating model. Grossman's model theorizes that individuals derive utility from their stock of health and consumption of other goods in each period. Individuals maximize their utility by choosing the appropriate level of health stock and consumption of other goods subject to an elaborate budget constraint that includes time as well as income and a set of household production functions for health and other commodities. They postulate that the production of health is determined by biological factors such as age, sex, genetic endowment, and race and environmental factors such as education, employment status, and marital status.

Grossman and Joyce (1989) describe the health production function as incorporating variables such as medical care utilization, diet, exercise, tobacco and alcohol consumption. The production of health not only depends on the inputs used to produce health but also on the individual's efficiency in producing

health with a given amount of health inputs. Characteristics that may affect the efficiency of the production process are age, sex, education, and the initial endowment of health.

Many of the studies cited in this paper do not explicitly develop models. The authors simply test what they believe are the relationships between health and the characteristics that influence health using bivariate or multivariate estimation procedures.

Evans and Stoddart (1990) present a conceptual framework of health that indicates the complex relationship between the determinants of health and health status (see Figure 2.1). The more general conceptual framework displayed in Figure 2.1 indicates that the pathways for the production of health are intertwined and even circular. Until longitudinal data sets with good measures of health status are available, it will be difficult to infer causal relationships. Cross-sectional data, although it cannot untangle the pathways, allows us to investigate the determinants of health within a conceptual framework. As health researchers we recognise the limitations of the data but also the usefulness of the research as a stepping stone to evaluate the existence of causal pathways when more sophisticated data are available.

The conceptual framework indicates that there are complex relationships between the many determinants of health. Health is a function of biological endowment (age, sex, genetic endowment), physical environment (income, occupation, province), social environment (social support and social interaction, marital status, presence of children), individual responses (education, smoking, exercise) and the availability of health care (province). The estimating model used to examine the associations between the characteristics mentioned above and Health Status is:

HS=HS(marital status, income, age, education, number of individuals in household, age of children, smoking habits, amount of exercise, labour force participation, occupational status, province)

2.4 DATA

Data were obtained from three Canadian population health surveys, the 1985 Canadian General Social Survey (GSS_85) (Statistics Canada, 1985), 1991 Canadian General Social Survey, Cycle Six (GSS_91) (Statistics Canada, 1991) and the 1994 National Population Health Survey (NPHS) (Statistics Canada, 1995). The design of the 1994 NPHS will be discussed briefly. Differences between the NPHS and the two GSS surveys will be highlighted.

The target population of the NPHS was household residents 12 years of age and older in the Canadian provinces (with the exception of individuals living on First Nation Reserves, Canadian Forces Bases and some remote areas of Ontario and Quebec). The sample design was a stratified two stage design. In all areas but Quebec, a multi-purpose methodology developed for the Labour Force Survey (LFS) was used. In Quebec the sample was selected from households participating in a previous health survey by Santé Québec, the 1992-1993 Enquête sociale et de santé (ESS). A rejective method was used to correct for the under-representation of individuals from large households. Interviews were conducted quarterly (June, August, November 1994 and March 1995) to correct for the seasonality of health status. The survey interviewed individuals to ascertain socioeconomic, religious, health status, psychological, and biological information.

The target population for the GSS is persons 15 years of age and older in Canada, excluding residents of the North West Territories, the Yukon and institutions. Random Digit Dialing (RDD) was used for those under 65, this excluded households without telephones (about 2% of the population in 1991). An individual was randomly selected from the household. No correction was performed for the under-sampling from larger households. The interviews in the 1991 GSS were evenly distributed over 12 months to offset any seasonality in the information collected; the 1985 GSS interviews were done in September and October.

Males were excluded from this study on two criteria: first, there were too few lone-male parents to generate any statistical reliability or comparability across male and female families and second, families

headed by lone-male parents tend to have characteristics similar to two-parent families and thus should not be included with lone-female families. Males accounted for approximately half of the married parents and except for the 1985_GSS in which males accounted for 28% of the lone parents, approximately 10% of the lone parents.

Females, under the age of 60, with dependent children, residing in households containing one nuclear family were included in the study. In the GSS_85 females with unmarried children living at home are included in the sample (no ages of children are known). In the GSS_91 and the NPHS only females with children under 25 years of age were included. Other studies of families with children tend to define children as those under 16 or 18 years of age. The only information available on children's ages in the NPHS is if they were under 5, 11 or 25 years of age. Finally, only observations with all the information necessary for the study were included.

The GSS_85 sample size was 11,200, approximately 60% of the sample was 60 years of age or older or had no children. 86% of the remaining sample was married, 44% of these were males while 28% of the lone-parents were males. Many of the observations, approximately 1,300, had information missing, mainly income. After excluding males and observations with missing information, the final sample size was 1,108 mothers with dependent children, 83% were married and 17% lone mothers. The original sample in the GSS_91 consisted of 11,924, approximately 70% of the sample was 60 years or over or had no children. The remaining sample consisted of 87% married parents, 44% were male, and 13% lone parents, 9% male. The final sample size was 1,613, with 344 lone parents (21%). Finally, the NPHS consisted of 17, 976 observations, 31% of the sample were under the age of 60 with dependent children, 84% were married. Males accounted for 44% of the married parents and 13% of the lone parents. The final sample size was 2,893, of which 716 were lone parents (25%).

The high proportion of lone mothers in the final samples caused some concern. Lone mothers represent 25% of mothers in the NPHS; this is much higher than the approximately 16% that is found in the Canadian Survey of Consumer Finances (CSF) where information is available on all adult family

members. These population health surveys randomly selected a household and then randomly selected an individual in the household and collected information on that person only. Information is available on the respondent only. Prior to eliminating males from the survey the percentage of lone parents was similar to that of the CSF. Once male parents were eliminated from the NPHS sample (44% of married couples but only 13% of lone parents) the percentage of lone parents in the sample rose substantially. This results in an over-sampling of lone mothers in the NPHS. Consequently, no inferences can be drawn on the population of mothers as a whole. The results in this paper always condition on the mother's marital status, thus the conclusions should be free of selection bias from this source, because the selection of the individual was random and not based on any of the characteristics of interest in the study.

2.4.A. Dependent Variables

Health status is a multidimensional entity with no single definition universally accepted or even consistently employed by researchers. In the literature, definitions for health range from the "Narrow medico-technical" model's definition of the absence of disease or infirmity to the World Health Organization's definition of "a state of complete physical, mental, and social well-being" (Evans, 1984). Due to absence of better measures, many studies incorporate utilization of health care as a measure of health status. Anson (1989) classifies utilization measures as illness behaviours rather than health status. She hypothesizes that illness behaviours will differ between married and unmarried mothers because of differences in the level of social support and interaction.

In this study in order to capture a range of definitions and to investigate differing implications among definitions the following measures of health status and utilization are used: self-reported health status; presence of a diagnosed illness[2]; self-reported life satisfaction; Health Utilities Index Mark 2 (HUI2) score; number of days spent in bed due to illness; number of days decreased activity due to illness; and number of nights spent in hospital. Appendix 2.1 presents detailed explanations of all the measures of health status and explanatory variables used. A brief description follows.

Self-reported health status has been shown to correlate closely with other measures of an individual's health status (Davies and Ware (1981), Kaplan and Camacho (1983) and Nagi (1976)). This variable is available across all of the surveys used in this study. The proxy used for overall well-being is self-reported overall life satisfaction and is only available in the two GSS surveys. Presence of at least one of five health problems is used as a measure of diagnosed illness.

The Health Utilities Index Mark 2 Score (HUI2), available only in the NPHS, is a global utility score for health-related quality of life. The HUI2 score is based on six dimensions of health status including physical, psychological, emotional and cognitive abilities, reflecting health-related quality of life on a scale from perfect health (= 1.00) to dead (= 0.00). The HUI2 score used in the NPHS is based on health status information collected using the Health Utilities Index Mark 3 (HUI3) system. The HUI3 information was mapped into the HUI2 system and then scored using the HUI2 multi-attribute utility function. (For an in-depth presentation on the HUI2 see Feeny et al. 1992, 1995, 1996 and Torrance et al. 1995, 1996.)

Utilization measures employed are the following: number of days the individual decreased activity in the last two weeks as a result of poor health; number of days spent in bed in the last two weeks for health reasons; and number of nights spent in the hospital in the last year. The utilization measures are count data with a high proportion of observations at zero. Ninety-two percent of the sample had zero number of bed days, 86% had no decreased activity days and 85% spent no nights in the hospital in the last year. Less than 2% of the sample are right censored at 15 hospital nights.

2.4.B Independent Variables

Lone mother is a dichotomous variable equal to one if the female identifies herself as a lone parent and does not have a partner living in the same household. If the females reported themselves as having a spouse (legal or common-law), they were considered married and the dummy was set to zero.

Household income is available in a continuous form in the GSS_85 and in grouped form in the latest two surveys. Income dummies were the best controls for income. A cubic in income and the natural

logarithm of income (the midpoint of each group was used) were also tested but did not add any information. Education and age were also grouped in all of the surveys and are measured as dummy variables.

The NPHS is the only data set with proxies available for social support. A perceived social support index measures whether respondents feel they have someone they can confide in, count on, look to for advice or someone who makes them feel loved. A social involvement scale is measured by the frequency of participation in associations, voluntary organizations and religious organizations in the last year (see Berkman (1984) as well). A frequency of contact score proxies for the number of contacts with friends and family, outside the household, in the last year. A higher score indicates a better outcome for all of these variables (Statistics Canada, 1995).

The Pineo socio-economic classification of occupation of the main job was used to create the dummy variables for occupational classification. The Pineo classification is used as an indication of the control one has over one's work and social environment, not simply an additional measure of human capital attainment. An individual had to report having an occupation within the last 5 years to receive a Pineo classification, almost half of the sample did not. Hence, a dummy category of no Pineo score was included.

Labour force participation is measured by three dummy variables: employed for those working for pay or profit; unemployed for those not working but searching for work or waiting for a call back from layoff or strike; those who are neither employed or unemployed are classified as not in the labour force. The unemployed variable was a constructed variable in the two GSSs but was not included in the NPHS. In the two GSS surveys an individual was considered unemployed if they had not worked in the last week, did not have a job to return to and were looking for work. In the NPHS the individual was assigned as unemployed if they were currently not working and claimed to be on strike, layoff, or their main activity was looking for work. This definition of unemployment is most likely stricter than those used in the GSS surveys, as is evident by the smaller sample of unemployed in the NPHS.

Positive and negative health habits are measured by exercise and smoking. (The number of alcoholic drinks consumed per week was originally included; this was never significant and did not increase the explanatory power of the regression and, thus, it was dropped from the estimation.) Activity indexes were constructed in all three data sets but the definitions differ between the GSSs and the NPHS. In the GSSs an individual was considered to have a sedentary lifestyle if she/he exerted less than 500 kcal/week in exercise activities, a moderate lifestyle if she/he exerted 500 to 1,999 kcal/week and an active lifestyle if she/he exerted 2,000 or more kcal/week. The NPHS definition of sedentary was less than 1.5 kcal/kg/day, moderate for 1.5 to 2.9 kcal/kg/day and active for 3.0 or more kcal/kg/day. The number of cigarettes smoked per day was used to measure the consumption of tobacco.

2.5 ESTIMATION METHODS

Weighted data were used to estimate the mean values of the variables used in the analysis. Testing was also done to indicate whether or not the data should be weighted for the multivariate estimations. Based on a test suggested by DuMouchel and Duncan (1983) each independent variable was interacted with the survey weights and an F-test of joint significance of all the interacted terms was performed. The tests failed to reject the hypothesis that the intersection terms were jointly equal to zero. Hence unweighted data were used for regression analysis.

Most studies on self-reported health status use linear regression (Slater et al., 1985, Anson, 1989, Macran et al., 1996) which treats it as a continuous variable even though it is categorical. This study uses ordered logit, which correctly assumes the dependent variable is an ordered integer (Kennedy, 1992, Becker and Kennedy 1992, Greene 1993, Maddala 1992, StataCorp., 1997, 1997a). The coefficients of the ordered logit are more difficult to interpret than those obtained in a linear regression, thus, an explanation is included in Appendix 2.3. The simplistic interpretation of the coefficients is as follows: an increase in a positive coefficient, ceteris paribus, indicates an increase in the probability of the highest value of the dependent variable occurring and a decrease in the probability of the lowest value of the dependent

variable occurring. The opposite is true for negative coefficients. The effect is ambiguous on the probability for the intermediate values.

The number of activity days lost, the number of bed days and the number of nights spent in hospital are all count data. A Poisson process is often assumed for count data. However, the Poisson process assumes a variance equal to the mean which is frequently rejected by the data, and these data were no exception. A negative binomial is less restrictive. It assumes the count variable is generated by a Poisson-like process but permits a greater variance than the true Poisson. Goodness-of-fit tests indicated that the Poisson regression was only appropriate for number of bed days. Negative binomial estimation was used on the other count variables. These regressions rendered very few significant variables and low F-statistics indicating weak ability to reject the null-hypothesis that all coefficients were jointly insignificant. The problems with the estimation of these count data may be because of the vast majority of the distribution lies at zero. The results for the number of bed days is presented but the other results are not. Further work is needed to find an appropriate estimation procedure for these data. The remaining measure, presence of diagnosed disease, is a dichotomous dependent variable thus a logit regression was used.

Investigators believe that social support and social interaction may be highly endogenous in a determinants of health framework. That is to say, individuals who are ill may not be able to form the social networks necessary for good social support in the first place. To deal with endogenous variables instrumental techniques are often used. That is, "instruments" that are correlated with social support or social interaction but not with the error term in the regression would be employed in the estimation procedure. Valid instruments were not available in this data set therefore, a sensitivity analysis approach (Grootendorst, 1995) was used. The primary results are presented without the social support and social interaction terms. The findings that incorporate social support and interaction into the NPHS estimations are then presented to determine whether or not the parameters in the equations are sensitive to the possible endogeneity of the social support and social interaction terms.

2.6 EMPIRICAL RESULTS

The health statuses of lone and married mothers are compared in the Table 2.1. In every survey lone mothers are more likely to have very poor or poor self-reported health status. This is significant at least the at the 5% level or better except for very poor in 1991. Lone mothers are also less likely to have excellent or very good self-reported health status but the differences were not always significant. When asked about life satisfaction, lone mothers were much more likely to have some dissatisfaction or be very unsatisfied with their lives and a dramatically lower proportion were very satisfied with their lives (all significant at the 1% level).

The remainder of the measures used for health status show no significant differences in 1985. In the 1991 data set, lone mothers were significantly more likely to have an illness present and more decreased activity days. In the NPHS (1994) the proportion of lone mothers with an illness present was almost 1.4 times that of married mothers. The HUI2 score (health-related quality of life) of lone mothers was significantly less, they had 70% more days in bed due to illness and 20% more hospital nights and decreased activity days than did married mothers. Hence, lone mothers had, on average, consistently lower levels of health.

Table 2.2 presents the correlations between the health status measures used in each survey. Notice that self-reported health status is consistently correlated most highly with the other measures across the three data sets. Surprisingly, there is little correlation between diagnosed illness and nights spent in hospital, amount of decreased activity (except in 1985) or the HUI2 score. Self-reported health status, diagnosed health problem and the HUI2 score are consistently highly correlated with each other across the time periods. All correlations have the expected signs except life satisfaction and nights in hospital in 1985.

In Appendix 2.2 the characteristics of lone mothers and females from two parent families are compared. In all years lone mothers have significantly smaller representation in the high income categories and higher representation in the lower income groups. Although the statistical significance is not as strong

this pattern is seen for education as well. In all years a higher proportion of the youngest mothers are lone parents (in 1985 the difference is only significant at the 10% level). The other age categories do not show consistent composition. A greater percentage of lone mothers are classified as unemployed and, except for the NPHS, the percentage of women not in the labour force does not differ by marital status. There are no consistent differences in occupational status by marital status except for the higher probability that a lone mother does not have a Pineo classification. In both surveys in which an indication of the receipt of government assistance is available, lone mothers are almost 8 times more likely to be receiving the government transfer. Married mothers come from larger households and are more likely to have pre-school children. Lone mothers smoke, on average, twice as many cigarettes per day but are not significantly different when it comes to being physically active, except for 1994 where there are more lone mothers who are active. The only province that has a disproportionate representation of lone mothers is Quebec in the 1994 data.

In summary, the data indicate that lone-female parents have significantly lower health status. They are also, poorer, less educated, more likely to be on social assistance, and more likely to be unemployed. Lone mothers are more likely to be young and have fewer pre-school children. These associations have persisted in each of three surveys. Table 2.3 contains the results from the ordered logits for self-reported health status in each of the three time periods. There is likely to be a great deal of colinearity between the independent variables in the regressions. The two surveys with the smaller sample sizes have fewer significant coefficients although the direction and magnitudes of the coefficients are similar to results from the NPHS. Also of note is the low adjusted R^2 value. This is common in studies of health status. (i.e. see any of the studies reviewed for this paper that used micro data such as Anson, 1989 and Macran et al., 1996.)

The base case, for all estimation procedures is a female who is married with children 12 years of age and over. She is also 30 to 39 years old, is a high school graduate, employed as a semi-skilled worker with family income of $40,000.00 to $59,999.00 per year. She is not on government assistance, has a sedentary

life-style and lives in Ontario. (Note that occupational class and child age are not available in GSS_85 and government assistance status is not available in GSS_91.)

The first set of results indicate a strong negative relationship between self-reported health status, low income and low education. The 1991, and to a lesser degree the 1994, data show a consistent income gradient. The marginal effect of having an income of less than $10,000 in 1994 is presented in Appendix 2.3. When a measure of government assistance was available (1985 and 1994) the negative relationship was as strong as that of low income and significant at less than 1% even in the GSS_85. Less than a high school degree has a coefficient that is statistically significantly negative with a magnitude close to that of low income.

The life-style indicators are consistently statistically significant and of the expected sign. The number of cigarettes smoked per day seems to have a relatively small coefficient but note that the average number of cigarettes consumed was close to 10 for lone moms and only half that for married mothers. Having young or very young children (12 years and over was the base) had a positive relationship with self-reported health status in all equations but was statistically significant only in 1994. The number of people in the household does not have a statistically significant relationship in any survey. In 1991 and 1994, the occupational class coefficients jointly insignificant at the 5% level, $\chi^2(5) = 10.69$ and $\chi^2(5) = 3.56$ respectively. The employment variables do not show a consistent or significant relationship with self-reported health status. Finally, there are no consistent patterns between provinces in any of the data sets.

Surprisingly, the coefficient on the lone mother term is, contrary to expectations, only negative in 1985 and it is insignificant at conventional levels. In 1991 and 1994 the term is positive; it is significant at the 5% level in 1994. The magnitude of the lone mother coefficient is substantially smaller than the low income coefficient in both of the samples and about half of the size of the low education coefficient in the latter. The marginal effect, ceteris paribus of being a lone mother is presented in Appendix 2.3.

The results from the logit regressions on the dichotomous diagnosed health problem are presented in Table 2.4. The only significant results in 1985 are that individuals making between $70,000.00 and

$75,000.00 per year are less likely to have a diagnosed health problem than someone earning between $59,999.00 and $69,999.00. Females under 30 are less likely and those over 39 are more likely to suffer from a diagnosed health problem than those 30 to 39 years of age. Those that smoke cigarettes are more likely to suffer from health problems than those who do not.

The results are similar in 1991. Females over 40 are significantly more likely to have problems, as are those with less than high school education. Smoking cigarettes has a significantly positive relationship, and being active has a significantly negative relationship, with diagnosed illness. Having children younger than 12 seems to be related to less illness and those who are not employed are more likely to have a diagnosed problem than those who are. In 1991, the provinces and the occupational classes are jointly insignificant with $\chi^2(9) = 5.14$ and $\chi^2(5) = 6.46$. Contrary to expectations, those earning between $29,999.00 and $39,999.00 per year are less likely to have diagnosed illness than those earning between $39,999.00 and $59,999.00.

The NPHS results agree with the 1991 results on smoking cigarettes, the presence of younger children and females 50 years and older. These results indicate that people with lower incomes are worse off when it comes to the probability of having an illness, as are those with less than high school education. Those with some post high school education are also more likely to suffer an illness than those with high school education. There are no significant differences over activity levels or those receiving social assistance. Employment categories, occupational classifications, and provinces are jointly insignificant, $\chi^2(2) = 3.17$, $\chi^2(5) = 3.10$ and $\chi^2(9) = 12.0$ respectively. The coefficient on the lone mother variable is insignificantly different from zero in all three surveys.

Table 2.5 presents the results of the Poisson estimation of the number of days an individual spent in bed in the two weeks prior to the survey due to health. The occupational classifications are again jointly insignificant at the 5% level in the two surveys in which they are measured, $\chi^2(5) = 5.91$ in 1991 and $\chi^2(5) = 9.65$ in 1994. The labour force variables are also jointly insignificant in 1991 and 1994 surveys with $\chi^2(2) = 5.60$ and $\chi^2(2) = 0.91$ respectively. Although the results are inconsistent across the three time

periods there seems to be a trend that younger individuals and those with lower income are likely to have more bed days than the base case. Those with lower levels of education have a greater probability of having bed days. Individuals with young children are likely to spend fewer days in bed due to illness than those with older children. Females that are active are less likely to have spent days in bed than those who are inactive. The results are mixed for smokers; smokers have a higher probability of more bed days in 1991 but there are no significant differences between smokers and nonsmokers in 1985 and 1994. Lone mothers consistently have more bed days but the relationship is only significant in 1985.

Results were also obtained (not reported) for these regressions adding self-reported health status to the right hand side of the equations. Health status was a very strong predictor of the number of days an individual spent in bed due to illness. Those with poor (excellent) self-reported health status have substantially more (fewer) days spent in bed due to illness than those reporting good health status. The remaining results were similar to those recorded without controlling for health status. One notable exception was that the coefficient on lone mothers in the 1991 sample became significantly positive, indicating lone mothers were more likely to have spent days in bed due to illness.

Table 2.6 presents two sets of results. The life satisfaction estimations in the first two columns and the HUI2 score equations in the last. The most noteworthy point in the life satisfaction results is that the lone-mother coefficient is highly significantly negatively associated with life satisfaction and the magnitude is relatively large in both surveys.

When using the HUI2 score as the measure of health status trends similar to those found with other health status measures persist, although there are few significant results. Those with lower income, less than high school education and who are older than 40 have significantly lower utility scores. Those who are in receipt of social assistance or are not in the labour force and smoke also have lower scores. Those who are active or have children under 12 years of age have significantly higher utility scores than the comparators. As in many other cases, the joint tests for the provinces and the occupational classifications could not reject the possibility that they were not jointly different from zero.

Finally the pattern seen in the previous estimations remains after the social support and interaction terms are added to the right hand side of the NPHS equations (Table 2.7). Low income, low levels of education, and smoking continue to have negative associations with self-reported health status and the presence of younger children and greater amounts of activity remain positively associated. The social support and interaction terms are highly positively significant. Although the magnitude of the social interaction variable and the frequency of contacts variable is small, the magnitude of the social support measure is very close and opposite in sign to the coefficients on the lower income categories. The addition of the social support and social interaction terms does not appear to change other coefficients importantly.

2.7 DISCUSSION

The results presented in the previous section consistently indicate a negative association between each of the health status measures and low income and low educational attainment. This supports previous findings in the literature. The consistently significant effect on health status of the less than high school education variable compared to high school graduation and the weaker significance of the higher levels of education compared to this base are also similar to other findings. Two other consistent and unsurprising results are that smoking and increased activity levels have negative and positive associations with health status respectively.

The persistent joint insignificance of the relationship between occupational classification and health status is worthy of remark. In the determinants of health literature, a consistent, step-wise negative relationship is often found between health status and occupational status even among individuals who earn relatively good incomes. In the British male population, the Black Report and the Whitehall Study are often referred to in this literature (Smith, Bartley and Blane, 1990; Smith, Shipley and Rose, 1990). Reasons for the lack of such a correlation in this report could be two-fold. First, only females with children were included in this study. Perhaps there is not a strong relationship between health and occupational class for women with children. Second, almost half of the sample population could not be

assigned an occupational class from the survey questions. As a result the sample size of the classified groups was small and could have led to the consistent lack of significance. Macran et al. (1996) were better able to categorize the work classifications for females and they did find a positive relationship between occupation and health status, although it is weak at times.

There was no indication of a strong relationship between unemployment and health status. Perhaps with almost half of the women reporting to be either unemployed or not in the labour force, there is no stigma or stress associated with the position of unemployment, after income is controlled for. Iverson et al.(1987) indicate that the effects of unemployment on health are mitigated in areas of high unemployment. Macran et al. (1996) found that unemployed women were worse off in health terms than those who were employed but the relationship was usually insignificant. A relatively consistent negative relationship between health and social assistance receipt is seen in the data for self-reported health status and life satisfaction.

Mothers must spend more time in child care activities with younger children than with older children. If the concept of the female being "time poor" holds, one would expect females with younger children to have, on average, lower health status than those with older children. This does not hold in the data. The presence of very young children in the household tends to have a positive relationship with health status and a negative relationship with utilization or health behaviours. Care must be taken with the interpretation of this result. The pathway here may be in question. Is it the fact that mothers with very young children are healthier or is it that to have very young children in the household the female must have been healthy enough to have had a child fairly recently? It may also be that small children offer the mother social support or social interaction. Older children develop friendships outside the home and this may mitigate the social support and social interaction they offer.

Residents of Quebec are the only individuals that have consistently different reports of health than residents of Ontario, ceteris paribus. Residents of Quebec tend to report their self-reported health status and life-satisfaction, on average, as lower than those that live in Ontario but they have fewer bed days.

The hypothesis of this paper was that, after controlling for the previously mentioned determinants of health, lone mother status would have a negative association with health when compared to married mothers. This hypothesis has not been supported. There were very few instances where the lone mother coefficient was significantly different from zero at conventional acceptance levels. Lone mothers are, however, much less satisfied with life and this is highly significant, even after controlling for income. Lone mothers, on average, used more bed days in 1985 but not significantly so in the other two surveys. The data on self-reported health status tends to show that lone mothers (after controlling for education, income and life-style factors) have better health status. Once social interaction is controlled for lone motherhood is more strongly associated with higher health status.

When looking at raw averages, lone mothers had consistently lower scores on all of the health status measures. Once income, education, life-style factors, the presence of children and social interaction and other confounding factors are controlled for lone mothers are no worse off than married mothers when it comes to health status and in some cases may be better off.

A speculative explanation for the increase in the positive correlation between lone motherhood and health status after controlling for social support and interaction is the following. The presence of children in the household offers some social support to the female parent. The additional support offered by a spousal relationship may be offset by the fact that the female has more family responsibilities. She not only has to look after the children but most likely has to devote time to looking after the spouse's needs. Once again, the female has less time to look after her own health. If social interaction is controlled for what could be driving the higher health status of lone parents is the additional time a married parent must spend to support the spousal relationship.

According to Grossman (1972, 1972a) an individual must use intermediate inputs and time to produce a final good, in this case, health. The lone-female parent does not have to devote time to the production of the spouse's final goods, including health. The time she does not have to devote to this production may outweigh the time she would have gained from the assistance of the spouse in household

production of final goods for the family. If this is so, one assumes that the female parent places a higher priority on the production of health of her spouse and children than her own health, then a lone mother may have more time to devote to the production of her own health than a married female.

Another explanation for the positive relationship between lone motherhood and self-reported health status comes from a recent investigation by Kingston-Riechers (1998). She finds that 53% of women who leave their first marriage claim that they suffered physical violence in the relationship. If the lone mother has left an abusive relationship and is starting over she may feel healthier and have more self confidence, and therefore report a high level of health.

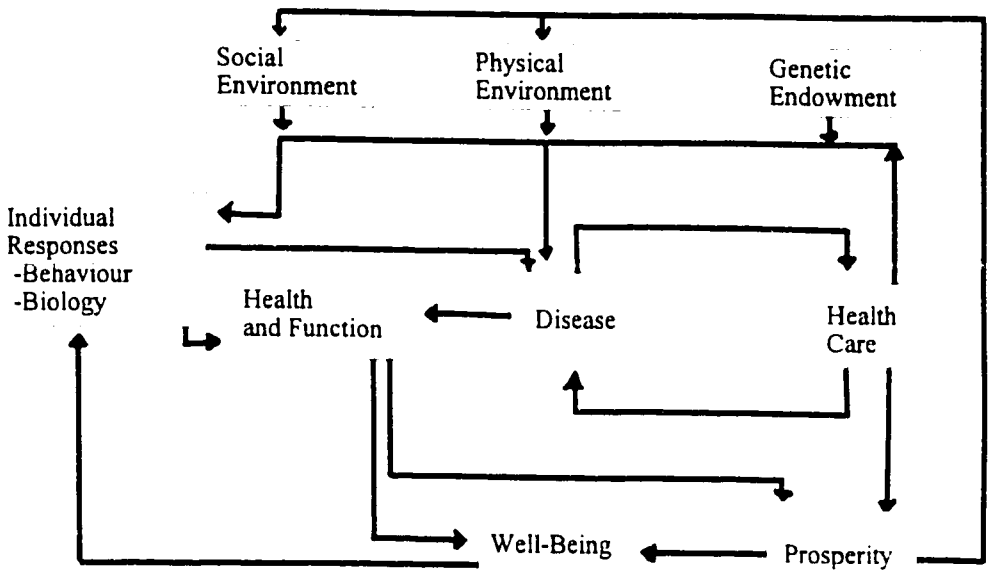
The evidence presented in this paper does not support the notion that marital status is a function of health status rather than health status being determined by marital status. If lower health status was the cause of marital dissolution or a marriage never taking place then the mothers who are not married would be expected to have significantly lower health status than those who are married, after controlling for other factors. The data do not support this. Evidence continues to grow that it is poverty and low levels of education and the life styles that accompany these characteristics that may have more to do with the poor health status of lone parents than their marital status does.

Notes

1. Families are classified as poor if they have one or more adults and children present under the age of 18 and family income does not exceed the Statistics Canada Low Income Cutoff Point (LICO)

2. The five health problems 1) Cardiac 2) Hypertension 3) Respiratory (asthma, bronchitis, or emphysema) 4) Arthritis/Rheumatism and 5) Diabetes were chosen because they are serious, usually chronic health problems. There were specific questions in the data pertaining to whether or not individuals had been "diagnosed" with the problems.

Figure 2.1



Source: Evans and Stoddart (1990), Figure 5 page 1359

This diagram presents a conceptual framework which illustrates the complex inter-relationships between health and the many determinants of health. An individual's genetic endowment, social and physical environment and the way the individual reacts to those environments are determinants of the individual's health. The health status of individuals will, in part, determine their (and the nation's) prosperity and well-being. That prosperity and well-being will influence the social and physical environments of the individuals. Prosperity will also partly determine the resources available to devote to the health care system. From this framework it is evident the formal health care system is but one factor in the determination of the individuals and the population's health status. It is possible that the health care system may have a negative effect on prosperity and therefore well-being if too many resources are being devoted to the health care system.

Table 2.1 **Weighted Means of Health Status Measures**

	1985 GSS		1991 GSS		1994 NPHS	
	Two Parent	Lone Mother	Two Parent	Lone Mother	Two Parent	Lone Mother
Self Reported Health Status						
Excellent	39.0%	32.3%	27.1%	23.8%	29.9%	24.8%[a]
Very Good	na	na	37.7%	29.2%[b]	37.1%	34.3%
Good	50.6%	43.0%	27.4%	26.7%	25.9%	27.7%
Poor	8.8%	18.2%[a]	5.3%	16.9%[a]	6.0%	9.1%[b]
Very Poor	1.6%	6.6%[a]	2.4%	3.2%	1.1%	3.9%[a]
Life Satisfaction						
Very Satisfied	50.1%	26.8%[a]	75.1%	50.2%[a]	na	na
Some Satisfaction	45.3%	52.2%	22.8%	34.0%[a]	na	na
Some Dissatisfaction	4.1%	16.5%[a]	1.4%	10.4%[a]	na	na
Very Unsatisfied	0.6%	4.5%[a]	0.7%	5.4%[a]	na	na
Non-Categorical Measures						
Diagnosed Health Problem	29.8%	35.4%	30.1%	43.8%[a]	18.2 %	24.7%[a]
HUI2 Score	na	na	na	na	0.92	0.87 [a]
Number of Bed days	0.278	0.21	0.157	0.253	0.145	0.247 [a]
Number of Hospital Nights	0.979	0.906	0.938	1.174	0.731	0.928 [c]
Number of Activity days	0.624	0.781	0.346	0.719 [a]	0.684	.914 [b]

[a] Indicates significance at 1% level [b] Indicates significance at 5% level [c] Indicates significance at 10% level

Table 2.2

Correlation of Health Status Measures

GSS - 1985

	Self-Reported	Health Problem	Number Bed days	Decreased Activity	Nights in Hospital
HS Problem	-0.3185	1.0000			
Number of Bed days	-0.1418	0.0775	1.0000		
Decreased Activity	-0.2491	0.1343	0.2985	1.0000	
Nights in Hospital	-0.1730	0.0363	0.2623	0.2850	1.0000
Life Satisfaction	0.2291	-0.1438	-0.0225	-0.0685	0.0131

Correlation of Health Status Measures

GSS - 1991

	Self-Reported	Health Problem	Number Bed days	Decreased Activity	Nights in Hospital
HS Problem	-0.3347	1.0000			
Number of Bed days	-0.1958	0.0912	1.0000		
Decreased Activity	-0.2326	0.0867	0.2487	1.0000	
Nights in Hospital	-0.1143	0.0172	0.1942	0.0969	1.0000
Life Satisfaction	0.2889	-0.1322	-0.1324	-0.1524	-0.0517

Correlation of Health Status Measures

NPHS - 1994

	Self-Reported	Health Problem	Number Bed days	Decreased Activity	Nights in Hospital
HS Problem	-0.3069	1.0000			
Number of Bed days	-0.1436	0.0657	1.0000		
Decreased Activity	-0.2156	0.1169	0.3087	1.0000	
Nights in Hospital	-0.1168	0.0556	0.1335	0.0882	1.0000
HUI2 Score	0.4610	-0.2439	-0.1191	-0.2876	-0.0640

Table 2.3

Ordered Logit - Self-Reported Health Status

	1985		1991		1994	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Lone mom	-0.164	(0.219)	0.318	(0.169)	0.232	(0.118)
$9,999	0.288	(0.314)	-1.645	(0.270)	-0.486	(0.187)
$14,999	-0.214	(0.275)	-0.862	(0.247)	-0.490	(0.165)
$19,999	-0.616	(0.277)	-0.426	(0.216)	-0.432	(0.161)
$29,999	-0.218	(0.182)	-0.387	(0.153)	-0.348	(0.126)
$39,999	-0.086	(0.177)	-0.028	(0.146)	-0.332	(0.113)
$79,999[1]	0.401	(0.281)	0.151	(0.156)	0.080	(0.119)
$80,000	0.252	(0.326)	0.329	(0.202)	0.515	(0.131)
Social Assist[2]	-0.691	(0.258)			-0.406	(0.135)
# in house	0.111	(0.108)	0.095	(0.061)	0.032	(0.050)
24 yrs	0.033	(0.245)	0.362	(0.222)	0.256	(0.162)
25-29 yrs	0.126	(0.152)	0.140	(0.141)	0.152	(0.114)
40-49 yrs	0.429	(0.167)	0.222	(0.136)	-0.126	(0.108)
50-59 yrs	-0.406	(0.369)	0.193	(0.257)	-0.080	(0.171)
university	0.137	(0.229)	-0.060	(0.181)	0.145	(0.139)
post high	0.013	(0.154)	0.067	(0.125)	-0.067	(0.093)
less high	-0.417	(0.171)	-0.343	(0.151)	-0.443	(0.115)
# of smokes	-0.020	(0.006)	-0.021	(0.005)	-0.026	(0.004)
moderate	0.287	(0.144)	0.363	(0.127)	0.330	(0.086)
active	0.318	(0.177)	0.653	(0.140)	0.480	(0.100)
child <5yrs[1]			0.185	(0.148)	0.569	(0.127)
child 6-11			0.044	(0.134)	0.291	(0.115)
unemploy	-0.139	(0.250)	0.047	(0.199)	0.291	(0.178)
not in lf	-0.141	(0.137)	0.015	(0.149)	-0.231	(0.154)
professional[4]			0.335	(0.203)	0.109	(0.152)
semiprof			-0.133	(0.162)	0.163	(0.122)
skilled			0.294	(0.172)	0.194	(0.128)
unskilled			0.098	(0.162)	0.021	(0.119)
no pinco			-0.278	(0.240)	-0.005	(0.169)
nfld	0.102	(0.264)	0.266	(0.213)	0.282	(0.162)
pei	0.746	(0.630)	0.198	(0.305)	0.181	(0.164)
ns	0.070	(0.284)	-0.128	(0.203)	0.173	(0.174)
nb	0.366	(0.301)	-0.069	(0.204)	-0.304	(0.159)
que	0.431	(0.176)	-0.387	(0.155)	0.112	(0.113)
man	-0.494	(0.229)	-0.067	(0.205)	0.065	(0.140)
sask	-0.134	(0.248)	0.086	(0.206)	-0.231	(0.164)
alb	-0.222	(0.214)	0.032	(0.167)	-0.046	(0.138)
bc	-0.191	(0.243)	-0.183	(0.173)	-0.334	(0.113)
_cut1	-3.5876	(0.506)	-3.476	(0.360)	-4.202	(0.285)
_cut2	-1.8144	(0.478)	-1.887	(0.329)	-2.368	(0.252)
_cut3	0.90838	(0.473)	-0.022	(0.321)	-0.523	(0.246)
_cut4			1.693	(0.324)	1.339	(0.247)
N	1108		1613		2893	
Adjusted R^2	0.0446		0.0502		0.0515	

1 Income categories are $74,999 and > $75,000 in 1985 2. Not available in GSS_91 3,4 Not available in GSS_85

Table 2.4

Logit - Diagnosed Health Problems

	1985		1991		1994	
	Coef.	Std. Err	Coef.	Std. Err.	Coef.	Std. Err.
Lone mom	-0.025	(0.252)	0.264	(0.201)	-0.008	(0.158)
$9,999	-0.142	(0.361)	0.102	(0.312)	0.643	(0.240)
$14,999	-0.084	(0.319)	0.215	(0.284)	0.400	(0.221)
$19,999	-0.007	(0.306)	-0.243	(0.261)	0.405	(0.219)
$29,999	-0.250	(0.214)	-0.459	(0.193)	0.316	(0.180)
$39,999	-0.248	(0.210)	-0.046	(0.184)	0.361	(0.162)
$79,999[1]	-1.072	(0.378)	-0.132	(0.201)	0.442	(0.167)
$80,000	-0.228	(0.383)	-0.104	(0.258)	-0.026	(0.192)
Social Assist[2]	-0.000	(0.296)			0.087	(0.176)
# in house	-0.177	(0.126)	0.025	(0.075)	-0.141	(0.070)
24 yrs	-0.750	(0.307)	0.334	(0.279)	-0.166	(0.233)
25-29 yrs	-0.454	(0.187)	0.001	(0.187)	-0.096	(0.172)
40-49 yrs	0.467	(0.195)	0.487	(0.160)	0.225	(0.144)
50-59 yrs	1.872	(0.415)	0.832	(0.292)	0.556	(0.207)
university	-0.152	(0.278)	-0.229	(0.240)	0.059	(0.206)
post high	-0.024	(0.185)	0.259	(0.162)	0.331	(0.138)
less high	0.299	(0.197)	0.553	(0.183)	0.427	(0.157)
# of smokes	0.030	(0.006)	0.019	(0.006)	0.017	(0.005)
moderate	-0.021	(0.166)	-0.177	(0.152)	-0.081	(0.121)
active	-0.067	(0.211)	-0.363	(0.173)	-0.087	(0.138)
child <5yrs[1]			-0.762	(0.186)	-0.726	(0.174)
child 6-11			-0.259	(0.157)	-0.394	(0.153)
unemploy	0.267	(0.286)	0.486	(0.231)	0.168	(0.233)
not in lf	-0.008	(0.160)	0.381	(0.183)	0.374	(0.213)
professional[4]			-0.042	(0.255)	0.254	(0.220)
semi-prof			0.014	(0.205)	0.277	(0.176)
skilled			-0.447	(0.227)	0.181	(0.187)
unskilled			0.129	(0.198)	0.113	(0.175)
no pnco			-0.041	(0.272)	0.240	(0.231)
nfld	0.242	(0.293)	-0.050	(0.259)	-0.284	(0.220)
pei	0.243	(0.726)	0.168	(0.370)	0.068	(0.215)
ns	-0.141	(0.325)	-0.076	(0.260)	-0.155	(0.231)
nb	-0.642	(0.379)	-0.113	(0.259)	-0.105	(0.210)
que	-0.430	(0.208)	-0.191	(0.192)	-0.488	(0.158)
man	0.658	(0.252)	0.037	(0.250)	-0.124	(0.199)
sask	-0.364	(0.317)	0.206	(0.250)	-0.125	(0.229)
alb	-0.219	(0.255)	-0.004	(0.208)	-0.234	(0.196)
bc	-0.453	(0.300)	-0.280	(0.220)	-0.232	(0.162)
const	-0.192	(0.543)	-0.841	(0.396)	-1.335	(0.346)
N	1108		1613		2893	
Adjusted R^2	0.070		0.090		0.066	

1 Income categories are $74,999 and ≥$75,000 in 1985 2 Not available in GSS_91 3,4 Not available in GSS_85

Table 2.5

Poisson - Number of Bed Days

	1985		1991		1994	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Lone mom	0.740	(0.220)	0.187	(0.199)	0.123	(0.153)
$9,999	-1.170	(0.363)	0.214	(0.313)	-0.006	(0.242)
$14,999	0.077	(0.231)	0.780	(0.280)	0.430	(0.200)
$19,999	-0.471	(0.260)	0.365	(0.269)	-0.336	(0.232)
$29,999	-1.133	(0.224)	0.550	(0.205)	0.023	(0.173)
$39,999	-0.527	(0.189)	0.114	(0.230)	-0.234	(0.172)
$79,999[1]	0.088	(0.260)	0.521	(0.227)	0.059	(0.166)
$80,000	-0.113	(0.358)	0.340	(0.308)	0.265	(0.169)
Social Assist[2]	-0.428	(0.286)			0.027	(0.170)
# in house	0.309	(0.115)	-0.032	(0.077)	-0.080	(0.065)
24 yrs	1.442	(0.208)	0.132	(0.280)	0.732	(0.171)
25-29 yrs	0.394	(0.163)	0.675	(0.165)	-0.238	(0.166)
40-49 yrs	-0.029	(0.191)	0.054	(0.175)	-0.313	(0.139)
50-59 yrs	-0.645	(0.514)	0.013	(0.272)	-0.917	(0.267)
university	0.112	(0.256)	-0.064	(0.289)	0.323	(0.195)
post high	0.220	(0.163)	0.221	(0.182)	0.320	(0.139)
less high	0.224	(0.184)	0.454	(0.194)	0.491	(0.156)
# of smokes	0.002	(0.006)	0.013	(0.006)	-0.002	(0.005)
moderate	0.520	(0.154)	-0.803	(0.144)	0.017	(0.110)
active	-0.547	(0.235)	-0.366	(0.161)	-0.284	(0.134)
child <5yrs[3]			-0.470	(0.186)	-0.385	(0.164)
child 6-11			-0.419	(0.167)	-0.020	(0.145)
unemploy	-1.426	(0.510)	0.152	(0.240)	0.040	(0.250)
not in lf	0.177	(0.139)	0.446	(0.189)	-0.193	(0.223)
professional[4]			0.012	(0.293)	0.292	(0.204)
semi-prof			0.008	(0.231)	0.126	(0.172)
skilled			-0.061	(0.250)	0.062	(0.187)
unskilled			0.137	(0.219)	-0.019	(0.179)
no pineo			0.460	(0.198)	0.613	(0.238)
nfld	-0.529	(0.359)	-0.558	(0.314)	-0.888	(0.276)
pei	-12.15	(175.2)	0.608	(0.313)	0.337	(0.177)
ns	-0.263	(0.306)	0.077	(0.240)	-0.408	(0.245)
nb	0.568	(0.274)	0.457	(0.204)	-0.836	(0.272)
que	-0.241	(0.199)	-0.422	(0.201)	-0.621	(0.163)
man	0.197	(0.208)	-1.218	(0.379)	-0.077	(0.179)
sask	-0.394	(0.281)	-0.437	(0.301)	-0.518	(0.245)
alb	-0.040	(0.218)	-0.404	(0.236)	0.453	(0.146)
bc	0.350	(0.225)	0.392	(0.195)	-0.052	(0.145)
const	-2.822	(0.498)	-1.801	(0.417)	-1.616	(0.328)
N	1108		1613		2893	
Adjusted R^2	0.094		0.104		0.059	

1 Income categories are $74,999 and ≥$75,000 in 1985 2 Not available in GSS_91. 3,4 Not available in GSS_85

Table 2.6

	Ordered Logit - Satisfaction with Life				Tobit - HUI2 Score	
	1985		1991		1994	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Lone mom	-1.001	(0.228)	-0.800	(0.194)	-0.006	(0.010)
≤ $9,999	-0.296	(0.319)	-1.068	(0.302)	-0.025	(0.015)
$14,999	-0.308	(0.281)	-0.567	(0.273)	-0.027	(0.014)
$19,999	-0.747	(0.279)	-0.395	(0.252)	-0.012	(0.013)
$29,999	0.006	(0.189)	-0.146	(0.189)	-0.014	(0.011)
$39,999	-0.043	(0.185)	-0.111	(0.188)	0.003	(0.010)
$79,999[1]	0.442	(0.296)	0.036	(0.208)	-0.011	(0.010)
$80,000	0.421	(0.348)	0.280	(0.272)	0.010	(0.011)
Social Assist[2]	-0.077	(0.263)			-0.019	(0.011)
# in house	-0.228	(0.113)	0.059	(0.074)	0.008	(0.004)
24 yrs	0.416	(0.257)	0.597	(0.280)	0.016	(0.014)
25-29 yrs	0.237	(0.158)	0.270	(0.180)	0.001	(0.010)
40-49 yrs	-0.011	(0.181)	-0.319	(0.163)	-0.023	(0.009)
50-59 yrs	-0.554	(0.370)	0.343	(0.319)	-0.030	(0.014)
university	-0.065	(0.242)	-0.477	(0.230)	0.007	(0.012)
post high	-0.390	(0.161)	-0.262	(0.160)	-0.003	(0.008)
less high	-0.196	(0.176)	-0.055	(0.187)	-0.019	(0.009)
# of smokes	-0.021	(0.006)	-0.019	(0.006)	-0.001	(0.000)
moderate	0.380	(0.147)	0.353	(0.148)	0.024	(0.007)
active	0.450	(0.183)	0.614	(0.171)	0.031	(0.008)
child <5yrs[3]			-0.013	(0.182)	0.037	(0.010)
child 6-11			0.082	(0.161)	0.021	(0.009)
unemploy	-0.218	(0.259)	-1.021	(0.216)	-0.023	(0.013)
not in lf	-0.114	(0.140)	-0.193	(0.181)	-0.032	(0.013)
professional[4]			0.175	(0.250)	-0.010	(0.013)
semi-prof			0.313	(0.208)	-0.006	(0.010)
skilled			0.356	(0.220)	-0.007	(0.011)
unskilled			0.075	(0.199)	-0.004	(0.010)
no pineo			0.317	(0.282)	-0.018	(0.014)
nfld	0.353	(0.282)	-0.141	(0.267)	0.019	(0.013)
pei	0.670	(0.716)	0.038	(0.401)	0.024	(0.014)
ns	0.709	(0.305)	-0.031	(0.266)	-0.014	(0.014)
nb	-0.486	(0.303)	-0.104	(0.264)	0.015	(0.013)
que	-0.688	(0.179)	-0.260	(0.190)	0.017	(0.009)
man	0.084	(0.240)	-0.163	(0.259)	0.017	(0.012)
sask	-0.437	(0.263)	-0.687	(0.247)	-0.018	(0.014)
alb	0.057	(0.223)	-0.219	(0.213)	-0.002	(0.011)
bc	0.031	(0.252)	-0.235	(0.216)	0.008	(0.010)
_cut1	-6.316	(0.600)	-4.465	(0.436)	0.919	(0.020)
_cut2	-4.162	(0.510)	-3.253	(0.409)		
_cut3	-1.069	(0.488)	-1.099	(0.396)		
N	1108		1613		2893	
Adjusted R^2	0.075		0.082		Log Likelihood	338.59

1 The last two income categories are $74,999 and ≥$75,000 in 1985 2 No proxies available in GSS_91 3,4 No proxies available in GSS_85

Table 2.7

Social Support Controls Included - NPHS

	Self-Reported HS		HS Problem		HUI2 Score	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Lone mom	0.311	(0.119)	-0.042	(0.159)	0.002	(0.010)
Social Support	0.333	(0.056)	-0.087	(0.071)	0.040	(0.004)
Social Interact	0.037	(0.015)	0.021	(0.021)	0.003	(0.001)
Freq of Cont	0.061	(0.041)	0.064	(0.056)	0.011	(0.003)
$9,999	-0.447	(0.188)	0.654	(0.243)	-0.018	(0.015)
$14,999	-0.457	(0.165)	0.416	(0.221)	-0.019	(0.013)
$19,999	-0.409	(0.161)	0.421	(0.220)	-0.005	(0.013)
$29,999	-0.337	(0.113)	0.327	(0.181)	-0.012	(0.010)
$39,999	-0.333	(0.113)	0.359	(0.163)	0.003	(0.009)
$79,999	0.085	(0.120)	0.443	(0.168)	-0.010	(0.010)
≥$80,000	0.509	(0.131)	-0.019	(0.192)	0.010	(0.011)
Social Assist	-0.358	(0.135)	0.073	(0.177)	-0.015	(0.011)
# in house	-0.038	(0.051)	-0.167	(0.071)	0.008	(0.004)
24 yrs	0.274	(0.163)	-0.146	(0.234)	0.018	(0.134)
25-29 yrs	0.155	(0.096)	-0.068	(0.174)	0.001	(0.093)
40-49 yrs	-0.145	(0.109)	0.230	(0.145)	-0.024	(0.087)
50-59 yrs	-0.092	(0.172)	0.554	(0.208)	-0.031	(0.014)
university	0.135	(0.140)	0.049	(0.207)	0.009	(0.011)
post high	-0.050	(0.094)	0.320	(0.139)	0.000	(0.008)
less high	-0.405	(0.116)	0.415	(0.158)	-0.014	(0.009)
# of smokes	-0.023	(0.004)	0.017	(0.005)	-0.001	(0.000)
moderate	0.296	(0.087)	-0.112	(0.122)	0.019	(0.007)
active	0.457	(0.101)	-0.116	(0.140)	0.027	(0.008)
child <5yrs	0.578	(0.127)	-0.726	(0.175)	0.036	(0.010)
child 6-11yrs	0.278	(0.116)	-0.380	(0.154)	0.019	(0.009)
unemploy	0.276	(0.177)	0.160	(0.234)	-0.024	(0.014)
not in lf	-0.205	(0.154)	0.349	(0.215)	-0.027	(0.013)
professional	0.087	(0.152)	0.265	(0.221)	-0.014	(0.012)
semiprof	0.132	(0.122)	0.279	(0.177)	-0.012	(0.010)
skilled	0.184	(0.129)	0.175	(0.188)	-0.011	(0.011)
unskilled	-0.016	(0.119)	0.134	(0.176)	-0.006	(0.010)
no pineo	-0.052	(0.169)	0.288	(0.233)	-0.025	(0.014)
nfld	0.187	(0.164)	-0.352	(0.224)	0.007	(0.013)
pei	0.096	(0.165)	0.024	(0.217)	0.014	(0.014)
ns	0.120	(0.174)	-0.194	(0.232)	-0.019	(0.014)
nb	-0.325	(0.161)	-0.151	(0.210)	0.012	(0.013)
que	0.146	(0.114)	-0.515	(0.160)	0.019	(0.009)
man	0.040	(0.141)	-0.142	(0.200)	0.015	(0.012)
sask	-0.303	(0.164)	-0.138	(0.230)	-0.025	(0.013)
alb	-0.068	(0.139)	-0.265	(0.197)	-0.003	(0.011)
bc	-0.358	(0.114)	-0.222	(0.163)	0.006	(0.009)
constant			-1.230	(0.474)	0.707	(0.028)
_cut1	-2.585	(0.373)				
_cut2	-0.740	(0.351)				
_cut3	1.132	(0.351)				
_cut4	3.013	(0.354)				
Adjusted R^2	0.058		0.068		397.14[1]	

[1] Log Likelihood

APPENDIX 2.1
DESCRIPTION OF THE VARIABLES USED IN ESTIMATION

Dependent Variables - Health Measures	
Variable	Description
Self-Reported Health Status	Self Reported Health Status- GSS_85: Poor; Fair; Good; and Excellent. 1996 GSS and NPHS : Poor; Fair; Good; Very Good; and Excellent. ***Categorical Variable*** (Ordered Logit)
Diagnosed Health Problem	Presence of at least One of Five Health Problems - 1) Cardiac 2) Hypertension 3) Respiratory (asthma, bronchitis, or emphysema) 4) Arthritis/Rheumatism 5) Diabetes ***Dichotomous Variable*** (Logit)
Life Satisfaction	Self Reported Overall Life Satisfaction - GSS_85 and GSS_91: Very Dissatisfied; Somewhat Dissatisfied; Somewhat Satisfied; Very Satisfied. Not available in the NPHS. ***Categorical Variable*** (Ordered Logit)
Number of Bed Days	Number of Days Spent in Bed in the last two weeks because of Health ***Censored Integer*** (Poisson reported - Tobit similar results)
Number of Activity Days Lost	Number of Days Individual Decreased Activity in the last two weeks because of Health ***Censored Integer*** (Not Reported)
Number of Nights in Hospital	Number of Nights spent in Hospital, Nursing Home, etc. in the last year ***Censored Integer*** (Not Reported)
HUI2 Score	Global Utility Score for Health-Related Quality of Life (based on HUI3 data) - available only in the NPHS. ***Censored Continuous Variable*** (Tobit)

Independent Variables	
Variable	Description
Lone Mom	dummy variable equal to one if the individual claims to be lone parent and has no partner living in the household.
<$9,999	dummy variable equal to one if family income ≤ $9,999.00.
$14,999	dummy variable equal to one if family income >$9,999.00 & ≤ $14,999.00.
$19,999	dummy variable equal to one if family income >$14,999.00 & ≤ $19,999.00.
$29,999	dummy variable equal to one if family income >$19,999.00 & ≤ $29,999.00.
$39,999	dummy variable equal to one if family income >$29,999.00 & ≤ $39,999.00.
$59,999	dummy variable equal to one if family income >$39,999.00 & ≤$59,999.00 (C)[1]
$79,999[2]	dummy variable equal to one if family income >$59,999.00 & ≤ $14,999.

≥ $80,000	dummy variable equal to one if family income ≥ $80,000.
Social Assist	dummy variable equal to one if government transfers are 60% of family income (GSS_85), not available in GSS_91, or family receives social assistance (NPHS).
# in House	integer equalling the number of individuals in living in the household. Capped at in the GSS_85 and GSS_91 and NPHS.
≤ 24 yrs	dummy variable equal to one if female is ≤ 24 years of age.
25-29 yrs	dummy variable equal to one if female is ≥ 25 and ≤ 29 years of age.
30-39 yrs	dummy variable equal to one if female is ≥ 30 and ≤ 39 years of age (C).
40-49 yrs	dummy variable equal to one if female is ≥ 40 and ≤ 49 years of age.
50-59 yrs	dummy variable equal to one if female is ≥ 50 and ≤ 59 years of age.
University	dummy variable equal to one if the individual has a university degree or higher.
Post high	dummy variable equal to one if the individual has some any post high school education but no university degree. This category includes college and trade-school diplomas.
Highschool	dummy variable equal to one if the individual has graduated highschool. (C)
Less high	dummy variable equal to one if has less than high school diploma.
#Smokes	Number of cigarettes individual smokes per day.
Sedentary	dummy variable equal to one if the individual has a sedentary lifestyle (C).
Moderate	dummy variable equal to one if the individual has a moderate lifestyle.
Active	dummy variable equal to one if the individual has an active lifestyle.
Child <5 yrs	dummy variable equal to one if the youngest child in household is under 5 years of age.
Child 6-11 yrs	dummy variable equal to one if the youngest child in household is 6 to 11 years old.
Child > 11 yrs	dummy variable equal to one if the youngest child in household is over 11 years old. (C)
Unemploy	dummy variable equal to one if the individual is unemployed.
Not in lf	dummy variable equal to one if the individual is not employed or unemployed.
Employed	dummy variable equal to one if the individual is currently working. (C)
Professional	dummy variable equal to one if the individual has a professional occupation. Not in GSS_85.
Semi-prof	dummy variable equal to one if the individual semi-professional occupation. Not in GSS_85.

Skilled	dummy variable equal to one if the individual is classified as a skilled worker. Not in GSS_85.
Semi-skilled	dummy variable equal to one if the individual is classified as a semi-skilled worker. Not in GSS_85. (C)
Unskilled	dummy variable equal to one if the individual is an unskilled worker. Not in GSS_85.
No Pineo	dummy variable equal to one if the individual has no pineo classification. Not in GSS_85.
Nfld	dummy variable equal to one if the individual resides in Newfoundland.
PEI	dummy variable equal to one if the individual resides in Prince Edward Island.
NB	dummy variable equal to one if the individual resides in New Brunswick.
NS	dummy variable equal to one if the individual resides in Nova Scotia.
Que	dummy variable equal to one if the individual resides in Quebec.
Ont	dummy variable equal to one if the individual resides in Ontario. (C)
Man	dummy variable equal to one if the individual resides in Manitoba.
Alb	dummy variable equal to one if the individual resides in Alberta.
BC	dummy variable equal to one if the individual resides in British Columbia.
Social Support	Perceived social support index measures if the individual feels they have someone they can confide in, count on, give them advice and make them feel loved. The higher the score the more social support the individual believes they have.
Social Involvement	Social involvement is measured participation in associations, voluntary organizations or by attendance at religious activities in the last year. A higher score means more involvement.
Freq of Cont.	Measures the frequency of contacts in the past 12 months with family and friends outside the household and neighbours. A higher score indicates more contacts.
Note: If a variable is equal to one in a situation it is equal to zero in all others.	

[1](C) = comparator [2] The last two income categories are $74,999 and + $75,000 in 1985

APPENDIX 2.2

Variable Means (Weighted)						
	1985 GSS		1991 GSS		1994 NPHS	
	Two Parent	Lone Mother	Two Parent	Lone Mother	Two Parent	Lone Mother
Inc < $9,999	2.5%	31.6%[a]	0.9%	22.7%[a]	2.5%	10.7%[a]
10,000-14,999	3.8%	19.2%[a]	1.9%	19.8%[a]	3.7%	26.1%[a]
15,000 - 19,999	5.1%	15.6%[a]	4.1%	17.8%[a]	4.4%	15.7%[a]
20,000 - 29,999	21.6%	20.6%	15.7%	17.9%	7.8%	16.7%[a]
30,000 - 39,999	25.8%	8.1%[a]	17.5%	11.1%[b]	14.3%	15.4%
40,000 - 59,999	28.3%	4.0%[a]	31.1%	9.7%[a]	32.6%	10.5%[a]
60,000-79,999^	7.4%	0.7%[a]	18.2%	1.0%[a]	17.9%	3.5%[a]
Inc ≥$80,000^	5.5%	0.2%[b]	10.5%	0.0%[a]	16.7%	1.3%[a]
University	10.6%	8.4%	14.7%	13.0%	16.7%	7.4%[a]
Some post H.S.	33.7%	37.5%	40.7%	37.4%	45.1%	50.2%[b]
H. S. Graduate	27.4%	18.6%[b]	22.4%	17.5%[c]	21.5%	14.9%[a]
Less than H. S.	28.3%	25.6%[c]	22.2%	32.2%[a]	15.7%	26.8%[a]
Age ≤ 24 years	5.9%	9.9%[c]	4.0%	10.0%[a]	3.3%	8.3%[a]
25 - 29 years	19.7%	18.7%	16.0%	10.4%[b]	10.9%	13.5%[a]
30 - 39 years	48.6%	47.9%	46.6%	38.6%[b]	44.4%	44.1%
40 - 49 years	20.7%	21.2%	27.8%	30.2%	33.1%	25.7%[a]
50 - 59 years	5.1%	2.3%	5.5%	10.7%[a]	8.3%	8.4%
Unemployed	3.7%	15.7%[a]	4.7%	10.1%[a]	3.1%	4.6%[c]
Not in LF	35.8%	29.9%	29.0%	27.3%	30.1%	40.9%[a]
Professional	na	na	13.1%	11.6%	10.0%	8.0%
Semi-Profess	na	na	18.6%	16.1%	17.8%	18.3%
Skilled	na	na	17.7%	13.7%	13.1%	10.4%[c]
Semi-skilled	na	na	25.4%	30.1%	19.7%	15.0%[b]
Unskilled	na	na	2.04%	18.5%	13.4%	11.4%
No Pineo	na	na	4.7%	10.0%[a]	26.1%	37.0%[a]

Social Assist	4.0%	31.4%[a]	na	na	5.7%	44.7%[a]
# in Household	3.66	2.80[a]	3.9	2.7[a]	3.89	2.79[a]
Child ≤ 5 years	na	na	38.7%	26.6%[a]	42.6%	38.2%[c]
Child 6-11yrs	na	na	26.7%	26.8%	39.1%	42.1%
# cigarettes/day	5.71	10.65[a]	5.1	8.8[a]	3.98	8.76[a]
Sedentary	27.3%	28.1%	23.7%	23.3%	62.5%	64.7%
Moderate	52.4%	48.4%	49.6%	53.4%	20.5%	17.8%
Active	20.3%	23.6%	26.7%	23.3%	14.0%	17.5%[b]
Newfoundland	2.1%	1.3%	2.6%	1.6%	2.2%	1.2%
P.E.I	0.3%	0.0%	0.6%	0.2%	0.5%	0.4%
Nova Scotia	2.0%	2.2%	3.8%	4.3%	2.9%	3.6%
New Brunswick	2.1%	1.3%	3.8%	2.9%	2.6%	1.6%
Quebec	30.1%	30.4%	26.4%	30.1%	23.7%	28.8%[b]
Ontario	37.6%	33.2%	31.0%	31.1%	38.2%	36.9%
Manitoba	5.5%	3.6%	4.8%	5.1%	3.6%	3.1%
Saskatchewan	3.9%	3.1%	4.0%	3.1%	3.2%	3.5%
Alberta	7.7%	8.4%	11.1%	18.7%	10.3%	9.5%
BC	8.4%	7.9%	11.9%	12.8%	12.9%	11.5%
# Observations	920	188	1269	344	2177	716
% Observations	83%	17%	79%	21%	75%	25%

[a] In the GSS_85 the last two income brackets were $60,000 - $74,999 and Income >= $75, 000

[a] Indicates significance at 1% level [b] Indicates significance at 5% level [c] Indicates significance at 10% level

APPENDIX 2.3

ORDERED LOGIT MODEL

(Becker and Kennedy 1992, Greene 1993, Maddala 1992, StataCorp. 1997, 1997a)

The ordered logit model is used when the qualitative dependent variable in the estimation equation is an ordered categorical variable and a logistically distributed error term. In this paper self-reported health status is such a variable. Individuals were given five categories in which to classify their health status: one representing very poor health status; two - poor: three - good; four - very good; and five - excellent (the GSS_85 has four categories, very good is not included). The individual's unobserved true health status will lie somewhere within the chosen category. The estimation equation for the true health status is: $HS^*=X'\beta + \mu$, where X represents the vector of characteristics, β is the vector of coefficients and μ is the error term (assumed to be logistically distributed).

Instead of observing the true health status HS^*, we observe

$$HS=1 \text{ if } HS^* \le \delta_0$$
$$HS=2 \text{ if } \delta_0 < HS^* \le \delta_1$$
$$HS=3 \text{ if } \delta_1 < HS^* \le \delta_2$$
$$HS=4 \text{ if } \delta_2 < HS^* \le \delta_3$$
$$HS=5 \text{ if } HS^* > \delta_3$$

The δ's are ancillary parameters (cuts) and are estimated along with the β's.

The probability of obtaining an observation HS=1 is the probability that $HS^* \le \delta_0$ or the probability that $\{X'\beta + \mu \le \delta_0\}$ which equals the probability that $\{\mu \le \delta_0 - X'\beta\}$. The probability obtaining HS=2 is equal to the probability that $\{\delta_0 < X'\beta + \mu_i \le \delta_1\}$ which equals the $Pr\{\delta_0 - X'\beta < \mu_i \le \delta_1 - X'\beta\}$. The numerical value of the probability can be obtained by using the logistic distribution as follows:

$$Pr\{X'\beta + \mu_i \le \delta_0\} = 1/(1+e^{X'\beta - \delta 0})$$
$$Pr\{\delta_0 < X'\beta + \mu_i \le \delta_1\} = 1/(1+e^{X'\beta - \delta 1}) - 1/(1+e^{X'\beta - \delta 0})$$
$$Pr\{\delta_1 < X'\beta + \mu_i \le \delta_2\} = 1/(1+e^{X'\beta - \delta 2}) - 1/(1+e^{X'\beta - \delta 1})$$

$$Pr\{X'\beta + \mu_i > \delta_3\} = 1 - 1/(1+e^{X'\beta - \delta 4})$$

All probabilities are calculated in the same manner.

As a demonstration coefficients from the NPHS estimation of self-reported health status will be used to estimate the probabilities. One characteristic will differ from the comparator, holding all other characteristics constant (an individual with the same characteristics as the comparator, smoking 5 cigarettes a day and living in a household with 4 people), in each example. The first will set the income of the individual at less than ≤$9,999 (instead of $39,000 to $59,000 per year) and the second will assume the female is a lone parent (not a married parent). The ancillary parameters, δ's, are $\delta_{0,-}$=-4.202 $\delta_{1,-}$=-2.368 $\delta_{2,-}$=-0.523 $\delta_{1,-}$=1.339

Example I

The coefficient on ≤$9,999 is negative, this indicates that the probability of having very poor health status will be greater and the probability of having excellent health status will be smaller than it would be for the comparator case. However, each of the middle categories must be calculated because it can not a priori be unambiguously determined. $X'\beta$ =-0.488

Example II

The coefficient on lone mom is positive thus the probability of having very poor health status will be less and the probability of having excellent health status will be greater than it would be for the comparator case. Again the intermediate probabilities must be calculated. $X'\beta$=0.23

	< $9,999/yr	Comparator	Lone Mom
Coefficient	-0.486		0.232
Prob (Very Poor Health)	0.024	0.015	0.012
Prob (Poor Health)	0.109	0.071	0.057
Prob (Good Health)	0.357	0.287	0.251
Prob (Very Good Health)	0.371	0.420	0.432
Prob (Excellent Health)	0.139	0.207	0.248

3. Permanent Income and Family Structure Matter: Evidence on the Determinants of Child Health from the 1983 and 1987 Ontario Child Health Study

3.1 Introduction

The objective of this paper is to improve our understanding of the relationship between family socioeconomic status and child health. The nature of this relationship has important implications for the health, social, and economic policy agendas in Canada and other developed countries. Better knowledge of the factors affecting child morbidity can help to inform decisions about the relative roles of health care, social support, educational expenditures, and income support in achieving important social goals such as the improvement of child physical, social and economic welfare.

The statistical association between poor child health, especially psychosocial morbidity, and socioeconomic status in Canada has been best documented in a series of papers using data from the Ontario Child Health Study (OCHS). These studies, which are reviewed in more detail in the following section, have demonstrated that the incidence of psychiatric disorders and poor school performance is higher among children of poor families than among children of non-poor families. The OCHS data also show that children in one-parent families have more such problems than do children in two-parent families.

In this paper, we use a variety of specific indicators of child health status in the OCHS to construct a continuous measure of health status with interval scale properties based on the Health Utilities Index Mark 2 (HUI2) system. The HUI2 system is comprised of seven attributes (sensation [vision, hearing and speech], mobility, self-care, emotion, pain, cognition[2], and fertility) with three to five levels of functioning per attribute. A multi-attribute utility function has been estimated for the HUI2 system so that health status can be converted into a utility score reflecting health-related quality of life on a scale from perfect health (= 1.00) to dead (= 0.00). We analyse both the ordinal measures of health status from the seven attributes and the health utility score, which is a cardinal measure.

The outline of the paper is as follows. Section 3.2 contains a brief review of the literature on child

health and socioeconomic status. Section 3.3 is a description of the OCHS Data. The HUI2 system is discussed in Section 3.4. Section 3.5 presents a brief discussion on attrition. The descriptive statistics and the results of our multivariate analysis are in Section 3.6. Section 3.7 is a summary and conclusion.

3.2 Literature Review

The only Canadian longitudinal data available, to date, on child psychosocial morbidity come from the Ontario Child Health Study (OCHS) which was carried out in 1983 (Boyle, Offord, Hoffman et al., 1987) with a follow-up in 1987 (Offord, Boyle, Racine, et al., 1992). The main objective of this study was to obtain unbiased, precise estimates of the prevalence of child psychiatric disorders. Data were also collected on child social and educational functioning, physical health and a variety of sociodemographic variables.

Several studies using the OCHS data have examined the relationship between family economic disadvantage and child morbidity. Cadman et al. (1986) demonstrated high rates of chronic physical health problems among children in low-income families. Studies of emotional and behavioural problems have demonstrated a consistent and significant association between economic disadvantage (low income or welfare status) and psychiatric disorder (Lipman, Offord and Boyle, 1994; Lipman and Offord, 1996; Offord, Boyle and Jones, 1987). Among 4 to 11 year-old children, the odds of one or more psychiatric disorders (attention deficit hyperactivity disorder, conduct disorder or emotional disorder) for a poor child were more than three times that for a non-poor child (Lipman and Offord, 1994). These odds for a poor boy aged 6 to 11 on welfare were four times that of a non-poor boy (Offord, Boyle and Jones, 1987).

Studies of social and educational functioning have demonstrated similar significant associations between poverty and morbidity (Lipman and Offord., 1994). Furthermore, the significant association between poverty and a variety of morbidities are not limited to childhood. For example, at least one-third of children with conduct disorder continue to experience serious psychosocial difficulties into adulthood (Offord and Bennett, 1994).

Three studies have examined the influence of family structure on child psychosocial morbidity using

the OCHS data. Munroe Blum, Offord and Boyle (1988), using cross-sectional data from the 1983 OCHS, found that children in single-parent families were at a significantly increased risk of a variety of psychiatric and academic morbidities. Single-parent family status did not, however, continue to have a significant relationship with morbidity when income was controlled in the analysis. In contrast, Lipman and Offord (1996), using longitudinal OCHS data, found that both family status and poverty indicators had significant independent relationships with poor child outcomes. Dooley and Lipman (1996) examined the association between family status, as well as maternal market work and income, and child psychosocial morbidity. Young children of poor lone mothers were found to be at particular risk of psychiatric disorder and poor school performance. Older children of poor lone mothers had the highest risk of poor school performance.

The OCHS findings of the association between increased rates of child psychosocial morbidity and both poverty and single-parent family status are consistent with findings from other data (see Lipman, Offord and Dooley, 1996; Lipman and Offord, 1996; Duncan and Brooks-Gunn, 1996; Dooley et al., forthcoming). For example, examination of the association between single-mother family status and child psychosocial morbidity using preliminary data from the new Canadian National Longitudinal Survey of Children and Youth (NLSCY) confirms that almost one-third (30.4%) of 4 to 11 year-old children from single-mother families have one or more behaviour problems (hyperactivity, conduct disorder or emotional disorder) which is significantly greater than the rate among children from two-parent families (18.8%) (Lipman, Offord and Dooley, 1996). Similarly, Offord and Lipman (1996) examined the frequency of emotional and behavioural problems by income among Canadian children using NLSCY data. In general, problem levels decrease as the income level rises and the pattern of differences across income levels is highly statistically significant. However, using the NLSCY and multivariate analysis, Dooley et al. (forthcoming) found that the relationship between lone-mother status and child psychosocial health was stronger in both significance and magnitude than the relationship between poverty and child health.

3.3 Data

3.3.A The Ontario Child Health Study

The survey methods and instrumentation of the OCHS are summarized here and described in detail elsewhere (Boyle et al., 1987). The target population of the OCHS included all children born between January 1, 1966 and January 1, 1979 whose usual place of residence was a household in Ontario. Three groups of children were excluded from the survey; children living on First Nations' Reserves, children living in collective dwellings such as institutions, and children living in dwellings constructed after June 1, 1981 (Census Day). These children accounted for only 3.3% of the target population. The sampling unit consisted of all household dwellings listed in the 1981 Census of Canada. Sample selection was done by stratified clustered random sampling. Statistics Canada surveyed a total of 1,869 families and 3,294 children in 1983. The interviewers collected information from a parent (usually the mother), from a teacher for 4 to 11 year-olds and from the youth for 12 to 16 year-olds.

The target population for the follow-up survey was all children who participated in the original OCHS survey. The families were located in October and November of 1986 and information was collected in April and May of 1987. For our sample, the methods for measuring psychiatric disorder were identical in the two surveys. Very slight differences in the information for constructing the attributes for the HUI2 (discussed later) were available in the two surveys. In this study we investigate the correlations between socioeconomic characteristics and health measures over two time periods, 1983 and 1987. We estimate these relationships in each year separately and we also preform analysis which utilizes data from both panels of the survey.

Initially we analyse the 1983 OCHS data only. The 1983 sample includes 2,899 children 4 to 16 years of age that have no missing information in the variables of interest to us. The following exclusions were made from the 3,294 children available in the full 1983 sample: 56 children from lone-father families, 232 children were missing information for a dependent variable and 107 children were missing information on independent variables. Lone fathers are excluded from our sample in both survey years. Their economic status is much closer to that of couples than of lone mothers. Although we do control for income

in our analysis we believe separate analysis is needed for lone fathers. However, the number of lone fathers in the sample is too small for this. Results are presented in Section 3.5.A.

Our analysis of either the 1987 data alone or of data from both periods were performed with those observations for which the necessary information in both 1983 and 1987 was available. There were 1,317 such observations. In addition to the observations excluded for the 1983 only sample, 93 observations were excluded due to missing information on the additional independent variable investigated in this section, low-birth-weight. There were 828 observations that had to be dropped due to the miscoding of marital status in 1987, 400 observations had no information in 1987 (lost due to attrition) and 261 had missing information on the variables of interest in the 1987 data.

The attrition in the longitudinal sample is the motivation for presenting the estimates from the larger 1983-only sample as well as the longitudinal results. Presenting the results from both samples allows the readers to judge the impact of the attrition in the longitudinal sample.

3.3.B 1983-Only Sample

We measure family structure by means of a dummy variable which indicates if the child lives with a lone mother or two parents. The only information available in the OCHS is the child's current living arrangements. In some cases, this may provide an inaccurate picture of the family structure(s) in which the child has been raised. Unfortunately, the number and timing of any previous marital unions are not known.

Our income measure is a dummy variable for low income status. The only income information in the two OCHS surveys is a categorical measure of total family income in 1982 or 1986 (depending on the year of the survey) recorded in increments of $5,000 up to a maximum category of $60,000 or more. The amounts or proportions of income received from different sources, such as individual earnings, are not reported on the OCHS. Furthermore, there is no income information in the OCHS for years other than 1982 and 1986. The information on family size and area of residence in the OCHS was sufficient to assign each family the 1969 Low Income Cutoff (LICO) calculated by Statistics Canada. A family is deemed low income if its income category is below the 1969 LICO.

The mother's age variable can reflect many influences including the fact that very young and older mothers may have less healthy children than other mothers (Panis and Lillard, 1994). We attempted to construct the mother's exact age at birth of the child but this was unreliable. When we subtracted the age of the child from the age of the mother, the resulting values ranged 10 to 55. We find it difficult to believe this range. One reason for the wide range may be that it is the possible that the person identified in the survey as the child's mother is not the biological mother. Unfortunately there is no information to determine whether a child is part of a step or blended family. Therefore we decided to use a dummy variable for mother's age with 35 as the break point. One-third of the mothers were under 35 and two-thirds were over. This variable may also be acting as a proxy for human capital acquisition, i.e. informal learning and wealth accumulation. The remainder of the independent variables for 1983 are described in Table 3.1.

3.3.C Longitudinal Sample

We use two measures of lone parenthood with this sample. The first is identical to the definition used in the previous section; a lone-mother family is a family that had a lone-female parent in the year under investigation. This measure of lone motherhood is used in the cross-sectional investigations. The second is a dummy variable which indicates whether the child lived with a lone mother in either 1983 or 1987. This measure is used in the longitudinal analysis and is meant to capture the long-term effects of lone motherhood. It is possible that there are lagged effects of lone-parent family status on child health (children in lone-mother families in 1983 and two-parent families in 1987) as well it is likely that the family situation prior to family break down may affect child health (those children in two-parent families in 1983 and lone-mother families in 1987). Kingston-Reichers (1998) found, in a study of the association between the frequency of physical violence against the wife and marital breakdown, that approximately 53% of women whose first marriage ended report physical abuse prior to the end of that union. Also included are those children that were in lone-mother families in both 1983 and 1987.

We also investigate two measures of income status. A family is deemed to have low income if its

income category is below the 1969 LICO in the appropriate year, 1983 or 1987, in the cross-sectional estimations. A family was considered low income in the longitudinal estimations if the average of the 1983 and 1987 income was below the 1969 LICO. We believe this average measure provides us with a superior measure of the family's permanent income. We hypothesize that a family's permanent income will be more highly correlated with children's health outcomes than family income at any one point in time. All the other socioeconomic characteristics were measured in 1983 alone. For approximately 13% of the children, mother's education did change over the time period. However, we have some questions as to the reliability of the changes in this variable (see section 3.6.C). Therefore, we did not use the change in mother's education in these analyses.

A measure of low birth-weight was added to the equations in this section as a proxy for health endowment. As well, low birth-weight is often associated with impaired child health. (Currie, 1995; Saigal et al. 1994a, b, and 1996) Low birth-weight is also inversely related to socioeconomic status. In this section we contolled for low birth-weight to ensure that the associations between family status, poverty and maternal education and child health status were independent of the relationships with low birth-weight. A child was considered low birth-weight if their birth-weight was less than 5.5 pounds. Table 3.2 contains the definitions and number of observations (for 1983, 1987 and 1983 & 1987) for each of the socioeconomic variables (independent).

A problem in the coding of marital status for children over the age of 16 was found in the 1987 data; therefore our sample is restricted to children who were 16 years of age or under 1987[1]. We include a dummy variable for those children age 12 and 13 in 1983 to be consistent with other studies who differentiate children (under 12 years of age) from adolescents (12 and over).

3.4 The Health Utilities Index Mark 2

3.4.A Description of the Health Utilities Index Mark 2

The Health Utilities Index Mark 2 system (HUI2) is a multi-attribute health status classification system and is explained in depth elsewhere (Curtis et al. 1997, Feeny et al. 1992, 1995, 1996 and Torrance

et al. 1995, 1996). We will discuss it briefly. HUI2 is comprised of two components. First, there is a seven attribute health status classification system (Feeny et al. 1992, 1995, 1996). Second, health status is valued on the basis of a multi-attribute utility function so that categorical health status information can be translated into cardinal scores on the conventional scale of perfect health equals 1.00 and dead equals 0.00 (Torrance et al. 1995, 1996).

The HUI2 was originally developed to describe the health status of children with cancer, a group with multiple, serious health impairments. The HUI2 has discriminative validity among those with serious illnesses. It may not, however, have the ability to detect mild impairments seen in the general population. This is a possible explanation for the very high HUI2 scores attributed to a large majority of a random sample of children as will be shown in subsequent sections. Sensation (vision, hearing, and speech), mobility, emotion, cognition, self-care, pain and fertility are the attributes included in HUI2. The first six attributes listed are based on the work of Cadman and others (1984, 1986a) in which a general public sample was asked to rate the importance of 15 attributes of child health status. The six listed were judged by the general public to be the most important. Fertility was added in the context of childhood cancer to capture sub-fertility and infertility sequella associated with some childhood cancers and their treatments. The identification of six key attributes by Cadman et al. also informed the construction of the Ontario Child Health Study that is the source of the data for this study. HUI2 has been widely used to assess the health status of children (Barr et al. 1993, 1994, 1995; Billson and Walker 1994; Feeny et al. 1992, 1993; Gemke et al. 1995, 1996; Saigal et al. 1994a, 1994b, 1996).

There are three to five levels per attribute in HUI2. Attribute levels range from level 1 (normal for age) to severely impaired (lowest level for that attribute). For instance, level 1 for cognition is "Learns and remembers school work normally for age" and level 4 (the lowest) is "Unable to learn and remember". The levels for each of the six attributes relevant for this study are described in Table 3.3. The health status of a person at a point in time is described as a seven-element vector with one level per attribute. HUI2 describes 24,000 unique health states. Discussion of the specific manner in which the HUI2 was applied to

the OCHS is presented in sub-section 3.4.B.

The valuation of health status, as described in HUI2, is based on preference measurements obtained from a random sample of 194 parents of general public school-aged children in Hamilton, Ontario. Parents were asked to value a number of health states on a visual analog scale and with the standard gamble (based on von Neumann-Morgenstern utility theory). The calculation of the utility score is relatively complex. Fortunately, Torrance et al. 1996 present a simplified method of calculating the utility scores for the multiattribute health states directly using the single attribute utility functions (also see Keeney and Raiffa 1993). Table 3.3a provides the single attribute utility functions and the simplified formula for calculating the utility scores. The multiplicative form of the utility function captures simple interactions in preferences among attributes. (The more simple additive utility function was rejected by the data.) More specifically preferences in the sample revealed complementarity[3] among the attributes that comprise HUI2. The resulting utility scores derived from the estimated multi-attribute utility function provide a measure of the desirability of each health state on a scale with interval scale properties. The individual attributes used in the following analyses are presented in Table 3.4.

3.4.B Application of the Health Utilities Index Mark 2 to the Ontario Child Health Survey.

We used only the parental reports to assess the child health status with the HUI2 system even though the OCHS also contains responses from youths (children age 12 to 16) and children's teachers (for children age 4 to 11). Grootendorst et al. (1997) indicate that proxy reports should not be considered interchangeable with self-reports and, therefore, that combining information from these different sources is not advisable. Furthermore, there was substantial missing information in the teacher's reports. Hence, the parental reports offered the broadest and most consistent base from which to draw the information necessary to construct the utility score for the entire sample of children age 4-16. The total number of observations with information necessary to construct an HUI vector was 3,038. In this paper, we restrict our sample to children for whom there was complete information on both HUI2 and the independent

variables used in our multivariate analyses. There were 2,899 such children in the 1983-only sample and 1,317 in the longitudinal sample.

Chapter 4 contains a detailed description of the manner in which the 1983 OCHS survey responses were used to assign each child to the most appropriate level in each of the six attributes in Table 3.3. Appendix 3.1 contains the mapping algorithm for the 1987 OCHS survey. In a few cases, there was insufficient information in the OCHS to assign a child to a particular level. (The most extreme case is fertility concerning which there is no information in the OCHS. For purposes of calculating the utility score, all children were assigned level 1 for fertility.) There were only two OCHS questions concerning self-care. Children who could "care for themselves" were assigned to level 1 and those who could not to level 2. Finally, there was insufficient information to assign children to level 4 in the case of cognition and to level 5 in the case of mobility and pain. Our general strategy throughout this process was to classify individuals so as to underestimate morbidity whenever any ambiguity existed as to which level an individual should be assigned. Any bias that may result from this strategy would be such as to understate the degree of impairment.

Each child was assigned a seven-element vector assessing their health status. The multiplicative multi-attribute utility function shown previously was used to convert the seven-element vector health status into a utility score reflecting health-related quality of life.

3.4.C Attrition

Longitudinal studies provide us with a much richer source of information than do cross-sectional studies but they are vulnerable to the problem of attrition. Attrition as a result of inability to locate subjects, refusal to participate or incomplete responses, may lead to biased estimates of coefficients when using the longitudinal data. Boyle et al. (1991, 1993) report that it is common to lose 20% to 30% of the original sample in the first follow-up of surveys concerning childhood psychiatric disorders. In the OCHS, 27% of the original sample was lost due to attrition. The sample loss for this paper was 33% of the initial

sample (excluding the 828 observations lost due to a coding error on marital status). Boyle et al. (1991, 1993) investigated the consequences of the attrition in the OCHS and concluded that, although the sample loss was not entirely random, estimates of outcome and risk derived using the OCHS follow-up would be "reasonably accurate" and estimates of prognosis would "have a downward bias."

As mentioned previously, we present the results from the 1983-only sample and the 1983 results from the smaller longitudinal sample because of the attrition. Table 3.5 compares the distribution of the outcomes and socioeconomic characteristics used in the longitudinal sample (data available for both years) and the attrited sample (information available in 1983 alone). The only significant differences are that there are slightly fewer children from poor families and substantially fewer (more) children whose mothers have less than high school education (high school education) in the usable longitudinal sample than among those with 1983 data only. This indicates that families who are poor and whose mothers are poorly educated attrit disproportionately. The difference in attrition rates by poverty status is smaller than that by education groups.

3.5 Empirical Results

3.5.A Cross-Section (1983-Only Sample)

Tables 3.6, 3.7 and 3.8 contain various frequencies and cross tabulations on the 1983-only sample[4]. The top panel of Table 3.6 contains the relative frequencies for each attribute in the full sample. The bottom two panels show the frequencies for children from low income and non-low income families. For each individual attribute, the majority, and usually the overwhelming majority, of children from both low income and non-low income families have no impairment (level 1). In the cases of emotion and cognition, however, poor children are considerably more likely to have an impairment than are non-poor children.

Table 3.7 presents the relative frequencies for the number of attributes in which a child has an impairment (levels 2 through 5). The top row shows that almost half of all children (48%) have one or more impairments and that 14% have two or more. The second panel of Table 3.7 shows a difference of eight percentage points in the proportion of poor and non-poor children with no impairments. Twenty-two

percent of low income kids have two or more impairments as opposed to only 12% of non-low income children.

The middle panel of Table 3.7 indicates that the children of lone mothers are more likely both to have an impairment and to have multiple impairments than are children from two-parent families. Children age 12-16 are also at greater risk of both an impairment and of multiple impairments than are those age 4-11. It is possible that the age-effect noted here may be, at least in part, due to problems not being observed in younger children (especially pre-schoolers) or if recognized the problems may be attributed to minor developmental delays. It may be that older children (>12 years old), if the problem is still present, are more likely to be diagnosed and labelled. Thus the health of the child may have been stable but the measured health status has declined. There are no differences between girls and boys in our sample.

Table 3.8 provides information concerning the distribution of the utility scores. Note that the proportion with a utility score of 1.00 (perfect health) is the same as the proportion with no impairments in Table 3.7. As measured by the HUI2, most children in the OCHS have a high health-related quality of life. All of the means in the Table 3.8 are 0.90 or greater and all of the 10th percentiles are 0.75 or greater. The greatest differences between groups is at the 20th percentile. This value is 0.80 for children from low income or lone-mother families as opposed to a score of 0.90 for children from non-low income and 0.88 from two-parent families. The 20th percentile for children age 12-16 is 0.85 compared to 0.92 for those age 4-11. There is no difference between girls and boys.

Tables 3.9 through 3.13 provide estimates from various multivariate approaches to the data. We have limited our initial efforts to single equation models with a small set of independent variables. This is due in part to the fact that this is the groundwork for the longitudinal study and in part to the limitations of the OCHS data. We realize that the causal relations among child health, family income and parental status are much more complex than the picture portrayed in the following tables. These findings are best viewed as our early attempts to summarize the joint distribution of the HUI2 measures of health status and key socioeconomic variables from the OCHS.

The adjusted R-squared (or its equivalent) in the multivariate regressions are quite low in magnitude

(all are <0.10). This indicates we are not "explaining" a relatively large proportion of the variation in child health with the measures we have used. This is not anomalous with respect to other studies (see Currie, 1995).

Table 3.9 contains the estimates of a logit equation for the likelihood of "perfect health", that is, the dependent variable is equal to 1 if the child has no impairments and equal to 0 if the child has any impairment. The logit coefficients are presented in the second column. The standard errors and p values are in the third and fourth columns respectively. The fifth column contains the marginal effects of the independent variable. Entries in this column show the impact on the probability of having perfect health of a change in each independent variable. For the interaction term, this entry shows the combined impact of lone motherhood and low income. This column allows the reader to easily obtain the conditional probability of having no health impairments for a child with a characteristic of interest. An example will make it clear. We are interested in the probability that a child will have perfect health conditional on the fact that they have a lone mother. To determine this we begin with the probability that a child in the omitted category (the constant - which in this case is a non-poor daughter, age 4-11, of a married mother who is age <35 with a secondary education) has perfect health. This is 0.55, the figure in the row corresponding to the constant in the last column. To this we add the marginal effect of a child having a lone mother which is -0.13 (the value in the fifth column in the row corresponding to lone mother). Thus, the conditional probability that a child with the same characteristics as the omitted category, except for having a lone mother, has perfect health is 0.42 (0.55-0.13).

The standard errors in Tables 3.9, 3.10 and 3.11 (but not 3.12 or 3.13) were estimated using White's (1980) method which takes account of the fact that many of our observations have a sibling in the sample. The 2,899 observations in the 1983-only sample came from a possible 1,869 different families. This adjustment typically did not make a large difference.

The last three rows of Table 3.9 show the results (p values) of joint tests of three combinations of the coefficients for lone motherhood and low income. The first null hypothesis is that the conditional probability of no health impairment is the same for poor lone mothers and non-poor couples or, expressed

more formally, that the sum of the coefficients for lone mother, low income and the lone mother-low income interaction is equal to zero. The other two joint tests are analogous.

The first row of Table 3.9 indicates that the probability of no impairments ("perfect health") are much smaller for the child of a lone mother than for a child of two parents and the p value is below the conventional threshold (5%). The impact of low income is in the expected direction but of very small magnitude and has a large p value. As indicated in Section 3.2, studies using the 1983 OCHS have more typically found the opposite, that is, the (partial) relationship between health and low income is stronger than that between health and parental status.

The coefficient for the interaction between lone motherhood and low income is unexpectedly positive, but the p value for this coefficient is large. The joint tests show that the data rejects ($p = 0.02$) the hypothesis that there is no difference in the probability of no impairment between low income lone mothers and non-low income couples. The data clearly can not reject the hypotheses of no differences between low income lone mothers and either low income couples or non-low income lone mothers.

The coefficients for mother's education show that higher levels of education have a positive relationship with child health. This is consistent with previous findings in the literature of an important link between child health and mother's schooling even when controlling for income and other socioeconomic characteristics (Grossman 1972, Barrerra 1990, Dooley and Lipman 1996). Being a teenager has a quantitatively important and highly significant negative relationship with perfect health in the OCHS when compared to children age 4-11. The age of the mother and the sex of child do not have a strong associations with this measure of child health.

Individual logit functions were estimated for the likelihood of no impairment in each of the individual attributes. In Tables 3.10 and 3.11, we present estimates for the only two of the single-attribute logits in which the OCHS socioeconomic variables played an important role, emotion and cognition. In the case of emotion, neither the coefficient for lone motherhood nor low income have low p values but the first joint test indicates that we can reject the hypothesis of no difference between the children of poor lone mothers

and non-poor couples. The estimated impact of the mother's education is even stronger (in both magnitude and statistical significance) than in Table 3.9 and the child's age continues to have a strong association.

One difference between Table 3.9 and Table 3.10 is that the estimate for mother's age has a low p value in the latter. The marginal effect on no emotional impairment is +0.06 for children of mothers age 35 and over. In addition, the difference between the sexes in the likelihood of no emotional impairment is still small but it now has a low p value.

The Table 3.11 shows the results for cognition. The likelihood of no cognitive impairment is significantly and negatively related to low income. The interaction between low income and lone motherhood now has the anticipated sign but is not significant. The individual coefficient for lone motherhood is now unexpectedly positive but insignificant. The first joint test shows that the data can reject the hypothesis of no difference between the children of poor lone mothers and non-poor couples. The data are unable to reject the hypotheses of no difference between poor lone mothers and either poor couples or non-poor lone mothers.

Cognitive impairment, like emotional impairment, is related to mother's education but the relationship is weaker. Unlike emotion, cognition shows little relationship with the age of the mother or child, but the likelihood of no cognitive impairment is higher among girls than among boys and this estimate has a p value of zero.

In Table 3.12, we begin our multivariate analysis using the utility score. Our first approach was to estimate a Tobit function given that 52% of the sample has a value at the upper bound of 1.00 for this dependent variable. The final column of Table 3.12 contains the marginal effect of a change in each independent variable on the expected value of the dependent variable. The omitted category (constant) and the calculations are identical to determining the conditional probability for the logit estimates.

The individual coefficients for both lone motherhood and low income have the expected effects (negative) and low p values. The p values in Tables 3.12 (and 3.22 and 3.23) might be somewhat higher if we had been able to adjust our Tobit standard error estimates for the fact that many children are siblings.

The impact of this adjustment, using White's (1980) method in the logit estimations, was generally quite small. However, the bootstrapping procedure used in the quantile regressions did change the standard errors substantially.

The coefficient for the interaction remains anomalously positive but is quantitatively small (zero with rounding) and it continues to have a large p value. Mother's education continues to have a positive association with child health and older children on average have a lower utility score. The differences by age of mother is of marginal significance by the conventional threshold and sex of child does not have a statistically significant relationship with a child's health-related quality of life.

One notable aspect of Table 3.12 is that virtually all of the marginal effects are quite small in magnitude. This likely reflects the fact, demonstrated in Table 3.8, that the conditional means of the utility score are all quite high. As an alternative approach to analysing the utility score and to address the very long left-hand tail of the utility score distribution, we estimated quantile regressions for the 20th and 10th percentiles which are presented in Table 3.13.

Our quantile regressions were estimated using the bootstrap procedure in Stata. This procedure is appropriate when errors are likely to be heteroscedastic which, as the Stata manual points out, is one of the major motivations for using quantile regression. This adjustment had a large effect on estimated standard errors, unlike the case when we used White's method for the logits in Tables 3.9 through 3.11. When the quantile regression errors were assumed to homoscedastic, the estimated p values tended to be either 0.00 or 1.00.

In the case of the 20th percentile regression, all the coefficients have the expected signs but only low income and the child's age are significant. The joint tests indicate that we are able to reject the null hypothesis in each case. The coefficients imply that low income has a strong relationship with health-related quality of life when we investigate children with lower utility scores (the 20^{th} percentile).

The bottom panel of Table 3.13 presents the quantile regression estimates for the 10^{th} percentile. The estimated effects for lone motherhood and the interaction term not only have large p values but are virtually zero in magnitude. As with the 20^{th} percentile, low income has the strongest relationship both

quantitatively and significantly but for the 10th percentile it is the only variable of significance. Finally, we can not reject the hypothesis that poor-lone mothers and poor couples have equal utility levels.

To summarize, in the 1983-only sample low-family income was associated with poorer cognitive health and lower health-related quality of life. Lone motherhood was negatively associated with the probability of no health problems and the HUI2 score. Mother's educational status had the expected relationships. 1983 outcome measures were worse (better), on average, for children of mothers with less than (greater than) high school education when compared to high school graduation. However, in some cases the relationship was weak.

3.5.B Longitudinal Sample

Tables 3.14 through 3.30 present the results obtained from the longitudinal data. As stated previously, we use only observations that have all the necessary information in both years for our analysis. This decreases our sample size to 1,317. Table 3.14 indicates that there are substantial differences in the frequencies of problems between children from two-parent and lone-mother families and between those from non-low-income versus low-income families in this sample. The first two columns of Table 3.14 show the percentage of children from two-parent and lone-mom families who have no problems of the specified type. In each of the health status measures, a significantly higher percentage of the children from two-parent families have no impairments when compared to children from lone-mom families. The difference ranges from 5 percentage points for "No Emotional Problems in 1983" to 18 percentage points for "No Health Problems in 1983." Of note is the fact that for emotional problems and cognitive problems in a given year, well over 50% of the children never have any problems.

The third and fourth columns of Table 3.14 indicate a similar relationship between health status and children from low-income and non-low-income families. For each measure except "No Emotional Problems in 1983" there are a significantly higher percentage of children from low-income families who experience problems than from non-low-income families. The differences range from 3 percentage points

for "No Cognitive Problems Ever" to 14 percentage points between the low-income and non-low-income families for "No Emotional Problems in 1987" and "No Emotional Problems Ever."

Table 3.15 provides information concerning the distribution of the HUI2 utility scores. Note that the mean utility score is relatively high for all groups which reflects, in part, the high proportion of children with a utility score of 1.00(perfect health). As measured by the HUI2, most children in the OCHS have a high health-related quality of life. All of the means in the Table 3.15 are 0.88 or greater and all of the 10th percentiles are 0.71 or greater. The greatest differences between groups is at the 10th percentile for the average utility score. This value is 0.72 and 0.71 for children from low income and lone-mother families respectively as opposed to a score of 0.84 for children from non-low income and two-parent families.

Tables 3.15 through 3.27 provide estimates from various multivariate approaches to the data. We have limited our initial efforts to single equation models with a small set of independent variables. This is due in part to the limitations of the OCHS data and in part to the small sample size. Again, we realize that the causal relations among child health, family income and parental status are much more complex than the picture portrayed in the following tables.

We did not include an interaction term between the lone mother and low income variables in these estimations. In our initial runs, this interaction term was consistently insignificant and likelihood ratio tests could not reject the null that the coefficient for it was zero. Therefore we excluded the interaction term from our estimations for the models reported here.

Tables 3.16, 3.18, 3.20, 3.22, 3.24, and 3.26 contain the estimates based on the cross-sectional data from 1983 and 1987 in the longitudinal samples. Tables 3.17, 3.19, 3.21, 3.23, 3.25, and 3.27 differ in two ways. The dependent variables include 1983, 1987 and average outcomes. In addition, the lone mother and low income variables use data from 1983 and 1987, i.e. whether or not a child ever lived in a lone-mother household and average low income. These are explained in more detail in Section 3.3.C.

The standard errors in Tables 3.16 through 3.21 were adjusted for the clustering of observations using White's (1980) method. The calculation of the probability that a child, with given characteristics, has the specified health outcome is identical to previous calculations except that a child in the omitted

category was not low birth-weight.

Table 3.16 presents the results for the cross-sectional estimations with "no health problems" as the dependent variable. The results are not very consistent across the two time periods. In 1983 having a lone-mother has a large significantly negative impact on the probability of a child having no health problems. In 1987 the lone mother coefficient has the expected sign but is insignificant. Surprisingly, low income is insignificant in both models and unexpectedly has a positive sign in 1987. As indicated in Section 3.2, studies using the 1983 OCHS have more typically found the opposite, that is the (partial) relationship between health and low income is stronger than that between health and parental status.

Being an older child has a large significantly negative impact in both years. A child whose mother has greater than a high school education has a moderately higher probability of having perfect health than a child whose mother has high school education in 1983, the relationship is positive but not significant in the 1987. Of note here is that the greater than high school variable may be somewhat misleading. A mother is deemed to have greater than high school if she obtained any post secondary education, even if she did not finish high school. For example, a female who has not completed high school but has taken an adult education course, is considered as having a greater than high school education. The less than high school coefficient is only marginally significant in 1987, although it does have the expected sign in 1983. A child with an older mother has a significantly lower probability of having any health problems in the 1983.

The low birth-weight coefficient is consistently negative but insignificant and being a male child has no consistent relationship with perfect health across the years. Further results will show that the low birth-weight variable is consistently negative but insignificant. The negative relationship is consistent with that found in the literature (Saigal et al. 1994a, b, and 1996) but the relationship is usually highly significant. We assign a child as having low birth-weight if they are less than 5.5 pounds; not an extremely low birth-weight. However, only six percent of our sample were below this 5.5 pounds at birth. We estimated the results using lower weight cut-offs but the results were similar and the number of observations with lower birth-weights was small, only 1.5% of the sample had birth-weights lower than 4.5 pounds.

The 1983-only results (tables 3.9 through 3.13) do not include the low birth-weight variable. In the original estimations we did not include the low birth-weight variable for two reasons. We were worried about multicolinearity and, as just explained, we did not believe we had a large enough sample of very low birth-weight children. Unconditionally the low birth-weight dummy was significantly related to all the health outcomes except cognition in the 1983-only sample. After obtaining consistently insignificantly negative results in the longitudinal sample, we re-estimated the 1983-only equations adding the low birth-weight dummy. In the larger 1983-only sample the relationship between low birth-weight and the health outcomes was significant and negative in all cases except for cognition and the HUI2 at the 10^{th} percentile. The addition of the low birth-weight dummy did not alter the other coefficients substantially.

In Table 3.17, we present the results of the logit estimates for No Health Problems in 1983, 1987 and No Health Problems Ever. Although most of the independent variables have the expected signs throughout there are very few significant relationships. A child that ever lived with a lone mother has a marginally significantly negative relationship with no health problems in 1983, the relationship is negative but insignificant in 1987 and with no health problems ever. Average low income is negative but insignificant in all equations. The only two variables that show some consistency across the three equations are mother's age and child's age. Having an older mother has a positively significant relationship with perfect health in 1983 and the Ever equation. Child's age has a large significantly negative relationship with health status across the three equations. The marginal impact is between -0.13 and -0.16, a 24% decrease in the probability of perfect health in 1983 to 47% decrease in the probability of never having a health problem.

When investigating the associations between a child's emotional status and socioeconomic factors the relationships are slightly stronger. In the cross-sectional results, presented in Table 3.18, having a lone mother at the time of the survey has a fairly large negative correlation with a child having no emotional problems, although it is only marginally significant in 1987. The relationship between current low income and no emotional problems is insignificant. Mother's education has the expected signs and is fairly

consistently significant across the equations. This is more consistent with previous findings in the literature of an important link between child health and mother's schooling even when controlling for income and other socioeconomic characteristics (Grossman 1972, Barrerra 1990, Dooley and Lipman 1996). Again having an older mother substantially increases the likelihood a child will have a better health outcome. Being an older child has a negative coefficient but is significant only in 1983. Low birth-weight is negative and insignificant and the male coefficient estimate is positive and insignificant throughout.

Table 3.19 contains the longitudinal relationships with No Emotional Impairments. A child that ever lived in a lone-mother household had consistently negatively lower probability of having no emotional problems but the relationship is very marginal at about 10%. The same holds for average low income. The fact that the permanent income measure seems to show a more consistent relationship with health status than the point in time measure supports our hypothesis that we should be investigating the relationship between health status and permanent income not income at a single point in time. The remainder of the relationships are similar to the cross-sectional results.

The most notable aspect of the results when investigating cognition (Table 3.20) is that while little else is significant having a low family income, having a mother with less than high school education or being a male child have a large significantly negative association with the likelihood of having no cognitive impairments in 1983. The only significant relationship with cognitive health in 1987 is being a male child. As in the first two outcomes, most of the remaining coefficients have the expected signs but are not significant. The longitudinal results in Table 3.21 present a similar picture with the permanent low income measure and the variable for male showing strong relationships both in magnitude and significance across the equations but the other independent variables exhibit no consistent relationship.

Tables 3.22 through 3.27 presents the results for the utility score. The results for the HUI2 score in Table 3.21 are consistent across the 1983 and 1987 cross-sectional estimations. The lone mother coefficients are significantly negative and relatively large (note that the HUI2 score only ranges from 0 to 1.0). A child from a family with low income in a given year does not have a significantly lower health-

related quality of life. Having a mother with less than high school education and being an older child have significantly negative relationships with the HUI2 score. The magnitudes of the coefficients are very similar to the lone mother coefficients.

A mother having greater than a high school degree has a positive relationship with the HUI2 score but the relationship is not consistently significant. A child with an older mother has a higher health-related quality of life than a child with a younger mother. Being a male child has a significant effect in 1983 but is not significant in 1987. Once again, low birth-weight is consistently negative but insignificant.

Table 3.23 presents the results of the tobit estimations with our longitudinal measures. The results are similar to those seen in the cross-sectional estimations except that the permanent income measure is now consistently significant with a magnitude almost identical to the lone mother ever coefficient. Once again, we get a much stronger relationship, both in terms of magnitude and significance, between the permanent income measure and health-related quality of life than we do between the point in time income measure and health status.

The results of the quantile regression for the 20th percentile (Table 3.24) are similar to the cross-sectional tobit results for the entire distribution (Table 3.21). Having a lone mother at the time of the survey has a strong negative relationship with the HUI2 score. Low income status in each particular year does not have a significant coefficient. The other characteristics have the expected signs. The results with the longitudinal measures are in Table 3.25; again there is a strong negative relationship with both ever having a lone mother and the permanent low income. The education measures show no strong relationship with the HUI2 score in these estimations. It could be that the strong relationship between education and health status in the cross-sectional results could in part be due to education being a proxy for permanent income. When we include a variable for long term income in the estimations the education variables are often less significant.

The 10th percentile estimations (Tables 3.26 and 3.27) do not add a great deal of information to the study.

3.5.C Random and Fixed Effects Models

We also used the longitudinal sample to estimate random and fixed effects models. The former to account for person-specific effects without a large loss of degrees of freedom. A random-effects probit was used to estimate the models with a dichotomous dependent variable and a linear random-effects model was used to estimate the relationships between socioeconomic characteristics and the HUI2 score. Consistency of the coefficient estimates in a random-effects model requires that the unit-specific error term, the "random effect," be uncorrelated with the individual characteristics (X's). It is often the case that this restriction is violated.

In the fixed-effects model the coefficient on any variable that does not change across time for any of the individuals will not be estimated. Male and low-birth-weight are excluded as they do not vary across time. These variables were also excluded from the random-effects model so the two models could be compared. Table 3.28 presents the results of the random-effect models. They are similar to the results obtained throughout the paper. The lone-mother variable is negatively associated with our health measures except for cognition. Once again low income is insignificant across the equations. Education has the expected relationship but greater than high school education is insignificant throughout. Having an older mother seems to indicate less likelihood of any health problems or emotional problems. Being an older child increases the probability of lower health outcomes except for cognition and it is insignificant there.

We used a Hausman test to indicate whether the linear random-effects model used to estimate the relationship between the HUI2 score and the socioeconomic characteristics was appropriate, i.e., whether the assumption that the unit-specific error terms are uncorrelated with the Xs held. A Chi^2 (6 degrees of freedom) of 42.75 was recorded. Thus, the null hypothesis could be rejected at the < 1% level. This indicates that the random effects model should not be used.

The rejection of the assumption of uncorrelated errors and Xs in the linear model, likely indicates that this assumption would not hold for the probit models either. However, there is no simple procedure, like the Hausman test, available in Stata to test this hypothesis with the non-linear models such as the probit model. The poor fit of the probit models, indicated by the low R_w^2 measure (Magee 1990), suggests that a

linear model may fit our data just as well as the probit model. The poor fit suggests that the predicted probabilities will lie comfortably within the expected zero to one values over the range in which we are interested. To test this we take the predicted values from the random-effects probit and compare them to predicted values obtained from a linear random-effects model. Table 3.29 shows that there is little difference between the predicted probabilities for any of the equations. The largest mean absolute difference in the predicted probabilities is 0.00065. This indicates that the function, over the range we are estimating, is very close to linear. Thus we use the linear model to test whether the random-effects model is appropriate and if it is not we will investigate linear fixed-effects models for the dichotomous outcomes. Non-linear fixed effects models are extremely difficult to estimate.

The bottom section of Table 3.29 contains the results from the Hausman tests on the linear models for the three dichotomous outcomes, no problems, no emotional problems and no cognitive problems. The test rejects the null for all of the equations. Hence, we must use fixed effects models to investigate the relationship between the dichotomous outcomes and the socioeconomic characteristics in which we interested.

Briefly, the fixed effects model uses differences from the unit-specific means of the variables across time to estimate the coefficients. As stated previously, a coefficient will not be estimated for any variable that does not change across time for any of the individuals. Male and low-birth-weight are excluded. The mother's age dummy remained in the equation because we assumed the effects of mother's age on child health are non-linear. The fixed-effects model controls for unobserved (to the investigator) individual heterogeneity that may be related to the characteristics in question. Controlling for these unobserved characteristics may allow a clearer picture of the relationship between the characteristic in question and the dependent variable. The fixed-effects model does not require the strong restrictions that a random effects model requires. However, the fixed effects models also raise a series of concerns. One is the cost of estimating a fixed-effects model which is a decrease in the precision of the estimates, which can be observed in our results. Other problems are related to the fact that the fixed effects model is estimated by first differencing. It may lead to magnification of measurement error problems (lower signal/noise ratio).

Johnston and Dinardo (1997) present a discussion on the problems of using fixed-effects models in the presence of measurement error. It is also possible that we are using life-cycle changes to estimate the effects of long run differences in our variables (i.e. income and education); it is unclear that this is an appropriate strategy. There are also some concerns regarding out of sample inferences (a detailed discussion of fixed-effects and random effects models can be found in Hsiao (1986) or Greene (1993)). In this paper, a final reason for concern is the small sample size of the longitudinal sample.

The fixed-effects estimates in Table 3.30 indicate that, even after controlling for unobserved characteristics associated with being a lone mother, lone-mother status remains negatively associated with child health in all our measures except cognition. However, the relationship is only significant with our global health-related quality-of-life measure. The relationship between low income and our health outcomes is significantly positive for all measures except for the cognitive measure. It is surprising that this relationship is positive and of the same or higher magnitude as lone-mother status.

In the fixed effects model we are interested only in characteristics that change across time. Therefore to obtain a positive relationship between low income and health, children whose family was below the 1969 LICO in 1983 and above it in 1987 would have had their health-related quality of life decrease (a lower HUI2 score) over the time period on average. Those whose poverty status declined (above the LICO in 1983 and below it in 1987) would have, on average, increased their health status. This could be occurring at the margin if some families who change poverty status also change their entitlement to welfare or other programs which provide assistance for their children's health care needs such as prescription drugs, eyeglasses and dental work. It is conceivable that children of slightly poor families who are eligible for health benefits receive better health care than the children of slightly non-poor families who are not eligible for health benefits. Welfare status is available in the OCHS and almost one-quarter of those that changed poverty status did change welfare status. We added a control for welfare status to the fixed effects equations. The relationship was positive with all outcomes except cognition but the only significant relationship was with "no problems." The positive coefficient on welfare status indicates that, on average, the health status of children, whose families changed welfare status from not receiving it to receiving it,

increased. The relationship between low income and the health outcomes did not change when the welfare dummy was added to the equation. The positive relationship between welfare status and the health outcomes is an indication that changing welfare status does have an effect on health and it is in the direction that would substantiate the explanation given for the positive coefficient on low income. To investigate this issue further we need additional information, on income and the receipt of social assistance or other programs that offer health care subsidies, not available in the OCHS.

Changes in low levels of education are not significant in this fixed effects model. However, changes in higher levels of education are negatively related to all our measures except cognition and the relationship is significant. This is puzzling. Two problems with the educational variable might be relevant here. First, as explained previously, the variable "greater than high school" includes individuals that do not necessarily have a high school degree. Second, for about 13% of the sample the mother's educational level decreased between 1983 and 1987. It is possible for a mother's educational level to have decreased in this data if divorce and remarriage has occurred over the period. That is, it is possible for a child to have a new female parent who has less education than the previous parent. We find it unlikely, though, that this is the case for 13% of the children.

To examine the effects of this problem we set the mother's educational level equal to the 1983 level in 1987 for all those observations in which the mother's education level decreased over the 4 years. Thus the mother's education level between 1983 and 1987 could only remain unchanged or increase. We than reran the fixed effects model. The results obtained were very similar to the results obtained in Table 3.30. Thus the fact that we have decreasing levels in mother's education does not seem to be responsible for the puzzling results in our greater than high school education variable.

A child's mother turning 35 is not significantly correlated with our health measures. Perhaps this is due to the fact that our measure of mother's age, as we suggested earlier, may be proxying for human capital accumulation, such as informal education and wealth. It may be that on average mothers who are older than 34 are wealthier and have accumulated more informal education related to attaining higher health for their children than mothers who are 34 or younger. If this is so the fixed effects model will

control for this unobserved heterogeneity. The insignificant relationship will then indicate that being a mother over 34, controlling for higher levels of wealth and informal education, has no significant impact on child health. The negative coefficient on the older child variable is as expected; however, the borderline significance of the relationship between child age and cognition is surprising.

For the sake of completeness we have presented the panel results. However, the results from the fixed effects models are very different from other results obtained in this study. We question the reliability of these results due to our sample size, some apparent inconsistencies in the data and more general concerns with this estimation technique.

3.6 Summary and Conclusion

Our general objective has been to improve our understanding of the relationship between family socioeconomic status and child health. The statistical association between poor child health, especially psychosocial morbidity and socioeconomc status in Canada has been well established in a series of papers using data from the Ontario Child Health Study (OCHS). Our specific goal has been to use the distinctive indicators of child health status in the OCHS to construct a continuous measure of health status with interval scale properties based on the Health Utilities Index Mark 2 (HUI2) system. We analyse both the ordinal measures of health status for particular attributes and the health utility score, a cardinal measure.

The majority of Ontario children are very healthy as measured by the HUI2 system. Approximately half of the sample have no problems in each of 1983 or 1987. As expected a lower percentage (33%) have no problems ever (either 1983 or 1987). The individual attributes of most interest in the study were emotion and cognition. Well over fifty percent report no emotional problems and almost 90% report no cognitive problems at any point in the sample. The good health of Ontario's children is also reflected in the distribution of HUI2 scores which has a mean of 0.94 in 1983 and 0.92 in 1987. The mean of the average score for the two years is 0.93 and even the 10th percentile is 0.80. Simple cross tabulations did reveal, however, that children of lone mothers and from low-income families are clearly at greater risk of poor health as judged by differences in the distribution of children without problems (Tables 3.6, 3.7 and

3.14), and in the mean and lower percentiles of the utility score distribution (Tables 3.8 and 3.15).

A variety of multivariate approaches to the data were employed including the following: logit functions for probability of any impairment and the individual impairments of emotion and cognition; a tobit function for the expected value of the health utility score; and quantile regressions for the 20th and 10th percentiles (the "lower percentiles"). Two samples were used to estimate these models. First we looked at the larger 1983 cross-section. Second we used the longitudinal sample of observations from 1983 and 1987. Using the longitudinal sample, we estimated models of 1983 outcomes, 1987 outcomes and joint outcome measures. We also constructed independent variables that allowed us to investigate long term effects of lone motherhood and poverty.

Low family income in the 1983-only sample was associated with poorer cognitive health and lower health-related quality of life. Lone motherhood was negatively associated with the probability of no health problems and the HUI2 score. Mother's educational status had the expected relationships. 1983 outcome measures were worse (better), on average, for children of mothers with less than (greater than) high school education when compared to high school graduation. However, in some cases the relationship was weak.

We caution the reader in their interpretation of the negative association between lone-mother status and health. It is quite possible that lone-motherhood is associated with conditions that we have not sufficiently, controlled for such as wealth accumulation, poor living conditions, and perhaps long term poverty. The fixed effects results point to this. Also, as stated previously, we do not have any indicators of the prior family situations. It could be that the child's health was affected by the presence of family violence in the marital home. Problems related to family violence are likely to linger or only surface over time. It could be that we are only measuring these problems when the child is living in the lone-parent family and thus detecting a negative relationship between health and lone parenthood.

We must also be careful in interpreting the relationship between cognition, low income and low levels of maternal education. We remind the reader that our measure of cognition in the OCHS is performance related and is not capacity related. The correlation between low income or low-parental education and cognition is likely in part due to parents being less able to assist their children with their

school work or learning in general and thus the children have more problems with learning and school work. We do not wish to imply that the learning capacity of children of low-income families or parents with low levels of education is impaired.

Among the other variables considered, adolescents (age 12-13) generally had lower levels of health compared to younger children age 4-11. Males were commonly worse off than females, as were children of younger mothers when compared to children of mothers over 34 years of age. Low birth-weight was consistently negatively associated with worse health outcomes but was never significant.

The longitudinal results present a similar picture. Lone motherhood (both current and long-term status) was negatively associated with all outcome measures except cognition. Most notable in this section was that although current low income showed little relationship with the outcome measures, our measure of long term poverty indicated a strong relationship (both in magnitude and significance) with child health. In most cases the marginal effect on child health of long term poverty was equal to or greater than the marginal effect of ever having lived in a lone-mother family. We believe this is demonstrates the necessity of obtaining measures of permanent income rather than current income levels when investigating child health status.

A few fixed effects model were estimated but the results are puzzling. The estimated positive association between low income and health and the negative relationship between higher education and health outcomes clearly needs further investigation. Better measures of income and education would certainly aid in investigating this issue further as would a larger sample size. Lone motherhood does not have a strong negative relationship in the fixed effects model.

Several important tasks clearly await us. The first is to use richer data sets. The 1983 OCHS, though an important advance over previously available data, has clear limitations, some of which it shares with all cross-sectional data and some of which are peculiar to the OCHS. The OCHS specific problems include the restricted measures of socioeconomic status and small sample size. In future work, we plan to use other longitudinal data which offer both a richer set of socioeconomic measures and/or multiple waves of data which will allow us to make more progress at disentangling the undoubtedly complex causal relationships

among child health, income, parental status and other family characteristics. Such data sets include the National Longitudinal Survey of Children and Youth and the National Population Health Survey. We have done some preliminary work with these data and are awaiting further releases.

A second important task is to consider further the application of the Health Utilities Index to this important problem. As noted above, the fact that the HUI2 was originally developed to assess children with serious health limitations (cancer) is reflected in our findings of both very high average levels of child health in the OCHS and generally small estimated marginal effects of socioeconomic variables. Hence, the question remains of how well the HUI2 (and the Health Utilities Index Mark 3, which was developed for use with the Ontario Health Survey and subsequently used in the National Longitudinal Survey of Children and Youth and the National Population Health Survey) can discriminate between different levels of child health and development and, therefore, serve to inform health and social policy in this regard.

Notes

1. There are 3 children who were 13 in 1983 but were 16 when interviewed in 1987. Except for these 3 all children were 12 years of age or under in 1983.

2. The underlying for the attribute cognition in the HUI2 is intellectual capacity with respect to memory, thinking and problem solving. The focus is on capacity. However, the description of the levels for cognition my be interpreted as performance based. The questions in the OCHS are geared towards problems in learning and performance in school, performance indicators. We should probably refer to the measure for cognition as "cognitive impairments or learning and schooling problems." We will, however, continue to use the term cognition now that the reader is advised of the probable misalignment of the meanings.

3. A simple thought experiment may be useful to illustrate an implication of this complementarity in preferences among attributes. Imagine the "disutility", the decrement in health-related quality of life, associated with going from level 1 cognition to level 4 cognition (holding all other attributes at level 1). Call this State A. Now imagine the disutility in going from level 1 emotion ("generally happy and free from worry") to level 5 emotion ("extremely fretful, angry, irritable, or depressed, usually requiring hospitalization or psychiatric institutional care") while holding all other attributes at level 1. Call this State B. Now imagine the disutility of going from level 1 cognition to level 4 cognition **and** also going from level 1 emotion to level 5 emotion (while the remaining 5 attributes are still at level 1). Call this State C. The implication of the complementarity interaction among attributes is that the disutility associated with State C is less than the summation of the disutilities associated with States A and B. (The disutility of C would equal the sum of the disutilities of A and B if the utility function were linear additive; if the disutility of C were greater than A plus B, the attributes would be preference substitutes.)

4. We have not included standard errors or p values for Tables 3.6, 3.7 and 3.8. However, we generally draw the reader's attention to those differences where the p value is 0.05 or less.

Table 3.1
Independent Variable Definition, Sample Size and % of Sample for 1983-only Sample

Definition	Number of Observations (%)
Total	2,899 (100%)
Lone Mother. Child lives with a lone mother. **Two Parents.** Child lives with two parents.	236 (8%) 2,663 (92%)
Low Income. Total family income in 1982 is equal to or less than the Statistics Canada Low Income Cutoff based on the 1969 Family Expenditure Survey. **Non - Low Income.** Total family income in 1982 is greater than the Statistics Canada Low Income Cutoff.	493 (17%) 2,406 (83%)
Child Age 4-11 **Child Age 12-16**	1,763 (61%) 1,136 (39%)
Mother Age <35 **Mother Age >34**	959 (33%) 1,940 (67%)
Males **Females**	1,469 (51%) 1,430 (49%)
Mother's Education < Secondary **Mother's Education = Secondary** **Mother's Education > Secondary**	381 (13%) 1,673 (58%) 845 (29%)

Table 3.2
Independent Variable Definition, Sample Size and % of Sample in Longitudinal Sample

Definition	1983	1987
Lone Mother. Child lives with a lone mother. **Two Parents.** Child lives with two parents.	103 (8%) 1,214 (92%)	118 (9%) 1,199 (91%)
Low Income. Family income ≤ Statistics Canada Low Income Cutoff (LICO) based on the 1969 Family Expenditure Survey **Non - Low Income.** Family income > Statistics Canada LICO.	200 (15%) 1,117 (85%)	170 (13%) 1,147 (87%)
Child Age 4-11 (in 1983) **7-15** (in 1987) **Child Age 12-13** (in 1983) **15-16** (in 1987)	1,183 (90%) 134 (10%)	1,183 (90%) 134 (10%)
Males **Females**	668 (51%) 649 (49%)	668 (51%) 649 (49%)
Low Birth-weight. Child's birth-weight < 5.5 lbs. **Non-Low Birth-weight.** Child's birth-weight ≥ 5.5 lbs	84 (6%) 1,233 (94%)	84 (6%) 1,233 (94%)
Mother Age <35 **Mother Age >34**	587 (45%) 730 (55%)	247 (19%) 1,070 (81%)
Mother's Education < Secondary **Mother's Education = Secondary** **Mother's Education > Secondary**	106 (8%) 805 (61%) 406 (31%)	103 (8%) 763 (58%) 451 (34%)
Longitudinal Measures		
Lone Mother. Child lived in a lone-mother family in 1983 **or** 1987. **Two Parents.** Child lived with a two-parent family in 1983 **&** 1987.	152 (12%) 1,165 (88%)	
Low Income. Average of 1982 & 1986 Family income ≤ LICO. **Non - Low Income.** Average of 1982 & 1986 Family income > LICO..	172 (13%) 1,145 (87%)	

Table 3.3
HEALTH UTILITIES INDEX MARK 2 (HUI2)

ATTRIBUTE	LEVEL	DESCRIPTION
SENSATION	1	Ability to see, hear and speak normally for age.
	2	Requires equipment to see or hear or speak.
	3	Sees, hears, or speaks with limitations even with equipment.
	4	Blind, deaf or mute.
MOBILITY	1	Able to walk, bend, lift, jump, and run normally for age.
	2	Walks, bends, lifts, jumps, or runs with some limitations but does not require help.
	3	Requires mechanical equipment (such as canes, crutches, braces or wheelchair) to walk or get around independently.
	4	Requires the help of another person to walk or get around and requires mechanical equipment as well.
	5	Unable to control or use arms and legs.
EMOTION	1	Generally happy and free from worry.
	2	Occasionally fretful, angry, irritable, anxious, depressed or suffering night terrors.
	3	Often fretful, angry, irritable, anxious, depressed or night terrors.
	4	Almost always fretful, angry, irritable, anxious, depressed.
	5	Extremely fretful, angry, irritable or depressed usually requiring hospitalization or psychiatric institutional care.
COGNITION	1	Learns and remembers school work normally for age.
	2	Learns and remembers school work more slowly than classmates as judged by parents and/or teachers.
	3	Learns and remembers very slowly and usually requires special educational assistance.
	4	Unable to learn and remember.
SELF CARE	1	Eats, bathes, dresses, and uses the toilet normally for age.
	2	Eats, bathes, dresses, or uses the toilet independently with difficulty.
	3	Requires mechanical equipment to eat, bathe, dress, or use the toilet independently.
	4	Requires the help of another person to eat, bathe, dress or use toilet.
PAIN	1	Free of pain and discomfort.
	2	Occasional pain. Discomfort relieved by non-prescription drugs or self-control activity without disruption of normal activities.
	3	Frequent pain. Discomfort relieved by oral medicines with occasional disruption of normal activities.
	4	Frequent pain; frequent disruption of normal activities, discomfort requires prescription narcotics for relief.
	5	Severe pain. Pain not relieved by drugs and constantly disrupts normal activities.
FERTILITY	1	Able to have children with a fertile spouse.
	2	Difficulty having children with a fertile spouse.
	3	Unable to have children with a fertile spouse.

Source: Torrance et. al. 1996, p. 706.

Table 3.3a
Multiattribute Utility Function on Dead-Healthy Scale

Level	Sensation b1	Mobility b2	Emotion b3	Cognition b4	Self-Care b5	Pain b6	Fertility b7
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	0.95	0.97	0.93	0.95	0.97	0.97	0.97
3	0.86	0.84	0.81	0.88	0.91	0.85	0.88
4	0.61	0.73	0.70	0.65	0.80	0.64	na
5	na	0.58	0.53	na	na	0.38	na

Formula u*=1.06 (b1*b2*b3*b4*b5*b6*b7)-0.06
where u* is the utility of the health state on a utility scale of 0.00 (dead) to 1 00 (healthy)

Source: Source: Torrance et. al. 1996, p. 716.

Table 3.4
Dependent Variables: Definition, Sample Size and % of Sample

	1983-Only Sample (2,899)	Longitudinal Sample (1,317)		
Definition	1983	1983	1987	1983 & 1987
No Health Problems. Child has no problems with attributes- Pain, Sensation, Mobility, Cognition, Emotion, or Self-Care.	1,507 (52%)	741 (56%)	626 (48%)	439 (33%)
No Emotional Problems. The child has no problems the with attribute - Emotion.	2,000 (69%)	925 (70%)	870 (66%)	698 (53%)
No Cognitive Problems. The child has no problems with the attribute - Cognition.	2,638 (91%)	1,210 (92%)	1,198 (91%)	1,140 (87%)
HUI2 Utility Score. The mean value of the Health Utilities Index Mark 2 score (HUI2 score) in the year concerned.	0.93	0.94	0.92	0.93

Table 3.5
Sample Frequencies: Longitudinal and Attrited Samples

Characteristic in 1983	Longitudinal Sample(%)[1]	In 1983 but attrited in 1987(%)[2]	Test of Difference[3]
No Problems	56.3	52.9	0.15
No Emotional Problems	70.3	67.3	0.18
No Cognitive Problems	91.9	90.6	0.34
Utility (mean)	0.94	0.93	0.15
Lone Mom	7.8	8.5	0.61
Poor	15.3	19.8	0.01
Mom's Age >34	55.4	58.2	0.24
Mom's Ed < HS	7.9	15.0	0.00
Mom's Ed = HS	61.1	55.5	0.02
Mom's Ed > HS	31.0	29.5	0.50
Male	50.9	49.2	0.48

1. % of children with stated characteristic with data available in both years.
2. % of children with stated characteristic with data available in 1983 only.
3. Significance (noted by P-value) of the difference in the % of children with given characteristic with data in both years and with data in 1983 only.

Table 3.6
Frequencies (%) of Levels for the Health Utilities Index Mark 2 (HUI2): 1983-only

Level	Sensation	Mobility	Emotion	Cognition	Self-Care	Pain
All Children						
1	83	96	69	91	100	95
2	15	3	18	6	0	3
3	2	0	12	3	n.q.	2
4	0	0	1	n.q.	n.q.	0
5	n.a.	n.q.	0	n.a.	n.a.	n.q.
Children from Low Income Families						
1	81	94	61	85	99	93
2	15	4	19	8	1	3
3	3	1	17	7	n.q.	3
4	1	0	2	n.q.	n.q.	1
5	n.a.	n.q.	1	n.a.	n.a.	n.q.
Children from Non-Low Income Families						
1	83	97	70	93	100	95
2	15	3	18	5	0	3
3	2	0	11	2	n.q.	1
4	0	0	0	n.q.	n.q.	0
5	n.a.	n.q.	0	n.a.	n.a.	n.q.

Sample Size = 2,899.
n.a. = no such level in the HUI2.
n.q. = no questions on OCHS which are appropriate for this level.

Table 3.7
Distribution by Number of Impairments in the Health Utilities Index Mark 2 (HUI2): 1983-only

Number of Attributes With An Impairment*	0	1	2	3	4-6
Total	52	35	10	3	1
Low Income	45	33	15	5	2
Non-Low Income	53	35	9	2	1
Lone Mother	41	40	14	4	1
Two Parents	53	34	10	3	1
Age 4-11	56	33	8	2	1
Age 12-16	45	38	13	4	1
Girls	51	36	10	3	1
Boys	53	34	10	2	1

Sample Size =2,899.
*An "impairment" is defined as Level 2 ,3 4 or 5. Hence, "no impairment" is Level 1.

Table 3.8
Distribution of HUI2 Utility Scores: 1983-only

	% with Score = 1[a]	Mean	S.D.	20th Percentile	10th Percentile
Total	52	0.93	0.10	0.88	0.80
Low Income	45	0.91	0.13	0.80	0.75
Non-Low Income	53	0.94	0.09	0.90	0.80
Lone Mother	41	0.90	0.13	0.80	0.76
Two Parents	53	0.94	0.10	0.88	0.80
Age 4-11	56	0.94	0.10	0.92	0.80
Age 12-16	45	0.92	0.11	0.85	0.80
Girls	51	0.94	0.10	0.88	0.80
Boys	53	0.93	0.11	0.88	0.80

Sample Size = 2,899.
[a]A score of 1.00 = perfect health and a score of 0.00 = dead.

Table 3.9
Logit Estimates for Probability of No Health Impairments: 1983-only

	Coef	Std. Err.	p values	Marginal Effect
Lone Mother	-0.50	0.25	0.04	-0.13
Low Income	-0.16	0.14	0.27	-0.04
Lone Mother x Low Income	0.19	0.34	0.59	+0.05
Mother's Education < High School	-0.20	0.14	0.14	-0.05
Mother's Education > High School	0.19	0.10	0.05	+0.05
Mother Age > 34	0.08	0.10	0.43	+0.02
Age 12-16	-0.46	0.09	0.00	-0.12
Male	0.07	0.07	0.36	+0.02
Constant	0.19	0.09	0.03	0.55
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.02	
Joint Test: Low Income Lone Mothers = Low Income Couples			0.19	
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.91	

Sample Size = 2,899.
The standard errors are estimated using White's (1980) method which takes account of sibling status.
The omitted category includes female children, age 4-11, from a non-poor two-parent family, with a mother who is age <35 and has a secondary education.

Table 3.10
Logit Estimates for Probability of No Emotional Impairment: 1983-only

	Coef	Std. Err.	p values	Marg
Lone Mother	-0.20	0.25	0.43	-0.05
Low Income	-0.17	0.15	0.26	-0.04
Lone Mother x Low Income	-0.09	0.36	0.81	-0.02
Mother's Education < High School	-0.30	0.15	0.05	-0.07
Mother's Education > High School	0.28	0.11	0.01	+0.06
Mother Age > 34	0.29	0.11	0.01	+0.06
Age 12-16	-0.22	0.09	0.02	-0.05
Male	0.15	0.08	0.06	+0.03
Constant	0.61	0.08	0.00	0.65
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.04	
Joint Test: Low Income Lone Mothers = Low Income Couples			0.27	
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.43	

Sample Size = 2,899.
The standard errors are estimated using White's (1980) method which takes account of sibling status.
For omitted category see Table 3.9.

Table 3.11
Logit Estimates for Probability of No Cognitive Impairment: 1983-only

	Coef	Std. Err.	p values	Marg
Lone Mother	0.42	0.82	0.61	+0.02
Low Income	-0.59	0.2	0.00	-0.04
Lone Mother x Low Income	-0.67	0.88	0.45	-0.05
Mother's Education < High School	-0.36	0.2	0.07	-0.02
Mother's Education > High School	0.36	0.19	0.07	+0.02
Mother Age > 34	-0.06	0.18	0.76	-0.002
Age 12-16	-0.05	0.15	0.74	-0.002
Male	-0.52	0.14	0.00	-0.03
Constant	2.83	0.16	0.00	0.94
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.00	
Joint Test: Low Income Lone Mothers = Low Income Couples			0.45	
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.15	

Sample Size = 2,899.
The standard errors are estimated using White's (1980) method which takes account of sibling status.
For omitted category see Table 3.9.

Table 3.12
Tobit Estimates for HUI2 Utility Score: 1983-only

	Coefficient	Std. Err.	p values	Marginal
Lone Mother	-0.04	0.02	0.08	-0.02
Low Income	-0.04	0.01	0.00	-0.02
Lone Mother x Low Income	0.00	0.03	0.92	+0.001
Mother's Education < High School	-0.02	0.01	0.06	-0.01
Mother's Education > High School	0.02	0.01	0.01	+0.01
Mother Age > 34	0.01	0.01	0.10	+0.01
Age 12-16	-0.05	0.01	0.00	-0.02
Male	0.00	0.01	0.91	-0.0003
Constant	1.02	0.01	0.00	0.94
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.00	
Joint Test: Low Income Lone Mothers = Low Income Couples			0.08	
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.19	

Sample Size = 2,899.
For omitted category see Table 3.9.

Table 3.13
Quantile Regressions for HUI2 Utility Score: 1983-only

	Coefficient	Std. Err.	p values
20th Percentile			
Lone Mother	-0.03	0.02	0.11
Low Income	-0.07	0.02	0.01
Lone Mother x Low Income	-0.01	0.02	0.54
Mother's Education < High School	-0.02	0.02	0.43
Mother's Education > High School	0.01	0.11	0.42
Mother Age > 34	0.01	0.12	0.45
Age 12-16	-0.05	0.01	0.00
Male	-0.01	0.01	0.34
Constant	0.92	0.01	0.00
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.00
Joint Test: Low Income Lone Mothers = Low Income Couples			0.03
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.00
10th Percentile			
Lone Mother	0.00	0.03	1.00
Low Income	-0.06	0.03	0.03
Lone Mother x Low Income	-0.00	0.05	0.92
Mother's Education < High School	-0.01	0.01	0.39
Mother's Education > High School	0.00	0.01	1.00
Mother Age > 34	0.02	0.02	0.37
Age 12-16	-0.02	0.02	0.39
Male	0.00	0.01	1.00
Constant	0.80	0.00	0.00
Joint Test: Low Income Lone Mothers = Non-Low Income Couples			0.03
Joint Test: Low Income Lone Mothers = Low Income Couples			0.91
Joint Test: Low Income L. Mothers = Non-Low Income L. Mothers			0.10

Sample Size = 2,899.
A bootstrapping procedure was used to calculate the standard errors.
For omitted category see Table 3.9.

Table 3.14
Percentage of Children With No Health Problems by Family Status and Poverty Status: Longitudinal Sample

	Two-Parent Family	Lone-Mother Family	Non-Poor Family	Poor Family
No Health Problems 1983	58%	40%*	57%	49%*
No Health Problems 1987	49%	37%*	49%	38%*
No Health Problems Ever	34%	26%*	34%	26%*
No Emotional Problems 1983	71%	66%*	71%	67%
No Emotional Problems 1987	68%	54%*	68%	54%*
No Emotional Problems Ever	55%	40%*	55%	41%*
No Cognitive Problems 1983	92%	85%*	93%	84%*
No Cognitive Problems 1987	92%	86%*	92%	83%*
No Cognitive Problems Ever	88%	78%*	88%	85%*

Sample size = 1,317.
* significantly different at the 5% level.

Table 3.15
Distribution of HUI2 Utility Score by Family Status and Poverty Status: Longitudinal Sample

	Two-Parent Family	Lone-Mother Family	Non-Poor Family	Poor Family
Mean Utility Score 1983	0.94	0.90*	0.94	0.92*
Utility Score 1983 20th Percentile	0.93	0.80*	0.93	0.83*
Utility Score 1983 10th Percentile	0.80	0.75*	0.80	0.76*
Mean Utility Score 1987	0.93	0.88*	0.93	0.88*
Utility Score 1987 20th Percentile	0.85	0.80*	0.85	0.79*
Utility Score 1987 10th Percentile	0.80	0.68*	0.80	0.71*
Mean Average Utility Score	0.94	0.90*	0.94	0.90*
Average Utility Score 20th Percentile	0.90	0.83*	0.89	0.82*
Average Utility Score 10th Percentile	0.84	0.71*	0.84	0.72*

Sample size = 1,317
* significantly different at the 5% level.

Table 3.16
Logit Estimates for Probability of No Health Problems:
Longitudinal Sample (Cross-sectional Measures of lone-mother and low-income status)

Sample	1983			1987		
	Coef	p value	Marg	Coef	p value	Marg
Lone Mother	-0.64	0.01	-0.16	-0.28	0.24	-0.07
Low Income	-0.03	0.88	-0.01	0.10	0.64	+0.03
Mom's Ed< High School	-0.36	0.14	-0.09	-0.48	0.06	-0.11
Mom's Ed > High School	0.26	0.06	0.06	0.14	0.28	+0.04
Mother Age > 34	0.32	0.01	0.08	0.16	0.18	+0.04
Male	-0.09	0.44	-0.02	0.15	0.20	+0.04
Age 12-13	-0.55	0.00	-0.14	-0.65	0.00	-0.15
Low Birth-weight	-0.38	0.12	-0.09	-0.23	0.33	-0.06
Constant	0.21	0.08	0.55	-0.18	0.12	0.45
Sample Size	1317			1317		
Pseudo R2	0.028			0.014		

Sample size = 1,317
The omitted category includes female children, age 4-11, not low birth-weight, from a non-poor two-parent family, with a mother who is age <35 and has a secondary education.
The standard errors are estimated using White's (1980) method which takes account of sibling status.

Table 3.17
Logit Estimates for Probability of No Health Problems:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	No Health Problems 1983			No Health Problems 1987			No Health Problems Ever		
	Coef	p value	Marg value	Coef	p value	Marg value	Coef	p value	Marg value
Lone Mother Ever	-0.36	0.08	-0.09	-0.35	0.12	-0.08	-0.19	0.39	-0.04
Average Low Income	-0.01	0.56	-0.03	-0.24	0.26	-0.06	-0.18	0.43	-0.04
Mom's Ed< High School	-0.33	0.18	-0.08	-0.39	0.13	-0.09	-0.53	0.06	-0.10
Mom's Ed> High School	0.26	0.06	+0.06	0.11	0.40	+0.03	0.21	0.14	+0.05
Mother Age > 34	0.31	0.02	+0.08	0.15	0.23	+0.04	0.36	0.01	+0.08
Male	-0.09	0.45	-0.02	0.14	0.20	+0.04	0.11	0.34	+0.02
Age 12-13	-0.54	0.01	-0.13	-0.66	0.00	-0.16	-0.83	0.00	-0.14
Low Birth-weight	-0.36	0.13	-0.09	-0.21	0.38	-0.05	-0.34	0.20	-0.07
Constant	0.21	0.08	0.55	-0.11	0.35	0.47	-0.85	0.00	0.30
Sample Size	1317			1317			1317		
Psuedo R2	0.02			0.018			0.023		

For omitted category see Table 3.16.
The standard errors are estimated using White's (1980) method which takes account of sibling status.

Table 3.18
Logit Estimates for Probability of No Emotional Impairments:
Longitudinal Sample (Cross-sectional Measures of lone-mother and low-income status)

Sample	1983			1987		
	Coef	p value	Marg	Coef	p value	Marg
Lone Mother	-0.60	0.03	-0.15	-0.45	0.06	-0.11
Low Income	0.10	0.64	+0.02	0.07	0.74	+0.02
Mom's Ed< High School	-0.27	0.28	-0.07	-0.63	0.01	-0.15
Mom's Ed> High School	0.34	0.03	+0.07	0.27	0.06	+0.06
Mother Age > 34	0.54	0.00	+0.11	0.23	0.10	+0.05
Male	0.03	0.80	+0.01	0.04	0.77	+0.01
Age 12-13	-0.42	0.04	-0.10	-0.24	0.22	-0.06
Low Birth-weight	-0.30	0.24	-0.07	-0.12	0.62	-0.03
Constant	0.58	0.00	0.64	0.57	0.00	0.64
Sample Size	1,317			1,317		
Pseudo R2	0.027			0.02		

For omitted category see Table 3.16.
The standard errors are estimated using White's (1980) method which takes account of sibling status.

Table 3.19
Logit Estimates for Probability of No Emotional Impairments:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	1983			1987			Ever		
	Coef	p value	Marg value	Coef	p value	Marg value	Coef	p value	Marg value
Lone Mother Ever	-0.37	0.10	-0.09	-0.35	0.10	-0.10	-0.33	0.12	-0.08
Average Low Income	-0.13	0.56	-0.03	-0.34	0.10	-0.10	-0.37	0.08	-0.09
Mom's Ed< High School	-0.21	0.41	-0.05	-0.54	0.03	-0.13	-0.43	0.07	-0.10
Mom's Ed> High School	0.33	0.04	+0.07	0.23	0.11	+0.05	0.30	0.03	+0.07
Mother Age > 34	0.54	0.00	+0.11	0.22	0.10	+0.05	0.37	0.00	+0.09
Male	0.04	0.78	+0.01	0.03	0.78	+0.01	0.07	0.57	+0.02
Age 12-13	-0.42	0.04	-0.10	-0.26	0.19	-0.06	-0.32	0.10	-0.08
Low Birth-weight	-0.29	0.25	-0.07	-0.10	0.69	-0.02	-0.20	0.41	-0.05
Constant	0.61	0.00	0.65	0.63	0.00	0.65	0.00	0.72	+0.49
Sample Size	1,317			1,317			1,317		
Pseudo R2	0.026			0.02			0.025		

For omitted category see Table 3.16.
The standard errors are estimated using White's (1980) method which takes account of sibling status.

Table 3.20
Logit Estimates for Probability of No Cognitive Impairments: Longitudinal Sample (Cross-sectional Measures of lone-mother and low-income status)

Sample	1983			1987		
	Coef	p value	Marginal value	Coef	p value	Marginal value
Lone Mother	-0.31	0.50	-0.01	-0.28	0.41	-0.02
Low Income	-0.74	0.02	-0.04	-0.35	0.24	-0.02
Mom's Ed< High School	-0.72	0.03	-0.04	-0.51	0.16	-0.04
Mom's Ed> High School	0.36	0.20	+0.01	0.22	0.35	+0.01
Mother Age > 34	0.11	0.63	0.00	0.25	0.22	+0.01
Male	-0.81	0.00	-0.05	-0.77	0.00	-0.06
Age 12-13	-0.48	0.10	-0.03	-0.12	0.71	-0.01
Low Birth-weight	-0.36	0.38	-0.02	-0.08	0.84	-0.004
Constant	3.09	0.00	0.96	2.7	0.00	0.94
Sample Size	1,317			1,317		
Pseudo R2	0.056			0.031		

For omitted category see Table 3.16.
The standard errors are estimated using White's (1980) method which takes account of sibling status.

Table 3.21
Logit Estimates for Probability of No Cognitive Impairments:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	1983			1987			Ever		
	Coef	p value	Marg value	Coef	p value	Marg value	Coef	p value	Marg value
Lone Mother Ever	-0 48	0 22	-0 02	-0 28	0 36	-0 02	-0 40	0 17	-0 04
Average Low Income	-0 75	0 04	-0 04	-0 70	0 01	-0 05	-0 69	0 01	-0 07
Mom's Ed< High School	-0 64	0 06	-0 03	-0 39	0 28	-0 03	-0 35	0 26	-0 03
Mom's Ed> High School	0 37	0 19	+0 01	0 18	0 16	+0 01	-0 27	0 21	+0 02
Mother Age > 34	0 08	0 73	+0 003	0 26	0 21	+0 01	0 23	0 20	+0 02
Male	-0 81	0 00	-0 05	-0 78	0 00	-0 06	-0 71	0 00	-0 08
Age 12-13	-0 50	0 09	-0 03	-0 15	0 63	-0 01	-0 20	0 45	-0 02
Low Birth-weight	-0 31	0 42	-0 01	0 10	0 81	+0 01	-0 36	0 22	-0 03
Constant	3 13	0 00	0 96	2 79	0 00	0 94	2 32	0 00	0 91
Sample Size	1,317			1,317			1,317		
Pseudo R2	0 061			0 040			0 044		

For omitted category see Table 3 16
The standard errors are estimated using White's (1980) method which takes account of sibling status

Table 3.22
Tobit Estimates of HUI2 Utility Score:
Longitudinal Sample (Cross-sectional Measures of lone-mother and low-income status)

Sample	1983			1987		
	Coef	p value	Marg	Coef	p value	Marg
Lone Mother	-0.06	0.00	-0.03	-0.05	0.01	-0.03
Low Income	-0.01	0.44	-0.01	-0.01	0.68	-0.003
Mom's Ed< High School	-0.04	0.04	-0.02	-0.05	0.01	-0.03
Mom's Ed> High School	0.03	0.03	+0.01	0.01	0.40	+0.01
Mother Age > 34	0.03	0.00	+0.01	0.02	0.04	+0.01
Male	-0.02	0.06	-0.01	-0.01	0.57	-0.003
Age 12-13	-0.06	0.00	-0.03	-0.05	0.01	-0.03
Low Birth-weight	-0.03	0.14	-0.02	-0.02	0.28	-0.01
Constant	1.03	0.00	0.94	0.99	0.00	0.92
Sample Size	1,317			1,317		
Pseudo R2	0.086			0.060		

For omitted category see Table 3.16.

Table 3.23
Tobit Estimates of HUI2 Utility Score:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	1983			1987			Ever		
	Coef	p value	Marg value	Coef	p value	Marg value	Coef	p value	Marg value
Lone Mother Ever	-0.04	0.02	-0.02	-0.05	0.01	-0.03	-0.03	0.01	-0.02
Average Low Income	-0.03	0.06	-0.02	-0.05	0.01	-0.03	-0.03	0.00	-0.02
Mom's Ed< High School	-0.04	0.08	-0.02	-0.04	0.04	-0.02	-0.03	0.02	-0.02
Mom's Ed> High School	0.03	0.03	+0.01	0.01	0.60	+0.003	0.01	0.13	+0.01
Mother Age > 34	0.03	0.00	+0.01	0.02	0.05	+0.01	0.02	0.00	+0.01
Male	-0.02	0.06	-0.01	-0.01	0.56	-0.003	-0.01	0.11	-0.01
Age 12-13	-0.06	0.00	-0.03	-0.05	0.01	-0.03	-0.04	0.00	-0.03
Low Birth-weight	-0.03	0.18	-0.01	-0.02	0.33	-0.01	-0.02	0.20	-0.01
Constant	1.03	0.00	0.94	1.0	0.00	0.93	0.96	0.00	0.93
Sample Size	1,317			1,317			1,317		
Pseudo R2	0.087			0.081			0.140		

For omitted category see Table 3.16.

Table 3.24
0.20 Quantile Regression - HUI2 Utility Score: Longitudinal Sample
(Cross-sectional Measures of lone-mother and low-income status)

Sample	1983		1987	
	Coef	p value	Coef	p value
Lone Mother	-0.10	0.00	-0.07	0.00
Low Income	-0.00	1.00	-0.01	0.79
Mom's Ed< High School	-0.03	0.45	-0.07	0.02
Mom's Ed> High School	0.02	0.04	0.01	0.74
Mother Age > 34	0.03	0.05	0.05	0.02
Male	-0.02	0.07	-0.07	0.00
Age 12-13	-0.08	0.01	-0.04	0.14
Low Birth-weight	-0.00	1.00	-0.04	0.07
Constant	0.90	0.00	0.87	0.00
Sample Size	1,317		1,317	
Pseudo R2	0.054		0.041	

For omitted category see Table 3.16.
A bootstrapping procedure was used to calculate the standard errors.

Table 3.25
0.20 Quantile Regression - HUI2 Utility Score:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	1983		1987		Ever	
	Coef	p value	Coef	p value	Coef	p value
Lone Mother Ever	-0.04	0.14	-0.05	0.00	-0.04	0.05
Average Low Income	-0.06	0.03	-0.07	0.00	-0.06	0.01
Mom's Ed< High School	-0.02	0.48	-0.03	0.28	-0.02	0.27
Mom's Ed> High School	0.02	0.01	0.00	1.00	0.01	0.53
Mother Age > 34	0.02	0.03	0.05	0.01	0.03	0.00
Male	-0.02	0.05	-0.07	0.00	-0.03	0.00
Age 12-13	-0.08	0.00	-0.05	0.01	-0.04	0.07
Low Birth-weight	-0.00	1.00	-0.02	0.62	-0.02	0.25
Constant	0.90	0.00	0.88	0.00	0.89	0.00
Sample Size	1,317		1,317		1,317	
Pseudo R2	0.056		0.052		0.048	

For omitted category see Table 3.16.
A bootstrapping procedure was used to calculate the standard errors.

Table 3.26
0.10 Quantile Regression - HUI2 Utility Score: Longitudinal Sample
(Cross-sectional Measures of lone-mother and low-income status)

Sample	1983		1987	
	Coef	p values	Coef	p values
Lone Mother	0.00	1.00	-0.08	0.08
Low Income	-0.07	0.14	-0.03	0.33
Mom's Ed< High School	-0.02	0.67	-0.05	0.28
Mom's Ed> High School	0.03	0.27	0.00	0.86
Mother Age > 34	0.06	0.05	0.00	1.00
Male	-0.03	0.12	-0.02	0.17
Age 12-13	-0.06	0.12	-0.02	0.30
Low Birth-weight	0.01	0.89	0.02	0.68
Constant	0.80	0.00	0.80	0.00
Sample Size	1,317		1,317	
Pseudo R2	0.054		0.027	

For omitted category see Table 3.16.
A bootstrapping procedure was used to calculate the standard errors.

Table 3.27
0.10 Quantile Regression - HUI2 Utility Score:
Longitudinal Sample (Longitudinal Measures of lone-mother and low-income status)

Sample	1983		1987		Ever	
	Coef	p value	Coef	p value	Coef	p value
Lone Mother Ever	-0.03	0.39	-0.10	0.02	-0.05	0.03
Average Low Income	-0.07	0.06	-0.06	0.15	-0.08	0.01
Mom's Ed< High School	-0.01	0.52	-0.02	0.71	-0.02	0.69
Mom's Ed> High School	0.03	0.29	0.00	1.00	-0.00	1.00
Mother Age > 34	0.05	0.03	0.00	1.00	0.03	0.01
Male	-0.02	0.24	-0.01	0.59	-0.04	0.03
Age 12-13	-0.06	0.00	-0.00	0.80	-0.04	0.15
Low Birth-weight	0.02	0.63	0.00	1.00	-0.04	0.25
Constant	0.80	0.00	0.80	0.00	0.85	0.00
Sample Size	1,317		1,317		1,317	
Pseudo R2	0.023		0.031		0.070	

For omitted category see Table 3.16.
A bootstrapping procedure was used to calculate the standard errors.

Table 3.28
Cross-Sectional Time Series: Random Effects Models

	No Problems		No Emotional Problem		No Cognitive Problem		HUI2 Utility Score	
	Coef	p value	Coef	p value	Coef	p value	Coef	p value
Lone Mother	-0.30	0.01	-0.32	0.00	-0.14	0.31	-0.04	0.00
Low Income	0.06	0.47	0.10	0.23	-0.15	0.15	0.00	0.83
Mom's Ed< High School	-0.20	0.04	-0.21	0.03	-0.33	0.01	-0.03	0.00
Mom's Ed> High School	0.07	0.21	0.08	0.21	0.08	0.38	0.00	0.97
Mother Age > 34	0.13	0.02	0.22	0.00	0.03	0.74	0.01	0.11
Age 12-13	-0.32	0.00	-0.19	0.00	0.03	0.63	-0.02	0.00
Constant	0.07	0.15	0.41	0.00	1.4	0.00	0.94	0.00
Sample Size	1336, t=2		1336, t=2		1336, t=2		1336, t=2	
Estimation Procedure	Probit Random Effects		Probit Random Effects		Probit Random Effects		Linear Random Effects	
R-squared measure	0.020		0.015		0.007		0.024	

Table 3.29
Test Results for Random Effects Probits vs Linear Random Effects Models
(Mean difference in Predicted Values)
and Linear Random Effects Models vs. Linear Fixed Effects Models (Hausman Test)

	No Problems		No Emotional Problems		No Cognitive Problems	
Random Effects Probit and Linear Random Effects Model						
Model	Probit	Linear	Probit	Linear	Probit	Linear
Minimum Predicted Value	0.252	0.239	0.412	0.428	0.781	0.799
Maximum Predicted Value	0.632	0.632	0.787	0.793	0.936	0.938
Mean Absolute Difference	0.00004		0.00032		0.00065	
Hausman Test for Random Effects vs Fixed Effects Models (Null : differences in coefficients are not systematic)						
Chi^2	27.45		32.99		28.97	
P-value	0.000		0.000		0.000	
Accept/Reject Null	Reject		Reject		Reject	

Table 3.30
Cross-Sectional Time Series
Linear Fixed Effects Models

	No Problems		No Emotional Problem		No Cognitive Problem		HUI2 Utility Score	
	Coef	p value	Coef	p value	Coef	p value	Coef	p value
Lone Mother	-0.06	0.38	-0.07	0.26	0.01	0.76	-0.03	0.01
Low Income	0.10	0.02	0.11	0.01	0.04	0.11	0.03	0.00
Mom's Ed< High School	0.06	0.40	0.10	0.17	-0.001	0.97	-0.01	0.35
Mom's Ed> High School	-0.10	0.05	-0.10	0.03	0.004	0.99	-0.02	0.03
Mother Age > 34	-0.01	0.77	0.01	0.64	-0.01	0.49	-0.01	0.13
Age 12-13	-0.08	0.00	-0.04	0.12	0.25	0.06	-0.02	0.00
Constant	0.57	0.00	0.70	0.00	0.91	0.00	0.95	0.00
Sample Size	1336, t=2		1336, t=2		1336, t=2		1336, t=2	
Estimation Procedure	Linear Fixed Effects		Linear Fixed Effects		Linear Fixed Effects		Linear Fixed Effects	
R-squared measure	0.017		0.014		0.005		0.03	

APPENDIX 3.1

DEVELOPMENT OF HUI2 ATTRIBUTES - 1987

COGNITION

Level One

A) Not in Level Two **AND**
B) Has No Remembering Problems **AND**
C) Has No Limitations in School **OR**
D) Has Limited In School question missing because do not attend school due to age or parental decision
And Has No Learning Problems or Remedial Help for Slow Child or Mentally Challenged

Level Two

A) Not in Level Three **AND**
B) Any of the Following:
a) Receives Part-time Remedial Help for Slow Learner **Or**
b) Has Learning Problems **Or**
c) Is Limited In School Work.

Level Three

A) Receives Full-time Remedial Help for Mentally Challenged or Slow Learner **OR**
B) Receives Part-time Remedial Help for Mentally Challenged **OR**
C) Has Learning Problems And Receives Part-time Remedial Help for Slow Learners **OR**
D) Is Limited In School And Receives Part-time Remedial Help for Slow Learners.

Level Four

No appropriate questions in OCHS for Unable to Learn and Remember

EMOTION

All items refer to last 6 months. A total of 17 questions are scored for a maximum score of 34.
Never=0, Sometimes=1, Often=2. The questions are: Now or within the last 6 months does/is your child:

1) worries terrible things might happen;
2) worries about health;
3) worries a lot;
4) worries something bad will happen to those close to them;
5) sudden changes in mood or feelings;
6) cranky;
7) not as happy as other children;
8) unhappy sad or depressed;
9) has nightmares;
10) is tense;
11) feels too fearful or anxious;

12) cries;
13) too concerned with neatness or cleanliness;
14) feels he/she has to be perfect;
15) repeats certain actions over and over; compulsion;
16) talks about killing self;
17) deliberately harms self or attempts suicide.

Level One

A) No Oftens **AND**
B) Less than or equal to 7 Sometimes **AND**
C) Parents report No Emotional Problems **AND**
D) Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
E) Never Talks about Killing Self **AND**
F) Has Never Harmed Self / Attempted Suicide

Level Two

A) Not in Level One **AND**
B) Less than or equal to 3 Oftens **AND**
C) Total score of less than or equal to 17 **AND**
D) Parents report No Emotional Problems **AND**
E) Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
F) Never Talks about Killing Self **AND**
G) Has Never Harmed Self / Attempted Suicide

Level Three

A) Has Never Harmed Self / Attempted Suicide **AND**
B) Any of the Following:
    a) Has greater than or equal to 4 Oftens **Or**
    b) Total Score of greater than or equal to 18 **Or**
    c) Parent Reports Emotional Problem **Or**
    d) Receives Part-time Remedial Help for Emotional Problems **Or**
    e) Sometimes Talks about Killing Self

Level Four

A) Often Talks about Killing Self **Or**
B) Sometimes Harms Self / Attempts Suicide **Or**
C) Receives Full-time Remedial Help for Emotional Problems

Level Five

A) Often Harms Self / Attempts Suicide

FERTILITY

Level One

All children - There are no appropriate questions for fertility therefore every child is assigned to Level One.

Level Two and Three

There are no appropriate questions

MOBILITY

Level One

A) Able to Walk **AND**
B) Has No Problems Walking **AND**
C) Has No Problems Bending **AND**
D) Is Not Limited In Activities **AND**
E) Does Not use Aids to Get Around

Level Two

A) Not in Level 3 **AND**
B) Able to Walk Without Assistance **AND**
C) Any of the Following:
    a) Has Problems Walking **Or**
    b) Has Problems Bending **Or**
    c) Is Limited In Activities.

Level Three

A) Not in Level 4 **AND**
B) Uses Mechanical Aids to get around.

Level Four

A) Not Able to Walk Without Assistance.

Level Five

There are no appropriate questions for - Unable to use arms and legs.

PAIN

Level One

Child has No Pain

Level Two

A) Not in Level 3 **AND**
B) Has Pain **AND**
C) Any of the Following:
    a) Has Little Pain **Or**
    b) Has Some Pain And Is Not Limited in Play And is Not limited in Normal Activities

Level Three

A) Not in Level Four **AND**
B) Has Pain **AND**
C) Any of the Following:
    a) Has A Great Deal of Pain **Or**
    b) Has Some Pain And Is Limited in Normal Play or Normal Activities

Level Four

A) Has Pain **AND**
B) Has A Great Deal of Pain **AND**
C) Is Limited in Normal Play or Normal Activities

Level Five

No appropriate questions for Severe Pain, not relieved by drugs and constantly interrupting activities

SELFCARE

Level One

A) Does Not Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Two

A) Does Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Three and Level Four

There are no appropriate questions

SENSATION

Sensation is comprised of ratings for vision, hearing and speech thus each of these are given a level and the individual is assigned the level of sensation that corresponds to the lowest level in any of these attributes.

Vision

Level One

A) Not in Level Two **AND**
B) Not Blind in Both eyes **AND**
C) Does Not have Problems Seeing **AND**
D) Does Not Wear Glasses

Level Two

A) Not in Level Three **AND**
B) Wears Glasses And Has No Problems Seeing **Or**
C) Does Not wear glasses And Has Problem Seeing

Level Three

A) Not in Level Four **AND**
B) Blind in One Eye **OR**
C) Wears Glasses And Has Problems Seeing

Level Four

A) Blind in Both Eyes

HEARING

Level One

A) Not in Level Two **AND**
B) Not Deaf in Both ears **AND**
C) Has No Problems Hearing **AND**
D) Does Not Wear a Hearing Aid

Level Two

A) Not in Level Three **AND**
B) Has No Problem Hearing And Wears Hearing Aids **Or**
C) Has Problems Hearing And Wears No Hearing Aids

Level Three
A) Not Included in Level Four **AND**
B) Deaf in One Ear **OR**
C) Has Problems Hearing And Wears a Hearing Aid

Level Four

A) Deaf in Both Ears

SPEECH

Level One

A) Not Included in Level Two **AND**
B) Has No Problems Talking **AND**
C) Can Speak

Level Two

A) Not Included in Level 3 **AND**
B) Has Problems Talking **AND**
C) Any of the Following:
    a) Speaks About the Same as Other Children **Or**
    b) Speaks Better than Other Children

Level Three

A) Not Included in Level Four **AND**
B) Has Problems Talking **AND**
C) Speech is Worse than Other Children's speech

Level Four

A) Does Not Talk

SENSATION

Level One

A) Level One in Speech And Hearing And Vision

Level Two

A) Not in Level Three **AND**
B) Level Two in Speech Or Hearing Or Vision

Level Three

A) Not in Level Four **AND**
B) Level Three in Speech Or Hearing Or Vision

Level Four

A) Level Four in Speech Or Hearing Or Vision

Note: Tabulations are done on two sets of children
A) all children 4 to 16
B) all children who were 4 to 12 in the 1983 survey and under 17 in the 1987 survey.

4. The Health Utilities Index Mark 2: Applying the Health Utilities Index to Ontario Child Health Survey Data

4.1 Introduction

Several studies have been completed to date using the Ontario Child Health Survey (OCHS). These include investigations on the relationship between poverty, maternal work patterns and family structure and psychiatric disorders and school performance of children in the OCHS (Lipman et al., 1994, Cadman et al., 1986, Offord et al., 1987, Dooley et al., 1995). These studies incorporate methods ranging from simple correlations between outcomes and socioeconomic characteristics to multivariate regressional analysis with dichotomous dependent variables used for measures of psychiatric disorder or school performance and a variety of measures of socioeconomic characteristics used as independent variables.

Another body of literature exists investigating the health status of low birth-weight children (Saigal et al., 1994, 1994a) and survivors of childhood cancer and its treatment (Barr et al., 1993, 1994, 1995, Feeny et al., 1992). These investigations use a Health Utilities Index (HUI) multi-attribute health status classification system (MAHS) to identify children with single or multiple disorders, i.e. emotional, mobility, sensation or cognitive problems. The HUI2 is a system composed of a categorical method of describing health status and a multi-attribute utility function to assess health-related quality of life. This allows researchers to investigate single dimensional problems by looking at individual attributes and multiple dimensional problems by studying the health status vectors and global health-related quality of life on a conventional dead=0.00, perfect health=1.00 scale using a multi-attribute utility function to obtain a utility score (Torrance et al. 1992, 1995, 1996).

The HUI approach and the resulting utility scores generated using the multi-attribute utility function enables researchers to capture the multidimensional aspects of health. The Health Utilities Index Mark 2 classification system devised by Feeny et al. (1992) consists of seven attributes (sensation, mobility, emotion, cognition, self-care, pain and fertility), each having three to five levels (see Appendix 4.1),

describing 24,000 health states. Examination of individual problems such as cognitive or emotional disorders is possible using single attribute utility function scores. (The single-attribute utility scale is defined from 0.00 for the lowest level (most impaired for that attribute) to 1.00 for level 1 (normal for that attribute).) As well, the global multi-dimensional utility score, Health Utility Index 2 (HUI2), can be treated as a continuous variable that measures overall health-related quality of life of the individual.

The continuous nature of HUI2 utility scores leads to fewer model restrictions than necessary for the use other measures of health status i.e. self reported health status that tends to be a categorical variable. To incorporate the use of the HUI in a study using any survey, the survey responses must be mapped into levels of the attributes in the HUI2 System.

Section 4.2 of this paper describes the surveys and data used in the paper, section 4.3 presents the methodology of the mapping system used. Development of the algorithms for mapping the 1983 OCHS responses into the HUI2 is contained in Section 4.4. Section 4.5 compares the results obtained by applying the different drafts of the algorithm to the OCHS data, as well as results obtained using an approximation of an algorithm developed for an earlier study of low birth-weight children (Saigal et al., 1994, 1994a) for mapping the OCHS data into the HUI2 scores. This will give us information on how two different mapping algorithms perform when applied to the same data. This section also presents results from the eighth draft (final one) and the approximation of the Saigal et al. algorithm compared with HUI2 attribute levels and scores obtained from different data sets (the NPHS and the Saigal et al. study reference group). This gives us some indication of what the consequences may be when we apply different algorithms to different data sets. A discussion of the findings is presented in section 4.6.

4.2 Survey and Data

The survey methods and instrumentation of the OCHS are summarized here and described in detail elsewhere (Boyle et al., 1987). The target population of the OCHS included children born between January 1, 1966 and January 1, 1979 whose usual place of residence, at the time of the survey, was a

household in Ontario. Children living on First Nations' Reserves, in collective dwellings such as institutions, and those living in dwellings constructed after June 1, 1981 (Census Day) are excluded from the survey; this leaves out only about 3.3% of the target population. The sampling frame was based on the 1981 Census. Sample selection was done by stratified clustered random sampling. Statistics Canada collected information from a parent (usually the mother), from a teacher for 4 to 11 year-olds and from the youth for 12 to 16 year-olds on 3,294 children from 1,869 families. As will be explained later, the sample was reduced to 2,465 for this study.

The primary objective of the OCHS was to obtain unbiased precise estimates of the prevalence of psychiatric disorder among Ontario children 4 to 16 years of age. To this end, information on emotional and behavioural problems, physical health, cognitive abilities and functional limitations in activities of daily living was collected. As well, a limited amount of information was also obtained concerning the socioeconomic characteristics of the family.

The final exercise in this paper uses data from the National Population Health Survey (NPHS). The NPHS is national survey of individuals over 12 years old in Canadian households. Like the OCHS children on First Nations' Reserves and Canadian Forces bases were not surveyed. Unlike the OCHS a component for surveying individuals in institutions was included.

The multi-attribute system included in the NPHS is the HUI Mark 3 system rather than the Mark 2 system but a mapping function was applied to the HUI3 system to obtain scores HUI2. For this exercise the attribute sensation for the Mark 2 is a conglomerate of vision, hearing and speech from the Mark 3 system and the attribute dexterity (Mark 3) is used to represent the attribute self-care (Mark 2).

The only age group contained in the NPHS that matches children in the OCHS is 12 to 14 years of age. Thus when comparing results using data from the NPHS to those using data from the OCHS, we restricted the OCHS sample to children 12 to 14 years of age and the NPHS sample to residents of Ontario who were 12 to 14 years old. This resulted in a sample size of 165 from the NPHS and 561 children aged 12 to 14 years from the OCHS.

4.3 Methodology - Mapping

Retrospective application of the HUI2 classification system to the OCHS data was somewhat troublesome due to the mix of questions in the original survey. Questions in the OCHS corresponded fairly closely to the information necessary to construct most levels in three of the attributes: mobility, sensation and pain. The remaining attributes were not as straight forward. There was only a single dichotomous question that could be matched to the self-care attribute and no questions were available on fertility. However, the attributes of emotion and cognition were the most difficult to map. As stated previously the survey was developed to investigate the prevalence of psychiatric disorders in children, consequently there are a plethora of questions delving into these facets of children's health. The identification of a manageable number of questions to capture adequately the information necessary to map the levels in these two attributes was an iterative process.

Six iterations were necessary to achieve a satisfactory algorithm and a further two iterations were necessary before a final product was realized. The criteria for the algorithm was to map responses to questions in the OCHS as closely as possible to the HUI2 classification system while maintaining a tractable computer program. The first two drafts of the algorithm involved matching appropriate survey questions to the attribute levels. Once the questions were agreed upon, the next step involved writing the computer algorithm that would be applied to the data. Application of the computer program to the data exposed a number of cases where individual data had to be interpreted and coded. An example of this arose in the attribute cognition. One hundred thirty seven observations had missing information on the school work questions as the children were too young to attend school (126 children aged 4 or 5 years) or the parents decided not to send them to school (11 children ages 4 and 8). These children were assigned to level one (normal cognition) if no other problems were identified.

If any ambiguity existed as to which level a child should be assigned, the observation was allocated to the level with the highest functional ability (lowest number). If no suitable question could be found for a level or levels in an attribute the observations were distributed among the attribute levels that could be

matched. A prime example is the attribute self-care. There is only one question in the survey that deals with the ability to care for one's self: "Does the child require assistance with eating, dressing or using the toilet because of illness, injury or medical problems." A negative response is necessary for the observation to be assigned to level one (normal), all others are assigned to level two. Levels three and four of self-care are assigned to "no questions available" (na) category. Other "no questions available" categories exist in level five of mobility (Unable to control or use arms and legs), level 4 of cognition (Unable to learn and remember) and level 5 of pain (Severe pain, not relieved by drugs and constantly disrupts normal activity). There are no questions regarding the child's fertility status in the survey therefore all children are assigned a level one. We believe these steps tend to underestimate the level of morbidity of subjects in the survey.

Beginning with the second draft of the algorithm only parental reports were used map the HUI2 even though the OCHS also contains responses from youths and children's teachers as well. Grootendorst et al. (1997) indicate that proxy reports should not be considered interchangeable with self-reports and, therefore, combining information from different sources is problematic. Second, there was substantial missing information in the teacher's reports. Using these reports would have lead to a non-trivial decrease in the number of observations available for our study. The parental reports offered the broadest and most consistent base from which to draw the information necessary to develop the health status and the corresponding HUI2 utility scores for the sample of children age 4-16. The total number of observations with sufficient information to construct an HUI2 vector was 3,038 (from a total of 3,294). Fewer observations are used in the study for reasons that will be discussed later.

4.4 Algorithm Development

The three main algorithms reviewed in this paper are presented in Appendixes Two through Four. Appendixes 4.2 and 4.3 are Draft Six and Draft Eight, respectively of the HUI2 algorithm used by Curtis et al. (1997). Appendix 4.4 includes an adaptation of the algorithm used by Saigal et al. (1994, 1994a); it is adapted for the OCHS data set, reproducing the original algorithm as closely as possible within the

constraints of the OCHS. Saigal et al. were able to incorporate additional measures such as IQ tests and Activities of Daily Living scales that were available in their study; these measures were not available in the OCHS. The authors of the Saigal et al also had complete teacher's reports for their subjects. This produced a larger base from which to draw the information necessary to construct the attribute levels.

The original draft of the algorithm was constructed using only the survey questionnaire, before the data were available for this project. A group of professionals, familiar with the HUI2 and the OCHS survey discussed the options and came to consensus on the questions that should be used for the initial attempt at mapping the OCHS to the HUI2. Draft One included all questions, parental, youth, and teacher, in the survey appropriate for assigning children to attribute levels. As mentioned previously it was later decided to use a single respondent. Thus Draft Two was constructed using information obtained from parental responses only.

Draft Two was the first algorithm applied to the OCHS data. In this first attempt it was realized that their were several combinations and permutations of responses that were overlooked by simply matching survey responses to levels in the algorithm. For example, using the attribute sensation a child is assigned to level one if they have no problems seeing, hearing and speaking; inclusion in level two requires no problems seeing, hearing and speaking with the use of equipment; and level three requires problems seeing, hearing or speaking, even with the use of equipment. There are 21 individuals with problems seeing but who do not wear glasses and 42 children who have problems hearing but do not wear hearing aids. There were several other cases like this in which children seemed to fall between levels of an attribute. The cases were evaluated on their individual or group merits. If any question remained as to which level the observations should be allocated to the observation was assigned to the highest functional level in question, as stated previously. The children in the examples given here were assigned to level 2 rather than level three. Two additional drafts of the algorithm (Draft Three and Four) were written before we were satisfied that the algorithm was not excluding any observations with adequate information.

After addressing the observations that had "slipped through the cracks", attention was focussed on

the distributional results of the algorithm. The mapping of sensation, mobility, pain and self-care resulted in seemingly sensible distributions within each attribute, i.e. the largest number of the observations were allocated to level one (no problems), with the proportion of observations within the remaining levels decreasing as the functional ability described by the level diminished. However, the allocation of observations within the attributes of emotion and cognition did not follow this pattern. The distribution of children across levels in the attribute emotion was such that only 15.5% of the population was allocated to level one, 71.9% to level two, 12.4% to level three, 0.1% to level four and 0% to level 5. The distribution within cognition was also unexpected, with 95% of the observations in level one, 1.8% in level two, and 3.2% in level 3 (there were no appropriate questions for level four).

The reason for the "unrealistic" distribution of emotion levels was immediately obvious. Level one emotion states the individual should be "generally happy and free from worry." In the survey there are a multitude of statements describing the child's feelings and behaviours (recall the survey was designed for this purpose). For instance the parent was to indicate whether the statement "feels he/she has to be perfect" was never, sometimes or often true. The task at hand was to choose a reasonable number of statements that would describe a child's emotional status yet remain tractable. In Drafts Two through Four the algorithm restricted those in level one emotion to those responding "never true" to all of the following list of statements: worries about doing the wrong thing; worries something bad will happen to people he/she is close to; worries a lot about health; worrying; temper tantrums or hot temper; cries a lot; stubborn, sullen or irritable; sudden changes in mood or feelings; cranky; unhappy, sad, or depressed; not as happy as other children; nightmares; nervous, high-strung or tense; and too fearful or anxious. As well, the parent must have responded no to the questions "has your child had any emotional or behavioural problems in the last six months?" and "has your child ever been an overnight patient in a treatment centre for the emotionally disturbed?" If the answers to the previous two questions were "yes", and the parent also responded affirmatively to "During the past 6 months did he/she tend to have more emotional or behavioural problems than other children?" and "Do you think he/she needs professional help?" the child

was assigned to level five. Observations were then included in level 4 if they answered "yes" to all the previous questions in level five except being in a treatment centre. The question concerning treatment centres was replaced by an affirmative answer to "Has the child ever received special education or special teaching for emotional or behavioural problems on a full time basis?" Level three included observations not assigned to levels one, four or five and having any answers of "often true" to the list of symptoms. Level two was the catch-all category including anyone not in levels one, three, four or five and having answers of "sometimes" to any of the symptoms in the list. After reviewing this algorithm the distribution was not so startling. There were very few individuals who "never" suffered any of the symptoms listed, which is not surprising as much of the data was collected about children who were entering their teenage years.

A second problem, suggested by the psychiatrist on the team, was that some of the manifestations used to judge a child's emotional state were not appropriate, e.g. temper tantrums may be a controlling mechanism rather than an indication of emotional state, while other major indicators of emotional instability were not included, e.g. repetitive actions and suicidal tendencies. The list of statements was reevaluated and now consists of the statements appearing in the emotional attribute in Appendices Two and Three.

The distributional issue was somewhat more perplexing. It was decided that an approach similar to that used to derive the Bradburn scales in the General Social Survey (1985) would lead to a more realistic distribution. This method assigns a score to each statement response in the list: zero for "never true"; one for "sometimes true"; and two for "often true." The scores were summed. The level a child is assigned within the attribute emotion depends on the score they received and several other limiting conditions. The additional limiting conditions are summarized in Appendix 4.2 (the algorithm for the attribute emotion remained the same from Draft Five onward). The scoring is discussed briefly as the reasoning behind it may not be transparent.

Inclusion in level one emotion indicates that a child's total score, as defined in the algorithm, is less

than or equal to seven with no answers of "often true." This allows a child's parent to respond "sometimes" to as many as seven of the statements, except for either of the statements indicating suicidal behaviours/tendencies. Level two is attained if the child is not assigned to level one and the child's score is less than or equal to 17, with not more than three "often true" responses. This indicates that the parent could respond "sometimes" to all the behaviours (except suicidal tendencies) and have as many as three "often true" responses to the behaviours. Level three includes any child with a score of greater than 17 and a zero score for both questions on suicidal tendencies. This indicates the child's parent has answered "sometimes" or "often" to many of the listed behaviours.

The resulting distribution of observations across levels in the attribute of emotion was, in the team's opinion, more reasonable. Now 68.3% of the population is in level one, 17.7% is in level two, 13% in level three, 0.7% in level four and the remaining 0.3% in level five. The team found the distribution to be more realistic because the majority of the population is in level one with the proportion of observations in each subsequent level diminishing as the emotional status worsens, with very few children reaching the minimal level (five). The algorithm for the attribute emotion remained unchanged from Draft Five through Draft Eight.

The reason for the unexpected distribution of the cognition attribute levels was less clear. The major problem with this attribute seemed to be the definition of "remedial help" or "special education". In the OCHS there are several categories of special education, including part-time or full-time participation in education for: perceptually handicapped children; mental retarded children[1]; slow learners; emotionally or behaviourally disturbed children; advanced learners; and any other type of remedial education. The first attempt at modelling children in "special education" was to include all children who were recorded as receiving full or part-time "special education" in any of the previously listed categories, except those for emotional and behavioural and advanced learners, as receiving remedial help. Two other responses were important in assigning children to the different levels of cognition: whether or not the parent thought the child had a problem with learning or remembering things (remembering problems); and whether or not the

parent believed the child was limited in the kind or amount of school work s/he could do due to physical, emotional or learning problems (limited in school). If the parent indicated that a child had either one or both of the previous two problems and received remedial help they were assigned to level three. Inclusion in level two resulted from a child having either or both, of limited in school or remembering problems but received no remedial help. Also included in level two were children who were too young to answer the schooling questions i.e. some 4 and 5 year olds but their parents believed they had remembering problems. Level one included those with no remembering problems, no limitations in school and no remedial help. There were 338 children with parental responses indicating no learning or remembering problems or limitations in school but the child was receiving remedial help, these were also included in level one due to the breadth of the description of remedial help. The belief is that the definition of remedial help is the main problem with the distribution of the attribute cognition.

After discussion concerning the definition of "remedial help" and the consequences of the definitions concerning the levels in the attribute cognition it was concluded that one sweeping definition for "remedial help" was inappropriate. Draft Five differentiates between children receiving full or part-time "special education" for mental retardation, part or full-time "special education" for slow learners and those receiving any other type of "special education" except for advanced learners and emotionally or behaviourally disturbed. The resulting distribution had 91.8% of the population in level one cognition with 4.2% in level two and 4.1% in level three.

Further discussion of the definitions of remedial help resulted in the decision that only children receiving "special education" for mental retardation or slow learners could, with certainty, be classified as having cognitive problems. A child that is blind with no cognition problems could be receiving "special education" for the perceptually handicapped. There is no clear definition for what "other type of remedial education" is so this was also dropped from the classification of remedial help. In Drafts Six through Eight the only categorization used for remedial help are full and part-time "special education" for mental retardation or slow learners. Appendix 4.5 indicates the differences in the attribute of cognition for Drafts

Five and Seven (Six and Eight are in Appendixes Two and Three) are a result attempting to assign the "special education" categories to the appropriate levels. In the end it was decided that any child receiving "special education" (full or part-time) for mental retardation should be assigned to level three, as the "labelling of mental retardation" was a significant indicator of cognitive problems. Those receiving full-time "special education" for slow learners were also included in level three. Children participating in part-time "special education" for slow learners and no limitations in school or problems with remembering, as reported by the parent were assigned to level two. If the parent reported either of these two problems and the child received part-time "special education" for slow learners they were included in level three.

Reviewing the process to this point will aid in the understanding the final changes. The results of Draft Four of the algorithm resulted in a distribution of the observations of levels in the attributes of emotion and cognition which appeared to be unrealistic. Changes made for Draft Five alleviated the concern about the distribution of the attribute emotion but not cognition. The only changes made to Drafts Six and Seven were in the definitions of remedial help used to assign children to appropriate levels of cognition. Unanimous agreement from the team, on the algorithm for cognition, did not occur until Draft Eight. Draft Eight also included changes to the attributes of mobility and sensation.

A coding error was found in the data set such that the definitions of blind and deaf (the difference between being blind/deaf in no, one or two eyes/ears) were being misinterpreted in the computer program. This was corrected leading to a change in the distribution of children across levels in the attribute sensation. The last change in Draft Eight was to mobility. It was discussed and decided that our use of the response "use of aids (wheel chair, artificial limbs, braces, a cane or crutches) to get around" had been misplaced. Draft Eight places those who can walk with the use of aids in level three and those who cannot walk, without assistance of another person, in level four. Draft Eight is the final version of the algorithm for the mapping of 1983 OCHS data to the HUI2.

As a comparison to the algorithm developed in this study to map the 1983 OCHS into a HUI2 we requested the algorithm used by Saigal et al. (1994, 1994a) in their study on low birth-weight children. In

their study, Saigal et al. used the 1983 OCHS questionnaire and other assessment tools including the Vineland Adaptive Behavioural Scale and WISC-R score (IQ tests) were used to assign the subjects to the levels within the attributes in the HUI2. Manual coding was possible when individual children did not "fit" into one of the levels as investigators had contact with their subjects. Saigal et al. used teacher and parental responses. Saigal et al. were also able to use complete teacher's reports and psychiatric assessments as well as parental reports. Therefore the algorithm used in this paper is only an approximation of the Saigal et al. algorithm, using only information found in the OCHS data. Appendix 4.4 presents the Saigal et al. version of the mapping algorithm.

4.5 Results

4.5.A Drafts Four, Five, Six, Seven, Eight and A.

Table 4.1 shows the distributions of observations to levels of the six attributes for Drafts Four through Eight and the Saigal et al. version draft which will be referred to as Draft A (for approximation of Saigal et al.). These are the raw distributions, no adjustments to obtain the same observations from each algorithm has been made, percentages are presented in brackets. Drafts Four through Seven are included in the table so that the reader may more readily interpret the explanations of derivations of the algorithms explained previously. Subsequent comparisons will be restricted to Drafts Six, Eight and A.

The reasoning behind the presentation of these three drafts is as follows: Draft Six was used for the first draft of Curtis et al. 1997; Draft Eight was used for the second draft of the paper; and Draft A is an algorithm written independently of this project (although the interpretation for this data was made by this team). The distributions of attribute levels based on Drafts Six and Eight are presented in Table 4.2, the distributions are almost identical, as is indicated by the fact that the null hypothesis of equal distributions can not be rejected, the p-values are very close to one for most of the attributes. The same observations were used across these distributions. The observations included were those that had no missing variables in all dependent and independent variables required for the multivariate analysis done in the Curtis et al.,

1997 paper. The criteria for inclusion of observations used in here is employed for the remainder of the paper.

4.5.B Draft Eight and Draft A

As there are no significant differences between Draft Six and Draft Eight of the algorithms, Draft Eight alone will be presented juxtaposed to Draft A, the approximation of the Saigal et al. algorithm. Table 4.3 presents the results of the comparisons of Draft Eight and Draft A.

Only the attributes of sensation and self-care show no significant difference in the distribution across levels. The remaining four attributes have significantly different distributions at the < 1% level ($p<0.01$). Cognition has the greatest Chi^2 value and emotion the next. An interesting point is that the Saigal et al. study is an assessment of extremely low birth-weight children. In previous studies this group and others have tended to concentrate on the cognitive abilities of low birth-weight children (Saigal et al., 1991, 1991a; Hack et al., 1992) . The algorithm used by approximation of the algorithm used by Saigal et al. allocates approximately half of the population of children in the OCHS to levels two or three of cognition, indicating that almost 50% of the population does not "Learn and remember school work normally for their own age group". Once again, the reader should recall that Saigal et al. had access to teacher's reports and psychiatrist's reports when assigning subjects to attribute levels in their study. Later in this paper we will compare the results using Draft Eight and A to some of the results obtained by Saigal et al. (1996) in a more recent paper. The attribute emotion is also quite different between the two algorithms. Draft Eight has 31% of the population with an impairment while Draft A has less than 20%. The investigators that have worked most extensively with the OCHS and the resulting data are a group of psychiatrists investigating children's psychological problems. As stated previously, the primary objective of the OCHS was to obtain unbiased estimates of the prevalence of psychiatric disorder among Ontario children 4 to 16 years of age. In light of the research agendas of the two groups perhaps it is not surprising that the questions chosen to allocate children to levels in the attributes, especially cognition and emotion, seem to highlight different deficits.

It is readily apparent that the results of the two mapping algorithms are significantly different in the distribution of observations across levels within individual attributes. Table 4.4 indicates that there is also a significant difference in the total number of attributes affected. The algorithm used in Draft Eight allocates 54% of the population to perfect health (no impairments) while the Saigal et al. draft assigns only 47% of the population to perfect health. The OCHS asks parents to state whether it is "definitely true", "mostly true", "definitely not true" or "mostly not true" that their child is in "excellent health". Table 4.5 presents the cross tabulation of these answers with the number of attributes affected, by algorithm. There is no significant difference of the number of attributes affected for children whose parents indicated that it was definitely or mostly not true that they were in excellent health. However, for parents indicating it was definitely or mostly true that their children were in excellent health there is a significant difference in number of attributes affected between the algorithms but the magnitude of the difference seems small. Eighty-nine percent of the children in excellent health have zero or one impairment using the mapping of Draft Eight, while 87% of children attain the same levels with the Draft A mapping.

Tables 4.3 through 4.6 present evidence that there are significant differences in the allocation of individual observations to levels within attributes when using the different mapping algorithms, Draft Eight and Draft A. However, in some cases the magnitude of the differences seems small. As explained earlier we want to use a utility score resulting from the Health Utility Index Mark 2 system as an indicator of health-related quality of life. The distribution of the utility scores, obtained using a multi-attribute utility function, resulting from the two different algorithms are shown in Table 4.6. The distribution from Draft Eight of the algorithm has more observations at the maximum score of one (including the median) and a higher mean; however, the left-hand tail of the distribution is longer and envelops more observations than the distribution resulting from Draft A. This results in lower values observed at the 20th and 10th percentiles. A glance back at Table 4.3 offers an explanation for the longer left-hand tail of Draft Eight. Although Draft A allocates fewer individuals to level one it also allocates fewer children to levels four and five (in all attributes that have levels four and five) and to level three except for mobility (where it allocates

the same) and cognition (where it allocates more) resulting in the distributional differences between the two algorithms.

The final exercise of comparing Draft Eight and Draft A mapping algorithms is contrasting results from multi-variate estimation of the relationship between health status and poverty, labour market activities and lone parenthood. As stated previously Drafts Six and Eight of the algorithm were used to generate the dependent variables in the two drafts of the Curtis et al., 1997 paper. The model in that paper is investigating the relationship between the global health utility (representing children's health-related quality of life) and the independent variables indicating lone motherhood, poverty, an interaction term between lone parenthood and poverty, mother's education, mother's age, males, and children's age. The distribution of the HUI2 score is truncated at the upper boundary of one and thus an estimation procedure that takes this into account, i.e. a Tobit, should be used. However, in this paper, we are not interested in the coefficients resulting from the estimation procedure except as an indication as to whether or not the distributions of the utility scores, ensuing from the two algorithms used, produce significantly different coefficients. To accomplish this a SURE (Seemingly Unrelated System of Equations) model of two linear equations, one from Draft Eight and done from Draft A, is estimated and the resulting coefficients are tested for equality across equations. Table 4.7 indicates that the test statistic rejects that the two equations are identical. Again, for individual coefficients, the magnitude of the difference does not seem to be large except for the mother's age and the interaction term where the signs change from one equation to the next.

The two algorithms are different, therefore, we know that their relationships with these regressors are different. With sufficient data these tests would strongly reject the null of identical equations. However, this exercise helps to identify how the algorithms differ in directions that will be of interest for future work.

4.5.C OCHS (Drafts Eight and A) and the Reference Group (from Saigal et al. 1994a)

The previous section presented contrasts between the results of applying different algorithms to the same data, the OCHS. This section investigates the results of taking individual algorithms to different

randomly selected samples. In the Saigal et al. (1994) paper a group of one -hundred-forty-five children were randomly selected from the two school systems in the Hamilton area. These children were matched for age, sex and family socioeconomic status to extremely low birth-weight children and used as a reference group. The comprehensive health status of these children was calculated using the HUI2. The resulting distributions of single and multi-attributes are presented in Tables 4.8 through 4.11. Again, it is apparent that there are significant differences between OCHS (Draft Eight) and the reference group across the allocation of children within individual attributes (Table 4.8). There are fewer significant differences between OCHS (Draft A) and the reference group (Table 4.9). Table 4.10 indicates that while there are differences in the frequency of impairments suffered by children when comparing Drafts Eight and A of OCHS, there are no significant differences when comparing OCHS (Draft Eight) to the reference group or when comparing OCHS (Draft A) to the reference group. Recall that the adapted Saigal et al. version of the algorithm is based on the algorithm used for the mapping in the reference group. A caveat should be mentioned here, although the children in the reference group were randomly sampled from the school boards in Hamilton, they may not be a representative sample of children in Ontario. It depends on how representative Hamilton is of Ontario and whether or not children from all health status groups are enrolled in the school system. If children with very low health status are not enrolled in the school system then this group of children will not be included in the sample. On the other hand, members in the reference group were matched by demographic characteristics to the extremely low birth-weight children's households. These households may, on average, have lower socioeconomic status. Individual's with lower socioeconomic status tend to have lower health status. The results presented in Table 4.11 may indicate the under-representation of "very unhealthy" children in the reference group. Although the median in Draft Eight and the reference group are equal the mean and 10th deciles are higher in the reference group. The minimum utility score observed in this population is 0.59, indicating that there were no "extremely unhealthy" children in the sample for the reference group.

4.5.D OCHS (Drafts Eight and A) and the National Population Health Survey.

The last exercise compares the results obtained using Draft Eight and Draft A on the OCHS data to the constructed HUI2 scores from the NPHS.

The results of this exercise are recorded in Tables 4.12 through 4.15. As previously stated, Tables 4.12 and 4.13 indicate significant differences in the individual distributions within attributes. Draft Eight seems to be slightly more similar to the NPHS distribution. Table 4.14 demonstrates the significant difference between number of attributes affected for Draft Eight and Draft A of the OCHS but there are no significant differences in the number of attributes affected when either Draft Eight or Draft A is compared to the NPHS. The distribution of HUI2 scores seems to be fairly consistent across the three samples. Although the NPHS has the lowest functional score, 0.34, its mean and 10th percentiles are higher than OCHS (Draft Eight). Draft Eight has the lowest score at the 10th percentile and the lowest mean. All groups have the same median. The proportion of individuals scoring perfect health declines from OCHS (Draft Eight) to the NPHS with 47% and 43% respectively and decreases again for OCHS (Draft A).

4.6 Discussion

This paper was undertaken to document the process of developing an algorithm to map OCHS survey questions and responses onto HUI2 system. We have observed the iterative and subjective nature of the process. The resulting single and multi-attribute scores were then juxtaposed against another example found in the literature. The results of the comparison of OCHS, Draft Eight and Draft A, indicate that while the distribution across individual attributes can be quite different (emotion and cognition attributes), the distribution of the HUI2 scores are more similar. Results using the HUI2 score, from the two algorithms, as a dependent variable give fairly consistent results, although significantly different, across estimation equations (Table 4.7).

Contrasting the scores across different samples has shown consistent differences across the distribution within individual attributes but less variability in the number of attributes affected (there are no

significant differences between Draft Eight and Draft A and the reference group or the NPHS, see Tables 4.10 and 4.14). The distribution of global health-related utility (HUI2) scores while not identical seem to be fairly consistent across Draft Eight, Draft A and the NPHS sample of children 12 to 14 years old.

The similarities and differences of using different mapping algorithms on the same data and of using different algorithms on different data sets has been investigated. While the major difference in this paper is seen when we apply two different algorithms to the same data (Drafts Eight and A to the OCHS), there seems to be little difference when we apply either of these algorithms to similar populations from another data set (comparing 12 to 14 year olds from the OCHS (either Draft Eight or Draft A) to the Ontario sub-sample of 12 to 14 year olds from the NPHS). Given the results in this paper, especially this last result, it is unlikely that the choice of mapping algorithm is an important factor in influencing the multivariate regression results. Therefore we have chosen to use Draft Eight of the mapping algorithm in subsequent studies.

Notes

1. The terms perceptually handicapped children, mentally retarded children, slow learners, and emotionally or behaviourally disturbed children are the terms used in the 1983 OCHS.

Table 4.1 Distribution of Attribute Levels in OCHS(Algorithms from Drafts 4, 5 6, 7, and A) (% in brackets)

Attribute	Level	Draft 4	Draft 5	Draft 6	Draft 7	Draft 8	Draft A
Sensation	1	2690 (83)	2690 (83)	2690 (83)	2690 (83)	2687 (83)	2514 (85)
	2	491 (15)	491 (15)	491 (15)	491 (15)	486 (15)	387 (13)
	3	48 (1)	48 (1)	48 (1)	48 (1)	67 (2)	29 (1)
	4	23 (1)	23 (1)	23 (1)	23 (1)	12 (0)	12 (0)
# of Observations		3252	3252	3252	3252	3252	2942
Mobility	1	3063 (96)	3063 (96)	3063 (96)	3063 (96)	3063 (96)	2985 (91)
	2	117 (4)	117 (4)	117 (4)	117 (4)	109 (3)	295 (9)
	3	3 (0)	3 (0)	3 (0)	3 (0)	12 (0)	12 (0)
	4	1 (0)	1 (0)	1 (0)	1 (0)	5 (0)	2 (0)
# of Observations		3184	3184	3184	3184	3185	3294
Emotion	1	499 (16)	2207 (68)	2207 (68)	2207 (68)	2207 (68)	2614 (79)
	2	2311 (72)	573 (18)	573 (18)	573 (18)	573 (18)	429 (13)
	3	399 (12)	419 (13)	419 (13)	419 (13)	419 (13)	239 (7)
	4	4 (0)	22 (1)	22 (1)	22 (1)	22 (1)	6 (0)
	5	0 (0)	9 (0)	9 (0)	9 (0)	9 (0)	6 (0)
# of Observations		3213	3230	3230	3230	3230	3294
Cognition	1	2894 (95)	2789 (92)	2852 (91)	2852 (91)	2854 (91)	2142 (69)
	2	54 (2)	126 (4)	191 (6)	179 (6)	176 (6)	857 (28)
	3	97	124 (4)	79 (3)	91 (3)	94 (3)	104 (3)
# of Observations		3045	3039	3122	3122	3124	3103
Self-Care	1	3189 (100)	3189 (100)	3189 (100)	3189 (100)	3189 (100)	3189 (100)
	2	13 (0)	13 (0)	13 (0)	13 (0)	13 (0)	13 (0)
# of Observations		3202	3202	3202	3202	3202	3202
Pain	1	3026 (95)	3026 (95)	3026 (95)	3026 (95)	3026 (95)	3026 (95)
	2	98 (3)	98 (3)	98 (3)	98 (3)	98 (3)	138 (4)
	3	53 (2)	53 (2)	53 (2)	53 (2)	53 (2)	12 (0)
	4	17 (1)	17 (1)	17 (1)	17 (1)	17 (1)	na
# of Observations		3194	3194	3194	3194	3194	3176

*na= no appropriate question available. There were no questions available for Levels 3 and 4 Self-Care, Level 4 Cognition and Level 5 Mobility, Sensation and Pain thus the levels were left out of the chart.

Table 4.2 Distribution of Attributes Levels across OCHS Data (Drafts 6 and 8, same sample, % in brackets)

	Sensation		Mobility		Emotion		Cognition		Self-Care		Pain	
Draft	Six	Eight	Six	Eight	Six	Eight	Six	Eight	Six	Eight	Six	Eight
Level 1	2124 (86)	2121 (86)	2385 (97)	2385 (97)	1699 (69)	1699 (69)	2273 (92)	2273 (92)	2456 (100)	2456 (100)	2359 (96)	2359 (96)
2	293 (12)	291 (12)	78 (3)	73 (3)	453 (18)	453 (18)	141 (6)	130 (5)	9 (0)	9 (0)	60 (2)	60 (2)
3	38 (2)	42 (2)	1 (0)	5 (0)	299 (12)	299 (12)	51 (2)	62 (3)	na	na	40 (2)	40 (2)
4	10 (0)	11 (0)	1 (0)	2 (0)	10 (0)	10 (0)	na	na	na	na	6 (0)	6 (0)
5	na	na	na	na	4 (0)	4 (0)	na	na	na	na	na	na
# of Obs	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465
df	3		43		4		2		1		3	
Chi^2	0.2566		3.1656		0		1.5173		0		0	
p-value	0.968		0.367		1		0.468		1		1	

Table 4.3 Distribution of Attributes Levels across OCHS Data (Drafts 8 and A, same sample, % in brackets)

	Sensation		Mobility		Emotion		Cognition		Self-Care		Pain	
Draft	Eight	A	Eight	A	Eight	A	Eight	A	Eight	Eight	Eight	A
Level 1	2121 (86)	2121 (86)	2385 (97)	2335 (95)	1699 (69)	1986 (81)	2273 (92)	1754 (71)	2456 (100)	2456 (100)	2359 (96)	2359 (96)
2	291 (12)	307 (12)	73 (3)	124 (5)	453 (18)	332 (13)	130 (5)	638 (16)	9 (0)	9 (0)	60 (2)	95 (2)
3	42 (2)	26 (1)	5 (0)	5 (0)	299 (12)	143 (6)	62 (3)	73 (3)	na	na	40 (2)	11 (0)
4	11 (0)	11 (0)	2 (0)	1 (0)	10 (0)	1 (0)	na	na	na	na	6 (0)	na
5	na	na	na	na	4 (0)	3 (0)	na	na	na	na	na	na
# of Obs	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465	2465
df	3		3		4		2		1		3	
Chi^2	4.1928		14.066		103.5688		403.8059		0		30.3934	
p-value	0.241		0.003		<0.001		<0.001		1		<0.001	

Table 4.4 Frequency Distribution by Number of Impairments in OCHS (% in brackets)							
Number of Attributes with an Impairment	0	1	2	3	4	5	6
Draft 8	1339 (54)	842 (34)	218 (9)	50 (2)	12 (0)	3 (0)	1 (0)
Draft A	1150 (47)	960 (39)	275 (11)	59 (2)	13 (1)	8 (0)	0 (0)
Chi2 (5 df) = 32.7246 P-value <0.001							

Table 4.5 Number of Attributes Affected by Subjective Health Status				
	Excellent Health (2993 observations)		Poor Health (50 observations)	
# of Attributes Affected	Draft 8	Draft A	Draft 8	Draft A
0-1	2137 (89%)	2066 (87%)	25 (50%)	26 (52%)
2	206 (9%)	263 (11%)	11 (22%)	10 (22%)
>3	50 (2%)	64 (3%)	14 (28%)	14 (28%)
Chi2 (2 df)	9.8462		0.0672	
P-value	0.007		0.967	

Table 4.6 Distribution of Health Utility Index Mark 2 Scores from OCHS							
	% at Max score=1.0	Median	Mean	Standard Deviation	20th Percentile	10th Percentile	Min Score
Draft 8	54	1	0.94	0.09	0.9	0.8	0.22
Draft A	47	0.95	0.95	0.08	0.93	0.87	0.37

Table 4.7 Test for Equality of Coefficients using Health Utility Index Scores from OCHS Data

Dependent Variable HUI2 Score	Coefficients		Test Equality of Coefficients	
	Draft 8	Draft A	F-Test (1, 4912)	P-value
Lone Parent	-0.0091	-0.0157**	0.6	0.4369
Poverty	-0.0169*	-0.0161*	0.03	0.8719
Lone Parent *Poverty	**-0.0119**	**0.0151**	**5.4**	**0.0201**
Mom < High-school Ed.	**-0.0206***	**-0.0115***	**3.99**	**0.0459**
Mom > High-school Ed	0.0069	0.0097*	0.71	0.3999
Mom age > 34	**0.0087***	**-0.003**	**11.89**	**0.0006**
Male	-0.0028	-0.0025	0.01	0.9242
Child age 12 - 16	**-0.0186***	**-0.0119***	**4.22**	**0.04**
Constant	0.9470*	0.9571*		
Test Equality of All Coefficients Simultaneously			F-Test (8,4912) 3.57	P-value 0.0004

* significant at 5% level ** significant at 10% level

Table 4.8 Frequency Distribution of Observations across OCHS (using Draft 8) and Reference Group (REF) (from Saigal et al., 1994) (% in Brackets)

	Sensation		Mobility		Emotion		Cognition		Self-Care		Pain	
Draft	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF
Level 1	2121 (86)	129 (89)	2385 (97)	144 (99)	1699 (69)	116 (80)	2273 (92)	104 (72)	2226 (100)	145 (100)	2359 (96)	132 (91)
2	291 (12)	15 (10)	73 (3)	0 (0)	453 (18)	19 (13)	130 (5)	38 (26)	8 (0)	0 (0)	60 (2)	13 (9)
3	42 (2)	1 (1)	5 (0)	1 (1)	299 (12)	9 (6)	62 (3)	3 (2)	na	0 (0)	40 (2)	0 (0)
4	11 (0)	0 (0)	2 (0)	0 (0)	10 (0)	1 (1)	na	0 (0)	na	0 (0)	6 (0)	0 (0)
5	na	na	na	0 (0)	4 (0)	0 (0)	na	na	na	na	na	na
Total	2465	145	2465	145	2465	145	2465	145	2234	145	2465	145
df	3		4		4		3		1		3	
Chi^2	1.8867		5.9158		9.09		99.6475		0		23.9054	
p-value	0.596		0.116		0.059		<0.001		1		<0.001	

na= either level not appropriate for the attribute or no appropriate questions to assign observations to level

Table 4.9 Frequency Distribution of Observations across OCHS (Draft A) and Reference Group (REF) (from Saigal et al., 1994) (% in brackets)

	Sensation		Mobility		Emotion		Cognition		Self-Care		Pain	
Draft	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF	OCHS	REF
Level 1	2121 (86)	129 (89)	2335 (95)	144 (99)	1986 (81)	116 (80)	1754 (71)	104 (72)	2456 (100)	145 (100)	2359 (96)	132 (91)
2	307 (12)	15 (10)	124 (15)	0 (0)	332 (13)	19 (13)	638 (16)	38 (26)	9 (0)	0 (0)	95 (2)	13 (9)
3	26 (1)	1 (1)	5 (0)	1 (1)	143 (6)	9 (6)	73 (3)	3 (2)	na	0 (0)	11 (2)	0 (0)
4	11 (0)	0 (0)	1 (0)	0 (0)	1 (0)	1 (1)	na	na	na	0 (0)	na	0 (0)
5	na	na	na	na	3 (0)	0 (0)	na	na	na	na	na	na
# Obs	2465	145	2465	145	2465	145	2465	145	2465	145	2465	145
df	3		3		4		2		1		3	
Chi²	1.453		8.9604		7.7636		0.3864		0		9.6064	
p-value	0.693		0.03		0.101		0.824		1		0.008	

na= either level not appropriate for the attribute or no appropriate questions to assign observations to level
*to test equality of the distribution of observations across this attribute this level was assigned a zero

Table 4.10 Frequency Distribution by Number of Impairments across OCHS (Drafts 8 and A) and Reference Group (REF) (from Saigal et al., 1994) (% in brackets)

# of Attributes Affected	OCHS (Draft 8)	OCHS (Draft A)	OCHS (Draft 8)	REF	OCHS (Draft A)	REF
0	1339 (54)	1150 (47)	1339 (54)	73 (50)	1150 (47)	73 (50)
1-2	1060 (43)	1235 (50)	1060 (43)	70 (48)	1235 (50)	70 (48)
3-6	66 (3)	80 (3)	66 (3)	2 (1)	80 (3)	2 (1)
df	2		2		2	
Chi²	29.0382		2.1657		2.0075	
p-value	<0.001		0.472		0.367	

Levels were used to test the null hypothesis that the distributions are equal.

Table 4.11 Distribution of Health Utility Index Scores across OCHS (using Draft 8 and A) and Reference Group (taken from Saigal et al., 1994) (% in Brackets)

	% at Max score=1.0	Median	Mean	Standard Deviation	20th Percentile	10th Percentile	Min Score
OCHS (Draft 8)	54	1	0.94	0.09	0.9	0.8	0.22
Reference Group	50	1	0.95	0.07	NA*	0.88	0.59
OCHS (Draft A)	47	0.95	0.95	0.08	0.93	0.87	0.37

*NA- information not available from study

Table 4.12 Distribution of attributes across OCHS (age 12-14, Draft 8) and NPHS (Ontario sub-sample)

	Sensation		Mobility		Emotion		Cognition		Self-Care*		Pain	
	OCHS	NPHS	OCHS	NPHS	OCHS	NPHS	OCHS	NPHS	OCHS	NPHS	OCHS	NPHS
Level 1	499 (81)	134 (81)	580 (94)	164 (99)	408 (66)	135 (82)	562 (92)	102 (62)	613 (100)	165 (100)	576 (94)	159 (95)
2	105 (17)	28 (17)	30 (5)	1 (1)	116 (19)	24 (15)	30 (5)	16 (10)	1 (0)	0 (0)	16 (3)	2 (1)
3	8 (1)	2 (1)	3 (0)	0 (0)	85 (14)	5 (3)	22 (4)	21 (13)	na^	0 (0)	19 (3)	2 (1)
4	2 (0)	1 (1)	1 (0)	0 (0)	3 (0)	1 (1)	na^	21 (13)	na^	0 (0)	3 (0)	1 (1)
5	na	na	na^	0 (0)	2 (0)	0 (0)	na^	5 (3)	na	na	na^	1 (1)
Total	614	165	614	165	614	165	614	165	614	165	614	165
df	3		4		4		4		1		4	
Chi²	0.2751		7.3921		19.5089		135.0196		0		6.6486	
p-value	0.965		0.06		0.001		<0.001		1		0.156	

na= either level not appropriate for the attribute or no appropriate questions to assign observations to level
* NPHS this category is Dexterity
^to test equality of the distribution number of observations in this level was assigned a zero

Table 4.13 Distribution of attributes across OCHS (age 12-14, Draft A) and NPHS (Ontario sub-sample)

	Sensation		Mobility		Cognition		Emotion		Self-Care*		Pain	
	A	NPHS	A	NPHS	A	NPHS	A	NPHS	A	NPHS	A	NPHS
Level 1	499 (81)	134 (81)	569 (93)	164 (99)	422 (69)	102 (62)	489 (80)	135 (82)	613 (100)	165 (100)	576 (94)	159 (95)
2	107 (17)	28 (17)	42 (7)	1 (1)	165 (27)	16 (10)	88 (14)	24 (15)	1 (0)	0 (0)	36 (6)	2 (1)
3	6 (1)	2 (1)	3 (0)	0 (0)	27 (4)	21 (13)	35 (6)	5 (3)	na^	0 (0)	2 (0)	2 (1)
4	2 (0)	1 (1)	0 (0)	0 (0)	na^	21 (13)	2 (0)	1 (1)	na^	0 (0)	0 (0)	1 (1)
5	na	na	na^	0 (0)	na^	5 (3)	2 (0)	0 (0)	na	na	na^	1 (1)
Total	614	165	614	165	614	165	614	165	614	165	614	165
df	3		3		4		4		1		4	
Chi²	0.351		10.5881		128.8327		2.6931		0		15.2895	
p-value	0.95		0.005		<0.001		0.61		1		0.004	

na= either level not appropriate for the attribute or no appropriate questions to assign observations to level
* NPHS this category is Dexterity
^to test equality of the distribution number of observations in this level was assigned a zero

Table 4.14 Distribution by Number of Impairments OCHS (age 12-14, Draft 8 and A) and NPHS (Ontario sub-sample)

# of Attributes Affected	OCHS (Draft 8)	OCHS (Draft A)	OCHS (Draft 8)	NPHS	OCHS (Draft A)	NPHS
0	290 (47%)	245 (40%)	290 (47%)	71 (43%)	245 (40%)	71 (43%)
1-2	302 (49%)	345 (56%)	302 (49%)	90 (56%)	345 (56%)	90 (56%)
3-6	22 (4%)	24 (4%)	22 (4%)	4 (2%)	24 (4%)	4 (2%)
df	2		2		2	
Chi²	6.7298		1.761		1.174	
p-value	0.035		0.415		0.556	

Table 4.15 Distribution of HUI2 Scores OCHS (age 12-14, Draft 8 and A) and NPHS (Ontario sub-sample)

	% at Max score=1.0	Median	Mean	Standard Deviation	20th Percentile	10th Percentile	Min Score
OCHS (Draft 8)	47	0.95	0.93	0.1	0.87	0.8	0.37
NPHS	43	0.95	0.93	0.09	0.88	0.83	0.34
OCHS (Draft A)	40	0.95	0.94	0.08	0.9	0.84	0.41

APPENDIX 4.1

HEALTH UTILITIES INDEX MARK 2 (HUI2)		
ATTRIBUTE	LEVEL	DESCRIPTION
SENSATION	1	Ability to see, hear and speak normally for age.
	2	Requires equipment to see or hear or speak.
	3	Sees, hears, or speaks with limitations even with equipment.
	4	Blind, deaf or mute.
MOBILITY	1	Able to walk, bend, lift, jump, and run normally for age.
	2	Walks, bends, lifts, jumps, or runs with some limitations but does not require help.
	3	Requires mechanical equipment (such as canes, crutches, braces or wheelchair) to walk or get around independently.
	4	Requires the help of another person to walk or get around and requires mechanical equipment as well.
	5	Unable to control or use arms and legs.
EMOTION	1	Generally happy and free from worry.
	2	Occasionally fretful, angry, irritable, anxious, depressed or suffering night terrors.
	3	Often fretful, angry, irritable, anxious, depressed or night terrors.
	4	Almost always fretful, angry, irritable, anxious, depressed.
	5	Extremely fretful, angry, irritable or depressed usually requiring hospitalization or psychiatric institutional care.
COGNITION	1	Learns and remembers school work normally for age.
	2	Learns and remembers school work more slowly than classmates as judged by parents and/or teachers.
	3	Learns and remembers very slowly and usually requires special educational assistance.
	4	Unable to learn and remember.
SELF CARE	1	Eats, bathes, dresses, and uses the toilet normally for age.
	2	Eats, bathes, dresses, or uses the toilet independently with difficulty.
	3	Requires mechanical equipment to eat, bathe, dress, or use the toilet independently.
	4	Requires the help of another person to eat, bathe, dress or use toilet.
PAIN	1	Free of pain and discomfort.
	2	Occasional pain. Discomfort relieved by non-prescription drugs or self-control activity without disruption of normal activities.
	3	Frequent pain. Discomfort relieved by oral medicines with occasional disruption of normal activities.
	4	Frequent pain; frequent disruption of normal activities, discomfort requires prescription narcotics for relief.
	5	Severe pain. Pain not relieved by drugs and constantly disrupts normal activities.
FERTILITY	1	Ability to have children with a fertile spouse.
	2	Difficulty having children with a fertile spouse.
	3	Unable to have children with a fertile spouse.

Source: Feeny et. al. 1992, p. 924.

APPENDIX 4.2

DEVELOPMENT OF HUI2 ATTRIBUTES - DRAFT 6

Individuals are assigned to level which describes their functional ability best. If there is ambiguity between two levels then the individual is assigned to the highest functional level in question. An implicit condition in each level is that the individual is not previously assigned to a lower level (higher number).

COGNITION

Level One

Has No Remembering Problems **AND**

Any of the Following:

Has No Limitations in School **OR**
Has Limited In School question missing due to age or parental decision

Level Two

Receives Part-time Remedial Help for Mentally Challenged or Slow Learner **Or**
Has Remembering Problems as stated by parent **Or**
Is Limited In School Work

Level Three

Receives Full-time Remedial Help for Mentally Challenged or Slow Learner **OR**

All of the following:

Receives Part-time Remedial Help for Mentally Challenged or Slow Learners **AND**
Has Remembering Problems Has Remembering Problems **AND**
Is Limited In School

Level Four

No appropriate questions

EMOTION

All items refer to last 6 months. A total of 17 questions scored for a maximum score of 34.
Never=0, Sometimes=1, Often=2. The questions are phrased as follows: Now or within the last 6 months does/is your child:

1) worries terrible things might happen;
2) worries about health;
3) worries a lot;
4) worries something bad will happen to those close to them;
5) sudden changes in mood or feelings;
6) cranky;
7) not as happy as other children;

8) unhappy sad or depressed;
9) has nightmares;
10) is tense;
11) feels too fearful or anxious;
12) cries;
13) too concerned with neatness or cleanliness;
14) feels he/she has to be perfect;
15) repeats certain actions over and over; compulsion;
16) talks about killing self;
17) deliberately harms self or attempts suicide.

Level One

No Oftens **AND**
Less than or equal to 7 Sometimes **AND**
Parents report No Emotional Problems **AND**
Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
Not in A Treatment Centre for the Emotional Problems **AND**
Never Talks about Killing Self **AND**
Never Harmed Self / Attempted Suicide

Level Two

Less than or equal to 3 Oftens **AND**
Total score of less than or equal to 17 **AND**
Parents report No Emotional Problems **AND**
Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
Not in A Treatment Centre for the Emotional Problems **AND**
Never Talks about Killing Self **AND**
Never Harmed Self / Attempted Suicide

Level Three

Not in A Treatment Centre for the Emotional Problems **AND**
Never Harmed Self / Attempted Suicide **AND**

Any of the Following:

Has greater than or equal to 4 Oftens **Or**
Total Score of greater than or equal to 18 **Or**
Parent Reports Emotional Problem **Or**
Receives Part-time Remedial Help for Emotional Problems **Or**
Sometimes Talks about Killing Self

Level Four

Not in a Treatment Centre for Emotional Problems **AND**

Any of the Following:

Often Talks about Killing Self **Or**
Sometimes Harms Self / Attempts Suicide **Or**
Receives Full-time Remedial Help for Emotional Problems

Level Five

Is or Has been in Treatment Centre for Emotional Problem **OR**
Often Harms Self / Attempts Suicide

FERTILITY

Level One

There are no appropriate questions for fertility therefore every child is assigned to Level One.

MOBILITY

Level One

Able to Walk Without Assistance **AND**
Has No Problems Walking **AND**
Has No Problems Bending **AND**
Is Not Limited In Activities **AND**
Does Not use Aids to Get Around

Level Two

Able to Walk Without Assistance **AND**

Any of the Following:

Has Problems Walking **Or**
Has Problems Bending **Or**
Is Limited In Activities

Level Three

Is Not Able to Walk Without Assistance **AND**
Does Not use Mechanical Aids

Level Four

Is Not Able to Walk Without Assistance **AND**
Does Use Mechanical Aids **AND**
Is Paralysed

Level Five

No appropriate questions

PAIN

Level One

Has No Pain

Level Two

Has Little Pain **OR**

Both of the following:

Has Some Pain **AND**
Is Not Limited in Normal Play or Normal Activities

Level Three

Has A Great Deal of Pain **OR**

Both of the following:

Has Some pain **AND**
Is Limited in Normal Play or Normal Activities

Level Four

Has A Great Deal of Pain AND
Is Limited in Normal Play or Normal Activities

Level Five

No appropriate questions

SELF-CARE

Level One

Does Not Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Two

Does Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Three and Level Four

No Appropriate questions

SENSATION

Sensation is comprised of ratings for vision, hearing and speech, a child is assigned a level in each of these. A child is then assigned the level of sensation that corresponds to the lowest level (highest number) in any of vision, hearing and speech.

Vision

Level One

Does Not have Problems Seeing **AND**
Does Not Wear Glasses

Level Two

Wears Glasses **And** Has No Problems Seeing **OR**
Does Not wear glasses **And** Has Problem Seeing

Level Three

Wears Glasses **AND**
Has Problems Seeing

Level Four

Is Blind

HEARING

Level One

Has No Problems Hearing **AND**
Does Not Wear a Hearing Aid

Level Two

Has Problems Hearing **And** Wears No Hearing Aid **OR**
Has No Problem Hearing **And** Wears a Hearing Aid

Level Three

Has Problems Hearing **AND**
Wears a Hearing Aid

Level Four

Is Deaf

SPEECH

Level One

Has No Problems Talking **AND**
Can Speak

Level Two

Has Problems with Speech **AND**

Any of the Following:

Speaks About the Same as Other Children **OR**
Speaks Better than Other Children

Level Three

Has Problems with Speech **AND**
Speech is Worse than Other Children's speech

Level Four

Does Not Talk

SENSATION

Level One

Level One in Speech And Hearing And Vision

Level Two

Level Two in Speech Or Hearing Or Vision

Level Three

Level Three in Speech Or Hearing Or Vision

Level Four

Level Four in Speech Or Hearing Or Vision

APPENDIX 4.3

DEVELOPMENT OF HUI2 ATTRIBUTES - DRAFT 8

Individuals are assigned to level which describes their functional ability best. If there is ambiguity between two levels then the individual is assigned to the highest functional level in question. An implicit condition in each level is that the individual is not previously assigned to a lower level (higher number).

COGNITION

Level One

Has No Remembering Problems **AND**

Any of the Following:

Has No Limitations in School **OR**
Has Limited In School question missing due to age or parental decision

Level Two

Receives Part-time Remedial Help for Slow Learner **Or**
Has Remembering Problems **Or**
Is Limited In School Work

Level Three

Receives Full-time Remedial Help for Mentally Challenged or Slow Learner **OR**
Receives Part-time Remedial Help for Mentally Challenged **OR**

Either of the following:

Receives Part-time Remedial Help for Slow Learner **And** Is Limited In School **OR** Receives Part-time Remedial Help for Slow Learner **And** Has Remembering Problems

Level Four

No appropriate questions

EMOTION

All items refer to last 6 months. A total of 17 questions scored for a maximum score of 34.
Never=0, Sometimes=1, Often=2. The questions are phrased as follows: Now or within the last 6 months does/is your child:

1) worries terrible things might happen;
2) worries about health;
3) worries a lot;
4) worries something bad will happen to those close to them;
5) sudden changes in mood or feelings;

6) cranky;
7) not as happy as other children;
8) unhappy sad or depressed;
9) has nightmares;
10) is tense;
11) feels too fearful or anxious;
12) cries;
13) too concerned with neatness or cleanliness;
14) feels he/she has to be perfect;
15) repeats certain actions over and over; compulsion;
16) talks about killing self;
17) deliberately harms self or attempts suicide.

Level One

No Oftens **AND**
Less than or equal to 7 Sometimes **AND**
Parents report No Emotional Problems **AND**
Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
Not in A Treatment Centre for the Emotional Problems **AND**
Never Talks about Killing Self **AND**
Never Harmed Self / Attempted Suicide

Level Two

Less than or equal to 3 Oftens **AND**
Total score of less than or equal to 17 **AND**
Parents report No Emotional Problems **AND**
Does not Receive Remedial help for Emotional Problems (part or full-time) **AND**
Not in A Treatment Centre for the Emotional Problems **AND**
Never Talks about Killing Self **AND**
Never Harmed Self / Attempted Suicide

Level Three

Not in A Treatment Centre for the Emotional Problems **AND**
Never Harmed Self / Attempted Suicide **AND**

Any of the Following:

Has greater than or equal to 4 Oftens **Or**
Total Score of greater than or equal to 18 **Or**
Parent Reports Emotional Problem **Or**
Receives Part-time Remedial Help for Emotional Problems **Or**
Sometimes Talks about Killing Self

Level Four

Not in a Treatment Centre for Emotional Problems **AND**

Any of the Following:

Often Talks about Killing Self **Or**
Sometimes Harms Self / Attempts Suicide **Or**
Receives Full-time Remedial Help for Emotional Problems

Level Five

Is or Has been in Treatment Centre for Emotional Problem **OR**
Often Harms Self / Attempts Suicide

FERTILITY

Level One

There are no appropriate questions for fertility therefore every child is assigned to Level One.

MOBILITY

Level One

Able to Walk Without Assistance **AND**
Has No Problems Walking **AND**
Has No Problems Bending **AND**
Is Not Limited In Activities **AND**
Does Not use Aids to Get Around

Level Two

Able to Walk Without Assistance **AND**

Any of the Following:

Has Problems Walking **Or**
Has Problems Bending **Or**
Is Limited In Activities

Level Three

Use Mechanical Aids to Get Around

Level Four

Is Not Able to Walk Without Assistance

Level Five

No appropriate questions

PAIN

Level One

Has No Pain

Level Two

Has Little Pain **OR**

Both of the following:

Has Some Pain **AND**
Is Not Limited in Normal Play or Normal Activities

Level Three

Has A Great Deal of Pain **OR**

Both of the following:

Has Some pain **AND**
Is Limited in Normal Play or Normal Activities

Level Four

Has A Great Deal of Pain AND
Is Limited in Normal Play or Normal Activities

Level Five

No appropriate questions

SELFCARE

Level One

Does Not Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Two

Does Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Three and Level Four

No Appropriate questions

SENSATION

Sensation is comprised of ratings for vision, hearing and speech, a child is assigned a level in each of these. A child is then assigned the level of sensation that corresponds to the lowest level (highest number) in any of vision, hearing and speech.

Vision

Level One

Does Not have Problems Seeing **AND**
Does Not Wear Glasses

Level Two

Wears Glasses **And** Has No Problems Seeing **OR**
Does Not wear glasses **And** Has Problem Seeing

Level Three

Blind in One Eye **OR**

Both of the following:

Wears Glasses **AND**
Has Problems Seeing

Level Four

Is Blind in Both Eyes

HEARING

Level One

Has No Problems Hearing **AND**
Does Not Wear a Hearing Aid

Level Two

Has Problems Hearing **And** Wears No Hearing Aid **OR**
Has No Problem Hearing **And** Wears a Hearing Aid

Level Three

Deaf in One Ear **OR**

Both of the following:

Has Problems Hearing **AND**
Wears a Hearing Aid

Level Four

Is Deaf in Both Ears

SPEECH

Level One

Has No Problems Talking **AND**
Can Speak

Level Two

Has Problems with Speech **AND**

Any of the Following:

Speaks About the Same as Other Children **OR**
Speaks Better than Other Children

Level Three

Has Problems with Speech **AND**
Speech is Worse than Other Children's speech

Level Four

Does Not Talk

SENSATION

Level One

Level One in Speech And Hearing And Vision

Level Two

Level Two in Speech Or Hearing Or Vision

Level Three

Level Three in Speech Or Hearing Or Vision

Level Four

Level Four in Speech Or Hearing Or Vision

APPENDIX 4.4

DEVELOPMENT OF HUI2 ATTRIBUTES - DRAFT A (approximation of Saigal et al. 1994)

COGNITION

Level One

Has Not Failed a Grade **AND**
Receives No Special Education (Perceptually Handicapped or Mentally Retarded or Slow Learners or Other Remedial Education) **AND**

Any of the Following:

Teachers Overall Assessment is At Grade **OR**
Teachers Overall Assessment is Somewhat Above Grade **OR**
Teachers Overall Assessment is Far Above Grade **OR**
Teachers Overall Assessment is Missing because child is young (4 or 5)

Level Two

Teachers Overall Assessment is Somewhat Below Grade **AND**

Any of the following:

Receives No Full-time Special Education (Perceptually Handicapped or Mentally Retarded or Slow Learners or Other Remedial Education) **OR**
Receives Part-time Special Education for Slow Learner or Other Remedial Help

Level Three

Receives Any Special Education (Perceptually Handicapped or Mentally Retarded or Slow Learners or Other Remedial Education) **OR**
Teachers Overall Assessment is Far Below Grade

Level Four

No appropriate questions

EMOTION

All items refer to last 6 months. A total of 4 questions are answered with Never=0, Sometimes=1, Often=2. The questions are phrased as follows: Now or within the last 6 months does/is your child:

1) Unhappy sad or depressed;
2) Nervous or tense;
3) Feels too fearful or anxious;
4) Worries;

Level One

No Oftens **AND**
Less than or equal to 2 Sometimes

Level Two

No Oftens **AND**
More than 2 Sometimes

Level Three

No more than 2 Oftens

Level Four

More than 2 Oftens

Level Five

Talks About Killing Self Often **OR**
Deliberately Harms self or Attempts Suicide Often

FERTILITY

Level One

There are no appropriate questions for fertility therefore every child is assigned to Level One.

MOBILITY

Level One

Does Not have CP **AND**
Able to Walk Without Assistance **AND**
Has No Problems Walking **AND**
Has No Problems Bending **AND**
Is Not Limited In Activities **AND**
Does Not use Aids to Get Around **AND**
Does Not Need Help to use Transportation **AND**
Does Not Need Supervision Getting Around Neighbourhood

Level Two

Does Not use Aids to Get Around **AND**
Not in Level One **OR** Four

Level Three

Does Use Aids to Get Around **AND**
Not in Level One **OR** Four

Level Four

Able to Walk Without Assistance **AND**
Has Problems Walking **AND**
Is Limited In Activities **AND**
Does Use Aids to Get Around **AND**
Does Need Help to use Transportation **AND**
Does Need Supervision Getting Around Neighbourhood

Level Five

No appropriate questions

PAIN

Level One

Has No Pain

Level Two

Has Pain **AND**
Takes No Prescribed Medications

Level Three

Has Pain **AND**
Takes Prescribed Medications **AND**
Medication Used equals Other

Level Four and Five

No appropriate questions

SELFCARE
(Saigal et al. used a Vineland Adaptive Behavioural Scale - Activities of Daily Living subscale as well)

Level One

Does Not Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Two

Does Need Help with Eating, Dressing or Using the Toilet (because of illness, injury or medical problems)

Level Three and Level Four

No Appropriate questions

SENSATION

Level One

Not Blind **And** Does Not Wear Glasses **And** Has No Problems Seeing **AND**
Not Deaf **And** Does Not Wear Hearing Aid **And** Has No Problem Hearing **AND**
Is Able to Communicate **And** Has No Problems Speaking **And** Speaks Same or Better Than Other Children (same age)

Level Two

Blind in One Eye (yes or no) **And** Wears Glasses **And** Has No Problems Seeing **OR**
Deaf in One Ear (yes or no) **And** Wears Hearing Aid **And** Has No Problem Hearing **OR**
Has Problems Speaking **And** Speaks Worse Than Other Children **And** Sometimes has Speech Problems

Level Three

Blind in One Eye (yes or no) **And** Wears Glasses **And** Has Problems Seeing **OR**
Deaf in One Ear (yes or no) **And** Wears Hearing Aid **And** Has Problem Hearing **OR**
Has Problems Speaking **And** Speaks Worse Than Other Children **And** Often has Speech Problems

Level Four

Blind in Both Eyes **OR**
Deaf in Both Ears **OR**
Mute

APPENDIX 4.5

EXPLANATION OF THE ATTRIBUTE COGNITION FOR DRAFTS 5 & 7.

DRAFT 5

COGNITION

Level One

No Limitations in School **And**
No Remembering Problems **And**

Any of the following:

Does not receive Remedial Help for Slow Learners or Mentally Handicapped **Or**
Is Missing in Limited in Schooling question because does not attend school due to age or parental decision

Level Two

Receives part-time Remedial Help for Slow Learner **Or**
Is Limited in Schooling only **Or**
Has Remembering Problems (as stated by parent) only **Or**
Is Missing in Limited School question due to parental decision or age but has Remembering Problems (as specified by parent)

Level Three

Receives Remedial Help for Mentally Handicapped (Full or Part-time) **OR**
Receives Full-time Remedial Help for Slow Learner **OR**
Receives any Remedial Help (except Emotional) **AND**

Any of the following:
Has Remembering Problems **OR**
Is Limited in School

DRAFT SEVEN

COGNITION

Level One

Has No Remembering Problems **AND**
Has No Limitations in School **AND**
Does Not Receive Any Remedial Help for Slow Child or Mentally Handicapped **OR**

All of the following:
Has Limited In School question missing due to age or parental decision **And**
Has No Remembering Problems And

Does Not Receive Any Remedial Help for Slow Child or Mentally Handicap.

Level Two

Receives Part-time Remedial Help for Mentally Handicapped or Slow Learner **Or**
Has Remembering Problems as stated by parent **Or**
Is Limited In School Work.

Level Three

Receives Full-time Remedial Help for Mentally Handicapped or Slow Learner **OR**
Is Limited in School Work And Receives Remedial Help (Full or Part-time) for Mentally Handicapped or Slow Learners **OR**
Has Remembering Problems And Receives Remedial Help (Full or Part-time) for Mentally Handicapped or Slow Learners **OR**
Has Remembering Problems And Is Limited In School And Receives Part-time Remedial Help for Mentally Handicapped or Slow Learners.

5. Child Psychiatric Disorders, Poor School Performance And Social Problems: The Roles Of Family Structure And Low Income In Cycle One Of The Canadian National Longitudinal Survey Of Children And Youth

5.1 Introduction

The primary goal of this paper is to improve our understanding of the roles which family structure[1] and low income play in the determination of psychiatric disorders, poor school performance and social problems among Canadian children. Both researchers and policy makers have a long standing interest in this topic. There is broad agreement that environmental factors have an impact on these outcomes. Until recently, however, there have been little or no Canadian data with which to assess the nature and magnitude of the role which socioeconomic factors play in incidence and severity of such problems.

The National Longitudinal Survey of Children and Youth (NLSCY) promises a major improvement in this situation. First, the sample is large; the first cycle of the NLSCY collected information on 22,831 children who were newborn to 11 years old in 1994-1995. Second, the information is comprehensive; the topics surveyed include child health, temperament, behaviour, school readiness/progress and other activities. Data were also collected on the child's custodial history, family functioning and the socioeconomic characteristics of the child's family and neighbourhood. Third, the survey is longitudinal; the long term goal is to conduct reinterviews every two years until the children are adults.

The panel nature of this new survey will provide many benefits. A single cross-section, for example, can tell us only if the family is currently poor. The NLSCY will eventually tell us for how long the family has been poor. Long spells of low income may have much more serious implications for child health and development than do short spells. In the case of family structure, a single cross-section permits one only to compare children from current one-parent and two-parent families. If the children of current lone parent families are observed to have poorer health than the children of current two-parent families, even after

controlling for other observed variables such as current income, what does this difference represent? It might be the emotional or financial deficit arising from the absence of one parent in which case marital dissolution might be said to have worsened child health. But it also might be the lagged effect of abuse or neglect by the non-custodial parent prior to separation in which case marital dissolution *per se* might be said to have improved child health. Making such distinctions is critical but a single cross section offers few insights in this regard. The NLSCY, however, will eventually permit us to observe the same children and their parents before and after occurrences of marital dissolution and remarriage (or even first marriage). This will better enable us to assess the circumstances under which a change in family structure has a harmful, neutral or beneficial impact on child health and development.

Only one subset of the data from Cycle One of the NLSCY was available at the time the analysis reported here was undertaken. Hence, many of the most important products of these data must await future cycles. The current paper, however, represents an essential, early step in exploiting the first data set available. We have two objectives. First, we use the national NLSCY sample to assess the association between a variety of psychiatric, academic and social difficulties and a range of socioeconomic variables including the number, age, income, education and market work of parents, and the sex, number and age of children.

Our second objective is to compare findings with NLSCY data to those provided by what previously was Canada's best survey of child health and development. This was the Ontario Child Health Study (OCHS) which used survey instruments similar to those used in the NLSCY to collect information on a random sample of children in that province in 1983 and 1987.

Briefly, our multivariate estimates with the national NLSCY sample reveal that being the child of a lone mother is strongly associated with virtually all of our outcomes. This finding is quite robust, but its interpretation is far from obvious when only a single cross-section of data is available. We find, however, that the estimated link between various child problems and the low-income status of the family is not robust, but rather depends importantly on the income measure and estimation method used. Access to

more of the NLSCY income data is clearly needed. Our comparison of estimates from the OCHS and the NLSCY indicate that psychiatric disorders have become more common and repeating a grade less common in Ontario between 1983 and 1993. Furthermore, the data suggest that the changes which took place during this time period may have been less favourable to the children of lone mothers than to the children of two-parent families.

The paper is divided into six sections. Section 5.2 provides a brief review of the literature. Data and measurement issues are discussed in Section 5.3. In Section 5.4, we use the full NLSCY sample to estimate a series of logit models for the same indicators of psychiatric, schooling and social problems that were analysed in the release volume. We compare estimates from the OCHS and the Ontario subsample of the NLSCY in Section 5.5. Section 5.6 provides a summary and conclusion.

5.2 Literature Review

The Ontario Child Health Study was carried out in 1983 (Boyle, Offord, Hoffmann et al., 1987) with a Follow-up in 1987 (Offord, Boyle, Racine, et al., 1992). Data were collected on child psychiatric disorders, social and educational functioning, physical health and a variety of sociodemographic variables. Several studies have used the OCHS data to examine the relationship between family economic disadvantage and child morbidity. Cadman et al. (1986) demonstrated high rates of chronic physical health problems among children in low-income families. Studies of emotional and behavioural problems have also demonstrated a consistent and significant association between economic disadvantage (low income or welfare participation) and psychiatric disorder (Lipman, Offord and Boyle, 1994; Lipman and Offord, 1996; Offord, Boyle and Jones, 1987). Among 4 to 11 year-old children, the odds of one or more psychiatric disorders (attention deficit hyperactivity disorder, conduct disorder or emotional disorder) for a poor child were more than three times that for a non-poor child (Lipman et al., 1994). Similarly, the odds for a boy aged 6 to 11 whose family received welfare income were four times that of a boy from a family with no welfare income (Offord, Boyle and Jones, 1987).

Studies of social and educational functioning have demonstrated similarly significant associations between poverty and morbidity (Lipman et al., 1994). Furthermore, the significant association between poverty and a variety of morbidities are not limited to childhood. For example, at least one-third of children with conduct disorder continue to experience serious psychosocial difficulties into adulthood (Offord and Bennett, 1994).

Four papers have examined the association between family structure and child psychosocial morbidity using the OCHS data. Munroe Blum, Offord and Boyle (1988), using 1983 cross-section, found that children in lone parent families were at a significantly increased risk of a variety of psychiatric and academic morbidities. Lone parent family status did not, however, continue to have a significant relationship with morbidity when welfare income was controlled in the analysis. Dooley and Lipman (1996) and Curtis et. al. (1997) also used data from the 1983 cross-section to examine the statistical relationships among family status, income and various measures of child psychosocial and physical health. Both papers found instances of significant associations between lone-mother status and child problems. However, the estimated impact of low income was found to be much more robust in the Dooley and Lipman (1996) paper.

Only two articles have used the longitudinal OCHS data to examine the issues of concern in this paper in part due to the small number of lone mothers for whom data are available in both 1983 and 1987. Lipman and Offord (1996) found that both family status and poverty indicators had significant independent relationships with poor child outcome. Curtis et. al. (1997) found that the data are more consistently supportive of a role for permanent rather than current low income, family status continued to have a significant relationship with poor child outcomes.

Data from other sources have found both poverty and single-parent family status to be associated with increased rates of child psychosocial morbidity (Duncan and Brooks-Gunn, 1996). Lipman, Offord and Dooley (1996) examined preliminary data from the NLSCY and found that almost one-third (30.4%) of 4 to 11 year-old children from lone-mother families have a psychiatric disorder (hyperactivity, conduct

disorder or emotional disorder) which is significantly greater than the rate among children from two-parent families (18.8%.) They note, however, that the majority of children from lone-mother families do not have these problems and most children with these problems come from two-parent families. They also find that both single mother family status and low income significantly and independently influence child well-being, but their multivariate analysis was limited to these two independent variables. Offord and Lipman (1996) also examined the frequency of emotional and behavioural problems using the early NLSCY data and generally find that problem levels decrease as family income rises.

5.3 Data and Estimation Methods

The NLSCY is designed to measure child development and well-being. Statistics Canada is conducting the survey on behalf of Human Resources Development Canada. The first cycle in 1994-1995 collected information concerning 22,831 children who were new-born to eleven years of age. The long term goal is to follow these children into adulthood. The sample excluded children who had been living in institutions for over six months and Aboriginal children living on-reserve. Information was collected in the Yukon and Northwest Territories but was not included in the first data release. The primary respondent in the NLSCY is the household member most knowledgeable about the child (PMK = person most knowledgeable).

One portion of the Cycle One data was released in a public use file in February of 1997 and is analysed in this paper.[2] A second release of Cycle One data (March, 1998) includes physical health variables for the child and parents, the custodial history of the child, and reports from the child's teacher and principal.

5.3. A Sample Selection

There are 14,226 children age 4 to 11 in the NLSCY. From this number, we omitted the following: 8 children who do not live with either parent (biological, step, adopted or foster), 21 children for whom

neither parent is the PMK, 195 children who live with a lone father, 1,103 children for whom there were missing values for a dependent (outcome) variable and 164 children for whom we were missing values for an independent (conditioning) variable. These omissions resulted in a sample of 12,735 children age 4 to 11. The school age sample is 9,283 children age 6 to 11. The reasons for these omissions are as follows. We excluded the children who do not live with either parent or for whom neither parent is the PMK on the grounds that these may represent quite unusual and/or temporary family structures. The children of lone fathers were excluded because their number is too small for separate analysis and their socioeconomic characteristics, especially income levels, are too dissimilar from those of lone mothers to justify a common category of "lone parents". Most (90%) of the missing values concern dependent variables and statistical "solutions" for this problem are not readily available at least to these authors. In the next section, we do provide more information about the observations omitted due to missing values.

5.3. B Child Outcomes

Child outcomes were examined in the areas of psychiatric, academic and social functioning. Selection of these child outcomes and of the methods used to assess the presence of a problem was guided by knowledge about the multiple components of healthy child development (Offord et. al. 1992), previous research studies examining child psychosocial health (Offord et. al. 1987) and availability of variables in the NLSCY. All of our data come from the parental reports because data from the teachers' reports were not in the first release by Statistics Canada.

5.3.B.i. Psychiatric Disorders

Table 5.1 provides the list of symptoms used in the NLSCY for each of the psychiatric disorders studied: hyperactivity, conduct disorder and emotional disorder. Briefly, hyperactivity is characterized by inattention, impulsivity and motor activity; conduct disorder is characterized by either physical violence against persons or property or a severe violation of societal norms; and emotional disorder is characterized

primarily by feelings of anxiety and depression. We define the variable one or more psychiatric problems as one or more of hyperactivity, conduct disorder or emotional disorder.

The PMK was asked if each symptom in Table 5.1 was "never or not true", "sometimes or somewhat true" or "often or very true" of the child in question. Values of 0, 1 and 2 respectively were assigned to these responses. The values of the responses to each question were then summed to obtain a score for each of the three possible problems. A disorder was deemed to be present if the child's score exceeded a given threshold. We used two sets of thresholds both of which have been used in previous research. The choice of threshold has little impact on the multivariate estimates. Therefore, we present one set of estimates in the tables and comment where relevant on the results yielded by the second set of thresholds. As we will show, the multivariate results for psychiatric disorders in particular are much more sensitive to sample weights and the low-income measure than to the disorder thresholds.

The estimates presented in the tables in Section 5.4 were derived using thresholds which are based on those used in the Ontario Child Health Study. The OCHS was based on a survey of a random sample of 3,294 children in Ontario in 1983 with a Follow-Up in 1987. The NLSCY survey instrument relied heavily upon the OCHS particularly in the area of psychiatric disorders. In the OCHS, a random sample of children who had participated in the survey were also clinically assessed by a child psychiatrist who was blind to the parental and teacher report data. The disorder thresholds were then established for the OCHS survey data by selecting scores which maximized agreement with the child psychiatrists' diagnosis of the same disorders. In other words, the threshold scores in the OCHS were established at the point which best discriminated the presence or absence of a disorder as diagnosed by a child psychiatrist. See Boyle et. al. (1987) for complete details.

The questions on the OCHS and the NLSCY are worded similarly. The number of questions asked on the two surveys of parents in the OCHS was similar but not identical. For example, there were 15 conduct disorder questions on the OCHS and, hence, a maximum score of 30 (= 15 times 2). The OCHS threshold score was 9 which is 30% of the maximum score of 30. The maximum score on the NLSCY is

28 (=14 times 2), 30% of which is 8.4. We performed our NLSCY analyses with conduct disorder thresholds scores of both 8 and 9. The resulting multivariate estimates were very similar and those with threshold of 8 are presented in the tables in Section 5.4. We used a similar procedure to establish OCHS-equivalent thresholds for hyperactivity and emotional disorders in the NLSCY data. Using this set of thresholds, 7 % of the children in our sample are hyperactive, 5 % have a conduct disorder and 10% have an emotional disorder. Sixteen per cent of the children have one or more of these three disorders.

Our second set of disorder thresholds was established by selecting that score which separated the top 10% of the scores from the bottom 90% in the sample. By definition then, 10% of the children have each individual disorder according to this set of thresholds. Twenty one percent (21%) of the children have one or more of disorders based on these thresholds. These are the same thresholds as used in Lipman, Offord and Dooley (1996).[3] Thresholds which yield prevalence rates of 5%-10% are commonly found in the literature. Support for these prevalence rates (and the associated thresholds) can be found in five major studies of child psychiatric epidemiology worldwide including Canada (Costello 1989). Henceforth, we refer to our two sets of thresholds as the OCHS and 10% thresholds respectively.[4]

5.3.B. ii Schooling and Social Problems

In the area of academic functioning, ever repeated a grade is defined exactly as stated. A child is defined as having a school problem if the PMK reports that current overall school performance is poor or very poor. These two indicators of schooling problems variables were available only for children age 6 to 11. Most children age 4 and 5 were not attending school.

A child is defined as having a social problem if the PMK reports the child as having frequent or constant problems over the last six months in getting along with any one of either children (e.g., friends, classmates), teachers or parents. This variable was available for 4- to 11-year-old children but we used it only for 6- to 11-year-olds because of the absence of teacher responses for most 4-and 5-year-olds.

One or more problems is defined as having one or more of the following: one or more psychiatric

disorders, ever repeated a grade, school problem or social problem. This variable was defined only for children age 6 to 11.

5.3. C Family Characteristics

We classified a family as a lone-mother family if the child was living with a mother who had no spouse or common-law partner living in the household. The comparison group is families in which a child was living with two parents. Parent refers to a biological, step, adoptive or foster parent. As noted in the previous section, 98% of Canadian children live in one of these two types of families. At present, we know only the child's current living arrangements. In some cases, this may provide an inaccurate picture of the family structure(s) in which the child has been raised. (Recently released data on the children's custodial history will provide a richer picture.)

Our principal income variable is a conventional measure of low income or poverty. Specifically, we classified a family as low income or poor if the family income level is below the 1992 Statistics Canada Low Income Cut-off (LICO). We selected this particular measure because the 1992 LICO is the one most commonly used in current analyses of poverty in Canada. Its value is a function of both family size and the size of the area in which the family resides. The entire set of LICOs is revised periodically to account for changes in proportion of income which the average family spends on necessities. The year of the LICO, which is 1992 in the case of the NLSCY, refers to the year of the Survey of Consumer Expenditures upon which a particular set of LICOs is based.

Why have we focussed on poverty as opposed to other measures of income? One reason is that many of the papers reviewed in the Section 5.2, particularly those from the OCHS, have found a non-linear relationship between family income and child health. The association is strongest at low levels of income. A second reason is that much recent discussion concerning child policy has centred on income-targeted proposals, such as an enriched federal child benefit, which have the principal goal of reducing the incidence of poverty among families with children. We wish to explore the possible health consequences

of such proposals. The third and most binding reason is that the income data available in the NLSCY public use file are very limited. Most importantly, the continuous measure of family income, the family LICO and the ratio of these two figures are all suppressed on the public use file.

One of the income measures, which is available from the public use file, divides the ratio of family income to needs (1992 LICO) into six categories, the lowest of which is 0.75 or less and the highest category of which is 1.25 or more. Our low income measure is derived from this variable. Also available on the public use file is a categorical variable for family income, the highest of which is $40,000 or more for lone mothers and $60,000 or more for couples. Family size is available on the public use file but city size is not so that the family's LICO can not be estimated. We have also experimented with two other measures of low income. One alternative was to classify a family as very low income or very poor if the family income level was below three-quarters (75%) of the 1992 LICO. A second alternative, used only in our multivariate analyses, was to use a dummy variable equal to one if total household income was less than $20,000 while controlling for the number of persons in the household. Our multivariate estimates of the association between low income and child problems turn out to be quite sensitive to the measure of low income which, we believe, emphasizes the need to make more of the income data available in the public use file.

Not only do we have limited income variables, we also as yet have only one year of income data. Hence, our low-income measures fail to distinguish between short and long spells of poverty which may have quite different consequences for child health and development. The absence of such information may affect the estimated coefficients of variables other than low-income status. In particular, we suspect that at least part of the estimated impact of lone motherhood is really a permanent income effect, that is, it reflects the fact that lone mothers have much longer spells of poverty than do couples (Laroche 1997). The same may be true of other variables in our multivariate analysis such as parental education. More insight into this matter will be provided by future cycles of the NLSCY data.

Several other variables are also used in our multivariate analyses. These include the age and sex of

the child, and the age, schooling level and market work of the PMK. The definitions of these variables, however, are straightforward and need little discussion.

Finally, we implicitly assume in our multivariate analyses that child health and schooling are the outcomes of socioeconomic factors such as income and family structure. It certainly possible, however, that the opposite causal effect may be true in some cases. For example, severe childhood health problems may reduce family income by limiting the paid work of one or both parents. The stress arising from severe health problems might also influence the likelihood of separation, divorce or remarriage. Unfortunately, there is little that can be done about this problem currently given the lack of identifying variables for a more complete structural model. Our approach is best viewed as one means of exploring the joint distribution of the variables which we believe to be of relevance to the process which determines child health and development.

5.4 Empirical Results With NLSCY National Sample

The percentages of children with psychiatric, schooling or social problems by family status and low-income status are presented in Table 5.2. Consider first the three psychiatric disorders. The most notable feature is that the children of lone mothers always have a higher incidence than do the children of two parents conditional on income class [comparing columns (2) and (4) and comparing columns (3) and (5)]. For example, the smallest such conditional difference is that for conduct disorder between the children of non-poor lone mothers and non-poor couples which is three percentage points (9% - 6%). The largest such differences are those between the children of poor lone mothers and poor couples for conduct disorder and emotional disorder. These are both eight percentage points [(15% - 7%) or (18% - 10%)]. Note also that the percentage of each disorder among the children of non-poor lone mothers exceeds the incidence among the children of poor couples.

The differences by low-income status, conditional on family-status class [comparing columns (2) and (3) and comparing columns (4) and (5)], are smaller. For example, the prevalence of hyperactivity is the

same among the children of poor and non-poor lone mothers (9%) and is also the same among the children of poor and non-poor couples (4%). In the cases of conduct and emotional disorders, the differences between the children of poor and non-poor couples are negligible but are six and four percentage points respectively among the children of lone mothers. In sum, family status appears to matter more than does low-income status when it comes to differences in the prevalence of these three psychiatric disorders. In results not shown here, this same qualitative conclusion emerges if one uses either our "very low income" measure or the 10% thresholds for each disorder.

Only 5% of children have ever repeated a grade which in part reflects the fact that the oldest children are only eleven years old. Unlike the case of psychiatric problems, the conditional differences by low-income status are similar in magnitude to the conditional differences by family status. The difference between poor and non-poor children is four percentage points for both lone mothers (13%-9%) and couples (8%-4%). The difference between the children of lone mothers and couples is five percentage points for both poor (13%-8%) and non-poor (9%-4%).

Only 3% of the PMK's report that the child is doing "poorly" or "very poorly" in school.[5] In Table 5.2, the children of poor lone mothers have the highest percentage with this problem but even this figure is only 7%. It is unfortunate that the teachers' reports in the NLSCY Cycle One were not included in the first release of the data because at least one other study has found that teachers provide lower assessments of student academic progress than do parents. Saigal, Szatmari et al. (1991) studied a small, control sample of full-term children that were used in a long term follow-up study of low birth-weight children. Parents reported that only 4% of the control sample were doing "poorly" in school. However, teachers reported that 17% of the same children were doing "poorly". The sample size for this study was small (145 children of age 8), but this finding does highlight the need for careful scrutiny of the NLSCY teachers' reports.

PMKs also report only 3% of children as having "frequent" or "constant" problems in getting along with parents, peers or teachers.[6] As with "doing poorly in school", the children of poor lone mothers stand out from the other groups with a prevalence rate of 9%. If one uses the "very low-income" measure,

however, differences of 4 and 5 percentage points also emerge between the children of poor and non-poor couples in the case of poor school performance and social problems respectively.

The final row of Table 5.2 presents the percentages of children, age 6-11, with one or more of any of the problems in the table. The differences by family status are large - 19 percentage points (43% - 24%) in the case of poor children and 12 points (32% - 20%) in the case of non-poor children. Among the children of lone mothers, the difference by low-income status is also sizable at 11 percentage points (43% - 32%) but among children with two parents this same difference is small at 4 points (24% - 20%). The general picture is that family status matters regardless of low-income status and that low-income status matters but most noticeably among lone-mother families.

The socioeconomic characteristics of the children and their families in our sample are presented in Table 5.3. Fourteen percent are from lone-mother families. Two-thirds of the children of lone-mothers are poor and one-half are very poor which clearly dwarfs the corresponding poverty rates among the children of couples. The PMKs who are lone mothers are more likely to lack a high school degree and less likely to have a diploma or degree from college or university. They are also younger and have fewer children than do the married PMKs. The age distribution of the children differs little by family status.

Table 5.3 demonstrates that families headed by lone mothers and married couples differ in a number of ways. Furthermore, the research cited in Section 5.2 has usually found child psychiatric, schooling and social problems to be associated with more than one of the variables in Table 5.3. Hence, we turn to multivariate analysis in order to assess the partial association between various child outcomes and these socioeconomic characteristics. We have chosen to use the logit model which assumes that the probability of an outcome is the following:

$$\text{Prob}\,(Y=1 \mid X) = e^{X'B}/(1 + e^{X'B}) = 1/(1 + e^{-X'B})$$

where Y = a dichotomous dependent variable, X = a vector of independent variables, B = the estimated logit coefficients and e = 2.718.[7] Our selection of independent variables was guided by the literature on the determinants of health (see for instance Evans and Stoddart 1990, Grossman 1972, Grossman and Joyce

1989) and by the availability of data in the NLSCY. We discuss a number of issues which are relevant to the multivariate estimates as a whole before turning to the estimates for specific outcomes.

The first issue is missing values. Recall that we omitted 1,103 observations from our sample because of missing values for a dependent variable. There is no obvious solution for this problem of which we are aware. However, we did examine the data to see if observations with and without missing values for the dependent variables differed in terms of the unconditional means of the independent variables. Using 5% level of significance, children with missing values for an outcome variable were more likely to be female, age 8-11, and to have a lone mother, low income and an above average number of siblings.[8]

The only independent variables with missing values were those for the age and education of the PMK. There were 164 such observations and these were not included in the estimation samples for the tables below. As a check, we re-estimated each logit model including these 164 observations and a dummy variable equal to one if there was a missing value for any independent variable.[9] The coefficient for the missing value dummy is never significant at even a 20% level of significance.

Second, we specify that the sex of the child can be represented by a simple dummy variable, that is, it just shifts the intercept in our logit models. It is plausible, however, that the impact of other independent variables depends on whether the child is a girl or a boy. Therefore, we estimated each logit model with an interaction term between the sex of the child and each other independent variable. We were never able to reject the hypothesis that the coefficients were individually or jointly equally to zero. The lowest p-value from these tests was 0.19. Hence, the data support our assumption that the sex of the child is a shift factor.

Third, the 11,833 children in our sample come from only 5,052 different families. In order to adjust for this fact and in order arrive at standard error estimates which are generally more robust than the conventional ones, we employed a method developed by White (1980). This adjustment typically did not make a large difference.

Fourth, one variable in which we are interested is the market work patterns of the parents. Parental market work may affect child health and development in a variety of ways - some negative and some

positive - and this may well be true even in the presence of controls for family income. A negative impact might reflect the absence of high quality, affordable substitutes for parental care. A positive impact might arise for at least two reasons. Greater parental market work may contribute to higher parental self esteem which would help the parent to pay more and better attention to the child's needs. In addition, greater market work specifically by a married mother may provide her with more control over family expenditures. The "good mother" hypothesis asserts that the average mother has greater concern for her children's welfare than does the average father. If true, then greater maternal economic control should result in a greater proportion of family income being directed to the children's interests including health care (Schultz 1990, Thomas 1990, Phipps and Burton 1992, and Browning et. al. 1993).

We estimated all of the logit models below in Section 5.4 including one dummy variable for whether or not the PMK worked "full-year, full-time" in the market and a second dummy variable for whether or not the PMK worked "part-year or part-time" in the market. We were consistently unable to reject the hypothesis that either of these coefficients is zero.[10] Hence, we do not include these estimates in the tables presented below. However, we have only begun to examine this issue with the NLSCY and further study is merited.

Finally, we had to decide whether or not to use the sample weights in our multivariate analyses. In the economics literature, this issue receives relatively little attention because it is commonly found, or at least assumed, that weighting makes little difference. We adapted a test suggested by DuMouchel and Duncan (1983) in the context of linear regression. Each logit model was estimated including an interaction between each independent variable and the sample weight. We then tested the hypothesis that the interaction terms were jointly equal to zero. We were able to reject the hypothesis with a p-value of at least 0.05 in the cases of conduct disorder, emotional disorder and social problems. The same hypothesis could not be rejected in the cases of hyperactivity, repeated grade and school problems. Hence, we estimated our logistic regressions using both weighted and unweighted data. The weights affect not only the standards errors but also some point estimates. This was especially true for low-income coefficients in the

psychiatric disorder regressions. Tables 4.4 and 4.5 present the estimates with weighted data and our principal low-income variable (income <1992 LICO). Table 5.6 illustrates the impact of using unweighted data or a different low-income measure.

Table 5.4 contains the estimates of our logit models for the three psychiatric disorders. All of the independent variables are dummies except for the number of children. The constant corresponds to a child who is a male, age 4 to 7, from a non-poor, two-parent family in which the mother is under age 35 and has a high school degree. Consider first, the estimates for hyperactivity. Lone-mother status is associated with a significantly higher probability of this disorder but low income is not.[11] We included an interaction term for these two variables because of an expectation that low income might have a different effect among lone mothers than among couples given that poverty spells tend to be longer among the former. The interaction coefficient is negative but not significantly different from zero. The lowest and highest categories for the mother's schooling have coefficients of the expected sign but only the latter has p-value less than 0.05. The probability of hyperactivity is significantly less among girls and there is weak evidence (p-value less than 0.10) that it is more likely among older children and those from smaller families.

We wish to illustrate the quantitative impact of these coefficients, particularly those for the family status and low income. This impact is non-linear so we first enter the predicted probability for a "base case" in the row after the constant. The "base case" has the characteristics of the constant (see the previous paragraph) except for the fact that we assume that there are two children in the family. The row after the "base case" shows the effect of changing the value of the lone mother variable from zero to one. This increases the predicted probability of hyperactivity by 7 percentage points from 6% to 13%. The next row shows the effect of the income coefficient which in this case is virtually zero. The interaction term is almost always not significant and, hence, we do not show a separate income effect for a lone mother.[12]

The coefficients for conduct disorder and emotional disorder are similar to those for hyperactivity in several respects. The coefficient for lone-mother status is both large and statistically significant. A change in this variable increases the predicted probability of a conduct disorder from 8% to 14% and of an

emotional disorder from 6% to 10%. Neither the low-income coefficient nor the interaction term are significant for either of these disorders. The absence of a high school degree for the PMK is associated with a significantly higher likelihood of a conduct disorder. The children of older mothers are less likely to have either a conduct disorder or an emotional disorder. Girls are less likely to have a conduct disorder and older children are more likely to have an emotional disorder. The number of children in the family is positively associated with the presence of a conduct disorder.

The final column of Table 5.4 indicates that one or more of the three psychiatric disorders is more likely if the child is a boy or is age 8-11, or if the child has a lone mother, a mother with less than a high degree or a mother under age 35. The lone-mother coefficient raises the predicted probability of a disorder by 10 percentage points from 15% to 25%.

Table 5.5 presents the estimates of our logit models for schooling problems, social problems and one or more of any of the problems in Tables 5.4 or 5.5. In each case, the coefficient for lone-mother status is statistically significant and increases the predicted probability by 2 to 4 percentage points which is quite a large increase relative to the base probability. Unlike psychiatric disorders, the low-income coefficients for both repeated grade and frequent social problems are also statistically significant and have the impacts on the predicted probability of 1 and 2 percentage points respectively. The interaction coefficients are all small and nonsignificant.

PMK's education generally has the expected sign but the only significant coefficient is for the impact of "no high school degree" on "repeated grade". Mother's age is significant only for grade repetition. Boys and older children are more likely to have each of the problems in Table 5.5. The number of children in the family has a weak positive association with "doing poorly in school" and a weak negative association with social problems. [13]

The last column of Table 5.5 presents the logit estimates for our most comprehensive summary measure. The value of this variable is one if the child has one or more of any of our psychiatric, schooling or social problems. The estimates indicate that the likelihood of one or more problems is greater if the

child is a boy or is age 8-11, or if the child has a lone mother, a mother with less than a high-school degree or a mother under age 35. Once again, the quantitative impact of the lone-mother coefficient is substantial and raises the predicted probability of a disorder by 14 percentage points from 20% to 34%.[14]

The most surprising feature of our results thus far is the weak association between (current) low-income status and any of the three psychiatric disorders or poor school performance. We undertook the following steps to assess the robustness of this finding. We estimated each of the logit models in Table 5.4 and 5.5 with the following variations undertaken one at a time: (1) "very low income" (income less than three-quarters of the 1992 LICO) was used in place of "low income" (income less than the 1992 LICO); (2) the 10% thresholds were used in place of the OCHS thresholds; (3) unweighted data were used in place of weighted; and (4) a dummy variable equal to one if total household income was less than $20,000 was used in place of our "low income".

Alternatives (1) and (2) produces coefficient estimates for low income and the interaction term (and other variables) which are quite similar to those in Tables 5.4 and 5.5. Such was not true of alternatives (3) and (4). The left side of Table 5.6 contains the coefficients for lone mother, low income and their interaction from test (3) above. The only noticeable change for the lone-mother variable is the drop in the coefficient for repeated a grade but this still remains highly significant. The low-income coefficients for conduct disorder, emotional disorder, one or more psychiatric problems, and one more of any problem are all now statistically significant. (Repeated a grade and social problems already had significant coefficients in Table 5.5.) The magnitude of each of these four coefficients, however, is only about one-third to one-half that of the corresponding lone-mother coefficients. The interaction coefficients are all non-significant. The other coefficient estimates (not shown here) are quite similar to those in Tables 5.4 and 5.5.

The right side of Table 5.6 contains the coefficients which result from test (4) above. In this case we used a dummy variable equal to one if total household income was less than $20,000 as the measure of low income.[15] We initially experimented with dummy variables for a larger set of the income categories which are available for both lone mothers and couples in the public use file, specifically, $20,000-$29,999,

$30,000-$39,999 and $40,000 and above. However, very few of the dummy variable coefficients for these other categories were significant. For the estimates on the right side of Table 5.6, we used weighted data and substituted the number of persons in the household for the number of children. Neither of these changes, however, had major effects on the estimates. The lone-mother coefficients remain highly significant and are all somewhat larger in size than in Tables 4 and 5. Most of the low-income coefficients are now significant. Conduct disorder has a p-value of 0.08 and only hyperactivity lacks a strong association with low income. The income coefficients are smaller than the lone-mother coefficient in the case of psychiatric disorders but not in the case of poor school performance and frequent social problems. The interaction terms never have a p-value less than 0.05; however, the point estimates are consistently negative and large in absolute size indicating that this particular "income measure" may discriminate better in the case of couples than in the case of lone mothers.

What are the main conclusions to be drawn from our results thus far? One conclusion is that our estimates of the effect of current low income are not robust. The most conventional approach (Table 5.4 and 5.5) indicate that low income matters in the cases of grade repetition and frequent social problems but not in the cases of psychiatric disorders or poor school performance. The use of either unweighted data or of a dummy variable for family under $20,000, however, yields a strong association between low income and every problem except hyperactivity. A major goal of the NLSCY is to assess the statistical association between child health and family income. Hence, the non-robust nature of the estimates of this relationship highlight the importance of giving researchers access to more of the income data. The currently available measures simply do not offer a clear answer to this key policy question.

A second conclusion is that lone-mother status is the variable which is most consistently and significantly associated with our psychiatric, schooling and social outcomes. The coefficient estimates for this variable are quite robust, but there are many questions concerning their proper interpretation. To what extent does this finding represent the fact that Canadian lone-mother families have longer spells of low income than do two-parent families (Laroche 1997)? If there is a lone-mother "effect" not due solely to

economic resources, what does this represent? Is it the limited time resources ("time poverty") of the typical lone mother or might it be the health problems of the lone mothers themselves (Lipman et al. 1997, Curtis 1997)? Would the lone-mother coefficient be as large were we using a different, and perhaps more appropriate, comparison group, e.g., comparing lone-mother families to those two-parent families with a high risk of dissolution as opposed to a random sample of all two-parent families? In the Violence Against Women Survey conducted by Statistics Canada in 1994, 16% of all currently married women reported that they have been physically abused by their current partner. However, 53% of previously married women reported that they were physically abused by their ex-partner (Kingston-Riechers 1998). This implies that, in at least some cases, the problems of the children of lone mothers may reflect primarily the abusive nature of the union into which the children were born. For such children, marital dissolution may represent a distinct improvement in their home environment which we are missing by comparing them to a random sample of children from two-parent families. Our ability in future NLSCY cycles to follow the same children into and out of families with different structures and constraints will represent a major improvement in this regard.

As for the other independent variables, we commonly, though not always, estimated a lower likelihood of problems among the children of women over age 34. This result, like that of the lone-mother coefficient, admits a variety of interpretations. One is that the mother's age may be a proxy for the long run income of the parents if, as seems likely, higher levels of earnings are positively associated with delayed fertility. Other possibilities are that older mothers may be more mature, have greater time resources or have more widely spaced children. All of these deserve further scrutiny in future studies.

We typically found a lower incidence of problems among girls. This has some support in the earlier literature especially in the case of hyperactivity and conduct disorder (Offord et al. 1987). Among the dummy variables for the PMK's education, only coefficient for "no high school degree" always had the expected sign and even this estimate was significant in only 2 out of 6 problems. This was somewhat surprising given our expectation that this variable might reflect a variety of influences on child health and

development including a permanent income effect.

5.5 Comparison of the Results With the NLSCY and OCHS Data

The Ontario Child Health Study provided the best Canadian data source for studying the questions of interest in this paper prior to the NLSCY. In this section, we compare estimates from the OCHS and the Ontario subsample of the NLSCY (henceforth NLSCY-Ontario). The survey methods and instrumentation of the OCHS are described in detail elsewhere (Boyle et al. 1987) and are summarized here. The target population included all children born between January 1, 1966 and January 1, 1979 whose usual place of residence was a household in Ontario. Statistics Canada surveyed a total of 1,869 families and 3,294 children in 1983. The interviewers collected information from a parent (usually the mother), from a teacher for the 4 to 11 year olds and from the youths themselves in the case of 12 to 16 year olds. There was also a Follow-Up survey in 1987. In this paper, we use only parental reports in 1983 for children age 4 to 11.[10]

The OCHS and the NLSCY differ in a number of respects other than provincial scope. First, the proportion of children with a lone mother is 9% in the OCHS sample but is 15% among children from Ontario in the NLSCY. This increase is consistent with the growth in the proportion of families with young children which are headed by lone mothers between 1983 and 1994 (Dooley 1995) and does not, we believe, primarily reflect differences in the methods used to identify lone-mother and two-parent families in the two samples. Second, the low-income status variable in the OCHS is a close, though not exact, approximation to whether or not the family's income is above or below the 1969 Statistics Canada LICO. The 1992 LICO's used in the NLSCY are substantially higher (in real dollars) than the 1969 LICO's. As discussed in Section 5.3 above, the best approximation which we have for OCHS low-income variable in the NLSCY data is whether or not the family has income below 75% of the 1992 LICO ("very low income"). Third, the sample sizes differ. There are 1,315 children, age 4-11, and 1,084 children, age 6-11, in the OCHS sample. In particular, the small number of children of lone mothers in the OCHS sample (110 of age 4-11 and 99 of age 6-11) should be kept in mind when assessing the results below. In contrast, there are 3,105 children, age 4-11, and 2,273 children, age 6-11, from Ontario in the NLSCY sample.

Finally, as discussed in Section 5.3, the number of questions asked to assess psychiatric disorders differed slightly between the two surveys.

Table 5.7 presents the proportion of children in each survey with each of three problems: one or more psychiatric disorders (hyperactivity, conduct disorder or emotional disorder); ever repeated a grade; has frequent problems in getting along with peers, parents or teachers. The figures for Ontario children in the NLSCY are similar to those for the national NLSCY sample in Table 5.2 with the following two exceptions: five per cent of the NLSCY children of non-poor lone mothers in Ontario have repeated a grade as opposed to 9% in the national sample; and 9% of the NLSCY children of poor couples in Ontario have frequent social problems as opposed to 5% in the national sample.

The bottom row of Table 5.7 shows that the percentage of children with a psychiatric disorder increased from 11% in the OCHS to 16% in the NLSCY-Ontario. This increase in the incidence of a psychiatric disorder between the two surveys is also true of each family status and low-income status in Table 5.7 except in the case of the children of poor couples using the 1992 LICO. The increases are larger for the children of lone mothers than for the children of couples. As noted above, however, there is a difference in the number of questions used to measure psychiatric disorders on the two surveys so that the differences in Table 5.7 may reflect measurement differences.

The percentage of children who have ever repeated a grade declined from 9% in the OCHS to 4% in the NLSCY-Ontario. This question is identical on the two surveys. We suspect that the downward trend may reflect a change in the propensity of school teachers and administrators to make students repeat a grade as much as it does a change in actual school performance.[17] However, we have no obvious explanation for why the decline in this percentage should be greater among the children of poor lone mothers and non-poor couples. The questions used to assess a "social problem" are identical on the two surveys as are the overall percentages of children with this type of problem (4%). Furthermore, there do not appear to be major differences between the surveys in the incidence of social problems by family status or low income status.

We estimated logit models for each of the three dependent variables in Table 5.7 using the same set of independent variables as in Tables 5.4 and 5.5. Table 5.8 contains the coefficients for lone-mother status, low-income status and the interaction between these two variables. We report NLSCY-Ontario estimates obtained with three different income measures. The very low-income measure was used because this best approximates the only low-income measure available in the OCHS data. Income under $20,000 was used because of the impact this had with the national NLSCY data. We comment in the text on any of the coefficient estimates for other variables that are especially notable.

Consider first the estimates for the presence of one or more psychiatric problems in the top panel of Table 5.8. The lone-mother coefficients are all of similar magnitude, but the NLSCY estimates have much larger t-ratios possibly reflecting the larger sample size. The OCHS low-income coefficient is large and quite significant. As with the national sample, the low-income coefficients for NLSCY-Ontario are not robust. Only income under $20,000 provides an estimate of a size and significance comparable to the OCHS. In each case, the interaction is not significant although, as with the national NLSCY sample, the estimate in the case of income under $20,000 indicates a possible difference between the children of couples and lone mothers. In other respects, the four sets of logits estimates for psychiatric disorder are quite similar. In each case, the likelihood of a disorder is distinctly lower for a child who is female, under age 8 and whose mother is age 35 or over. The impact of mother's education is weak in each case.

The middle panel of Table 5.8 presents the estimates for "ever repeated a grade". In the OCHS estimates, neither lone-mother nor low-income status appear to matter. In the case of the NLSCY data, however, both lone-mother and low-income status are strongly associated with the likelihood of repeating a grade in most cases especially that of income under $20,000. The interaction coefficient implies that this income effect may be true only of two-parent families. In results not shown here, mother's education does have a significant coefficient in the OCHS data along with the gender and age of the child. This was also generally true of the NLSCY estimates.

The bottom panel of Table 5.8 presents the logit estimates for the presence of "frequent or constant"

problems in getting along with parents, peers or teachers. Low income has a large and statistically significant coefficient in all four specifications. Just as consistently and interestingly, none of the lone-mother coefficients have a p-value less than 0.05. This is the only case in which the NLSCY data, from either Ontario or Canada as a whole, did not indicate a strong association between lone-mother status and the likelihood of a problem.[18] In results not reported here, mother's age and the child's age and sex continue to play important roles in the NLSCY estimates but not in the OCHS. Mother's education has weak effects in each case.

What are the principal differences revealed by comparing the OCHS and NLSCY data? The data in Table 5.7 indicate that there may have been an increase in the prevalence of psychiatric disorders and a decrease in the prevalence of grade repetition at least in Ontario. There is no indication of change in the prevalence of social problems. The multivariate estimates for NLSCY-Ontario in Table 5.8 reveal that being the child of a lone mother was generally associated with a higher likelihood of a psychiatric disorder and of repeating a grade. This partial relationship was not statistically significant in the OCHS. The same was true of income and grade repetition. Low income implied a greater likelihood of repeating a grade in the NLSCY-Ontario data but not in the OCHS. Multivariate estimates for social problems were similar in the two data sets. Do the observed differences in these multivariate results represent a real change in conditional differences between children of varying socioeconomic backgrounds in Ontario? One should clearly hesitate to infer too much from these early findings. Differences between estimates from the OCHS and the NLSCY may primarily reflect measurement matters and sample size. These caveats notwithstanding, such results should also prompt further research. We make a few additional suggestions on this topic in the next and final section of the paper.

5.6 Summary and Conclusion

Our goal in this paper is to improve our understanding of the roles which socioeconomic factors play in the determination of psychiatric disorders, poor school performance and social problems among

Canadian children. Data from the new National Longitudinal Survey of Children and Youth will greatly improve our understanding of these processes among Canadian children. The panel nature of the NLSCY data will be of particular value, but only a subset of the data from Cycle One were available for analysis.

Our specific objectives in this paper were two. The first is to use the national NLSCY sample to assess the association between a variety of psychiatric, academic and social difficulties and a range of socioeconomic variables including the number, age, income, education and market work of parents, and the sex, number and age of children. We analysed three types of psychiatric disorders: hyperactivity, conduct disorder and emotional disorder. Two sets of thresholds were used to measure the presence of each disorder. One was based on the thresholds used in the OCHS. A second set, which is commonly found in the literature, were those thresholds which yielded a prevalence rate of 10% for each disorder in our NLSCY sample. Our two measures of academic performance were whether or not the child had ever repeated a grade and whether or not the "person most knowledgeable" reported the child as doing "poorly" or "very poorly" in school. A social problem was deemed present if the PMK reported the child as having "frequent" or "constant" problems in getting along with other children, teachers or parents. The prevalence of any one individual problem among the children in our sample was at most 10%. Twenty-three per cent of the children had one (or more) of any of these problems.

Our multivariate (logit) estimates with the national NLSCY sample provided a number of interesting and not always expected conclusions. One is that the estimated effect of low income was quite sensitive to the income measure used and to the use of sample weights. We started with what we judged to be the most conventional approach which was to use weighted data and a dummy variable for whether or not family income was below the (1992) Low Income Cutoff. The resulting the low-income coefficients were significant only for repeated a grade and frequent social problems and were not significant for any psychiatric disorder or for poor school performance. The use of either unweighted data or of a dummy variable for family under $20,000, however, yields a strong association between low income and every problem except hyperactivity. Only very limited income measures are currently available on the NLSCY public use file. Greater access to the income data is needed if we are to shed more light on this key policy

issue.

A second conclusion is that lone-mother status is strongly associated with virtually all of our (poor) outcomes. The coefficient estimates for this variable are both robust with respect to the estimation approach (weighting, disorder thresholds, income measures) and they imply sizable quantitative effects on the predicted probability of a disorder or problem. Interpretation of this finding, however, is not straightforward. We have followed the standard practice of comparing the children of current lone-mother families to the children of current two-parent families. Is this appropriate? It may not be if many or most of the problems observed in the children of lone mothers have resulted from the dysfunctional nature of the two-parent family in which those children once lived. Exiting from such two-parent families may have had a beneficial impact on the health and development of the children in question rather than the negative effect which might be inferred from a simplistic reading of our estimates based on a single cross-section.

Even if our estimates are assumed to reflect the impact of one or more current differences between lone-mother and two-parent families, which of these differences are most relevant? Is it that low-income spells are longer among lone-mother families? Or is it the lack of non-monetary assistance from family, friends and social service agencies? The availability of data from future NLSCY cycles will enlarge our capacity to sort out the relative importance of the above and other possible interpretations of this very strong and consistent empirical relationship.

In our multivariate estimates with the national NLSCY sample, we also usually found a lower incidence of problems among girls and commonly, though not always, found the same among the children of women over age 34. We did not find a strong relationship between the individual problems and the PMK's level of schooling. Only the coefficient for "no high school degree" always had the expected sign and even this estimate was statistically in only about one-half of the cases.

We also experimented with a dummy variable for whether or not the PMK worked "full-year, full-time" in the market and a second dummy variable for whether or not the PMK worked "part-year or part-time" in the market. We consistently found that the coefficients for both variables were not significantly different from zero. In future work, however, this issue should be pursued further using other measures of

market work for both the PMK and the spouse of the PMK. Such work will be most useful once researchers have access to more complete income and earnings data for the family and the individual parents.

Our second objective in this paper was to compare estimates provided by NLSCY data for Ontario to those from the Ontario Child Health Study which had previously been Canada's best survey of child health and development. Our comparison implied that psychiatric disorders may have become more common and repeating a grade less common in Ontario between 1983 and 1993. There is no indication of a change in the prevalence of social problems. In the multivariate estimates with the OCHS data, there were no significant differences by family status. In logit estimates with the NLSCY-Ontario data, however, the children of lone mothers were more likely both to have a psychiatric disorder and to have repeated a grade. Furthermore, poor children were more likely than non-poor children to have repeated a grade in the NLSCY-Ontario, but that was not observed in the OCHS.

As stressed in the previous section, measurement issues and sample size may account for these different findings in the OCHS and the NLSCY-Ontario, but there are other possibilities. Could changes in the relative income levels of these two types of families have played a role? We do know that poverty rates fell little or not all among lone-mother families over this period, but that was also true of young couples with children (Dooley 1994). We also know that the population of young (under age 35) lone mothers became much more likely to be never married and to rely on welfare between these two surveys (Dooley 1997). What role might be played by changes in these and other characteristics of the lone-mother population? Was there any change in the relative access of different types of families to the services needed to deal with various psychiatric disorder or academic difficulties? Might practices governing grade repetition have changed in such a fashion as to have created a greater differences by family status or income level in the likelihood that this actually occurs? Much additional study with the first and future cycles of the NLSCY and with the OCHS is needed to shed light on these and other questions.

Notes

1. Our reading of the social science literature is that the use of "family structure" to refer to the number of parents residing with the family is common. This reflects the fact that the number of resident parents is arguably the most important source of variation in family structure among contemporary families with dependent children. We also have yet to find an alternative term which is more specific and equally succinct.

2. A volume of papers based on early data from the first cycle of the NLSCY was published last year (HRDC and Statistics Canada 1996).

3. The approach of Lipman, Offord and Dooley differed from that taken in this study in a number of ways other than the thresholds used. They excluded all observations in which the PMK was not the mother and the only independent variables used in their multivariate analysis were lone-mother and low-income status.

4. Note that the prevalence of an emotional disorder in the NLSCY sample is 10% using either of our thresholds. In order to provide a sensitivity test for this outcome, we used a second threshold for emotional disorder that was used in some OCHS studies. Seventeen percent of the NLSCY sample had an emotional disorder using this alternative threshold, but the multivariate estimates were very similar regardless of the threshold used.

5. Indeed, only 25% report that the child is doing "average" or worse. Canada appears to be exceeded in this regard only by Garrison Keillor's fictional town of Lake Wobegon, Minnesota where "all the children are above average". We comment on the use of this alternative measure later in the paper.

6. Twenty-three percent of PMKs report that her child has "occasional", "frequent" or "constant" problems in getting along with parents, peers or teachers. We comment on the use of this alternative measure of social problems later in the paper.

7. Economists tend to use the probit conditional probability function and discuss policy implications in terms of differences in predicted probabilities of the dependent variable. Health scientists tend to use the logistic conditional probability function and discusses policy implication in terms of the odds ratios. The compromise of our inter-disciplinary team is to use the logit conditional probability function and discusses policy implications in terms of differences in predicted probabilities of the dependent variable.

8. As our multivariate estimates will show, children who are poor, age 8-11 and have lone mothers tend to have more problems. Girls, however, tend to have fewer problems. Hence, it is not clear if the absence of these observations tends to raise or lower the overall percentage of children with various difficulties in Table 5.2.

9. In order to include such observations in the estimation sample, a specific value must be assigned to the "missing value" of the variable in question. We assigned a value of zero.

10. The same is true if one substitutes the mother's market work variables for the relatively few cases where the father is the PMK.

11. Our use of the term statistically significant usually refers to a p-value of 0.05 or less. "Weak significance" usually refers to a p-value less than 0.10 but greater than 0.05.

12. Due to the large standard error for the interaction term, we also usually can not reject the hypothesis that the sum of the low income coefficient and the interaction term is different from zero.

13. We also estimated logit models with several alternative measures of schooling and social problems. One alternate schooling measure is whether or not the child receives special education because of a "physical, emotional, behavioural or some other problem limits the kind or amount of school work she/he can do." Seven percent (7%) of the children receive such education. A second alternate schooling measure is whether or not the parent reports that the children is doing "average" or worse ("poorly" or "very poorly") in school. Twenty five percent (25%) of children meet this criterion. The alternate measure of social problems is whether or not the parent reports that the child has "occasional" or more frequent ("frequent" or "constant") problems in getting along with parents, peers or teachers. Twenty three percent (23%) of children meet this criterion. In each case, the lone-mother coefficients have large marginal effects and t-ratios. Furthermore, the low-income coefficients are not significant ($p<0.05$) and have smaller marginal effects than do the lone-mother coefficients.

14. We also analysed the predictive power of our estimates. For almost all individual outcomes and observations, our coefficients predict "no problem" in the sense that the individual predicted probability is less than fifty percent. In that limited sense, our models predict "well" because 10% or less of the children in our sample actually have each of the problems. An alternative test is to see if there is a difference in the mean predicted probability of each outcome for (1) children who actually do have a problem and (2) children who do not have the problem. For each outcome, the mean for group (1) is higher (p-value <0.01) than the mean for group (2).

15. Thirteen percent of the sample has income below $20,000. As shown in Table 5.3, 14% of the children are "very low income" and 22% are "low income". About 80% of those who have income less than $20,000 also have "very low income" and vice versa. Virtually all of those who have income less than $20,000 also have "low income", but only 60% of those who have low income also have income less than $20,000. Of those children with families of income less than $20,000, two-fifths live with two parents and three-fifths live with a lone mother.

16. Sample attrition between the initial OCHS and the 1987 Follow-Up survey was substantial. The number of lone mothers appearing in both 1983 and 1987 was less than 100 due to both sample attrition and changes in marital status.

17. The propensity of teachers and administrators to fail a student of a given achievement level may also vary by province as well although we note that the incidence of this problem among Ontario children in the NLSCY (4%) is virtually the same as for the national sample (5%).

18. We also estimated the logits in Table 5.8 using the national NLSCY sample and including a dummy variable equal to one if the child is from Ontario. The coefficient estimates for the Ontario dummy were not significant for psychiatric disorder, significantly negative for repeated grade and significantly positive for social problems.

TABLE 5.1
Symptoms of Hyperactivity, Conduct Disorder and Emotional Disorder in the National Longitudinal Survey of Children and Youth

Hyperactivity	Conduct Disorder	Emotional Disorder
Can't sit still, is restless or hyperactive	Destroys his/her own things	Seems to be unhappy, sad or depressed
Fidgets	Gets into many fights	Is not as happy as other children
Is distractible, has trouble sticking to any activity	Destroys things belonging to his/her family or other children	Is too fearful or anxious
Can't concentrate, can't pay attention for long	When another child accidentally hurts him/her (such as bumping into him/ her) assumes the child meant to do it, then reacts with anger and fighting	Is worried
Is impulsive, acts without thinking	Physically attacks people	Cries a lot
Has difficulty awaiting turn in games or groups	Threatens people	Is nervous, high-strung or tense
Cannot settle to anything for more than a few moments	Is cruel, bullies or is mean to others	Has trouble enjoying him/ herself
Is inattentive	Kicks, bites, hits other children	
	When mad at someone, tries to get others to dislike that person	
	When mad at someone, says bad things behind the other's back	
	When mad at someone, tells the other one's secrets to a third person	
	Steals at home	
	Vandalizes	
	Steals outside the home	

Table 5.2
Percentage of Children With Psychiatric Disorders, Schooling Problems and Social Problems

	Poor Lone Mother	Non-Poor Lone Mother	Poor Couple	Non-Poor Couple	Total
Hyperactivity	9	8	4	4	5
Conduct Disorder	15	13	7	6	7
Emotional Disorder	18	14	10	8	10
One or More Psychiatric Disorders	29	22	16	14	16
Repeated a Grade	13	9	8	4	5
Poor School Performance	7	3	4	2	3
Frequent Social Problems	9	4	5	2	3
One or More of Any Problems	43	32	24	20	23

Number of Observations: 12,735 children, age 4-11 for psychiatric disorders and 9,283 children age 6-11 for schooling and social problems. OCHS thresholds used.

Table 5.3
Characteristics of Families in the NLSCY

Percentage With:	Lone Mother	Couples	Total
Lone Mother	-	-	14
Very Low Income[a]	50	7	14
Low Income[b]	66	15	22
No High School Degree	22	15	16
High School Degree	16	19	19
Some Postsecondary	35	28	29
College or University Diploma or Degree	27	38	36
Mother's Age > 34	47	60	58
Child's Age 8-11	49	51	51
Mean Number of Children Per Family	2	2.4	2.3
Unweighted Number of Families: Age 4-11	872	5567	6439
Unweighted Number of Families: Age 6-11	807	5489	6296

[a]Family income is below 75% of the 1992 Low Income Cutoff.
[b]Family income is below the 1992 Low Income Cutoff.

Table 5.4
Logit Estimates for Psychiatric Disorders

	Hyperactivity	Conduct Disorder	Emotional Disorder	One or More Psychiatric Disorders
Lone Mother	0.87 (3.6)	0.64 (2.6)	0.55 (2.8)	0.63 (3.6)
Low Income	-0.01 (0.06)	-0.08 (0.51)	0.22 (1.4)	0.10 (0.79)
Lone Mother*Low Income	-0.21 (0.62)	0.35 (1.1)	0.14 (0.53)	0.12 (0.51)
No High School Degree	0.30 (1.5)	0.49 (2.9)	0.14 (0.83)	0.24 (1.8)
Some Postsecondary	0.01 (0.06)	0.15 (1.0)	-0.01 (0.09)	0.02 (0.14)
College or University Diploma or Degree	-0.38 (2.1)	0.12 (0.81)	0.05 (0.30)	0.007 (0.06)
Mother Age > 34	-0.17 (1.2)	-0.48 (4.3)	-0.25 (2.4)	-0.34 (4.1)
Female Child	-0.80 (5.9)	-0.57 (5.3)	0.03 (0.28)	-0.32 (4.1)
Child Age 8-11	0.21 (1.6)	0.14 (1.4)	0.81 (8.4)	0.47 (6.1)
Number of Children	-0.12 (1.8)	0.21 (3.7)	-0.03 (0.50)	0.02 (0.59)
Constant	-2.5 (10.6)	-3.0 (14.0)	-2.7 (13.8)	-1.8 (11.9)
Probability of Outcome (base)[a]	0.058	0.08	0.06	0.15
Effect of Lone Mother Coefficient[b]	0.07	0.06	0.04	0.1
Effect of Low Income for Couples[b]	-0.0006	-0.006	0.01	0.01

T-ratios in parentheses. Weighted data with OCHS thresholds. Number of Observations: 12,735 children, age 4-11.

[a] Predicted probability corresponding to the constant (a boy, age 4 to 7, from a non-poor, two-parent family with mother under 35 with a high school degree) and a total of two children.

[b] Change in the predicted probability for the base case when the dummy variable changes from zero to one.

Table 5.5
Logit Estimates for School Problems, Social Problems, and One or More of Any of Psychiatric, Schooling or Social Problems

	Repeated Grade	Poor School Performance	Frequent Social Problems	One or More Of Any Problems
Lone Mother	1.04 (3.5)	0.58 (1.9)	0.67 (2.0)	0.74 (4.0)
Low Income	0.44 (2.3)	0.19 (0.70)	0.86 (3.2)	0.13 (1.0)
Lone Mother*Low Income	-0.35 (0.93)	0.24 (0.54)	-0.03 (0.06)	0.13 (0.52)
No High School Degree	0.59 (3.1)	0.36 (1.4)	0.24 (0.82)	0.35 (2.6)
Some Postsecondary	-0.13 (0.65)	-0.04 (0.13)	-0.16 (0.60)	0.01 (0.12)
College or University Diploma or Degree	-0.07 (0.34)	-0.39 (1.5)	-0.06 (0.22)	-0.02 (0.15)
Mother Age > 34	-0.29 (2.1)	-0.10 (0.49)	-0.22 (1.1)	-0.31 (3.6)
Female Child	-0.48 (3.5)	-0.76 (3.8)	-0.39 (2.0)	-0.35 (4.4)
Child Age 8-11	1.12 (6.0)	0.53 (2.7)	0.58 (2.5)	0.44 (5.0)
Number of children	0.07 (0.92)	0.18 (1.7)	-0.15 (1.7)	0.02 (0.43)
Constant	-3.9 (13.2)	-4.1 (9.7)	-3.6 (9.2)	-1.4 (9.0)
Probability of Outcome (base case)[a]	0.02	0.03	0.02	0.2
Effect of Lone Mother Coefficient[b]	0.04	0.02	0.02	0.14
Effect of Low Income Coefficient[b]	0.01	0.005	0.02	0.02

T-ratios in parentheses. Weighted data with OCHS thresholds. Number of Observations: 9,283 children age 6-11.
[a] Predicted probability corresponding to the constant (a boy, age 4 to 7, from a non-poor, two-parent family with mother under 35 with a high school degree) and a total of two children.
[b] Change in the predicted probability for the base case when the dummy variable changes from zero to one.

Table 5.6
Selected Logit Estimates Using Unweighted Data
And An Alternative Low Income Measure

OUTCOMES	Unweighted Data Household Income < 1992 LICO			Alternative Low Income (weighted) Household Income <$20,000		
	Lone Mother	Low Income	Lone Mom* Low Income	Lone Mother	Income <$20.000	Lone Mom* Income<$20K
Hyperactive	0.77 (4.2)	0.17 (1.3)	-0.15 (0.63)	0.68 (3.2)	0.35 (1.3)	-0.44 (1.2)
Conduct Disorder	0.64 (4.1)	0.31 (2.8)	0.05 (0.24)	0.99 (4.8)	0.37 (1.8)	-0.35 (1.1)
Emotional Disorder	0.67 (4.9)	0.24 (2.5)	-0.09 (0.52)	0.72 (3.8)	0.65 (3.3)	-0.47 (1.7)
One or More Psychiatric Disorders	0.66 (5.8)	0.22 (2.7)	-0.04 (0.23)	0.71 (4.4)	0.51 (3.2)	-0.33 (1.4)
Repeated Grade	0.63 (3.0)	0.50 (3.8)	-0.08 (0.30)	1.2 (4.3)	0.70 (2.9)	-0.68 (1.8)
Poor School Performance	0.76 (3.0)	0.13 (0.71)	0.0007 (0.002)	0.78 (2.7)	0.99 (2.9)	-0.33 (.71)
Frequent Social Problems	0.68 (2.6)	0.56 (3.1)	0.05 (0.16)	0.69 (2.3)	1.4 (4.3)	-0.63 (1.3)
One or More of Any Problems	0.65 (5.5)	0.27 (3.4)	0.06 (0.41)	0.82 (4.8)	0.57 (3.3)	-0.30 (1.2)

T-ratios in parentheses. Number of Observations: 12,735 children, age 4-11 for psychiatric disorders and 9,283 children age 6-11 for schooling and social problems. Models included all regressors from Tables 5.4 and 5.5 which are education and age of PMK, age and sex of child, and number of children in family.

Table 5.7
Percentage of Children With Psychiatric, Schooling or Social Problems: Ontario Child Health Study and National Longitudinal Study of Children and Youth (Ontario Data)

Family Status and Low Income Status	One or More Psychiatric Disorders			Repeated Grade			Frequent Social Problems		
	OCHS	NLSCY		OCHS	NLSCY		OCHS	NLSCY	
		Very Poor	Poor		Very Poor	Poor		Very Poor	Poor
(Very) Poor Lone Mother	24	32	29	22	14	13	11	11	9
Non-Poor Lone Mother	14	22	21	6	7	5	3	4	3
(Very) Poor Couple	18	22	16	10	8	8	8	11	9
Non-Poor Couple	9	14	14	8	2	2	3	3	2
Total	11	16		9	4		4	4	

Number of Observations. Behavioural problems: 1,315 (3,369) children age 4-11 in the OCHS (NLSCY-Ontario). Repeated grade and social problems: 1,084 (2,450) children age 4-11 in the OCHS (NLSCY-Ontario).

[a] Very Poor (Low Income). Families are classified poor if they are below 75% of the 1992 Low Income Cutoff (LICO). This better approximates the 1969 LICO used in the OCHS.

[b] Poor (Low Income). Families are classified poor if they have income below the 1992 LICO.

Table 5.8

Selected Logit Estimates from the Ontario Child Health Study and National Longitudinal Study of Children and Youth (Ontario Data)

	OCHS	NLSCY		
		Very Low Income	Low Income	Income <$20,000
One or More Psychiatric Disorders				
Lone Mother	0.48 (1.0)	0.55 (2.2)	0.55 (1.7)	0.77 (2.8)
(Very) Low Income	0.74 (2.2)	0.44 (1.6)	0.12 (0.6)	0.67 (2.5)
Lone Mother * (Very) Low Income	-0.27 (0.4)	0.04 (0.1)	0.21 (0.5)	-0.60 (1.5)
Ever Repeated Grade				
Lone Mother	-0.23 (0.3)	1.1 (2.3)	1.1 (1.4)	1.6 (3.2)
(Very) Low Income	-0.14 (0.7)	0.91 (1.7)	1.0 (2.9)	1.2 (2.2)
Lone Mother * (Very) Low Income	1.1 (1.0)	-0.33 (0.4)	-0.43 (0.5)	-1.3 (1.8)
Frequent Social Problems				
Lone Mother	-0.90 (0.9)	0.39 (1.0)	0.35 (0.7)	0.48 (1.3)
(Very) Low Income	1.5 (2.9)	1.6 (3.8)	1.4 (4.1)	1.2 (3.3)
Lone Mother * (Very) Low Income	0.65 (0.6)	-0.49 (0.4)	-0.37 (0.6)	-0.52 (1.0)

T-ratios in parentheses. Weighted data with OCHS thresholds. Number of Observations: 1,315 (3,369) children age 4-11 in the OCHS (NLSCY-Ontario) for psychiatric disorders and 1,084 (2,450) children age 4-11 in the OCHS (NLSCY-Ontario) for repeated grade and social problems. In each logit, we have also controlled for the age and gender of the child, and the age and education of the mother in the same fashion as in Tables 5.4 and 5.5.

6. Summary

The first essay (chapter 2) in this thesis investigates the health status of mothers, in particular, the relationship between family structure, socioeconomic status and health status. The results indicate that lone mothers have, on average, consistently lower unconditional health status than mothers from two-parent families, regardless of what measure of health status is used. However, lone mothers are also, on average, younger, poorer, less educated, have fewer children and smoke more. When these factors are controlled for, a negative relationship between lone motherhood and health status (when compared with married mothers) can be rejected. In fact, lone motherhood has a significantly positive relationship with self-reported health status.

Two explanations are offered for the positive relationship between lone motherhood and self-reported health status. First, according to Grossman (1972, 1972a) an individual must use intermediate inputs and time to produce a final good, in this case, health. The lone-female parent does not have to devote time to the production of the spouse's final goods, including health. The time she does not have to devote to this production may outweigh the time she would have gained from the assistance of the spouse in household production of final goods for the family. If this is so, one assumes that the female parent places a higher priority on the production of health of her spouse and children than her own health, then a lone mother may have more time to devote to the production of her own health than a married female. Second, a recent investigation by Kingston-Riechers (1998) finds that 53% of women who leave their first marriage claim that they suffered physical violence in the relationship. If the lone mother has left an abusive relationship and is starting over, she may feel healthier, have more self confidence, and thus, report a higher level of health.

The evidence presented in the essay does not support the notion of selection into and out of marriage on the basis of health. If lower health status was the cause of marital dissolution or a marriage never taking

place then the mothers who are not married would be expected to have significantly lower health status than those who are married after controlling for other factors. The data do not support this conclusion.

The expected relationships between income, education, life-style factors and social interaction terms are observed in these data. One must interpret these results with care due to the cross-sectional nature of the data. The initial inferences may indicate that it is the consistently lower levels of income, education, and life-style factors that lead to the lower unconditional health status of lone mothers.

The second essay (chapter 3) uses the Ontario Child Health Survey to investigate the roles which family structure, poverty, mother's education, child's age and sex play in child health. The majority of children in this survey had no health problems. Using measures of cognition and emotional health, children from low income families were more likely to have impairments than non-low income children. Twenty two percent of low-income children had multiple problems versus 12% of non-low income children. Children of lone parents were also more likely to have health impairments. In multivariate analysis, lone motherhood was the most consistent and strongest variable associated with child health in the 1983 OCHS data. Unexpectedly, current low income had no consistent relationships with the measures of health status except for cognitive problems. Mother's education and child's age and sex had the expected relationships. No consistent relationships were found between mother's labour force participation or social assistance receipt.

When both panels of the survey were included, the proxies used for permanent income (or long-term poverty) showed the strongest and most consistent relationship with child health status even after controlling for low birth-weight (a proxy for health endowment). This indicates the need for long term income measures when studying child health status. The measure for long-term lone-mother status had a negative relationship with health status but the relationship was weaker than that found between lone motherhood and child health when only current income was controlled for in the 1983-only sample. This may be an indication that the lone-mother variable in the 1983-only data is in some way proxying for long-term poverty. The results from the longitudinal data must be interpreted with care as there was substantial

attrition. In addition, the sample size is small and there are some concerns about consistency in the data.

The third essay (chapter 4) presented the process used to map the OCHS survey responses into the attribute levels of the Health Utilities Index Mark 2 (HUI2) used in the second essay. The resulting single and multi-attribute scores were then juxtaposed against HUI2 scores of children from another study found in the literature. The results obtained from different mapping algorithms applied to the same survey indicate that while the distribution across individual attributes can be quite different (especially the attributes of emotion and cognition) the distribution of the HUI2 scores are more similar. When investigating single attributes scores obtained from different surveys, the data showed consistent differences across the distribution within individual attributes but less variability in the number of attributes affected. Multivariate results using the HUI2 score, from the two different algorithms, as a dependent variable give fairly consistent results. The distribution of the global health-related utility (HUI2) scores were not identical but were fairly consistent across samples of children 12 to 14 years old from Ontario.

When we investigate different mapping algorithms the major difference is seen when we apply two different algorithms to the same data. There seems to be little difference when we apply either of these algorithms to similar populations from another data set. Given the results in this paper it is unlikely that the choice of mapping algorithm is an important factor in influencing the multivariate regression results.

In the final essay (chapter 5) the goal was to improve our understanding of the roles which socioeconomic factors play in the determination of psychiatric disorders, poor school performance and social problems among Canadian children. Data from the new National Longitudinal Survey of Children and Youth were used to improve our understanding of these processes among Canadian children, at the time this work was done only a subset from the data from Cycle One was available. In the NLSCY data a significantly higher proportion of children of lone mothers have health problems when compared to those of married mothers. The same holds when comparing children from low-income families with children from non-low income families.

In multivariate analysis current low income mattered more for schooling and social problems than for psychiatric disorders. However, the estimated effect of low income was quite sensitive to the measure used and the use of sample weights. Lone-mother status was quantitatively more important and more consistently associated with the health and schooling outcomes of Canadian children than low income. The coefficient estimates for lone-mother status are both robust with respect to the estimation approach (weighting, disorder thresholds, and income measures) and they imply sizable quantitative effects on the predicted probability of a disorder or problem. Female children and the children of mothers over age 34 were fairly consistently less likely to experience the full range of difficulties which were measured. Higher levels of maternal schooling were associated with fewer child problems but less consistently than expected. There was little evidence of a link between maternal market work and the outcomes we studied.

Interpretation of the consistently negative relationship between lone-mother status and child health status is not straightforward. In the 1983 OCHS and the NLSCY we have followed the standard practice of comparing the children of current lone-mother families to the children of current two-parent families. This may not be the appropriate approach if many or most of the problems observed in the children of lone mothers have resulted from the dysfunctional nature of the two-parent family in which those children once lived. Exiting from such two-parent families may have had a beneficial impact on the health and development of the children in question rather than the negative effect which might be inferred from a simplistic reading of our estimates based on a single cross-section.

Our estimates may also be reflecting the impact of one or more unobserved current differences between lone-mother and two-parent families. It may be that low-income spells are longer among lone-mother families or the problem may be the lack of non-monetary assistance from family, friends and social service agencies. The availability of data from future NLSCY cycles will enlarge our capacity to sort out the relative importance of the above and other possible interpretations of this very strong and consistent empirical relationship.

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