Edgeworth Series in Quantitative Behavioral Science
(Report No. ESQBS-2002-3)

Effects of the British Columbia Public Health Officer's health determinants on the health utility index and the Richardson-Zumbo health profile

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When citing this paper please use the following format (for APA style):

Leisinger, M. A., Michalos, A. C., & Zumbo, B. D. (2002). *Effects of the British Columbia Public Health Officer's health determinants on the health utility index and the Richardson-Zumbo health profile.* (Paper No. ESQBS-2002-3). Prince George, B.C.: University of British Columbia. Edgeworth Laboratory for Quantitative Behavioral Science.

Abstract

The objective of this study was to examine what effects, if any, determinants of health would have on the Richardson-Zumbo Health Profile, and the Health Utility Index. Data came from the 1994/95 National Population Health Survey (NPHS) over-sample for the population of Prince George, B.C., Canada, consisting of 838 randomly selected individuals (436 female, 402 male). The key health determinants included: income level, educational attainment, employment status, single parenthood, tobacco use, alcohol consumption, gender, and age. A multivariate analysis was done. The model predictors identified through stepwise regression were identified. Beta values, Pratt scores, R-squared values, and tests for significance were calculated. As expected, being employed, greater income adequacy, and less tobacco consumption were all associated with a higher state of health. Gender was not a significant health determinant except on the social well-being factor where there was an apparent advantage to being female. Overall, the R^2 of the multivariate analyses were low, ranging from .017 to .212 on the five Richardson and Zumbo Factors, .097 for the Composite Score, and .123 for the HUI. The net result of these regressions seems to be that there is a poor fit between the determinants of health and population health status. The HUI was hardly describing population health, while the five Richardson-Zumbo scores and the Composite Score fared little better. This analysis demonstrates the difficulty of capturing the complex interplay between the myriad of variables that form the construct of health. The challenge to future researchers is to continue to explore profiles that accurately capture the status of the population's health; also being sensitive to underlying changes as they occur.

Keywords: Health Determinants; Health Utility Index; Richardson-Zumbo Health Profile; National Population Health Survey; British Columbia; Canada

Introduction

The Health Utility Index (HUI) endeavours to capture the state of a population's health through a single, summary, numeric measure analogous to the Gross National Product's (GNP) description of the national economy. The health of a population is influenced by many factors commonly referred to as determinants of health. In Canada, the Provincial Health Officer for the province of British Columbia (BCPHO) has suggested indicators that measure those determinants. Richardson and Zumbo (2000) proposed a multi-dimensioned health profile to describe the health status of a population.

Using 1994/95 National Population Health Survey (NPHS) over-sample data for the population of Prince George, British Columbia, Canada, we investigated the sensitivity of the HUI and the Richardson-Zumbo Health Profile to a set of key health determinants considered important by the British Columbia Provincial Health Officer.

Health, Health Status, and Determinants of Health

Health is defined in the preamble to the constitution of the World Health Organization (WHO) as "a state of complete physical, mental, and social well-being; not merely the absence of disease or infirmity" (Siddiqui, 1995, p. 226). Originally adopted in 1948, the WHO definition continues to be widely accepted by most healthcare planners, authorities and policy makers (e.g., British Columbia Provincial Health Officer, 1994), and is cited in most of the literature when health is defined.

Hansluwka (1985) reviews the international debate over the WHO definition of health and whether the definition can ever be achieved. Difficulties in defining health arise out of the "vagueness of the concept, the value judgment of the definer, the multidimensionality of the phenomenon, and the impossibility of meaningful operationalization" (p. 1208). As The Institute of Health Promotion Research, University of British Columbia (1999) claims, such definitions seem to classify all human activity as being health-related. Evans and Stoddart (1994) comment that such definitions are, "honoured in repetition, but rarely in application" (p. 28). Bergner (1985) notes that many definitions of health abound but most are variants of the WHO declaration.

> Population health refers to the health of a population as measured by health status indicators and as influenced by social, economic and physical environments, personal health practices, individual capacity and coping skills, human biology, early childhood development, and health services …. The goal of a population health approach is to maintain and improve the health status of the entire population and to reduce inequities in health status between groups. This requires a thorough, ongoing examination of both health status and the factors that determine or influence health.
>
> (Federal, Provincial and Territorial Committee on Population Health, 1999, pp.7-8).

Each year the BCPHO issues an annual report that has a central theme or focus for the year, along with the standard tables and statistics reported each year. The 1994 Annual Report concentrated on the determinants of health. The report promoted the view that the health of a population is influenced by more factors than the healthcare system alone. It grouped the determinants of health into five broad categories: social and economic environment, the physical environment, health services, biological influences, and health behaviours and skills. Within each of the five determinants of health categories the BCPHO listed several potential health indicators.

There is no unanimous agreement on what the determinants of health are, or their relative ranking, but those enumerated by the BCPHO are consistent with the literature as being central to health. There is, however, growing emphasis on self-esteem, social support networks, quality of life issues, early child development, and the role of gender and culture (Mustard and Frank, 1994; Sutherland and Fulton, 1994; Evans and Stoddart, 1994; Decter, 1994; Federal, Provincial and Territorial Committee on Population Health, 1994, 1999; Frank, 1995; Health Canada, 1996[1]; Institute of Health Promotion Research, University of British Columbia, 1999; Denton and Walters, 1999; Edwards, 2000).

There can also be many individual health indicators that measure a given health determinant. The indicators also interact with one another, just as the determinants are not isolated from one another. The complexity of the multiple interactions of the indicators and the determinants, combined with an illusive definition of health, makes the quantification of health status and its explanation so very difficult.

Specific Determinants of Health

This review focused on specific health status determinants from the 1994 BCPHO's Annual Report.

a) Income Level

The literature shows a definite linkage between income and health. Overall, mortality and most forms of morbidity follow a gradient worldwide across socioeconomic classes such that lower income and lower social status are associated with poorer health (Mustard and Frank, 1994; Evans and Stoddart, 1994; Denton and Walters, 1999). In general, wealthier populations and countries are healthier than poorer ones (Sutherland and Fulton, 1994), and virtually no examples of any society, past or present, are evident where overall health status is inversely related to wealth, income, or social class (Hertzman, Frank and Evans, 1994). Denton and Walters (1999) state, "poor health is not simply concentrated among those who are most deprived. Health status declines with each decline in socioeconomic status" (p. 1222).

Not only is level of income significant, it appears to be of even greater importance how equitably wealth is distributed amongst a population i.e., the gap

between the rich and the poor (Mustard and Frank, 1994; Decter, 1994[2]; Hertzman, Frank and Evans, 1994[3]; Frank, 1995; British Columbia Provincial Health Officer, 1997; Judge, Mulligan and Benzeval, 1998[4]; Poland, Coburn, Robertson and Eakin, 1998; Federal, Provincial and Territorial Committee on Population Health, 1999). The greater the disparities between rich and poor, the greater the health consequences. This linkage seems to be constant over time, and as the diseases that are responsible for mortality change. One disease merely replaces another and the social gradient remains intact (Frank, 1995).

b) Educational Attainment

Higher levels of educational attainment relate directly to greater health in terms of higher self-rated health status, greater positive health behaviours, decreased activity limitation, increased opportunities for income and job security, and generally a greater sense of well-being (British Columbia Provincial Health Officer, 1994; Health Canada, 1996; Federal, Provincial and Territorial Committee on Population Health, 1999).

Educational attainment is linked to employment, which is linked to income level; all three are important determinants of health. It is difficult to disassociate one health determinant from another.

c) Employment Status

Mustard and Frank (1994) and Avison (1998) report on studies done in the United States, Denmark, and by the WHO that all conclude mortality (including suicide and death by accidents), and morbidity (mental and physical ill-health), increase with unemployment. Specifically, unemployed persons exhibit greater psychological distress, anxiety, depressive symptoms, panic, substance abuse, disability days, health problems, and hospitalizations than those who are employed.

Employment provides not only money, but also a sense of identity and purpose, social contacts, and opportunities for personal growth. When unemployed, the effects on health go beyond the person who is unemployed and extend to the family unit and the community in general. Negative impacts are not immediately reversed upon re-employment (Hunt, McEwen and McKenna, 1986; Mustard and Frank, 1994; Sutherland and Fulton, 1994; British Columbia Provincial Health Officer, 1994[5], 1997; Health Canada, 1996[6]; Avison, 1998; Denton and Walters, 1999[7]; Federal, Provincial and Territorial Committee on Population Health, 1999).

d) Single Parenthood

The proportion of families headed by lone (single) parents is considered an indicator of socioeconomic conditions. “The living conditions of single-parent families have been associated with a number of problems, including poor housing conditions, behavioral problems in children, overload of parental responsibilities[8], loneliness, dissatisfaction with social situation[9], and health problems” (British Columbia Provincial Health Officer, 1994, p. 28).

d) Tobacco Use

According to the British Columbia Provincial Health Officer (1994) smoking is the leading preventable cause of death in the province, accounting for one-fifth of all deaths in the province. As a cause of early death, smoking far outweighs suicide, motor vehicle crashes, AIDS, and murder combined (Federal, Provincial and Territorial Committee on Population Health, 1999). Smoking is a known risk factor for heart disease, stroke, cancer, chronic obstructive pulmonary disease, diabetes, and birth defects (Federal, Provincial and Territorial Committee on Population Health, 1994).

f) Alcohol Consumption

Excessive alcohol consumption can lead to a range of health and social problems. Drinking alcohol during pregnancy has been linked to lower birth weights, and other negative outcomes (Federal, Provincial and Territorial Committee on Population Health, 1994).

Alcohol consumption increases with income; people in higher income brackets tend to be heavier drinkers. Lower income earners are less likely than upper income earners to consume any alcohol at all. However, among lower income earners who do drink alcohol, their rate of heavy drinking tended to slightly exceed that of higher income earners (Federal, Provincial and Territorial Committee on Population Health, 1999).

g) Gender[10]

The most basic health difference between men and women is life expectancy. According to the Federal, Provincial and Territorial Committee on Population Health (1999) a male Canadian child born in 1996 could expect to live to age 75.7 years; 81.4 years for a female child. Men are far more likely than women to die before age 70, mainly because of gender differences in deaths due to heart disease, cancer, suicide, and unintentional injuries. Rates of potential years of life lost (PYLL) are almost twice as high for men than women. Suicide rates among young men are high in Canada, compared to other countries. Boys and young men tend to experience more unintentional injuries and more severe injuries than girls and young women. Although living longer, women are more likely to suffer from long-term activity limitations and chronic conditions such as osteoporosis, arthritis, and migraine headaches.

National Population Health Survey

The National Population Health Survey was conducted by Statistics Canada in four data gathering periods between June 1994 and March 1995. The survey was conducted by telephone and obtained data from 26,430 households in every province and territory[11] with a final response rate of 88%. The survey was to be conducted every two years over the course of two decades in order to obtain longitudinal data. Eight Hundred Fifty households in Prince George were part of the 1994/95 survey. This was a one-time inclusion with no longitudinal follow-up planned (Statistics Canada, 1995; Tambay and Catlin, 1995).

Health Utility Index

The literature of the mid-1980's (Hansluwka, 1985; Bergner, 1985) commented that there was a shift away from individual health indicators towards the creation of health profiles and of single aggregated indices for the measurement of health status. Such profiles and indices would be useful for the comparison of groups across time. In order for them to be meaningful, however, the critical components of health would need to be identified and included, which assumes that health can be measured on a single continuum. Bergner (1985) calls this the single-continuum dilemma. Hansluwka (1985) was more pessimistic about the success of such an approach, stating that while specific views differ, the majority are inclined to agree that it is not possible to construct a single index of health capable of "summarizing the various aspects of health in a way similar to the Gross Domestic Product concept" (p. 1208). Richardson and Zumbo (2000) note that interpretation of a summary statistic would be problematic since improvement or worsening of individual components of the index would be hidden (see also Bergner, 1987). Wolfson (1994), however, points out that despite the flaws and imperfections of the GNP as a measure of the economy, no one suggests we would be better off without the index and concludes, "the best should not be the enemy of the good" (p. 291), and as such, the pursuit of a comprehensive health index continues.

One such aggregate index is the Health Utility Index. According to Statistics Canada (1995):

> The Health Utility Index is a generic health status index that is able to synthesize both quantitative and qualitative aspects of health. The system developed at McMaster University's Centre for Health Economics and Policy Analysis, the Comprehensive Health Status Measurement System (CHSMS), provides a description of an individual's overall functional health, based on eight attributes: vision, hearing, speech, mobility (ability to get around), dexterity (use of hands and fingers), cognition (memory and thinking), emotion (feelings), and pain and discomfort.
>
> In addition to describing functional health status levels, the CHSMS is the basis for a provisional Health Utility Index (HUI). The HUI is a single numerical value for any possible combination of levels of these eight self-reported health attributes. The HUI maps any one of the vectors of eight health attribute levels into a summary health value between 0 and 1. For instance, an individual who is near-sighted, yet fully healthy on the other seven attributes, receives a score of 0.95 or 95% of full health.
>
> The HUI value also embodies the views of society concerning health status. These views are termed societal preferences, since preferences about various health states are elicited from a representative sample of individuals.
>
> This version of the CHSMS was tested for consistency[12] and was deemed to provide a realistic appraisal of individual health status.

(Statistics Canada, 1995, p. 28)

Richardson-Zumbo Health Profile

Richardson (1999) followed by Richardson and Zumbo (2000) studied how well the HUI was able to describe the health status of the population as a single summary (GNP-like) measure. Richardson and Zumbo (2000) concluded that the HUI used by the NPHS fails to capture the multi-dimensionality of health. Most of the explained variation comes from states of ill-health and is unable to differentiate among various levels of well-being. It was hypothesized that this should not be too surprising since the HUI was initially developed to measure the health status of a paediatric oncology population whose state of ill-health would be much higher than the general population. The general population tended to rate its health at or near the highest health level states almost all of the time.

Richardson and Zumbo (2000) selected seventeen variables from the 1994/95 NPHS for exploratory factor analysis in order to see if, and how well, they would identify the broader dimensions of health i.e., physical health, mental health, social and role functioning, and general perceptions of well-being. Various statistical measures supported the use of factor analysis. Following further statistical examination and manipulation it was found that the 17 variables loaded on to five factors: physical impairment, mental ill-health, mental well-being, general health impairment, and social well-being.

The next phase was to run a multiple regression of the HUI scores on to the five Richardson and Zumbo factors to determine the relative proportion of variation in the HUI accounted for by each factor. A Pratt index was generated to determine the relative contribution of each factor to the regression.

They found that general health impairment and social well-being explained only 72.2% and 22.2% respectively of the variation in the HUI scores.

Research Design and Methods

Six indicators were selected from the 1994/95 NPHS that correspond to significant determinants of health described in the BCPHO's 1994 Annual Report. Based on the literature review, age and gender were also selected. Table 1 displays the NPHS indicators chosen and the corresponding BCPHO's health determinant. No indicators were selected from the domains of physical environment, biological influences, or health services.

The NPHS variables (Statistics Canada, 1995) are explained as follows:

1 - Single Parenthood is a dichotomous indicator we created which segregates Derived Type of Household into two categories: other and single parent.

2 - Derived Variable for Working Status is a derived indicator based on the respondent's recent employment history, with a higher score indicating greater unemployment.

3 - Derived Highest Education Level Attained is a derived variable with a higher score indicating more schooling

4 - Derived Income Adequacy is based on household income and the size of the household, with a higher score indicating greater income adequacy.

5 - Type of Smoker, with a lower score indicating greater smoking frequency.

6 - Derived Type of Drinker, with a lower score indicating greater frequency of alcohol consumption.

7 – Age, created grouped age cohorts with a higher score indicating greater age.

8 - Gender is a dichotomous variable: Male or female.

Data for analysis were extracted from the full 1994/95 NPHS data set specific to the Prince George over-sample. The five Richardson and Zumbo factors (physical impairment factor, mental ill-health factor, mental well-being factor, general health impairment factor, and social well-being factor) were also combined into a Composite Score to create an additional dependent variable that would be directly comparable to the HUI, such that:

Composite of 5 Factors = sum (social well-being, mental well-being) - sum (physical impairment, mental ill-health, general health impairment).

The negative scales (physical impairment, mental ill-health, general health impairment) were reverse-coded so that the Composite of 5 Factors would measure health in a manner that a large positive number would mean better health.

A multivariate analysis was then done. Beta values[13] and the Pratt Index[14] for those model predictors identified through stepwise regression were calculated.

Results

A multivariate analysis was done using the six NPHS indicators (single-parenthood, derived variable for working status, derived highest level of education attained, derived income adequacy, type of smoker, and derived type of drinker) plus age and gender, and the seven dependent variables (Health Utility Index, Composite of 5 Factors, physical impairment factor, mental ill-health factor, mental well-being factor, general health impairment factor and social well-being factor). See Table 2.

Health Utility Index

Stepwise regression identified the derived variable for working status, type of smoker, and age as model predictors for HUI. That is, in the presence of the eight predictors taken together, only three influenced the dependent variable. Greater unemployment, more tobacco consumption, and increased age are related to a lower Health Utility Index Score. Employment status is responsible for 45.3% (Beta = -.207) of the R-squared value (R^2 = .123), smoking 18.2% (Beta = +.147), and age 36.2% (Beta = -.178).

Composite of 5 Factors

Stepwise regression identified the derived variable for working status, derived income adequacy and derived type of smoker as model predictors for the Composite of 5 Factors. That is, in the presence of the eight predictors taken together, only three influenced the dependent variable. Greater unemployment, less income adequacy, and greater tobacco consumption are related to lower a Composite score. Employment status is responsible for 34.7% (Beta = -.165) of the R-squared value (R^2 = .097), income adequacy 18.0% (Beta = +.096), and smoking 47.8% (Beta = +.209).

Physical Impairment Factor

Stepwise regression identified the derived variable for working status and derived type of drinker as model predictors for the physical impairment factor. That is, in the presence of the eight predictors taken together, only two influenced the dependent variable. Greater unemployment and less alcohol consumption are related to greater physical impairment. Employment status is responsible for 54.9% (Beta = +.088) of the R-squared value (R^2 = .017) and drinking 46.0% (Beta = +.079).

Mental Ill-Health Factor

Stepwise regression identified single parent, the derived variable for income adequacy, type of smoker, and age as significant model predictors for the mental ill-health factor. That is, in the presence of the eight predictors taken together, only four influenced the dependent variable. Being a single parent, lower income adequacy, greater tobacco consumption, and lower age are related to greater mental ill-health. Single parenthood is responsible for 19.6% (Beta = +.115) of the R-squared value (R^2 = .114), income adequacy 20.9% (Beta = -.139), smoking 30.9% (Beta = -.177), and age 28.5% (Beta = -.174).

Mental Well-Being Factor

Stepwise regression identified the derived variable for income adequacy, type of smoker, derived type of drinker, derived variable for working status, and age as significant model predictors for the mental well-being factor. That is, in the presence of the eight predictors taken together, five influenced the dependent variable. Greater employment, income adequacy, alcohol consumption, and age along with less tobacco consumption are related to greater mental well-being. Income adequacy is responsible for 19.1% (Beta = +.092) of the R-squared value (R^2 = .075), smoking 42.7% (Beta = +.179), drinking 7.5% (Beta = -.077), employment 18.2% (Beta = -.112), and age 12.3% (Beta = +.128).

General Health Impairment Factor

Stepwise regression identified the derived variable for working status, type of smoker, derived type of drinker, and age as significant model predictors for the general health impairment factor. That is, in the presence of the eight predictors taken together, four influenced the dependent variable. Increasing levels of unemployment, greater tobacco consumption, greater age, and lower levels of alcohol consumption are related to greater general health impairment.

Employment status is responsible for 36.4% (Beta = +.228) of the R-squared value (R^2 = .212), smoking 15.4% (Beta = -.184), drinking 6.2% (Beta = +.089), and age 42.3% (Beta = +.257).

Social Well-Being Factor

Stepwise regression identified the derived variable for income adequacy, type of smoker, and gender as significant model predictors for the social well-being factor. That is, in the presence of the eight predictors taken together, only three influenced the dependent variable. Greater income adequacy, less tobacco consumption, and being female are related to greater social well-being. Income adequacy is responsible for 20.3% (Beta = +.094) of the R-squared value (R^2 = .049), smoking 68.7% (Beta = +.179), and gender 11.2% (Beta = +.082).

Conclusions

Richardson and Zumbo (2000) examined the HUI as a measure of health status for use in the 1994/95 NPHS. Their results demonstrated "that the use of the [Health Utility Index] as the sole summary measure of health status … [was] problematic … [since it did] not appear to discriminate between the many different levels of positive health experienced by the vast majority of the general population … [and it was] more or less insensitive to variation in key indicators of mental well-being" (p. 188). Richardson and Zumbo questioned the ability of any single score to measure the health status of a population suggesting a better approach would be to use a multi-dimensional health profile instead.

Utilizing the Richardson-Zumbo Health Profile, the HUI, and the Composite Score of the Richardson-Zumbo Health Profile (a dependent variable that would be directly comparable to the Health Utility Index, being the summation of the five Richardson and Zumbo factors), we attempted to examine the effect determinants of health identified by the BCPHO and a literature search would have on those dependent variables in terms of their ability to be sensitive to underlying changes in the population's health status.

The key health determinants included: income level, educational attainment, employment status, single parenthood, tobacco use, alcohol consumption, gender, and age. Indicators closely paralleling these determinants were selected from the 1994/95 NPHS and used as model predictors.

A multivariate analysis was done. The model predictors identified through stepwise regression were identified. Beta values, Pratt scores, R-squared values, and tests for significance were calculated.

The results of the analysis yielded no surprises. As expected, being employed, greater income adequacy, and less tobacco consumption were all associated with better health. All these were intuitively plausible and consistent with the literature.

Gender was not a significant health determinant except on the social well-being factor , where there was an apparent advantage to being female. Being a single parent was only significant on the mental ill-health factor where being a single parent was associated with greater mental ill-health. There was no

apparent significant association between education level and any of the dependent variables. Of interest was the improvement in mental well-being and the decrease in mental ill-health with increasing age, while youth, as expected, was associated with higher Health Utility Index scores and less general health impairment.

One exception that was counter intuitive was the apparent health advantage gained by alcohol consumption on the physical impairment, mental well-being and general health impairment factors. Before one asserts the benefits to health of alcohol consumption, however, the underlying indicator needs to be more closely examined. The NPHS derived variable for Derived Type of Drinker had the heaviest class of drinker consuming one or more drinks per month. Clearly this washes out any differences which may occur between a heavy drinker and the person who has but one drink per month.[15]

Overall, the R^2 of the multivariate analyses were low ranging from .017 to .212 on the five Richardson and Zumbo Factors, .097 for the Composite Score and .123 for the Health Utility Index.

The net result of these regressions seems to be that there is a poor fit between the determinants of health and population health status. The determinants do not seem to be determining much which, unfortunately, was the problem we started with. The HUI was hardly describing population health while the five Richardson-Zumbo scores and the Composite Score fared little better.

The general health impairment R-squared (R^2 = .212) was the highest of all dependent variables; explained by the following NPHS indicators: vision, hearing, mobility, cognition, pain, and health description. This would suggest a nice, overview, summary-type variable that could on its own, or in a profile, be examined as a good health status indicator.

Does this mean the determinants of health are unimportant? Clearly not. What this analysis once again demonstrates is the difficulty in capturing the complex interplay between the myriad of variables that form the construct of health. Given the multi-faceted nature of health, it seems even less useful to attempt to develop a single summative measure of health even though, as Hunt McEwen and McKenna (1986) assert, health policy makers are usually more interested in a single global number which can summarize the health status of a population into a summary statistic akin to the way the GNP is an indicator of the health of the economy.

Although our health indicators were not able to account for much of the variation in the five Richardson and Zumbo factors or the Composite Score of the Richardson-Zumbo Health Profile, attempted explanations of the factors yielded more information about health determinants than explanations of the HUI.

The challenge to future researchers is to continue to explore profiles that accurately capture the status of the population's health and that are also sensitive to underlying changes as they occur.

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Table 1. NPHS Indicators and BCPHO Health Determinants

NPHS Indicator	**BCPHO Health Determinant**
1- Single Parenthood	Social and Economic Environment
2- Derived Variable for Working Status	Social and Economic Environment
3 - Derived Highest Education Level Attained	Social and Economic Environment
4 - Derived Income Adequacy	Social and Economic Environment
5 - Type of Smoker	Health Behaviours and Skills
6 - Derived Type of Drinker	Health Behaviours and Skills
7 - Age	Nil
8 - Gender	Nil

Table 2. Multivariate Analysis Where Only the Model Predictors Identified Through Stepwise Regression are Indicated

Dependent Variable → Model Predictors ↓	**Health Utility Index** n =773	**Composite of 5 Factors** n = 776	**1 - Physical Impairment Factor** n =776	**2 - Mental Ill-Health Factor** n =776	**3 - Mental Well-Being Factor** n =776	**4 - General Health Impairment Factor** n =776	**5 - Social Well-Being Factor** n =776
Single Parent				Beta = +.115 Pratt = 19.6%			
Derived Variable for Working Status	Beta = -.207 Pratt = 45.3%	Beta = -.165 Pratt = 34.7%	Beta = +.088 Pratt = 54.9%		Beta = -.112 Pratt = 18.2%	Beta = +.228 Pratt = 36.4%	
Derived Highest Level of Education Attained							
Derived Income Adequacy		Beta = +.096 Pratt = 18.0%		Beta = -.139 Pratt = 20.9%	Beta = +.092 Pratt = 19.1%		Beta = +.094 Pratt = 20.3%
Type of Smoker	Beta = +.147 Pratt = 18.2%	Beta = +.209 Pratt = 47.8%		Beta = -.177 Pratt = 30.9%	Beta = +.179 Pratt = 42.7%	Beta = -.184 Pratt = 15.4%	Beta = +.179 Pratt = 68.7%
Derived Type of Drinker			Beta = +.079 Pratt = 46.0%		Beta = -.077 Pratt = 7.5%	Beta = +.089 Pratt = 6.2%	
Age Cohort	Beta = -.178 Pratt = 36.2%			Beta = -.174 Pratt = 28.5%	Beta = +.128 Pratt = 12.3%	Beta = +.257 Pratt = 42.3%	
Gender							Beta = +.082 Pratt = 11.2%
R^2	.123	.097	.017	.114	.075	.212	.049
F	F (3,769) = 35.815	F (3, 772) = 27.745	F (2,773) = 6.764	F (4,771) = 24.722	F (5,770) = 12.477	F (4,771) = 51.967	F (3,772) = 13.269
Sig.	p < .001	p < .001	p = .001	p < .001	p < .001	p < .001	p < .001

Endnotes

[1] Health Canada (1996) had a view of the health determinant categories similar to that of the British Columbia Provincial Health Officer. The following list was used as a starting point for future population health policy and research directions: income and social status, social support networks, education, employment, working conditions, social environments, physical environments, biology and genetic endowment, personal health and coping skills, health services, and three new areas: healthy child development, gender, and culture.

[2] The poorest 20% of the population would gain 13 additional disability free years if their socioeconomic status was the same as the top 40% of income earners.

[3] Japan, which has the highest life expectancy in the world, has the smallest relative difference between the average incomes of the richest and poorest 20% of the population of any OECD country. Some, however, point to the economic success of Japan as the reason for the rise in life expectancy, once again highlighting the difficulty in disentangling the intertwining factors which contribute to health status (Frank, 1995).

[4] Their paper reviews twelve studies (some of which were also reviews of multiple studies) the primary focus of which was the relationship between measures of income inequality and average levels of population health. All but two studies found evidence of an association. Even so, Judge, Mulligan and Benzeval (1998) are not convinced that a definite association exists citing flawed study design, choice of income measures and questionable data manipulation. The authors do not discount the existence of a possible association and so

produced their own study with a view of not replicating the errors of their predecessors. The study's results caused the authors to conclude that income inequality is not a significant but only modest determinant of population health in rich industrialized countries for which good income distribution data are available.

[5] The British Columbia Provincial Health Officer (1994) also comments that the northern regions of the province generally have the highest unemployment rates in British Columbia.

[6] Health Canada (1996) grouped underemployment and stressful work in the same category as unemployment.

[7] The literature explores more than the employed / unemployed dichotomy, also examining degree of job security, full-time versus part-time employment, type of shifts worked, decision making latitude, psychological demands.

[8] Denton and Walters (1999) comment on the stress arising from women's unpaid work in the home especially when coupled with participation in the paid workforce.

[9] Denton and Walters (1999) refer to the association between health and social support today being as compelling as the association was between health and tobacco use in the 1960's.

[10] Health Canada (1996) defines gender as "a social construct rooted more in human culture than biological differences between the sexes. Gender refers to the array of society-determined roles, personality traits, attitudes, behaviours, values, relative power and influence that society ascribes to the two sexes on a differential basis" (Appendix D).

[11] The NPHS target population excluded persons living on Indian reserves, on Canadian Forces Bases, and in some remote areas (Tambay and Catlin, 1995).

[12] Boyle, Furlong, Feeny, Torrance and Hatcher (1995) in a test-retest study of the reliability of the Health Utility Index-Mark III state the reliability was substantial for the attributes of vision, ambulation, and emotion; moderate for hearing, cognition, and pain; speech and dexterity had the lowest estimates of reliability. Bergner (1987) in an examination of the McMaster Health Index Questionnaire stated it could be expected to show a skewness of scores because of being designed to assess a dysfunctional population. Hunt, McEwen and McKenna (1986) commenting on the McMaster Health Index Questionnaire, precursor to the Health Utility Index, state that for physical function items the validity is robust but considerably weaker for social and emotional items.

[13] "When all variables are standardized to have means of zero and standard deviations of one, the standardized regression coefficients (Betas) measure the percent of movement in the dependent variable when a predictor variable moves one full unit and every other predictor in the set is held constant" (Michalos, 1996, p. 55).

[14] "The Pratt Index quantifies the relative contribution each explanatory variable makes to the overall regression equation by partitioning the model R^2 into that proportion attributable to each explanatory variable. The scores are additive and will therefore sum to 1.0" (Richardson, 1999, p. 32).

$$\text{Pratt Index} = \frac{\text{Beta} * \text{corr}_{xy}}{R^2} * 100$$

[15] The Derived Type of Drinker variable could have captured higher levels of alcohol consumption by including the results from National Population Health Survey questions ALCO-Q3, Q4 and Q5 which captured number of times when more than five drinks were consumed on one occasion, the greatest number of drinks on one occasion, and how many drinks the person had on each of the last seven days. Schwarz & Strack (1999) suggest asking open ended questions is better than giving the respondent a range of responses to choose from. They suggest that "respondents assume the list of response alternatives reflects the researcher's knowledge of the distribution of the behaviour …. [and] accordingly, they use the range of the response alternatives as a frame of reference in estimating their own behavioral frequency" (p. 73).