CARE

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FOR **A**PPLIED
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THE DETERMINANTS OF LIFE SATISFACTION IN NEWFOUNDLAND AND LABRADOR

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Abstract

Happiness, subjective well-being and utility have been at the centre of the neoclassical microeconomic analytical framework for a considerable period of time. In its strictest form the utility that an individual obtains is dependent upon the combination of goods and services that he or she consumes. The actual or perceived utility of these goods or services is the very characteristic that makes the individual want to consume them. At the same it has been recognized that there are aspects of our lives beyond consumption that help to determine our subjective well-being. These concerns of micro-economists have spilled over to those interested in macroeconomics and the System of National Accounts, which focuses on the production of goods and services within an economy or by its nationals. For example, in 1974 Richard Easterlin noted that happiness does not seem to increase within a country such as the United States as GDP per capita increases. This seems to pose a paradox (called the" Easterlin paradox") for economists. Over the past decade there have been a number of studies that have attempted to measure the determinants of subjective well-being or life satisfaction and ours is one of them. These studies have increasingly relied on access to appropriate cross-sectional data on individuals and to more sophisticated econometric techniques. Our study follows that tradition by using 2012-12 Canadian Community Health Survey (CCHS) data from Statistics Canada for Newfoundland and Labrador to estimate the determinants of subjective life satisfaction using a generalized ordered logistic regression model using a gologit3 command written Richard Williams for use in the STATA statistical package. Our results demonstrate the added value of using such a procedure including a non-linear response of subjective life satisfaction categories to changes in income as traditional economic theory would predict. Surprisingly, we also find that gender does not make a great deal of difference in explaining subjective well-being for our sample.

In his book "Happiness: Lessons from a New Science", the author Richard Layard wastes no time in describing the main problem that this "new science of happiness" is meant to tackle. In the very first paragraph of chapter one he states:

> There is a paradox at the heart of our lives. Most people want more income and strive for it. Yet as Western societies have got richer, their people have become no happier.

We will not entangle ourselves too much here in the debate over whether this paradox is real or not. For our purposes, we will focus on the two underlying "facts" that suggest there is a paradox at all. Namely, what do we mean when we say that societies have gotten richer and how do we know that people have become no happier?

Of course, when we say that societies have gotten richer we mean that their Gross Domestic Product has increased. The paradox that a richer society does not imply a happier society is often referred to as the "Easterlin paradox" since it was Easterlin (1974) who first highlighted the fact that happiness does not necessarily increase with an increase in GDP. Easterlin analyzed U. S. data from 1946 to 1970 and concluded that even though income had increased dramatically over that time period, the level of self-reported happiness had remained flat. This does not imply that money does not buy happiness. Money does "buy" happiness for the individual in the sense that "at a point in time both among and within countries, happiness and income are positively correlated" (Easterlin 1974). However, money, or growth in GDP, does not necessarily buy overall happiness for a country's citizens.

Ever since its development by American economist Simon Kuznets in the 1930's, the GDP has been used as the primary indicator of a nation's wealth. But is it the best measure of progress? In a famous speech at the University of Kansas on March 18, 1968 Robert F. Kennedy remarked that GDP "counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for the people who break them." All of these negatives add to the growth of GDP. It counts everything, Kennedy says "except that which makes life worthwhile." As Anielski (2007) points out the original, Old English, meaning of the word wealth was "the state, condition or quality of well-being." This was probably not the meaning of word wealth that Adam Smith was referring to when he wrote his treatise *An Inquiry into the Nature and Causes of the Wealth of Nations,* but perhaps it is time "go beyond GDP" and produce measures of "wealth" in the archaic sense of the word that encompass both material and psychological well-being. So one way to resolve the paradox is to replace GDP with a more appropriate measure of how rich a society is.

In the last several decades researchers have endeavored to produce such a replacement for GDP. As Dehley and Kroll (2013) have observed, there are essentially three ways that this can be done: by "healing the GDP", by "complementing the GDP", and by "replacing the GDP."

An early attempt to "heal" the GDP was carried out by Nordhaus and Tobin (1973). They developed a measure of economic welfare (MEW) that started with GDP but added in the value of leisure time and unpaid work and subtracted the value of environmental damage. Another attempt at healing the GDP was the genuine progress indicator, or GPI, that was introduced by Daly and Cobb (1989). This is a popular replacement of GDP that "allows for the identification of which factors increase or decrease economic welfare." Using GPI as the measure of economic welfare, Kubiszewski et al (2013) were able to use estimates for 17 countries representing over half the world's population to show that global economic welfare has been stagnant since 1978.

However, since well-being is multi-dimensional, it may be more appropriate to complement GDP with other indicators. Perhaps the most popular measure of progress that complements GDP is the Human Development Index (http://hdr.undp.org/en/content/human-development-index-hdi) which combines Gross National Income per capita with life expectancy at birth and an education index (mean years of schooling and expected years of schooling)

A more recent composite index that is meant to complement GDP is the OECD's Better Life Index (http://www.oecdbetterlifeindex.org/). This index, launched by the OECD in 2011 as a part of its Better Life Initiative and in conjunction with its 50th Anniversary, consists of 11 dimensions and a total of 24 indicators. The dimensions can be grouped into two broad categories: Material Living Conditions and Quality of Life. Housing, income and jobs are the three dimensions included under Material Living Conditions, while community, education, environment, civic engagement, health, life satisfaction, safety and work-life balance are the eight dimensions included under Quality of Life. Each dimension consists of one or more indicators, which are normalized and aggregated in a standard way to produce an overall composite index of well-being. In their study of well-being indices, Dehley and Kroll (2013) showed that the OECD's Better Life Index was in fact a better predictor of subjective well-being that Gross National Income.

An example of a measure that tries to replace the GDP altogether is the Happy Planet Index (http://www.happyplanetindex.org/). This index combines life expectancy, experienced well-being (as

measured by the "Ladder of Life" question on the Gallup World Poll) and ecological footprint (the amount of land per capita needed to sustain consumption).

How do we know how happy people are? Easterlin (1974) used self-reported happiness data from the U.S. General Social Survey in which happiness was measured by a single question:

> Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?

This was a bold departure from traditional economic theory which tended to rely on "revealed preferences" to determine what makes people happy. Economists were skeptical about using "subjective well-being" data at first (and many still are), but in the past few decades an entire new field of "happiness economics" has emerged.

Can we trust the measures of happiness that are produced by surveys of this sort? After all life satisfaction is a subjective measure that cannot be objectively verified. As Kahneman and Krueger (2006) state life satisfaction is

> a global retrospective judgment, which in most cases is constructed only when asked and is determined in part by the respondent's current mood and memory, and by the immediate context.

It may be that reported life satisfaction can be influenced by something trivial like the current weather. Indeed, a study by Schwarz and Clore (1983) claims to show that people reported higher life satisfaction when the weather was sunny. The same result was found in a more recent study (Kämpfer and Mutz, 2013). Life satisfaction scores may also be influenced by the order of questions on a survey, particularly when the life satisfaction question is preceded by questions that can affect the mood of the respondent. For example, in their analysis of life satisfaction on the Canadian General Social Survey from 2003 to 2011, Bonikowska et al (2013) noticed that the lowest levels of life satisfaction (in particular the percentage of respondents reporting the highest score of 10) occurred in 2005 and 2010. During those years the life satisfaction question was preceded by questions on time use and the authors speculate that this emphasis on a negative aspect of people's lives deflated the number of responses in the highest categories. In the same paper, the authors also note that the highest percentage of people responding with a score of 10 occurred in 2009 when the life satisfaction question was proceeded by

questions on criminal victimization. The speculation here is that the people surveyed who were reminded of the fact that they were not victimized were more likely boosted by the thought of being fortunate and rated their life satisfaction higher as a result. The percentage of people responding with 10 in 2009 (with victimization questions) was 29.7%, whereas the percentage of people responding with 10 in 2010 (with time use questions) was 14.6%. It is highly unlikely that such a large decrease could have been caused by anything other than contextual factors.
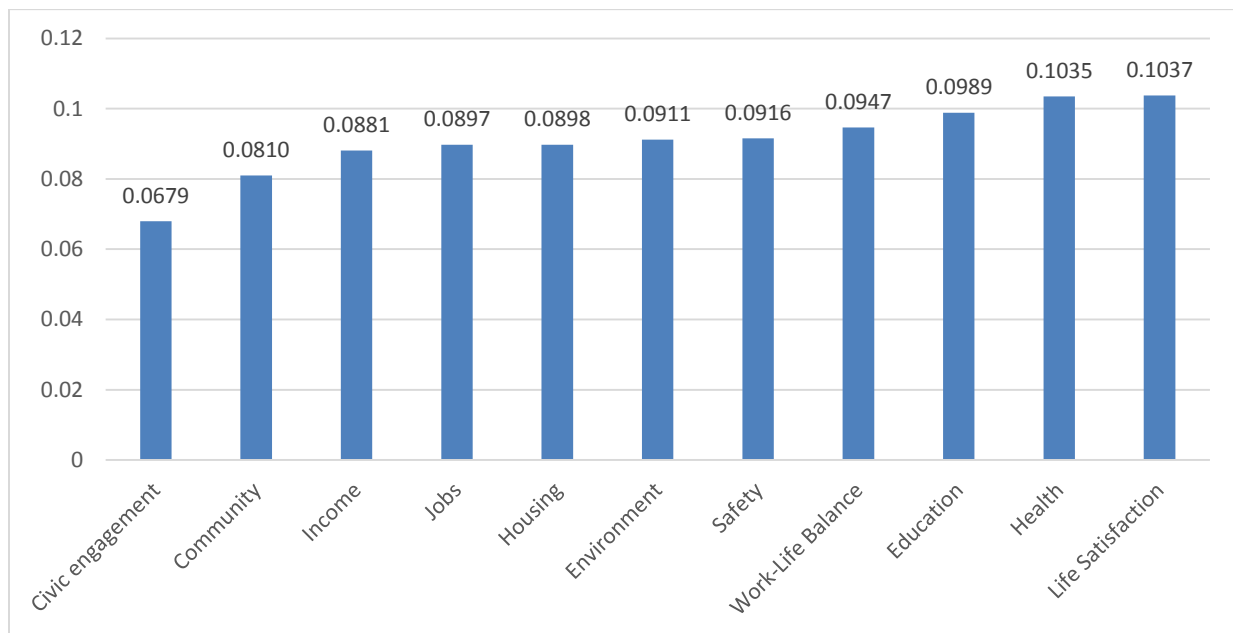
However, there have been numerous studies which have tested the robustness of these subjective measures of life satisfactions from surveys. For example, Krueger and Schkade (2008) show that there is enough consistency in life satisfaction responses through time that would allow the results to be used for statistical analysis. Oswald and Wu, S. (2010) looked at measures of well-being throughout the United States and found a strong correlation between subjective and objective measures of well-being. The authors conclude that "subjective well-being data contain genuine information about the quality of human lives."

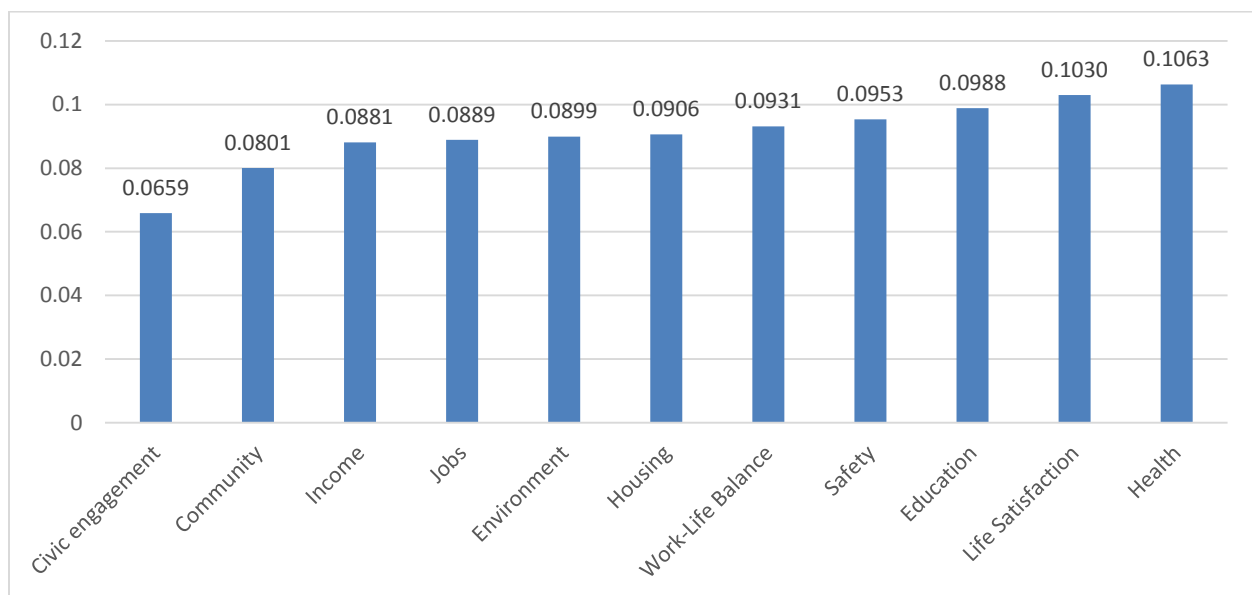**The Determinants of Life Satisfaction**

The Better Life Index is defined as a linear aggregation of the individual dimensions and indicators. But what should these weights be? When weights are assigned they act as coefficients that "embody the relative importance attached to each component" (Foster, McGillivray and Seth, 2013). However, determining what those weights should be for a multidimensional index is a very difficult problem that can be approached using many different techniques (Decancq and Lugo, 2013). The OECD does not make any attempt to determine the dimension weights: it sets all weights equal to one initially and lets the user decide on the "importance" of each dimension by adjusting the individual sliders from 0 to 5.

As of March 7, 2014 users had submitted a total of 66,639 indices through the interactive online tool. (See http://blirt.oecdcode.org/).

Figure 1 Average user defined weights for the 11 dimensions (All responses)

Civic engagement: 0.0679
Community: 0.0810
Income: 0.0881
Jobs: 0.0897
Housing: 0.0898
Environment: 0.0911
Safety: 0.0916
Work-Life Balance: 0.0947
Education: 0.0989
Health: 0.1035
Life Satisfaction: 0.1037

Figure 2 Average user defined weights for the 11 dimensions (Canadian responses)

Civic engagement: 0.0659
Community: 0.0801
Income: 0.0881
Jobs: 0.0889
Environment: 0.0899
Housing: 0.0906
Work-Life Balance: 0.0931
Safety: 0.0953
Education: 0.0988
Life Satisfaction: 0.1030
Health: 0.1063

Now it should be noted that the collected user defined vectors of weights do not represent a statistically representative sample and should be used with caution. However, the OECD's decision to let users submit their own weights suggests that the constructors of the index think that individuals are the best judges of what makes them happy. As we can see in Figures 1 and 2 above, the top two dimensions are

Health and Life Satisfaction. The Life Satisfaction dimension consists of a single indicator: the average score from 0 to 10 on the Gallup World Poll's life satisfaction question. The Gallup World Poll uses Cantril's Ladder and asks people to rate of their current life relative to the best (10) and worst (0) possible lives they can imagine.

It is interesting that Life Satisfaction is ranked first overall by users. Helliwell and Putnam (2004) assert that "a case can be made that the ultimate 'dependent variable' in social science should be human well-being, and in particular, well-being as defined by the individual herself, or 'subjective well-being'. Perhaps we can use life satisfaction (which has been used interchangeably with subjective well-being and happiness) as a proxy for objective well-being.

If we follow this advice and take the response to a life satisfaction question on a survey (such as the Canadian Community Health Survey) as our dependent variable and regress on a selection of demographic and socio-economic explanatory variables, we should be able to estimate the relative importance of the various drivers of well-being. The OECD Guidelines on Measuring Subjective Well-being (OECD 2013) states:

> If it is accepted that measures of subjective well-being are valid, and that they accurately capture the concepts that they claim to measure – an overall evaluation of life or the experienced moods and emotions of an individual over a period of time – then it follows that such measures can be used to provide information on the relative contribution of different factors and circumstances to a person's well-being…

Using the Gallup World Poll, for example, Boarini et al. (2012) did an ordinary least squares regression of life satisfaction as the dependent variable against a list of demographic and socio-economic independent variables that represented the various domains of the OECD Better Life Index (a complete list of Better Life Index dimensions and indicators is given in Table 1). They found for instance that the coefficient of the log base two of household income was 0.1482 while the coefficient of being married was 0.2584. From this we can conclude that being married is 0.2584/0.1482 = 1.7435 times as "important" as the log of household income in determining life satisfaction.

Dimension	Indicator
Housing	Dwellings without basic facilities
	Housing expenditure
	Rooms per person
Income	Household net adjusted disposable income
	Household net financial wealth
Jobs	Employment rate
	Job security
	Long-term unemployment rate
	Personal earnings
Community	Quality of support network
Education	Educational attainment
	Student skills
	Years in education
Environment	Air pollution
	Water quality
Civic engagement	Consultation on rule-making
	Voter turnout
Health	Life expectancy
	Self-reported health
Life Satisfaction	Life satisfaction
Safety	Assault rate
	Homicide rate
Work-Life Balance	Employees working very long hours
	Time devoted to leisure and personal care

Data

The data come from the 2011-12 Canadian Community Health Survey (CCHS). The CCHS is a national, cross-sectional survey administered by Statistics Canada that queries the health status, health care utilization and other health determinants of Canadians. It is a national survey that covers about 98% of the Canadian population, excluding persons on Indian reserves, persons in prisons and institutions, and also excludes members of the Canadian Armed Forces. In particular, data for this study comes from the Share File of the 2011-12 CCHS and only contains data for the province of Newfoundland and Labrador. The share file contains data for those respondents who have agreed to share their personal data with Statistics Canada partners and had a sample size of 3,415. For the purposes of this study the sample was restricted to respondents aged 15 and over, giving a sample of 3,267.

Since the CCHS is not a simple random sample and follows a complex survey design, the strata and primary survey units (PSUs) must be taken into account when calculating standard errors. However, to protect the confidentiality of the survey participants Statistics Canada does not identify the strata and PSUs used. Instead, they provide a set of 500 bootstrap weights that can be used to calculate valid standard errors in statistical analysis and regression.

Measures
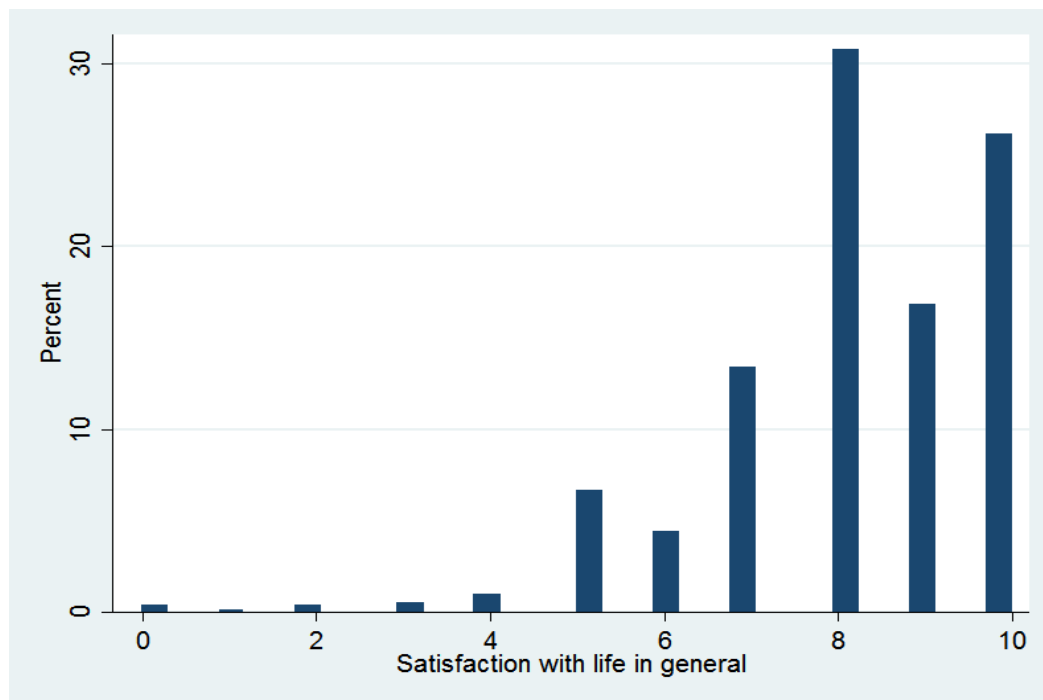
Life satisfaction

The dependent variable used to measure life satisfaction comes from the question asked of participants on the 2011-12 CCHS (variable GEN_02A2):

> Using a scale of 0 to 10, where 0 means "Very dissatisfied" and 10 means "Very satisfied", how do you feel about your life as a whole right now?

The distribution of responses are displayed in Figure 3.

Figure 3: Frequency of responses to the life satisfaction question, 2011-12 CCHS, Newfoundland and Labrador


Prior to the 2009-10 CCHS survey, this life satisfaction question was measured on a 5 point scale with respondents being asked to rate their life satisfaction from "Very dissatisfied" to "Very satisfied'. To compare the results of this question over time, the CCHS includes a derived variable (GENGSWL) that combines categories from a 0-10 to a 5-point scale as follows:

- A response 0 and 1 becomes "Very dissatisfied"
- Responses of 2,3, and 4 become "Dissatisfied"
- A response of 5 is considered "Neither satisfied nor dissatisfied"
- Responses of 6,7, and 8 are considered "Satisfied", and
- Responses of 9 and 10 are given top rating of "Very satisfied"

However, in the following chart (where we are using the 5-point derived variable for the years 2009 - 2012) we can clearly see that the percentage of respondents who were "Very satisfied" rises sharply from 2008 to 2009, and that the percentage of respondents who were "Satisfied" decreases sharply from 2008 to 2009. Since this change is probably due to the conversion from the 0-10 scale to the 5-pont scale and not due to any real change in life satisfaction, for 2009 to 2012 it is best to assume that the 0-10 point scale gives the best measure of life satisfaction and that "collapsing of categories" to

produce a 5-point scale may not give a measure of life satisfaction that is truly comparable with the 5-point scale used in previous years.

Figure 3: Life Satisfaction, CCHS, Newfoundland and Labrador 2003-2012
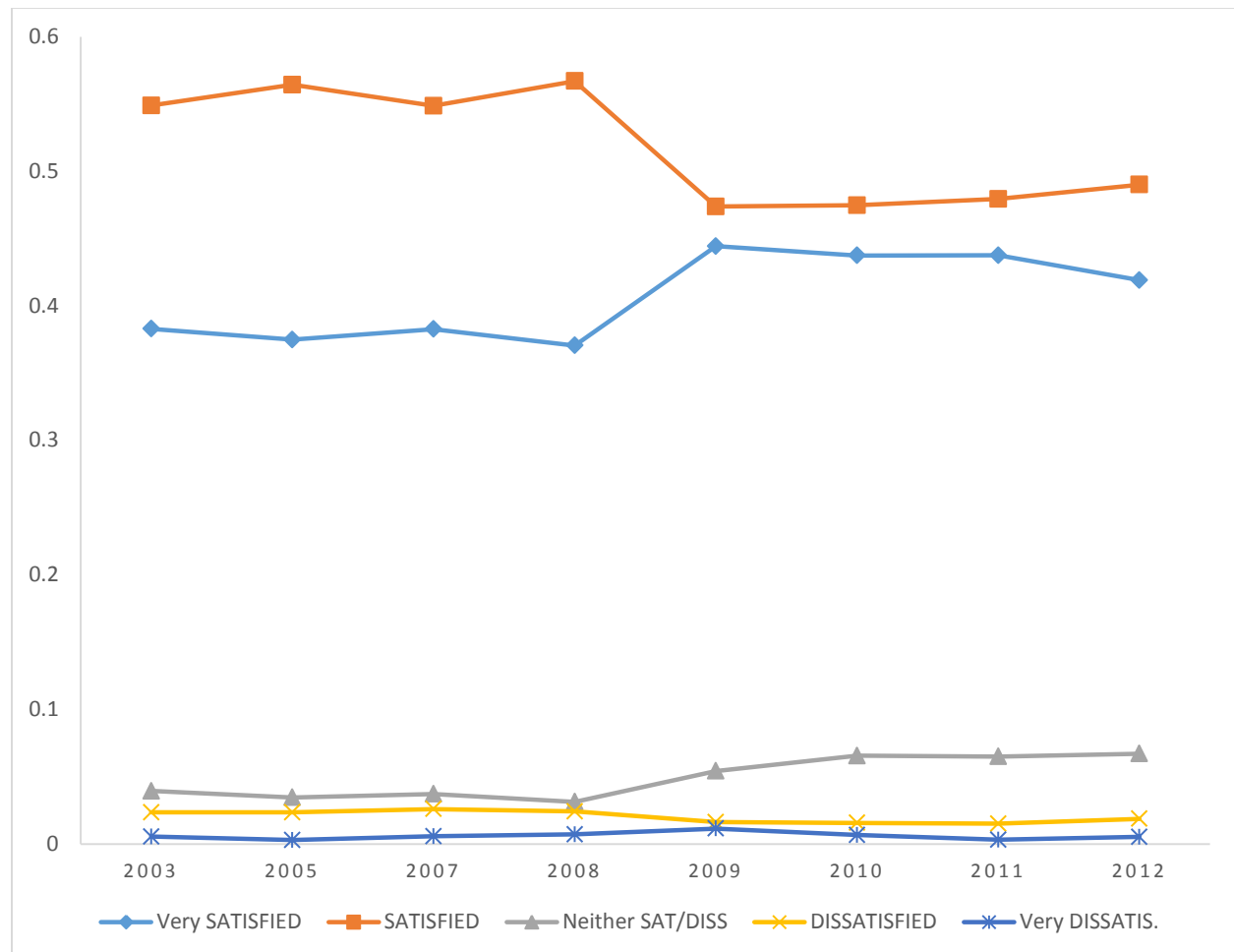
That said, for the purposes of this study, we will collapse the categories to facilitate the use of ordered logistic and the generalized ordered logistic regression. Following Statistics Canada's conversion rules to derive a 5-point scale ranging from "Very dissatisfied", "Dissatisfied", "Neither satisfied nor dissatisfied", "Satisfied" and "Very dissatisfied". However, with the small number of responses in the bottom three categories, we have combined the *Very dissatisfied*, *Dissatisfied* and *Nether satisfied nor dissatisfied* categories into a single category called "Not satisfied".

Figure 4: Frequency of life satisfaction (5 point scale), CCHS 2011-12, Newfoundland and Labrador
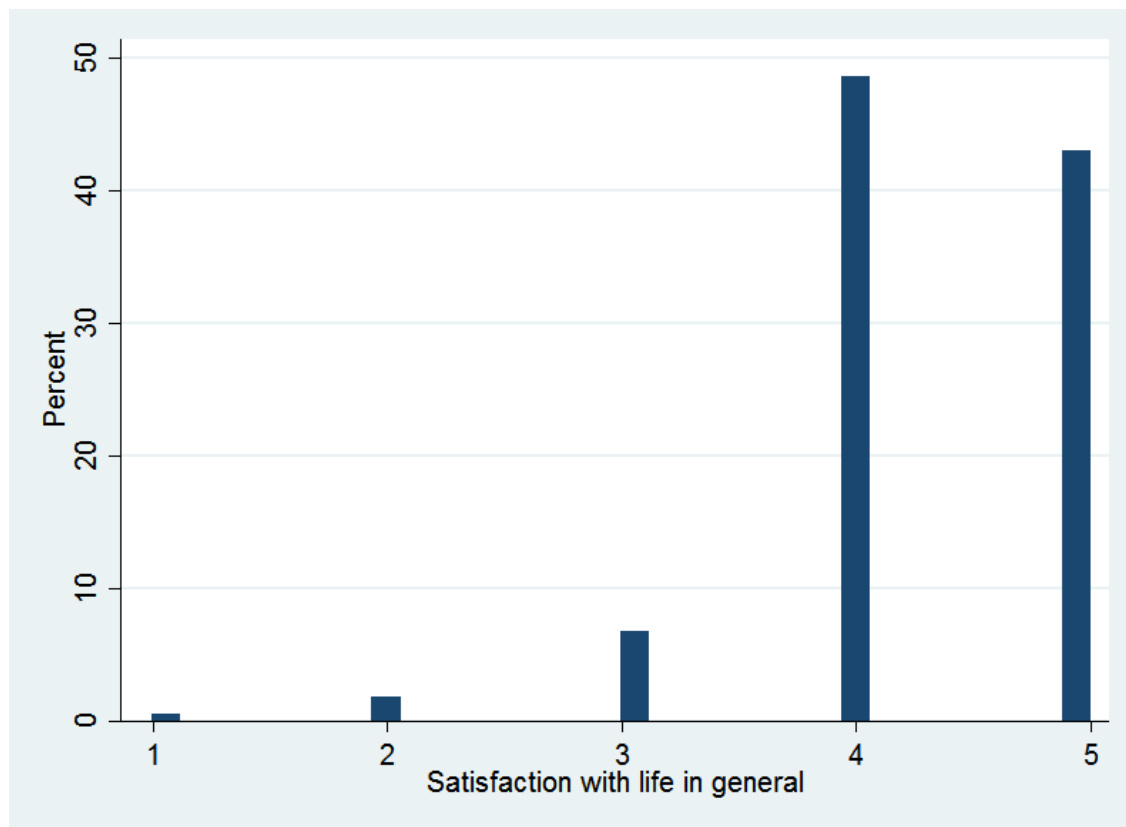
Covariates

Research on life satisfaction and happiness has revealed that there are many socio-demographic factors that determine subjective well-being; age, gender, income, marital status, and employment status, for example, have been shown to affect an individual's well-being (Clark & Oswald, 1994; Layard, 2005; Blanchflower & Oswald, 2008; Dolen et al, 2008). All of these determinants, and others, are included as covariates in the present study.

Independent Variables and Life Satisfaction

We include gender, age (years), and number of persons under 12 in the household. For income we take the log base two of household income and divide by the square root of household size to get the log base two of household equivalent income. We also include marital status (married, living common-law, widowed, separated or divorced, and single), educational attainment (less than secondary, secondary,

some post-secondary, college diploma, and university degree), employment status (employed, unemployed), and house ownership (owner and renter).

We include some lifestyle variables as well. These are Physical activity (Inactive, Moderately active, and Active), smoking and drinking (where we have defined a heavy drinker as someone who consumes more than 5 drinks at least once a month).

A chronic conditions variable is included (a person has a chronic condition if they answered yes to any of the chronic conditions questions on the CCHS survey) and the food security variable with categories Food secure and Moderately/Severely food secure was included as well.

Finally, we include subjective measures of well-being. These include self-rated health status (ordinal variable with ranking Poor, Fair, Good, Very Good and Excellent), self–rated mental health status (with categories Poor/Fair, Good, Very Good and Excellent), self-rated life stress (ordinal variable with categories No stress, Not very much stress, A bit of stress, and Quite a bit/extreme amount of stress), and sense of belonging to community (Very weak, Somewhat weak, Somewhat strong, and Very strong),

See Table 3 below for a brief description of the variables of interest.

Table2: Descriptive Summary of Variables of Interest

	Obs	Mean	Std. Dev.	Min	Max
Gender (reference: Men**)**	3267	0.442608	0.496771	0	1
Women	3267	0.557392	0.496771	0	1
Age	3267	50.49801	18.80555	15	94
Children under 12 (reference:					
None**)**	3267	0.835323	0.370946	0	1
One	3267	0.093358	0.290978	0	1
Two or more	3267	0.071319	0.257397	0	1
Log base two household equivalent income	3263	14.42121	1.07848	3.807355	19.93157

Education (reference: Less than secondary**)**	3191	0.284237	0.451121	0	1
Secondary	3191	0.179568	0.383887	0	1
Some postsecondary	3191	0.025384	0.157313	0	1
College diploma	3191	0.396428	0.489232	0	1
University degree	3191	0.114384	0.318327	0	1
Marital status (reference: Married**)**	3263	0.499234	0.500076	0	1
Living common-law	3263	0.080601	0.272263	0	1
Widowed	3263	0.107263	0.309495	0	1
Divorced or separated	3263	0.074778	0.263073	0	1
Single	3263	0.238124	0.426001	0	1
Employed (reference: Employed**)**	2959	0.515377	0.499848	0	1
Unemployed	2959	0.484623	0.499848	0	1
Owner (reference: Renter**)**	3212	0.16812	0.374031	0	1
Owner	3212	0.83188	0.374031	0	1
Physical activity (reference: Inactive**)**	3178	0.526746	0.499363	0	1
Moderately active	3178	0.245437	0.430414	0	1
Active	3178	0.227816	0.419489	0	1
Smoking (reference: Non-smoker**)**	3263	0.775667	0.417207	0	1
Smoker	3263	0.224333	0.417207	0	1
Heavy drinking (reference: Not heavy drinker**)**	3234	0.768089	0.422118	0	1
Heavy drinker	3234	0.231911	0.422118	0	1
Chronic conditions (reference: No chronic condition**)**	3266	0.36038	0.480184	0	1
Chronic condition	3266	0.63962	0.480184	0	1
Food security (reference: Food secure**)**	3201	0.937832	0.241498	0	1
Moderately/Severely food insecure	3201	0.062168	0.241498	0	1

Self-rated health (reference:					
poor**)**	3263	0.037695	0.190488	0	1
Fair	3263	0.102666	0.303569	0	1
Good	3263	0.261416	0.439473	0	1
Very good	3263	0.439473	0.496399	0	1
Excellent	3263	0.15875	0.365498	0	1
Self-rated mental health					
(reference: Poor/Fair**)**	3173	0.041916	0.200429	0	1
Good	3173	0.221872	0.415571	0	1
Very Good	3173	0.363694	0.481138	0	1
Excellent	3173	0.372518	0.483552	0	1
Sense of belonging to					
community (reference: Very					
weak**)**	3247	0.161996	0.368504	0	1
Somewhat weak	3247	0.282107	0.450094	0	1
Somewhat strong	3247	0.431167	0.495316	0	1
Very strong	3247	0.124731	0.330464	0	1
Self-rated life stress (reference:					
No stress**)**	3146	0.045137	0.207637	0	1
Not very much	3146	0.146217	0.35338	0	1
A bit of stress	3146	0.535919	0.498788	0	1
Quite a bit/extreme	3146	0.272727	0.445433	0	1

Regression

We first apply ordinary least squares to determine effects of the covariates on life satisfaction. Although life satisfaction is an ordinal variable which would seem to require an ordinal regression method, the CCHS question that measures life satisfaction has 11 response categories on a numerical scale from 0 to 10. With this many levels of the dependent variable, ordinal regression would be very cumbersome (unless the categories were collapsed), so we employ ordinary least squares as a first step in modelling the effects of the predicting variables on life satisfaction. Ordinary least squares regression requires that the independent variable is cardinal. This would imply, for instance, that a person who responded with an 8 on the life satisfaction question is "twice" as happy as someone who responded with a 4. It is impossible to verify this assumption; nevertheless it is often made and ordinary least squares regression is often applied.

The standard regression techniques to use would be ordered logistic or probit regression. Sharpe et al (2010), for example, used ordered probit regression to do an extensive analysis of life satisfaction of Canadians using the Canadian Community Health Survey of 2007-08. For the ordered logistic regression model, our dependent variable will be life satisfaction with the categories from 0 to 11 collapsed into three categories (0 – 5 collapsed to become the category "Not satisfied", 6 - 8 collapsed to become the category "Satisfied", and 9 – 10 collapsed to become "Very satisfied").

One of the key assumptions of the ordered logistic regression model is that the parameters do not differ across the categories of the dependent variable. This is often referred to as the parallel lines assumption. For the cumulative ordered logistic regression model, this means that for an ordinal dependent variable Y with M categories the model can be written as:

$$P(Y_i > j) = g(X\beta) = \frac{\exp(\alpha_j + X_i\beta)}{1 + [\exp(\alpha_j + X_i\beta)]}, j = 1,2, \ldots, M - 1$$

Note that the beta coefficients are the same for all levels of the dependent variable (for $j = 1,2, \ldots, M - 1$).

This assumption is often violated, and when it is, the results of the ordered logistic regression model may be incorrect (Williams, 2006) and it may be more appropriate to use the generalized ordered logistic regression model. This can be written as:

$$P(Y_i > j) = g(X\beta_j) = \frac{\exp(\alpha_j + X_i\beta_j)}{1 + [\exp(\alpha_j + X_i\beta_j)]}, j = 1,2, \ldots, M - 1$$

Note that each level j of the dependent variable has its own set of beta coefficients.

The probabilities that Y will be equal to the values $j = 1,2, \ldots, M - 1$ are given by:

$$P(Y_i = 1) = 1 - g(X\beta_1)$$

$$P(Y_i = j) = g(X_i\beta_{j-1}) - g(X_i\beta_j), j = 1,2, \ldots, M - 1$$

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$$P(Y_i = M) = g(X_i \beta_{M-1})$$

This model can be estimated in STATA by the user-written *gologit2* command (Williams, 2006) which will compute a different set parameters for each level of the dependent variable. The *autofit* option of the *gologit2* command will perform a series of Wald tests to see if any of the variables violate the parallel lines assumption. This will produce a more parsimonious model since it will compute different sets of coefficients for each level of the dependent variable only for those independent variables that fail to meet the parallel lines assumption.

The *gologit2* program has been used to study the determinants of life satisfaction by Vinson and Ericson (2014), Liang, Yamashita, and Brown (2013) and Ambrey and Fleming (2013).

As we did for ordered logistic regression, for the generalized ordered logistic regression we use the collapsed life satisfaction variable with three levels ("Not satisfied", "Satisfied", and "Very satisfied") as the dependent variable. The *gologit2* command, however, does not work with bootstrap weights so we had to use *gologit3*, which is a beta program written by Richard Williams that does work with bootstrap weights and produces the same results as *gologit2.* The *gologit3* command requires the *golsvy* subroutine in order to work with the complex survey design of the CCHS.

Bivariate Regression Results

We first applied ordinary least squares, ordered logistic and generalized ordered logistics regression on the dependent variable, life satisfaction, and each of the independent variables separately. The following table show the results of the individual pairwise regressions (we report odds ratios for the ordered and generalized ordered logistic regression).

Table4: Bivariate Regression Results

	OLS	Ordered Logistic Regression (OR)	Generalized Ordered Logistics Regression (OR)	
			Not satisfied vs (Satisfied and Very satisfied)	(Not satisfied and Satisfied) vs Very satisfied
Gender (reference: Men**)**				
Women	0.0492	1.060	0.861	1.100
Age	0.00172	1.004	0.983***	1.007***
Children under 12 (reference: None**)**				
One	0.228**	1.315*	2.902**	1.211
Two or more	0.221	1.499**	1.812	1.461**
Log base two household equivalent income	0.171***	1.207***	1.443***	1.154***
Education (reference: Less than secondary**)**				
Secondary	-0.0506	0.818	1.526	0.719**
Some postsecondary	0.0123	0.867	2.140	0.732
College diploma	0.0733	1.018	1.655**	0.925
University degree	0.155	1.264	2.052*	1.154
Marital status (reference: Married**)**				
Living common-law	-0.205	0.806	1.372	0.750
Widowed	-0.385**	0.689*	0.460***	0.778
Divorced or separated	-0.865***	0.326***	0.255***	0.419***
Single	-0.476***	0.577***	1.010	0.512***
Employed (reference: Employed**)**				
Unemployed	-0.239***	0.828*	0.391***	0.943
Owner (reference: Renter**)**				
Owner	0.451***	1.837***	1.582**	1.922***

Physical activity (reference: Inactive**)**				
Moderately active	0.191**	1.181	2.124***	1.061
Active	0.446***	1.538***	2.936***	1.401***
Smoking (reference: Non-smoker**)**				
Smoker	-0.483***	0.645***	0.405***	0.726**
Heavy drinking (reference: Not heavy drinker**)**				
Heavy drinker	-0.155*	0.779**	1.011	0.739**
Chronic conditions (reference: No chronic condition**)**				
Chronic condition	-0.299***	0.792**	0.287***	0.908
Food security (reference: Food secure**)**				
Moderately/Severely food insecure	-1.068***	0.260***	0.223***	0.302***
Self-rated health (reference: poor**)**				
Fair	1.573***	3.341***	3.014***	1.373
Good	2.267***	8.393***	12.88***	2.109**
Very good	2.741***	15.37***	34.76***	3.811***
Excellent	3.247***	29.64***	65.05***	7.538***
Self-rated mental health (reference: Poor/Fair**)**				
Good	1.508***	5.822***	5.387***	2.999**
Very Good	1.825***	8.199***	13.86***	3.614**
Excellent	2.574***	23.16***	30.63***	10.81***
Sense of belonging to community (reference: Very weak**)**				
Somewhat weak	0.332	1.337	1.728	1.107
Somewhat strong	0.811***	2.317***	3.877***	1.803**

|				
Very strong	1.153***	3.861***	5.477***	3.079***
Self-rated life stress **(**reference: No stress**)**				
Not very much	-0.439***	0.447***	0.766	0.428***
A bit of stress	-0.901***	0.253***	0.283***	0.247***
Quite a bit/extreme	-1.696***	0.123***	0.0817***	0.170***

It is perhaps surprising to see that education does not have a significant effect on life satisfaction; in fact, as we can see in Figure 5 below, respondents with some post-secondary education reported a slightly lower mean life satisfaction than respondents who had less than a high school education.

Figure 5: Education and life satisfaction
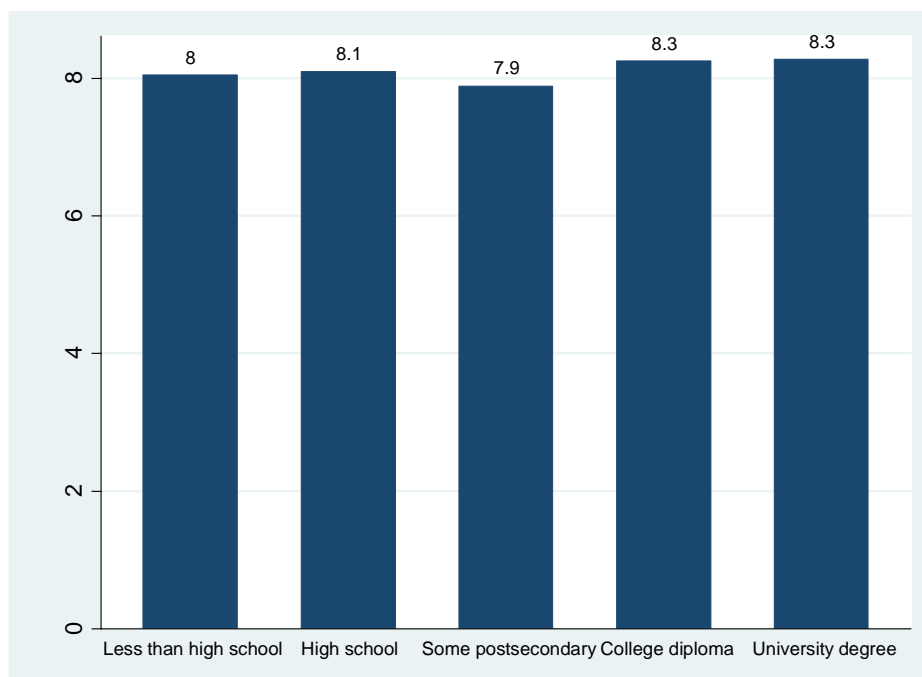
The most significant variables in the pairwise regressions would seem to marital status and the subjective variables self-rated health, self-rated mental health, sense of belonging to community and self-rated life stress.

Figure 6: Marital status and life satisfaction
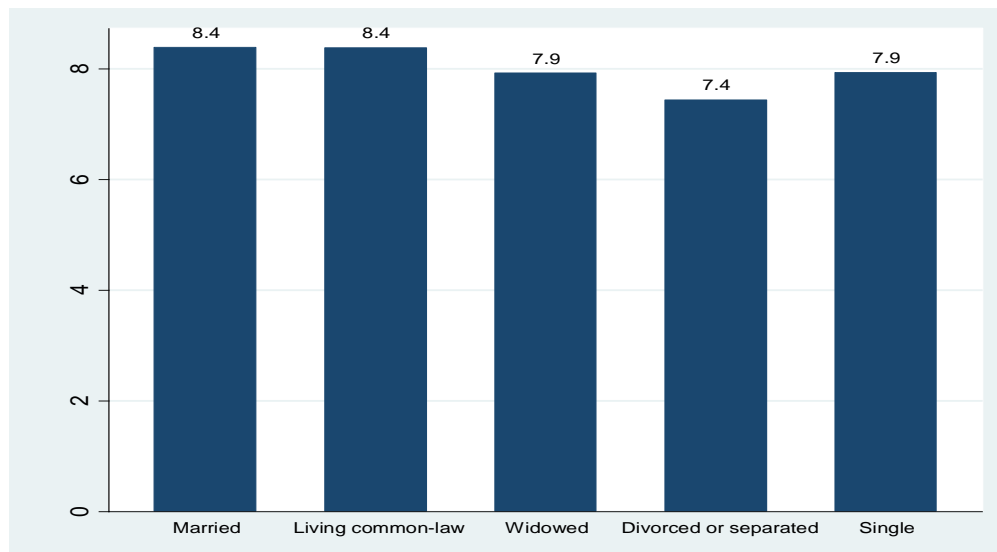
For marital status we note in particular that divorced or separated individuals have a mean life satisfaction score of 7.4 compared to a mean score of 8.4 for those who are married or living common-law.

Figure 7: Self-rated health and life satisfaction
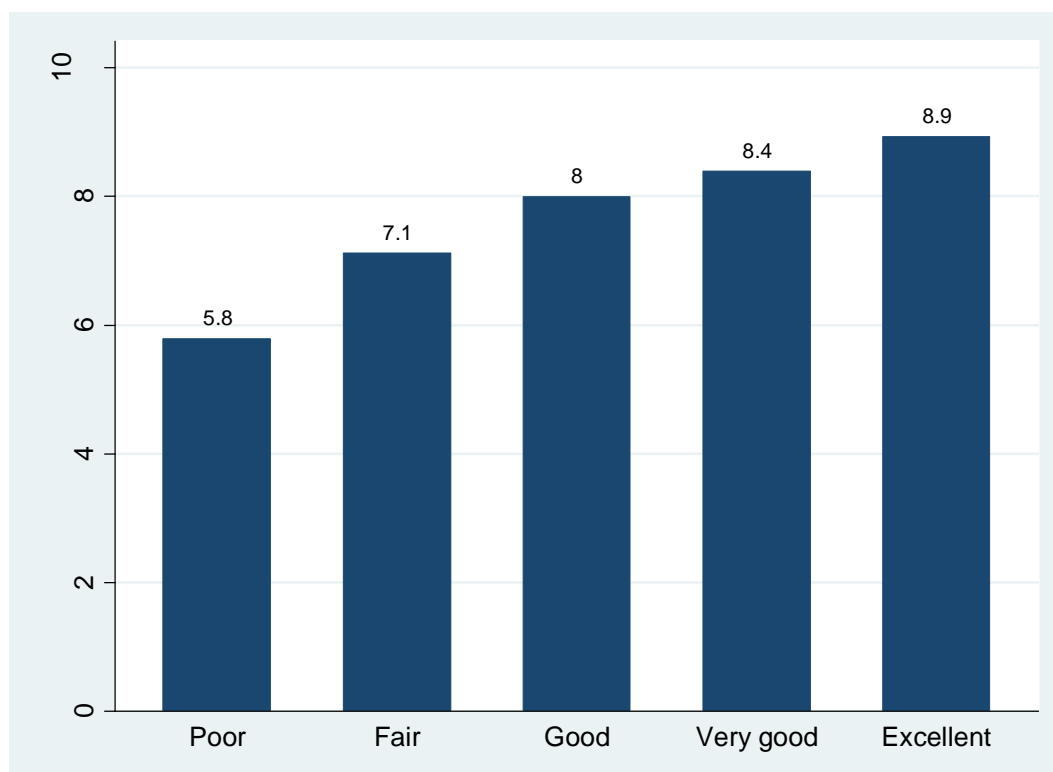
Self-rated health is highly significant. The odds ratio for respondents with Excellent self-rated health is 29.64 compared to the base category of respondents with Poor self-rated health.

Household income is significant and we note that the odds ratios in the generalized ordered logistic regressions for income are 1.443 for Not satisfied vs (Satisfied and Very satisfied) and 1.154 for (Not satisfied and Satisfied) vs Very satisfied. How do we interpret these coefficients?

These coefficients indicate that the effect of income on life satisfactions depends on where the respondent is in the life satisfaction outcome distribution. A doubling of income would mean more to someone on the lower end of the life satisfaction scale than to someone on the upper end. The odds of being Satisfied or Very satisfied as opposed to Not satisfied is 1.443 while the odds of being Very satisfied as opposed to Not satisfied or Satisfied is only 1.154. As Boes and Winkelmann (2004) ask "is it possible that the effect of income on happiness is different in different parts of the outcome distribution? Could it be that "money cannot buy happiness, but buy-off unhappiness" as a proverb says?" Although Boes and Winkelmann do not use the *gologit2* procedure, we can see clearly it can certainly be used to answer their question.

Multivariate Regression Results

We produce four different models. In Model 1 we include just the standard socio-demographic variables and also include the variable **age2by100** which is the square of the age divided by 100. In Model 2 we add in the lifestyle variables physical activity, smoking and heavy drinking. In Model 3 we add in chronic conditions and food security variable. Finally, in Model 4 we add in all the subjective variables: self-rated health, self-rated mental health, sel-rated life stress and sense of belonging to community.

Table 5: Model 1

	OLS	Ordered Logistic Regression	Generalized Ordered Logistics Regression	
			Not satisfied vs (Satisfied and Very satisfied)	(Not satisfied and Satisfied) vs Very satisfied
Gender (reference: Men**)**				
Women	0.0798	1.105	0.902	1.130
Age	-0.0636***	0.942***	0.869***	0.961*
age2by100	0.0698***	1.073***	1.164***	1.050*
Children under 12 (reference: None**)**				
One	0.282**	1.486**	3.225**	1.345
Two or more	0.308*	1.755***	2.101	1.665**
Log base two household equivalent income	0.128***	1.168**	1.392***	1.114*
Education (reference: Less than secondary**)**				
Secondary	-0.123	0.726**	1.175	0.637***
Some postsecondary	0.0440	0.948	1.629	0.832
College diploma	-0.109	0.838	1.199	0.763*
University degree	-0.150	0.903	1.074	0.878
Marital status (reference: Married**)**				
Living common-law	-0.215	0.886	1.062	0.851
Widowed	-0.420*	0.666	0.579	0.733
Divorced or separated	-0.763***	0.356***	0.279***	0.471***

Single	-0.567***	0.624***	0.784	0.576***
Employed (reference: Employed**)**				
Unemployed	-0.263***	0.794*	0.431***	0.901
Owner (reference: Renter**)**				
Owner	0.251**	1.478**	1.285	1.554**

Table 6: Model 2

	OLS	Ordered Logistic Regression	Generalized Ordered Logistics Regression	
			Not satisfied vs (Satisfied and Very satisfied)	(Not satisfied and Satisfied) vs Very satisfied
Gender (reference: Men**)**				
Women	0.0423	1.035	0.830	1.062
Age	-0.0434***	0.960*	0.910**	0.974
age2by100	0.0484***	1.051**	1.107**	1.034
Children under 12 (reference: None**)**				
One	0.317***	1.522**	3.113**	1.365
Two or more	0.294*	1.717***	1.864	1.628**
Log base two household equivalent income	0.0985**	1.135**	1.302**	1.096
Education (reference: Less than secondary**)**				
Secondary	-0.13	0.733*	1.099	0.645***
Some postsecondary	0.0217	0.95	1.679	0.840
College diploma	-0.109	0.849	1.191	0.769*
University degree	-0.25	0.836	0.884	0.835

Marital status (reference: Married**)**

	OLS	Ordered Logistic Regression	Generalized Ordered Logistics Regression	
			Not satisfied vs (Satisfied and Very satisfied)	(Not satisfied and Satisfied) vs Very satisfied
Living common-law	-0.162	0.906	1.386	0.840
Widowed	-0.427*	0.653	0.626	0.706
Divorced or separated	-0.779***	0.343***	0.302***	0.449***
Single	-0.542***	0.617**	0.865	0.559***

Employed (reference: Employed**)**

Unemployed	-0.281***	0.769**	0.410***	0.876

Owner (reference: Renter**)**

Owner	0.181	1.396*	1.211	1.481**

Physical activity (reference: Inactive**)**

Moderately active	0.152	1.152	2.016**	1.035
Active	0.513***	1.733***	2.437***	1.621***

Smoking (reference: Non-smoker**)**

Smoker	-0.277**	0.838	0.447***	0.981

Heavy drinking (reference: Not heavy drinker**)**

Heavy drinker	-0.155	0.764**	0.822	0.740**

Table 7: Model 2

Gender (reference: Men**)**				
Women	0.0548	1.041	0.874	1.066
Age	-0.0374**	0.966	0.933	0.978
age2by100	0.0438**	1.046*	1.083*	1.03
Children under 12 (reference: None**)**				
One	0.255**	1.414*	2.712**	1.279
Two or more	0.182	1.510*	1.494	1.477*
Log base two household equivalent income	0.0378	1.058	1.169	1.035
Education (reference: Less than secondary**)**				
Secondary	-0.117	0.746*	1.056	0.651***
Some postsecondary	0.0208	0.926	1.678	0.827
College diploma	-0.0851	0.873	1.263	0.782
University degree	-0.227	0.867	0.847	0.860
Marital status (reference: Married**)**				
Living common-law	-0.174	0.892	1.350	0.827
Widowed	-0.452**	0.635	0.574	0.693
Divorced or separated	-0.720***	0.363***	0.296***	0.469***
Single	-0.578***	0.589***	0.780	0.535***
Employed (reference: Employed**)**				
Unemployed	-0.282***	0.760**	0.395***	0.873
Owner (reference: Renter**)**				
Owner	0.0508	1.185	0.834	1.311
Physical activity (reference: Inactive**)**				
Moderately active	0.108	1.105	1.790*	1.001
Active	0.474***	1.687***	2.222**	1.585***

Smoking (reference: Non-smoker**)**				
Smoker	-0.239**	0.859	0.462***	1.005
Heavy drinking (reference: Not heavy drinker**)**				
Heavy drinker	-0.188*	0.736**	0.735	0.717**
Chronic conditions (reference: No chronic condition**)**				
Chronic condition	-0.327***	0.737***	0.401**	0.807*
Food security (reference: Food secure**)**				
Moderately/Severely food insecure	-0.794***	0.359***	0.254***	0.423***

Table 8: Model 4

	OLS	Ordered Logistic Regression	Generalized Ordered Logistic Regression	
			Not satisfied vs (Satisfied and Very satisfied)	(Not satisfied and Satisfied) vs Very satisfied
Gender (reference: Men**)**				
Women	0.042	1.052	0.760	1.118
Age	-0.0253*	0.973	0.900**	0.991
age2by100	0.0242	1.026	1.106*	1.006
Children under 12 (reference: None**)**				
One	0.106	1.211	2.609*	1.082

Two or more	0.0428	1.39	1.615	1.302
Log base two household equivalent income	0.00921	1.046	1.223	0.995
Education (reference: Less than secondary**)**				
Secondary	-0.171	0.678**	0.918	0.579***
Some postsecondary	0.0981	1.106	2.287	0.825
College diploma	-0.139	0.802	1.311	0.705**
University degree	-0.261*	0.774	0.952	0.724
Marital status (reference: Married**)**				
Living common-law	-0.166	0.904	2.112	0.782
Widowed	-0.512***	0.561*	0.501	0.622
Divorced or separated	-0.604***	0.323***	0.362*	0.346***
Single	-0.552***	0.531***	0.905	0.450***
Employed (reference: Employed**)**				
Unemployed	-0.0984	0.888	0.638	0.958
Owner (reference: Renter**)**				
Owner	-0.042	1.017	0.859	1.136
Physical activity (reference: Inactive**)**				
Moderately active	0.0254	1.063	1.577	0.963
Active	0.131	1.166	1.170	1.126
Smoking (reference: Non-smoker**)**				
Smoker	-0.138	0.914	0.496**	1.090
Heavy drinking (reference: Not heavy drinker**)**				
Heavy drinker	-0.216***	0.678***	0.533*	0.688**

Chronic conditions (reference: No chronic condition)

Chronic condition	-0.0258	1.069	0.762	1.148

Food security (reference: Food secure)

Moderately/Severely food insecure	-0.444**	0.514**	0.360***	0.562*

Self-rated health (reference: Poor)

Fair	1.629***	3.498**	1.946	1.855
Good	1.991***	6.735***	6.327***	2.105
Very good	2.233***	10.22***	12.13***	3.383**
Excellent	2.548***	16.07***	19.82***	5.712***

Self-rated mental health (reference: Poor/Fair)

Good	0.857***	2.906***	3.071**	1.837
Very Good	0.882***	3.056***	4.570***	1.774
Excellent	1.458***	7.872***	10.39***	4.838**

Sense of belonging to community (reference: Very weak)

Somewhat weak	0.0975	1.169	1.767	0.953
Somewhat strong	0.430**	1.913**	4.254***	1.489
Very strong	0.554***	2.584***	5.470***	1.985**

Self-rated life stress (reference: No stress)

Not very much	-0.293***	0.468***	1.036	0.474***
A bit of stress	-0.577***	0.293***	0.393*	0.293***
Quite a bit/extreme	-0.953***	0.209***	0.140***	0.288***

Significance levels: * p<0.10, ** p<0.05, *** p<0.01

Discussion

Gender is not significant in any of the models. The coefficients for gender in the ordinary least squares regressions in Models 1, 2, 3, and 4 are 0.0798, 0.0423, 0.0548, and 0.042, respectively, with none of the coefficients being statistically significant. This indicates that there is no difference in life satisfaction between males and females in our data. Similarly, none of the coefficients for gender in the ordered logistic and generalized ordered logistic regression models are significant.

Age is significant for life satisfaction. In Model 1, for instance, the ordinary least squares regression coefficients for age and age squared divided by 100 are -0.0636 and 0.0698, respectively, with both coefficients significant at the $p < 0.01$ level. The fact that the coefficient of age is negative and the coefficient of age squared is positive indicates that life satisfaction is "U-shaped" for the age variable, with life satisfaction dropping as age increases, reaching a minimum at a certain point in middle age and then increasing once again as age increases. The coefficient for age in Model 2 is -0.0434 (significance level $p < 0.01$), while the coefficient in Model 3 is -0.0374 (significance level $p < 0.05$) and for Model 4 the coefficient for age is -0.0253 (significance level $p < 0.1$).

The ordinary least squares coefficient for household equivalent income (logarithm base two) in Model 1 is 0.128 (significance level $p < 0.01$). This indicates that a one unit increase in the income variable (which means that the household income doubles) corresponds to a 0.128 point increase in life satisfaction on the 0 - 10 scale. However, as other variables are added, income becomes less significant. In fact, in Models 3 and 4 household income is not significant in the ordinary least squares, ordered logistic or generalized ordered logistic regressions.

Being employed is significant for life satisfaction in Models 1, 2 and 3, but, as with income, being employed ceases to be a significant factor when the subjective variables on self-rated health, self-rated mental health, sense of belonging to community and self-rated life stress are added in Model 4. We see the same pattern with the number of children under twelve and owner variables; having children under twelve and being a home owner is significant Model 1 but neither is significant in Model 4.

This is not true of marital status, however, which is significant in all four models. The ordered logistic regression odds ratio for separated and divorced in Model 1 is 0.356 ($p < 0.01$). This means that for someone who is separated or divorced the odds of being in a higher category of life satisfaction is 0.356 times that of someone who is married. In Model 4 the ordered logistic odds ratio for separated and divorced is even smaller at 0.323 ($p < 0.01$). If we look at the generalized ordered logistic regression, the odds ratios for separated and divorced in Model 1 are 0.279 ($p < 0.01$) for Not satisfied vs Satisfied and Very satisfied and 0.471 ($p < 0.01$) for Not satisfied and Satisfied) vs Very satisfied. As with income, marital status affects the lower part of the life satisfaction distribution more than the upper part. The odds that a person who is divorced or separated will be Satisfied or Very satisfied as opposed to Not satisfied is only 0.279 times that of a person who is married. The odds that a person who is divorced or separated will be Very satisfied as opposed to Not satisfied or satisfied are slightly higher, at 0.471 times that of a person who is married. It is interesting to note though that in Model 4, while still significant, the coefficients for divorced or separated are 0.362 ($p < 0.1$) for Not satisfied vs Satisfied and Very satisfied and 0.346 ($p < 0.01$) for Not satisfied and Satisfied vs Very satisfied. In this case it would appear that separation or divorce has the same effect on life satisfaction regardless of what a person's life satisfaction level is.

In general then, other than for marital status, when we introduce subjective well-being variables in Model 4, other variables which were significant in earlier models become less statistically significant or not significant at all. Being physically active as opposed to being inactive, for example, is significant in Models 2 and 3, with the ordered logistic regression odds ratios of 1.733 ($p < 0.01$) in Model 2 and 1.687 ($p < 0.01$). However, in Model 4, being physically active ceases to be significant with an odds ratio of 1.116. A chronic health condition variable is introduced in Model 3 and having a chronic condition is significant with an ordered logistic regression odds ratio of 0.737 ($p < 0.01$). But when we introduce self-rated health in Model 4, the odds ratio for having a chronic health condition drops to 1.069 and is not statistically significant. The self-rated health variable is very significant, with even fair health having an odds ratio of 3.498 ($p < 0.05$) compared to the base category of poor health. For those with excellent health, the odds of being in a higher life satisfaction category is 16.07 ($p < 0.01$) times that of someone with poor health. It appears that subjective feelings about health may be more important in determining life satisfaction than objective measures of health. The generalized ordered logistic regression odds ratios for Excellent health in Model 4 are 19.82 ($p < 0.01$) for Not satisfied vs Satisfied and Very satisfied and 5.712 ($p < 0.01$) for Not satisfied and Satisfied vs Very satisfied. So self-rated health would appear to

make a much greater difference at the lower end of the life satisfaction distribution than it does at the upper end.

The other subjective well-being variable, self-rated mental health, sense of belonging to community, and self-rated stress are also highly significant, and, not surprisingly, the generalized ordered logistic regression odds ratios indicate that these subjective variables have a greater effect on the lower end of the life satisfaction distribution.

Finally, we note that heavy drinking, defined as having more than 5 drinks at a time at least once a month, does not become statistically insignificant when subjective well-being variables are included in the model. Heavy drinking is significant in Model 2 with ordered logistic regression odds ratio of 0.764 ($p < 0.05$) and in Model 3 it has an odds ratio of 0.736 ($p < 0.05$). However, in Model 4 heavy drinking becomes more significant with an ordered logistic regression odds ratio of 0.678 ($p < 0.01$). The generalized ordered logistic regression odds ratios for heavy drinking I n Model 4 are 0.533 ($p < 0.10$) for Not satisfied vs Satisfied and Very satisfied and 0.688 ($p < 0.05$) for Not satisfied and Satisfied vs Very satisfied. In this case there is very little difference between the effect of heavy drinking on the lower end of the life satisfaction distribution and on the upper end.

Conclusion

We can conclude that the most important determinants of life satisfaction Canadian Community Health Survey for Newfoundland and Labrador seem to be subjective measures of well-being. Other than marital status, which remains highly significant in all four models, most of the variables in Model 1 are not significant when subjective well-being variables are introduced in Model 4. Other than the interpretation of the coefficients, the results from ordinary least squares and ordered logistic regression are very similar, and one could argue, as others have, that there is no advantage to using ordered logistic regression, particularly when there are 11 categories of the dependent variable. However, generalized ordered logistic regression is an improvement since it provides different set of coefficients for different levels of the life satisfaction distribution. This gives a more complete picture of how the explanatory variables affect the dependent variable.

In addition, if independent variables affect different parts of the life satisfaction distribution differently, then it may be important to look at ways of measuring inequality in the distribution of life satisfaction in

much the same way as we look at measuring inequality in the distribution of income. Is it more important to improve the life satisfaction of someone who is currently dissatisfied, or is it more important to improve the life satisfaction of someone who is already satisfied with life? If a certain number of people who currently put their life satisfaction score at 8 moves up to a score of 9, then the overall mean life satisfaction score has improved. But perhaps it is more important to raise the overall mean life satisfaction score by improving the life satisfaction score of people who have a much lower score.

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