An Analysis of the Relationship between Health Expenditure and Health Outcomes

by

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Abstract

With the effects of the 2007 world financial crisis still overshadowing the country's financial security, the US is looking to cut back in many areas, including health care. The US currently spends twice the average amount on health than the average of the other OECD nations. Despite these levels of expenditure, we see lower outcomes and relatively smaller improvements in outcomes than these countries. This paradox has led many researchers to explore other factors influencing health outcomes. The purpose of this study was to analyze the relationship between health expenditure and health outcomes with the inclusion of lifestyle variables. Another unique aspect of this study was the use of happiness and satisfaction as measures of health. We hypothesized that once lifestyle choices had been accounted for, health expenditure would lose significance and we would see that lifestyle factors had a greater influence on health.

The lifestyle variables included measures of education, alcohol consumption, and tobacco use. Education was found to be negatively associated with both infant mortality and PYLL. Alcohol consumption was found to be positively associated with infant mortality, and tobacco use was negatively associated with life expectancy and positively associated with PYLL. While the results from the lifestyle variables align with the hypothesis, it is important to note that we had expected to see health expenditure lose significance once lifestyle variables were accounted for. This was not the case. In addition to these unexpected findings, the variables accounting for well-being (happiness and satisfaction) did not appear to act as hypothesized either.

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Introduction

Despite being one of the most developed countries in the world, the US ranks below average in terms of life expectancy and infant mortality rate, both of which are considered to be the best indicators of health outcomes. Why do health outcomes differ so greatly between the United States and the other OECD countries? Considering that the US spent $7,072.65 per capita for a population of almost 300 million on health care in 2006, it is an area of extreme concern in these times of financial upset. This leads researchers to ask whether the returns to health care, or health outcomes, are high enough to warrant such astronomical levels of expenditure.

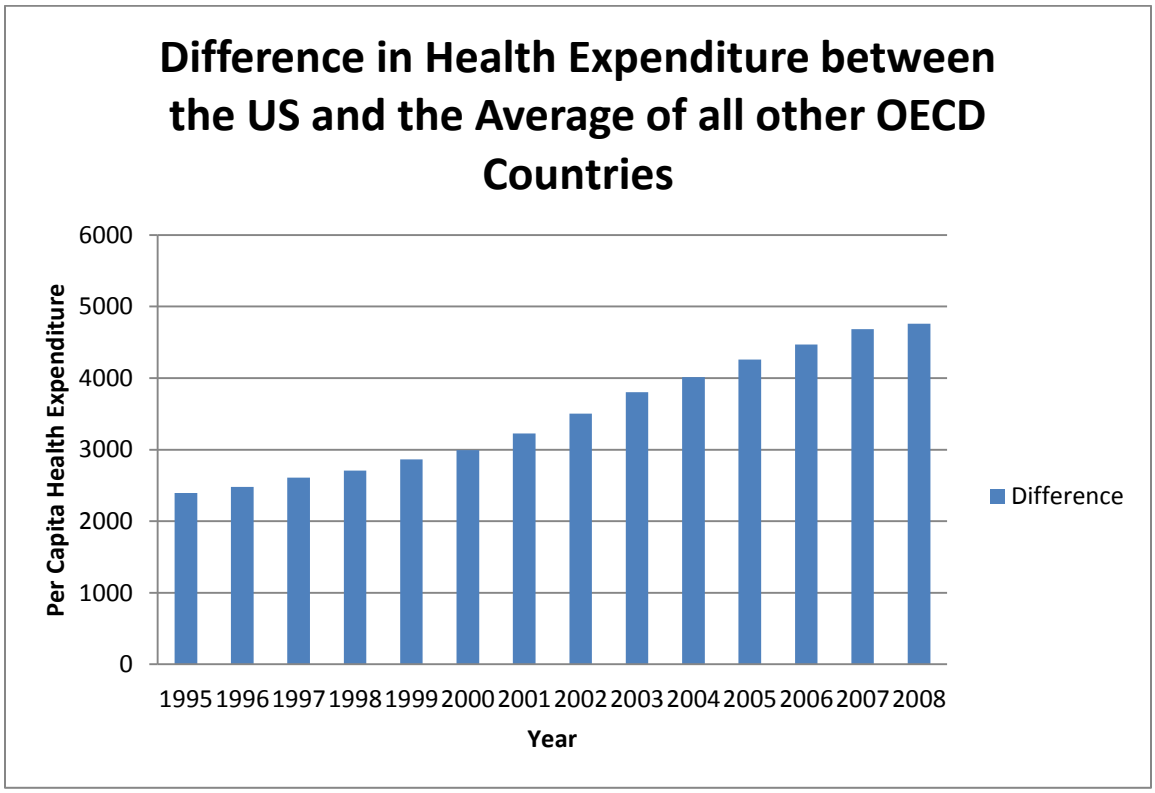
There are a few questions that will be governing this research. The first being, how does healthcare production in other OECD countries compare to that of the US? Below the data on health outcomes is displayed in graphs. The next question we try to address is what factors are contributing to the variation in health outcomes across these relatively similar countries? We hypothesize that these variations in health outcomes are due to more than just health expenditure, they are directly and significantly related to lifestyle choices made in these countries.

In order to answer these research questions, we must analyze the data and compare results across multiple countries with comparable economic conditions. This study is unique because it utilizes a combination of variables that is different from previous research. In addition to using the variable of potential years of life lost in addition to the commonly used life expectancy and infant mortality rate variables, this

study also uses happiness and satisfaction as indicators of health. We hypothesize that happiness and satisfaction will react similarly to life expectancy, as one would expect that those individuals who are healthier are also happier, and in turn live longer lives. In relation to the other variables, PYLL and infant mortality, we expect to see them react negatively, following that if people are not healthier they are not happier and instances of premature death and infant mortality rise.

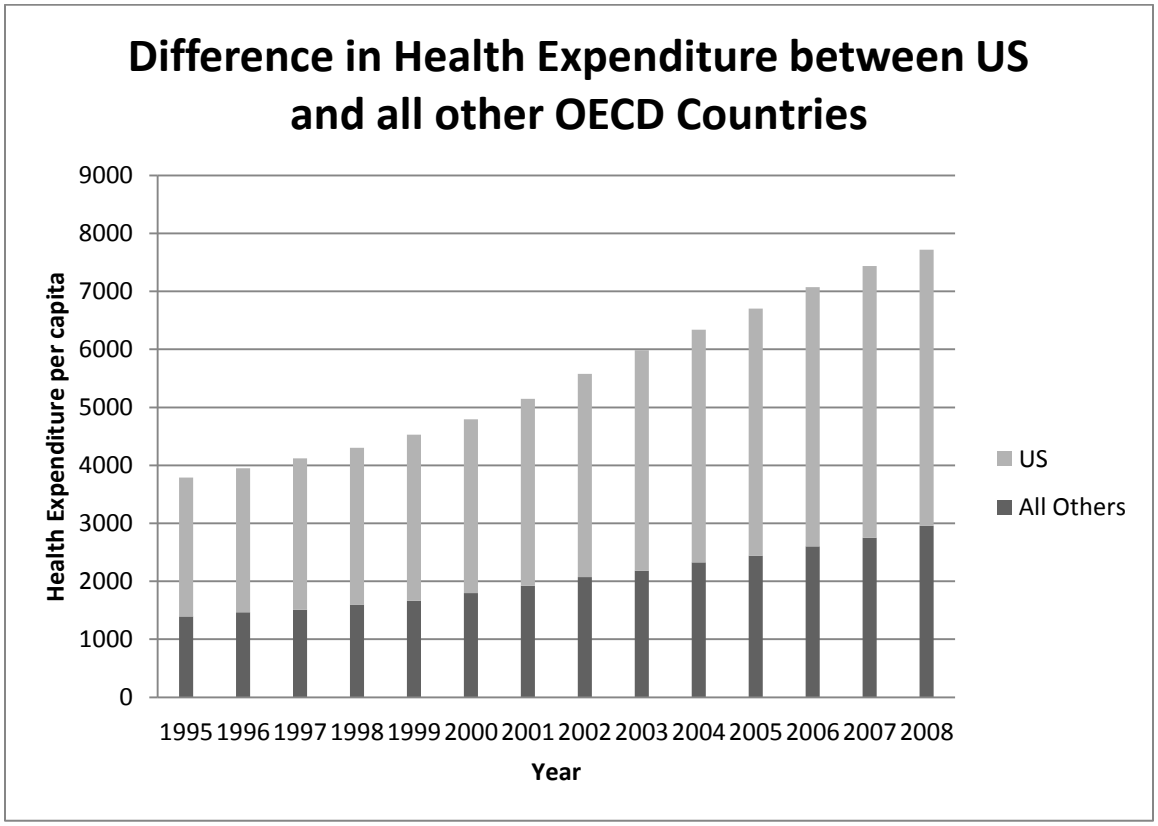
We will use data from 33 countries that are members of the Organization of Economic Cooperation and Development (OECD) in the following comparisons. These countries represent some of the highest earning countries in the world and are relatively advanced, especially in the field of healthcare. They are also used in many scholarly articles to represent an accurate comparison group to the United States. In the following graphs we will compare the health expenditure and outcomes of the US to those of the average of the other OECD countries together.

Graph 1: Health Expenditure Differences



Note. All data in Graph 1 is obtained from the OECD. This graph represents the distance between the average per capita health expenditure (US dollars, PPP) of all other OECD countries to that of the average US health expenditure (US dollars, PPP).

Graph 2: Health Expenditure Levels



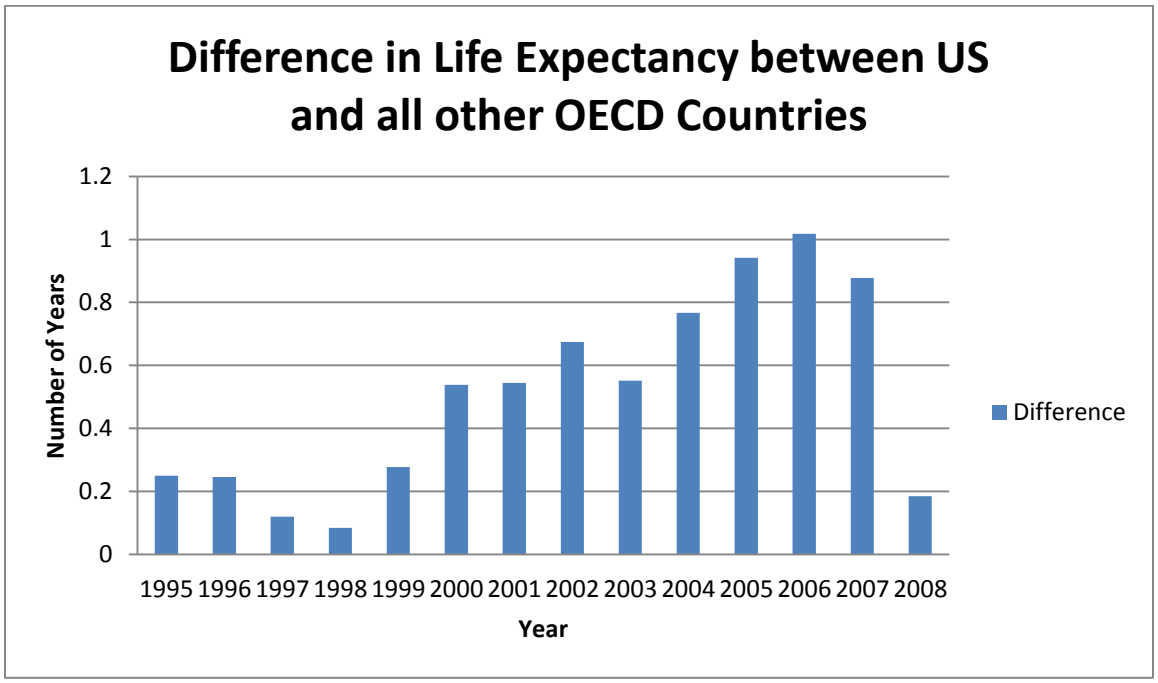
Note. All data in Graph 2 is obtained from the OECD. This graph represents the distance between the average infant mortality of all other OECD countries to that of the average US infant mortality.

As you can see in the graphs above, the difference in expenditure per capita is increasing at an increasing rate and the US greatly outspends the average of the other OECD countries over time. The top three OECD countries with the highest per capita GDP in 2010 were Belgium with $68,823, Norway with $46,908, and the US with $42,976. All other countries fell within three per capita GDP brackets with 14 countries earning $31-38,000, 11 countries earning $20-30,000, and finally 6 countries earning $12-18,000 per capita. With this data we can see that excluding Belgium and Norway,

the US should rank highest in health outcomes, assuming that health outcomes are dependent on health expenditure. Because we see in the accompanying graphs that the US ranks relatively low, research must be done to further explain the gap between outcomes.

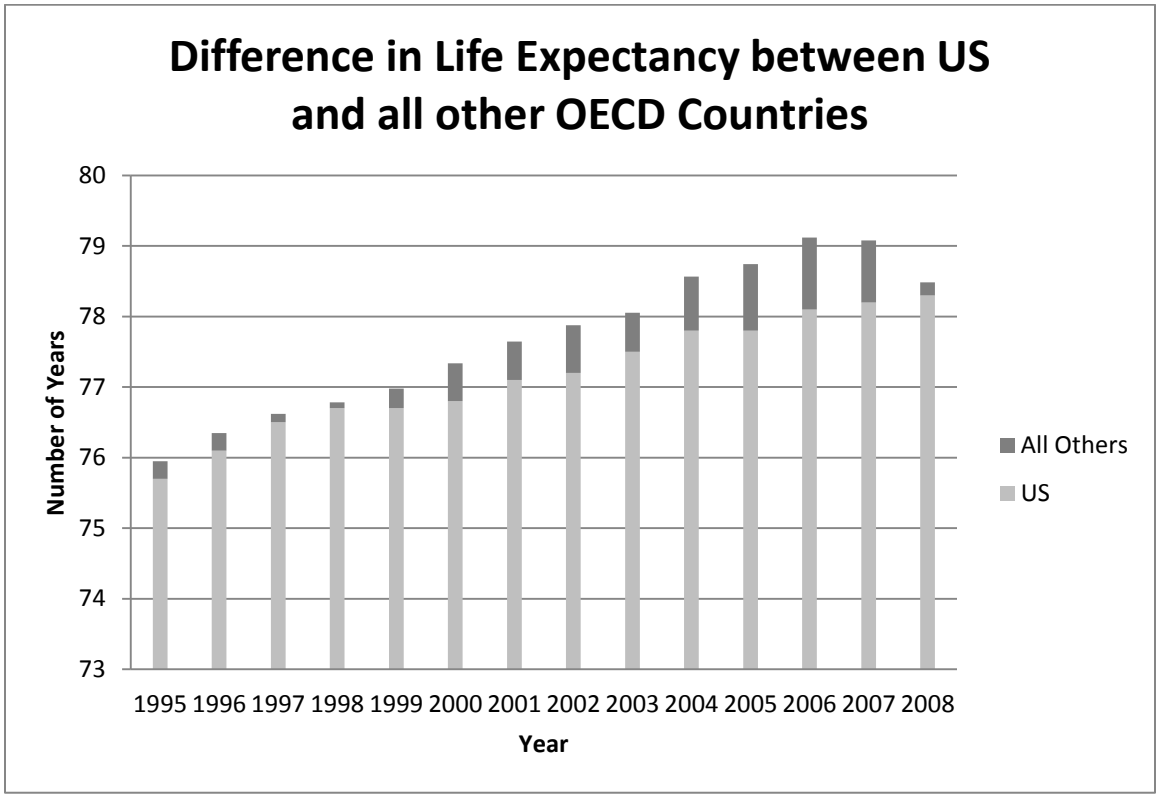
The first indication that the healthcare in the US is lacking is found in the life expectancy of its citizens. The average total life expectancy in the United States is less than the average of the other OECD countries analyzed. If healthcare outcomes are affected by health expenditure alone, then the life expectancy in the US would be considerably higher than any other individual country in the world. Instead, we find the opposite is true. The countries with the highest life expectancy range between 1995 and 2006 are Sweden and Japan with average life expectancies ranging from 78.8 to 81 years and 79.6 to 82.6 years respectively. The country with the lowest average life expectancy is Estonia with a range of 67.61 to 74.06 average years of life. The United States has a range of 75.7 to 78.1, which is approximately 2 years below the average of all OECD countries.

Graph 3: Life Expectancy Differences



Note. All data in Graph 3 is obtained from the OECD. This graph represents the distance between the average life expectancy of all other OECD countries to that of the average US life expectancy.

Graph 4: Life Expectancy Levels

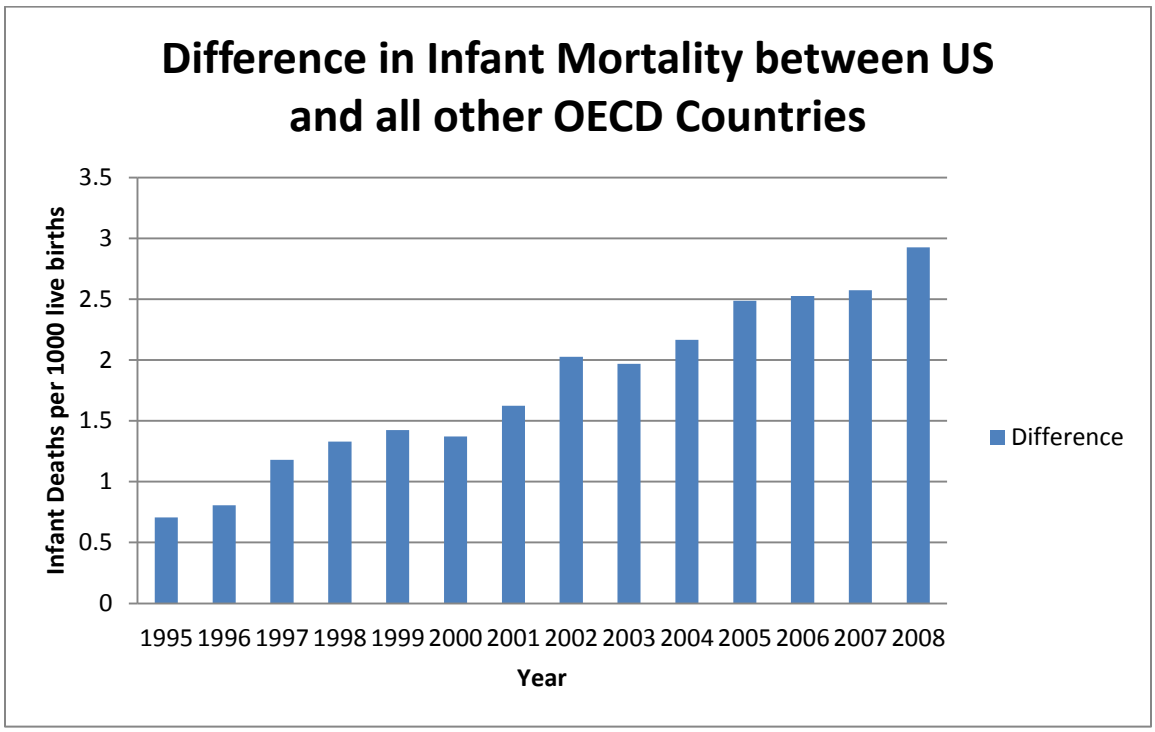


Note. All data in Graph 4 is obtained from the OECD. This graph represents the distance between the average infant mortality of all other OECD countries to that of the average US infant mortality.

Another indication of healthcare quality is infant mortality rate. Infant mortality is measured as number of deaths per 1000 live births. Below are graphs comparing the average infant mortality rate of the US with that of the total average of the other OECD countries. According to the data, the US has consistently experienced higher levels of infant mortality. We see that between the years of 1996 and 2002 the United States has had very little change in overall infant mortality rates, hovering around 7 infant deaths per 1,000 live births each year. The rest of the OECD has seen a steady decrease in

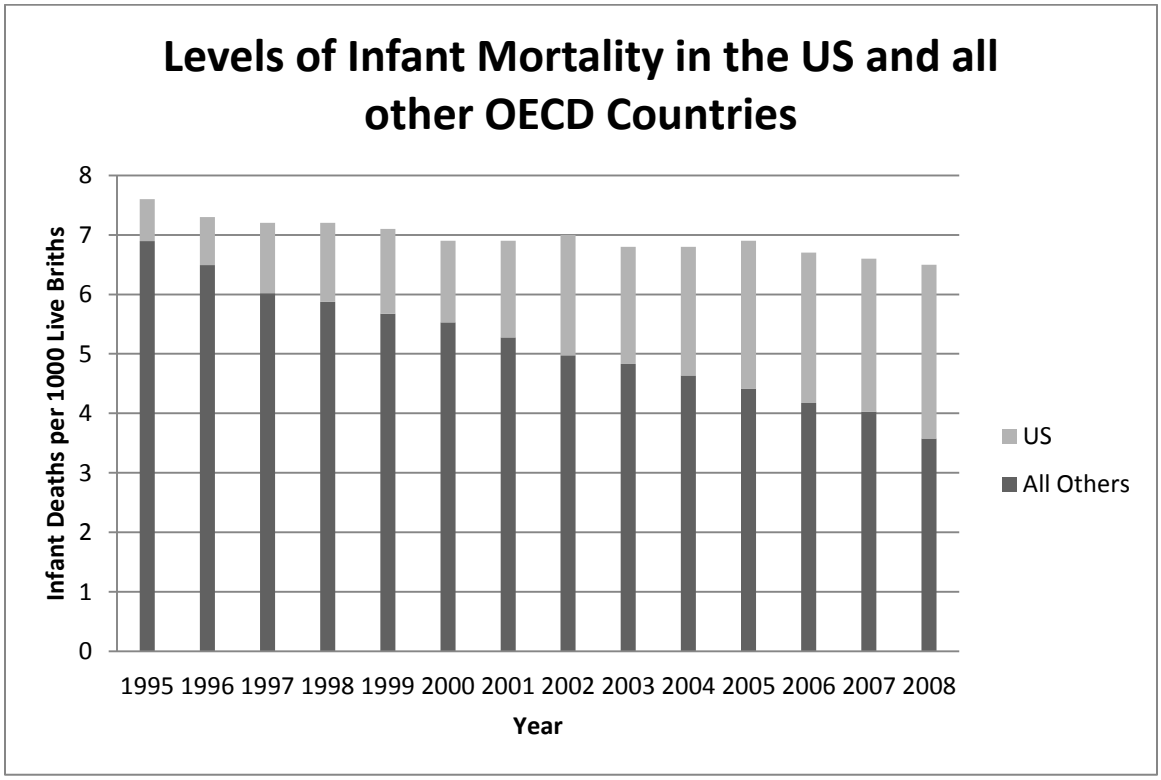
infant mortality rates in this time period, dropping from six to five infant deaths per 1,000 live births each year. Again, the United States is not producing the expected health outcomes rates in comparison to the rest of the OECD.

Graph 5: Infant Mortality Rate Differences



Note. All data in Graph 5 is obtained from the OECD. This graph represents the distance between the average infant mortality of all other OECD countries to that of the average US infant mortality.

Graph 6: Infant Mortality Rate Levels



Note. All data in Graph 6 is obtained from the OECD. This graph represents the distance between the average infant mortality of all other OECD countries to that of the average US infant mortality.

Based on the data seen in the previous graphs, it seems apparent that health expenditure is not the only important factor in determining health outcomes. Combined with demographic variables, we hope to see in the following study that lifestyle choices are in fact the best determinants of health outcomes. Throughout this paper we will be focusing on the importance of these variables in the study of health outcomes and come to some surprising results concerning both health expenditure and lifestyle factors.

The following literature review is a summary of the leading works in the field. They encompass many different aspects of health care but emphasize studies done on OECD countries with a focus on expenditure or the use of the lifestyle variables. We will see that researchers have found a variety of results especially concerning the significance of health expenditure as an independent variable. The importance of this literature review is that it shows the relevance of the use of key variables employed in this study, specifically PYLL, happiness, and satisfaction. These variables are employed in a number of settings but are often associated with health outcomes or at least with standard of living.

Several different dependent variables were used in this study; infant mortality rate, life expectancy, potential years of life lost, happiness, and satisfaction were found to be the most prominent in leading literature and relevant to this research. These variables are meant to express health outcomes. The explanatory variables are broken into two categories. The first, demographic variables, includes GDP, population in total and divided into age groups, and urban population. The second category, lifestyle variables, consists of higher education enrollment, alcohol, and cigarette consumption.

We expect to find that once lifestyle variables are accounted for, health expenditure will no longer have a significant relationship with our dependent variables. After utilizing the basic ordinary least squares model, we encountered several different methodological issues such as heterogeneity and autocorrelation. In order to avoid these issues we employ fixed effects and random effects models but heteroscedasticity

remains a problem. Finally, the use of robust errors is found to be the most efficient method to correct for this heteroscedasticity.

The data analysis portion of this study begins by examining results of the most basic linear regression model. This model is run in its most simple ordinary least squares form, and then made more complex with the introduction of the country fixed effects and robust standard errors. The first set of regressions seeks to determine the nature of the relationship between the health outcomes and expenditure while accounting for basic explanatory variables such as income and the population's age distribution.

Because the purpose of this analysis is to expound upon earlier studies by including lifestyle variables, it is then necessary to run new regressions which include the variables of education, alcohol consumption, and cigarettes smoked per day. When these lifestyle variables are accounted for, we find that expenditure continues to have significant relationships with the dependent variables life expectancy, potential years of life lost, and happiness. Expenditure is positively associated with life expectancy and happiness, suggesting that increases in health expenditure are associated with increases in both of these variables. Expenditure is found to be negatively associated with PYLL.

As far as the lifestyle variables are concerned, education, or Percent Higher Education, is found to have negative and significant relationships with infant mortality rate and potential years of life lost, suggesting that an increase in higher education is associated with decreases in both forms of premature death; infant and adult. Alcohol consumption is found to only have one significant relationship and that is with infant

mortality rate. The results suggest that an increase in alcohol consumption is associated with an increase in infant mortality; a result that many other studies and the surgeon general both support. Finally, tobacco is found to have two significant relationships. The first is a negative association with life expectancy, which implies that increases in tobacco consumption are associated with decreases in life expectancy. The second is a positive relationship with PYLL, suggesting that increases in tobacco consumption are associated with increases in premature death, which confirms the first relationship. The implications of these findings and the methodology employed will be discussed in further detail later in this paper.

We can clearly see that there are problems with healthcare production in the United States, but finding the solutions has proven to be difficult. Some politicians argue that healthcare should be government run as it is in many European countries where we see lower spending on healthcare and higher degrees of health outcomes. Other suggestions call for insurance reform. Advocates of this reform believe that indications of good health depend directly on access to health and therefore healthcare should be made equally available to everyone through subsidizing insurance. We hope to address potential solutions to this problem as well, using the results of this study.

In the following sections we will discuss what others have studied and compare their results. From those results, we hope to gain valuable insight into the healthcare field and determine which variables are the most relevant for this study and what results to expect. Analysis will be performed based upon those results. This study may

help us determine whether investments in healthcare are giving equivalent returns. Finally, we will discuss these new results and the possible policy implications.

Literature Review

The purpose of this section is to survey the foremost literature in the healthcare field pertaining to economic analysis. The focus is on the major, and often contradictory, results of the leading literature, and on various methodological issues in determining the effect of health expenditures on health outcomes. The goal of this section is to establish benchmarks for article selection. The criteria for selecting the articles were based on relevance to our topic of factors affecting health outcomes. These included use of relevant outcome variables, input variables, and methodology. The following literature review will help determine the direction of this study. We will now begin by looking at the criteria required in the articles and then look at the methodology employed by these articles.

Nixon and Ulmann (2006) present a detailed survey of the literature examining the effect of health expenditures on health outcomes, and by doing so outline the basic criteria for relevant studies in the field. They remark that the literature divides the major writings of recent decades between methodology and variable usage. Their study reviews the major 16 articles of the field and details the results. The variables of these 16 articles and most analyses performed in the field are broken up into two major categories; medical and non-medical. The dependent or output variables used in the studies that they reviewed are divided entirely into measurements of mortality and life

expectancy. Though it is commonly written in the popular literature that they are less than perfect gauges of healthcare, these variables are the accepted standard of measuring health outcomes. In accordance with the format of this paper, the following literature reviews will be organized by variable usage; types of dependent variables followed by independent variables.

Based on similarities and availability of data, most studies comparing health outcomes across countries use those that are part of the OECD. These countries are typically more developed, westernized countries with stable government and health systems. They also typically have similar reporting standards for data. This, in addition to the focus on health outcomes and expenditure, is what we look for when determining the most appropriate articles for review.

Grossman's (2000) human capital model optimizes the amount of individual health with respect to its inputs and level of endowments. The human capital model defines health as a commodity that an individual would maximize subject to his or her budget constraint. The articles surveyed below use some form of the production function to analyze health outcomes in relation to health inputs. The simplest form of this equation is Grossman's production function model but other, more complex forms of this formula are used by Miller and Frech (2002), where health is a function of medical care and lifestyle variables for different countries. The following data analysis section uses this format to develop an appropriate equation for this study.

The variables most pertinent to this study will be discussed in the following sections. We will begin by reviewing the literature that focuses on the major dependent variables in the field, specifically life expectancy, potential years of life lost, happiness, and satisfaction. Then the reviews will be focused on the independent variables of lifestyle, diet, and education.

Life expectancy as a measure of health outcome is subject to different methods of measurement. These included total life expectancy at birth and at varying ages and potential years of life lost (PYLL) by gender in total, and also for cancer, respiratory, and circulatory disease. Measurements of mortality included perinatal and maternal mortality, infant mortality (total and by gender), age-specific mortality rates, cause-specific mortality rates at particular ages. The variable PYLL is relatively new to the field and is be explained in further detail below.

Or (2000) argues that potential years of life lost, as opposed to life expectancy, is the preferred and most efficient measure of health. PYLL is the number of years of life lost, or number of years of premature death per 100,000 persons in a country, which is calculated by multiplying the number of deaths at each age by the number of remaining years until 70. Or presents a hypothesis suggesting that using total life expectancy is inefficient for three reasons. The first is that mortality is inevitable and therefore must be measured by using a maximum limit, which is currently higher than 100 years of age but is not common. The second reason that life expectancy is a potentially outdated variable is that as people age, the causes of death are usually due to natural factors

instead of those that are preventable. PYLL gives more weight to premature death than simply taking an overall average like total life expectancy. Finally, the third reason is that the use of average life expectancy discounts instances of premature death. As mentioned before, premature death is usually caused by outside sources and is considered to be more preventable than death from "old age." These factors would appear to make PYLL a more efficient variable in regards to measuring health outcomes than total life expectancy. Or's research is of vital importance to this paper as it justifies the use of PYLL and by doing so, expands upon the preceding work in the field.

Continuing our survey of dependent variables, now we will discuss those of happiness and satisfaction. These variables are the most innovative components of this study. The rationale behind the use of happiness and satisfaction as health outcomes is that healthier people are expected to be happier people. It follows that people in good health are more satisfied with life and happier in general. The following article uses this hypothesis to conduct research in Sweden and finds the anticipated results.

Gerdtham, Ulf-G, and Johannesson (2001) proposed that happiness is a measure of utility and used data from Sweden that was gathered using a three point scale poll. Individuals were asked to rate their daily life as 'never a source of personal satisfaction,' 'sometimes a source of personal satisfaction,' and 'a source of personal satisfaction most of the time.' They were also asked to rate their health status using a similar method, giving the options of bad health, fair health, and good health.

The dependent variable 'happiness' was measured against the independent variables of gross annual income, health, age, gender, education, marital status, unemployment, and urbanization. The results found that health status had a highly significant and positive association with happiness. Happiness was also found to increase with income and education, and decrease with unemployment, urbanization, being male, and being single. Finally, "the relationship between age and happiness is U-shaped, with happiness being lowest in the age-group 45-64 years." Gerdtham, Ulf-G, and Johannesson (2001) used health as an independent variable while examining the relationship with happiness. In the following study the roles are changed, as happiness is considered to be a degree, or measure of health.

There is very little relevant previous literature on satisfaction. Most studies concerning health use satisfaction as a dependent variable and focus on patient satisfaction. Satisfaction is also studied heavily in the business field in terms of customer or job satisfaction. The few studies that include a relationship between health and satisfaction will be discussed here. Abdallah, Thompson, and Marks (2008) compiled satisfaction data for 178 countries using the World Values Survey. Satisfaction is measured by answering the simple question, "All things considered, how satisfied are you with your life as a whole these days?" Respondents are then asked to consider this question while giving a rating of zero through ten, ten being satisfied and zero being dissatisfied.

Diener, Suh, Lucas, and Smith (1999) found that health was strongly correlated with satisfaction, or subjective well-being, but only for self-reported measures of health. In fact, the relationship weakens considerably when objective measurements are provided from a third party, such as a physician. This may be due to the fact that people under-emphasize the importance of their health with regards to satisfaction, or perhaps that people are more resilient and tend to cope better with their situations, especially those in the long-term. This is a reflection of individuals' personalities, which was found to be a significant factor in perception. Regardless of the reasoning behind it, it is clear that one's perception of health depends greatly on personality and is measured differently by the individual. This subjectivity leads to some concern in the economics community as to whether self-ratings can accurately reflect an individual's actual state of satisfaction.

Helliwell and Putnam (2004) sought to analyze the effects of social capital on well-being, happiness, and health. They defined social capital as family strength, neighborhood, and religious and community ties. Other factors affecting happiness, health, and life satisfaction include ties to friends, coworkers, and neighbors, marriage and family, civic engagement and trust/trustworthiness. The results concluded that happiness self-ratings tended to be more short term, while satisfaction self-ratings were longer term. This study addressed the issue of subjectivity by comparing the individual self-reported results with those of an external source, like physicians, spouses, and family members. Helliwell and Putnam found that the self-rating results were consistent and corroborated with those from external sources. This study does bring to light the

controversial causation between health and well-being. They acknowledge that social factors influence health as well as well-being, suggesting that health can be seen as a conduit “through which social factors influence subjective well-being.” (Helliwell, Putnam 435) This idea further justifies the use of satisfaction as a health outcome, recognizing that the two factors are highly related and influential in each other’s outcomes.

The main independent or input variables used fall under the categories of medical and nonmedical resources. Nonmedical variables include health spending, income, education, fertility, development, lifestyle, demographics, and a few other variables that potentially influence health outcomes. These also include lifestyle variables such as diet, smoking, and so on. A few of these variables are characterized as "vices" although that is subject to specific cultural interpretation.

The literature uses various methods to measure health expenditure. These include total health expenditures, which includes both public and private expenditures, public health expenditure (purchasing power parity terms), and pharmaceutical expenditure. These variables are usually expressed as total expenditures, in per capita terms, or as a proportion of total expenditures or GDP. In some articles, the healthcare system of Canada was analyzed from state to state therefore the variable NHS financing of medical services was employed.

Accounting for the income of each country was common in many studies. Income was represented by the variables per capita GDP (PPP and exchange rates) and

per capita income. Income is often considered to be a demographic variable, giving researchers a better idea of the type of country being analyzed based on its development progress. Nixon and Ulmann surveyed 16 articles, of which ten studies use the independent variable income in their analyses. They point out that the use of both income and health expenditure is problematic because they are highly correlated with each other. Income is commonly used as a demographic variable and later in this study income will be represented by GDP per capita.

Education plays a significant role in many regressions as an independent variable. It can be hypothesized that there is a positive relationship between levels of education and improvements in health outcomes. The different forms of education variables include proportion of adult population who are literate, proportion of population aged over 25 years with post-secondary education, and real education expenditures per capita. Barlow and Vissandjee (1999) found that literacy rates were a strong predictor of life expectancy. Their research is important to this study as it directly relates to one of the main indicators of health outcomes. Further in this study we recreate the relationship found by Barlow and Vissandjee by using tertiary school enrollment as a measure of education.

In Grossman's model, education also plays a very important role as an explanatory variable. In this production function model, a person is using his or her education as an input whose purpose is to maximize health. Cremieux (1999) finds that people with a higher education are likely to be more aware of potential health threats.

These findings align those of Grossman, Barlow and Vissandjee, and exhibit the importance of education when studying the change in health outcomes.

Because some studies include comparisons between developed and less developed countries, there are a few variables used that indicate levels of development. These development indicator variables are access to safe water, proportion of population living in tropics, Gini coefficient, poverty, direct democracy, decentralization coefficient, and structural indicators such as political rights, corruption, and ethnicity. These variables are not included in the following data analysis in this paper due to potential problems arising from heterogeneity and the exclusion of less developed countries.

Alcohol and tobacco variables were common in articles that compared lifestyles across countries. Tobacco consumption was represented by the following variables; percentage of males aged 15 years or over who smoke, percentage of females aged 15 years or over who smoke, tobacco consumption, cigarette consumption per capita per annum, tobacco consumption, per capita real expenditure on tobacco, tobacco consumption expenditure per capita (PPP), and gender-specific tobacco products spending. Alcohol variables were measured in the form of consumption and spending also. The other variables included alcohol beverages spending, per capita real expenditures of alcohol, and total alcohol consumption in liters per capita per annum.

The leading studies using alcohol as an independent variable are done by Cochrane et al. and Cremieux et al. Cochrane et al. (1978) found alcohol to be in the top

seven of their variables with the greatest explanatory power when examining mortality rates. Their results suggest that an increase in consumption of alcohol is associated with an increase in maternal mortality, perinatal mortality, and infant mortality. Cremieux et al. (1999) studied alcohol consumption per capita as well. They found a positive relationship between alcohol consumption and infant mortalities. They also found a negative relationship between alcohol and life expectancy. These results confirm the notion that alcohol consumption is an important input variable in a study concerning mortality and life expectancy rates.

Zeynep Or (2000) found alcohol consumption to have a significantly positive relationship with infant mortality when using data for women only. Nixon and Ulmann (1987) go so far as to say that alcohol consumption in combination with other lifestyle variables is among the most important determinants of healthcare outcomes. Cigarette consumption data was often harder to obtain since per capita use is not always readily available for some countries.

Cremieux et al. (1999) found information on the percentage of smokers in each country. Their results were as expected, showing a positive relationship with infant mortality rates and a negative relationship with life expectancy. They found that an increase in cigarette smokers was associated with an increase in both male and female infant mortality. Concerning life expectancy, an increase in number of smokers was associated with a decrease in male life expectancy and in female life expectancy.

In addition to alcohol, cigarettes were also a strong explanatory variable in the study conducted by Cochrane et al. (1978). Cigarette consumption is positively associated with maternal, perinatal, and infant mortality rates. These results are not surprising. The health consequences of cigarette use have been studied for many years and it is now the common consensus in most westernized countries that cigarettes are strongly associated with illnesses such as cancer and emphysema. Because of this knowledge and the results found by other economists, it was necessary to include some form of cigarette consumption as a lifestyle variable.

There are three categories of demographic variables used; these include age distribution, population patterns, and workforce participation. Population pattern variables are comprised of population density, urban population as a proportion of total population, and urbanization. Age distribution variables used include proportion of population less than 15 years of age and population aged over 65 years (both in total and in proportions). Those demographic variables based on labor include proportion of white-collar workers in total work force and female labor force participation rate.

Findings varied greatly between the different studies performed. For example, Hitiris and Possnett (1992) found that health expenditure had a negative impact on mortality, while most of the other studies found it to have a positive impact, or none at all. These variations could be due to several factors. The articles vary in countries, variables, and time periods examined. The countries examined range from global, regional, and even within a single country. The variables used in each article depend on

the focus of the study. Finally, the time periods analyzed vary as well due to availability of data. The following summary of results is divided between the three variables of infant mortality, life expectancy, and lifestyle.

Mortality Results

Overall, several variables were found to have a significant relationship with infant mortality rates. In only one of the studies, that of Hitiris and Possnett (1992), health expenditure was actually found to have a negative impact on mortality, meaning that an increase in expenditure was associated with a decrease in infant mortality. This same study found that the variables population aged over 65 years and GDP had a positive effect on mortality rates. Other variables that greatly affected mortality rates included the number of physicians, GDP, alcohol, and tobacco. According to Babazono (1994) non-health care spending was found to be significant for both perinatal and infant mortalities. Health care expenditure was found to be a better predictor of infant mortality than GDP in the study performed by Elola et al. (1995).

Life Expectancy Results

The length of hospital stays is found to have a significant relationship with male life expectancy at birth according to Nixon and Ulmann (2006). As far as expenditure is concerned, there were a variety of results found within the articles surveyed. Elola et al. (1995) found that health-care spending is significant for female life expectancy at birth while others, like Barlow and Vissandjee (1999), found results suggesting that expenditure did not have a significant relationship with life expectancy. Despite these

contradicting results, non-health care spending was found to be significant for both male and female life expectancy variables by Babazono and Hillman (1994).

Barlow and Vissandjee (1999) also found that per capita income had a significant and positive relationship with life expectancy, while animal product consumption formed a U shape in life expectancy results. They also found that literacy is a strong predictor of life expectancy, which is a result that agrees with the findings of Grossman (2000) and Leu (1986) about education being an input and an aid in understanding health and healthcare issues.

Lifestyle Results

The hypothesis governing the study by Wolfe and Gabay (1987) maintained that accurate analysis of the relationship between health outcomes and health expenditure can only be captured if lifestyle variables are included. They found results suggesting that negative changes in life-style are strongly associated with negative changes in health outcomes. As would be expected, these negative health outcomes are associated with increases in medical expenditure.

Nixon and Ulmann (2006) elucidate the problem of complete data access. For many of the variables used in these studies are not governed by the same standard of reporting. For this reason, it is very difficult to obtain data on variables like diet and exercise. While all articles are seeking to differentiate the causes behind differences in healthcare performance between countries, such cross country analysis, is difficult. In some studies the countries were from a similar region, subverting heterogeneity issues

found when comparing countries globally. Other studies even removed all other countries and focused on large countries with unified healthcare systems, such as Canada.

Anderson et al. (2000) acknowledge that the United States would appear to spend more based solely on the fact that it is often the innovator of healthcare treatments and tools. This means that the US invests more money into research and development of pharmaceuticals or other medically related ventures that give the US higher health expenditures than other countries. In addition to this investment cost, other countries benefit from the knowledge spillover that the US creates with these innovations.

Most importantly, none of the previous literature reviewed above contains analysis on the relationship between lifestyle variables and happiness or satisfaction. These variables remain the focus of this study, where we hope to show that happiness and satisfaction are both representative of health, and that taking into account the individuals lifestyle is critical in determining health outcomes. The next section details the use of these variables and their results.

The following tables (4-13) analyze the effect of total health care expenditure per capita in US dollars on several healthcare outcome indicators for 34 of the Organization for Economic Cooperative Development (OECD) countries between the years of 1995 and 2008. These indicators include infant mortality rate, life expectancy, PYLL, happiness, and satisfaction. The use of infant mortality and life expectancy

variables to indicate health outcome levels is standard in most literature. Also, we have added happiness and satisfaction as both can be potential measures of health. No previously written papers have used either happiness or satisfaction as health outcomes but this paper hypothesizes that they will react similarly to other, more commonly used variables.

We consider OECD countries because they are relatively similar in culture and government structure when compared to countries across the globe. These countries are all considered to be developed countries with strong economies and advanced healthcare systems. The purpose of excluding less developed countries or those with dissimilar government systems is to avoid the heterogeneity that occurs when comparing different countries. Unfortunately, it is impossible to perform cross country analysis while eliminating these issues entirely.

Data Description

The data used in this study was provided by the Organization for Economic Cooperation and Development, the World Bank, and the Happy Planet Index. The OECD is an association of countries that strive to progress economic development. These countries include but are not limited to those in Western Europe and North America, which are among the most developed and relatively homogenous in terms of political systems. They collect data on each country and aim to provide unabridged data for analysis. The Happy Planet Index supplies data that is collected through surveys of individuals across the globe.

Below we will discuss the variables used and their descriptive statistics. First we begin with the dependent variables or health outcome variables. These include infant mortality rate, life expectancy, potential years of life lost, happiness, and satisfaction. The dependent variable infant mortality rate, IMR, is commonly used as a health indicator in the leading literature of the field. We are trying to determine the type of relationship that exists between health expenditure and infant mortality rate, hypothesizing that there exists a significant and negative association between the two variables. Infant mortality rate is measured as the number of infant deaths under the age of 1 year, per 1,000 live births.

Life expectancy as a measure of health outcome is subject to different methods of measurement. These include total life expectancy at birth and at ages 40 and 60 years, gender-specific life expectancy at birth and at age 65 years, male life expectancy at 80 years, female life expectancy at 80 years, and potential years of life lost (PYLL) by gender. Measurements of mortality include perinatal and maternal mortality, infant mortality (total and by gender), mortality rate per 1,000 population, age-specific mortality rates (ages 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64 years per 10,000 population), cause-specific mortality rates at particular ages including 35-54,65-74, and 75 years of age, and potential years of life lost (PYLL) in total and also for circulatory disease, cancer, and respiratory disease. The variable PYLL is relatively new to the field and will be explained in further detail below.

Life expectancy is also a very common variable used to measure health outcomes. Some researchers, such as Zeynep Or (2000) argue that this is not the best indicator of health and instead use the innovative variable Potential Years of Life Lost. Instead of using the average length of life, PYLL measures the number of years lost due to premature death per 100,000 persons. In this study we will use both variables. PYLL is a summary measure of premature mortality, which involves adding up deaths occurring at each age and multiplying them with the number of remaining years to age 70. The value is given as per 100,000 persons.

The most important variables being used in this study are those of happiness and satisfaction. These variables have never before been used as indicators of health. The measurement of this data is discussed in further detail later in this section. Based on our hypothesis, we expect that happiness and satisfaction will react similarly to the other dependent variables, as they are being considered health outcomes. We also expect them to have significant relationships with the lifestyle variables. These variables, Happiness and Satisfaction, are provided by Happy Planet and are measurements taken worldwide. Happiness, as defined by the New Economics Foundation, or NEF, is well-being in terms of long, happy, and meaningful lives with respect to resource consumption. The NEF seeks to measure happiness as well-being for both people and the planet. The HPI results are found within the range of 0 to 100, the highest values being those that are more happy or satisfied. They are measured by using the following equation:

$$\text{Happy Planet Index} = \frac{\text{Happy Life Years}}{\text{Ecological Footprint}}$$

Where “the ecological footprint of an individual is a measure of the amount of land required to provide for all their resource requirements plus the amount of vegetated land required to sequester (absorb) all their CO2 emissions and the CO2 emissions embodied in the products they consume. This figure is expressed in units of ‘global hectares’.” (Happy Planet Index) The numerator, Happy Life Years, is determined by multiplying life expectancy by life satisfaction, a method called happiness-adjusted life expectancy, developed by Ruut Veenhoven. The final result is a measure of ‘sustainable’ happiness that evaluates the interaction between people and the environment with respect to well-being.

The next set of variables includes the demographic variables that are also incorporated in the leading studies on healthcare outcomes. Gross domestic product per capita is representative of income, which is used in several other articles and was often found to be significant to health outcomes. For example, Grossman (2000) found that income played a prominent role as an explanatory variable as well as education. Cochrane et al. (1978) found that income had a significant and negative relationship with mortality in most age groups.

Taking the log of the population is a method to standardize the variable by reducing the variation between data points. Population age distribution is accounted for by the independent variables Population below the age of 15 (%) and Population above

the age of 64 (%). The final demographic variable is Urban Population which represents the proportion of people living in an urban area.

The final set of variables that is included later in this study is that of the lifestyle variables. These are also conductive to an innovative approach to examining factors that contribute to health outcomes. These lifestyle variables include the consumption of alcohol and tobacco, and education. Percent Higher Education is representative of the level of education in a given country. It is the proportion of the population during the five years following high school graduation (usually those aged 18-23 years) enrolled in some form of tertiary education. Below is a table showing the demographic statistics of these variables. The number of observations varies between the variables due to missing data. Specific variable definitions can be found in Table 1.

< Insert Table 2 Here >

Seen in the graph above are the descriptive statistics for the all of the variables included in this study. Concerning the dependent variables, the minimum infant mortality rate was in Luxembourg, with a rate of 1.8 infant deaths per 1000 live births and the maximum was 14.9 infant deaths in Estonia. The US average for this time period was 7 deaths per 1,000 live births. Estonia also had the highest instances of potential years of life lost, with 12,357.5 year per 100,000 persons. Iceland had the lowest with 2,213.3 years of life lost, or years of premature death per 100,000 persons. The average PYLL for the United States during this time period was 5193.8 years per 100,000 persons. Life expectancy was longest in Japan with an average lifespan of 82.6 years,

and shortest in Austria and Italy with an average of 67.60 years. For this time period, the US had an average life expectancy of 77 years. It is surprising that Luxembourg had the lowest Happy Planet Index (HPI) score of 22.03 out of 100. The country with the highest score on the HPI was Mexico, with a score of 61.34. The US's average HPI score for this time period was 29.6 out of 100, just above that of Luxembourg. The calculation of the HPI will be discussed in further detail in the empirical results section. Iceland had the highest level of satisfaction with a score of 8.46, while South Korea had the lowest average satisfaction rating of 5.09. The US had an average satisfaction score of 7.3 out of 10.

Now concerning the independent variables, the lowest level of health expenditure was in Turkey, where on average they spent $172.77 US dollars (PPP) per capita. It's no surprise that the US had the highest level of health expenditure, with a maximum average of $7,719.63 US dollars (PPP) per capita. Higher education attendance was highest in South Korea, where 98 percent of the population had enrolled in some kind of post-high school education during the five years following graduation. It was lowest in Luxembourg, with less than ten percent of the population having been enrolled in a tertiary school during the five years after graduating from secondary school. There could be another factor at work here, such as university attendance in other EU countries due to ease of movement or perhaps students in Luxembourg wait to attend college. As the variable does not specify whether this includes the students that travel abroad for education, this value is likely lower than the actual percentage. The US average was about 77 percent of people age 18-23 enrolled

or attending tertiary education. The highest number of liters of alcohol purchased was in Luxembourg with an average of 15.7 per person, and the lowest was in Turkey with an average of 1.2 liters per person. These findings are expected, as they are likely due to cultural influences. Luxembourg is similar to the French in that they regularly consume wine with their meals, and in Turkey there is a large Muslim population, which traditionally does not allow the consumption of alcohol. The US average for this time period was 8.5 liters per person annually. Tobacco consumption was highest in Greece, with an average of 3,741 grams, and lowest was in the UK with an average of 950 grams consumed. The US's average was 1,553 grams per person annually for this time period.

Empirical Model

The existing literature analyzes healthcare using a production function which expresses healthcare as a function of its inputs, which are medical resources and various social, economic, and life-style indicators represented by the equation H = f (M, E), (Or 2000 pg. 55). In concurrence with this method, the following study we will use total expenditure as a percentage of GDP as a measure of medical resources. The equation being employed in this study will be

$$\log\text{Outcome}_{it} = \alpha_i + \gamma_t + \beta_1 \log\text{HealthExp}_{it} + \beta_2 \log\text{Lifestyle}_{it} + \delta \log X_{it} + \mu_{it}$$

Where:

$\alpha = \text{country specific, time invariant, fixed effects}$

$\gamma = \text{country specific, time variant, fixed effects}$

$X = \text{vector of control variables}$

From the previous studies above, a log-log production function was found to be the most appropriate for this analysis. The log is taken to standardize the variables. Outcome represents infant mortality rate, life expectancy, PYLL, happiness, and satisfaction. HealthExp represents total per capita health expenditure in US dollars, PPP. Lifestyle represents the lifestyle variables higher education, alcohol, and tobacco. Finally, X represents the demographic statistics; GDP per capita, population, urban population, population below the age of 15, and population above the age of 64. The country fixed effects were included in all final results to account for potential heterogeneity, or variability, across countries. After performing f-tests, the time fixed effects were found to be unnecessary. Initially the ordinary least squares model is used but in the final results robust standard errors are employed to account for heteroscedasticity, or correlated errors.

The regressions are setup in a way that details the process. Each dependent variable has 2 sets of regressions. This first set of regressions is each dependent variable being regressed on health expenditure and the demographic variables. The second set is each dependent variable being regressed on health expenditure, demographic variables, and the lifestyle variables. The purpose of this is to confirm initial results of health

expenditure with previous literature, and then to add on to those results using lifestyle variables and happiness and satisfaction. In the equation above, outcome variables include infant mortality, life expectancy, potential years of life lost, happiness, and satisfaction.

The country fixed effects were included in the model to account for heterogeneity across countries. This is a common practice as heterogeneity is expected due to the differences between countries with regards to social and political systems, level of economic development, and income. After performing F tests on each of the regressions equations comparing results between regressions using time fixed effects and those same regression results when time fixed effects were omitted, it was apparent that time fixed effects were not necessary for the regressions. Initially, the regressions operate under the ordinary least squares assumption (columns 1-3 of Tables 4-13) but in order to account for heteroscedasticity, or correlated errors, robust standard errors are employed in columns 4 of Tables 4-13.

The purpose of the first five sets of regression equations, whose results are found in Tables 4-8, is to verify that this study and its results align with those of previous researchers. These regressions seek to determine the nature of the relationship between health expenditure and the five health outcomes; infant mortality rate, life expectancy, potential years of life lost, happiness, and satisfaction. We hypothesize that health expenditure will be significant in these regressions, as lifestyle factors have not been taken into account yet. We expect to see any signs of significance with respect to

expenditure change once lifestyle variables are introduced. In the following results section we will compare the findings by dependent variable and compare expenditure results from before and after the lifestyle variables were included.

Empirical Results

Table 4 shows the results of the basic infant mortality rate regressions. Column 1 displays the results of an ordinary least squares (OLS) regression of infant mortality rate on health expenditure as a percentage of GDP. The result is a significant and negative relationship with a coefficient of -.36. However, the assumptions of the OLS model are that the regression is linear in parameters, has input variable values that are independent from the error term, the error term has a zero mean, is homoscedastic, has no autocorrelation, and the number of observances are greater than the number of parameters. Because of these assumptions we must make the regression more complex to account for other variables that may have a relationship with infant mortality.

Column 2 includes basic demographic variables to account for changes in infant mortality. Column 3 includes the country fixed effects, which are continued in column 4 as well. Because we are dealing with cross sectional time series data heterogeneity is to be expected and therefore we must use the country fixed effects. Year fixed effects were considered, but was found to be less efficient in a study that is only looking at a decade of data. Finally, column 4 employs a robust model in order to alleviate the requirements of the basic OLS model. This set of regression models is used for each of the other health outcome variables in tables 4-8.

After adding in these other explanatory variables in Table 4, our final health expenditure results (found in column 4) coincide with those of other studies. The significant relationships between infant mortality and the independent variables were those of health expenditure with a coefficient of -.34, GDP with a coefficient of -.27, urban population and proportion of the population below the age of 15 with coefficients of .02 each, and finally proportion of the population age 65 and above with the coefficient -.05. These results are not unexpected for such a basic regression; increases in health expenditure and income are associated with decreases in infant mortality. Increases in proportion of the population living in an urban setting and below the age of 15 are both associated with increases in infant mortality.

Potential problems with the results in Table 4 are based on the basic OLS model which is too straightforward for analysis of cross sectional time series data. To solve for potential heteroscedasticity issues, we must run a White's Test and a Breusch-Pagan Test for heteroscedasticity. Both of these models test the null hypothesis, which is that the variance of the residuals is homogenous. We have found a small p-value and therefore reject the null that the residuals are homogenous, meaning that there is evidence of heteroscedasticity. We must be careful when using these tests because they are very sensitive and could cause alarm in situations where the heteroscedasticity is negligible. To check the degree of heteroscedasticity we must make a scatter plot of the residuals against the fitted values and check for patterns.

< Plot 1 here >

Plot 1 is the scatter plot of the residuals against the fitted values for the regression equation in Table 4, Column 2. In order to confirm the OLS assumption of homoscedasticity, we should see no pattern in the plotted residuals, meaning that their variances are constant. In the plot above we can say that there is a high degree of heteroscedasticity in our residuals because we see definite patterns in our scatter plot. When we find that the OLS assumptions are not true in our regression it is necessary to correct the OLS standard errors for heteroscedasticity.

Robust standard errors are also known as heteroscedasticity corrected errors. They are typically used in large sample sizes when the ordinary least squares assumption of homoscedasticity is not valid, meaning that the residuals form a pattern instead of being evenly scattered when plotted against the fitted values. Heteroscedasticity, when the variance of the residuals is not uniform, is common when performing analysis on cross sectional time series data. Because there is this problem of heteroscedasticity, robust standard errors are used in the final results given below and seen in columns 4 of each of the results tables.

Table 5 uses total life expectancy at birth as the dependent variable. The basic OLS regression suggests a positive, albeit insignificant relationship between expenditure and life expectancy. After including the control variables in column 2 we find that the relationship between life expectancy and health expenditures is positive but insignificant. The results in the third and fourth columns are those including the country fixed effects into the model. In the final set of results, we see that life expectancy has

significant and positive associations with expenditure, total population, and proportion of the population above the age of 64, with the coefficients of .03, .07, and .002 respectively. The only significant and negative relationship is that between life expectancy and proportion of the population below the age of 15, with a coefficient of -.003. Due to these results, questions concerning the use of life expectancy as an accurate measurement of health arise.

Fortunately there are a few economists who have addressed this issue in the past. Zeynep Or (2000) and Elola et al. (1995) have both written articles arguing that total life expectancy is not the most appropriate gauge for determining healthcare outcomes. Zeynep Or (2000) suggests that the use of total life expectancy has a few major flaws. These include the fact that despite how efficient the healthcare system operates, it is impossible to live indefinitely. He also claims that the use of the average of the total life expectancy in each country underweights instances of premature death. The variable he introduces is called PYLL, or Potential Years of Life Lost per 100,000 persons. Because death below the age of 65 is more likely to be caused by environmental factors, his variable only considers years of life lost below the age of 65. This method of calculation gives more weight to the cases of death that were likely to be more preventable.

When using the variable Potential Years of Life Lost (PYLL) in Table 6 we see that there is a highly significant, negative relationship with health expenditure. This could be interpreted as an increase in expenditure is associated with a decrease in potential

years of life lost, or premature mortality, which is what one would expect to find using such a simple set of regressions. The second regression, column 2, introduces other explanatory variables and maintains significance. In columns 3 and 4 the country fixed effects are introduced to account for heterogeneity. In Column 4 we include the use of robust errors and our results remain unchanged. The significant relationships with PYLL include expenditure with a coefficient of -.27, total population with a coefficient of -.64, and proportion of the population above the age of 64 with the coefficient of -.03. These coefficients suggest that in the most basic regression forms, an increase in any of these three variables is associated with a decrease in premature death. The expenditure results suggest that if the US wanted to decrease PYLL, expenditure must also be increased.

In tables 7 and 8 we introduce two new variables to measure healthcare outcomes. Table 7 displays the results from regressions on the dependent variable of Happiness. A plausible theory would postulate that if increases in spending produce higher health outcomes in the basic regressions, then there would be a positive relationship between healthcare expenditure and happiness as well. The results shown in Table 7 confirm that there is a positive relationship between happiness and expenditure. This would suggest that increases in spending are associated with increases in happiness. The results of Table 7 suggest that happiness has a significant relationship with health expenditure, whose coefficient is .13, and also income, with a coefficient of -.66. These results are in disagreement with the hypothesis which conjectures that unhealthy people, and therefore unhappy people, are likely to spend

more to increase health (or happiness) outcomes. It is also surprising to see a negative association between happiness and income. It is not uncommon to find that income has decreasing returns to scale at high levels, but these results suggest that income may even decrease happiness. These findings are so contrary to the literature that there must be another problem present. This may be a case of reverse causality, which implies that income is dependent on happiness. This and other possible situations will be discussed in further detail later in this study. The results also suggest a positive and a significant relationship with proportion of the population living in an urban area, with a coefficient of .01.

Table 8 displays the results for the regression on Satisfaction. Satisfaction is measured by asking individuals to complete a survey answering a simple question that rates their life satisfaction with a value between 1 and 10, ten being extremely satisfied. We would expect to see similar results to those of Happiness but find otherwise. There is not a significant relationship between satisfaction and health expenditure. There are significant relationships between satisfaction and population with a coefficient of .08, population above the age of 64 with a coefficient of .01, and urban population with a coefficient of -.006.

In the following tables (9-13) we will reevaluate that effect of health expenditure on healthcare outcomes after lifestyle variables are taken into account. These lifestyle variables include education, alcohol consumption, cigarette use, and obesity rates. The use of lifestyle variables to explain the differences in healthcare outcomes between

countries is common in the popular literature. In addition to the variables listed above, diet and exercise data is included in several studies. Unfortunately, there are limitations when trying to access such data as not all of the countries collect such statistics.

According to Cochrane et al. (1978) there are only three different types of variables that should be included when determining healthcare outcomes: healthcare indices, dietary consumption, and demographic variables. These dietary variables included alcohol, tobacco, protein, fat, and sugar. Their results showed that all of these except sugar have a significant and positive relationship with mortality. The article emphasizes that protein and fat held the most significance in their results. As noted earlier, Or (2000) found a significantly positive relationship between alcohol and infant mortality.

We begin the process again in Table 9 with the basic Ordinary Least Squares regressions in column 1. In column 2 we add the lifestyle variables to the basic regression and obtain interesting results. We continue in the same format as that in Tables 4-8, introducing the country fixed effects model in column 3 and finally including robust standard errors in column 4. Now that lifestyle variables have been added to the regressions, we expect to see that health expenditure is no longer significantly associated with improvements in health outcomes.

The results in Table 9 do in fact suggest that health expenditure is negatively associated with infant mortality but the relationship is not significant. Of the three lifestyle variables, education and alcohol have significant relationships with infant

mortality and react as hypothesized. A one percent increase in higher education attendance is associated with a .005 percent decrease in infant mortality. In 2002 the US averaged 78.9 percent of the people during the five years following high school (about ages 18-23) enrolled or having been enrolled. This was well above average, which was 55 percent. The overall average infant mortality rate was 5 infant deaths per 1000 live births, and the US average was 7 per 1000 live births. If the US increased enrollment in higher education for percentage of people age 18-22 by 5 percent, it would merely decrease the infant mortality rate by .17 percent, to 6.99 infant deaths per 1000 live births, which is still well above average.

Alcohol results on infant mortality showed a coefficient of .03 suggesting that if the US decreased alcohol consumption by 5 percent, to 7.89 liters per person, it would reduce its infant mortality rate by .18 percent, to 6.99 infant deaths per 1,000 live births. The other significant variables included urban population with a coefficient of .02, population below the age of 15 with a coefficient of .05, and population above the age of 64 with the coefficient -.04. We see that expenditure lost significance in determining infant mortality with the introduction of lifestyle variables, just as was hypothesized.

Table 10 presents the results of the regressions on total life expectancy. Compared to our original life expectancy results in Table 4, we find similarities when examining the relationship between health expenditure and life expectancy. As the regression equations become more complex, meaning that there are more variables

accounted for and less potential errors being made, the relationship between health expenditure and life expectancy remains unchanged in significance. The results suggest that a one percent increase in health expenditure per capita is associated with a .03 percent increase in life expectancy. Based on 2002 values a 5 percent increase in expenditure, raising its per capita health expenditure by $278.88 to $5866.53 per person, is associated with a .18 percent increase in life expectancy, or .14 years becoming 77.34 years. This value is almost three times larger than the 2002 average per capita health expenditure of the other OECD countries.

We do see that population growth rate, urban population, and population above the age of 64 are all significant variables when determining life expectancy. Population and proportion of the population aged 65 or greater have positive relationships with life expectancy, with coefficients of .07 and .001 respectively. These are among the most basic demographic variables and it is no surprise that they have positive relationships with life expectancy. The more interesting variables are urban population and cigarettes per day, which both have a negative relationship with the dependent variable total life expectancy. From these results we find a coefficient of .02. This means that if the US were to focus solely on reducing tobacco consumption, it could increase its life expectancy by .12 years to 77.3 years by reducing per person tobacco consumption by 5 percent or 77.1 grams per person, to the level of 1465 grams per person. Alcohol and education do not appear to have significant associations with life expectancy. Comparing the results from before and after the inclusion of lifestyle variables,

expenditure remained significant and only one of the lifestyle variables was found to be significant as well.

Table 11 displays the regressions on potential years of life lost (PYLL) with lifestyle variables included. Similar to the earlier regressions using PYLL, expenditure maintains significance. The final results show significant and positive relationships between PYLL and health expenditure, population, and population aged 65 and above. Using values from 2002, if health expenditure was increased by 5 percent, to $5866.53 per person, the US would achieve reductions in PYLL of 6.08 years per 100,000 persons, to 5,059.9 years per 100,000 persons. This expenditure is almost three times the value of the average OECD health expenditure in 2002.

As far as lifestyle variables are concerned, cigarette consumption has a coefficient of .13. If the US reduced its tobacco consumption by 5 percent to 1465 grams per person, the premature death would be reduced to .21 percent, or 10.64 years per 100,000 persons. This becomes an average of 5,055.36 years per 100,000 persons. Tobacco consumption in the US is already lower than the average level of tobacco consumption in the other OECD countries for 2002, which is 1878 grams per person.

Education is also significant, with a coefficient of -.001, suggesting that a one percent increase in higher education attendance is associated with a .001 percent decrease in premature death. If higher education attendance in 2002 for the US was increased by 5 percent of people between the ages of 18 and 22 enrolled or having been enrolled in tertiary school, then PYLL would decrease by .17 percent, becoming about

5,057.36 years per 100,000 persons instead of 5,066 years per 100,000 persons. Health expenditure was significant before and after the lifestyle variables were included, which is contrary to the hypothesis, but two of the three lifestyle variables were significant which was expected.

In Table 12 happiness is used as a healthcare outcome. We hypothesize that happiness would follow the same rationale as our other healthcare outcome variables once lifestyle variables have been included. This is that once lifestyle variables are accounted for, health expenditure will no longer be significant. The results tell us a different story. In Column 1, the basic OLS regression shows a significant and negative relationship between health expenditure and happiness. After including the medical and non-medical resource variables in Column 2, the sign of the relationship does not change but health expenditure becomes less economically significant. Again we encounter potential reverse causality issues.

The final results of Table 12 suggest that lifestyle variables do not have significant relationships with happiness outcomes. The two significant variables include health expenditure with a coefficient of .14 and proportion of the population below the age of 15 with a coefficient of .05. Health expenditure also remained significant even after including lifestyle variables into the regression, and none of the lifestyle variables were significant, both of which are findings that were unexpected and contrary to the hypothesis.

The final table, 13, presents the results of the regressions run on the variable satisfaction. After including the country fixed effects in Column 3 and then using robust standard errors in Column 4 we see that health expenditure is no longer significant. This is in agreement with the hypothesis but the lifestyle results are contrary to what was expected. Just as in the happiness regressions, none of the lifestyle variables were found to be significant determinants of satisfaction. The robust model results in column 4 show a positive relationship between expenditure and satisfaction just as they had prior to adding the lifestyle variables but now we see that there is no significance to this relationship. As far as demographic variables are concerned, total population was found to have a significant relationship with satisfaction, with a coefficient of .58. Urban population was found to be significant, with a negative coefficient of .01. Population above the age of 64 was also significant, with a positive coefficient of .02. Finally, just as in the happiness regressions, none of the lifestyle variables were significant. Also, health expenditure was never a significant independent variable in our satisfaction findings, regardless of the use of lifestyle factors.

Overall, we find that the lifestyle variables are not as significant as we had hoped. They have significant relationships with infant mortality, life expectancy, and PYLL with expected associations. Despite our hypothesis that happiness and satisfaction were representative of health outcomes and that lifestyle variables would have significant relationships with health outcomes, we do not see any significant associations between these variables. The expenditure results were also unanticipated. We see significant relationships between health expenditure and life expectancy, PYLL,

and happiness. If our hypothesis had been correct, we would have seen few to no significant relationships once lifestyle variables had been accounted for. In the following section we will discuss the implications of these results along with political policy recommendations based on these findings.

< Insert Table 3 Here >

Table 3 is a summary of the results found in this study. You will see that health expenditure was found to have significant relationships with life expectancy, PYLL, and Happiness. We see from the results that our hypothesis was incorrect in assuming that lower health outcomes are associated with higher expenditure as expenditure is positively associated with life expectancy and negatively associated with potential years of life lost. Focusing on the concentration of this study, we move on to the lifestyle results. Education is found to be negatively associated with both infant mortality and PYLL. Alcohol consumption is found to be positively associated with infant mortality, and tobacco use is negatively associated with life expectancy and positively associated with PYLL. While the results from the lifestyle variables align with the hypothesis, it is important to note that we had expected to see health expenditure lose significance once lifestyle variables were accounted for. This was not always the case. In addition to these unexpected findings, the variables accounting for well-being, happiness and satisfaction did not appear to act as hypothesized.

Conclusion

In the following section we will discuss the results found in the previous section and the potential implication of those findings. Below we will compare each of the output variables; infant mortality, life expectancy, potential years of life lost, happiness, and satisfaction, to define the most significant findings of this study. Then we will discuss the potential methodology issues encountered in the process, and finally conclude this study with the discussion of policy implications as a result of these findings. The examination of policy implications will include current policy practices and recommendations to improve their structure based on the results found in this study.

The final infant mortality results included several significant relationships. We can see from Table 12 that infant mortality had significant relationships with urban population, proportion of the population below the age of 15, proportion of the population above the age of 64, education, and alcohol. Health expenditure is not found to have a significant relationship with infant mortality. The results suggest that a one percentage increase in education is associated with a .005 percent decrease in infant mortality. They also suggest that a percentage increase in alcohol consumption is associated with a .03 percent increase in infant mortality. It is not surprising that tobacco consumption did not have a significant relationship with infant mortality. While smoking is believed to have adverse effects on unborn fetuses, the time period for which they are being considered is relatively short to develop most of the serious illnesses associated with cigarettes and other forms of tobacco.

In the United States the Surgeon General warns that consumption of alcohol while pregnant can lead to adverse results in fetal health. For this reason we are not surprised to find results suggesting that alcohol is negatively associated with infant mortality. Alcohol also has a negative relationship with the variable happiness. These are significant at the five percent and ten percent levels respectively. The effects of alcohol may vary from country to country as there are different cultural views on the consumption of alcohol. In some countries alcohol is commonplace in everyday life whereas in others it is considered to be a vice. Cultural views may contribute to abuse of alcohol and therefore diminishing health.

The final results of the life expectancy regressions showed several significant relationships. Those of the demographic variables included a positive relationship with total population and a coefficient of .07, a negative relationship with urban population and a coefficient of .001, and finally a positive relationship with the proportion of the population above the age of 64 with a coefficient of .001. Concerning the focus of the paper, we found significant relationships with both health expenditure and most of the lifestyle variables. The results suggest that a percentage increase in health expenditure is associated with a .03 percentage increase in life expectancy. These results are contrary to the hypothesis which theorized that once lifestyle variables were added to the equation, expenditure would lose significance. The results also suggested that a percentage increase in tobacco consumption was associated with a .02 percent decrease in life expectancy. Because alcohol was not a significant variable in the

determination of life expectancy, we question whether life expectancy is the best variable available to represent health outcomes.

Cigarette use is already known to contribute to illnesses and some forms of cancer. This is common knowledge due to the surgeon general warning on the label of every pack of cigarettes. While these results may seem to prove that cigarettes are detrimental to health outcomes, it is merely agreeing that there does appear to be a significant and negative relationship between cigarette consumption and health outcomes. In fact, in this analysis we found that the number of cigarettes smoked per day has a significant relationship with most of the outcome variables (varying between ten percent and one percent levels) and is negatively associated with the quality of health in each country.

The next health outcome variable is potential years of life lost, PYLL, which represents premature death. The significant relationships with demographic variables include the factors total population and proportion of the population above the age of 64. Both of these relationships were negative with coefficients of .52 and .03 respectively. Again we see a significant relationship with expenditure, suggesting that a one percent increase in expenditure is associated with a .17 percent decrease in PYLL. Both education and tobacco consumption had positive relationships with PYLL. A one percent increase in higher education attendance is associated with a very minimal decrease in premature mortality, a .001 percent decrease specifically. Also, a one

percent increase in tobacco consumption was associated with a .13 percent increase in premature death.

The explanatory variable Percent Higher Education, which represented the proportion of people within the five years after high school enrolled in higher education, was another lifestyle variable with noteworthy results. Education had significant relationships with infant mortality rate, happiness, and satisfaction, resulting in improved results in all three health outcomes. These results are intuitive as it is expected that higher levels of education would be associated with a higher quality of life in general. Unfortunately they are not as economically significant as we had hoped.

Happiness is the first of the experimental outcome variables to be analyzed. The results were unexpected, showing significant relationships with income, health expenditure, and proportion of the population below the age of 15. The results suggested that a one percent increase in health expenditure was associated with a .14 percent increase in happiness. These results were contrary to the hypothesis, which theorized that happiness would react as a measure of health, therefore having no significant relationship with expenditure after the lifestyle variables were included. We also expected to see a negative relationship with expenditure as poor health would lead to lower levels of happiness and in turn high levels of spending. These contrary findings lead us to question our methodology. The following section will discuss the potential for reverse causality in the data.

The satisfaction results were similar to those of the variable happiness. We found significant relationships with the demographic variables of total population, urban population, proportion of the population below the age of 15, and proportion of the population above the age of 65. There was no significance with health expenditure, which was expected, but there was also no significance with the lifestyle variables, contradicting the hypothesis. Overall, health expenditure was significant with life expectancy, PYLL, and happiness. These findings were contrary to the hypothesis as we expected health expenditure to lose significance once the lifestyle variables were included. Concerning lifestyle variables, education was a significant factor in the determination of infant mortality and PYLL. Alcohol was only significant in determining one variable; infant mortality. Finally, tobacco consumption was significant for life expectancy and PYLL.

Potential Methodology Issues

It is possible that we saw spurious results due to reverse causality, especially with respect to the happiness results. It is most likely untrue that income is negatively associated with happiness, even in advanced countries where higher levels of income are associated with more responsibility at work and therefore more stress in general. In this situation it is more likely that happiness is U shaped, where it increases with income until a certain point and then begins decreasing again. These results, in combination with the fact that the neither the happiness nor the satisfaction variables reacted in a way similar to the other dependent health outcome variables, leads this paper to

conclude that perhaps these two variables are not indications of health outcomes as hypothesized. They cannot be conclusively excluded until more research has been done, perhaps expanding on the independent variables as a good first step.

Reverse causality was a potential issue in the case of cases of happiness and satisfaction. According to our hypothesis, expenditure should not be a significant factor in determining health outcomes and we expect to see negative relationships as those who are less health would, in theory, spend more to increase health outcomes. We expected happiness and satisfaction to follow this reasoning but satisfaction had a positive relationship with expenditure and a significant and positive relationship between happiness and expenditure. These results would suggest potential reverse causality except that expenditure also had significant and negative (but outcome improving) relationships with other health outcomes variables; specifically life expectancy and PYLL. These results suggest that the hypothesis is flawed.

Another potential cause for the unexpected results with happiness was the inclusion of environmental factors. It follows that typically, and especially for the US, as a country develops and becomes wealthier, it tends to have a larger carbon footprint. This causes the denominator to grow larger in the happiness calculations and results in lower levels of happiness. As the environment does not have immediate, direct effects on health outcomes, it causes the true relationship between happiness and health outcomes to be skewed. Until other data is available on happiness in the future, the HPI

happiness data should be used only in studies focusing on interactions with the environment.

There were a few data issues encountered specifically with the country Luxembourg. According to the OECD, Luxembourg had the lowest level of education during the time period analyzed, ranging between 9 and 12 percent. It is difficult to accept that one of the richest per capita countries had such low levels of higher education enrollment for students recently out of high school, especially when compared to much poorer countries like Estonia and Chile. Therefore we must hypothesize that there is another factor at work here. A parsimonious explanation would be that perhaps students moved to other countries to attend school, as the European Union allows ease of movement between countries, especially for those seeking employment or education. Since the variable PercentHigherEd does not specify whether this value includes students who travel to other countries, this is most likely the situation.

A common problem in the field of health economics is the heterogeneity found when comparing countries. Some studies alleviated this issue by only examining the healthcare systems in a single country, or highly similar region of countries. For example, Cremieux, Ouellette, and Pilon (1999) analyzed only the healthcare in Canada. This is a relatively large region governed by one entity and is therefore highly homogenous. Comparing countries over time is a very good way to determine the overall effect of expenditure on healthcare but it does not take into account

technological growth and medical advancements and knowledge. In this study, F tests revealed that the use of time fixed effects to account for commonalities across time was unnecessary, most likely because of the short time period used. Unfortunately a lack of complete data forced this study to exclude any other years in the analysis, but upon gaining access to greater time periods, pursuing this study further may be useful in the field of health economics.

A concern for this paper was the presence of multicollinearity. This was apparent in the results and after testing was found to be high. After creating a correlation matrix to show the degree of relationship between the independent variables, it was concluded that the variables GDP per capita and total population were highly correlated with the other variables. GDP per capita, or income, was likely to be related with health expenditure, as wealthier countries have the funds to spend more on health. Total population was likely to be highly correlated with the proportions of the population below 15 and above 64. In addition, the two variables were highly related with each other as well. Once GDP per capita and total population were removed, multicollinearity did decrease drastically. The future exclusion of these variables will likely yield different results and may be considered as an extension to this work.

A common issue encountered in other analysis is that of differing levels of investment. The United States invests heavily in healthcare innovation compared to that of other countries and this leads to relatively higher healthcare expenditures according to Anderson, Hurst, and Hussey (2000). While the United States spends the most on

healthcare every year, it might also be sharing its knowledge and technology with other countries, therefore eliminating the need for those countries to spend as much on healthcare. It is also possible that differing levels of spending are related to income distribution. The wealthiest individuals, and therefore highest spenders, may be skewing the average spending for the overall population. Measuring this transfer in terms of money is nearly impossible and makes estimating the value of healthcare unfeasible. It is worth noting that more research in this area may help explain some of the differences in health expenditure.

Based upon the findings of this research, there are limited suggestions to be made concerning changes in current policies. Spithoven (2009) attributes differences in health expenditure across countries to diverse national cultures. He specifically compares Canada to the US stating that the concern in Canada is one of macroeconomic efficiency, where people are more concerned with income protection against exorbitant medical fees and equity in access across income brackets. The US appears to be more focused on microeconomic efficiency, he argues, and is more concerned about freedom of choice for patients and limited government intervention. This difference in national culture may be the reason why the US allows the market to lead the health care system instead of the government mandating universal access. Scheiber and Poullier (1989) question whether there may be more worthy projects being crowded out.

These theories give rise to serious concerns about implementing health care policy changes. The US is divided as to whether health care should be a right or as some

coin it, a 'privilege.' Based on the findings in this study, it is clear that health expenditure is still a very important factor in health outcomes, as it is statistically significant for both life expectancy and PYLL, but the results are not so economically significant as in both cases the US would need to spend about three times the average rate of other OECD countries to achieve marginal improvements. These marginal improvements coupled with the fact that the US already spends more than twice the amount per capita on health, is evidence that there are other factors affecting health outcomes that should be included.

Implications

This issue is of extreme importance in our country today because the political landscape is changing and government is instituting bills on healthcare reform. Many in the United States are worried that government intervention will drive down the competition and upset the market for healthcare. Those working in the healthcare field are concerned with joblessness and pay reduction. Some critics wonder whether or not the healthcare in the United States will be worth having once lack of competition drives down the quality.

To answer the concerns of Americans it is necessary to look at other countries with similar economies and determine the effects that socialized healthcare had on their institutions. Western Europe has a relatively similar structure to the United States and most of these countries do have some form of public healthcare available. The question that must be answered is, compared to the expenditures of similar nations on

healthcare, is the healthcare in the United States the best? Or perhaps more directly, do higher levels of spending on healthcare directly correlate with better healthcare?

The immediate response may be to suggest that the United States adopt some form of socialized healthcare to equalize the healthcare outcomes between the US and most of the other high performing healthcare systems of the OECD. Before suggesting such a drastic change it is necessary to determine whether such change is requisite. Instituting universal healthcare in the US may be much more complicated than politicians are suggesting. Public goods have the tendency to be overused and therefore abused and healthcare would be no exception. The price of insurance would most likely increase because covering the entire population opens companies up to higher levels of risk compared to insuring only those that are healthy enough to work full time. Finally, there are concerns about universal healthcare driving down the competition in the healthcare market and decreasing healthcare workers' wages.

The data shows an inconsistency with the amount of expenditure being used on health in the US and the levels of the health outcomes. The US is one of the wealthiest countries in the world and as the charts earlier in this study show, its health expenditure is also considerably higher than the mean of all other OECD countries. This leads researchers to question why. Why does the US spend so much on health care? Why are the health outcomes in the US lacking? This paper hypothesized that the answer would be found by introducing lifestyle variables into the analysis. Once lifestyle variables were

included, we hypothesized; expenditure would no longer be a significant factor in the determination of health outcomes.

Contrary to this hypothesis, this research found that health expenditure did not completely lose significance. It remained a statistically significant factor in determining life expectancy, PYLL, and happiness. Based on previous literature, the lifestyle variables, which included education, alcohol, and tobacco consumption, were hypothesized to be significant factors affecting health outcomes. The final results were not as strong as expected, especially with regards to happiness and satisfaction results.

Unfortunately, this paper does not contain a definitive solution for the US's problem of relatively low health outcomes despite absolutely high health expenditure, as this is a simplified version of a much larger and complicated situation. What this study does provide is some insight into an area that needs further exploration. If increasing health expenditure were the only solution to problems with health outcomes then the US would be a leader in health. As we know this is untrue and see that lifestyle variables such as education, alcohol consumption, and tobacco consumption do have some statistically and economically significant results.

Policy makers need to take these lifestyle factors into account when deciding the direction of health care for the US. It is clear that while health expenditure is statistically significant, it holds very little economic significance in improving health outcomes. The solution to deficient health outcomes is not whether to simply spend more or less, but to redirect spending to other areas. Specific ways to address lifestyle variables include

more spending in schools to ensure success in primary and secondary education, in turn encouraging post-secondary attendance. Policy makers should also consider campaigns focused towards the population most at risk, to reduce tobacco use and decrease alcohol consumption. While the solution is as complex as the problem, refocusing expenditure to improving lifestyle choices is an appropriate first step.

As previously discussed, happiness and satisfaction did not react in a way that suggested they were a good measure of health. This should not exclude them from further use in health research as other studies, such as that of Helliwell and Putnam, found them to be related to health. Lifestyle factors were both statistically and economically significant, especially tobacco consumption. This shows the importance of including lifestyle factors in the analysis of health outcomes and should be continued in the future when more data is available. It is most important to note that health expenditure remained significant for 3/5 independent variables even after the inclusion of lifestyle variables. While it was statistically significant it was not as economically significant as the lifestyle variables, especially tobacco consumption. While a large increase in expenditure would produce a minimal increase in health outcomes, a moderate decrease in tobacco consumption could produce even greater improvements in health outcomes. If this situation is upended, a large decrease in expenditure would only negatively affect health outcomes minimally, and if supplemented by decreases in tobacco consumption, there may even be improvements in health outcomes.

Now we will address the major question that results from this study. Why does the US spend so much on health care? There are a myriad of answers to this question and following are a few relevant options for this study. The first may be that the US only appears to spend the most because there is an unequal distribution of spending. Just as the income in the US is unequally distributed, where the top ten percent of the population earns considerably more than the bottom ninety percent, so is expenditure on healthcare. If income distribution were considered into the analysis, perhaps the US would fare better compared to other OECD countries. Another variable to consider is the allocation of health expenditure in different countries. Before expenditure can be reduced, it is important to consider where this funding would have been allocated. It is common knowledge that physicians and health care workers are paid more in the US than other countries, but it is important to ensure that funding is not taken from worthier projects and therefore hinder the improvement of health outcomes.

Now we must begin formulating solutions to the problem. Spithoven argues that it is difficult to compare countries because of diverse national cultures. This makes comparing countries difficult and making specific and individual suggestions based on the results even more so. Because of this, it is safe to assume that there is no single system that will work for every country. As Anderson points out, it is important to acknowledge that the US would appear to spend more based solely on the fact that it is often the innovator of healthcare treatments and tools. Future research should include factors to capture this relationship. Scheiber and Poullier argue that spending in the US is potentially crowding out other, worthier projects. For example, if the US were to focus

more on preventive measures instead of curative, it could potentially cut spending drastically in the long run.

Based on the findings of this research, there should be more analysis into the cost of changing the healthcare system. We saw in the previous regressions that health expenditure remained a significant factor, despite the introduction of lifestyle variables. With this said, it is also important to note that education, alcohol, and tobacco were also significant factors in determining health outcomes. While expenditure was a statistically significant factor, tobacco's significance was the most economically significant in this study.

It is recommended that policy makers aiming to improve health outcomes in the US put more effort into reducing tobacco consumption and in turn, potentially increasing life expectancy. Allocating funding to worthy projects such as education about the effects of alcohol and tobacco specifically to groups of the population that may not know the severity of the situation may help improve health outcomes and also decrease healthcare costs in the long run since the focus becomes more preventative. It is possible that if the US's efforts were shifted from curative medicine to more preventative measures, such as increased education, and decreased alcohol and tobacco consumption, health outcomes would improve. Because the lifestyle variables were statistically significant factors in determining health outcomes, it follows that more research into this field and that of preventative measures should be continued.

Appendix

Table 1: Variable Definitions
Infant mortality: The number of deaths of children less than one year of age that occurred in a given year, expressed per 1000 live births.
Life expectancy at birth: Life expectancy at birth is the average number of years that a person at that age can be expected to live, assuming that age-specific mortality levels remain constant.
Potential years of life lost: PYLL is a summary measure of premature mortality, which involves adding up deaths occurring at each age and multiplying them with the number of remaining years to live until age 70, given as per 100,000 persons.
Happiness: The Happy Planet Index, or HPI, is calculated by dividing the number of healthy life years by the country's ecological footprint, where ecological footprint is the amount of land required to produce necessary resources and negate carbon emissions.
Satisfaction: Satisfaction is a self-rated measure calculated by asking respondents to rate their well-being on a scale of 1-10 using the question, "How satisfied are you with your life as a whole these day?" where one is the least satisfied and ten is the most satisfied.
Health Expenditure: Total health expenditure (both public and private) per capita, in US dollars (PPP)
Gross domestic product (per capita): The per person sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units.
Population: Total population, in millions
Urban Population: Proportion of the population living within an urban area
Percent Higher Education: Tertiary school enrollment (% gross) Gross enrolment ratio is the total enrollment in tertiary education regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.
Population less than 15: Proportion of the population below the age of 15
Population greater than 64: Proportion of the population above the age of 64
Alcohol consumption in liters per capita (age 15+): Annual consumption of pure alcohol in liters, per person, aged 15 years and over.
Tobacco consumption in grams per capita (15+): Annual consumption of tobacco items (e.g. cigarettes, cigars) in grams per person aged 15 years or more.

Note. The information in Table 1 is provided by the OECD, World Bank, and Happy Planet Index.

Table 2: Descriptive Statistics

Type	Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Dependent Variables	Infant Mortality	388	5.32	1.92	1.8	14.9
	Life Expectancy	404	77.60	2.61	67.60	82.6
	PYLL	425	4344.50	1487.43	2213.3	12357.5
	Happiness	275	40.73	6.34	22.03	61.34
	Satisfaction	275	7.26	0.56	5.09	8.46
Independent Variables	Health Expenditure	469	2158.28	1206.13	172.77	7719.63
	GDP per capita	396	19791.76	12054.96	1862.78	57111.93
	Population (millions)	396	35	53.8	.268	299
	Urban Population	396	74.93	11.15	51.1	97.22
	Population below 14	396	19.66	4.50	13.78	35.79
	Population above 64	396	13.54	3.44	4.53	20.25
	Alcohol	442	9.50	3.00	1.2	15.7
	Tobacco	294	1858.47	624.77	950	3741
	Percent Higher Ed	441	54.41	18.57	9.63	98.09

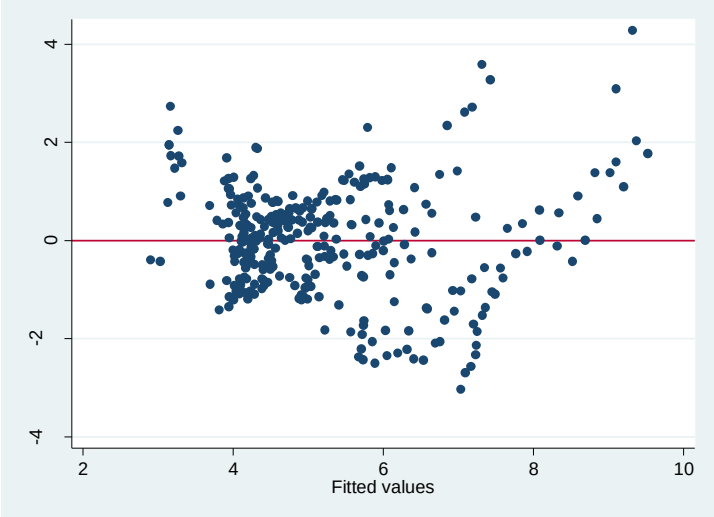
Note. The data in Table 2 was provided by the OECD, Happy Planet Index, and World Bank. Table 2 displays the descriptive statistics results of the data.

Table 3: Significant Input Variables by Health Outcome Variable

	Infant Mortality	Life Expectancy	PYLL	Happiness	Satisfaction	Total
Health Expenditure		.03	-.17	.14		3/5
GDP				-.2		1/5
Population		.07	-.52		.58	3/5
Urban Population	.02	-.001			-.01	3/5
Population below 15	.05			.05	.03	3/5
Population above 64	-.04	.002	-.03		.02	4/5
Percent Higher Ed	-.005		-.002			2/5
Alcohol	.03					1/5
Tobacco		-.02	.13			2/5

Note. The data in Table 3 was obtained from the OECD, Happy Planet Index, and World Bank. Table 3 displays the basic results from the regressions performed in this study.

Plot 1: Residuals



Plot 1 charts the residuals of the infant mortality regression

Chart 1: Correlation Matrix									
	Exp	GDP	Pop	Urb	<15	>64	Edu	Alc	Tob
Health Exp	1								
GDP	0.62	1							
Population	0.50	0.98	1						
Urban Population	0.33	0.06	0.01	1					
Population <15	-0.18	-0.06	0.04	0.26	1				
Population >64	0.26	0.09	-0.03	-0.06	-0.88	1			
Schooling	0.52	0.23	0.13	0.17	-0.21	0.31	1		
Alcohol	0.09	0.01	-0.07	-0.25	-0.62	0.47	0.03	1	
Tobacco	-0.26	-0.06	-0.01	-0.50	-0.26	0.11	-0.48	0.09	1

Table 4: Infant Mortality and Health Expenditure				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.361***	-0.0941**	-0.344***	-0.344***
	(0.0226)	(0.0448)	(0.0728)	(0.0756)
Log GDP per capita		-0.151***	-0.269*	-0.269*
		(0.0311)	(0.152)	(0.160)
Log Population		0.0277***	-0.0543	-0.0543
		(0.00878)	(0.245)	(0.349)
Urban Population		-0.00153	0.0206**	0.0206*
		(0.00133)	(0.00798)	(0.0115)
Population <15		0.0380***	0.0219**	0.0219*
		(0.00678)	(0.0102)	(0.0131)
Population >64		0.00344	-0.0504***	-0.0504***
		(0.00777)	(0.0104)	(0.00861)
Standard Errors	OLS	OLS	OLS	Robust
Constant	4.325***	2.693***	6.319	6.319
	(0.171)	(0.278)	(4.187)	(6.027)
Observations	382	341	341	341
R-squared	0.401	0.536	0.922	0.922

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 5: Life Expectancy and Health Expenditure				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.00956	0.0139	0.0280***	0.0280***
	(0.0253)	(0.0520)	(0.00405)	(0.00548)
Log GDP per capita		0.0874**	0.00966	0.00966
		(0.0362)	(0.00875)	(0.00860)
Log Population		0.0246**	0.0709***	0.0709***
		(0.0102)	(0.0149)	(0.0122)
Urban Population		-0.0135***	0.000155	0.000155
		(0.00144)	(0.000477)	(0.000484)
Population <15		0.0128	-0.00309***	-0.00309***
		(0.00789)	(0.000593)	(0.000634)
Population >64		-0.0229**	0.00200***	0.00200***
		(0.00906)	(0.000623)	(0.000541)
Standard Errors	OLS	OLS	OLS	Robust
Constant	4.371***	4.040***	2.897***	2.897***
	(0.191)	(0.319)	(0.247)	(0.224)
Observations	398	356	356	356
R-squared	0.000	0.236	1.000	1.000

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 6: Potential Years of Life Lost and Health Expenditure				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.354***	-0.114***	-0.271***	-0.271***
	(0.0157)	(0.0377)	(0.0295)	(0.0331)
Log GDP per capita		-0.146***	-0.0410	-0.0410
		(0.0268)	(0.0621)	(0.0683)
Log Population		0.0122*	-0.642***	-0.642***
		(0.00630)	(0.109)	(0.113)
Urban Population		-0.00261**	0.00628*	0.00628
		(0.00105)	(0.00372)	(0.00398)
Population <15		0.00917*	0.00747*	0.00747
		(0.00517)	(0.00427)	(0.00511)
Population >64		0.000224	-0.0286***	-0.0286***
		(0.00667)	(0.00462)	(0.00557)
Standard Errors	OLS	OLS	OLS	Robust
Constant	10.98***	10.41***	21.10***	21.10***
	(0.119)	(0.225)	(1.810)	(2.052)
Observations	418	362	362	362
R-squared	0.550	0.586	0.980	0.980

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 7: Happiness and Health Expenditure				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.100***	-0.117***	0.126**	0.126**
	(0.0192)	(0.0370)	(0.0510)	(0.0627)
Log GDP per capita		0.0117	-0.645***	-0.645***
		(0.0307)	(0.118)	(0.140)
Log Population		0.0139**	0.372	0.372
		(0.00612)	(0.295)	(0.366)
Urban Population		-0.00154	0.0136**	0.0136**
		(0.00101)	(0.00606)	(0.00685)
Population <15		0.0171***	-0.0117	-0.0117
		(0.00658)	(0.00789)	(0.0151)
Population >64		0.0300***	0.00182	0.00182
		(0.00862)	(0.00767)	(0.00769)
Constant	4.458***	3.603***	1.885	1.885
	(0.147)	(0.298)	(4.519)	(6.113)
Observations	275	275	275	275
R-squared	0.090	0.175	0.890	0.890

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 8: Satisfaction and Health Expenditure				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	0.0735***	-0.00652	0.000858	0.000858
	(0.00873)	(0.0101)	(0.0214)	(0.0462)
Log GDP per capita		0.0974***	-0.0318	-0.0318
		(0.00839)	(0.0495)	(0.0801)
Log Population		-0.00894***	0.570***	0.570***
		(0.00167)	(0.124)	(0.219)
Urban Population		0.00125***	-0.00612**	-0.00612***
		(0.000275)	(0.00254)	(0.00212)
Population <15		0.00503***	0.00929***	0.00929
		(0.00179)	(0.00331)	(0.00788)
Population >64		-0.00766***	0.0107***	0.0107**
		(0.00235)	(0.00322)	(0.00494)
Constant	1.419***	1.129***	-7.019***	-7.019*
	(0.0668)	(0.0813)	(1.894)	(4.147)
Observations	275	275	275	275
R-squared	0.206	0.740	0.919	0.919

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 9: Infant Mortality, Health Expenditure, and Lifestyle Variables				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.361***	-0.0711	-0.140	-0.140
	(0.0226)	(0.0579)	(0.0911)	(0.0990)
Log GDP per capita		-0.146***	-0.0949	-0.0949
		(0.0365)	(0.180)	(0.211)
Log Population		0.0674***	-0.126	-0.126
		(0.0122)	(0.247)	(0.303)
Urban Population		0.000910	0.0201**	0.0201**
		(0.00168)	(0.00883)	(0.00887)
Population <15		0.0418***	0.0494***	0.0494**
		(0.0110)	(0.0140)	(0.0202)
Population >64		-0.0307**	-0.0405***	-0.0405***
		(0.0128)	(0.0125)	(0.0112)
Percent Higher Ed		-0.00117	-0.00510***	-0.00510***
		(0.00114)	(0.000918)	(0.00107)
Log Alcohol		0.206***	0.0307	0.0307*
		(0.0419)	(0.0313)	(0.0166)
Log Tobacco		0.0737	0.109	0.109
		(0.0564)	(0.0694)	(0.0724)
Standard Errors	OLS	OLS	OLS	Robust
Constant	4.325***	1.095	3.038	3.038
	(0.171)	(0.680)	(4.432)	(5.925)
Observations	382	207	207	207
R-squared	0.401	0.601	0.952	0.952

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 10: Life Expectancy, Health Expenditure, and Lifestyle Variables				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.00956	0.00691	0.0305***	0.0305***
	(0.0253)	(0.00580)	(0.00458)	(0.00454)
Loge GDP per capita		0.0246***	0.00841	0.00841
		(0.00369)	(0.00905)	(0.00937)
Log Population		-0.000643	0.0721***	0.0721***
		(0.00123)	(0.0125)	(0.0137)
Urban Population		0.000384**	-0.00102**	-0.00102*
		(0.000169)	(0.000446)	(0.000521)
Population <15		-0.00170	-0.00135*	-0.00135
		(0.00112)	(0.000707)	(0.00114)
Population >64		0.000186	0.00146**	0.00146**
		(0.00129)	(0.000633)	(0.000714)
Percent Higher Ed		0.000270**	6.12e-05	6.12e-05
		(0.000114)	(4.64e-05)	(4.21e-05)
Log Alcohol		-0.0177***	-0.000164	-0.000164
		(0.00424)	(0.00159)	(0.00148)
Log Tobacco		0.0176***	-0.0167***	-0.0167***
		(0.00571)	(0.00351)	(0.00304)
Standard Errors	OLS	OLS	OLS	Robust
Constant	4.371***	3.964***	3.060***	3.060***
	(0.191)	(0.0689)	(0.224)	(0.257)
Observations	398	210	210	210
R-squared	0.000	0.652	0.990	0.990

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 11: PYLL, Health Expenditure, and Lifestyle Variables				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.354***	0.00754	-0.174***	-0.174***
	(0.0157)	(0.0424)	(0.0498)	(0.0550)
Log GDP per capita		-0.206***	0.0117	0.0117
		(0.0275)	(0.105)	(0.120)
Log Population		0.0414***	-0.517***	-0.517***
		(0.00731)	(0.149)	(0.137)
Urban Population		-0.00576***	-0.00153	-0.00153
		(0.00122)	(0.00528)	(0.00560)
Population <15		0.0257***	0.0147*	0.0147
		(0.00837)	(0.00842)	(0.0120)
Population >64		-0.000551	-0.0250***	-0.0250***
		(0.00972)	(0.00755)	(0.00777)
Percent Higher Ed		-0.00243***	-0.00148***	-0.00148**
		(0.000835)	(0.000505)	(0.000578)
Log Alcohol		0.168***	0.0140	0.0140
		(0.0318)	(0.0189)	(0.0175)
Log Tobacco		-0.225***	0.133***	0.133***
		(0.0423)	(0.0412)	(0.0355)
Standard Errors	OLS	OLS	OLS	Robust
Constant	10.98***	10.97***	17.31***	17.31***
	(0.119)	(0.516)	(2.653)	(2.695)
Observations	418	220	220	220
R-squared	0.550	0.684	0.976	0.976

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 12: Happiness, Health Expenditure, and Lifestyle Variables				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	-0.100***	-0.0948**	0.138**	0.138**
	(0.0192)	(0.0464)	(0.0620)	(0.0547)
Log GDP per capita		0.0815*	-0.195	-0.195*
		(0.0416)	(0.127)	(0.113)
Log Population		-0.0199***	0.480	0.480
		(0.00759)	(0.344)	(0.372)
Urban Population		-0.000902	0.000445	0.000445
		(0.00122)	(0.00618)	(0.00609)
Population <15		-0.0203**	0.0475***	0.0475***
		(0.00964)	(0.0129)	(0.0112)
Population >64		0.00924	0.000534	0.000534
		(0.00976)	(0.00883)	(0.00801)
Percent Higher Ed		-0.00337***	0.000523	0.000523
		(0.00101)	(0.000557)	(0.000512)
Log Alcohol		-0.0688*	-0.0141	-0.0141
		(0.0360)	(0.0196)	(0.0103)
Log Tobacco		-0.0848*	-0.0386	-0.0386
		(0.0500)	(0.0479)	(0.0377)
Constant	4.458***	5.247***	-4.333	-4.333
	(0.147)	(0.706)	(5.775)	(6.130)
Observations	275	170	170	170
R-squared	0.090	0.336	0.942	0.942

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

Table 13: Satisfaction, Health Expenditure, and Lifestyle Variables				
	(1)	(2)	(3)	(4)
VARIABLES				
Log Health Exp	0.0735***	-0.0195	0.0365	0.0365
	(0.00873)	(0.0139)	(0.0409)	(0.0429)
Log GDP per capita		0.118***	0.0335	0.0335
		(0.0125)	(0.0834)	(0.0775)
Log Population		-0.0167***	0.580**	0.580**
		(0.00228)	(0.227)	(0.279)
Urban Population		0.00196***	-0.0109***	-0.0109***
		(0.000365)	(0.00407)	(0.00387)
Population <15		-0.00657**	0.0252***	0.0252*
		(0.00290)	(0.00853)	(0.0150)
Population >64		-0.0160***	0.0181***	0.0181***
		(0.00293)	(0.00582)	(0.00564)
Percent Higher Ed		0.000215	-0.000286	-0.000286
		(0.000303)	(0.000368)	(0.000404)
Log Alcohol		0.00638	0.00696	0.00696
		(0.0108)	(0.0129)	(0.00780)
Log Tobacco		-0.0187	0.0140	0.0140
		(0.0150)	(0.0316)	(0.0252)
Constant	1.419***	1.554***	-8.213**	-8.213
	(0.0668)	(0.212)	(3.808)	(5.291)
Observations	275	170	170	170
R-squared	0.206	0.779	0.907	0.907

Note. The standard errors are in parentheses and significance is denoted as *** for p<0.01, ** for p<0.05, * for p<0.1. The country fixed effects are used in all regressions. Based on the results of an F test, time fixed effects were not included. Robust standard errors are used in the final regression equations whose results are displayed in column 4. All data is provided by the OECD, World Bank, and Happy Planet Index.

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