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**Self-Reported Dietary Behavior and It's Effects on Healthcare Expenditures For  
Wellness Participants at the University of Kentucky**

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*Selected Paper prepared for presentation at the Agricultural & Applied Economics  
Association's 2011 AAEA & NAREA Joint Annual Meetings, Pittsburgh, Pennsylvania,  
July 24-26, 2011*

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# **Self-Reported Dietary Behavior and It's Effects on Healthcare Expenditures For Wellness Participants at the University of Kentucky**

**Michelle Kibler**

## **Introduction**

The United States Department of Agriculture (USDA) promotes recommended daily serving amounts for specific groups of foods. The USDA illustrates food groups with a graphic known as My Pyramid. Established in 1992, the Food Guide Pyramid provided a way for people to visually identify recommended daily consumption of seven food "groups". The pyramid was altered slightly in 2005, now operating under the name My Pyramid, to provide a more user friendly visual aid. The pyramid's website is now interactive and can accommodate for differing age groups and various exercise levels. With so many resources available to consumers regarding proper nutrition, it is hard to imagine that the United States can have such high rates of obesity and disease associated with dietary habits(Kennedy Blaylock & Kuhn). Obesity and diseases, such as hypertension, diabetes and cancer, generate high health care costs, especially as the rates of these conditions are on the rise. Improved eating patterns, such as a food guide, may begin to reduce the incidences of said diseases and thus begin to decrease health care expenditures.

This study will analyze self-reported food servings provided through a health assessment. Participants of the health assessment are University of Kentucky health plan members who are enrolled in the workplace wellness program Healthtrac Rewards, an incentive-based wellness program provided to university faculty and staff who are enrolled with UK healthcare. Participating in Healthtrac is optional and the first requirement of the program is completion of a health assessment. The assessment inquires about specific foods and the weekly amount of servings consumed by the

individual. The hypothesis to be tested will use summed health care expenditures for a given year as the dependent variable. Independent variables will include demographics, previous expenditures and reported weekly food servings.

## **Importance**

It is impossible to avoid media ads regarding weight loss, cereals promising to reduce cholesterol or other food's claiming to improve heart health. Ads regarding health swamp television, radio and the internet. Most talk-show television and radio programs speak on some aspect of human health regularly. The flood of media attention to health addresses the growing concern over these diseases that continue to cause health expenditures to increase and kill many Americans every day. Studies have shown that specific food groups are correlated with positive and negative health care expenditures (Curtis & McCluskey, 2004). Obesity, for example, can be linked directly with processed foods. While obesity is not considered a cause of death it is linked to many of the leading causes of death such as high blood pressure (Kennedy, Blaylock and Kuhn). While obesity is not considered a cause of death it is linked, if not directly connected, to hypertension, accounting for nearly 26-28% of all cases of high blood pressure (Obesity Action Coalition). It is estimated that the health condition of hypertension generates health care costs of over \$18 billion (Kennedy, Blaylock and Kuhn). This is true of many other diseases that may be made preventable by alterations, moderations and monitoring diet. As a result, many health care providers seek to improve the health of their members. This effort includes promoting healthy eating habits and thus reducing the risk of expensive diseases.

## **Background**

The United States, along with other nations, have adopted fast-paced, "need-it-now" societies. This can be seen in ever-faster internet connections, instant email updates and fast-food restaurants.

With the desire for things to get done faster, processed food has allowed for quick meals on-the-go or at home. While a box of Hamburger-Helper may provide for a quick and convenient meal choice for a busy lifestyle, it does not provide the essential nutrients needed for a healthy diet. What's worse is the risk processed foods place on an individual's health, increasing the chances of developing coronary heart disease or diabetes. Processed foods provide not only convenience but also have longer shelf-life than their non-processed counter-parts and may be significantly less expensive.

In recent years, a push towards healthier lifestyles and eating habits has emerged. This can be seen where many food choices at grocery stores offer low-fat, non-fat, low sodium or lower calorie options. Many restaurants provide consumers with healthy alternatives to greasy or high-fat menu items. However, even with the increased promotion for healthier food, the numbers for disease and obesity remain alarming causing health care costs to remain high.

### **Economic Theory, Methods and Data Sources**

People choose what foods to consume each day. In economics, it is believed that consumers make rational decisions about what and how much to consume to reach maximum utility. However, when it comes to food choices, many consumers act against rational economic decisions trading long-term health risks for immediate satisfaction (Just and Payne, 2009). Consumers may make irrational decisions for a number of reasons, lack of time, monetary resources or lack of information.

In a study similar to this, consumption in China was used to explain health care expenditures per household. In contrast to this study, the expenditures were those paid out by the household including doctor visits, hospitalization, missed work and travel expenses. This study will examine the health care expenditures paid out by the university's health care provider. A Tobit model was used in the 2004 study due to the nature of the variables used in the study. This may make sense in a study so similar that the only difference is the payer of expenditures. (Curtis and McCluskey, 2004)

Nearly all studies regarding daily food servings and health expenditures gathered data from survey information. The survey data was self-reported and included random samples of specific populations.

### **Conclusions of Previous Studies**

The studies review showed overwhelmingly that the type of food consumed is highly correlated to disease and weight gain. This is not necessarily a surprise but the time spent and medical costs may be much higher than expected. It is estimated that obesity generated costs of \$117 billion per year in direct and indirect costs to the United States (Kuchler and Ballenger, 2002). Estimated medical costs in 1994 for coronary heart disease, cancer, diabetes and hypertension were \$39.8 billion, \$47.4 billion, \$52.8 billion and \$18.3 billion respectively (Kennedy, Blaylock and Kuhn). What is obvious is the desire to improve dietary behavior in an effort to reduce healthcare costs and promote healthier living practices. Policy makers, healthcare providers and employers have increasing incentives to encourage employees to adopt better eating habits in order to reduce overall expenditures on healthcare. It is important to note that while the costs of disease are staggering, increased productivity in the form of less sick days is expected from healthier lifestyles as well.

Evidence for certain food groups' promotion of health has been well documented. The model specified in this paper will attempt to explain health care costs using self-reported food consumption including other self reported factors. While eating habits may be an indicator of poor health (or good health), it is certainly one of many possible lifestyle choices that may influence health. Because of this, the model will attempt to add as many of these other influences as possible to assume the correct model.

## Data

Data used for this study was provided by the University Health and Wellness program. Several data sets were merged to produce one larger data set with many variables, either self-reported or provided by the University of Kentucky and/or the university's health care provider. The university's health and wellness program, which provides monetary incentives to its participants, requires a health assessment survey upon enrollment into the program. This assessment provides self-reported responses from program members regarding eating choices, health history, and family health history among other things. Another data set provides health care expenditures by year, the diagnosis associated with the expenditure and prescription costs. The observations used in this study are only those who are considered participants of the wellness program. Since it is a requirement of the wellness program for participants to be members of the university's health care plan, expenditure data can be broken down into specific diagnosis, prescription costs and preventative doctor visits. These preventative visits include cancer screenings, mammograms or any other visit designed to prevent a future diagnosis. These types of doctor visits will add expenditures to the health care plan but are designed to reduce future expenditures.

The model to be estimated is

$$(1) y_i = \alpha + x_i\beta + \epsilon_i$$

The dependent variable,  $y_i$ , are the 2009 health care expenditures<sup>1</sup>. Explanatory variables are represented by  $x_i$  and are shown in their entirety in **Table 1**, along with definitions for each variable.

Independent variables include, but are not limited to, 2008 health assessment responses to food, age, gender, reported stress in 2008 and the diagnosis costs from 2008. The error term will be denoted by  $\epsilon_i$ .

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<sup>1</sup> These health care expenditures include all costs associated with diagnosis 2 through diagnosis 4. This excludes costs associated with preventative visits.

There are several possible dependent variable possibilities given the data available. It is clear that the left side variable will be health expenditures in some form. A Box-Cox test was performed to determine the use of natural logs for 2009 expenditures. The dependent variable includes 2009 expenditures less preventative costs as those visits are expected to prevent future health care expenditures. For this analysis diagnosis were broken down into categories. Using the ICD-9 codes, plan costs were divided up into three categories; RX prescription costs, preventative visits and diagnoses costs. Circulatory diseases (390-459) include hypertension and heart disease. Endocrine/nutritional/metabolic diseases (240-279) include nutritional deficiencies, diabetes and hypothyroidism. Respiratory diseases (460-519) represent lung disease, pneumonia and influenza among others.

The most frequent preventative visits are included and broken down into four sub-categories. General health checkups (V70 or V20.2) are routine medical exams at a health care facility. Cancer screenings (V76.0 – V76.9) include all examinations for malignant neoplasms. These can be cancer screenings for the skin, breast, prostate or respiratory organs just to name a few. Gynecological exams (V72.3) are routine exams and follow up exams after abnormal findings. Endocrine/nutritional/metabolic disease screenings (V77.0 – V77.9) are special screenings that include, but are not limited to, screenings for thyroid disorders, diabetes, gout, and obesity. It is important to distinguish between preventative type visits and all other visits since preventative procedures detect potential health issues early on. Early detection of diseases or health issues can reduce the amount of prescriptions, hospital stays and overall health costs a person might be subject to. While preventative costs are incurred, they should not be included in diagnosis costs or prescription costs and can be used as an explanatory variable instead.

## Empirical Method

While the dependent variable can include all cost listed as preventative, prescription and diagnoses, it may be more advantageous to restrict this left-side variable as 2009 expenditures less preventative costs. This study attempts to show impacts of lifestyle choices on health care expenditures. Previous scientific research has shown that factors such as food choices can positively or negatively impact a person's health. It can also be implied that participating in preventative type activities would detect problems at an early stage and prevent many future health care costs. A person who elects preventative behavior should have lower diagnosis costs associated with them. Inversely, someone who has high prescription costs will likely have high diagnosis costs requiring the need for prescriptions. Other explanatory variables in the model have similar expectations on the dependent variable. The 2009 expenditures less preventative costs should be directly connected to 2008 expenditure costs for chronic conditions. However, someone may have a high number of doctor visits in the previous year due to an ailment, such as a broken bone, that may have no bearing on 2009 expenditures. An explanatory variable for self-reported stress level in 2008 has been added. High stress levels are thought to have negative impacts on health and may have positive impacts on 2009 costs. Finally, a binary variable for high blood pressure will attempt to explain 2009 expenditures since high blood pressure, stress and prescriptions may be linked to health problems. The model to be estimated is:

$$Lndiagcost09_i = sumdiag08_i + sumpres08_i + lnprevcost08_i + reportedstress08_i + highpb_i + butter08_i + icecream08_i + deficientfood08_i + alcohol08_i + diabetes_i + age_i + age2_i + age3_i + male_i + \epsilon_i$$

As stated earlier, a Box-Cox was performed to determine the correct form of the model as log-linear. **Table 2** gives some summary statistics for the explanatory variables in the model, along with the expected sign of the given variable. Using the Food Guide Pyramid, food categories were broken down

into “good foods” and “bad foods”. The Pyramid provides the number of servings for the 5 major food groups on a daily basis. Taking these numbers and multiplying by 7 created the target serving consumption number. Each reported consumption of weekly servings was subtracted from the target serving number to generate a serving deficient number for “good foods”. For example, weekly serving requirement for vegetables is about 20, if the participant reported only consuming 15 the serving deficient number will be 5. Deficiencies of healthy foods are expected to have positive impacts on expenditures. Ice cream and butter are not a part of any food category on the Pyramid and are associated with unhealthier diets. Since the Food Guide Pyramid does not give suggested consumption for fatty foods, ice cream and butter are left to stand alone as regressors and would suggest positive impacts on health care costs. Recent research has shown that specific forms of alcohol, for example some red wines, in moderation, can have health benefits. However, while alcohol in moderation may not have negative impacts on one’s health, excess can have severe consequences. It can’t be predicted the impact alcohol will have on health expenditures.

Variables concerning previous year’s diagnoses, prescription, number of doctor visits, stress level or having high blood pressure are all expected to have positive impacts on expenditures. It is likely that a person who has health issues in the year previous will have high cost in a current year. Participants who elect to have preventative procedures are expected to reduce future cost and an expected negative sign for previous year preventative costs. Finally, the expected sign for age is positive and the expected sign for gender was not determined. It is reasonable to assume that as people age, they experience increased health costs.

**Table 3** compares 2008 averages to 2009 averages, showing differences between years. Of the data population 33% are male and the average age is 49. The number of diagnosis, preventative procedures and prescriptions remains nearly the same from 2008 to 2009. On average, participants had



additional prescription filled in 2008, 2009 expenditures increase on average 1.6% holding all else constant. In some cases, expensive health care events can occur (such as a broken bone), that do not impact the following year's expenditures. Chronic health conditions are expected to impact expenditures from one year to the next. Self-reported stress levels have a positive correlation to 2009 expenditures. For each additional point (on a scale from 1 to 100), 2009 expenditures increase ½%. The variable for high blood pressure was not significant.

Preventative procedure costs in 2008 were replaced as a regressor for the number of preventative procedures a participant elected to have in 2008. An inverse relationship to 2009 expenditures was observed for the natural log of 2008 preventative costs. A 1% increase in preventative costs in 2008 on average, results in a 4% decrease in 2009 expenditures holding all else constant. This result was expected as early detection of health concerns/conditions allows doctors to treat and resolve a potential health issue, preventing future expenditures.

Parameter estimates for the food variables were not significant excluding alcohol and vegetables. Due to the similarity of some of the food variables, a collinearity problem was considered. A variance inflation factor test was performed and results can be seen in Table 5. The test determined no multicollinearity between the food variables. While alcohol and vegetable variables are significant, the signs on the estimates are opposite of the anticipated. In an attempt to better explain a negative sign on alcohol, a breakdown of the variable was included. Recent studies have shown moderate consumption of alcoholic beverages has health benefits. The right-side variable for alcohol was broken down into moderate and heavy consumption. Moderate drinkers are those who reported consumption of 1 to 2 alcoholic beverages per day while heavy drinkers were those who consumed more than 2 drinks a day. Both moderate and heavy variables were significant and negative. While a negative estimate for moderate drinking can be explained there is no logical reason for a negative estimate on

heavy drinking. The single significant food variable for vegetables also has an unanticipated sign. Results showed for each additional serving of vegetables per week, a participant has \$0.01 increase in 2008 costs, *ceteris paribus*. While the known health benefits of vegetables is not shown in this result, the magnitude of the estimate is very low.

Estimates for gender and age are shown to be significant with anticipated signs. Women are thought to be more likely to go to the doctor and report illness. A positive, significant estimate suggests that women have 60% higher costs than males holding all else constant. A positive sign for age and negative sign for age<sup>2</sup> suggests that costs increase as people get older and begin to decrease again after a certain age.

## **Conclusion**

The results generated by the model did not produce unexpected results. The food variables proved to be either insignificant or having a sign that was not expected. Due to the nature of the collection process, the data may not represent true values for many of the explanatory variables used in the estimated model. Self-reported dietary behavior may not represent true values for weekly serving consumption. One aspect of the wellness program that has not been considered is the option participants have to receive a personal phone call from a wellness employee. This wellness employee has access to a participant's health assessment answers and provides a personal phone call each week to those participants who elect to receive it. Some participants may feel the need to give answers in the assessment that are closer to the "correct" answers to avoid negative consequences in the weekly phone call. In a study conducted by Miller, Abdel-Maksod, Marcus and Byers, discovered that when food intake is self-reported social approval bias can occur.

Results from this study have potential for significant impacts for decision makers in the wellness program. In assessing the effectiveness of the wellness program, program personnel may choose to

review these results when making necessary changes to the wellness curriculum. The insignificance of the food variables may provoke change for the health assessment. Requiring self-reporting of weekly food servings can be difficult for some people to answer since this may be difficult to figure out.

Another aspect of the program decision makers should consider is the monetary incentives provided for electing to have the personal phone call. People may gain more utility from the extra incentive because of the phone call than they gain from reporting truthfully on the assessment.