An Econometric Analysis of Obesity

Debarshi Dutta
Fordham University
The Graduate School of Arts and Sciences
The Bronx, New York City
Email: ddutta@fordham.edu

***Abstract*—There are multiple factors that affect obesity. Amongst them are- poverty, density of fast food restaurants in the locality and low proximity to a conventional grocery store. Conversely, people who live in the vicinity of fitness centers are more likely to participate in recreational activities and have shown to be less obese. The paper analyzes the role these conditions which constitute the standard of living and living conditions play in the cause of obesity.**

1. Introduction

According to the Centers for Disease Control (CDC), a person is obese [1] when their calculated Body Bass Index (BMI) is 30.0 or higher. There have been substantial efforts made to curb the rise of obesity but there is a lack of evidence of clear success thus far. Data collected by the CDC in 2017-2018 indicate that a whopping 42.4% of American adults are considered obese, while obesity affects 13.7 million children and adolescents aged 2-19 years, which is about [2] 18.5% . Despite an increasing recognition of the problem, obesity continues to grow in the United States and the world at large. The problem is pervasive. The convoluted nature of obesity makes it one of the most difficult public health issues that confronts our society at this point.

1.1. An Overview of Obesity

Besides the CDC, the most comprehensive data regarding the proliferation of the epidemic has been provided by the National Health and Nutrition Examination Surveys (NHANES). An analysis of the NHANES data published during 2007-2008 was done by [3] Katherine M Flegal et al. The data indicates obesity rates for adults have been gradually on the rise over the past 30 years or so. In fact, the NHANES data indicates that approximately 68% were overweight or obese, and approximately 34% were obese. So there has been an approximate increase of 8% in obesity in adults in the United States over a span of twelve to thirteen years.

Obesity by itself is a recognized disease, but can be the source of a number of other diseases. Some of these [4]are-

1) Type 2 diabetes and prediabetes
2) Coronary artery disease (CAD)
3) Cancer
4) Sleep apnea
5) [5] With the rise of obesity amongst children and adolescents, they are beginning to develop risk factors for chronic diseases usually seen much later in life, such as dyslipidemia, hypertension, and hyperinsulinemia
6) An increased number of obese children and adolescents are now being diagnosed with type 2 [6] diabetes. This is especially troubling because this disease was virtually nonexistent in this particular population a few generations ago.

2. Literature Review

[7]David Hughes et al analyzes obesity from the economic point of view in the United Kingdom. Besides the conventional economic analysis prevalent in healthcare studies namely cost minimization, cost effectiveness, cost benefit and cost utility, the paper introduces burden of illness and cost of illness analysis in the disease area of obesity. These two metrics gauge the finances and resources required to treat an illness over a given period. They indicate the full cost (measured in terms of mortality and morbidity as well as treatment resource costs) imposed by a disease on society. Here the approach introduced by [8] Colditz in 1986 and then revised in 1990 by Wolf and Colditz [9] to find the cost of treating obesity as a disease is of particular interest. The total cost of treating obesity in the US in 1986 was $39.3 billion, while the number rose to $45.8 billion by 1990, which was 6% of the overall health care expenditure. The enormity of this number has been attributed to the fact that obesity invariably leads to other diseases and the cost of treating these co-morbidities gets added to the amount. For instance, 27% of Cardiovascular diseases is diagnosed in obese individuals and that, among the obese, 70% of CVD is attributable to obesity. 19% (0.27 x 0.70) then of the estimated aggregate cost of treating CVD in the US can be attributed to the disease obesity.

The paper however merely glosses over the indirect costs associated with obesity. For instance, because of the nature of the disease and the co-morbidities it leads individuals may need to take time off work. The lose of revenue arising from

lost productivity to $20 billion for the US in 1986. There is also the significant psychological and social toll on obese individuals, which is recognized but unfortunately cannot be quantified. The author completely fails to mention relevant factors like prescriptions, operations or support groups. These factors may be difficult to quantify but are extremely useful in treating obesity and therefore significant. Isolated cases like an individual born with hereditary diseases like diabetes and an overall healthy individual contracting CVD are not taken into account as well. The paper is limited because it assumes the co-morbidities are primarily weight related.

[10]Revels et al predicts obesity rate and obesity related healthcare costs using data analytic techniques specifically the autoregressive integrated moving average or the ARIMA model trained using data from the CDC. The ARIMA model was designed using the Box Jenkins method. Prediction was done with 95% confidence levels. Their results predict around 45% of the population will be obese by the year 2035. The number becomes nearly 75% if the percentage of the population that is overweight is taken into consideration. The predicted expenditure rises by $2.2 billion from 2016 to 2035, which is an annual increase of around $118 million of healthcare expenditure associated with obesity.

The study is affected adversely by the fact that time series analyses using the ARIMA model will include noise in the computation by definition, though some of the methods implemented by the Box Jenkins method negates some of the noise. The study did not include indirect costs and all the co-morbidities associated with obesity. Finally, the costs related to the successful treatment of obesity was not considered.

Allison et al [11] provides an analysis on whether the medical cost of people who had returned to a normal-weight and lived longer differed from the medical costs of people who simply lived longer. In this approach the population was divided in 5-year increments starting from 20-24 age range. For each range, the probability of obesity, a base mortality rate due to obesity, and the per capita healthcare costs were calculated. After that, two sensitivity analyses were conducted: one that included mortality rates associated with obesity, and one that which didn't feature obesity. Their results indicate that when including the mortality rates associated with obesity in the model, the healthcare costs were about 25% less than the projected healthcare costs for non-obese individuals.

There were a number of limitations in this study. The indirect costs of obesity do not feature at all. These costs however difficult to quantify are significant. The paper also assumes all co-morbidities are weight related and does not account for the isolated cases mentioned earlier. In addition the confidence intervals also appear to be too wide.

Thorpe et al [12] comments on the difference in healthcare spending between 1987 to 2001 on obesity, diabetes and hyperlipidemia for those considered obese and overweight. Healthcare spending on obesity increased by 51% relative to other categories over that period. In 2001, the spending on obese was 37.2% more than on individuals who fall within the normal weight range. This is an increase of 15.2% for the same category measured in 1987.

The paper does not take into account the issues associated with obesity can affect normal-weight individuals too. The co-morbidity list related to obesity included in the study does not consider gallbladder disease. The risk of gall bladder disease increases with a rise in BMI [13].

Finkelstein et al [14] used the Medical Expenditure Panel Surveys (MEPS) data from 1998 to 2006 and came to the conclusion that the approximate healthcare cost for an obese person is 42% higher than an individual considered within a the normal-weight range. One significant aspect of the paper is that it takes into account the indirect cost of prescription drugs- that amount is estimated to be around $7 billion for non-institutionalized obese patients in 1998.

There is an inherent flaw in the study because MEPS requires respondents to self-report their respective height and weights to calculate the BMI. There is also a bias in the reported numbers because MEPS only reports the non-institutionalized patients.

3. Need for Study

Obesity has been recognized as a disease by itself and it leads to other complications and illnesses as well. It is abundantly clear that the cost of treating obesity is a major draw on finances and resources. There are both direct and indirect costs involved, the latter of which are difficult to quantify but extremely significant. The expenditure to treat obesity and its related diseases have been rising for a while and the projections indicate the trend will continue. The situation is widespread across the world and the United States is not exempt from this.

It might be beneficial in this to take a step back and to survey and pinpoint the overarching factors that lead to obesity. This will lead to suitable policies being put into place and subsequent diversion of funds and resources to tackle the problem at a more grassroots level.

4. Data

The US Department of Agriculture publishes the Food Environment Atlas. The data from the USDA is collected from multiple sources and cover a range of years and geographic levels. [1] Obesity rates in the data set used in the paper are from 2010 released in 2011 by the USDA. The data is published in comma separated values format with variables aggregated on the respective worksheet.Each row in the data set contains food environment indicators for

1. Source: The United States Department of Agriculture (USDA)- Food Environment Atlas.

- The link for the data download available at https://www.ers.usda.gov/data-products/food-environment-atlas/data-access-and-documentation-downloads/
- The complete Food Environment Atlas Data Documentation available at- https://www.ers.usda.gov/webdocs/DataFiles/80526/archived_documentation_2011.pdf?v=3604.3

one of the U.S. counties. The data comprises of two hundred and eleven variables in three categories. They are-

1) Food Choices- the proximity of the population divided by counties to healthy, affordable food
2) Health and Well being- describes diabetes, and obesity rates
3) Community Characteristics- demography divided by age and race, income and poverty, metro and non metro status of a county, availability of recreational facilities.

5. Analysis

5.1.

1

5.2.

2

6. Conclusion

—

References

[1] "Defining adult overweight and obesity — overweight & obesity — cdc," https://www.cdc.gov/obesity/adult/defining.html, (Accessed on 12/01/2020).

[2] "Childhood obesity facts — overweight & obesity — cdc," https://www.cdc.gov/obesity/data/childhood.html, (Accessed on 12/01/2020).

[3] "Prevalence and trends in obesity among us adults, 1999-2008 - pubmed," https://pubmed.ncbi.nlm.nih.gov/20071471/, (Accessed on 12/02/2020).

[4] "Obesity: Overview of an epidemic," https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3228640/, (Accessed on 12/01/2020).

[5] "Cardiovascular risk factors and excess adiposity among overweight children and adolescents: The bogalusa heart study - sciencedirect," https://www.sciencedirect.com/science/article/abs/pii/S0022347606008171, (Accessed on 11/29/2020).

[6] "Type 2 diabetes among north american children and adolescents: an epidemiologic review and a public health perspective - pubmed," https://pubmed.ncbi.nlm.nih.gov/10802501/, (Accessed on 11/29/2020).

[7] "A review of the economic analysis of obesity - pubmed," https://pubmed.ncbi.nlm.nih.gov/9246835/, (Accessed on 11/26/2020).

[8] "Economic costs of obesity and inactivity - pubmed," https://pubmed.ncbi.nlm.nih.gov/10593542/, (Accessed on 12/07/2020).

[9] "Current estimates of the economic cost of obesity in the united states - pubmed," https://pubmed.ncbi.nlm.nih.gov/9545015/, (Accessed on 12/07/2020).

[10] "Predicting obesity rate and obesity-related healthcare costs using data analytics," file:///Users/debarshi/Downloads/Predicting_Obesity_Rate_and_Obesity-Related_Health.pdf, (Accessed on 11/29/2020).

[11] "The direct health care costs of obesity in the united states. — ajph — vol. 89 issue 8," https://ajph.aphapublications.org/doi/10.2105/AJPH.89.8.1194, (Accessed on 11/29/2020).

[12] "The impact of obesity on rising medical spending — health affairs," https://www.healthaffairs.org/doi/full/10.1377/hlthaff.W4.480, (Accessed on 11/29/2020).

[13] "Relation of regional gray and white matter volumes to current bmi and future increases in bmi: a prospective mri study — international journal of obesity," https://www.nature.com/articles/ijo2011175, (Accessed on 12/08/2020).

[14] "Annual medical spending attributable to obesity: Payer-and service-specific estimates — health affairs," https://www.healthaffairs.org/doi/10.1377/hlthaff.28.5.w822, (Accessed on 12/02/2020).