Title Page

**Obesity and Climate Change: Advocacy for a Brighter Future**

by

**Jesse Helfer**

BS, Kent State University, 2013

Submitted to the Graduate Faculty of the

Department of Health Policy and Management

Graduate School of Public Health in partial fulfillment

of the requirements for the degree of

Master of Public Health

University of Pittsburgh

2020

Committee Page

UNIVERSITY OF PITTSBURGH

Graduate School of Public Health

This essay is submitted

by

**Jesse Helfer**

on

April 21, 2020

and approved by

**Essay Advisor:** Gerald Barron, MPH, Associate Professor, Health Policy and Management, Associate Professor, Behavioral and Community Health Sciences, Deputy Director, Center for Public Health Practice, Graduate School of Public Health, University of Pittsburgh

Essay Reader: Martha Ann Terry, PhD, Associate Professor, Behavioral and Community Health Sciences, Graduate School of Public Health, University of Pittsburgh

Copyright © by Jesse Adam Helfer

2020

Title Page

Gerald Barron, MPH

**Obesity and Climate Change: Advocacy for a Brighter Future**

Jesse Adam Helfer, MPH

University of Pittsburgh, 2020

**Abstract**

Obesity and climate change are two concepts of public health importance that are explored and discussed in this paper. These two concepts have been explored in the literature. Obesity rates have continued to rise, and projections do not predict that the rates will subside within the near future. Individuals with obesity have more severe adverse health outcomes than individuals without obesity. These outcomes can affect the individual’s health and their finances. In the past 40 years, the financial burden attributed to obesity related issues has increased over 15 times. This includes surgical procedures and a decrease in work productivity.

Climate change, further escalated by the Industrial Revolution, has the potential to lead to dire circumstances. CO2 levels within the past 200 hundred years have increased significantly and show no signs of slowing down. Obesity rates and the effects of climate change are projected to increase over the next 50 years. The primary aim of this paper is to discuss the implications of obesity, climate change, and the interaction between them while advocating for initiatives that could curb the growing rates. Further study is required to research the impact of these topics.

Table of Contents

[1.0 Introduction 1](#_Toc38624122)

[2.0 Literature Review: Search Strategy 3](#_Toc38624123)

[3.0 Background 4](#_Toc38624124)

[3.1 Obesity 4](#_Toc38624125)

[3.2 Economics of Obesity 5](#_Toc38624126)

[3.3 Climate Change 9](#_Toc38624127)

[4.0 Obesity and Climate Change 11](#_Toc38624128)

[4.1 What is the Interaction? 11](#_Toc38624129)

[5.0 Discussion 14](#_Toc38624130)

[5.1 What Projections Could Be Made? 14](#_Toc38624131)

[5.2 Recommendations 18](#_Toc38624132)

[5.3 Limitations 20](#_Toc38624133)

[6.0 Conclusion 21](#_Toc38624134)

[Bibliography 23](#_Toc38624135)

List of Figures

[Figure 1: Medical expenditures 7](#_Toc38624136)

[Figure 2: Absenteeism 8](#_Toc38624137)

[Figure 3: Climate change poll 10](#_Toc38624138)

[Figure 4: Projected healthcare costs 16](#_Toc38624139)

# Introduction

Have we ignored this for too long? Are the current trends ever going to stop? What can we do? These are all questions that this paper attempts to answer. Obesity and climate change are the two topics explored in this paper. Obesity rates have been rising for decades and may continue to rise. Climate change scientists have warned us that the situation will only worsen without immediate intervention.

This paper will discuss obesity, the factors related to it, the effect obesity has on the economy, and the relationship to climate change. Obesity and climate change have been researched separately. Obesity is a disease that can lead to significant long-term health outcomes, not to mention other economic issues. As Hales and colleagues note, “the prevalence of obesity was 39.8% among adults and 18.5% among youth in the United States (U.S.) in 2015–2016. From 1999–2000 through 2015–2016, a significantly increasing trend in obesity was observed in both adults and youth” [[1]](#endnote-1). These figures roughly equate to 93 million people in the United States being obese. Over that near 20-year gap, the increase was over 9% in adults (age adjusted), from 30.5% - 39.6%, and over 4% in youth (age adjusted), from 13.9% to 18.5%.[[2]](#endnote-2) Individuals at risk for obesity may have several conditions, including but not limited to, type 2 diabetes[[3]](#endnote-3) , coronary heart disease[[4]](#endnote-4) , and hypertension[[5]](#endnote-5).

 Projections show that this has no signs of slowing. This paper will examine projections set forth by experts in the field and illustrate the severity of this issue. This paper will explore the relationship that obesity has on climate change, “the greatest challenge humans have ever faced.”[[6]](#endnote-6) Climate change, a man-made phenomenon, will be defined, explained, and forecasted. Humans have increased the prevalence of greenhouse gases in the environment causing further rise of temperature within the atmosphere. There has been a constant rise of greenhouse gases since the Industrial Revolution causing the earth to heat at an accelerated rate.

The interaction between obesity and climate change will be explored and will show the relationship between the two topics. Finally, this paper will advocate for different alternatives set in place to curb these issues.

# Literature Review: Search Strategy

The literature review in this paper was based on an initial search on each topic on PubMed and Wiley. The three topics searched for were obesity, climate change, and the interaction of the two disciplines.

The initial review of the main topics of obesity and climate change was expansive and unrelated to the topic in this paper. The research was narrowed down to relevance of subtopic. This review was conducted with a search of the topic “Obesity” and a subtopic ie. gender, economics, and projections. The same efforts were made with literature related to climate change. Climate change was then searched using subtopics: ie. definition, history, and projections. The information found was cited with an attempt to use the data most representative of the topic necessary to the paper. In situations where the literature was found to be too expansive when searching for subtopics, the literature was searched by ‘title’ only.

Then, the literature produced with keywords ‘obesity’ and ‘climate change’ was reviewed on PubMed and Wiley. Wiley continued to produce significant results and the search was narrowed by including both keywords within the title. PubMed produced far fewer results from the initial search and the literature was synthesized from that search. Overall, most of the literature was eliminated from the paper due to lack of relevance to the study topic.

# Background

## Obesity

The Centers for Disease Control and Prevention (CDC) defines obesity as a higher than normal weight based off a healthy weight for an individual of the same height. The common screening tool used to define overweight and obesity is Body Mass Index, commonly referred to as BMI.[[7]](#endnote-7) While BMI is an imperfect measurement tool[[8]](#endnote-8), it seems to be the most cost effective and best available tool for monitoring crude weight assessment.[[9]](#endnote-9) Overweight is generally denoted as a BMI of between 25.0 to <30, while a BMI 30.0 or higher is considered obese.[[10]](#endnote-10)

One important note about obesity is that of negative attitudes and discrimination[[11]](#endnote-11). An article written about obesity claims that “the authors emphasize that it is critically important that this new information does not lead to more weight stigmatization. People with obesity already suffer from negative attitudes and discrimination, and numerous studies have documented several prevalent stereotypes.”[[12]](#endnote-12)

Obesity in childhood seems to indicate a higher risk for obesity in adulthood.[[13]](#endnote-13) One question about obesity is, do individuals from a lower socioeconomic status have a higher risk for obesity? According to one study conducted in Massachusetts, there was a correlation between those with lower income and the prevalence of obesity. This study curated information collected from eight Massachusetts school districts totaling 111,799 students in grades 1, 4, 7, and 10. The research sought to determine the effects of socioeconomic status and race/ethnicity on obesity rates. In this study, the rates of obesity amongst African American students and Hispanic students were controlled for based on family income. While true that African American and Hispanic students have higher rates of obesity, low socioeconomic status was independently significantly associated with overweight/obese status: “For every 1% increase in low-income, there was a 1.17% increase in overweight/obese status.”[[14]](#endnote-14)

Men and women are also affected in different ways. As the aforementioned article states,

In men who were obese during adolescence, all-cause mortality and mortality from cardiovascular disease and colon cancer were increased. In both men and women obese during adolescence, rates of cardiovascular disease and diabetes were increased. Among women but not men obese during adolescence, obesity has a variety of adverse psychosocial consequences. These include completion of fewer years of education, higher rates of poverty, and lower rates of marriage and household income.[[15]](#endnote-15)(Page 411S) Have we ignored this for too long? What does the research say will happen in the future?

## Economics of Obesity

The impact of obesity on public health is clear from a societal perspective, and also from an economic perspective. In 2016, the National Health Expenditure (NHE), a metric used to account for all of the healthcare spending in America, was roughly 3.3 trillion dollars, totaling 17.9% of the Gross Domestic Product and was projected to increase to 19.7 % by 2026. This increase of the NHE is growing at a level of 1 percentage point faster than the GDP,[[16]](#endnote-16) meaning, total healthcare spending is increasing faster than the level at which we are producing goods. Healthcare expenditures 40 years ago in 1970 totaled less than 100 billion dollars. By the year 2000, the expenditure was around 1.5 trillion dollars. On a per-capita basis, healthcare expenditure has increased by almost 30 times.[[17]](#endnote-17)

The relationship between healthcare expenditure and obesity has been researched. In 2003, an article was published titled “National Medical Spending Attributable To Overweight And Obesity: How Much, And Who’s Paying?”[[18]](#endnote-18) The researchers postulate that rising medical costs can be attributed to the expenditure for individuals who are either overweight or obese. The attributable cost of obesity rivaled the annual cost of smoking. This study further states that obese individuals who live to be 65 or older have a larger annual expenditure than those individuals who are not obese. While unable to draw a correlation for payer-specific estimates, there was a suggestion that the per-capita annual expenditure is highest in Medicare recipients. In 1998, roughly half of the nearly $80 billion cost due to obesity was financed by Medicare and Medicaid.[[19]](#endnote-19)

One prevalent medical procedure related to obesity is that of bariatric surgery. A multitude of benefits and risks are associated with bariatric surgery. Benefits can include weight loss, improved blood glucose level, and others.[[20]](#endnote-20) One could see why this procedure would be tempting to those battling obesity. While limited in methodology, one research study estimated that the cost of bariatric surgery could range from $7,000 to $33,000. There was variation depending on the procedure completed, as well as the manner in which the figures were determined.[[21]](#endnote-21) However, individuals with obesity have been shown to have decreased expenditures upon completion of the operation. This is especially true for those with high levels of comorbidities.[[22]](#endnote-22) Figure 1 illustrates how mean cost of medical expenditures progressively decreased up to three years post-surgery:



Figure 1: Medical expenditures

The researchers concluded that bariatric surgery led to better health and even though the procedural cost is high, the long-term benefits warrant the procedure. From a productivity standpoint, while direct medical costs are quite large there can further indirect costs for individuals battling obesity. These indirect costs can stem from either a loss of productivity while at work or productivity lost due to inability to work. A metanalysis was conducted showing the economic impact of absenteeism, the act of regularly staying away from work for no good reason, and presenteeism, the act of working while sick.[[23]](#endnote-23)

Figure 2 shows that the cost of absenteeism ranges from $200 - $1724 (overweight) and $108 to $1857 (obese). This figure shows the increased indirect costs individuals battling obesity may incur due to costs other than direct medical expenditures.



Figure 2: Absenteeism

In 2004, Michael Grossman and Inas Rashad wrote an article titled “The economics of obesity.” In the final sentence of their nine-page article they postulate, “Whether public policies should be pursued that offset the ignored or unanticipated consequence of previous policies that contributed to the rise in obesity will depend, in the end, on these policies' costs and benefits over time.”[[24]](#endnote-24)(Pg.112) In 2008, a study was conducted through the Urban Institute, The New York Academy on Medicine, and TFAH claiming, “We could see significant returns for as little as a $10 investment per person into evidence-based programs that improve physical activity and nutrition and lower smoking rates in communities. Not only could we save money, many more Americans would have the opportunity to live healthier lives.”[[25]](#endnote-25)(Page 57)

## Climate Change

Climate change, according to the U.S. Global Change Research Program, is a complex set of shifts that affect our planet’s weather and climate systems.[[26]](#endnote-26) Contrary to most people’s understanding of the difference between climate change and global warming, climate change is used as an encompassing term when referring to the set of shifts that can include extreme weather events, while global warming refers solely to increasing temperatures due to the release of greenhouse gases (GHG)[[27]](#endnote-27). Therefore, global warming is an aspect of climate change. This paper addresses climate change, rather than global warming, and the effect of climate change and obesity.

 First, let us focus on the “greenhouse effect,” the trapping of certain gases within the atmosphere leading to a rise in temperature. The greenhouse effect begins with understanding that the planet receives radiation, primarily from the sun. Approximately 70% of the radiation makes it to the earth’s surface and heats the planet. Then, 90% of that radiation is absorbed by greenhouse gases leading to further heating. [[28]](#endnote-28) [[29]](#endnote-29) [[30]](#endnote-30) [[31]](#endnote-31)

It is important to provide some historical context. Scientists measured the levels of CO2 emissions by taking samples of ancient ice, dating back to the 1800s. The CO2 levels observed showed that the ice held 290 ppm (parts per million). Parts per million is a metric used to describe the concentration of something in water or soil. [[32]](#endnote-32) Currently, the levels of CO2 in the atmosphere are at 412 ppm, a 42% increase since the 1800s. [[33]](#endnote-33)

Even with the overwhelming scientific data that climate change is occurring and man-made,[[34]](#endnote-34) public opinion is still relatively unchanged. According to a recent Gallup poll, when Americans were asked if the seriousness of global warming is generally exaggerated, generally correct, or generally underestimated, nearly 40% of individuals believe it is exaggerated (see figure 3).[[35]](#endnote-35)



Figure 3: Climate change poll

Dr. Stephen Weart, a historian of physics and geophysics, created the website history.aip.org in hopes of providing further information on climate change. He wrote,

Extensive studies showed that the consequences of a two degree rise would be severe in many parts of the world — and such a rise was more likely than not by the late 21st century, even if the world took immediate and radical action to restrict greenhouse gas emissions. And if we did not? It was highly probable that by the end of the century we would face a grievous degradation of the ecosystems on which civilization depends. Worse still: past some tipping point a cascade of irreversible self-reinforcing processes might gradually push the global system into an ancient ice-free "Hothouse Earth" mode, with sea levels and temperatures climbing far above anything in human experience. [[36]](#endnote-36)

# Obesity and Climate Change

## What is the Interaction?

In December 2019, an article was published stating that obesity contributes to an extra 1.6% of greenhouse gas (GHG) emissions[[37]](#endnote-37). The researchers estimated the amount of CO2 emissions from an individual’s oxidative metabolism. Oxidative metabolism is the body’s way of converting the nutrients we consume into energy. Individuals who are not obese produce 260 ml/minute of CO2 on average[[38]](#endnote-38) while individuals who are obese produce roughly 30% more CO2.

In the U.S., nearly one third of all food and water are wasted on the food supply chain. Production of 1kcal of food requires the use of 3kcal of fossil fuel energy.[[39]](#endnote-39) In 2010, global food availability was 20% higher than was required[[40]](#endnote-40). This shows that the food supply chain is producing a surplus of food than is required to feed the world, leading to a greater burden. By decreasing food production and creating a more efficient food supply chain, emissions would be reduced.

Further, in the past 50 years daily food consumption increased by less than 5% while food production increased by over 60%. Meanwhile, GHG emissions related to production increased by over 50% in that same span. By 2050, food production may double, food consumption may increase slightly, and GHG emissions may quadruple. Food production contributes to CO2 emissions. Increased weight being transported increases the amount of fuel needed and increase in individual’s size leads to greater fuel use. [[41]](#endnote-41) In Sweden from 1990-2005, animal production contributed to an increase of GHG emissions by 22%. Alternatively, more efficient means of production and less animal consumption lead to decreased GHG emissions.[[42]](#endnote-42)

From a dietary perspective, individuals struggling with obesity consume 30% more calories, which leads to increased GHG emissions through the food production cycle.[[43]](#endnote-43) The IPCC claims that eliminating food waste contributes to nearly 10% reduction on all GHG emissions while also stating that individuals in the U.S. should consume fewer animal products.

Airplane CO2 emissions, which contribute to 2% of all human induced CO2 emissions[[44]](#endnote-44), have increased by 32% in the past five years alone[[45]](#endnote-45) An increase of consumption and food production would increase the GHG emissions, barring a change of dietary habits or an alternative efficient production system.

Now, let us discuss the agricultural market. The literature establishes that changes in the climate will alter agricultural productivity.[[46]](#endnote-46)All food produced from an outdoor source will be affected from an economic perspective which would lead to increased prices for consumers.[[47]](#endnote-47) Furthermore, outdoor production could face hardships and would lead to an uptick of individuals consuming goods produced indoors. An increase of 2 degrees Celsius could lead to a change in GDP of 2 percent.[[48]](#endnote-48) Farmland production has been shown at a statistically significant certainty to either maintain moderate production or yield great loss with a 10-25% decline in crop land value from 2020-2049.[[49]](#endnote-49) Research has shown that vegetable and legume production can also be radically changed by climate change[[50]](#endnote-50). There has been a 1% to 5% reduction in global agriculture production in the past three decades. Tropical areas are most likely to be affected by the climate. For those individuals harvesting in a tropical climate, the change of the climate will only continue to affect production[[51]](#endnote-51).

In Obradovich and Fowler’s article, “Climate change may alter human physical activity patterns,” they postulate that physical activity and weather-related activities have a positive correlation. According to their model, physical activity will increase during the colder months and reduce during the warmer months. This change in behavior would lead to an increase in net physical activity levels.[[52]](#endnote-52) Further research confirmed the results set forth by Obradovich and Fowler.[[53]](#endnote-53)

To summarize, individuals battling obesity naturally produce more CO2 which contributes to an increase in GHG emissions. Food production has increased in the last 50 years and similarly, so have GHG emissions related to food production. However, food consumption rates have increased at a far slower rate, leading to a surplus of food and food waste. Finally, the agricultural market is going to change as the climate changes. This change in the market could lead to significant change in dietary habits by individuals around the globe. The decrease of crop yields and increase in price could lead consumers to vary their purchase patterns significantly. There are projections made that show a positive impact on obesity via climate change with a net increase in physical activity.

# Discussion

This paper has explored the concepts of obesity and climate change while discussing their interaction. The projections have shown that we are in a dire situation and these issues are projected to continue to become more serious unless otherwise mediated. This section will lay out future projections, what could be advocated for, and the limitations of the paper.

## What Projections Could Be Made?

This section examines projections for obesity and climate change. It should be noted that the projections set forth are only estimates as current information can provide only an educated assumption based on the collected data.

In 2008, an article titled “Will All Americans Become Overweight or Obese? Estimating the Progression and Cost of the U**.**S**.** Obesity Epidemic”[[54]](#endnote-54) using only data collected from National Health and Nutrition Examination Survey (NHANES), showed a projected outcome of 90% overweight and 50% obese by 2030. This projection also showed that by the year 2048, 100% of individuals in America would be considered either overweight or obese. In 2011, a *Lancet* article[[55]](#endnote-55) claimed an increase in obesity would increase the cases of diabetes, heart disease, and cancer by 8 million cases, 6.8 million cases, and .5 million cases respectively.

A study published in 2012 using the Behavioral Risk Factor Surveillance System Survey (BRFSSS) reported a 42% obesity prevalence [[56]](#endnote-56) across the nation. This article showed obesity rates leveling off, which has been proved incorrect as levels have continued to rise. Further research has been conducted showing that quality of life, life expectancy and employment will all decrease while obesity associated diseases, mental health issues, and economic burden will increase as time progresses. [[57]](#endnote-57) [[58]](#endnote-58) [[59]](#endnote-59) Furthermore, in other extreme projections, calculating the burden of potential disease, by 2030, 86.3% adults will be overweight or obese.[[60]](#endnote-60)

A research study published in the *New England Journal of Medicine (NEJM)* in 2019 titled “Projected U.S. State-Level Prevalence of Adult Obesity and Severe Obesity”[[61]](#endnote-61) used BMI data reported by the BRFSSS and the NHANES. This research curated information from over six million individuals. This study was able to estimate obesity prevalence and trends until 2030 considering variables such as race, sex, socioeconomic status, education and age. Using a 95% confidence interval, a metric used to estimate the true population mean, the research showed that by 2030 obesity levels will rise to above 50% in more than half of the states while obesity rates will not be below 35% in any state. Across subgroups, there were significant disparities by socioeconomic status, sex, and race. In states with low socioeconomic groups, there is a clear correlation between low household income and a higher likelihood of obesity.

In more extreme projections, this study showed that obesity figures will approach 60%. Severe obesity, which incurs greater health risks and greater healthcare expenses, is also projected to rise drastically. A few limitations include the methodology of data collection, the use of BMI as a metric, and states with limited data.

Clearly, obesity is a topic that is becoming more important, and the figures will be constantly evolving as new information emerges. Besides the clear implications of obesity being a health crisis, projected direct healthcare costs, in billions of dollars, attributable to overweight and obesity for U.S. adults 2000–2030, are shown below in Figure 4:[[62]](#endnote-62)



Figure 4: Projected healthcare costs

To summarize, this table shows that in 2030, the total expenditure of healthcare costs related to overweight/obesity will nearly double every decade. The projected range in 2030 will be from $860 to $956 billion, which would account for roughly 15% of all healthcare costs. The authors point out that the study has limitations and indicates that the figures are likely an underestimation.[[63]](#endnote-63) This assertion by the authors was made because medical cost of individuals with obesity far exceeded the medical cost of individuals without obesity, which were adjusted for inflation.[[64]](#endnote-64) Estimates show that if the obesity levels remained consistent, based on 2010 levels, the economy would have saved over 500 billion dollars in healthcare costs over the next two decades.

In addition to exploring obesity, it is important to look at projections for climate change. The earth has been rapidly heating, heavily attributed to the Industrial Revolution and the increase of greenhouse gases. In 2009, the USDA published a report stating that “During the past 100 years, average global temperatures have risen by about 0.8 °C… Even if human sources of greenhouse gas emissions were stabilized, warming would continue for centuries ” [[65]](#endnote-65)(pg.2) The USDA cites an increase of one to six degrees Celsius from 1990 to 2100. This equates to an increase of about two degrees Fahrenheit to ten degrees. Drought is projected to increase. Since the 1950s drought has increased substantially with projections indicating further increases through the 21st century[[66]](#endnote-66). Studies have shown that the increase of global warming has also led to an increase of wildfires.[[67]](#endnote-67)

The Intergovernmental Panel on Climate Change (IPCC), an organization used to “provide governments at all levels with scientific information that they can use to develop climate policies”[[68]](#endnote-68), forecasts a projection of an increase of two degrees Celsius[[69]](#endnote-69), or over 3.5 degrees Fahrenheit. This is projected with high confidence by the year 2100. It was also noted that different regions may exhibit different levels of temperature increases. However, there will be more extreme hot temperatures than extreme cold temperatures. The ocean will continue to warm and has been projected to continue to warm even if counter measures were set in place immediately. For centuries, CO2 levels are going to continue to rise. If counter measures were set in place immediately, CO2  levels would remain constant for centuries. Further noted was the potential for thousands of years of consequences to the ice sheets, vegetation, and changes to the ocean.

The Fourth National Climate Assessment[[70]](#endnote-70) projected further damage to individuals from marginalized communities, citing the lack of infrastructure and resources to combat the changes. From an economic perspective, communities with agricultural expertise have already begun to feel the effect of climate change.[[71]](#endnote-71)

According to a January 2020[[72]](#endnote-72) NASA study using the Goddard Institute for Space Studies Surface Temperature Analysis (GISTEMP) time series, an estimate of global surface temperature change, the climate change projections were neither too extreme or too mild.

While the projections are clear that the climate is changing and some of the damage will be irreversible for centuries, policy initiatives, changing societal norms, and other circumstances may change the severity of climate change.

## Recommendations

Have we ignored these issues for too long? Are the current trends ever going to stop? The research has shown that these trends are not going to subside for an extended period. These are the realities of our generation, and for generations to come. The projections show us that we need to make immediate changes to many different aspects of our lifestyle. This section will advocate for efforts to curb climate change and obesity. This section will tackle each concept individually.

Curbing obesity rates through public policy has long focused on changing diets, rather than empowering individuals to take control of their own weight.[[73]](#endnote-73) Empowering individuals would be the main advocacy focus of curbing obesity. A pilot study in Massachusetts showed that children will reduce sugary drink intake after being empowered to create their own narrative on why each individual personally should stop the behavior.[[74]](#endnote-74) Individuals with a stake in their own weight loss journey would be more inclined to change their behaviors. In late 2018, one survey conducted claimed that toddlers are eating more French fries than vegetables.[[75]](#endnote-75) Eating patterns begin to develop at a young age and by the time they enter the public-school system we are put at a disadvantage. Acting swiftly is paramount.

Another issue is not having enough time for students to fully take a reprieve from their daily schedule. One study measured 1000 students grade 3-8 in urban, low income areas and showed most students have an insufficient amount of time to eat during school lunch time. This could hinder nutritional standards and may reduce food waste.[[76]](#endnote-76) Increasing lunches and an influx of higher nutritional standards could help remedy these issues. This could be a benefit from a societal and an economic perspective. Increasing school lunch time and restructuring the school lunch menus with increased amounts of fruits and vegetables should lead the healthy school lunch revolution.

The sugary drink tax, first implemented in Denmark in the 1930s,[[77]](#endnote-77) is one policy that has garnered attention in the United States in the past decade. The main concept of the policy is to increase the cost of a drink with added sugars. A study in 2007, a meta-analysis of 88 studies, titled “Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis” showed clear associations of soft drink intake with increased energy intake and body weight. Soft drink intake also was associated with lower intakes of milk, calcium, and other nutrients and with an increased risk of several medical problems.[[78]](#endnote-78)

Many cities in the United States have experimented with a sugar tax to varied levels of legislative success. Those that have passed legislation have found a reduction in the consumption of sugary drinks. As of now eight cities in the United States have sugary drink taxes . Berkeley, California’s tax policy was enacted in 2015 and saw a “52 percent decline in consumption over the first three years".[[79]](#endnote-79) Philadelphia, Pennsylvania’s tax policy was proposed with the intention of using the tax revenue to fund different projects around the communities.[[80]](#endnote-80) This policy was enacted in 2017. The mayor claimed a $91 million revenue increase in the first year alone with funds being used to spend funds on public health programs such as universal pre-kindergarten.

Curbing climate change is another issue entirely. There are signs of encouragement in the form of public interest. Over the past 15 years, interest in climate change has increased dramatically.[[81]](#endnote-81) Creation of a scientific literate community is the main advocacy focus. Social media can be used as an effective avenue to improve scientific literacy.[[82]](#endnote-82) Considering the prevalence of smart phones and mobile gaming,[[83]](#endnote-83) these can be used as effective tools to increase scientific literacy.[[84]](#endnote-84) Ideally, this will lead to education about climate change and policy initiatives proposed to curb this issue.

## Limitations

This paper has several limitations. This paper did not conduct any original research. Additionally, the research conducted is still very new and constantly expanding. The research conducted in these topics will only continue to expand in the years to come. Further exploration of this topic should conduct research of the interaction of the two concepts.

# Conclusion

This paper has provided an insight into obesity, climate change, and the interaction between the two. Firstly, we focused on obesity. This paper defined obesity, presented some statistics, and discussed some of the factors related to it. This paper presented the current rates of obesity and overweight, currently at nearly 40%. Also, this paper examined how the effect of childhood obesity could lend itself to challenges later in life, how men are affected more than women, and how income may be a better predictor of obesity status than race/ethnicity. Then, we explored the economics of obesity, how obesity has affected the healthcare system, how bariatric surgery impacts obesity and the economy, and how obesity affects job performance as well.

Next, this paper explored climate change. This paper defined climate change, provided historical context on the subject, and discussed some of the hurdles associated with this topic. Then, this paper examined the relationship of obesity and climate change. This paper has shown that projections made for these topics is rapidly growing more important and evolving. Obesity, in extreme projections, may affect nearly 60% of individuals. Climate change scientists have already claimed an increased warming for centuries. Wildfires have increased, vegetation will change, sea levels have risen, CO2 levels will continue to rise, and those living in marginalized communities will be affected at a disproportionate rate.

The interaction between the two concepts was explored and there were fundamental ways in which obesity affected climate change in reference to the delivery and production of food. The food production system is growing at a rate that is far exceeding the consumption of these goods. The transport and delivery of food products lead to greater GHG emissions as heavier products require more fuel, regardless of the mode of transportation. This could be limited by mitigating food waste. The projections are also clear that obesity and climate change are forecasted to increase for the foreseeable future. At this point, these trends have the potential to be curbed, yet not reversed. This paper proposes initiatives that have had success and should be used to effectuate change to curb the issues with drastic measures. These measures range from education initiatives to policy changes.

Bibliography

1. Hales, C. M., M.D., Carroll, M. D., M.S.P.H, Fryar, C. D., M.S.P.H., & Ogden, C. L., Ph.D. (n.d.). Prevalence of Obesity Among Adults and Youth: United States, 2015–2016. Retrieved December 4, 2018, from <https://www.cdc.gov/nchs/data/databriefs/db288.pdf> [↑](#endnote-ref-1)
2. Hales, C. M., M.D., Carroll, M. D., M.S.P.H, Fryar, C. D., M.S.P.H, & Ogden, C. L., Ph.D. (2017, October). Prevalence of Obesity Among Adults and Youth: United States, 2015–2016. Retrieved from https://www.cdc.gov/nchs/data/databriefs/db288.pdf [↑](#endnote-ref-2)
3. Algoblan, A., Alalfi, M., & Khan, M. (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy,* 587. doi:10.2147/dmso.s67400 [↑](#endnote-ref-3)
4. Artham, S. M., M.D., Lavie, C. J., M.D., Milani, R. V., M.D., & Ventura, H. O., M.D. (2009, Fall). Obesity and Hypertension, Heart Failure, and Coronary Heart Disease—Risk Factor, Paradox, and Recommendations for Weight Loss. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3096264/ [↑](#endnote-ref-4)
5. Re, R., M.D. (2009, Fall). Https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3096270/. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3096270/ [↑](#endnote-ref-5)
6. Davies, Dave. “Climate Change Is 'Greatest Challenge Humans Have Ever Faced,' Author Says.” *NPR*, NPR, 16 Apr. 2019, www.npr.org/2019/04/16/713829853/climate-change-is-greatest-challenge-humans-have-ever-faced-author-says#. [↑](#endnote-ref-6)
7. Defining Adult Overweight and Obesity. (2016, June 16). Retrieved from https://www.cdc.gov/obesity/adult/defining.html [↑](#endnote-ref-7)
8. Lois, et al. “'An Imperfect Tool': The Controversy over Whether BMI Is the Best Measure of Obesity.” *Healthy Debate*, healthydebate.ca/2016/01/topic/bmi-obesity. [↑](#endnote-ref-8)
9. Hall, D M B, and T J Cole. “What Use Is the BMI?” *Archives of Disease in Childhood*, BMJ Group, Apr. 2006, www.ncbi.nlm.nih.gov/pmc/articles/PMC2065990/. [↑](#endnote-ref-9)
10. Zierle-Ghosh A, Jan A. Physiology, Body Mass Index (BMI) [Updated 2018 Dec 16]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK535456/ [↑](#endnote-ref-10)
11. Puhl, Rebecca M, and Chelsea A Heuer. “Obesity stigma: important considerations for public health.” *American journal of public health* vol. 100,6 (2010): 1019-28. doi:10.2105/AJPH.2009.159491 [↑](#endnote-ref-11)
12. ObesitySociety. “Study Suggests Obesity Associated with Greater Greenhouse Gas Emissions.” *EurekAlert!*, [www.eurekalert.org/pub\_releases/2019-12/tos-sso121819.php](http://www.eurekalert.org/pub_releases/2019-12/tos-sso121819.php). [↑](#endnote-ref-12)
13. Dietz, W. H. (1998). Childhood Weight Affects Adult Morbidity and Mortality. *The Journal of Nutrition,* *128*(2). doi:10.1093/jn/128.2.411s [↑](#endnote-ref-13)
14. Rogers, R., Eagle, T. F., Sheetz, A., Woodward, A., Leibowitz, R., Song, M., Sylvester, R., Corriveau, N., Kline-Rogers, E., Jiang, Q., Jackson, E. A., & Eagle, K. A. (2015). The Relationship between Childhood Obesity, Low Socioeconomic Status, and Race/Ethnicity: Lessons from Massachusetts. *Childhood Obesity*, *11*(6), 691-695. <https://doi.org/10.1089/chi.2015.0029> [↑](#endnote-ref-14)
15. Dietz, W. H. (1998). Childhood Weight Affects Adult Morbidity and Mortality. *The Journal of Nutrition,* *128*(2). doi:10.1093/jn/128.2.411s [↑](#endnote-ref-15)
16. NHE-Fact-Sheet. (2018, December 06). Retrieved from https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nhe-fact-sheet.html [↑](#endnote-ref-16)
17. How has U.S. spending on healthcare changed over time? (n.d.). Retrieved from https://www.healthsystemtracker.org/chart-collection/u-s-spending-healthcare-changed-time/#item-per-capita-basis-health-spending-grown-substantially\_2017 [↑](#endnote-ref-17)
18. Finkelstein, Eric & Fiebelkorn, Ian & Wang, Guijing. (2003). National Medical Spending Attributable To Overweight And Obesity: How Much, And Who's Paying?. Health affairs (Project Hope). Suppl Web Exclusives. W3-219. 10.1377/hlthaff.w3.219. [↑](#endnote-ref-18)
19. Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual Medical Spending Attributable To Obesity: Payer-And Service-Specific Estimates. *Health Affairs,* *28*(5). doi:10.1377/hlthaff.28.5.w822 [↑](#endnote-ref-19)
20. Understanding the Health Benefits and Risks of Bariatric Surgery. (n.d.). Retrieved from https://www.niddk.nih.gov/news/archive/2015/understanding-health-benefits-risks-bariatric-surgery [↑](#endnote-ref-20)
21. Doble, B., Wordsworth, S., Rogers, C. A., Welbourn, R., Byrne, J., Blazeby, J. M., By-Band-Sleeve Trial Management Group (2017). What Are the Real Procedural Costs of Bariatric Surgery? A Systematic Literature Review of Published Cost Analyses. *Obesity surgery*, *27*(8), 2179-2192. [↑](#endnote-ref-21)
22. Sussenbach, S. P., Padoin, A. V., Silva, E. N., Benzano, D., Pufal, M. A., Barhouch, A. S., . . . Mottin, C. C. (2011, December 06). Economic Benefits of Bariatric Surgery. Retrieved from https://link.springer.com/article/10.1007/s11695-011-0558-z [↑](#endnote-ref-22)
23. Goettler A, Grosse A, Sonntag D Productivity loss due to overweight and obesity: a systematic review of indirect costs BMJ Open 2017;7:e014632. doi: 10.1136/bmjopen-2016-014632 [↑](#endnote-ref-23)
24. I. Rashad and M. Grossman, “The Economics of Obesity,” Public Interest, Vol. 156, 2004, pp. 104-112. [↑](#endnote-ref-24)
25. Trust for America’s Health. [Prevention for a Healthier America: Investments in Disease Prevention Yield Significant Savings, Stronger Communities](http://healthyamericans.org/reports/prevention08/). Washington, D.C.: Trust for America’s Health, 2008. (accessed April 2013). [↑](#endnote-ref-25)
26. “Understand Climate Change.” *GlobalChange.gov*, www.globalchange.gov/climate-change. [↑](#endnote-ref-26)
27. MacMillan, Amanda. “Global Warming 101.” *NRDC*, 30 July 2019, www.nrdc.org/stories/global-warming-101. [↑](#endnote-ref-27)
28. “Greenhouse Effect.” *Department of Agriculture, Water and the Environment*, www.environment.gov.au/climate-change/climate-science-data/climate-science/greenhouse-effect. [↑](#endnote-ref-28)
29. “Greenhouse Effect.” *Department of Agriculture, Water and the Environment*, www.environment.gov.au/climate-change/climate-science-data/climate-science/greenhouse-effect. [↑](#endnote-ref-29)
30. [↑](#endnote-ref-30)
31. Denchak, Melissa. “Greenhouse Effect 101.” *NRDC*, 23 July 2019, www.nrdc.org/stories/greenhouse-effect-101. [↑](#endnote-ref-31)
32. *Parts per Million (Ppm) Definition*, groups.molbiosci.northwestern.edu/holmgren/Glossary/Definitions/Def-P/parts\_per\_million.html. [↑](#endnote-ref-32)
33. “The Atmosphere: Getting a Handle on Carbon Dioxide – Climate Change: Vital Signs of the Planet.” *NASA*, NASA, 16 Oct. 2019, climate.nasa.gov/news/2915/the-atmosphere-getting-a-handle-on-carbon-dioxide/. [↑](#endnote-ref-33)
34. Nuccitelli, Dana. “Survey Finds 97% Climate Science Papers Agree Warming Is Man-Made | Dana Nuccitelli.” *The Guardian*, Guardian News and Media, 16 May 2013, www.theguardian.com/environment/climate-consensus-97-per-cent/2013/may/16/climate-change-scienceofclimatechange. [↑](#endnote-ref-34)
35. Gallup. “Environment.” *Gallup.com*, Gallup, 31 Jan. 2020, news.gallup.com/poll/1615/environment.aspx. [↑](#endnote-ref-35)
36. Weart, Spencer. *The Carbon Dioxide Greenhouse Effect*, Jan. 2020, history.aip.org/climate/co2.htm#L\_M095. [↑](#endnote-ref-36)
37. Magkos, F., Tetens, I., Bügel, S.G., Felby, C., Schacht, S.R., Hill, J.O., Ravussin, E. and Astrup, A. (2020), The Environmental *Foodprint* of Obesity. Obesity, 28: 73-79. doi:[10.1002/oby.22657](https://doi.org/10.1002/oby.22657) [↑](#endnote-ref-37)
38. Antoine E. El-Khoury, Melchor Sánchez, Naomi K. Fukagawa, Ray E. Gleason, Vernon R. Young, Similar 24-h Pattern and Rate of Carbon Dioxide Production, by Indirect Calorimetry vs. Stable Isotope Dilution, in Healthy Adults under Standardized Metabolic Conditions, The Journal of Nutrition, Volume 124, Issue 9, September 1994, Pages 1615–1627, <https://doi.org/10.1093/jn/124.9.1615> [↑](#endnote-ref-38)
39. *Hall KD*, *Guo J*, *Dore M*, *Chow CC*. *The progressive increase of food waste in America and its environmental impact*. *PLoS One* *2009*;*4*:e7940. doi:[*10.1371/journal.pone.0007940*](https://doi.org/10.1371/journal.pone.0007940) [↑](#endnote-ref-39)
40. *Environ. Sci. Technol.* 2016, 50, 8, 4269-4277, Publication Date:April 7, 2016

<https://doi.org/10.1021/acs.est.5b05088> [↑](#endnote-ref-40)
41. Helfand, Gloria. “>Evaluating the Consumer Response to Fuel Economy: A Review of the Literature.” *International Review of Environmental and Resource Economics*, vol. 5, no. 2, Jan. 2011, pp. 103–146., doi:10.1561/101.00000040. [↑](#endnote-ref-41)
42. Cederberg, C., Hedenus, F., Wirsenius, S., & Sonesson, U. (2013). Trends in greenhouse gas emissions from consumption and production of animal food products – implications for long-term climate targets. *Animal,* *7*(2), 330-340. doi:10.1017/S1751731112001498 [↑](#endnote-ref-42)
43. Kahn, Michael. “Obesity Contributes to Global Warming: Study.” *Reuters*, Thomson Reuters, 15 May 2008, www.reuters.com/article/us-food-climate-obesity/obesity-contributes-to-global-warming-study-idUSL1572011320080515. [↑](#endnote-ref-43)
44. *Facts & Figures*, www.atag.org/facts-figures.html. [↑](#endnote-ref-44)
45. Graver, Brendan, et al. “CO2 Emissions from Commercial Aviation, 2018.” *The International Council on Clean Transportation*, theicct.org/publications/co2-emissions-commercial-aviation-2018. [↑](#endnote-ref-45)
46. Kurukulasuriya, Pradeep; Rosenthal, Shane. 2013. *Climate change and agriculture : a review of impacts and adaptations (English)*. Environment department papers ; no. 91. Climate change series. Washington DC ; World Bank. <http://documents.worldbank.org/curated/en/757601468332407727/Climate-change-and-agriculture-a-review-of-impacts-and-adaptations> [↑](#endnote-ref-46)
47. Howard, Peter & Sterner, Thomas, 2014. "[Raising the Temperature on Food Prices: Climate Change, Food Security, and the Social Cost of Carbon](https://ideas.repec.org/p/ags/aaea14/170648.html)," [2014 Annual Meeting, July 27-29, 2014, Minneapolis, Minnesota](https://ideas.repec.org/s/ags/aaea14.html) 170648, Agricultural and Applied Economics Association. [↑](#endnote-ref-47)
48. Thomas Sterner, U. Martin Persson, An Even Sterner Review: Introducing Relative Prices into the Discounting Debate, Review of Environmental Economics and Policy, Volume 2, Issue 1, Winter 2008, Pages 61–76, <https://doi.org/10.1093/reep/rem024> [↑](#endnote-ref-48)
49. [The Impact of Global Warming on U.S. Agriculture: An Econometric Analysis of Optimal Growing Conditions](https://www.mitpressjournals.org/doi/abs/10.1162/rest.2006.88.1.113), W**olfram Schlenker , W. Michael Hanemann , and Anthony C. Fisher**

The Review of Economics and Statistics 2006 88:1, 113-125 [↑](#endnote-ref-49)
50. Effect of environmental changes on vegetable and legume yields and nutritional quality

Pauline F. D. Scheelbeek, Frances A. Bird, Hanna L. Tuomisto, Rosemary Green, Francesca B. Harris, Edward J. M. Joy, Zaid Chalabi, Elizabeth Allen, Andy Haines, Alan D. Dangour Proceedings of the National Academy of Sciences Jun 2018, 115 (26) 6804-6809; DOI: 10.1073/pnas.1800442115 [↑](#endnote-ref-50)
51. Eduardo, Carlos, et al. “Tropical Agriculture and Global Warming: Impacts and Mitigation Options.” *Scientia Agricola*, Scientia Agricola, www.scielo.br/scielo.php?script=sci\_arttext&pid=S0103-90162007000100013. [↑](#endnote-ref-51)
52. Obradovich, Nick, and James H. Fowler. 2017. “Climate Change MayAlter Human Physical Activity Patterns.” Nature Human Behaviour 1(5) (April 24): 0097. doi:10.1038/s41562-017-0097 [↑](#endnote-ref-52)
53. Heaney, Alexandra K., et al. “Climate Change and Physical Activity: Estimated Impacts of Ambient Temperatures on Bikeshare Usage in New York City.” *Environmental Health Perspectives*, vol. 127, no. 3, 2019, p. 037002., doi:10.1289/ehp4039. [↑](#endnote-ref-53)
54. Wang, Y., Beydoun, M.A., Liang, L., Caballero, B. and Kumanyika, S.K. (2008), Will All Americans Become Overweight or Obese? Estimating the Progression and Cost of the US Obesity Epidemic. Obesity, 16: 2323-2330. doi:[10.1038/oby.2008.351](https://doi.org/10.1038/oby.2008.351) [↑](#endnote-ref-54)
55. Wang, Y Claire, et al. “Health and Economic Burden of the Projected Obesity Trends in the USA and the UK.” *Lancet (London, England)*, U.S. National Library of Medicine, 27 Aug. 2011, www.ncbi.nlm.nih.gov/pubmed/21872750. [↑](#endnote-ref-55)
56. Finkelstein, Eric A., et al. “Obesity and Severe Obesity Forecasts Through 2030.” *American Journal of Preventive Medicine*, Elsevier, 15 May 2012, www.sciencedirect.com/science/article/pii/S0749379712001468?via=ihub. [↑](#endnote-ref-56)
57. Agha, Maliha, and Riaz Agha. “The rising prevalence of obesity: part A: impact on public health.” *International journal of surgery. Oncology* vol. 2,7 (2017): e17. doi:10.1097/IJ9.0000000000000017 [↑](#endnote-ref-57)
58. “HEALTH | Obesity Link to Cancer.” *BBC News*, BBC, 17 May 2001, news.bbc.co.uk/2/hi/health/1334311.stm. [↑](#endnote-ref-58)
59. Northstone K, Joinson C, Emmett P, et al Are dietary patterns in childhood associated with IQ at 8 years of age? A population-based cohort study, J Epidemiol Community Health 2012;66:624-628. [↑](#endnote-ref-59)
60. Wang, Y., Beydoun, A., Liang, L., Caballero, B., & Kumanyika, S. K. (2012, September 06). Will All Americans Become Overweight or Obese? Estimating the Progression and Cost of the US Obesity Epidemic. Retrieved from <https://onlinelibrary.wiley.com/doi/full/10.1038/oby.2008.351> [↑](#endnote-ref-60)
61. Ward, Zachary J., and Center for Health Decision Science. “Projected U.S. State-Level Prevalence of Adult Obesity and Severe Obesity: NEJM.” *New England Journal of Medicine*, www.nejm.org/doi/full/10.1056/NEJMsa1909301. [↑](#endnote-ref-61)
62. Wang, Y. , Beydoun, M. A., Liang, L. , Caballero, B. and Kumanyika, S. K. (2008), Will All Americans Become Overweight or Obese? Estimating the Progression and Cost of the US Obesity Epidemic. Obesity, 16: 2323-2330. doi:[10.1038/oby.2008.351](https://doi.org/10.1038/oby.2008.351) [↑](#endnote-ref-62)
63. Wang, Y. , Beydoun, M. A., Liang, L. , Caballero, B. and Kumanyika, S. K. (2008), Will All Americans Become Overweight or Obese? Estimating the Progression and Cost of the US Obesity Epidemic. Obesity, 16: 2323-2330. doi:[10.1038/oby.2008.351](https://doi.org/10.1038/oby.2008.351) [↑](#endnote-ref-63)
64. E Thorpe, Kenneth & Florence, Curtis & H Howard, David & Joski, Peter. (2004). Trends: The Impact Of Obesity On Rising Medical Spending. Health affairs (Project Hope). Suppl Web Exclusives. W4-480. 10.1377/hlthaff.w4.480. [↑](#endnote-ref-64)
65. Kliejunas, John T. *Review of Literature on Climate Change and Forest Diseases of Western North America*. United States Dept. of Agriculture, Forest Service, Pacific Southwest Research Station, 2009. [↑](#endnote-ref-65)
66. Dai, Aiguo. “Drought under Global Warming: a Review.” *Wiley Interdisciplinary Reviews: Climate Change*, vol. 2, no. 1, 2010, pp. 45–65., doi:10.1002/wcc.81. [↑](#endnote-ref-66)
67. **Pechony, O. and D.T. Shindell. 2010. Driving forces of global wildfires over the past millennium and the forthcoming century. PNAS, Vol 107, pp 19167-19170, DOI: 10.1073/pnas.1003669107** [↑](#endnote-ref-67)
68. “About the IPCC.” *IPCC*, www.ipcc.ch/about/. [↑](#endnote-ref-68)
69. Collins, Matthew & Knutti, Reto & Arblaser, Julie & Dufresne, Jean-Louis & Fichefet, Thierry & Friedlingstein, Pierre & Gao, Xuejie & Gutowski, William & Johns, Tim & Krinner, Gerhard & Shongwe, Mxolisi & Teballdi, Claudia & Weaver, Andrew & Wehner, Michael. (2014). Long-term Climate Change: Projections, Commitments and Irreversibility. [↑](#endnote-ref-69)
70. *Fourth National Climate Assessment. Report-in-Brief*. U.S. Government Publishing Office, 2018. [↑](#endnote-ref-70)
71. Thornton, P., Dinesh, D., Cramer, L., Loboguerrero, A. M., & Campbell, B. (2018). Agriculture in a changing climate: Keeping our cool in the face of the hothouse. Outlook on Agriculture, 47(4), 283–290. <https://doi.org/10.1177/0030727018815332> [↑](#endnote-ref-71)
72. “Study Confirms Climate Models Are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet.” *NASA*, NASA, 9 Jan. 2020, climate.nasa.gov/news/2943/study-confirms-climate-models-are-getting-future-warming-projections-right/. [↑](#endnote-ref-72)
73. Etzioni, Amitai. “On Curbing Obesity.” *Society*, vol. 51, no. 2, 2014, pp. 115–119., doi:10.1007/s12115-014-9749-2. [↑](#endnote-ref-73)
74. Wang, Monica L., et al. “Reducing Sugary Drink Intake through Youth Empowerment: Results from a Pilot-Site Randomized Study.” *International Journal of Behavioral Nutrition and Physical Activity*, vol. 16, no. 1, 2019, doi:10.1186/s12966-019-0819-0. [↑](#endnote-ref-74)
75. Thompson, Dennis. “U.S. Toddlers Eat More French Fries Than Vegetables.” *Consumer HealthDay*, 1 May 2017, consumer.healthday.com/caregiving-information-6/infant-and-child-care-health-news-410/u-s-toddlers-eat-more-french-fries-than-vegetables-722150.html. [↑](#endnote-ref-75)
76. Cohen, Juliana F.w., et al. “Amount of Time to Eat Lunch Is Associated with Children’s Selection and Consumption of School Meal Entrée, Fruits, Vegetables, and Milk.” *Journal of the Academy of Nutrition and Dietetics*, vol. 116, no. 1, 2016, pp. 123–128., doi:10.1016/j.jand.2015.07.019. [↑](#endnote-ref-76)
77. https://www.foodnavigator.com/Article/2013/04/25/Denmark-to-scrap-decades-old-soft-drink-tax# [↑](#endnote-ref-77)
78. https://ajph.aphapublications.org/doi/10.2105/AJPH.2005.083782 [↑](#endnote-ref-78)
79. <https://www.npr.org/sections/thesalt/2019/02/21/696709717/u-s-soda-taxes-work-studies-suggest-but-maybe-not-as-well-as-hoped> [↑](#endnote-ref-79)
80. https://www.phillymag.com/citified/2016/02/26/jim-kenney-soda-tax/ [↑](#endnote-ref-80)
81. *Interest over Time: Climate Change*. trends.google.com/trends/explore?date=all&q=climate change. [↑](#endnote-ref-81)
82. Cooper, Caren B. “Media Literacy as a Key Strategy toward Improving Public Acceptance of Climate Change Science.” *BioScience*, vol. 61, no. 3, 2011, pp. 231–237., doi:10.1525/bio.2011.61.3.8. [↑](#endnote-ref-82)
83. Fuller, Steve. “Topic: Mobile Gaming.” *Www.statista.com*, [www.statista.com/topics/1906/mobile-gaming/](http://www.statista.com/topics/1906/mobile-gaming/). [↑](#endnote-ref-83)
84. Leuzinger, Sebastian, et al. “Improving Climate-Change Literacy and Science Communication Through Smart Device Apps.” *Frontiers in Education*, vol. 4, 2019, doi:10.3389/feduc.2019.00138. [↑](#endnote-ref-84)