THE ECONOMIC IMPACT OF WEIGHT LOSS

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L. WILLIAM SEIDMAN RESEARCH INSTITUTE

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- *Yavapai County Jail District*

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EXECUTIVE SUMMARY

- Achieving weight loss goals is often perceived (rightly or wrongly) to improve overall quality of life and personal satisfaction. It's well-known that certain weight loss strategies do not result in improved overall quality of life or other health outcomes. Thus, gaining a better understanding of optimal weight loss strategies is paramount to both short and long term success.

- There are also tangible, measurable activities of daily living and worksite metrics associated with weight loss such as: the number of days with improved health and ability to perform normal tasks; medical treatment cost-savings avoided with fewer weight induced diseases; and the levels of worker productivity gained due to improved health outcomes. Gauging these benefits is the central focus of this study.

- The negative economic impacts of disease resulting from weight related conditions are well-documented. For example, Milken (2016), based on the literature regarding population attributable risk, estimates the potential cost of overweight and obese individuals at over $1.4 trillion dollars per annum. This equates to $7,500 per person for the U.S. population with BMIs exceeding 25. [1]

- Reductions in BMI that lead to reductions in the population-attributable risk (PAR) in overweight and obese individuals could therefore yield substantial benefits in terms of lower treatment costs and greater workforce productivity.

- This study estimates the potential cost savings associated with sustainable weight loss programs for four distinct groups:

    (a) A peer-reviewed published human clinical trial intervention consisting of 40 men and women conducted by Dr. Paul J. Arciero FACSM, FTOS.
    (b) A 12,561 sample of Isagenix clients self-reporting weight loss to the firm.
    (c) A simulated sample of 500,000 Isagenix U.S. customers nationwide.

[1] BMI (Body Mass Index) is a measure of body fat based on height and weight widely used in medical literature. It is calculated as the person's weight in kilograms divided by the square of height in meters.

(d) The U.S. population as a whole.

- The published study by Arciero et al. (2017) demonstrates the significant reduction in BMI (3.8 point reduction) representing successful weight loss and the associated significant health improvements as a result of following a high quality nutrition plan consisting of Protein Pacing™ and intermittent fasting. It also estimates the economic impact or cost savings associated with weight loss and weight loss maintenance. These clinical trials reveal the types of health outcomes that result from nutrition programs that lead to BMI reductions, thereby providing the rationale for the linkage between BMI reduction and reduced disease risk.

- Seidman implements two distinct approaches to identify the economic impact of BMI reductions. First, Seidman matches the BMI levels of the Isagenix sample to BRFSS estimates of lost days per month.

- An estimated 57,320 days are retained annually as a result of the BMI reductions observed in the Isagenix sample. This is equivalent to a savings rate of about 4.5 "reported healthy" days per year per Isagenix sample client in comparisons with BRFSS surveys. The average individual in the clinical trials experiences a 3.8 BMI reduction. Reductions on this scale correspond to a savings of over 7 "reported healthy" days per year based on BRFSS surveys.

- A second approach obtains more precise links to particular diseases and BMI based on results obtained from the academic literature. In this second approach, a sample of self-reported results from Isagenix clients is used. The findings are compared with Arciero et al.'s clinical trial based results obtained from their human nutrition intervention study.

- Seidman constructs population-attributable BMI risk profiles for 20 types of disease, then estimates the number of disease cases that could be avoided through BMI reductions. Milken's direct and indirect cost estimates are used to help quantify the health and economic impacts of the weight loss magnitudes achieved by the sample of Isagenix clients.

- Seidman estimates that approximately 20% of the total weight-related disease expenses identified by Milken could be avoided if BMI reductions akin to those observed in the Isagenix sample took place

across the nation's overweight and obese populations. The results obtained using the BMI reductions observed in the clinical trials are even higher – assuming that the types of BMI reductions observed in the trials could be achieved across the entire sample of obese individuals.

- Seidman estimates that over $23 million in annual benefits accrue through the self-reported BMI reductions of Isagenix's 12,561 U.S. client sample.

- Seidman also estimates that approximately $918 million in total retained earnings and treatment savings could occur each year if Isagenix's total U.S. client base achieved the same successes observed in the self-reported sample. The average age of an Isagenix sample client is 45 years old, which means that a permanent BMI reduction could foster ongoing workforce productivity gains for on average 20 years. This suggests total impacts at 20 times the annual figure, or over $18 billion in working age benefits over individual careers. Using comparable risk profile formulas, Arciero et al.'s human clinical trial suggests approximately 30% larger impacts, because the clinical trial average of starting BMI is significantly greater than the average of the BMIs in Isagenix's self-reported sample. Nevertheless, the findings from the Arciero et al. human trial clearly reinforce the self-reported sample results.

- Focusing exclusively on typically re-occurring chronic conditions like asthma, back pain, diabetes, hypertension and osteoarthritis, and applying the observed BMI reductions in the self-reported sample, Seidman estimates:

    - $357 million savings over 20 years for the 12,561 sample of Isagenix clients.
    - More than $14 billion in savings over 20 years for the total Isagenix U.S. client population of 500,000.
    - Trillions of dollars savings over 20 years for the U.S. population.
    - All these impacts could increase by 32% to 78%, depending on BMI/disease risk profiles, if the types of BMI reductions observed in Arciero et al.'s peer-reviewed human clinical generally persist.

INTRODUCTION

Isagenix is a global health and wellness network marketing company that sells dietary supplements and personal care products via over 200,000 sales associates in 13 countries in the Americas, Asia, and Australasia. Founded in 2002 by John Anderson and Jim and Kathy Coover, the company is headquartered in Gilbert, AZ, and primarily manufactures its global products in-state. In February 2016, the company hit $4 billion in cumulative global sales. Isagenix was also ranked #22 on the Direct Selling Network's Global 100 List, based on 2015 net sales.

In spring 2017, Seidman completed an economic impact assessment of Isagenix's 2016 operations using an IMPLAN model. This estimated that Isagenix contributed $326.4 million to Gross Domestic Product (GDP) in the State of Arizona in 2016, including 3,368 direct, indirect and induced jobs. The economic impact study also estimated that Isagenix's U.S. operations contributed approximately $1.5 billion to national GDP in 2016, including 13,447 direct, indirect and induced jobs.

Weight loss is a key objective for Isagenix customers, as demonstrated by the 100 Pound Club (in which the health and wellness company shares stories from customers that have lost at least 100lb) and the 16-week Isagenix Challenge Total Body Transformation Program (IsaBody Challenge). A recent study published in the New England Journal of Medicine emphasizes the need for timely information about the impact of high levels of BMI on the health of a population.[2] Of course, diet remains the cornerstone of successful weight loss and evidence clearly supports the quality of the diet, not the quantity, as the primary factor leading to successful weight loss and related health outcomes. Specifically, extensive work by Arciero and colleagues has directly examined the combined effect of meal frequency and timing along with the distribution of protein intake with and without interventions using a Protein Pacing™ model.[3] [4] Most recently, Arciero and colleagues demonstrated increased muscular strength and power in exercise-trained physically fit men and women using Protein Pacing™ compared to ingestion of similar sized meals

[2] Gregg, E. W., and Shaw, J. E., (2017). Global Health Effects of Overweight and Obesity, *New England Journal of Medicine*, June 12, 2017 DOI: 10.1056/NEJMe1706095.

[3] Protein Pacing™ is currently under trademark registration by Dr. Paul Arciero.

[4] See Arciero, Baur, Connelly and Ormsbee, (2014); Arciero, Edmonds, Bunsawat, Gentile, Ketcham, Darin, Renna, Zheng, Zhang, and Ormsbee (2016); Arciero, Gentile, Martin-Pressman, Ormsbee, Everett, Zwicky, and Steele, (2006); Arciero, Gentile, Pressman, Everett, Ormsbee, Martin, Santamore, Gorman, Fehling, and Vukovich, (2008); and Ruby, Repka, and Arciero, (2016).

at similar times but different protein contents, both of which included the same multi-component exercise training during a 12-week intervention.[5]

Isagenix customers attaining weight loss will almost certainly experience quality of life improvements and enhanced feelings of self-satisfaction that are difficult to objectively and accurately measure. However, there are also more tangible, measurable worksite-related metrics associated with weight loss, including reported days of improved health, medical treatment cost-savings, and changes in the levels of worker productivity. Quantifying these benefits is the central focus of this study.

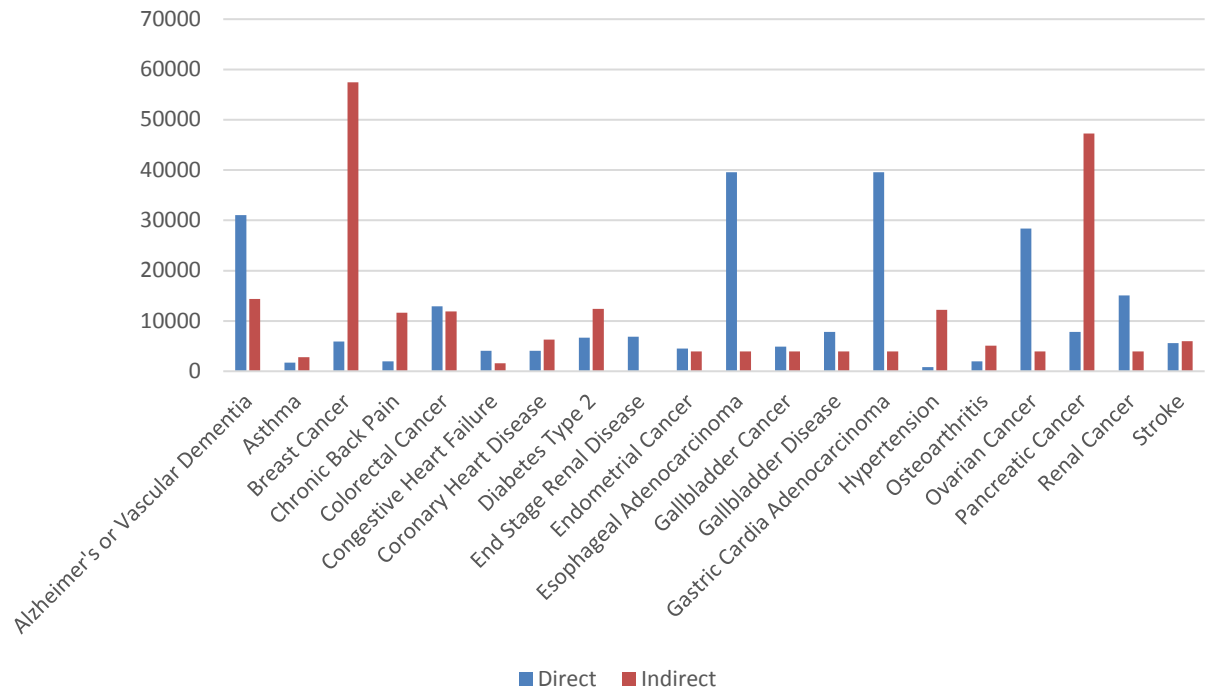
Insights on the Prevalence and Costs of Diseases, and Risks Associated with High BMI Levels

A literature review reveals that high numbers of individuals suffer from disease, and that some of the observed cases are associated with risk factors that generally increase with higher BMIs. Overweight and obese individuals are particularly identified having a higher risk of disease in several studies. The Milken Institute summarized much of the literature in a comprehensive investigation of the link between obesity and disease in *Weighing down America, the Health and Economic Impact of Obesity (2016).* Using data on the overall population risk of disease and the relative risk (RR) factors associated with overweight and obese conditions, Milken estimated the population-attributable risk (PAR) of disease that may be linked to overweight and obese individuals.

Milken then compared PAR estimates with the total number of overweight and obese people in the U.S. to calculate the number of diseases by type that may be attributed to the higher BMI weight classifications. The cost of these weight-induced cases are measured by estimating the direct treatment costs and, separately, the indirect costs of lost workforce participation and reduced worker productivity that is created when workers suffer from particular diseases. These costs are well documented in the literature, summarized by Milken, and reproduced in Figure 1.

[5] See Arciero, Baur, Connelly, and Ormsbee, (2014).

Figure 1: Total Attributable Direct and Indirect Cost per Case, 2014



Source: Weighing down America, the Health and Economic Impact of Obesity. Milken Institute (2016).

Dr. Paul Arciero investigated the link between his Protein Pacing™ nutrition concept and intermittent fasting using the Isagenix weight wellness products during successful weight loss and long-term weight loss maintenance in a series of published papers.[6] Briefly, Protein Pacing™ requires eating 4-6 small meals or snacks per day, which are evenly spaced approximately every 3 hours. Each meal contains 20 to 40 grams of high quality complete protein. The first meal/snack is eaten within 1 hour of waking in the morning, and the last meal/snack within 2 hours of going to bed in the evening. Protein Pacing™ is designed to provide "the right amount of protein at the right time". The Isagenix Shake Days, as part of their Weight Wellness Solution, can support Protein Pacing™ because the meal replacement shakes (IsaLean and IsaLean Pro) contain between 20 and 40 grams of protein per serving. The consumption of two meal replacement shakes is recommended per day to help support Protein Pacing™.[7]

[6] See Zuo et.al. (2016), Arciero et.al. (2016), Arciero et.al. (2017), Ives et.al. (2017), and He et.al. (2017).
[7] Please note: the Isalean bars, which are also part of the Shake Days and utilized in the Arciero et al. human intervention weight loss study, support Protein Pacing™.

Intermittent fasting involves a drastic reduction in total daily caloric intake to a level comparable to 300-500 calories per day for men and women, respectively. The intermittent fasting component, referred to as Cleanse Days, consists of four to six small liquid meals that are derived from antioxidant- and adaptogen-rich plant sources, consumed on a similar nutrient-timing schedule as the Protein Pacing™ Shake Days. In addition to the shakes, bars and cleanse drinks, the Isagenix Weight Loss solution also consisted of a vitamin/mineral and phytonutrient pack (Complete Essentials Day Pack), a natural caffeine and antioxidant beverage (e+ shot), and a phytonutrient/antioxidant herbal beverage (Ionix Supreme). The combination of Protein Pacing™ Shake Days for 5-6 days a week with 1-2 Cleanse Days has been shown to favorably induce healthy weight loss and overall improvement in health outcomes. For example, Arciero et al. estimate weight loss of approximately 25 lbs. and a 4 points BMI reduction. Arciero et al.'s clinical trials also suggest that the types of impacts estimated in this report could be sustained over time if clients maintain lower BMI levels and therefore experience lower risk of disease.

Seidman reviewed the literature surveyed by Milken and examined the papers co-authored by Dr. Paul Arciero. The conclusions are clear. For the 20 diseases depicted in Figure 1, there is a higher risk borne by individuals with BMIs in the overweight and obese range. There is also evidence to suggest that the risk increases with greater reported BMIs as documented in the Milken (2016) report. Further, the clinically demonstrated 3.8 reduction in BMI reported by Arciero et al. suggests that Protein Pacing™ and intermittent fasting using the Isagenix Shake Days and Cleanse Days provides an efficacious method to reduce BMI and therefore disease risk. Moreover, Arciero et al. also identify factors that help explain the link between Isagenix programs, BMI reduction and reduced disease risk. Specifically the clinical trials reveal:

- 21 lbs. loss of body fat
- 3 lbs. loss of abdominal fat
- 2 lbs. loss of visceral fat
- 10 mg/dL reduction of fasting blood glucose (sugar)
- 3 uU/ml reduction of fasting blood insulin
- 32 ng/ml reduction in fasting blood leptin
- 30 mg/dL reduction in fasting cholesterol

- 13 mg/dL reduction in fasting LDL-cholesterol
- 45 mg/dL reduction in fasting triglyceride
- 8 mmHg reduction in resting systolic blood pressure
- 8 mmHg reduction in resting diastolic blood pressure

Seidman also reviewed additional papers cited by Milken to help verify the assumptions made in the report. A summary of this review is categorized by disease type below:

Alzheimer's or Vascular Dementia: Prevalence of disease data is sourced from the Alzheimer's Association. Anstey et al. (2014), Pedditizi et al. (2016), and Calle et al. (2004) offer estimates of the relative risk factors associated with patient weight. Cost of disease estimates appear in Hurd et al. (2013), Stefanacc1 (2011), and various reports from Alzheimer's Association (2014).

Asthma: Prevalence of disease data is sourced from the Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (2014, 2015). Calle et al. (2004), Beuther et al. (2006), Shore and Johnson (2006), Roberts et al. (2000), Luppino et al. (2010), Hung et al. (2014) and Chen et al. (1994-95) all offer estimates of the relative risk factors for asthma associated with patient weight. Cost of disease estimates appear in Kubendran et al. (2016), Anstey et al. (2011), and Rappaport and Bonthapallly (2012).

Breast Cancer: Prevalence of disease data is sourced from the National Institutes of Health, National Cancer Institute. Chang et al.(2006), Hu (2008), Lahmann et al. (2004), Tehard et al. (2006) Tehard and Clavel-Cahpelon (2006), Rock and Demark-Wahnefreied (2002) and Tao et al. (2006) offer estimates of the relative risk factors for breast cancer associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011) Wolf et al. (1998), Goetzel et al. (2004), and Zeng et al. (2016).

Chronic Back Pain: Prevalence of disease data is sourced from Shmagell et al. (2009). Guh et al. (2009) offer estimates of the relative risk factors for chronic back pain associated with patient weight. Cost of disease estimates appear in Dagenais et al. (2008), and various reports from DHHS-AHRQ.

Colorectal Cancer: Prevalence of disease data is sourced from the National Institutes of Health, National Cancer Institute. Calle et al. (2004), Chang et al. (2006), Hu (2008), Saydah et al. (2014), and Tehard et al.

(2006) offer estimates of the relative risk factors for colorectal cancer associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011), Wolf et al. (1998), and various reports from DHHS-AHRQ.

Congestive Heart Failure and Coronary Heart Disease: Prevalence of disease data is sourced from various reports from the CDC. Guh et al.(2009), Saydah et al. (2014), McTigue et al. (2006), Kenchaiah et al. (2002), and Bogers et al. (2007) offer estimates of the relative risk factors for heart illnesses associated with patient weight. Cost of disease estimates appear in Soni (2012), DHHS-AHRQ (2007), and Yang et al. (2013).

Diabetes Type 2: Prevalence of disease data is sourced from the CDC (2014). Saydah et al. (2014), Cawley et al. (2015), the NIH National Institute of Diabetes, Kahn et al. (2006), Labad et al. (2010), Wang et al. (2005), and Hu et al. (1998) offer estimates of the relative risk factors for diabetes associated with patient weight. Cost of disease estimates appear in Cawley et al. (2015), Yang et al. (2013) and Zhuo et al. (2013).

End Stage Renal Disease: Prevalence of disease data is sourced from the CDC. He et al. (2001), Fox et al. (2004) and Calle (2004) offer estimates of the relative risk factors for diabetes associated with patient weight. Cost of disease estimates appear in Laliberte et al. (2013), Sood et al. (2011), and US Renal Data System (2013).

Endometrial Cancer: Prevalence of disease data is sourced from the National Institutes of Health, National Cancer Institute. Hu (2008) and Calle (2004) offer estimates of the relative risk factors for endometrial cancer associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011), and DHHS-AHRQ (2007).

Esophageal Adenocarcinoma: Prevalence of disease data is sourced from the National Institutes of Health, National Cancer Institute. Chang et al. (2006), Calle (2004), Guh et al. (2009), and He et al. (2001) offer estimates of the relative risk factors for Esophageal Adenocarcinoma associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011) and DHHS-AHRQ (2007).

Esophageal Adenocarcinoma: Prevalence of disease data is sourced from the National Institutes of Health, National Cancer Institute. Chang et al. (2006), Calle (2004), Guh et al. (2009), and He et al. (2001)

offer estimates of the relative risk factors for Esophageal Adenocarcinoma associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011) and DHHS-AHRQ (2007).

Gallbladder Cancer, Gallbladder Disease and Gastric Cardia Adenocarcinoma: Prevalence of disease data is sourced from Everhart et al. (1999) and NIH national Cancer Institute. Calle et al. (2004) and Hu (2008) offer estimates of the relative risk factors for these diseases as associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011) and DHHS-AHRQ (2007).

Hypertension: Prevalence of disease data is sourced from the CDC- National Center for Health Statistics. Guh et al. (2009 and Huang et al. (1998) offer estimates of the relative risk factors for Hypertension associated with patient weight. Costs of disease estimates appear in Soni (2012), DHHS-AHRQ (2007), CDC High Cholesterol Fact Sheet, White et al. (2008), and AHA (2016).

Osteoarthritis: Prevalence of disease data is sourced from Lawrence et al. (2008) and the CDC-NCCD. Guh et al. (2009) offer estimates of the relative risk factors for Osteoarthritis associated with patient weight. Cost of disease estimates appear in Wolf et al. (1998), Goetzel et al. (2004), and White et al. (2008).

Ovarian Cancer, Pancreatic Cancer and Renal Cancer: Prevalence of disease data is sourced from the NIH National Cancer Institute. Guh et al.(2009), Hsu et al. (2006), Amling et al. (2004), Freedland et al. (2004), and Strom et al. (2005) offer estimates of the relative risk factors for these diseases associated with patient weight. Cost of disease estimates appear in Mariotto et al. (2011), DHHS-AHRQ (2007), DHHS-NIH, Soni DHHS-AHRQ, and Wolf et al. (1998).

Stroke: Prevalence of disease data and the relative risk factors associated with patient weight are sourced from Jensen et al. (2014), Song et al.2004), and Strazzullo et al. (2010). Cost of disease estimates appear in Alzheimer's Association, Rappaport and Bonthapallly (2012), Yang et al. (2013), CDC, and AHA (2016).

METHOD

Seidman pursues two distinct approaches to identify the economic impact of BMI. First, an extract is taken from the Behavioral Risk Factor Surveillance System (BRFSS) compiled by the Centers for Disease Control and Prevention (CDC). The extract contains responses to the question, "*During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?"* Seidman matches the BMI levels to each respondent who has answered this question. Table 1 depicts the relationship between BMI and the average of the "lost days" responses.

Table 1: Relationship between BMI and Average Activity Day Loss per Month

BMI RANGE	AVERAGE DAY LOSS
BMI>=25 & BMI<26	4.31
BMI>=26 & BMI<27	4.47
BMI>=27 & BMI<28	4.63
BMI>=28 & BMI<29	4.79
BMI>=29 & BMI<30	4.95
BMI>=30 & BMI<31	5.10
BMI>=31 & BMI<32	5.26
BMI>=32 & BMI<33	5.42
BMI>=33 & BMI<34	5.58
BMI>=34 & BMI<35	5.74
BMI>=35 & BMI<36	5.90
BMI>=36 & BMI<37	6.06
BMI>=37 & BMI<38	6.22
BMI>=38 & BMI<39	6.38
BMI>=39 & BMI<40	6.54
BMI>=40 & BMI<41	6.70
BMI>=41 & BMI<42	6.86
BMI>=42 & BMI<43	7.01
BMI>=43 & BMI<44	7.17
BMI>=44 & BMI<45	7.33
BMI>=45 & BMI<46	7.49
BMI>=46 & BMI<47	7.65
BMI>=47 & BMI<48	7.81
BMI>=48 & BMI<49	7.97
BMI>=49 & BMI<50	8.13
BMI>=50	9.39

Source: BRFSS/Authors' Calculations

A regression line linking BMI to lost days suggests that, on average, the reported "lost days per month due to poor health" increases by about 0.16 days for each additional BMI increment. This relationship is used to establish the link between "healthy days gained" and BMI reductions observed in the Isagenix sample of clients reporting weight loss.

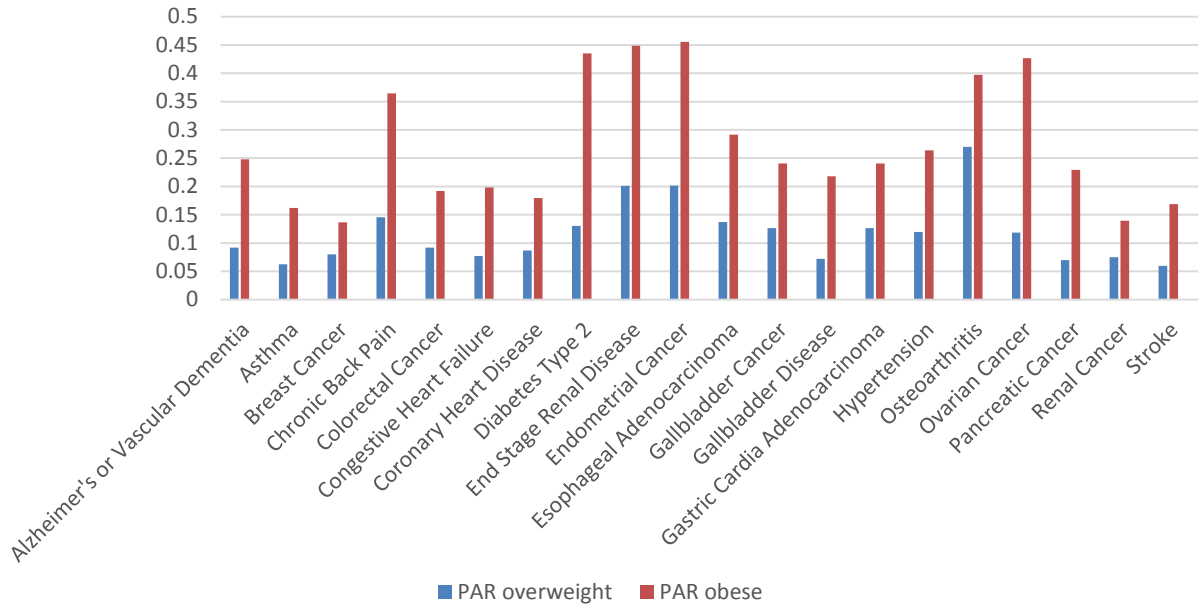
In the second approach, Seidman obtains more precise links to particular diseases and BMI based on academic literature results summarized in *Weighing down America, the Health and Economic Impact of Obesity* (Milken, 2016). Seidman's analysis incorporates the Milken framework, adds distribution data on BMI levels across overweight and obese classifications, and constructs population-attributable BMI risk profiles for each disease. The reductions in BMI levels yields PARs that are lower than those estimated in the literature. Seidman then applies the new lower PAR estimates to the total population of weight related diseases to ascertain the number of cases that could be avoided if the entire U.S. population achieves the same probability of success rates observed in the Isagenix sample.

Seidman applies Milken's direct and indirect cost estimates to establish the avoided health and economic costs of the weight loss at rates observed in the Isagenix sample. These impacts are measured on a per capita (or per person basis) to allow for the tabulation of estimates for all Isagenix clients in the U.S., and also the Isagenix study sample.

The work by Arciero et al. (2016) suggests that the weight loss observed in the sample could be permanent based upon the healthy outcomes observed in clinical trials as discussed in the prior section. Hence, the weight loss benefits estimated to accrue in the study sample could extend to most Isagenix clients and remain constant, leading to the permanent avoidance of days lost due to poor health, treatment costs, and recurring annual benefits that stem from greater workforce participation and productivity. If the types of BMI reduction observed in the Isagenix sample can be obtained more broadly, the potential benefits for the U.S. as a whole could be huge.

The additional availability of client performance data, and the continuous refinement of PAR profiles, would help to more firmly establish the economic benefits of nutrition programs such as Isagenix.

Figure 2: Milken (2016)'s PAR Factors for 20 Diseases[8]



Source: Weighing down America, the Health and Economic Impact of Obesity. Milken Institute (2016).

The PAR factors linking the conditions of overweight and obesity to the incidence of 20 diseases[9] are reproduced from Milken in Figure 2. These overweight and obesity PAR values form the basis of Seidman's population-attributable BMI risk profiles. The distribution of overweight and obese people in the population is based on the frequency of responses in the BRFSS. The frequency distribution of BMI in the range of 26 to 50+ is noted in Tables 2 and 3.

Seidman combines the weighted average of people from BMI 26-30 and BMI 30+ to arrive at an average overweight BMI of 27.3 and average obese BMI of 35.4. These average BMI values for overweight and obese population are then linked to Milken's average PAR values of each disease to hypothetically project population-attributable BMI risk on the full spectrum of BMI values. For example, an average overweight PAR value of 0.06 for asthma is linked with BMI level 27.3, and an average obese PAR value of 0.16 for

[8] Milken's PAR calculation is based on the formula PAR = P(RR-1)/[1 + P(RR-1)] (where RR=relative risk for a specific condition), and Seidman recalculates PAR value for each disease using the table provided in Milken's Appendix. Figure 1 includes an adjusted value for ovarian cancer, which is larger than the value provided in Milken's report. The calculation of direct and indirect cost saved from Isagenix's sample would be smaller if Milken's value is used.

[9] Alzheimer's or Vascular Dementia; Asthma; Breast Cancer; Chronic Back Pain; Colorectal Cancer; Congestive Heart Failure; Coronary Heart Disease; Diabetes Type 2; End Stage Renal Disease; Endometrial Cancer; Esophageal Adenocarcinoma; Gallbladder Cancer; Gallbladder Disease; Gastric Cardia Adenocarcinoma; Hypertension; Osteoarthritis; Ovarian Cancer; Pancreatic Cancer; Renal Cancer; Stroke.

asthma with BMI level 35.4. The two points reveal a positive correlation between BMI and PAR value that is used as a basis for establishing BMI/PAR profiles for each of 20 disease categories.

Table 2: BMI Distribution for Overweight

BMI CATEGORY	PERCENT
26	26.3%
27	18.6%
28	20.7%
29	17.6%
30	16.8%
Total	100%

Source: Behavioral Risk Factor Surveillance System (BRFSS).

Table 3: BMI Distribution for Obese

BMI CATEGORY	PERCENT
31	15.81%
32	14.56%
33	12.45%
34	10.29%
35	8.39%
36	6.31%
37	5.74%
38	4.16%
39	3.60%
40	3.23%
41	2.59%
42	2.29%
43	1.81%
44	1.29%
45	1.16%
46	0.85%
47	0.87%
48	0.56%
49	0.71%
50	0.35%
50+	2.98%
Total	100%

Source: Behavioral Risk Factor Surveillance System (BRFSS).

The basis for the linkage between BMI reduction and disease risk is based upon the Milken (2016) literature review and reinforced by the findings on health outcome improvements reported by Arciero et

al. From these calculations Seidman uses the linear risk profiles to obtain the PAR reduction estimates associated with the reported BMI reductions in the relevant samples. Results are depicted in Table 4.

Table 4: PAR Reduction Estimates Associated with Reported BMI Reductions[10]

	OVERWEIGHT SAMPLE AVE BMI REDUCTION: 1.6	OBESE SAMPLE, AVE BMI REDUCTION 3.1
	Average PAR Reduction	Average PAR reduction
Asthma	1.45%	3.72%
Alzheimer's	1.93%	5.98%
Breast Cancer	3.47%	8.10%
Chronic Back Pain	0.89%	2.11%
Colorectal Cancer	1.47%	3.71%
Congestive Heart Failure	1.79%	4.49%
Coronary Heart Disease	1.35%	3.40%
Diabetes	3.42%	8.00%
End Stage Renal Disease	3.56%	9.17%
Endometrial Cancer	3.25%	8.07%
Esophageal Adenocarcinoma	2.32%	5.73%
Gallbladder Cancer	1.58%	4.29%
Gallbladder Disease	2.12%	5.39%
Gastric Cardia Adenocarcinoma	1.58%	4.29%
Hypertension	2.09%	5.32%
Osteoarthritis	2.06%	4.76%
Ovarian Cancer	4.06%	10.32%
Pancreatic Cancer	2.42%	5.91%
Renal Cancer	0.94%	2.38%
Stroke	1.53%	4.02%

Source: Authors' Calculations

Seidman estimates the population-attributable BMI risk profiles for each disease category using two separate profile calculation strategies. The first assumes that the population risk increases in a linear manner. That is, the increase in risk is constant with each additional BMI increment. In the current application, this would imply that a unit change in BMI has the same PAR reduction regardless of the starting BMI level. The second strategy assumes that risk increases exponentially with additional increments in BMI. This means that the level of risk can increase at a faster rate, the greater the increase in BMI. That is, larger PAR reductions could be observed for higher starting BMI levels. Regardless of the

[10] Based on the Isagenix client "self-reported" sample.

shape of the population risk BMI profile, Seidman links each profile back to Milken estimates, and ties average overweight and obese individuals to the indicated BMI induced disease risk probabilities indicated in Figure 2.

The linear and exponential population risk profiles are depicted in the Appendix. The linear profiles result in greater disease probability reductions with each unit of BMI reduction for clients who begin their programs at BMI 35 or lower. The exponential profiles predict greater disease probability reductions with each unit of BMI reduction for those clients who begin programs at higher BMI levels. Both the linear and exponential profiles predict a positive correlation between BMI and risk of disease reduction, but they do so at different rates with the linear profile set at a constant rate and the exponential profile defined at an increasing rate.

Appendix Figures A1-A20 display greater slopes for the linear risk profiles at lower BMI levels, and greater slopes for the exponential population risk profiles at higher BMI levels. This suggests that BMI reductions result in greater risk reduction for lower starting BMIs in the linear rendering, and greater risk reduction for higher starting BMIs in the exponential rendering. Section 3's results are all based on linear profiles as the impacts are very similar overall regardless of the shape of the risk profile. Alternative results based on the exponential profiles are available on request.

As more information about the link between BMI and disease risk is established, it may be useful to explore results associated with alternative disease profile patterns.

To estimate results, Seidman constructs a sample work file based on self-reported weight loss data provided by 12,561 Isagenix clients. This includes an adjustment based on the average of the starting weight and the end weight for any sample client reporting multiple starting and ending points.

Seidman's original work file contains 17,631 unique participants, with the following characteristics:

- 5,070 participants (29%) start out with a normal BMI.
- 7,122 (40.4%) are in the normal BMI range at the end.
- 93% are of prime working age (25-65).
- Nearly all of the responds in the sample reported weight loss.

The portion of the sample with a starting BMI less than 25 is excluded from the analysis because there is no basis for estimating the population-attributable BMI risk differentials for individuals who experience weight loss from one normal BMI level to another.[11]

The sample revealed significant reductions in BMI that averaged 2.4 BMI points in the overall sample, 1.6 BMI points among the respondents that started in the overweight (25-30) range and 3.1 BMI points for the respondents that reported BMIs in the obese (30+) range prior to participating in the Isagenix program.

[11] Seidman has no basis for estimating final PAR values for clients who end up in the normal range. Conceptually, PAR values could be set at zero assuming that the relative BMI risk of disease is zero for normal BMI cases. However, assigning zero PAR to all clients who achieve below 25 ending BMI levels would conceptually overstate the impact of the BMI reductions from being, for example, slightly overweight to achieving a normal BMI. In the calculations Seidman assumes that the pace of PAR reduction observed from 30 to 25 BMI continues with incrementally lower BMI levels until zero probability is attained. This approach insures that the calculations are not based on PAR profiles that "step down from" - for example, 5% PAR to 0% as clients move from just above 25 to just below 25 BMI. Clients who began their programs in the normal range are excluded from the analysis.

KEY FINDINGS

BRFSS "Lost Healthy Days" Experiment Results

Applying the estimates of the Lost Day/BMI relationship discussed in Section 2 to the self-reported data of 12,561 clients, Seidman estimates that 57,320 (17,771 for those who are overweight and 39,546 for the obese) days are retained annually as a result of the BMI reductions observed in the Isagenix sample. This equates to a savings rate of about 4.5 days per year per client.

The same calculations can be drawn from the Arciero et al.'s clinical trial estimates. In this case Arciero et al. find an average BMI reduction from 37.5 to 33.7 (3.8 BMI absolute reduction). Using BRFSS estimates of "lost heathy days, this would suggest on average approximately 0.6 days per month or over 7 days per year if the observed BMI reductions are attained across a wider population. The greater impacts forthcoming from the clinical trials are to be expected since the self-reported Isagenix sample is comprised, on average, of individuals with lower BMI indices prior to exposure to Isagenix programs and, accordingly, respondents reported smaller BMI reductions because their starting BMIs were generally lower than subjects in the clinical trials. Indeed, the sample is comprised of significant numbers of respondents who start with BMI below 30. Nevertheless, the clinical trial based analysis reinforces the significant findings forthcoming from a sample based on self-reported data; and the clinical trial also suggests that the impact of BMI reduction could be greater, the higher the starting BMI.

Quantifying the value of these saved days is challenging but there are significant channels for value creation. For those in the workforce, it will represent wages retained or sick time not claimed which yields value for the worker and retained productive output for the employer. For participant care providers, the savings for families with children, the disabled and elderly manifest themselves in not having to seek alternative care provision. For those who seek to retain leisure time, it is the value of the time that accrues to the individual. These values are difficult to estimate but are nonetheless significant; and it is conceivable that the value of a retained healthy day is measured in hundreds of dollars for most individuals, workers, and/or businesses.

BMI Reduction and Disease Risk Reduction Results

More precise estimates of the economic impact of BMI reduction can be obtained from the population-adjusted BMI risk profiles developed by Seidman from the Milken report and related literature. Applying these risk profiles to the Isagenix sample, Seidman uses probabilities of disease risk reduction to yield estimates of the potential number of prevented cases of each disease as a result of the weight loss observed in the sample. New BMI weight-adjusted PARs observed in the Isagenix sample are also applied to the entire population of diseases impacted by weight.[12]

Milken find that 115.5 million disease cases for the subset of 20 diseases can be linked with changes in BMI. Seidman's analysis suggests that if BMI reductions akin to those observed in the Isagenix sample could take place across the U.S., the number of weight-related cases across this set of 20 diseases could fall by more than 22.5 million to 93 million (see Table 4). This would result in a potential economy wide saving of $281 billion, using Milken's (2016) direct and indirect cost estimates. The saving is equivalent to about 20% of the $1.4 trillion in total costs Milken estimates are associated with all of the diseases they examine. [13]

These aggregate figures can also be expressed on a per capita basis using total overweight and obese populations for direct per capita expenses, and numbers of overweight and obese persons of age 20-64 to approximate per capita indirect costs which apply to workforce related savings. For diseases endemic to a single gender, per capita figures are adjusted accordingly. Table 6 estimates total U.S. overweight/obese per capita figures if the Isagenix sample's BMI reductions and commensurate disease risk reductions could be achieved throughout the nation.

[12] Seidman's analysis excludes dyslipidemia, liver and prostate cancer despite their inclusion in the Milken study. The PARS for these diseases are elevated for overweight and obese individuals, but do not exhibit increases with higher BMI levels. Accordingly there is no discernible relationship between reductions in BMI and PAR reductions for the diseases.

[13] Calculations based on the exponential risk profiles revealed disease case/cost reductions that are about 4% higher overall with the savings for obese clients increasing and the savings for overweight clients decreasing. Results available on request.

Table 5: Prevented Cases, U.S. Annual Totals

CONDITION	OVERWEIGHT	OBESE	TOTAL CASE REDUCTION
Asthma	653,445	1,675,767	2,329,212
Alzheimer's or Vascular Dementia	102,487	316,962	419,449
Breast Cancer	27,363	64,995	92,357
Chronic Back Pain	1,074,920	2,511,662	3,586,583
Colorectal Cancer	17,536	44,427	61,964
Congestive Heart Failure	486,064	1,219,206	1,705,270
Coronary Heart Disease	211,512	531,479	742,990
Diabetes	1,014,661	2,372,952	3,387,613
End Stage Renal Disease	163,921	422,360	586,281
Endometrial Cancer	20,672	51,343	72,016
Esophageal Adenocarcinoma	851	2,099	2,950
Gallbladder Cancer	132	358	491
Gallbladder Disease	433,692	1,105,167	1,538,859
Gastric Cardia Adenocarcinoma	1,245	3,370	4,615
Hypertension	1,486,772	3,789,334	5,276,106
Osteoarthritis	700,690	1,623,884	2,324,574
Ovarian Cancer	8,015	20,364	28,378
Pancreatic Cancer	1,133	2,763	3,896
Renal Cancer	3,623	9,152	12,775
Stroke	99,922	261,764	361,686
TOTAL CASES (all conditions)	6,508,656	16,029,409	22,538,065

Source: Authors' Calculations

Table 6: Prevented Cases Per Capita, Nationwide[14]

Total Disease Cases across 20 Diseases (2014)	296,446,831
Milken attributed to overweight	36,169,867
Milken attributed to obese	79,363,826
After BMI reduction overweight	29,661,211
After BMI reduction obese	63,334,417
Savings/Reduced Costs compared with Milken	
Overweight	$80,857,919,181
Obese	$199,966,395,885
Savings per overweight and obese individuals (annual)	
Direct	
Overweight	273
Obese	627
Indirect (20-64 population)	
Overweight	909
Obese	1,969

Source: Authors' Calculations

To express the cost savings and retained productivity gains for Isagenix alone, Seidman applies the national overweight and obese per capita figures to the firm's client counts. Table 7 estimates the impacts for a simulated total U.S. client base of 500,000 and also for the 12,561 overweight and obese members of the original study sample. The total U.S. client base is simulated to have the same overweight and obese proportions and age shares as the sample.

Results suggest that approximately 20% of the weight related disease expenses identified by Milken could be eliminated if BMI reductions akin to those observed in the Isagenix sample take place across the nation's overweight and obese populations.

Focusing exclusively on Isagenix clients, Seidman estimates that approximately $918 million in total retained earnings and treatment savings could occur annually if all 500,000 Isagenix clients nationwide achieve the successes observed in the sample. Moreover, over $23 million in annual benefits could accrue to study sample participants as a result of their self-reported BMI reductions.

[14] Based on the 20 diseases in Seidman's analysis and BMI losses reported in the Isagenix client "self-reported" sample.

Table 7: Estimated Annual Isagenix Savings – U.S. Client Base and Study Sample[15]

CLIENT POPULATION SIMULATED AT 500,000			
	Overweight	**Obese**	**Total**
Direct	$62,948,858	$165,721,719	$228,670,577
Indirect	$198,422,352	$490,447,850	$688,870,202
Total	$261,371,210	$656,169,569	$917,540,779
ISAGENIX SAMPLE OF 12,561			
	Overweight	**Obese**	**Total**
Direct	$1,581,401	$4,163,261	$5,744,662
Indirect	$4,983,871	$12,321,031	$17,304,902
Total	$6,565,272	$16,484,292	$23,049,564

Source: Authors' Calculations

Comparisons based on Clinical Trials

Arciero et al. (2016) in a set of clinical trials find that Protein Pacing™ and intermittent fasting using the Isagenix Weight Loss solutions resulted in a 3.8 BMI reduction from BMI 37.5 to BMI 33.7. Seidman compared this incremental change in BMI with both the exponential and linear risk profiles for each disease and then tallied the case reductions and cost savings for comparisons with results obtained in the sample. Findings for the overall population of 20 diseases are presented in Table 8.

The measured impact from the clinical trial based experiment yields reductions in disease probabilities that are larger than those observed based upon the self-reported sample. Results based on the exponential experiments are considerably larger than those observed in the sample. If the 3.8 BMI point reduction observed in the clinical trials can be obtained with all the obese Isagenix clients, the national savings for Isagenix clients alone would range from $866 million to $1.168 billion, as shown in Table 9, dependent on the risk profile linking BMI reduction and disease risk used.

The clinical trial based impacts are larger because the analysis is based on a group of individuals with significantly higher starting BMIs on average than the Isagenix sample of self-reported BMI participants.

[15] Based on linear risk profiles and self-reported responses from Isagenix clients.

Table 8: Estimated Savings based on Clinical Trials BMI Reductions – Overall U.S. Population[16]

Total Disease Cases across 20 Diseases (2014)	296,446,831
Milken original attributable (linear +exponential)	172,594,297
After BMI reduction exponential	55,705,005
After BMI reduction linear	67,210,088
Savings/Reduced Costs compared with Milken	
Exponential Obese only	$356,718,671,724
Linear Obese only	$264,110,029,016
Savings per overweight and obese individuals (annual)	
Direct	
Exponential	1,158
Linear	831
Indirect (20-64 population)	
Exponential	3,457
Linear	2,597

Table 9: Estimated Savings based on Clinical Trials BMI Reductions – Isagenix Client Population

	Exponential Risk Profile	Linear Risk Profile
Direct	$305,490,372	$219,548,632
Indirect	$862,346,259	$646,929,395
Total	$1,167,836,630	$866,478,027

Implications

The cost savings and value of retained workforce productivity measured above pertain to a single year based on the findings of Milken (2016). Arciero et al. (2016) suggest that participants in nutrition programs using his Protein Pacing™ and intermittent fasting method could experience ongoing BMI reductions, thereby generating multi-year benefits. Given that the average age of an Isagenix sample client is 45 years old, a permanent BMI reduction could also foster ongoing workforce productivity gains for approximately 20 years using the age profile in the Isagenix sample. Comparable impacts are estimated for participants in clinical trials as noted above. Based upon the age profile in the sample,

[16] Based on the 20 diseases in Seidman's analysis using the Arciero et al. Human Clinical Data.

working lifetime benefits from the observed BMI reductions could be as large as 20 times the annual savings.

Moreover, a considerable share of the benefits accrue to those with chronic diseases simply because these are most prevalent in the overall population. Permanent BMI reduction can presumably prevent treatment costs for at least 5 sets of chronic conditions examined by Milken on an annual basis. These are asthma, back pain, diabetes, hypertension and osteoarthritis. A tally for the 5 chronic diseases is tabulated for illustrative purposes below.

Table 10: Estimated 20-Year Savings for the U.S. as a Whole for 5 Chronic Conditions

CONDITION	COST SAVINGS OVER 20 YEARS (Billions $)
Asthma	210.0
Chronic Back Pain	974.5
Diabetes	1,291.4
Hypertension	1,368.6
Osteoarthritis	326.0
Total	4,170.5

Source: Authors' Calculations

The avoided treatment costs and retained workforce productivity gains over 20 years for the subset of 5 chronic conditions listed above through BMI reductions among the 12,561 Isagenix study sample could be worth approximately $357 million. This equates to over $28,000 per person over the 20-year period. For all 20 diseases these numbers grow to $461 million and $36,700 per person

Extrapolating to the Isagenix U.S. client population of 500,000, the total savings over 20 years could total over $14 billion for the chronic diseases alone. For the U.S. population as a whole, the savings could equate to trillions of dollars, as shown in Table 10. Expanding these results to include all 20 diseases raises the impacts by an additional 30% over the 20 year period.

Table 11 illustrates the annual direct, indirect and total costs for each disease category at a national level.

Table 11: Annual U.S. Costs Saved due to Simulated BMI Reduction by Condition[17]

	DIRECT COST (Billions $)	INDIRECT COST (Billions $)	TOTAL COST (Billions $)
Asthma	$4.03	$6.47	$10.50
Alzheimer's	$13.03	$6.03	$19.06
Breast Cancer	$0.55	$5.31	$5.85
Chronic Back Pain	$7.07	$41.66	$48.72
Colorectal Cancer	$0.80	$0.74	$1.53
Congestive Heart Failure	$6.93	$2.68	$9.62
Coronary Heart Disease	$3.02	$4.69	$7.71
Diabetes	$22.61	$41.96	$64.57
End Stage Renal Disease	$4.01	$0.00	$4.01
Endometrial Cancer	$0.32	$0.28	$0.61
Esophageal Adenocarcinoma	$0.12	$0.01	$0.13
Gallbladder Cancer	$0.00	$0.00	$0.00
Gallbladder Disease	$12.00	$6.02	$18.02
Gastric Cardia Adenocarcinoma	$0.18	$0.02	$0.20
Hypertension	$4.17	$64.26	$68.43
Osteoarthritis	$4.53	$11.77	$16.30
Ovarian Cancer	$0.80	$0.11	$0.92
Pancreatic Cancer	$0.03	$0.18	$0.21
Renal Cancer	$0.19	$0.05	$0.24
Stroke	$2.02	$2.17	$4.19
TOTAL COSTS (all diseases)	$86.43	$194.40	$280.82

Source: Authors' Calculations based on linear risk profiles and BMI reductions obtained from the "self-reported" Isagenix sample.

Summary

Milken (2016) reveals the huge cost that overweight and obesity causes by increasing the risk of disease. BMI reductions obtained from Arciero et al.'s Protein Pacing™ and intermittent fasting method using Isagenix products can lead to healthy outcomes observable in peer-reviewed human clinical trial interventions. The logical extension of these findings is that BMI reductions lead to reductions in risk of disease that can, if achieved at a national level, reduce the costs of weight related diseases by 20% or more. Moreover, maintaining the BMI reductions over time results in reoccurring savings measurable in terms of more reported "healthy days", greater workforce productivity, and lower treatment costs.

[17] Rows and columns may not tally exactly due to rounding.

APPENDIX

Figure A1: Alzheimer's or Vascular Dementia

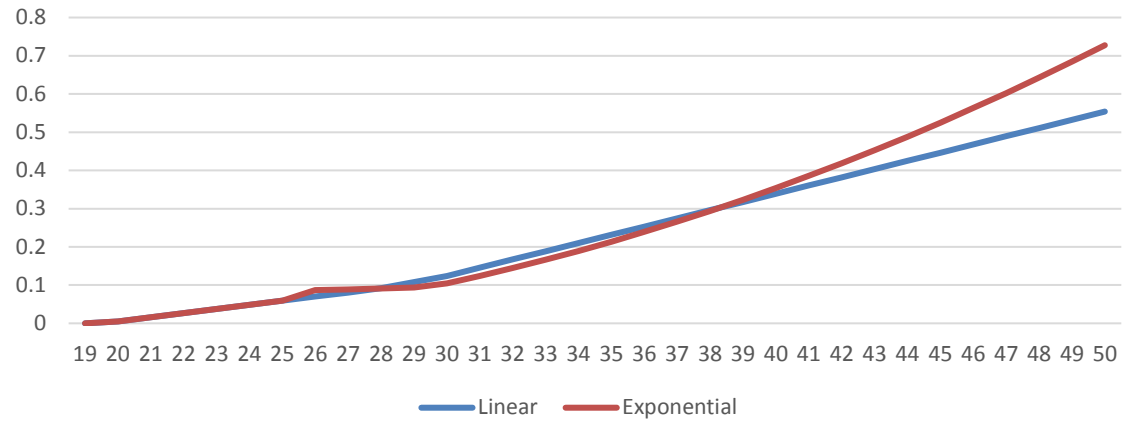


Figure A2: Asthma

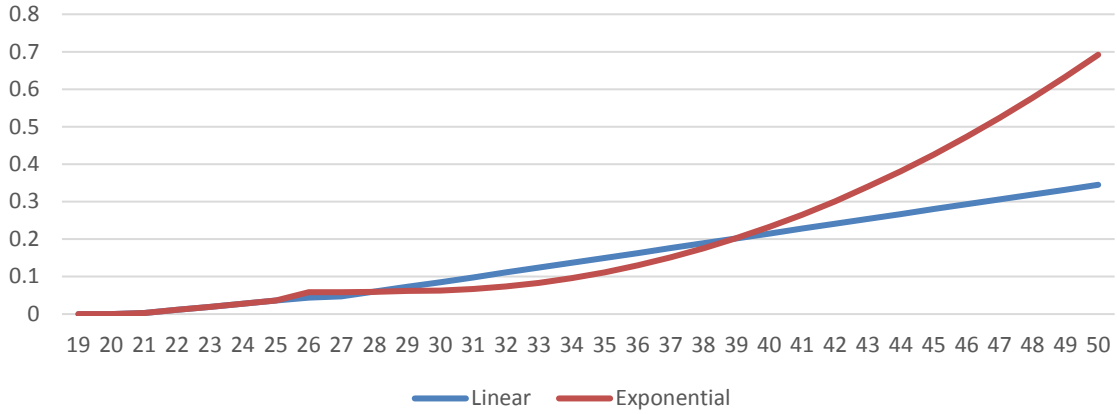


Figure A3: Breast Cancer

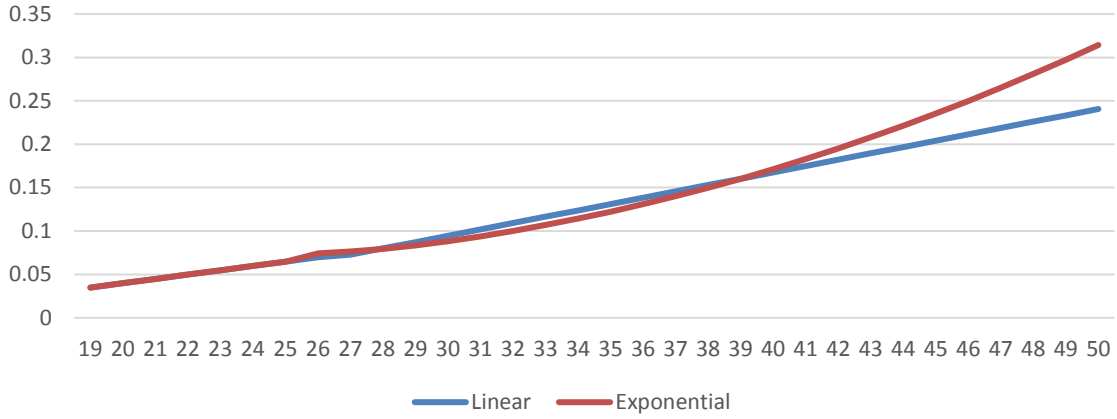


Figure A4: Chronic Back Pain

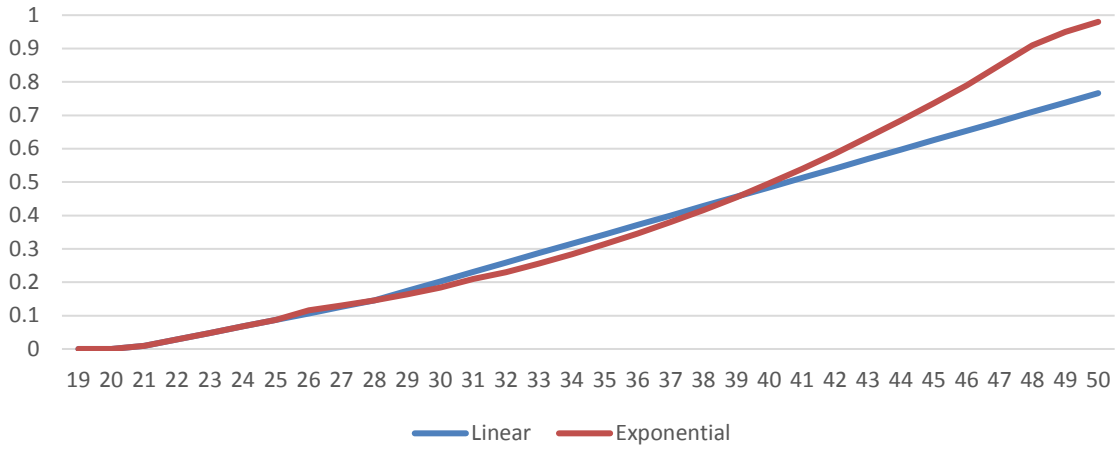


Figure A5: Colorectal Cancer

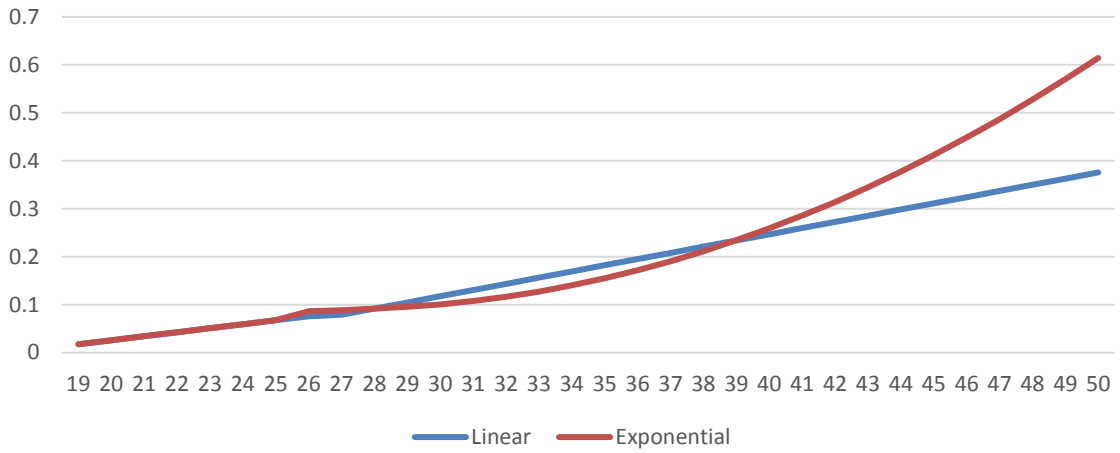


Figure A6: Congestive Heart Failure

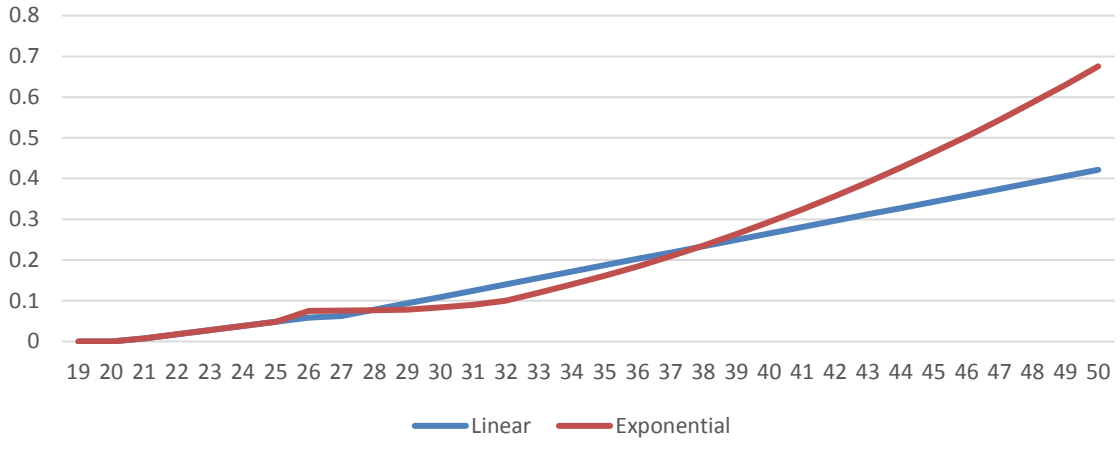


Figure A7: Coronary Heart Disease

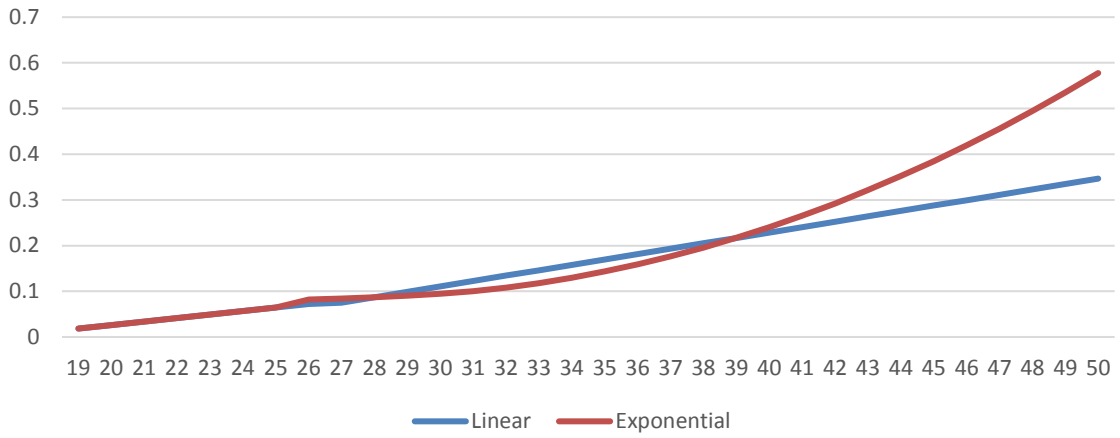


Figure A8: Diabetes Type 2

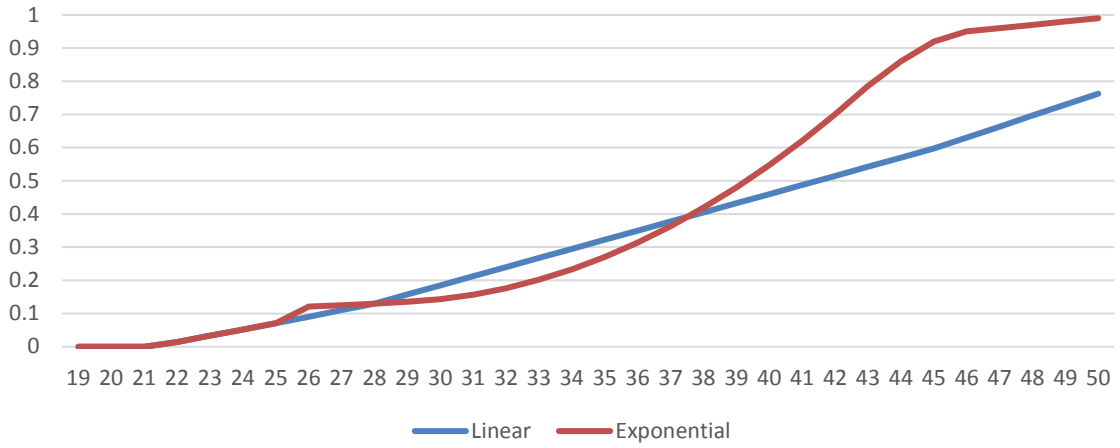


Figure A9: End Stage Renal Disease

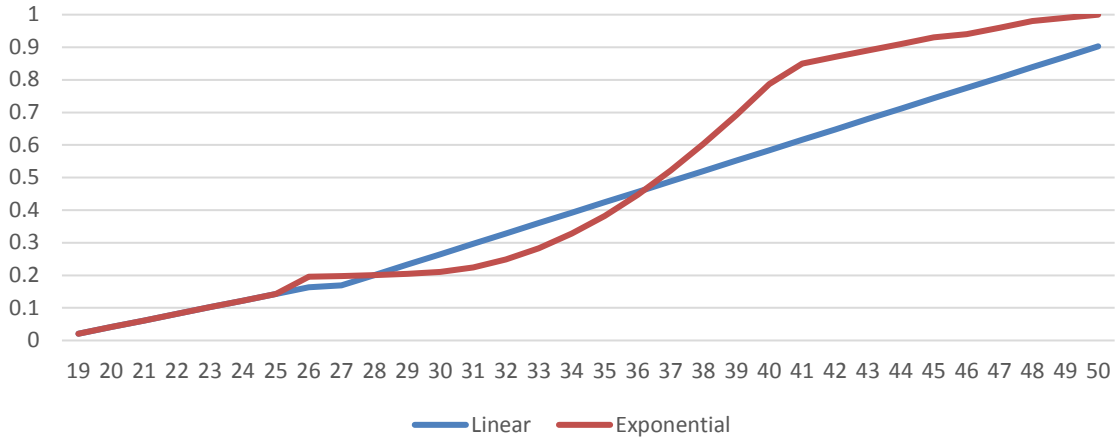


Figure A10: Endometrial Cancer

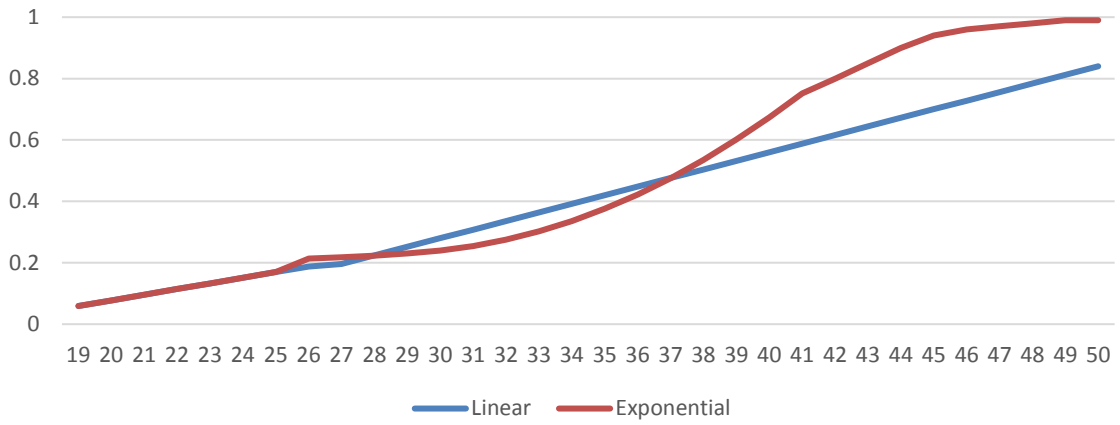


Figure A11: Esophageal Adenocarcinoma

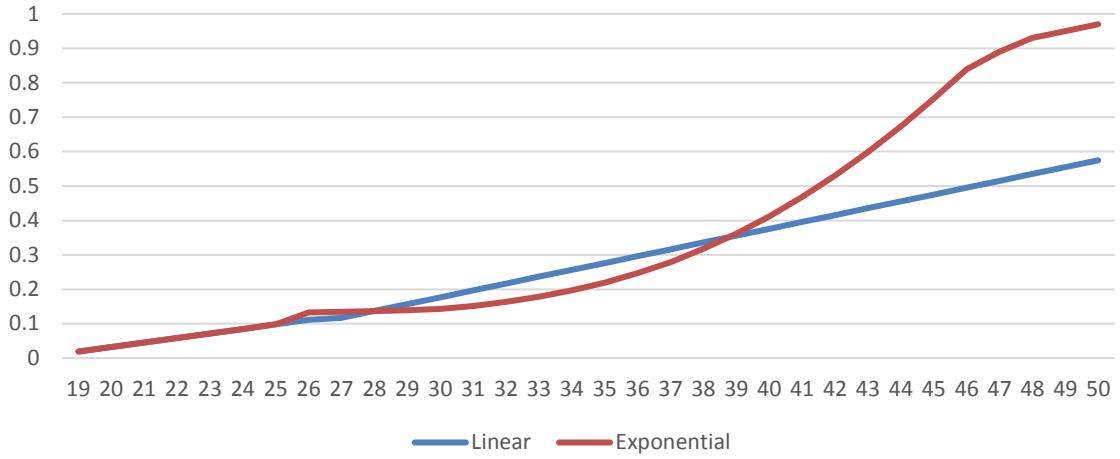


Figure A12: Gallbladder Cancer

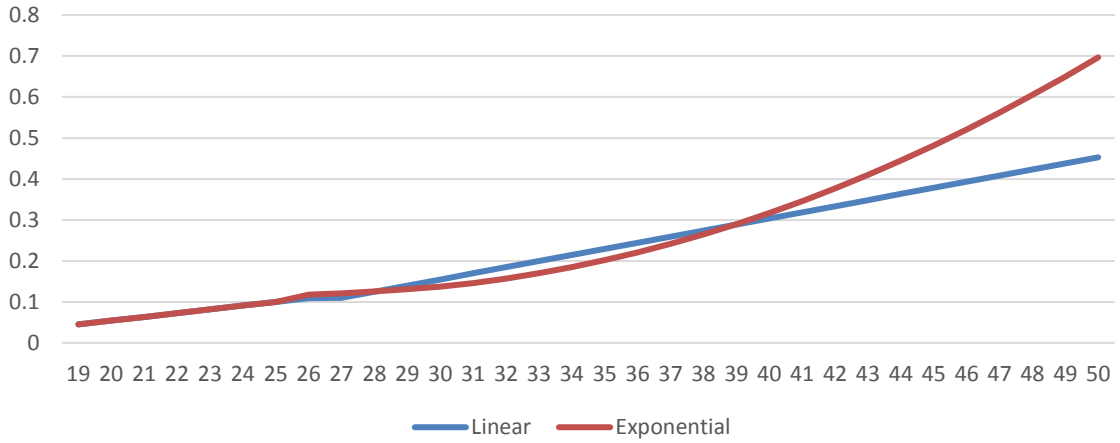


Figure A13: Gallbladder Disease

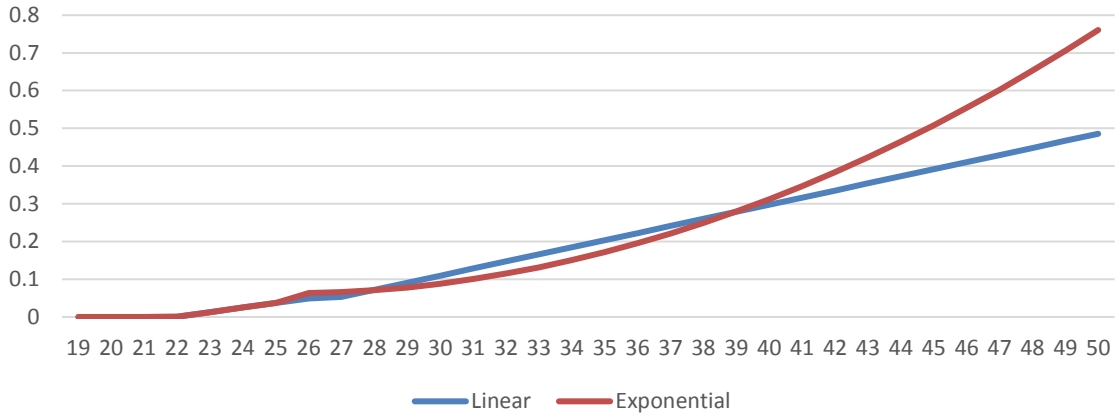


Figure A14: Gastric Cardia Adenocarcinoma

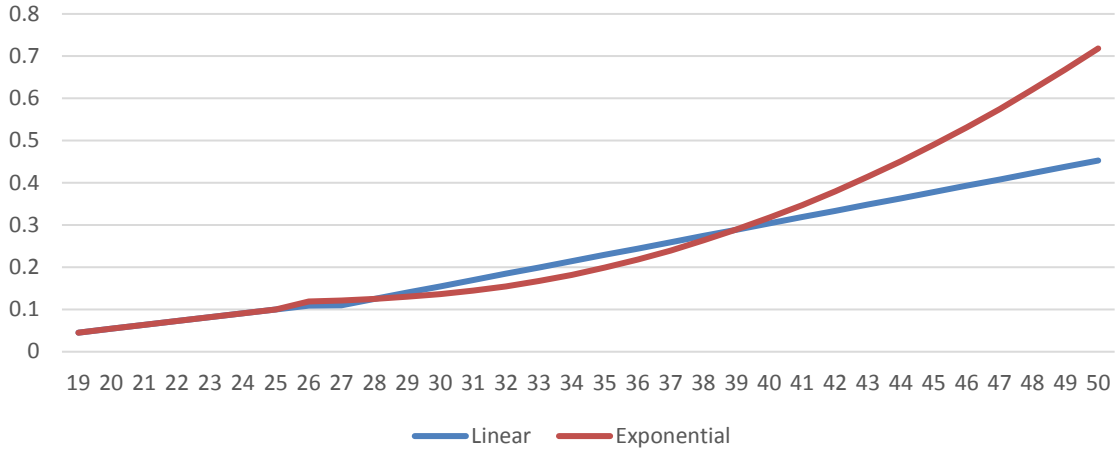


Figure A15: Hypertension

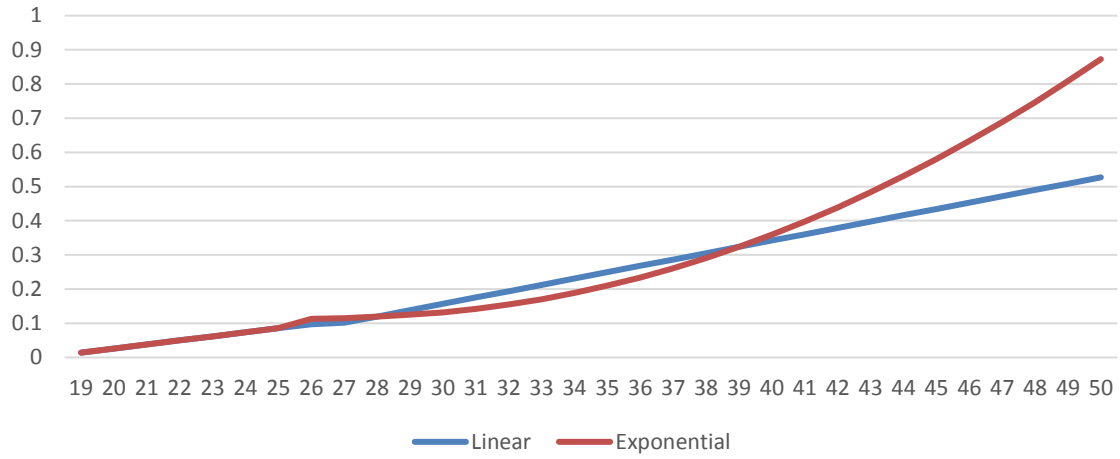


Figure A16: Osteoarthritis

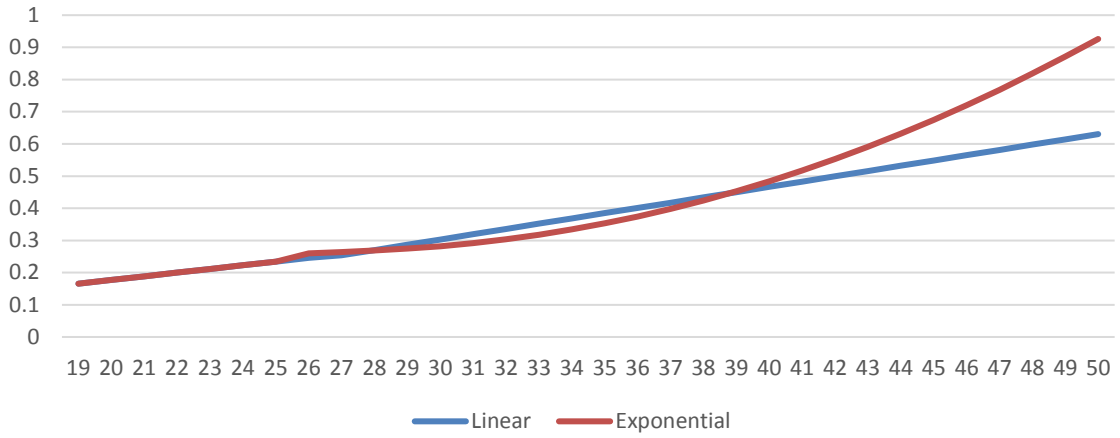


Figure A17: Ovarian Cancer

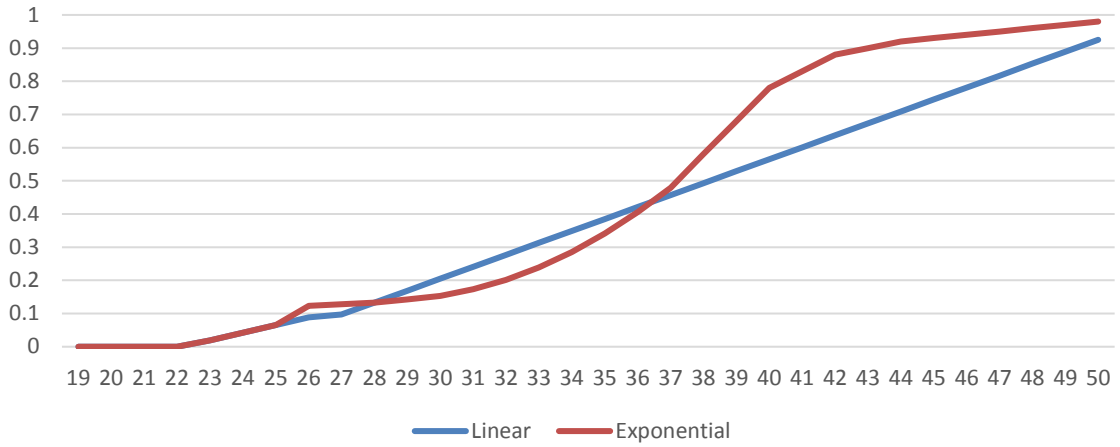


Figure A18: Pancreatic Cancer

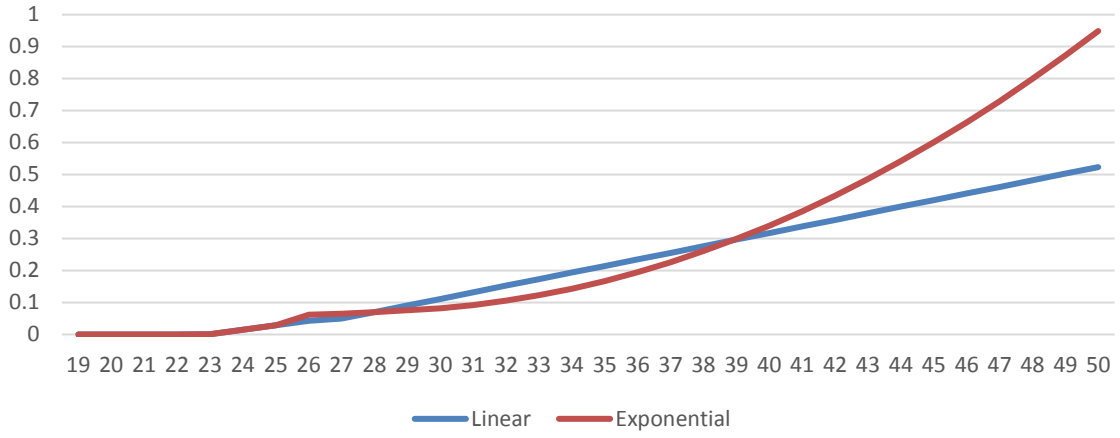


Figure A19: Renal Cancer

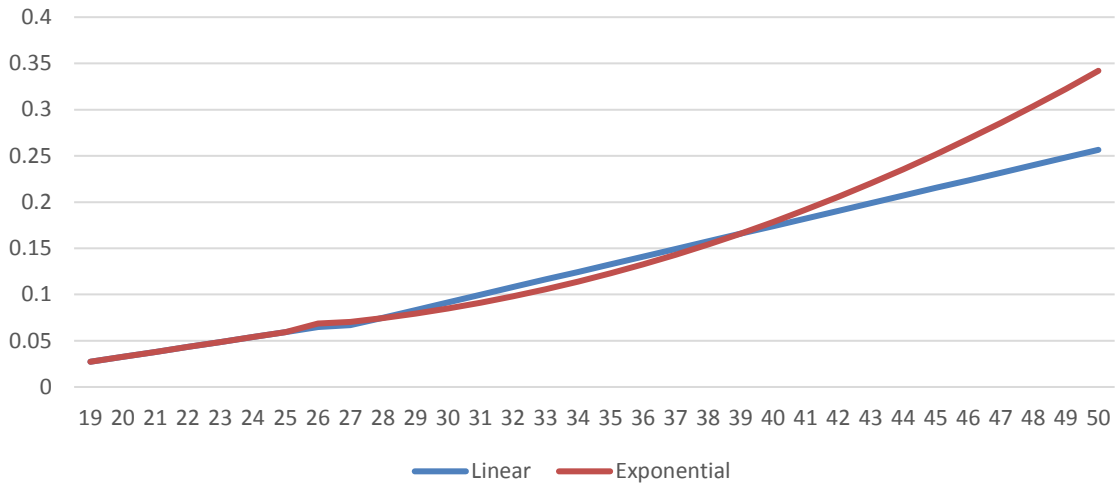
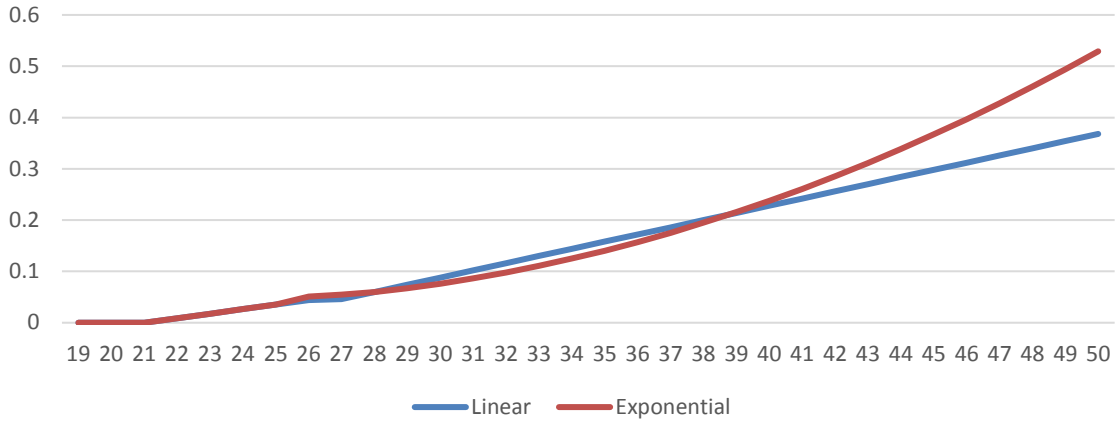


Figure A20: Stroke



REFERENCES

Agency for Healthcare Research and Quality (AHRQ). Medical Expenditure Panel Survey. MEPSnet Query. Available at: https://www.ahrq.gov/research/data/meps/index.html

Alzheimers.net. Alzheimer's Statistics.

Alzheimer's Association. 2014 Alzheimer's Facts & Figures. Available at: https://www.alz.org/downloads/facts_figures_2014.pdf

Amling, Christopher L., Robert H. Riffenburgh, Leon Sun, Judd W. Moul, Raymond S. Lance, Leo Kusuda, Wade J. Sexton, Douglas W. Soderdahl, Timothy F. Donahue, John P. Foley, Andrew K. Chung and David G. McLeod. Pathologic Variables and Recurrence Rates as Related to Obesity and Race in Men with Prostate Cancer Undergoing Radical Prostatectomy. Journal of Clinical Oncology, Vol. 22 (2004), pp. 439-445.

Anstey KJ, Cherbuin N, Budge M, Young J. Body Mass Index in Midlife and Late-life as a Risk Factor for Dementia: A Meta-Analysis of Prospective Studies. Obesity Review, Vol. 12 (2011), pp. e426-e437.

Arciero PJ, Baur D, Connelly S, and Ormsbee MJ. Timed-Daily Ingestion of Whey Protein and Exercise Training Reduces Visceral Adipose Tissue Mass and Improves Insulin Resistance: The Prise Study. Journal of Applied Physiology. 2014; 117(1):1–10.

Arciero PJ, Edmonds RC, Bunsawat K, Gentile CL, Ketcham C, Darin C, Renna M, Zheng Q, Zhang JZ, Ormsbee MJ. Protein-Pacing From Food or Supplementation Improves Physical Performance in Overweight Men and Women: The Prise 2 Study. Nutrients. 2016: 8(5):E288.

Arciero PJ, Gentile CL, Martin-Pressman R, Ormsbee MJ, Everett M, Zwicky L, and Steele CA. Increased Dietary Protein and Combined High Intensity Aerobic and Resistance Exercise Improves Body Fat Distribution and Cardiovascular Risk Factors. International Journal Sport Nutrition Exercise Metabolism 2016: 16(4):373–92.

Arciero PJ, Ormsbee MJ, Gentile CL, Nindl BC, Brestoff JR, and Ruby M. Increased Protein Intake and Meal Frequency Reduces Abdominal Fat during Energy Balance and Energy Deficit. Obesity (Silver Spring). 2013: 21(7):1357–66.

Arciero PJ et al. Protein-Pacing Caloric-Restriction Enhances Body Composition Similarly in Obese Men and Women during Weight Loss and Sustains Efficacy during Long-Term Weight Maintenance. Nutrients 8.8 (2016): 476. PMC.

Arciero PJ et al. Protein-Pacing and Multi-Component Exercise Training Improves Physical Performance Outcomes in Exercise-Trained Women: The PRISE 3 Study. Nutrients 8.6 (2016): 332. PMC.

Beuther, David A., Scott T. Weiss, and E. Rand Sutherland. Obesity and Asthma. American Journal of Respiratory and Critical Care Medicine, Vol. 174 (2006), pp. 112-119.

Bogers RP, Bemelmans WJ, Hoogenveen RT, Boshuizen HC, Woodward M, Knekt P, van Dam RM, Hu FB, Visscher TL, Menotti A, Thorpe RJ Jr, Jamrozik K, Calling S, Strand BH, Shipley MJ; and the BMICHD Collaboration Investigators. Association of Overweight with Increased Risk of Coronary Heart Disease Partly Independent of Blood Pressure and Cholesterol Levels: A Meta-Analysis of 21 Cohort Studies Including More Than 300,000 Persons. Archives of Internal Medicine, Vol. 167 (2007), No. 16, pp. 1720-1728.

Calle, Eugenia E., and Rudolf Kaaks. Overweight, Obesity and Cancer: Epidemiological Evidence and Proposed Mechanisms. Nature Reviews Cancer, Vol. 4 (2004), pp. 579-591.

Centers for Disease Control and Prevention (CDC), Division for Heart Disease and Stroke Prevention. High Cholesterol Facts. Available at: https://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_cholesterol.htm

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS) National Health Interview Survey, 2014. Table A-2a. Age-Adjusted Percentages (with Standard Errors) of Selected Respiratory Diseases among Adults Aged 18 and Over, by Selected Characteristics: United States, 2014. Available at: https://ftp.cdc.gov/pub/health_statistics/NCHS/NHIS/SHS/2014_SHS_Table_A-2.pdf.

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS) National Health Interview Survey, 2014. Table C-1a. Age-Adjusted Percentages (with Standard Errors) of Ever Having Asthma and Still Having Asthma for Children under Age 18 Years, by Selected Characteristics: United States, 2014. Available at: https://www.cdc.gov/nchs/data/series/sr_10/sr10_260.pdf

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS). National Health Interview Survey Figure 15.1. Percentage of Persons of All Ages who experienced an Asthma Episode in the Past 12 Months: United States, 1997-June 2015. Early Release of Selected Estimates Based on Data from the NHIS, January-June 2015.

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS). Heart Disease. Available at: https://www.cdc.gov/nchs/fastats/heart-disease.htm

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS). Vital and Health Statistics, Series 10 (2014), No. 260. Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2012. Available at: https://www.cdc.gov/nchs/data/series/sr_10/sr10_260.pdf

Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Statistics Report, 2014. Available at: https://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf

Centers for Disease Control and Prevention (CDC), Division for Heart Disease and Stroke Prevention. Cholesterol Fact Sheet. Available at: https://www.cdc.gov/dhdsp/index.htm

Centers for Disease Control and Prevention (CDC), National Center for Health Statistics. NCHS Data Brief No. 220, November 2015. Hypertension Prevalence and Control among Adults: United States, 2011–2014. DC, NCHS. Available at: https://www.cdc.gov/nchs/products/databriefs/db220.htm

Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion. Osteoarthritis. Available at: https://www.cdc.gov/chronicdisease/resources/publications/aag/arthritis.htm

Centers for Disease Control and Prevention, National Center for Health Statistics (CDC/NCHS). Health, United States, 2015, with Special Feature on Racial and Ethnic Health Disparities. Table 58. Normal Weight, Overweight, and Obesity among Adults Aged 20 and Over, by Selected Characteristics: United States, Selected years 1988-1994 through 2011-2014. Available at: https://www.cdc.gov/nchs/data/hus/2015/058.pdf

Centers for Disease Control and Prevention, National Center for Health Statistics (CDC/NCHS). Health, United States, 2015, with Special Feature on Racial and Ethnic Health Disparities. Table 59. Obesity among Children and Adolescents Aged 2-19 Years, by Selected Characteristics: United States, Selected Years 1988-1994 through 2011-2014. Available at: https://www.cdc.gov/nchs/data/hus/hus15.pdf

Chang, Shih-Chen, Regina G. Ziegler, Barbara Dunn, Rachael Stolzenberg-Solomon, James V. Lacey, Jr., Wen-Yi Huang, Arthur Schatzkin, Douglas Reding, Robert N. Hoover, Patricia Hartge, and Michael F. Leitzmann. Association of Energy Intake and Energy Balance with Postmenopausal Breast Cancer in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial. Cancer Epidemiology Biomarkers & Prevention, Vol. 15 (2006), pp. 334-341. Available at: http://cebp.aacrjournals.org/content/15/2/334.full

Chen, Yue, Robert Dales, Daniel Krewski, and Krista Breithaupt. Increased Effects of Smoking and Obesity on Asthma Among Female Canadians: The National Population Health Survey, 1994-1995. American Journal of Epidemiology, Vol. 150, pp. 255-262.

Department of Health and Human Services, Agency for Healthcare Research and Quality (AHRQ). Medical Expenditure Panel Survey Statistical Brief #289: Back Problems: Use and Expenditures for the U.S. Adult Population, 2007. Available at: https://meps.ahrq.gov/data_files/publications/st289/stat289.pdf

Department of Health and Human Services, National Institutes of Health, National Cancer Institute. Cancer Prevalence and Cost of Care Projections. Available at: https://costprojections.cancer.gov/

Everhart, James E., Meena Khare, Michael Hill, and Kurt R. Maurer. Prevalence and Ethnic Differences in Gallbladder Disease in the United States. Gastroenterology, Vol. 117 (1999), No. 3, p. 632.

Freedland, Stephen J., William J. Aronson, Christopher J. Kane, Joseph C. Presti, Christopher L. Amling, David Elashoff, and Martha K. Terris. Impact of Obesity on Biochemical Control after Radical Prostatectomy for Clinically Localized Prostate Cancer: A Report by the Shared Equal Access Regional Cancer Hospital Database Study Group. Journal of Clinical Oncology, Vol.22 (2004), pp. 446-453.

Fox, Caroline S., Martin G. Larson, Eric P. Leip, Bruce Culleton, Peter W. Wilson, and Daniel Levy. Predictors of New-Onset Kidney Disease in a Community-Based Population. Journal of the American Medical Association, Vol. 291 (2004), No. 7, pp. 844-850.

Goetzel, Ron Z., Stacey R. Long, Ronald J. Ozminkowski, Kevin Hawkins, Shaohung Wang, Wendy Lynch. Health, Absence, Disability, and Presenteeism - Cost Estimates of Certain Physical and Mental Health Conditions Affecting U.S. Employers. Journal of Occupational and Environmental Medicine, Vol. 46 (2004), No. 4, pp.398-412.

Guh, Daphne P., Wei Zhang, Nick Bansback, Zubin Amarsi, C. Laird Birmingham, Aslam H. Anis. The Incidence of Co-morbidities related to Obesity and Overweight: A Systematic Review and Meta-Analysis. BMC Public Health, Vol. 9 (2009), No. 88.

Halperin JL, Albert NM, Bozkurt B, Brindis RG, Curtis LH, DeMets D, Hochman JS, Kovacs RJ, Ohman EM, Pressler SJ, Sellke FW, Shen WK, Smith SC, Tomaselli GF. 2013 AHA/ ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Obesity Society. Circulation, Vol. 129 (2014), No. 25, pp. S102–S138.

He, Jiang, Lorraine G. Ogden, Lydia A. Bazzano, Suma Vupputuri, Catherine Loria, and Paul Whelton. Risk Factors for Congestive Heart Failure in US Men and Women: NHANES I Epidemiologic Follow-Up Study. Archives of Internal Medicine, Vol. 161 (2001), pp. 996-1002.

Heart Disease and Stroke Statistics—2016 Update. American Heart Association. Available at: https://www.heart.org/idc/groups/ahamah-public/@wcm/@sop/@smd/documents/downloadable/ucm_480110.pdf

He, Feng et al. Serum Polychlorinated Biphenyls Increase and Oxidative Stress Decreases with a Protein-Pacing Caloric Restriction Diet in Obese Men and Women. Ed. Peter Clifton. International Journal of Environmental Research and Public Health 14.1 (2017): 59. PMC.

Hu, Frank B. Obesity Epidemiology. New York: Oxford University Press. 2008. Available at: http://sgh.org.sa/Portals/0/Articles/Obesity%20Epidemiology%20-%20Methods%20and%20Applications.pdf

Hu, Frank B., JoAnn E. Manson, Meir J. Stampfer, Graham Colditz, Simin Liu, Caren Solomon, and Walter C. Willett. Diet, Lifestyle, and the Risk of Type 2 Diabetes Mellitus in Women. New England Journal of Medicine, Vol. 345 (2001), pp. 790-797.

Huang, Zhiping, Walter C. Willett, JoAnn E. Manson, Bernard Rosner, Meir J. Stampfer, Frank E. Speizer, and Graham A. Colditz. Body Weight, Weight Change, and Risk for Hypertension in Women. Annals of Internal Medicine, Vol. 128 (1998), No. 2, pp. 81-88.

Hung, Chi-Fa, Margarita Rivera, Nick Craddock, Michael J. Owen, Michael Gill, Ania Korszun, Wolfgang Maier, Ole Mors, Martin Preisig, John P. Rice, Marcella Rietschel, Lisa Jones, Lefkos Middleton, Kathy J. Aitchison, Oliver S.P. Davis, Gerome Breen, Cathryn Lewis, Anne Farmer, Peter McGuffin. Relationship between Obesity and the Risk of Clinically Significant Depression: Mendelian Randomisation Study. The British Journal of Psychiatry, Vol. 205 (2014), No. 1, pp. 24-28.

Hurd, Michael D., Paco Martorell, Adeline Delavande, Kathleen J. Mullen, and Kenneth M. Langa. Monetary Costs of Dementia in the United States. New England Journal of Medicine, Vol. 368 (2013), pp. 1326-1334.

Hsu Chi-Yuan, Charles E. McCulloch, Carlos Iribarren, Jeanne Darbinian, and Alan S. Go. Body Mass Index and Risk for End-Stage Renal Disease. Annals of Internal Medicine, Vol. 144 (2006), pp. 21-28.

International Association for the Study of Obesity. Estimated Relative Risk of Disease by BMI Category: Overweight and Obesity. Available at: https://www.worldobesity.org/what-we-do/policyprevention/projects/eu-projects/dynamohiaproject/estimatesrelativerisk/

Ives SJ, Norton C, Miller V, Minicucci O, Robinson J, O'Brien G, Escudero D, Paul M, Sheridan C, Curran K, Rose K, Robinson N, He F, and Arciero PJ. Multi-Modal Exercise Training and Protein-Pacing Enhances Physical Performance Adaptations Independent of Growth Hormone and BDNF but may be Dependent on IGF-1 in Exercise-Trained Men. Science Direct (2017). Available at: http://www.sciencedirect.com/science/article/pii/S1096637416300600

Jensen MD, Ryan DH, Apovian CM, Ard JD, Comuzzie AG, Donato KA, Hu FB, Hubbard VS, Jakicic JM, Kushner RF, Loria CM, Millen BE, Nonas CA, Pi-Sunyer FX, Stevens J, Stevens VJ, Wadden TA, Wolfe BM, Yanovski SZ, Jordan HS, Kendall KA, Lux LJ, Mentor-Marcel R, Morgan LC, Trisolini MG, Wnek J, Anderson

Kenchaiah, Satish, Jane C. Evans, Daniel Levy, Peter W.F. Wilson, Emelia J. Benjamin, Martin G. Larson, William B. Kannel, and Ramachandran S. Vasan. Obesity and the Risk of Heart Failure. New England Journal of Medicine, Vol. 347 (2002), pp. 305-313.

Kubendran, Sindhu, Ross DeVol, and Anusuya Chatterjee. The Price Women Pay for Dementia: Strategies to Ease Gender Disparity and Economic Costs, Milken Institute (2016), p. 7.

Labad J, Price JF, Strachan MW, Fowkes, FG, Ding, J, Deary, IJ, Lee, AJ, Frier, BM, Decki, HR, Walker, RR, Reynolds, RM. Symptoms of Depression but not Anxiety are associated with Central Obesity and Cardiovascular Disease in People with Type 2 Diabetes: the Edinburgh Type 2 Diabetes Study. Diabetologia, Vol. 53 (2010), No. 3, pp. 467-471.

Lahmann, Petra H., Kurt Hoffmann, Naomi Allen, Carla H. Van Gils, Kay-Tee Khaw, Bertrand Tehard, Franco Berrino, Anne Tjønneland, Janne Bigaard, Anja Olsen, Kim Overvad, Francoise Clavel-Chapelon, Gabriele Nagel, Heiner Boeing, Dimitrios Trichopoulos, George Economou, George Bellos, Domenico Palli, Rosario Tumino, Salvatore Panico, Carlotta Sacerdote, Vittorio Krogh, Petra H.M. Peeters, H. Bas Bueno-De-Mesquita, Eiliv Lund, Eva Ardanaz, Pilar Amiano, Guillem Pera, José R. Quiros, Carmen Martinez, Marıa J. Tormo, Elisabet Wirfalt, Goran Berglund, Goran Hallmans, Timothy J. Key, Gillian Reeves, Sheila Bingham, Teresa Norat, Carine Biessy, Rudolf Kaaks, and Elio Riboli. Body Size and Breast Cancer Risk: Findings from the European Prospective Investigation into Cancer and Nutrition (EPIC). International Journal of Cancer, Vol. 111 (2004), pp. 762-771.

Laliberté, François, Brahim K. Bookhart, Francis Vekeman, Mitra Corral, Mei Sheng Duh, Robert A. Bailey, Catherine Tak Piech, and Patrick Lefebvre. Direct All-Cause Health Care Costs Associated with Chronic Kidney Disease in Patients with Diabetes and Hypertension: A Managed Care Perspective. Journal of Managed Care Pharmacy, Vol. 15 (2009), No. 4, pp. 312-322.

Lawrence, Reva C., David T. Felson, Charles G. Helmick, Lesley M. Arnold, Hyon Choi, Richard A.Deyo, Sherine Gabriel, Rosemarie Hirsch, Marc C. Hochberg, Gene G. Hunder, Joanne M. Jordan, Jeffrey N. Katz, Hilal Maradit Kremers, and Frederick Wolfe, for the National Arthritis Data Workgroup. Estimates of the Prevalence of Arthritis and Other Rheumatic Conditions in the United States. Part II. Arthritis & Rheumatism, Vol. 58 (2008), No. 1, pp. 26-35.

Li, Mengying, M. Daniele Fallin, Anne Riley, Rebecca Landa, Sheila O. Walker, Michael Silverstein, Deanna Caruso, Colleen Pearson, Shannon Kiang, Jamie Lyn Dahm, Xiumei Hong, Guoying Wang, Mei-Cheng Wang, Barry Zuckerman, Xiaobin Wang. The Association of Maternal Obesity and Diabetes with Autism and Other Developmental Disabilities. Pediatrics, Vol. 137 (2016), No. 2.

Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, Zitman, FG. Overweight, Obesity, and Depression: A Systematic Review and Meta-Analysis of Longitudinal Studies. Archives of General Psychiatry 2010; 67(3): 2209.

Mariotto, Angela B., K. Robin Yabroff, Yongwu Shao, Eric J. Feuer, Martin L. Brown. Projections of the Cost of Cancer Care in the United States: 2010–2020. Journal of the National Cancer Institute, Vol. 103 (2011), pp. 117–128.

McTigue, Kathleen, Joseph C. Larson, Alice Valoski, Greg Burke, Jane Kotchen, Cora Lewis, Marcia Stefanick, Linda van Horn, Lewis Kuller. Mortality and Cardiac and Vascular Outcomes in Extremely Obese Women. Journal of the American Medical Association, Vol. 296, No. 1, pp. 79-86.

Milken Institute. Weighing Down America: The Health and Economic Impact of Obesity. 2016.

National Institutes of Health, National Cancer Institute (NCI). Cancer Prevalence and Cost of Care Projections. Available at: https://costprojections.cancer.gov/

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Colon and Rectum Cancer. Available at: https://seer.cancer.gov/statfacts/html/colorect.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Esophageal Cancer. Available at: https://seer.cancer.gov/statfacts/html/esoph.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Kidney and Renal Pelvis Cancer. Available at: https://seer.cancer.gov/statfacts/html/kidrp.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Liver and Intrahepatic Bile Duct Cancer. Available at: https://seer.cancer.gov/statfacts/html/livibd.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Female Breast Cancer. Available at: https://seer.cancer.gov/statfacts/html/breast.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Ovary Cancer. Available at: https://seer.cancer.gov/statfacts/html/ovary.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Prostate Cancer. Available at: https://seer.cancer.gov/statfacts/html/prost.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Stomach Cancer. Available at: https://seer.cancer.gov/statfacts/html/stomach.html

National Institutes of Health, National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). SEER Stat Fact Sheets: Pancreas Cancer. Available at: https://seer.cancer.gov/statfacts/html/pancreas.html

Osteoarthritis (OA). Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/arthritis/basics/osteoarthritis.htm

Pedditizi, Emilio, Ruth Peters, and Nigel Beckett. The Risk of Overweight/Obesity in Mid-Life and Late Life for the Development of Dementia: A Systematic Review and Meta-Analysis of Longitudinal Studies. Age and Ageing, Vol. 45 (2016), No. 1, pp. 14-21.

Rappaport, Harvey and Vijayveer Bonthapally. The Direct Expenditures and Indirect Costs Associated with Treating Asthma in the United States. Journal of Allergy & Therapy, Vol. 3 (2012), No. 2.

Roberts, Robert E., George A. Kaplan, Sarah J. Shema, and William J. Strawbridge. Are the Obese at Greater Risk for Depression? American Journal of Epidemiology, Vol. 152 (2000), No. 2, pp. 163-170.

Rock, Cheryl, and Wendy Demark-Wahnefried. Nutrition and Survival after the Diagnosis of Breast Cancer: A Review of the Evidence. Journal of Clinical Oncology, Vol. 20 (2002), No. 15, pp. 3302-3316.

Saydah, Sharon, Kai McKeever Bullard, Yiling Cheng, Mohammed K. Ali, Edward W. Gregg, Linda Geiss, and Giuseppina Imperatore. Trends in Cardiovascular Disease Risk Factors by Obesity Level in Adults in the United States, NHANES 1999-2010. Obesity, Vol. 22 (2014), pp. 1888-1895.

Ruby M, Repka CP, and Arciero PJ. Comparison of Protein-Pacing Alone or with Yoga/Stretching and Resistance Training on Glycemia, Total and Regional Body Composition, and Aerobic Fitness in Overweight Women. Journal of Physical Activity and Health. 2016: 13(7):754–64.

Shmagel, Anna, Robert Foley, and Hassan Ibrahim. Epidemiology of Chronic Low Back Pain in U.S. Adults: National Health and Nutrition Examination Survey 2009-2010. Arthritis Care & Research, forthcoming. DOI 10.1002/acr.22890. Available at: http://onlinelibrary.wiley.com/doi/10.1002/acr.22890/pdf

Shore, Stephanie, and Richard Johnston. Obesity and Asthma. Pharmacology and Therapeutics, Vol. 110 (2006), pp. 83-102.

Simon Dagenais, Jaime Caro, and Scott Haldeman. A Systematic Review of Low Back Pain Cost of Illness Studies in the United States and internationally. The Spine Journal, Vol. 8 (2008), pp. 8-10.

Song, Yun-Mi, Joohon Sung, George Davey Smith, and Shah Ebrahim. Body Mass Index and Ischemic and Hemorrhagic Stroke: A Prospective Study in Korean Men. Stroke, Vol. 35 (2004), pp. 831-836.

Soni, Anita. Trends in the Five Most Costly Conditions among the U.S. Civilian Noninstitutionalized Population, 2001 and 2012. Medical Expenditure and Panel Survey Statistical Brief #470. Agency for Healthcare Research and Quality (AHRQ), Department of Health and Human Services.

Sood, Vipan, LeeAnn Braun, Susan Hogue, Kimberly Davis, Catherine Copley-Merriman, Bonnie Lieberman. Chronic Kidney Disease Burdens Patients, Health Care Systems, and Employers. RTI Health Solutions. Presented at the ISPOR 14th Annual European Congress, Madrid, Spain, Nov. 5-8, 2011.

Stefanacci, Richard G. The Costs of Alzheimer's Disease and the Value of Effective Therapies. American Journal of Managed Care, Vol. 17 (2011), pp. S356-S362.

Strazzullo, Pasquale, Lanfranco D'Elia, Giulia Cairella, Francesca Garbagnati, Francesco P. Cappuccio, and Luca Scalfi. Excess Body Weight and Incidence of Stroke: Meta-Analysis of Prospective Studies with 2 Million Participants. Stroke, Vol. 41 (2010), pp. e418–e426.

Strom, Sara S., Xuemei Wang, Curtis A. Pettaway, Christopher J. Logothetis, Yuko Yamamura, Kim-Anh Do, Richard J. Babaian, and Patricia Troncoso. Obesity, Weight Gain, and Risk of Biochemical Failure among Prostate Cancer Patients following Prostatectomy. Clinical Cancer Research, Vol. 11 (2005), pp. 6889-6894.

Tao Meng-Hua, Shu Xiao-Ou, Zhi Xian Ruan, Yu-Tang Gao, and Wei Zheng. Association of Overweight with Breast Cancer Survival. American Journal of Epidemiology, Vol. 163 (2006), pp. 101-107.

Tehard, Bertrand, and Francoise Clavel-Chapelon. Several Anthropometric Measurements and Breast Cancer Risk: Results of the E3N Cohort Study. International Journal of Obesity, Vol. 30 (2006), pp. 156-163.

United States Renal Data System. Costs of ESRD—2013 USRDS Annual Data Report. Available at: https://www.usrds.org/atlas13.aspx

U.S. Census Bureau Population Division, Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States. Available at: https://www.healthdata.gov/dataset/us-census-annual-estimates-resident-population-selected-age-groups-sex-united-states

Wang, Youfa, Eric B. Rimm, Meir J. Stampfer, Walter C. Willett, and Frank B. Hu. Comparison of Abdominal Adiposity and Overall Obesity in Predicting Risk of Type 2 Diabetes among Men. American Journal of Clinical Nutrition, Vol. 81 (2005), pp. 555-563.

White AG, Birnbaum HG, Janagap C, Buteau S, Schein J. Direct and Indirect Costs of Pain Therapy for Osteoarthritis in an Insured Population in the United States. Journal of Occupational and Environmental Medicine, Vol. 50 (2008), No. 9, pp. 998-1005.

Wolf, Anne M., and Graham A. Colditz. Current Estimates of the Economic Cost of Obesity in the United States. Obesity Research, Vol. 6 (1998), No. 2, pp. 97-106.

Yang, Wenya, Timothy Dall, Pragna Hader, Paul Gallo, Stacey Kowal, and Paul Hogan. Economic Costs of Diabetes in the U.S. in 2012. Diabetes Care, Vol. 36 (2013), pp. 1033-1046.

Zheng, Zhiyuan, K. Robin Yabroff, Gery P. Guy, Xuesong Han, Chunyu Li, Matthew P. Banegas, Donatus U. Ekwueme, and Ahmedin Jemal. Annual Medical Expenditure and Productivity Loss among Colorectal, Female Breast, and Prostate Cancer Survivors in the United States. Journal of the National Cancer Institute, Vol. 108 (2016), No. 5.

Zhuo, Xiaohui, Ping Zhang, and Thomas J. Hoerger. Lifetime Direct Medical Costs of Treating Type 2 Diabetes and Diabetic Complications. American Journal of Preventive Medicine, Vol. 45 (2013), No. 3, pp. 253-261.

Zuo Li, He Feng, Tinsley Grant M., Pannell Benjamin K., Ward Emery, Arciero Paul J. Comparison of High-Protein, Intermittent Fasting Low-Calorie Diet and Heart Healthy Diet for Vascular Health of the Obese. Frontiers in Physiology, August 2, 2016.

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