

2023 INTERNATIONAL CONGRESS OF ACTUARIES



BRIDGE TO TOMORROW

28 MAY – 1 JUNE 2023 • SYDNEY





The Growing Global Obesity Risk: Implications and Strategies

Ken Beckman, ASA, ACAS, MAAA, CFA
ken.beckman@actuariesforsustainablehealthcare.org
May 30, 2023

*This presentation has been prepared for the 2023 International Congress of Actuaries.
The Actuaries Institute Australia Council wishes it to be understood that opinions put forward herein are not necessarily those
of the Institute and the Council is not responsible for those opinions.*

BRIDGE TO TOMORROW
2023 INTERNATIONAL
CONGRESS OF ACTUARIES
28 MAY – 1 JUNE 2023 • SYDNEY

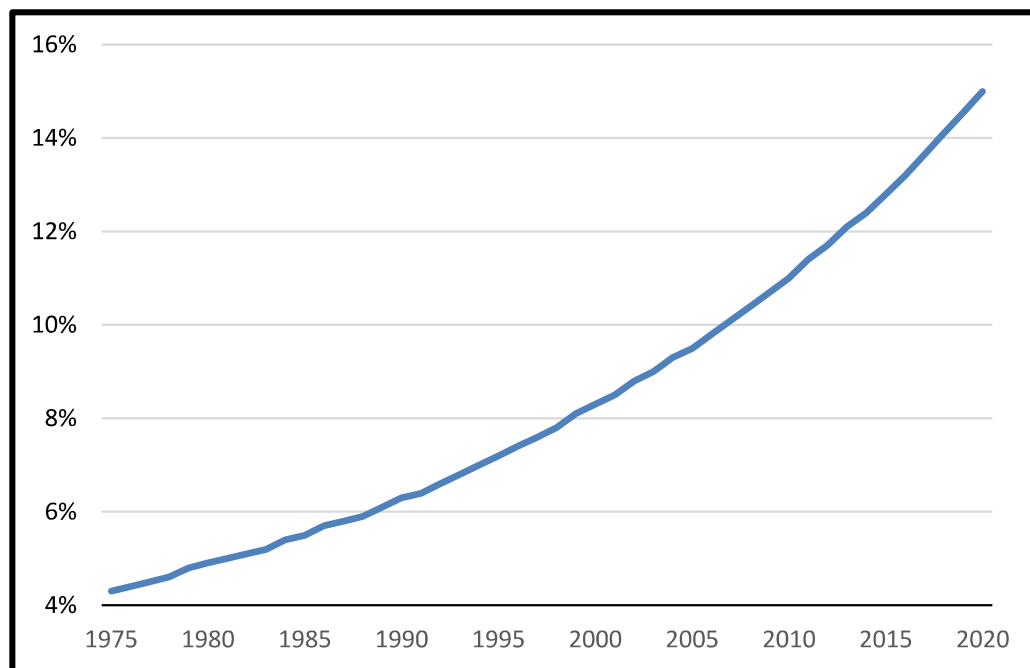


A GLOBAL PANDEMIC



A Pandemic of Obesity

Global obesity rate has more than tripled over the last 40+ years



Current global obesity > 15%

USA 42%

Mexico 36%

Saudi Arabia 35%

New Zealand 34%

Australia 31%

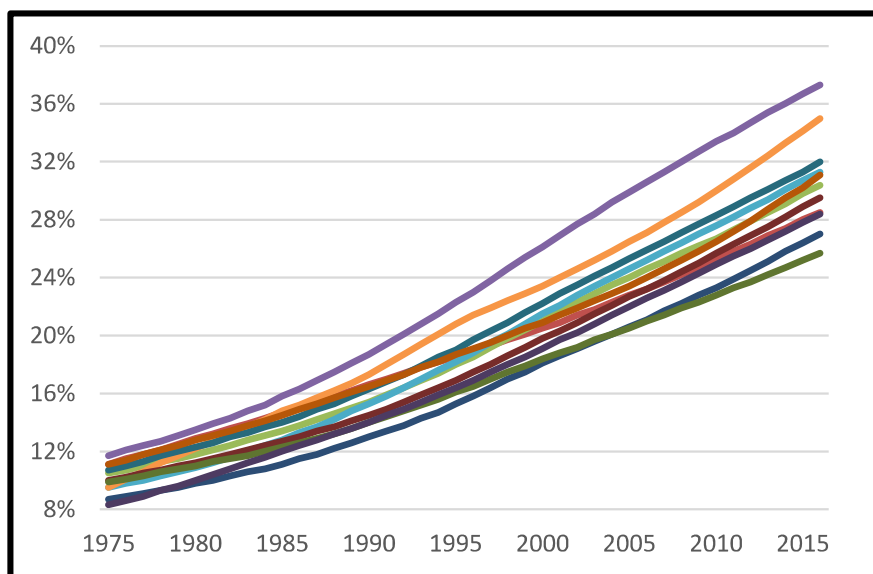
Canada 27%

UK 26%



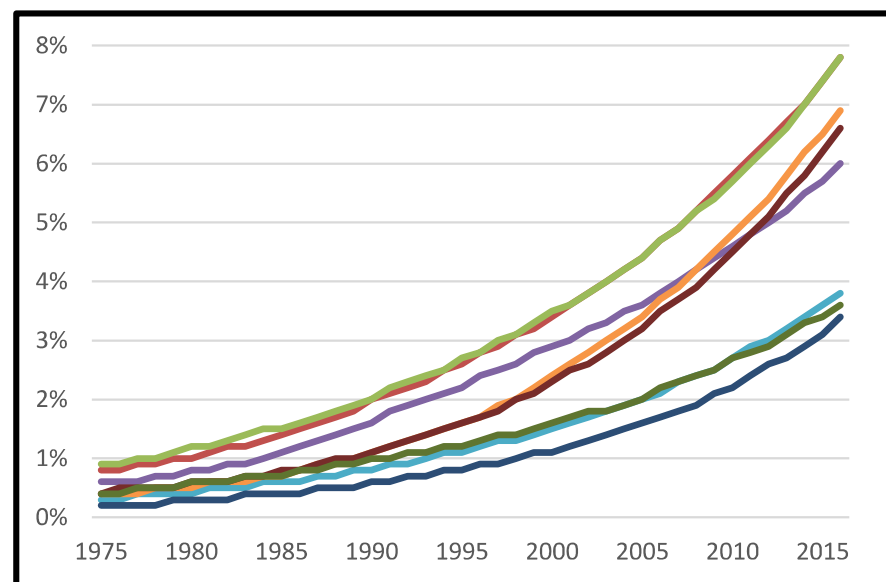
Obesity in Selected Countries

Countries where obesity was relatively high
40 years ago: average increase = 186%



USA, Saudi Arabia, New Zealand, Canada, Egypt,
Australia, UK, Argentina, Mexico, South Africa, Germany
(countries listed in decreasing order of 2016 obesity prevalence)

Countries where obesity was relatively rare
40 years ago: average increase = 1,116%



Pakistan, Nigeria, Indonesia, China, Philippines,
India, Ethiopia, Bangladesh
(countries listed in decreasing order of 2016 obesity prevalence)



What are the implications of obesity?

(continued)

Increased Morbidity	
Type 2 Diabetes	600% increased risk
Musculoskeletal disorders (#1 source of pain and disability)	163% increased risk of knee osteoarthritis
Alzheimer's / Dementia	93% increased risk*

***Obesity at midlife: #1 modifiable risk factor for Alzheimer's in U.S., #2 in Australia**



What are the implications of obesity?

(continued)

Increased Mortality	
All-Causes	64%
Cardiovascular (Heart) Disease	107%
Stroke	64%
Cancer	41%
COVID-19	42% (154% higher for 65+ age group)



What are the implications of obesity?

(continued)

Increased Cost	
Obesity (BMI>30)	52%
Severe Obesity (BMI>35)	74%

For risk-bearing entities:

- Inadequate pricing/reserving (life/disability/long term care products)
- Unsustainable rate increases or politically infeasible tax increases (health coverages)

BMI = Body Mass Index = body mass (kg) / height (m)²

BRIDGE TO TOMORROW
2023 INTERNATIONAL
CONGRESS OF ACTUARIES
28 MAY – 1 JUNE 2023 • SYDNEY



HOW HAS OBESITY BEEN ADDRESSED ...AND WHY HASN'T IT WORKED?



Five Common (Unsuccessful) Strategies to Address Obesity

- **Count Calories / Eat Less**
- **Eat More Fruits and Vegetables**
- **Eat Less Sugar**
- **Bariatric Surgery**
- **Exercise More**



Failed Strategy #1: Count Calories/Eat Less

- Counting calories is difficult, time consuming and in many cases impossible
- Calorie labeling on packages and in restaurants has not influenced calories consumed
- Advice to eat less is vague, uses scientific language, often doesn't reference specific foods
 - World Health Organization – *“limit energy intake from total fats”*
 - U.S. Dietary Guidelines – *“limit saturated fat to less than 10% of calories”* and *“consume smaller portions”*
- Eating less is not sustainable - works against human nature - people need to be satisfied to maintain anything long-term
 - “Numerous studies show that individuals have a strong tendency to eat a consistent weight of food over a day and therefore strategies that rely on maintaining smaller portions of all foods are unlikely to be optimal or sustainable.”* – Rolls (2014)



Failed Strategy #2: Eat More Fruits/Vegetables

- Eating more fruits and vegetables is great advice and everyone should do it, but does not address underlying cause of obesity
- Average calories consumed from fruit and vegetables increased 30% over the past 40 years
- Provides an excuse for eating obesity-causing food (*"It's OK, I had an extra carrot"*)



Failed Strategy #3: Eat Less Sugar

- Global consumption of sugar has only increased 7% over the last 40 years
- Sugar is now a smaller proportion of the overall diet than 40 years ago (8% of total calories)
- Distracts from the addressing an individual's entire dietary intake
- In the U.S., sugar consumption declined 15% while obesity is up 60% over the past 20 years



Failed Strategy #4: Bariatric Surgery

- Side effects are numerous and significant:

Complications of surgery	17%
Reoperation after initial surgery	7%
Death	0.3%

- Expensive: about \$25,000 USD
- Ineffective: after 5 years, only 40% of the initial excess weight was lost



Failed Strategy #5: Exercise More

- Everyone should exercise more, but lack of exercise does not address root cause of obesity
- Insufficient levels of exercise have not changed since 2001, obesity up 50%+ since then
- Not enough time in the day to compensate for foods that are being regularly consumed

Food	Minutes of walking to burn off calories
Sirloin steak	80
2 slices cheese pizza	78
Grilled chicken sandwich	62
Salmon filet	55
Ice cream cone	48

- Even if someone could exercise this much, after an initial adjustment period, humans burn about the same number of calories per day regardless of physical activity levels



Failed Strategy #5: Exercise More

(continued)

Constrained Total Energy Expenditure Research

- At higher levels of physical activity the body compensates and conserves energy by reducing the calories used for other bodily processes
 - Example: very active hunter-gatherer societies burn about the same number of calories as similar sized sedentary individuals in Western societies
- *“Increasing daily activity through exercise or other programs will ultimately have little effect on the calories burned per day.” – Pontzer (2021)*

BRIDGE TO TOMORROW
2023 INTERNATIONAL
CONGRESS OF ACTUARIES
28 MAY – 1 JUNE 2023 • SYDNEY



THE SOLUTION TO THE OBESITY PANDEMIC



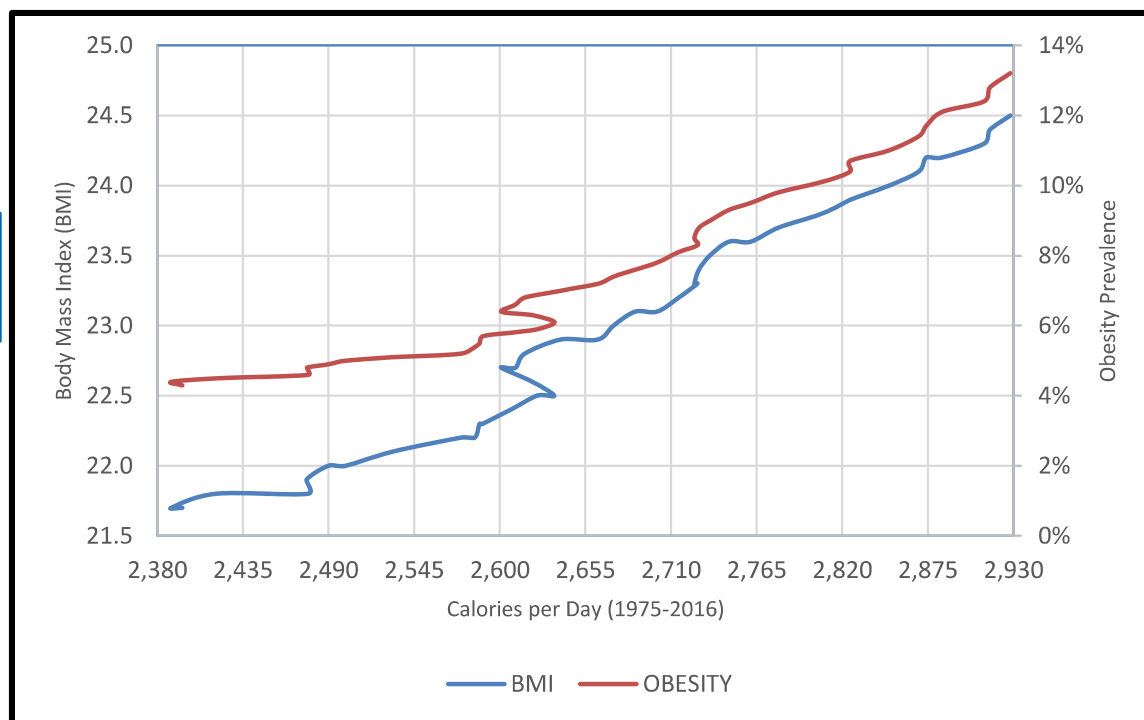
What is the Root Cause of Obesity?

Excess Calories

- **Calories available have increased 22% over the past 40 years**
- **Both Obesity and BMI are almost perfectly correlated with calories**



Excess Calories: Feeding the Obesity Pandemic



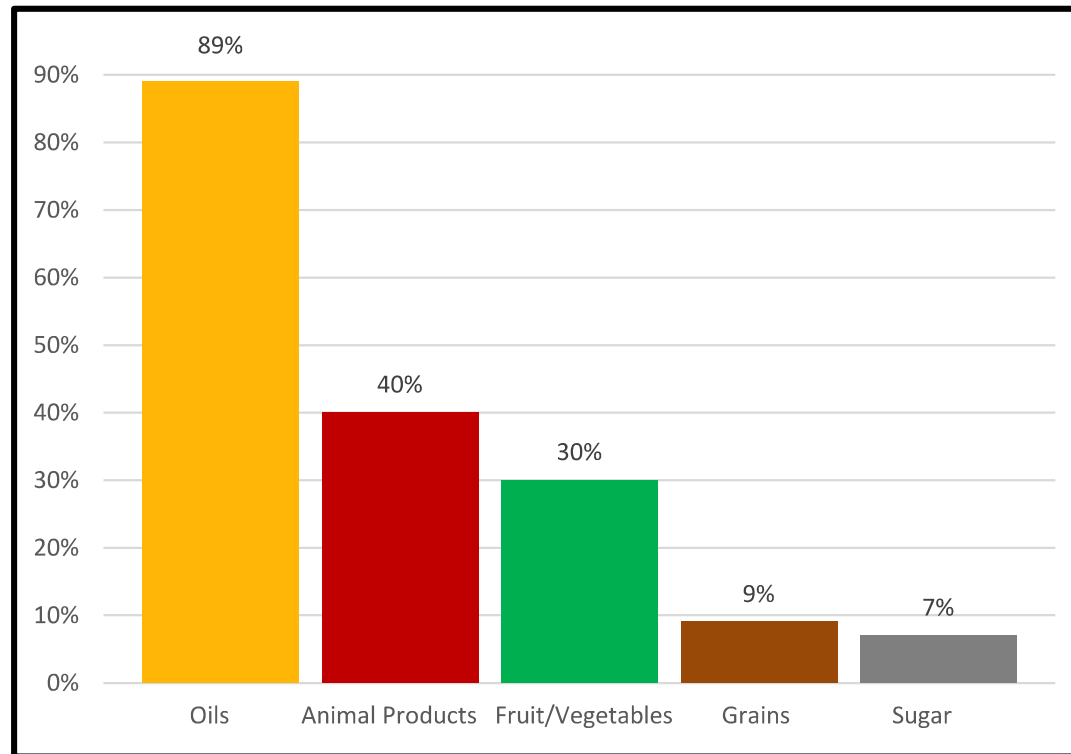
Calories & BMI
Correlation: $\rho = .99$

Calories & Obesity
Correlation: $\rho = .97$



Source of the Excess Calories

% Change in Calories over the past 40 years





Oils and animal products: Driving the growth in excess calories

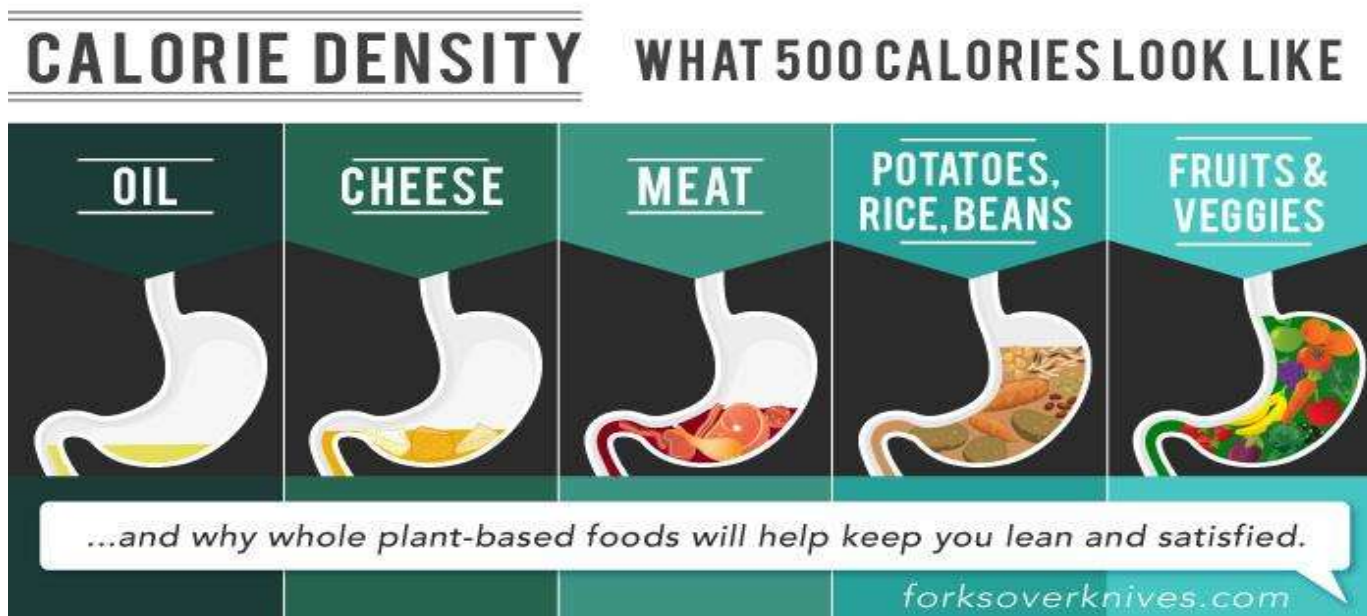
Item	Growth in amount consumed over last 40 years*	Calories per 100g serving
Oil	89%	884
Beef	-20%	150-250
Chicken	236%	165-230
Processed Meat	152%	150-400
Cheese	175%	200-400

For comparison, the calories per 100g of common fruits and vegetables are substantially lower: broccoli (34), apple (52), sweet potato (92), brown rice (112)

**Processed meat and cheese are slightly different time frames than 40 years than the other foods shown due to data availability.*



Impact of Calorie Density on Obesity



Obesity spiral: as the proportion of the diet based on animal products and oils increases, the amount of calories to feel satisfied increases.



Whole Food Plant-Based Nutrition:

What does it look like in practice



The Simple Solution to Eliminate Obesity

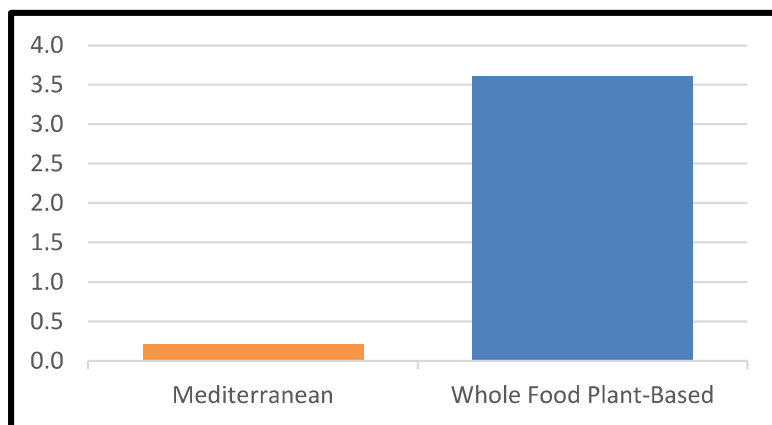
- Include all minimally processed plant foods: whole grains, legumes (beans), vegetables, fruits
- Exclude all oils (present in almost all highly processed foods)
- Exclude all animal products: meat (beef, chicken, fish, turkey, pork etc.), dairy products, eggs
- Eat until satisfied - don't count calories or portions
- Enjoy your food!



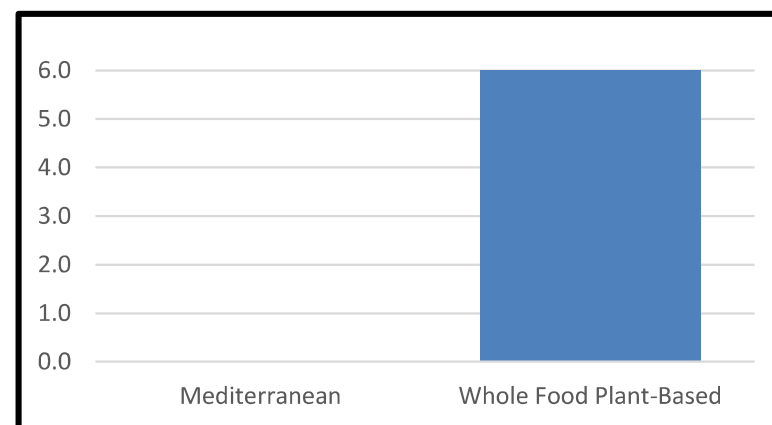
What about the popular Mediterranean Diet?

Randomized Crossover Trial Among Obese Individuals – No limits on calories – 36 week duration

Body Fat Loss (kg)



Weight Loss (kg)



- Mediterranean diet includes whole plant-based foods and discourages processed foods, but also includes substantial calories from meat, dairy products, oil
- No evidence from this or other studies that a Mediterranean diet will reduce obesity, unless subject to strict calorie restriction



Whole Food Plant-Based Nutrition: The Solution to the Obesity Pandemic

Reasons Why This Approach Has Been Successful for Treating Obesity

- **No willpower necessary:** eat until satisfied and if hunger occurs, simply eat more
- **Sustainable:** positive results are achieved quickly, motivation to continue is high
- **Adaptable to any cultural preference,** no specialty or expensive foods required
- **Infinite variety and combinations of different flavors/textures** to suit any taste preference
- **Whole and minimally processed plant-based foods** are very affordable



Whole Food Plant-Based Nutrition Addresses Many of Obesity's Comorbidities

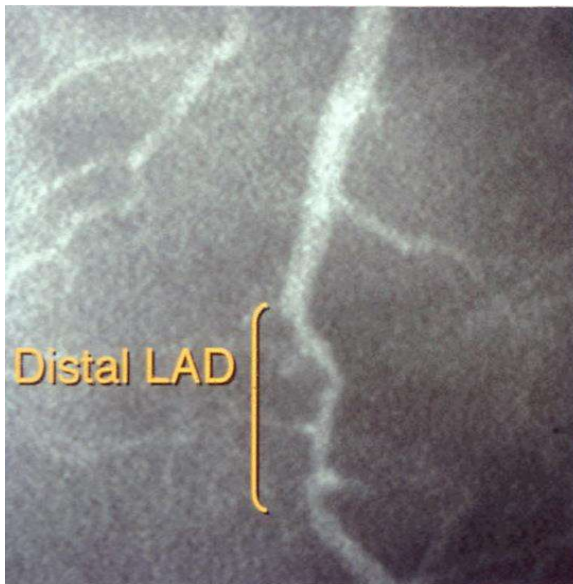
Example: Heart Disease (obesity increases risk > 100%)

- World's #1 killer
- Heart disease has killed millions more people than COVID since 2020
- Whole food plant-based nutrition has reversed heart disease as demonstrated in randomized clinical trials (no other treatment has done this)

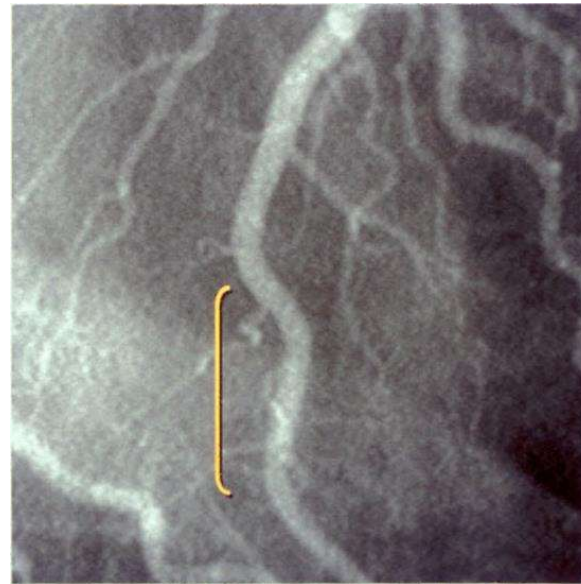


Reversal of Heart Disease Using Whole Food Plant-Based Nutrition

27 November 1996



22 July 1999





Positive Side Effects of Treating Obesity with Whole Food Plant-Based Nutrition

Has effectively treated and often reversed all of the following:

<p>Cardiovascular (Heart) Disease</p> <p>Diabetes</p> <p>High Blood Pressure</p> <p>Osteoarthritis / Rheumatoid Arthritis</p> <p>Erectile Dysfunction</p> <p>Multiple Sclerosis</p> <p>Lupus</p> <p>Chronic Kidney Disease</p>	<p>Cancer (some forms)</p> <p>Constipation/IBS</p> <p>Acid Reflux/GERD</p> <p>Dementia/Alzheimer's</p> <p>Asthma</p> <p>Kidney Stones</p> <p>Crohn's / Ulcerative Colitis</p> <p>Acne</p>
--	---

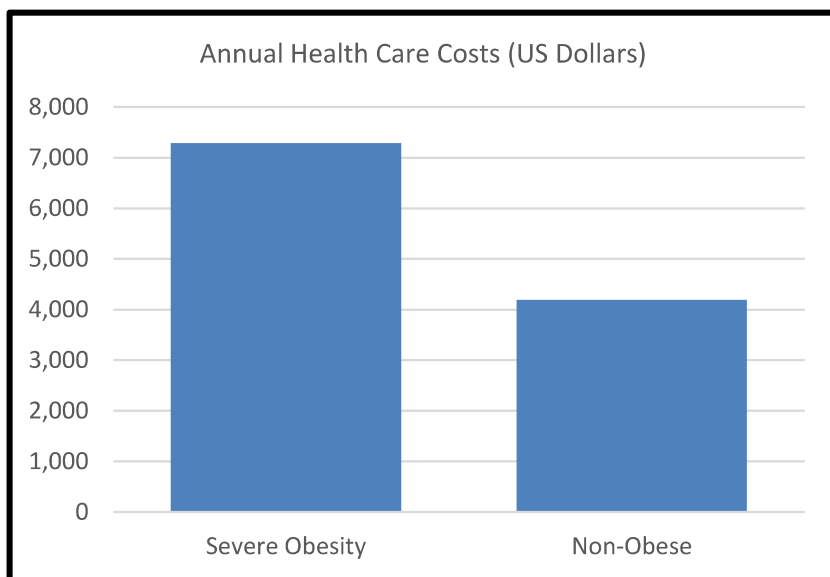


STRATEGIES TO IMPLEMENT THE WHOLE FOOD PLANT-BASED SOLUTION AND HOW ACTUARIES CAN PLAY A ROLE



Financial Incentive Strategy #1: Providers

Health care providers receive cash payments for educating patients about whole food plant-based treatment for obesity



- Reversal of severe obesity in one patient generates significant reductions in health care costs
- A portion of this savings is paid to the responsible health care provider
- Payments would continue on an annual basis if improved BMI is maintained



Financial Incentive Strategy #2: Facilities

Health care facilities (e.g. hospitals) reimbursement is contingent upon foods served to patients

Without financial incentives, most health care facilities have not acted on the following:

- **2015 World Health Organization (WHO) determination: processed meats cause cancer**
- **2017 resolution by American Medical Association:**
Hospitals should provide plant-based meals and eliminate processed meats from menus.
- **2018 position statement by Australian Medical Association:**
Food provided in health care settings should include options that are plant-based.
- **2019 Canada eliminated dairy as a food group from its Food Guide**

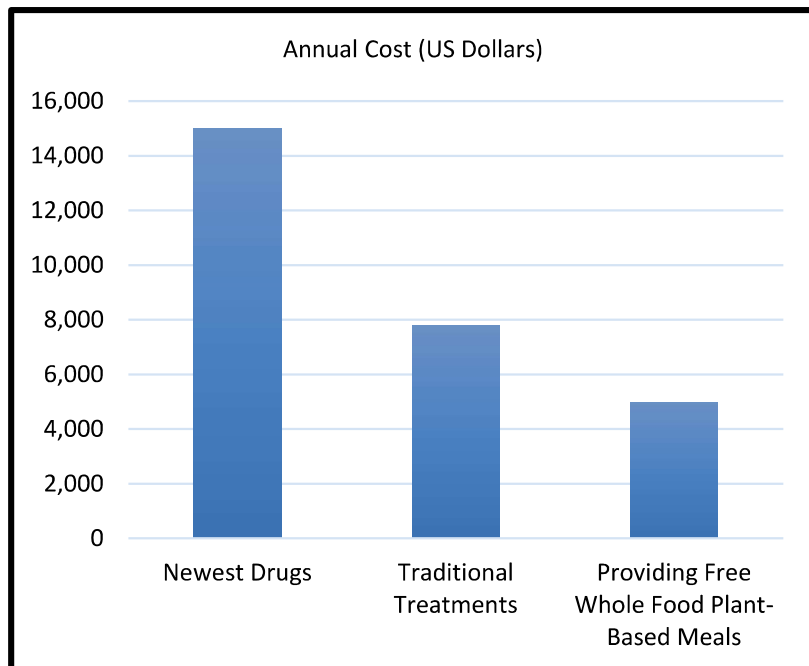
Reimbursement Example: Heart bypass surgery

Health Care Facility Meals	Payment to Facility
Default meal = whole food plant-based	\$100,000
Whole food plant-based options	\$50,000
Meal options include processed meat	\$25,000



Financial Incentive Strategy #3: Patients

Provide whole food plant-based meals to obese patients



- **Newest drugs to treat obesity have unsustainable costs and numerous side effects**
- **Drug treatments require a lifetime of expense**
- **Meals provided for an introductory period only**
- **Free meals help facilitate patient transition to and permanent adoption of new dietary lifestyle**



Role of Actuaries:

Making Financial Incentives to Reduce Obesity Practical, Sustainable and Effective

- Advise health care payers (government, employers, insurers) who fund financial incentives
- Quantify expected cost savings for BMI reduction and proportion of savings shared with health care providers
- Develop reimbursement system based on health care facility meals
- Demonstrate to payers that providing plant-based meals to obese patients is more cost-effective than a drug-based treatment approach
- Monitor cost savings from supplying plant-based meals and analyze patient adherence



Summary

- **Attempts to address obesity pandemic have failed: none have addressed its root cause**
- **Excess calories are the driving force of the obesity pandemic**
- **Successful strategy must address excess calories and NOT require less food be consumed**
- **Whole food plant-based nutrition: satisfying and sustainable solution based on decades of research without negative side effects or added cost (we all have to eat)**
- **Actuaries have responsibility to the public to do more than quantify increased cost of obesity: develop incentives to increase use of this approach to treat obesity and other conditions**
- **Try it for yourself: even if you have no current health conditions consider adopting a whole food plant-based way of eating for 30 days and evaluate your own results**

BRIDGE TO TOMORROW
2023 INTERNATIONAL
CONGRESS OF ACTUARIES
28 MAY – 1 JUNE 2023 • SYDNEY



QUESTIONS?

Contact Details:

Ken Beckman, ASA, ACAS, MAAA, CFA

Phone: +1 402-997-8303

Email: ken.beckman@actuariesforsustainablehealthcare.org



Additional Resources



Actuaries for Sustainable Health Care
actuariesforsustainablehealthcare.org



Plantrician Project
plantricianproject.org



Lifestyle Medicine Global Alliance
lifestylemedicineglobal.org



NutritionFacts.org
NutritionFacts.org



Sources by Slide Number

(4) World Health Organization, Global Health Observatory, Prevalence of obesity among adults, BMI ≥ 30 (crude estimate) (%): [\(https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi>=30-\(crude-estimate\)-\(-\)\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi>=30-(crude-estimate)-(-)) (1975-2016)

2020 data from World Obesity Atlas 2022, World Obesity Federation, https://www.worldobesityday.org/assets/downloads/World_Obesity_Atlas_2022_WEB.pdf p19 [2017-2019 interpolated between 2016 and 2020]

Values for specific countries:

US: <https://www.cdc.gov/obesity/data/adult.html>

Mexico: <https://www.reuters.com/world/americas/mexicos-obesity-epidemic-2021-06-16/>

Saudi Arabia: <https://onlinelibrary.wiley.com/doi/full/10.1111/obr.13448>

New Zealand: <https://www.health.govt.nz/health-statistics/health-statistics-and-data-sets/obesity-statistics>

Australia https://www.health.gov.au/sites/default/files/documents/2022/03/national-obesity-strategy-2022-2032_0.pdf

Canada: <https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00005-eng.htm>

UK: <https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england/2021/health-survey-for-england-2021-data-tables>

(5) Prevalence of obesity among adults, BMI ≥ 30 (crude estimate) (%): World Health Organization, Global Health Observatory

[\(https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi>=30-\(crude-estimate\)-\(-\)\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi>=30-(crude-estimate)-(-)) (1975-2016)

(6) Abdullah, A., Peeters, A., de Courten, M., & Stoelwinder, J. (2010). The magnitude of association between overweight and obesity and the risk of diabetes: A meta-analysis of prospective cohort studies. *Diabetes Research and Clinical Practice*, 89(3), 309–319. doi.org/10.1016/j.diabres.2010.04.012

Malik KM, Beckerly R, Imani F. Musculoskeletal Disorders a Universal Source of Pain and Disability Misunderstood and Mismanaged: A Critical Analysis Based on the U.S. Model of Care. *Anesth Pain Med*. 2018 Dec 15;8(6):e85532. doi: 10.5812/aapm.85532.

Blagojevic, M., Jinks, C., Jeffery, A., & Jordan, K. P. (2010). Risk factors for onset of osteoarthritis of the knee in older adults: A systematic review and meta-analysis. *Osteoarthritis and Cartilage*, 18(1), 24–33. doi.org/10.1016/j.joca.2009.08.010

Singh-Manoux A, Dugravot A, Shipley M, Brunner EJ, Elbaz A, Sabia S, Kivimaki M. Obesity trajectories and risk of dementia: 28 years of follow-up in the Whitehall II Study. *Alzheimers Dement*. 2018 Feb;14(2):178-186. doi: 10.1016/j.jalz.2017.06.2637. Epub 2017 Sep 21.

Nianogo RA, Rosenwohl-Mack A, Yaffe K, Carrasco A, Hoffmann CM, Barnes DE. Risk Factors Associated With Alzheimer Disease and Related Dementias by Sex and Race and Ethnicity in the US. *JAMA Neurol*. 2022;79(6):584–591. doi:10.1001/jamaneurol.2022.0976

Ashby-Mitchell K, Burns R, Shaw J, Anstey KJ. Proportion of dementia in Australia explained by common modifiable risk factors. *Alzheimers Res Ther*. 2017;9(1):11. doi:10.1186/s13195-017-0238-x

(7) Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents *Lancet*. 2016 Aug 20; 388(10046): 776–786. dx.doi.org/10.1016/S0140-6736(16)30175-1

See eTable 16 for cause specific mortality calculated as weighted average based on number of deaths for BMIs >30

Poly TN, Islam MM, Yang HC, Lin MC, Jian W-S, Hsu M-H and Jack Li Y-C (2021) Obesity and Mortality Among Patients Diagnosed With COVID-19: A Systematic Review and Meta-Analysis. *Front. Med*. 8:620044. doi: 10.3389/fmed.2021.620044

(8) Ward ZJ, Bleich SN, Long MW, Gortmaker SL (2021) Association of body mass index with health care expenditures in the United States by age and sex. *PLoS ONE* 16(3): e0247307. doi.org/10.1371/journal.pone.0247307
Increased Cost of Obesity: BMI >30 / 18.5 < BMI < 25 ; Increased Cost of Severe Obesity: BMI >35 / 18.5 < BMI < 25



Sources by Slide Number

- (11) Kiszko, K.M., Martinez, O.D., Abrams, C. et al. The Influence of Calorie Labeling on Food Orders and Consumption: A Review of the Literature. *J Community Health* 39, 1248–1269 (2014). doi.org/10.1007/s10900-014-9876-0
Berry, C., Burton, S., Howlett, E., & Newman, C. L. (2019). Understanding the Calorie Labeling Paradox in Chain Restaurants: Why Menu Calorie Labeling Alone May Not Affect Average Calories Ordered. *Journal of Public Policy & Marketing*, 38(2), 192–213. doi.org/10.1177/0743915619827013
World Health Organization Fact Sheet: Obesity and overweight <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
Dietary Guidelines for Americans, U.S. Department of Agriculture, December 2020 https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf (p26, 63)
Rolls, B. What is the role of portion control in weight management?. *Int J Obes* 38 (Suppl 1), S1–S8 (2014). doi.org/10.1038/ijo.2014.82
(12) Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-) <https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
(13) Calories: Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-) <https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
World Health Organization, Global Health Observatory, Prevalence of obesity among adults, BMI ≥ 30 (crude estimate) (%): [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-30-\(crude-estimate\)-\(-\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-30-(crude-estimate)-(-)) (1975-2016)
(14) Chang SH, Stoll CR, Song J, Varela JE, Eagon CJ, Colditz GA. The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003-2012. *JAMA Surg*. 2014 Mar;149(3):275-87. doi: 10.1001/jamasurg.2013.3654.
Turri JAO, Anokye NK, Dos Santos LL, Júnior JMS, Baracat EC, Santo MA, Sarti FM. Impacts of bariatric surgery in health outcomes and health care costs in Brazil: Interrupted time series analysis of multi-panel data. *BMC Health Serv Res*. 2022 Jan 7;22(1):41. doi: 10.1186/s12913-021-07432-x. Erratum in: *BMC Health Serv Res*. 2022 Jan 17;22(1):83.
(15) World Health Organization, Global Health Observatory, Prevalence of obesity among adults, BMI ≥ 30 (crude estimate) (%): [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-30-\(crude-estimate\)-\(-\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-30-(crude-estimate)-(-)) (1975-2016)
Regina Guthold, Gretchen A Stevens, Leanne M Riley, Fiona C Bull, Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants *Lancet Glob Health* 2018; 6: e1077–86. dx.doi.org/10.1016/S2214-109X(18)30357-7
Westerterp KR, Speakman JR. Physical activity energy expenditure has not declined since the 1980s and matches energy expenditures of wild mammals. *Int J Obes (Lond)*. 2008 Aug;32(8):1256-63. doi: 10.1038/ijo.2008.74. Epub 2008 May 27.
<https://www.bupa.com.au/healthlink/health-tools/calories-burned-calculator> => Assumes walking briskly for 4 miles per hour, burns about 100 calories per mile for someone who weighs 175 lbs / 79kg
Source of calories:
Sirloin Steak: <https://nutritiondata.self.com/facts/beef-products/3589/2>
Cheese Pizza: <https://nutritiondata.self.com/facts/fast-foods-generic/9298/2>
Grilled Chicken: <https://nutritiondata.self.com/facts/fast-foods-generic/9933/2>
Salmon: <https://nutritiondata.self.com/facts/finfish-and-shellfish-products/4259/2>
Ice Cream: <https://nutritiondata.self.com/facts/foods-from-dairy-queen/6647/2>



Sources by Slide Number

- (16) Pontzer H, Raichlen DA, Wood BM, Mabulla AZP, Racette SB, et al. (2012) Hunter-Gatherer Energetics and Human Obesity. *PLoS ONE* 7(7): e40503. doi:10.1371/journal.pone.0040503
Pontzer, Herman. Constrained Total Energy Expenditure and the Evolutionary Biology of Energy Balance. *Exercise and Sport Sciences Reviews* 43(3):p 110-116, July 2015. | DOI: 10.1249/JES.0000000000000048
Pontzer et. al. *Curr Biol*. Constrained Total Energy Expenditure and Metabolic Adaptation to Physical Activity in Adult Humans, 2016 February 8; 26(3): 410–417. doi:10.1016/j.cub.2015.12.046.
H. Pontzer, B. M. Wood and D. A. Raichlen. Hunter-gatherers as models in public health. *Obesity Reviews* 19 (Suppl. 1), 24–35, December 2018. doi: 10.1111/obr.12785
Quote from Pontzer, H., Burn, 2021, Random House, p166.
- (18) Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-)
<https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
- (19) Calories: Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-)
<https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
- Obesity: World Health Organization, Global Health Observatory, Prevalence of obesity among adults, BMI >= 30 (crude estimate) (%): [\(https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi--30-\(crude-estimate\)-\(-\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi--30-(crude-estimate)-(-)) (1975-2016)
BMI: World Health Organization, Global Health Observatory, Mean BMI (kg/m²) (crude estimate) [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mean-bmi-\(kg-m\)-\(-crude-estimate\) 18+ years \(1975-2016\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mean-bmi-(kg-m)-(-crude-estimate) 18+ years (1975-2016)
- (20) Calories:
Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-)
<https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
- (21) Oil, Beef (Bovine) and Chicken (Poultry) is from 1975-2016:
Food and Agriculture Organization of the United Nations, Food Balances (-2013, old methodology and population) & Food Balances (2010-)
<https://www.fao.org/faostat/en/#data/FBSH> (World, Food Supply (kcal/capita/day) (1975-2013)
<https://www.fao.org/faostat/en/#data/FBS> (World, Food Supply (kcal/capita/day) (2014-2016)
- Cheese: Food and Agriculture Organization of the United Nations, Production, Crops and livestock Products is from 1975-2020
<https://www.fao.org/faostat/en/#data/QCL> (World, Production (kcal/capita/day)
- Processed meat is from 1990 to 2018:
Global, regional, and national consumption of animal-source foods between 1990 and 2018: findings from the Global Dietary Database; *Lancet Planet Health* 2022; 6: e243–56; Victoria Miller, Julia Reedy, Frederick Cudhea, Jianyi Zhang, Peilin Shi, Josh Erndt-Marino, Jennifer Coates, Renata Micha, Patrick Webb, Dariush Mozaffarian: [https://doi.org/10.1016/S2542-5196\(21\)00352-1](https://doi.org/10.1016/S2542-5196(21)00352-1)
Source of calories: <https://www.calories.info/> Oils are 100% Fat, with each gram having 9 calories, animal products vary but some cheeses and meats exceed 50% fat, carbs and protein only have 4 calories per gram
- (22) www.forksoverknives.com
- (23) Photos of dishes courtesy of Brandi Doming: <https://thevegan8.com/recipe-index/>
- (24) Barnard ND, Alwarith J, Rembert E, Brandon L, Nguyen M, Goergen A, Horne T, do Nascimento GF, Lakkadi K, Tura A, Holubkov R, Kahleova H. A Mediterranean Diet and Low-Fat Vegan Diet to Improve Body Weight and Cardiometabolic Risk Factors: A Randomized, Cross-over Trial. *J Am Nutr Assoc*. 2022 Feb;41(2):127-139. doi: 10.1080/07315724.2020.1869625. Epub 2021 Feb 5.
Range for graphs 0.9 to -0.9 Mediterranean, -4.9 to -7.2 vegan



Sources by Slide Number

[26] <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>

<https://www.thinkglobalhealth.org/article/just-how-do-deaths-due-covid-19-stack>

Dean Ornish et al., Intensive Lifestyle Changes for Reversal of Coronary Heart Disease, JAMA 280 (16 Dec 1998):2001-2007.

K. Lance Gould, Dean Ornish et al., "Changes in Myocardial Perfusion Abnormalities by Positron Emission Tomography After Long-term, Intense Risk Factor Modification," JAMA 274 (September 20, 1995): 894-901.

Dean Ornish, "Avoiding Revascularization with Lifestyle Changes: The Multicenter Lifestyle Demonstration Project," American Journal of Cardiology 82 (1998).

Decision Memo for Intensive Cardiac Rehabilitation (ICR) Program - Dr. Ornish's Program for Reversing Heart Disease (CAG-00419N)," August 12, 2010, Centers for Medicare & Medicaid Services. <http://www.cms.gov/>

Caldwell B. Esselstyn Jr. et al., A Way to Reverse CAD? Journal of Family Practice 63 (July 2014): 356–364.

[27] Caldwell B. Esselstyn Jr., Society of Actuaries 2017 Health Meeting, "The Nutritional Reversal of Cardiovascular Disease: Fact or Fiction?"

[28] Thomas M. Campbell and T. Colin Campbell. "The Breadth of Evidence Favoring a Whole Foods, Plant-based Diet: Part I Metabolic Diseases and Diseases of Aging". Primary Care Reports 18(2012): 13-23.; Thomas M. Campbell and T. Colin Campbell. "The Breadth of Evidence Favoring a Whole Foods, Plant-based Diet: Part II Malignancy and Inflammatory Diseases". Primary Care Reports 18(2012): 25-35.

healthyforalifetime.org/wfpbresearch.pdf

[30] Ward ZJ, Bleich SN, Long MW, Gortmaker SL (2021) Association of body mass index with health care expenditures in the United States by age and sex. PLoS ONE 16(3): e0247307. doi.org/10.1371/journal.pone.0247307

[31] https://www.iarc.who.int/wp-content/uploads/2018/07/pr240_E.pdf

<https://policysearch.ama-assn.org/policyfinder/detail/Healthy%2520Food%2520Options%2520in%2520Hospitals%2520H-150.949?uri=%252FAMADoc%252FHOD.xml-0-627.xml>

<https://www.ama.com.au/position-statement/nutrition-2018>

<https://food-guide.canada.ca/en/food-guide-snapshot/>

Payments for heart bypass surgery are illustrative only

[32] <https://news.cornell.edu/stories/2022/12/how-much-money-too-much-obesity-treatments>