

Global Burden of Disease Attributable to Sugar Sweetened Beverages

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Press Conference

Mexico City, Mexico

November 11, 2014



Gerald J. and Dorothy R. Friedman
School of Nutrition Science and Policy

The State of U.S. Health, 2010

Risk Factors

Dietary risks

Tobacco smoking

High blood pressure

High body mass index

Physical inactivity and low physical activity

High fasting plasma glucose

High total cholesterol

Ambient particulate matter pollution

Alcohol use

Drug use

Lead exposure

Occupational risks

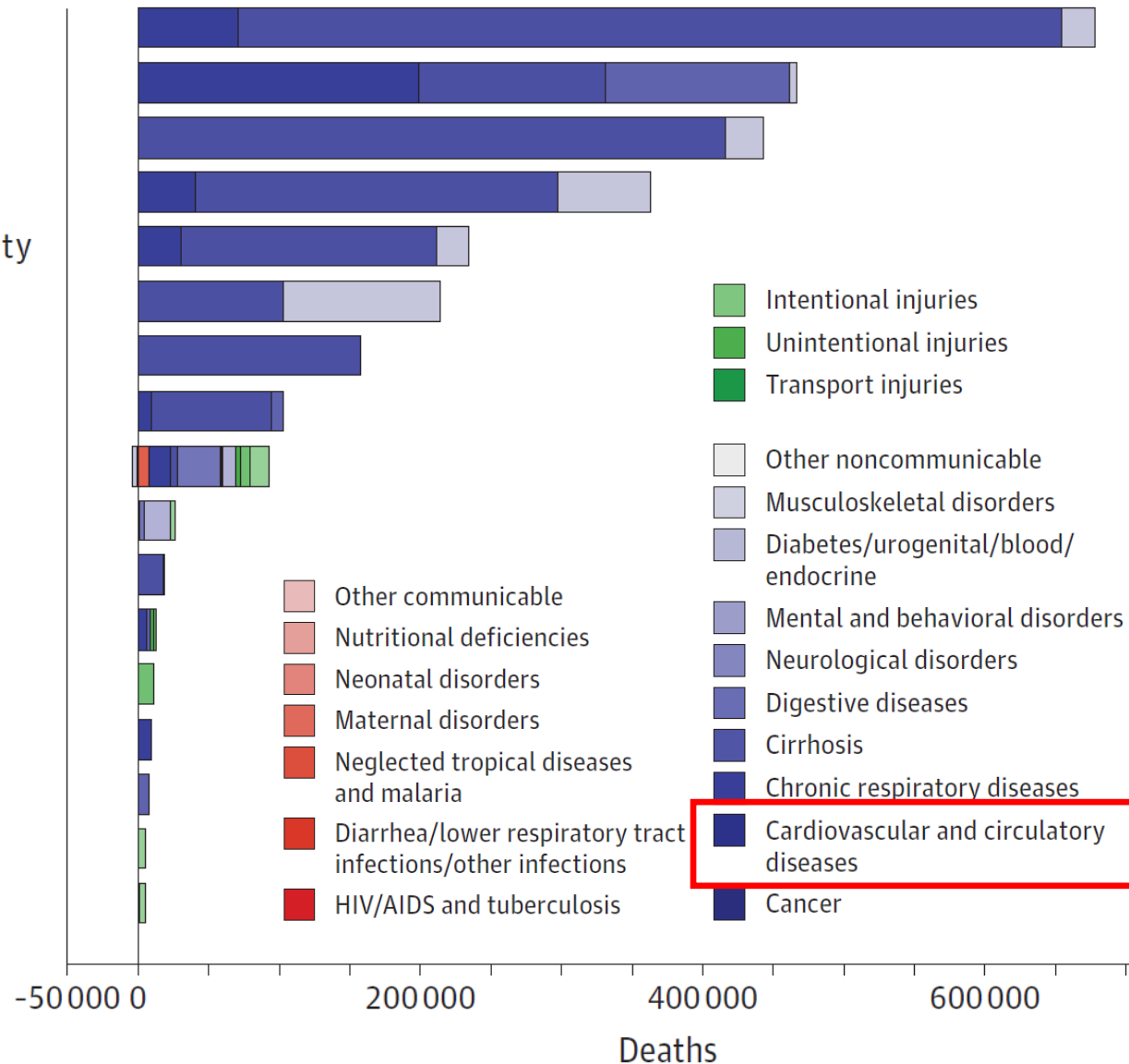
Low bone mineral density

Residential radon

Ambient ozone pollution

Intimate partner violence

Childhood sexual abuse

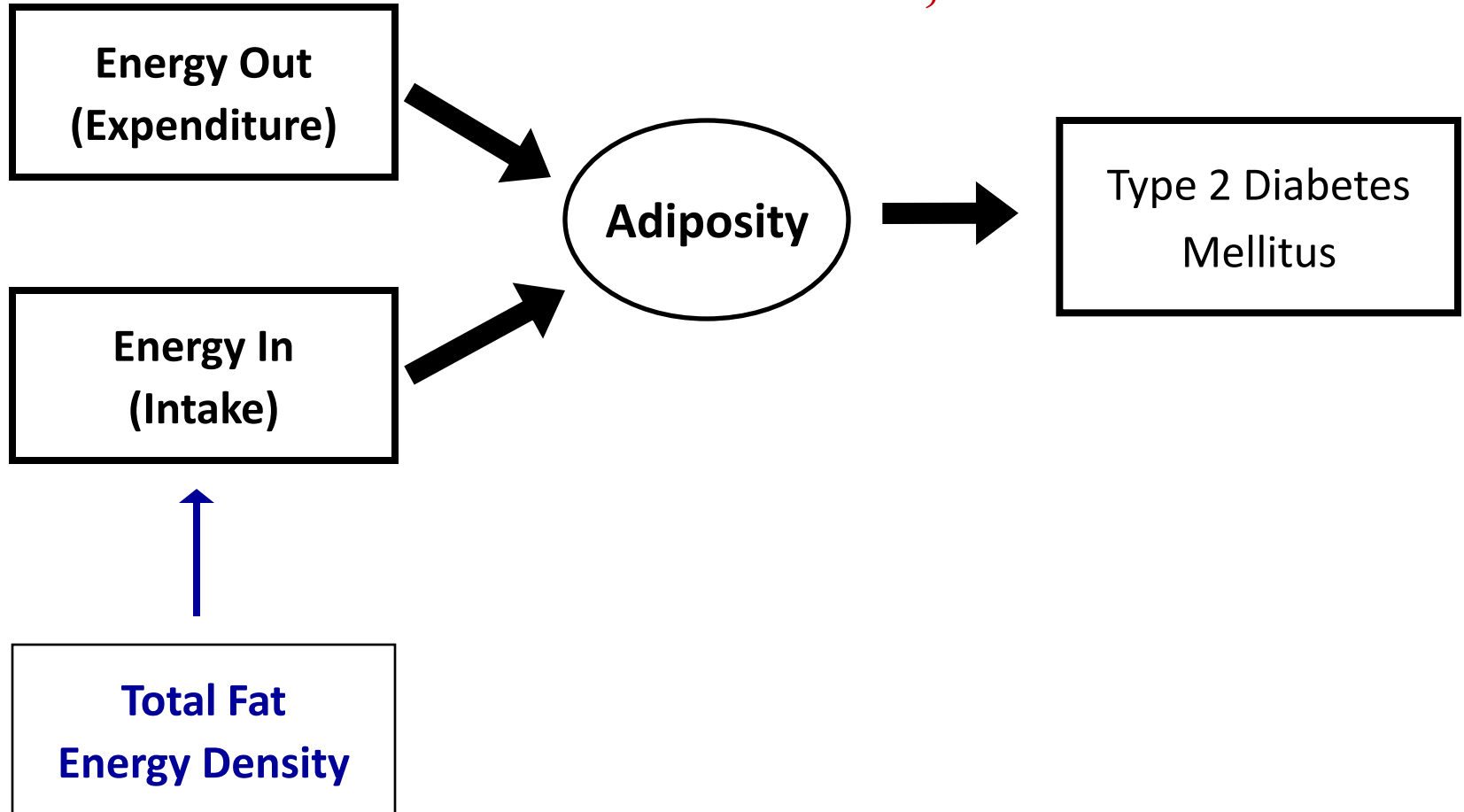


The top global risk factors for mortality in 2010

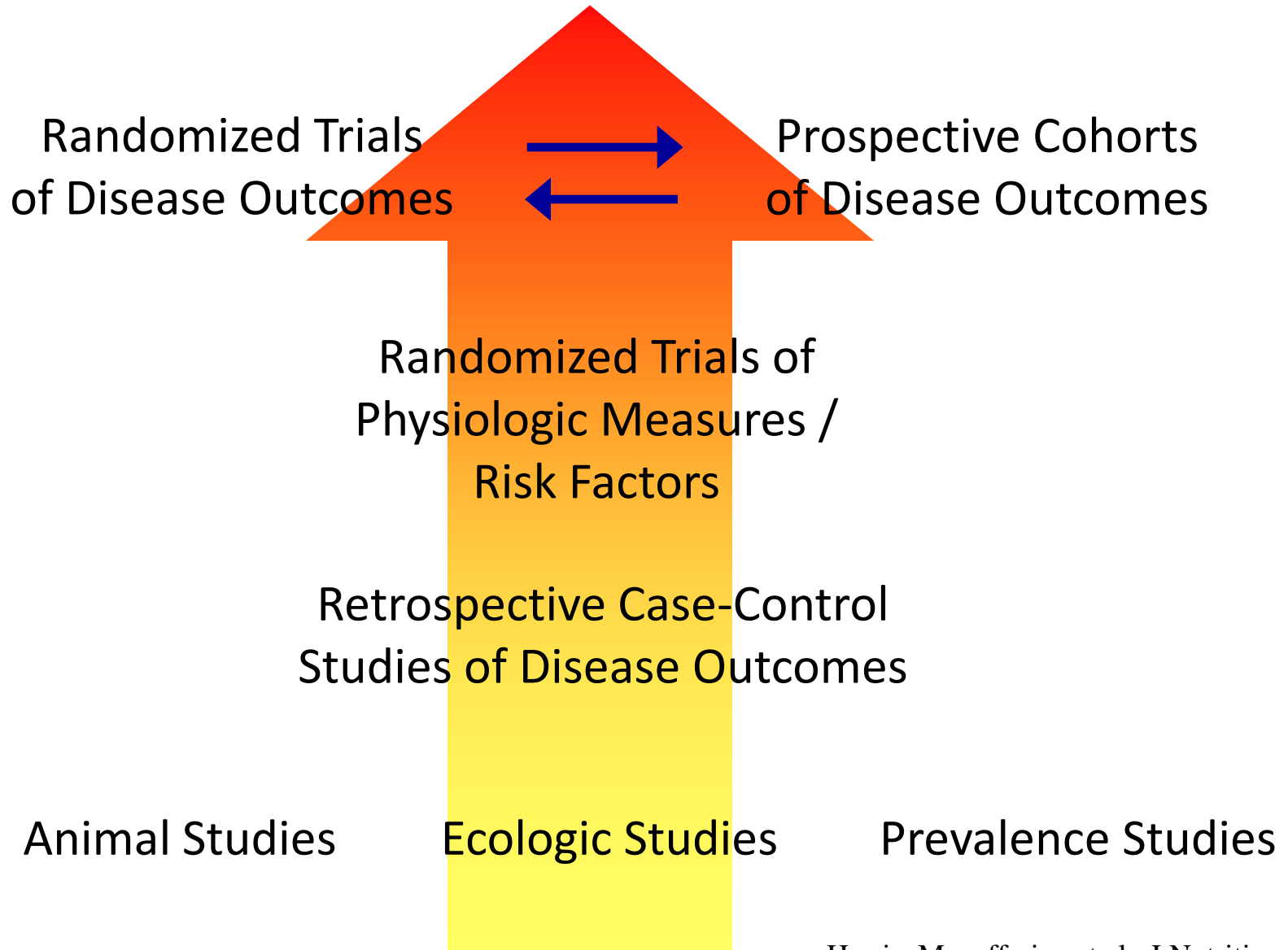
| | Global | High-income Asia Pacific | Western Europe | Australasia | High-income North America | Central Europe | Southern Latin America | Eastern Europe | East Asia | Tropical Latin America | Central Latin America | Southeast Asia | Central Asia | Andean Latin America | North Africa and Middle East | Caribbean | South Asia | Oceania | Southern Sub-Saharan Africa | Eastern Sub-Saharan Africa | Central Sub-Saharan Africa | Western Sub-Saharan Africa |
|-----------------------------|--------|--------------------------|----------------|-------------|---------------------------|----------------|------------------------|----------------|-----------|------------------------|-----------------------|----------------|--------------|----------------------|------------------------------|-----------|------------|---------|-----------------------------|----------------------------|----------------------------|----------------------------|
| Dietary risks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 4 | 6 | 5 | 7 |
| High blood pressure | 2 | 2 | 3 | 4 | 4 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 4 | 6 | 2 | 3 | 6 | 6 |
| Smoking | 3 | 3 | 2 | 3 | 2 | 3 | 4 | 4 | 3 | 5 | 6 | 3 | 3 | 6 | 4 | 4 | 3 | 3 | 6 | 8 | 13 | 12 |
| Household air pollution | 4 | 24 | 24 | 24 | 24 | 10 | 18 | 15 | 5 | 14 | 11 | 4 | 9 | 8 | 16 | 8 | 2 | 4 | 8 | 2 | 2 | 2 |
| Alcohol use | 5 | 5 | 7 | 8 | 7 | 5 | 5 | 2 | 7 | 3 | 3 | 6 | 5 | 2 | 13 | 9 | 11 | 9 | 1 | 7 | 10 | 5 |
| High body-mass index | 6 | 7 | 4 | 2 | 3 | 4 | 2 | 5 | 9 | 4 | 2 | 8 | 4 | 4 | 3 | 3 | 13 | 2 | 3 | 14 | 17 | 16 |
| High fasting plasma glucose | 7 | 6 | 6 | 6 | 5 | 7 | 6 | 8 | 6 | 6 | 4 | 5 | 6 | 7 | 5 | 5 | 8 | 1 | 7 | 11 | 14 | 13 |
| Childhood underweight | 8 | 21 | 20 | 19 | 21 | 20 | 19 | 19 | 21 | 19 | 15 | 12 | 16 | 14 | 14 | 11 | 5 | 8 | 9 | 1 | 1 | 1 |
| Ambient PM pollution | 9 | 8 | 9 | 16 | 10 | 9 | 14 | 9 | 4 | 16 | 14 | 10 | 8 | 17 | 7 | 15 | 7 | 21 | 20 | 17 | 15 | 8 |
| Physical inactivity | 10 | 4 | 5 | 5 | 6 | 6 | 7 | 6 | 10 | 7 | 7 | 7 | 7 | 10 | 6 | 6 | 12 | 7 | 11 | 16 | 16 | 17 |
| Occupational risks | 11 | 10 | 10 | 10 | 11 | 11 | 9 | 10 | 8 | 8 | 8 | 9 | 11 | 9 | 8 | 13 | 6 | 11 | 12 | 9 | 12 | 11 |
| Iron deficiency | 12 | 14 | 17 | 13 | 18 | 14 | 11 | 12 | 13 | 11 | 10 | 11 | 13 | 5 | 10 | 7 | 9 | 12 | 10 | 4 | 4 | 4 |
| Suboptimal breastfeeding | 13 | 25 | 24 | 24 | 24 | 25 | 16 | 25 | 17 | 13 | 12 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 5 | 3 | 3 | 3 |
| High total cholesterol | 14 | 9 | 8 | 7 | 8 | 8 | 8 | 7 | 11 | 9 | 9 | 14 | 10 | 13 | 9 | 12 | 14 | 13 | 17 | 22 | 21 | 22 |
| Drug use | 15 | 11 | 11 | 9 | 9 | 13 | 10 | 11 | 12 | 10 | 13 | 15 | 14 | 12 | 12 | 14 | 17 | 14 | 13 | 19 | 19 | 18 |
| Intimate partner violence | 16 | 12 | 14 | 14 | 13 | 16 | 13 | 13 | 14 | 15 | 17 | 16 | 17 | 15 | 15 | 17 | 15 | 16 | 14 | 18 | 18 | 19 |
| Lead | 17 | 15 | 13 | 11 | 14 | 12 | 12 | 14 | 15 | 12 | 16 | 17 | 15 | 16 | 17 | 16 | 18 | 18 | 18 | 20 | 20 | 20 |
| Sanitation | 18 | 20 | 21 | 21 | 23 | 24 | 22 | 22 | 23 | 22 | 21 | 19 | 23 | 20 | 20 | 19 | 16 | 15 | 16 | 10 | 8 | 10 |
| Vitamin A deficiency | 19 | 22 | 22 | 20 | 22 | 23 | 23 | 24 | 25 | 23 | 22 | 20 | 21 | 21 | 23 | 23 | 20 | 20 | 15 | 12 | 7 | 9 |
| Zinc deficiency | 20 | 19 | 19 | 17 | 19 | 21 | 21 | 21 | 22 | 21 | 18 | 18 | 18 | 18 | 22 | 18 | 21 | 19 | 19 | 15 | 9 | 15 |
| Childhood sexual abuse | 21 | 16 | 15 | 12 | 12 | 18 | 15 | 16 | 18 | 17 | 19 | 23 | 19 | 19 | 18 | 20 | 19 | 22 | 22 | 21 | 22 | 21 |
| Unimproved water | 22 | 23 | 23 | 22 | 20 | 22 | 24 | 23 | 24 | 24 | 23 | 21 | 22 | 23 | 19 | 21 | 22 | 17 | 21 | 13 | 11 | 14 |
| Low bone mineral density | 23 | 13 | 12 | 15 | 15 | 15 | 17 | 17 | 16 | 18 | 20 | 22 | 20 | 22 | 21 | 22 | 24 | 23 | 23 | 23 | 23 | 23 |
| Ozone | 24 | 18 | 18 | 23 | 17 | 19 | 25 | 20 | 20 | 25 | 25 | 25 | 25 | 25 | 24 | 24 | 23 | 25 | 25 | 24 | 24 | 24 |
| Radon | 25 | 17 | 16 | 18 | 16 | 17 | 20 | 18 | 19 | 20 | 24 | 24 | 24 | 24 | 25 | 25 | 25 | 24 | 24 | 25 | 25 | 25 |

Diet & Obesity/Diabetes: Conventional Wisdom

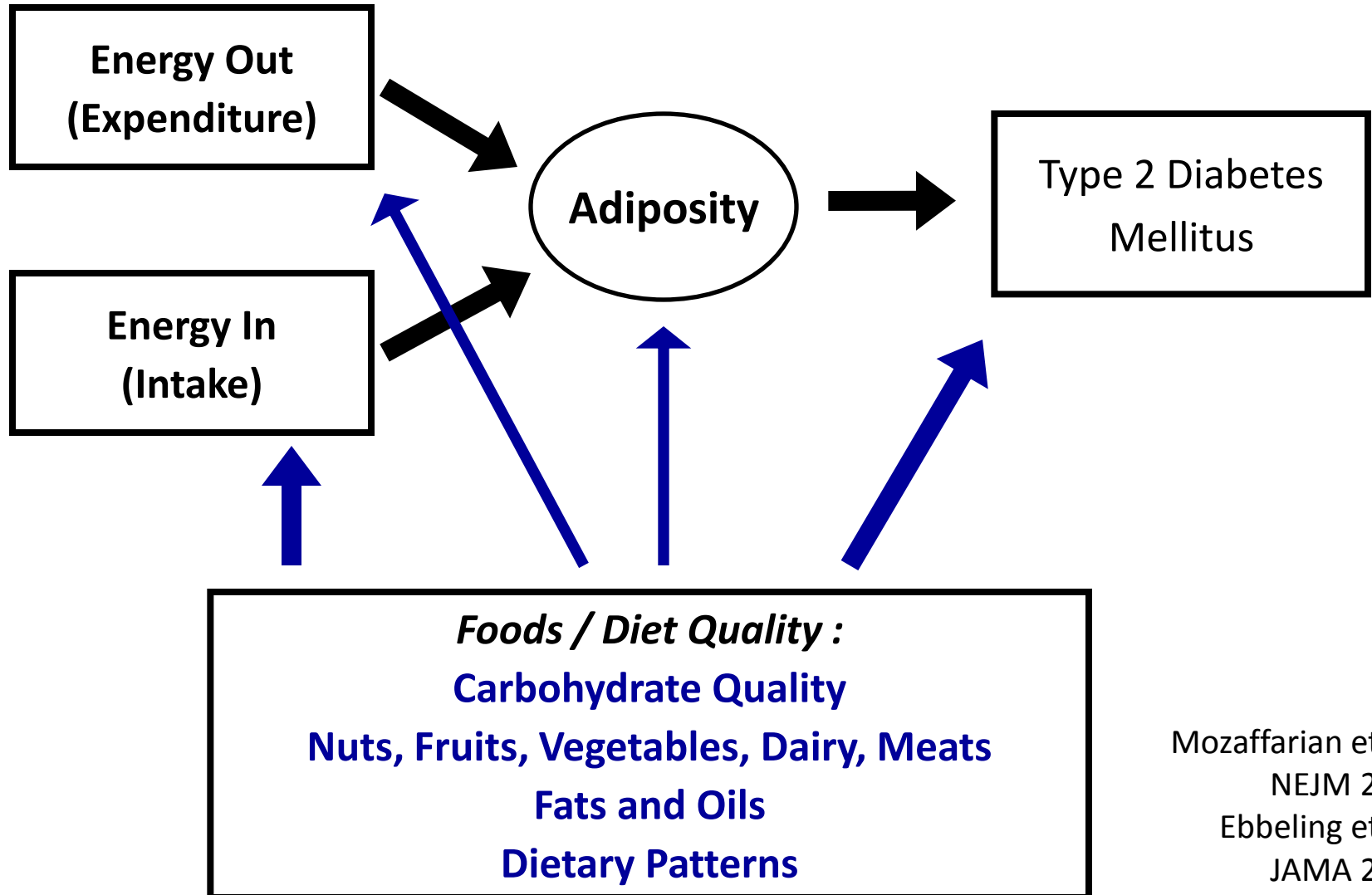
“Calories In, Calories Out”



Advances in Nutritional Science



Diet & Obesity/Diabetes: Modern Science



Mozaffarian et al.,
NEJM 2011
Ebbeling et al.,
JAMA 2012

Diet Quality and Obesity: All Calories are *Not* Created Equal

Complex influences of different foods on:

- Hunger, fullness
- Insulin, adrenalin, other hormonal responses
- Liver fat production (de novo lipogenesis, conversion of carbohydrate to fat)
- Brain reward
- Microbiome
- Metabolic expenditure (*energy out*)

e.g., Browning AJCN 2011; Ebbeling JAMA 2012;
Poutahidis Plos ONE 2013; Lennerz AJCN 2013; Ludwig JAMA 2014

Preventing Chronic Diseases: Food Patterns



Dietary Priorities for Good Health

EAT:

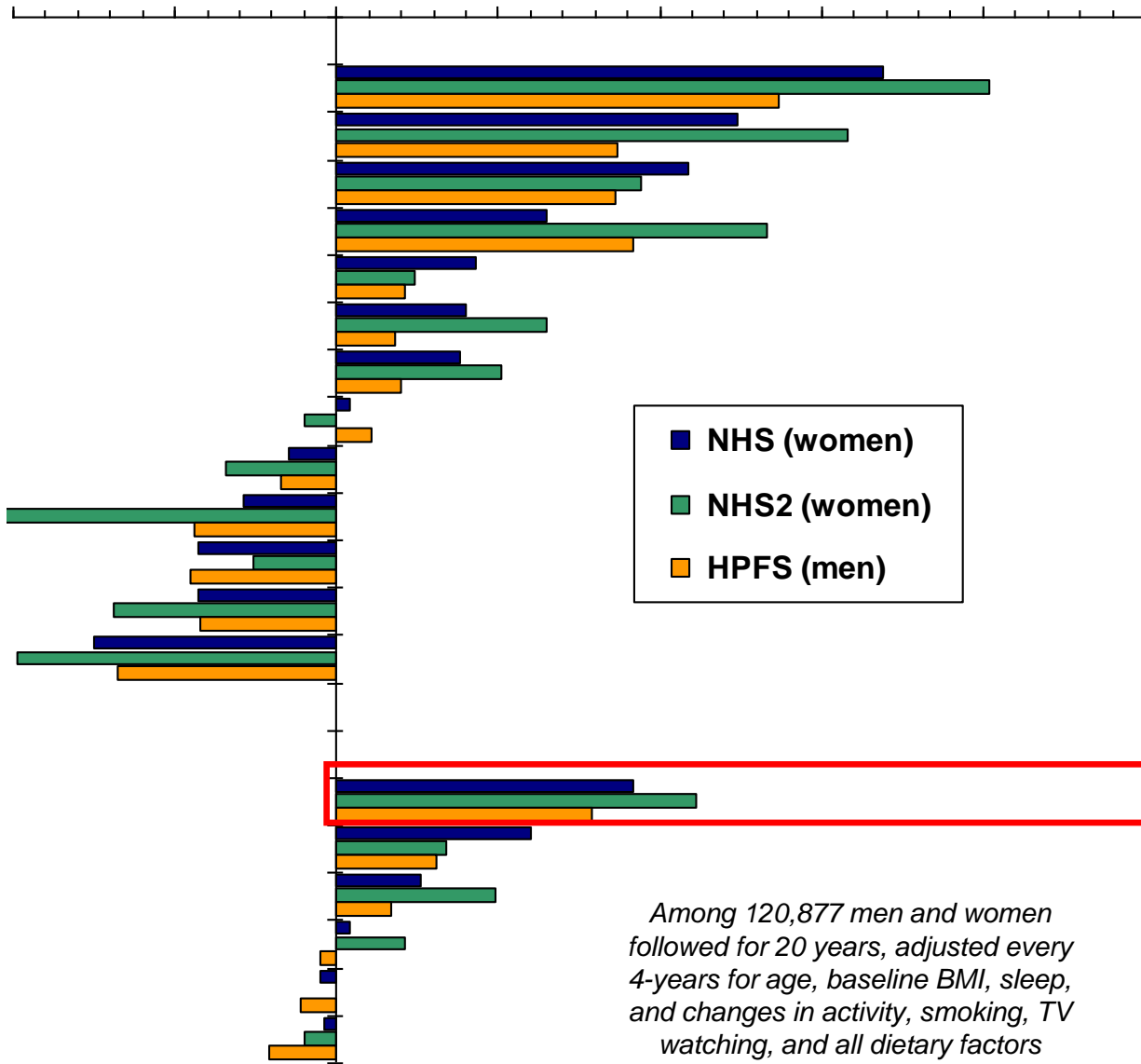
- **Fruits**
- **Nuts and Seeds**
- **Fish and Seafood**
- **Vegetables**
- **Vegetable Oils**
- **Whole Grains**
- **Moderate Dairy**

LIMIT:

- **Refined Grains, Starches, Sugars**
- **Processed Meats**
- **Sweetened Drinks**
- **Industrial Trans Fat**
- **Salt**
- **Alcohol**

Weight Change Each Four Years (lbs)

-1 -0.5 0 0.5 1 1.5 2 2.5



Weight Change Associated with Each Increased Daily Serving of:

Foods

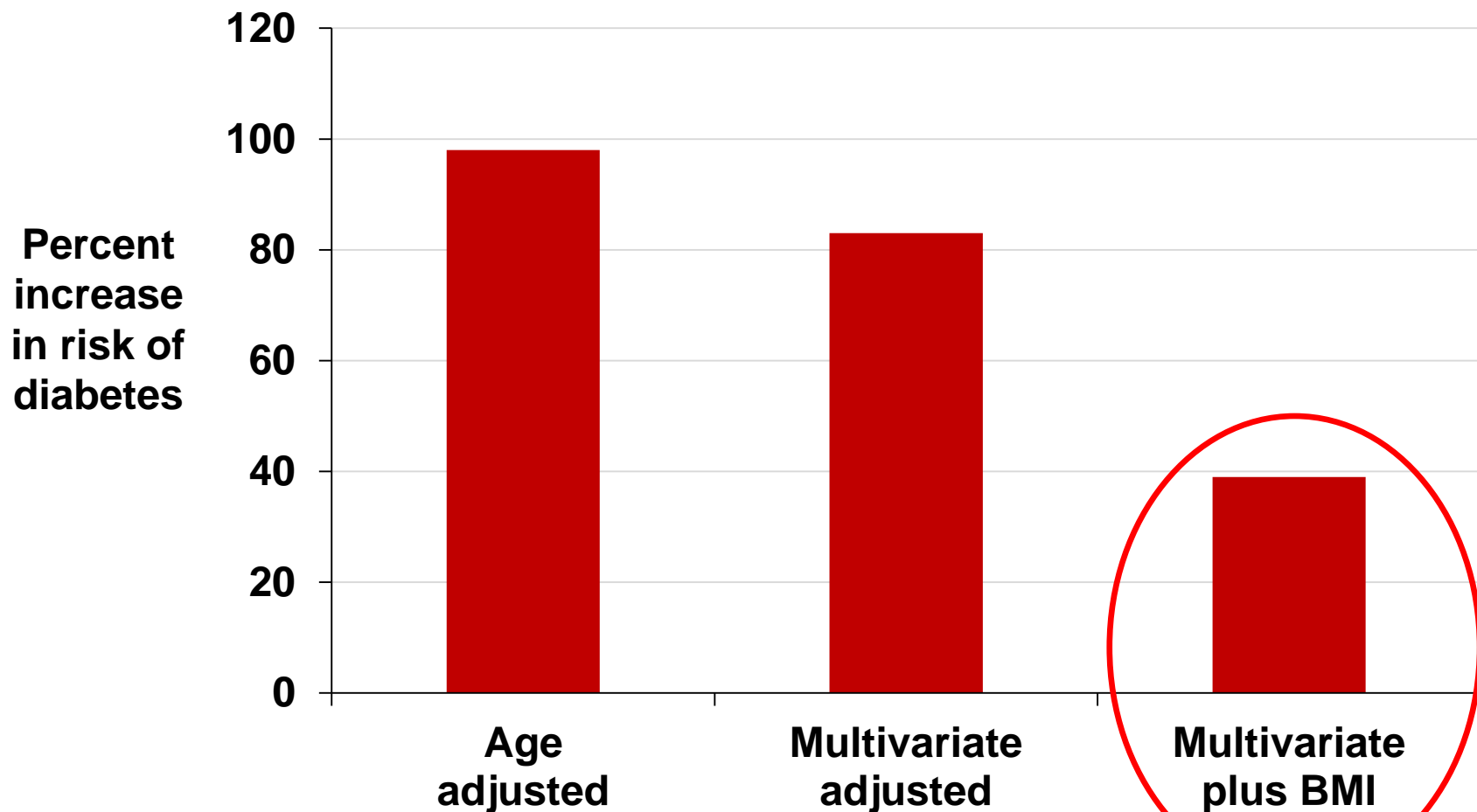
- Potato chips
- Potatoes/fries
- Processed meats
- Unprocessed red meats
- Butter
- Sweets and desserts
- Refined grains
- Cheese
- Vegetables
- Nuts
- Whole grains
- Fruits
- Yogurt

Beverages

- Sugar-sweetened beverages**
- Alcohol
- 100% fruit juice
- Low fat or skim milk
- Whole fat milk
- Diet (zero calorie) soda

Among 120,877 men and women followed for 20 years, adjusted every 4-years for age, baseline BMI, sleep, and changes in activity, smoking, TV watching, and all dietary factors simultaneously.

SSBs and Incident Diabetes



Risk for 1+ drink (12 oz) per day, compared with <1 per month

Among 91,249 women followed for 8 years. Schulze et al., JAMA 2004

Impact of SSBs on Global Health ?

Compiled Global Data on SSB Consumption

- **63 individual-level dietary surveys, 1980-2010**
 - **54 countries**
 - **720,859 individuals**
 - **88% nationally representative**
 - **Covering 63% of the world's population**
- **United Nations FAO food balance sheets, 1980-2010**
 - **National availability of sugar**
 - **187 countries**
 - **Covering 99.9% of the world's population**

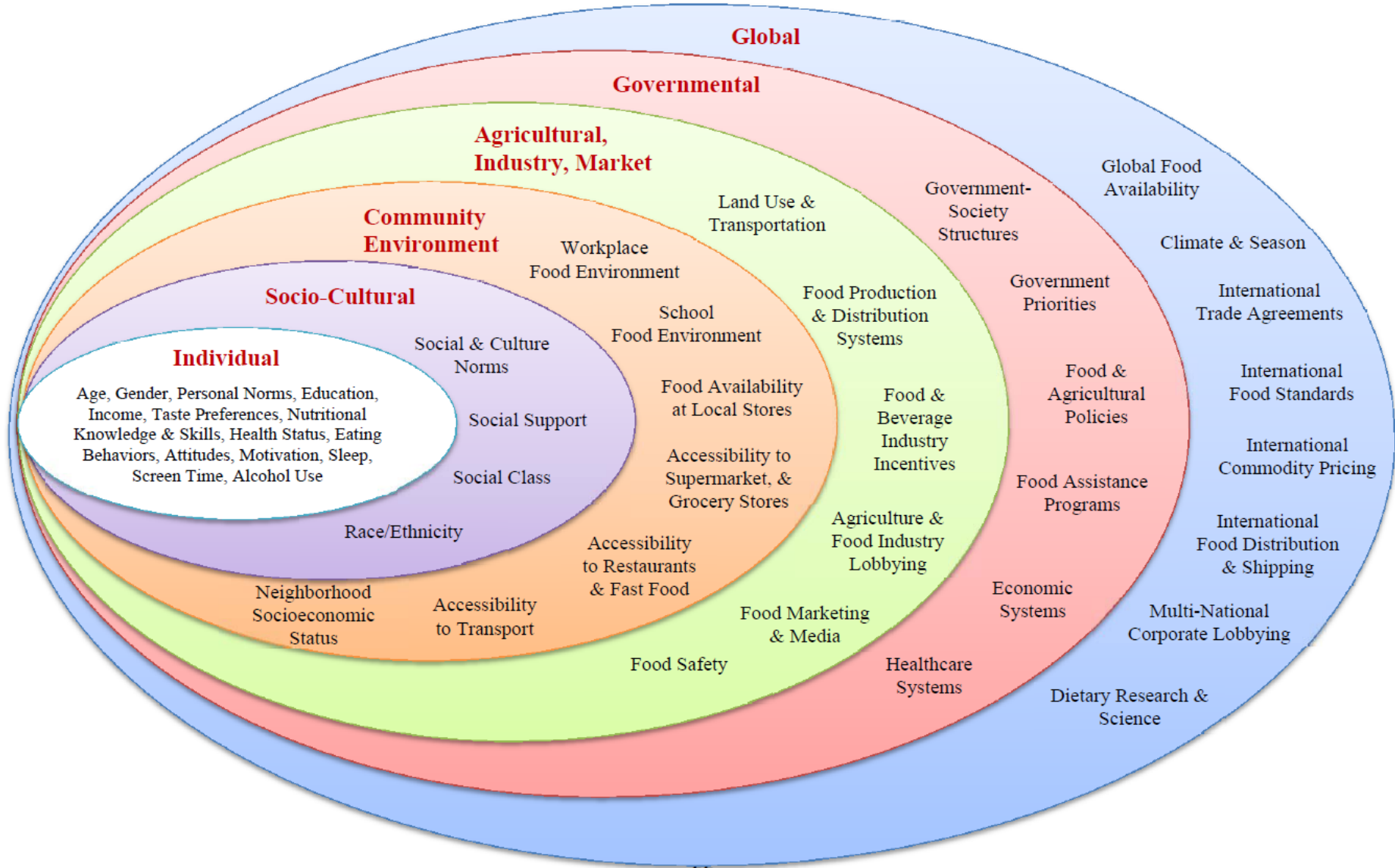
- Evaluated sugar-sweetened soda, energy drinks, sweet iced tea, frescas.
- Excluded diet soda, 100% fruit juice.



Global Deaths Attributable to SSBs in 2010

- In 2010, **184,000** (95% CI: 161,000-208,000) deaths/year were attributable to SSBs worldwide. Globally, this represents **1.2%** of all of diabetes, CVD, and obesity-related deaths.
- **72%** from diabetes, **24%** from CVD, and **4%** from cancers.
- Numbers of SSB-related deaths similar in **men vs. women**.
- In **Mexico**, SSBs cause **24,100 deaths/year**. This is **1 in 8 (12.1%)** of all diabetes, CVD, and obesity-related cancer deaths in Mexico. Among younger women and men (<**age 45**), SSBs cause **22%** and **33%** of all diabetes, CVD, and obesity-related deaths.
- **Not only a rich-country problem:** More overall SSB-related deaths in low/middle-income countries than in high-income countries.

Barriers and Opportunities for Healthy Eating

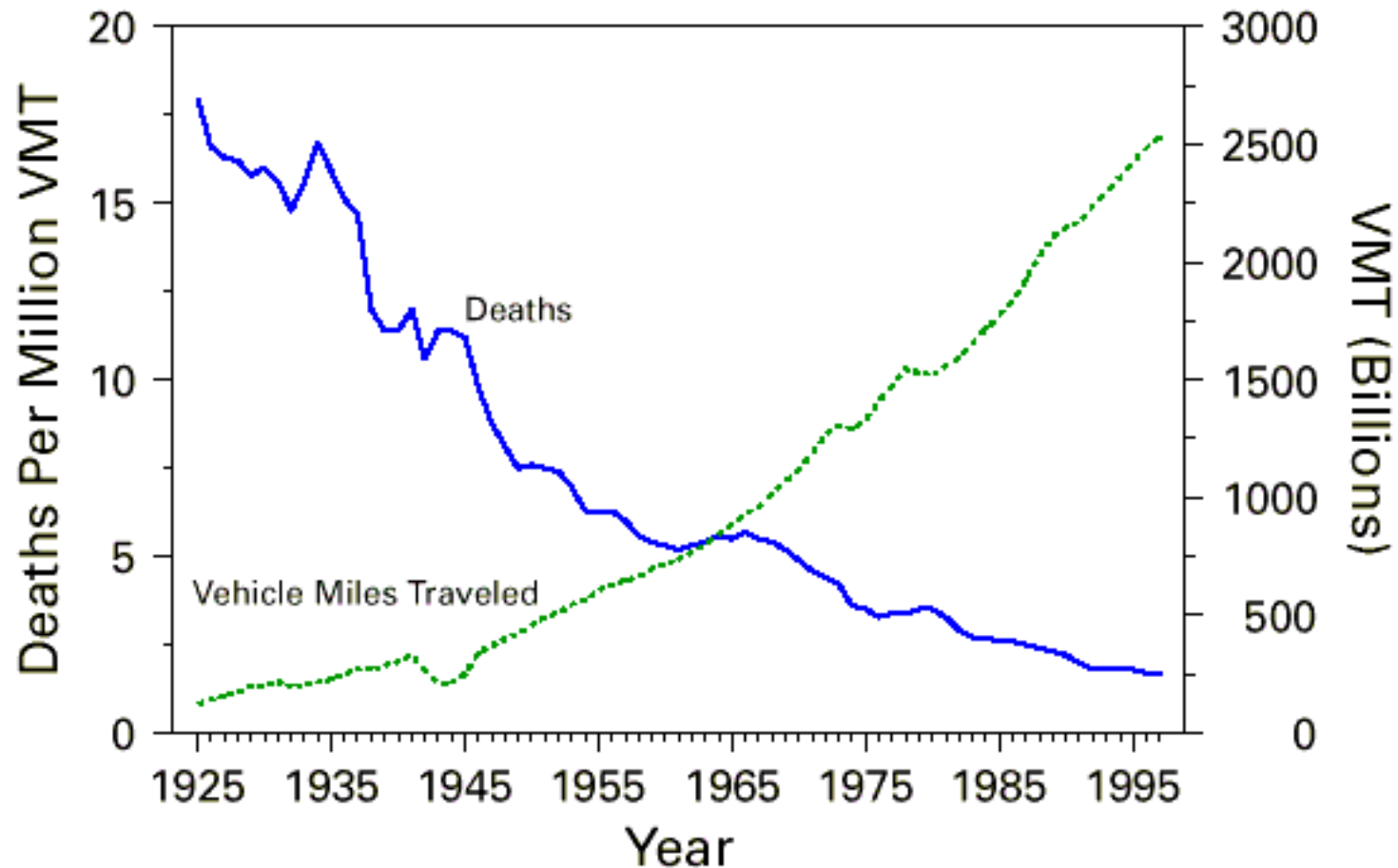


Healthy Diet Policies: Barriers

- **Incomplete policy maker knowledge on key dietary targets:**
 - *Not just “calories”.*
- **Insufficient use of the best evidence-based policies:**
 - **Considerable emphasis on labeling, information, education, guidelines.**
 - **Very little focus on other complementary approaches.**
- **Opposition, by food industry, hunger groups, the public.**
- **“Disease-treatment” health care system:**
 - **Diversion of both attention and resources.**

Lessons From Past Public Health Successes

FIGURE 1. Motor-vehicle-related deaths per million vehicle miles traveled (VMT) and annual VMT, by year — United States, 1925–1997



Lessons From Past Public Health Successes

- **Driver:**

- Education.
- Licensing.
- Limits on phone use, texting.

- **Car:**

- Active: seat belts, child seats, motorcycle helmets.
- Passive: padded interiors, collapsible steering columns, shatterproof glass, air bags.
- Crash safety standards.
- Safety inspections.

- **Road:**

- Road engineering, guard rails, rumble strips.
- Speed limits.
- Stop signs, stop lights, caution signs.

- **Culture:**

- Designated driver campaign.
- Drunk-driving legislation.
- Private advocacy, e.g. MADD.

Evidence-Based Policy Interventions for Diet

| | |
|---------------------------------|--|
| Media and Education | <ul style="list-style-type: none">• Sustained, focused media campaigns, especially combined with multi-component strategies, focused on specific foods or drinks. |
| Labeling and Information | <ul style="list-style-type: none">• Mandated nutrition facts, front-of-pack labels/icons, or menu labeling to influence industry behavior and product formulations. |
| Schools | <ul style="list-style-type: none">• Multicomponent diet and activity program including classes, teacher training, supportive policies, environmental changes, family components. |
| Workplaces | <ul style="list-style-type: none">• Comprehensive worksite wellness programs for diet, activity, tobacco.• Increased availability of healthier options and/or strong nutrition standards, combined with on-site prompts, labels, or icons. |
| Economic Incentives | <ul style="list-style-type: none">• Subsidy strategies to lower prices of more healthful foods and beverages.• Tax strategies to increase prices of less healthful foods and beverages.• Long-term changes in agricultural and related policies for infrastructure to facilitate production, transportation, and marketing of healthier foods. |
| Bans and Mandates | <ul style="list-style-type: none">• Restrictions on ads/marketing of less healthy foods/drinks to children on television, and near schools and public places, and on packages.• Direct bans (e.g., sodium, trans fat) or mandates (e.g., vegetable oils). |

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The Real Cost of Food – Dietary Taxes and Subsidies to Improve Public Health

| | Packaged and supermarket foods | Restaurant and other food service establishments |
|-----------------------------------|--|---|
| Simple Flat Tax (10-30%) | Most packaged foods (e.g., nearly all foods with a label). | Most chain restaurants, large cafeteria vendors, and other similar food service establishments. |
| Subsidy (from tax revenue) | Minimally processed healthful foods, such as fruits, nuts, vegetables, beans, seafood, plain yogurt, vegetable oils, and minimally processed whole grains. | School lunch and afterschool programs. |