OBESITY:
A Rising Threat to Global Health

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AMERICAN BOARD OF OBESITY MEDICINE DIPLOMATE

Disclosure Statement

Speaker:

Dr. Fatima Cody Stanford

- Has no relevant financial relationships to disclose
- Will not be discussing unlabeled/unapproved use of drugs or products

Weill Cornell Medicine-Qatar

Points of Discussion

- What is obesity and what is its prevalence in the US and throughout the world?

- How did obesity become a threat to global health?

- Do I play a role in weight bias? If so, how do I make a change?

- What strategies might we take to address the obesity epidemic?

Obesity defined- the role of Body Mass Index (BMI)

Metric measurements:

$$\frac{Weight\ (kg)}{Height\ (m)^2}$$

English measurements:

$$\frac{Weight\ (lb)\ X\ \ 703}{Height\ (in)^2}$$

How is Obesity defined in Children and Adolescents?

Weight Status Category	BMI Percentile Range
Underweight	< 5th Percentile
Healthy Weight	5th Percentile - <85th Percentile
Overweight	85th Percentile- <95th Percentile
Obesity	≥ 95th Percentile

How is Obesity defined in Adults?

Weight Status Category	Body Mass Index (BMI)
Underweight	< 18.5
Normal Weight	18.5-24.9
Overweight	25- 29.9
Class I Obesity	30-34.9
Class II Obesity	35-39.9
Class III Obesity	≥40

Body Mass Index Calculation

Metric measurements:

$$\frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

English measurements:
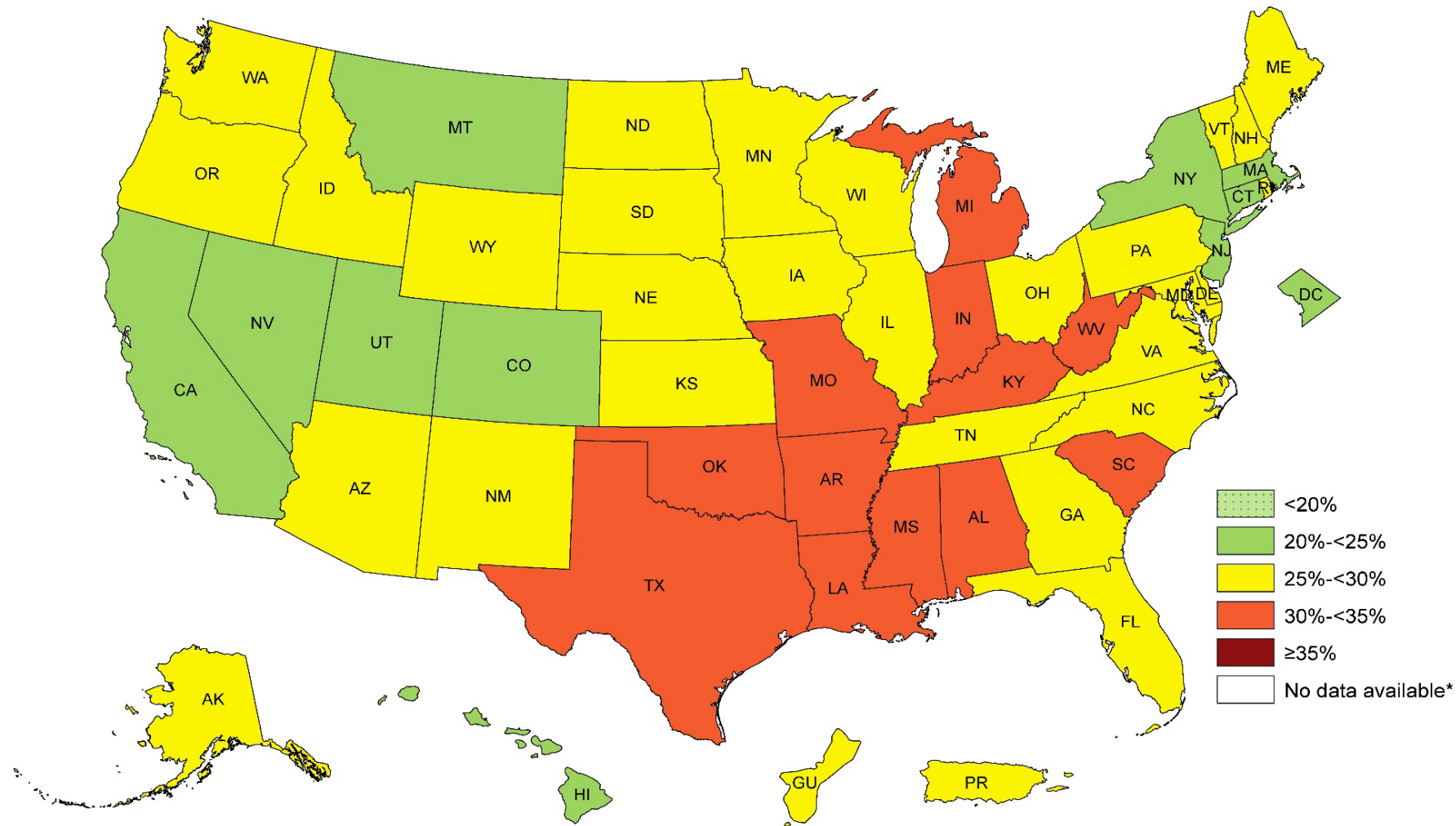
$$\frac{\text{Weight (lb) X } 703}{\text{Height (in)}^2}$$

How is Obesity defined in Children and Adolescents?

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Class III Obesity	≥40

Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2011

Legend:
- <20%
- 20%-<25%
- 25%-<30%
- 30%-<35%
- ≥35%
- No data available*

¶ **Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.**

***Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.**

Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2012

Legend:
- <20%
- 20%-<25%
- 25%-<30%
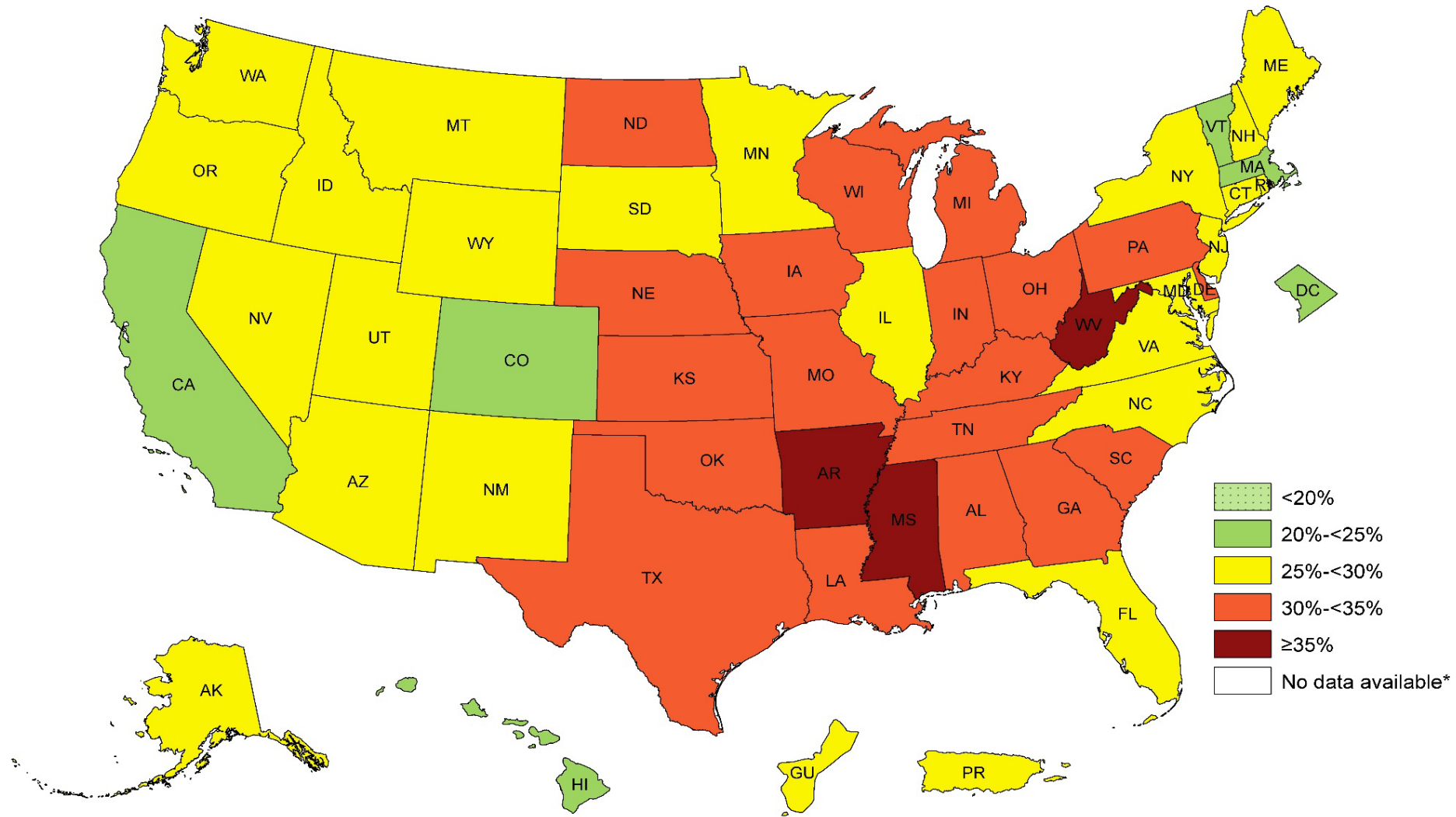- 30%-<35%
- ≥35%
- No data available*

¶ **Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.**

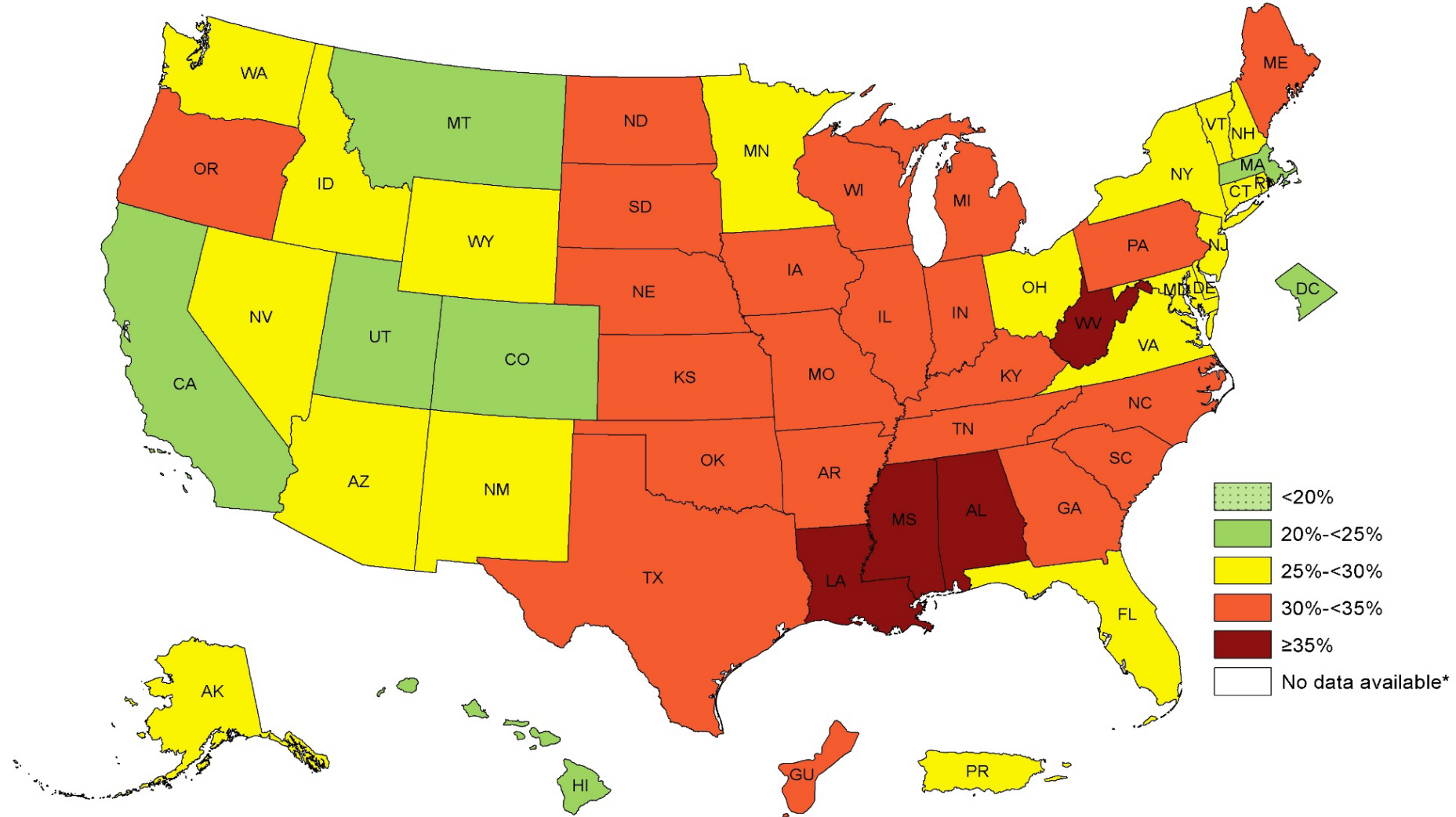*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.**

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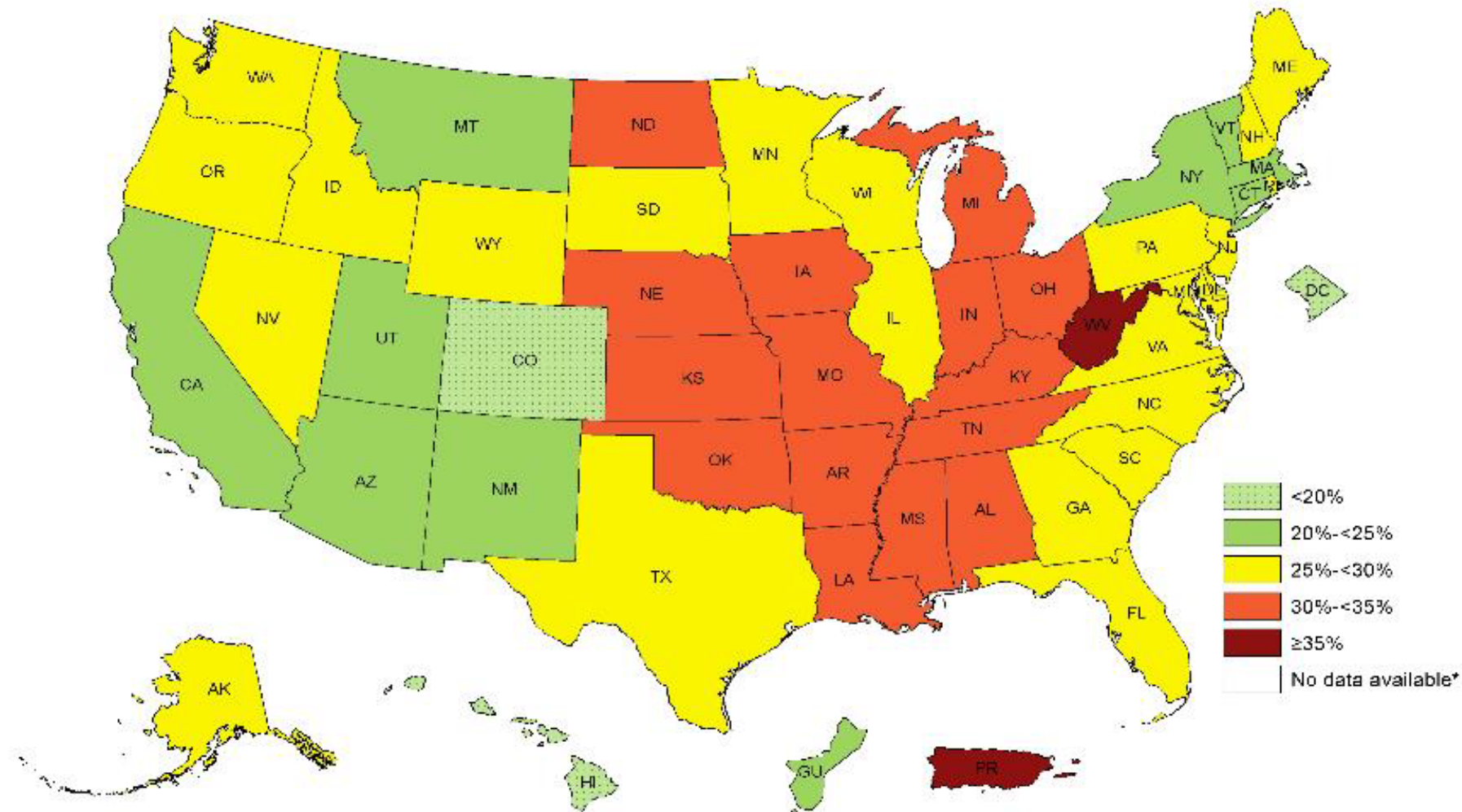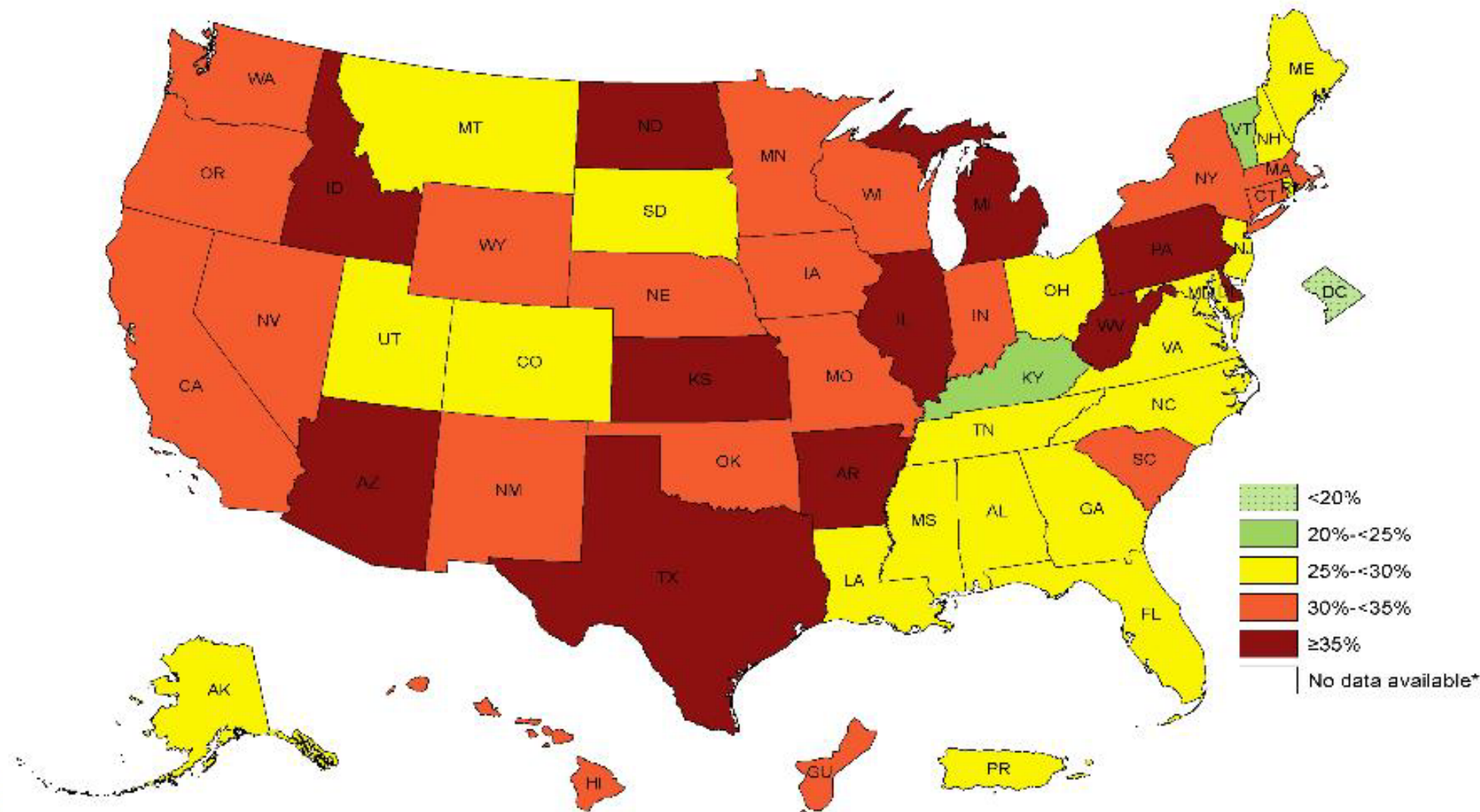
Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2015

Legend:
- <20%
- 20%-<25%
- 25%-<30%
- 30%-<35%
- ≥35%
- No data available*

¶ Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

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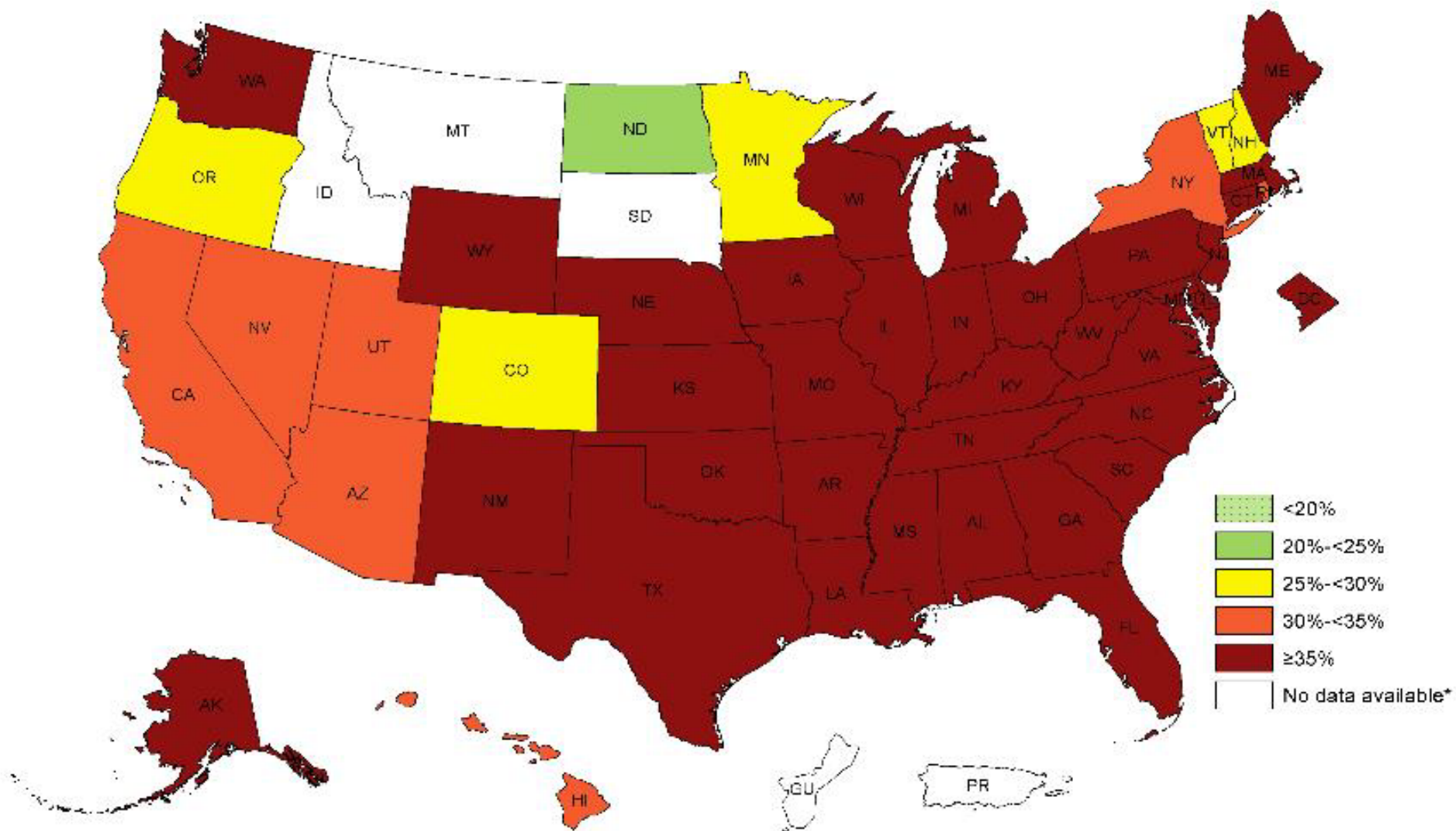
Prevalence of Self-Reported Obesity Among Non-Hispanic White Adults, by State and Territory, BRFSS, 2013-2015

Prevalence of Self-Reported Obesity Among Hispanic Adults, by State and Territory, BRFSS, 2013-2015
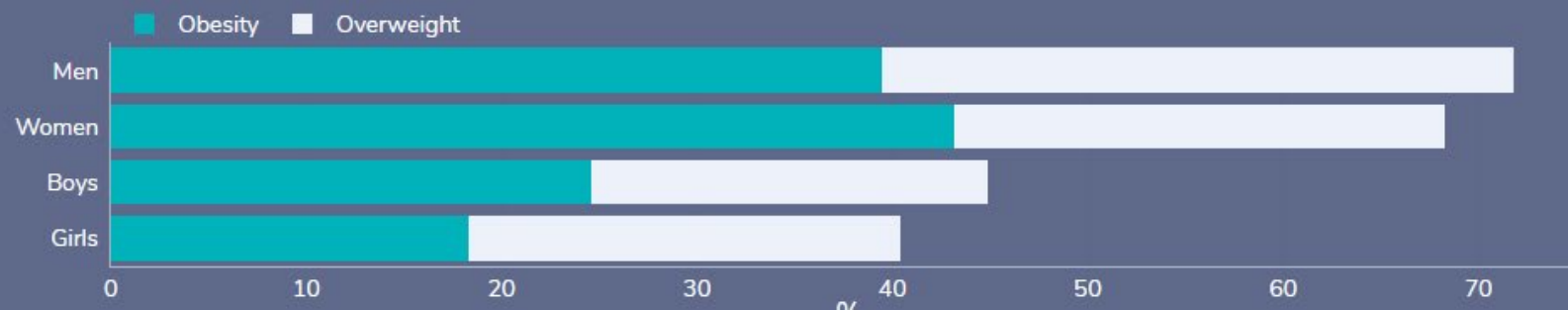
Prevalence of Self-Reported Obesity Among Non-Hispanic Black Adults, by State and Territory, BRFSS, 2013-2015

Overweight and Obesity in Qatar

Qatar

Overview | Obesity prevalence | Population breakdowns | Drivers | Comorbidities | Health systems | Actions

■ Obesity ■ Overweight

Men
Women
Boys
Girls

0   10   20   30   40   50   60   70
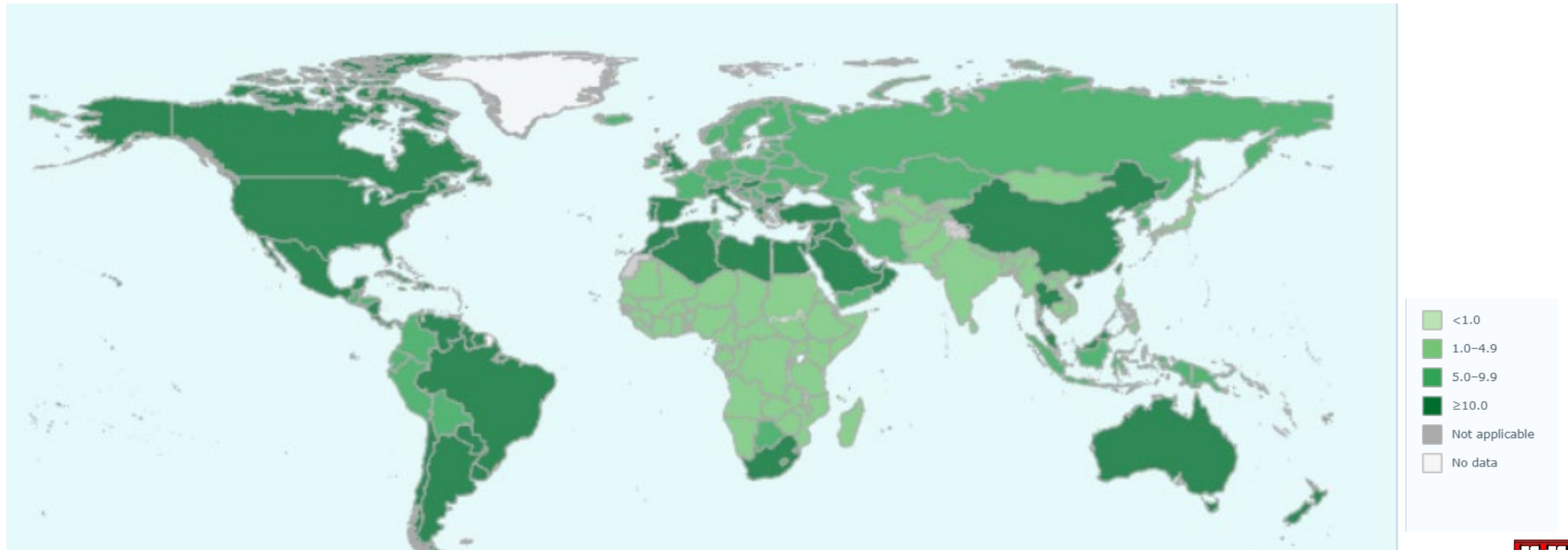
National obesity risk *
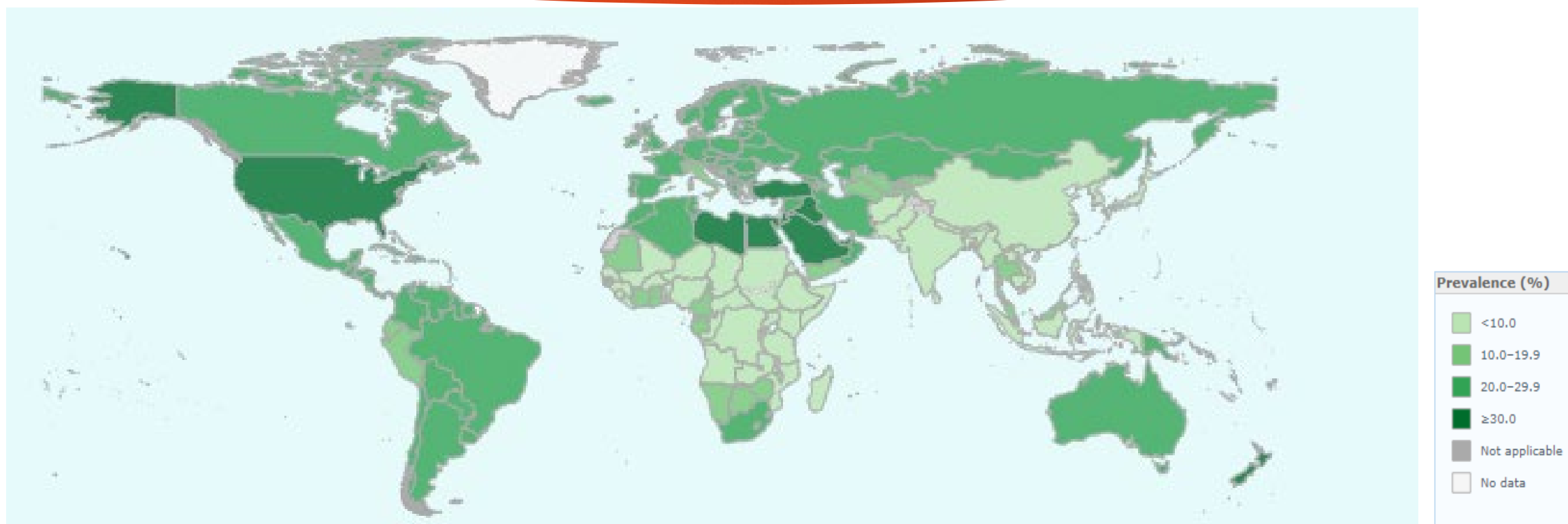7.5/10

Childhood obesity risk *
8.5/11

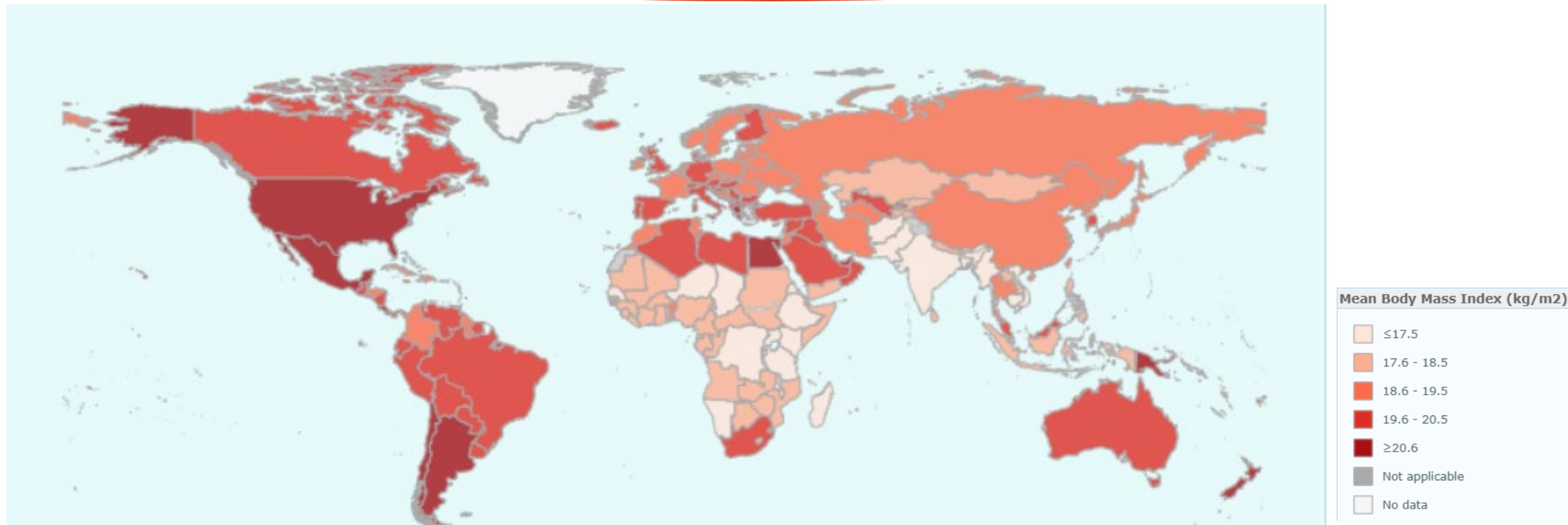* Based on estimated data. _For more information see Publications_

Prevalence of Obesity Among Children and Adolescents, Both Sexes, 2016

Prevalence of Obesity Among Adults, Both Sexes, 2016

Prevalence (%)

- <10.0
- 10.0–19.9
- 20.0–29.9
- ≥30.0
- Not applicable
- No data

Prevalence of Mean Body Mass Index Among Children and Adolescents, Both Sexes, 2016

Mean Body Mass Index (kg/m2)

- ≤17.5
- 17.6 - 18.5
- 18.6 - 19.5
- 19.6 - 20.5
- ≥20.6
- Not applicable
- No data

Prevalence of Mean Body Mass Index Among Adults, Both Sexes, 2016

Mean Body Mass Index (kg/m2)

- ≤22.5
- 22.6 - 24.9
- 25.0 - 27.4
- 27.5 - 29.9
- ≥30.0
- Not applicable
- No data

https://www.who.int/gho/ncd/risk_factors/overweight_obesity/bmi_trends_adults/en/
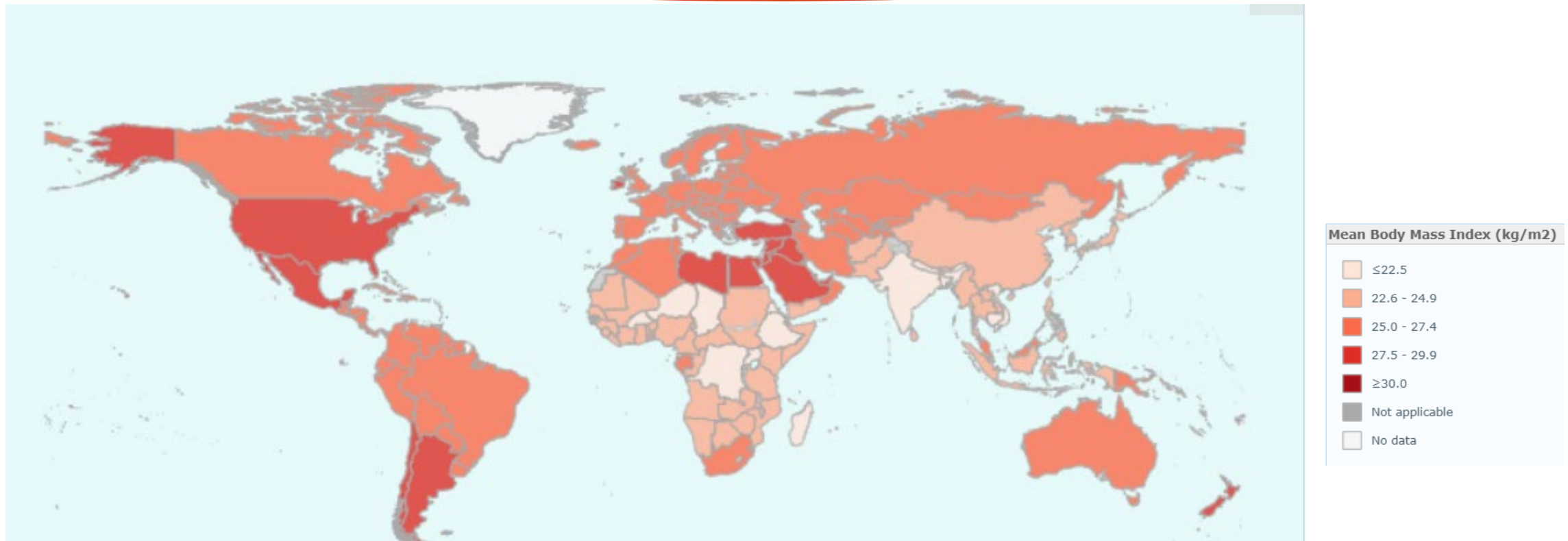
Share of deaths attributed to obesity, 2017

Obesity is defined as having a body-mass index (BMI) equal to or greater than 30. BMI is a person's weight in kilograms
 divided by his or her height in metres squared.

Our World in Data

No data 0%   5%   7.5%   10%   12.5%   15%   >20%

Source: IHME, Global Burden of Disease

OurWorldInData.org/obesity • CC BY
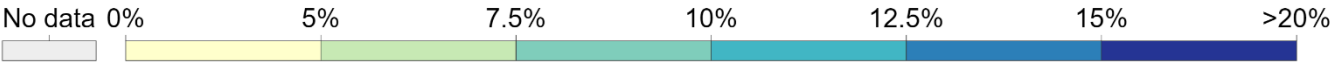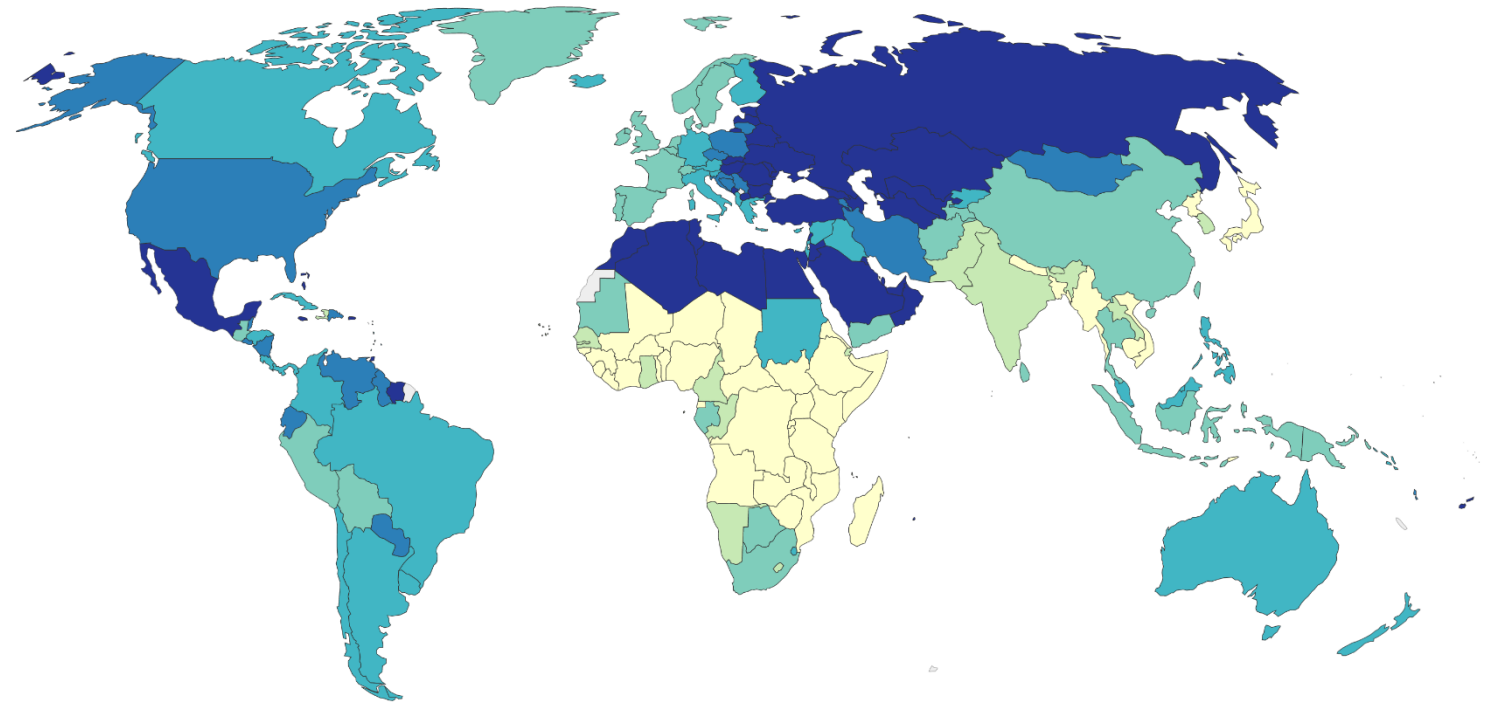
Share of Deaths Attributable to Obesity in 2017

Death rate from obesity, 2017

Premature deaths attributed to obesity per 100,000 individuals. Obesity is defined as having a body-mass index (BMI) equal to or greater than 30. BMI is a person's weight in kilograms divided by his or her height in metres squared.
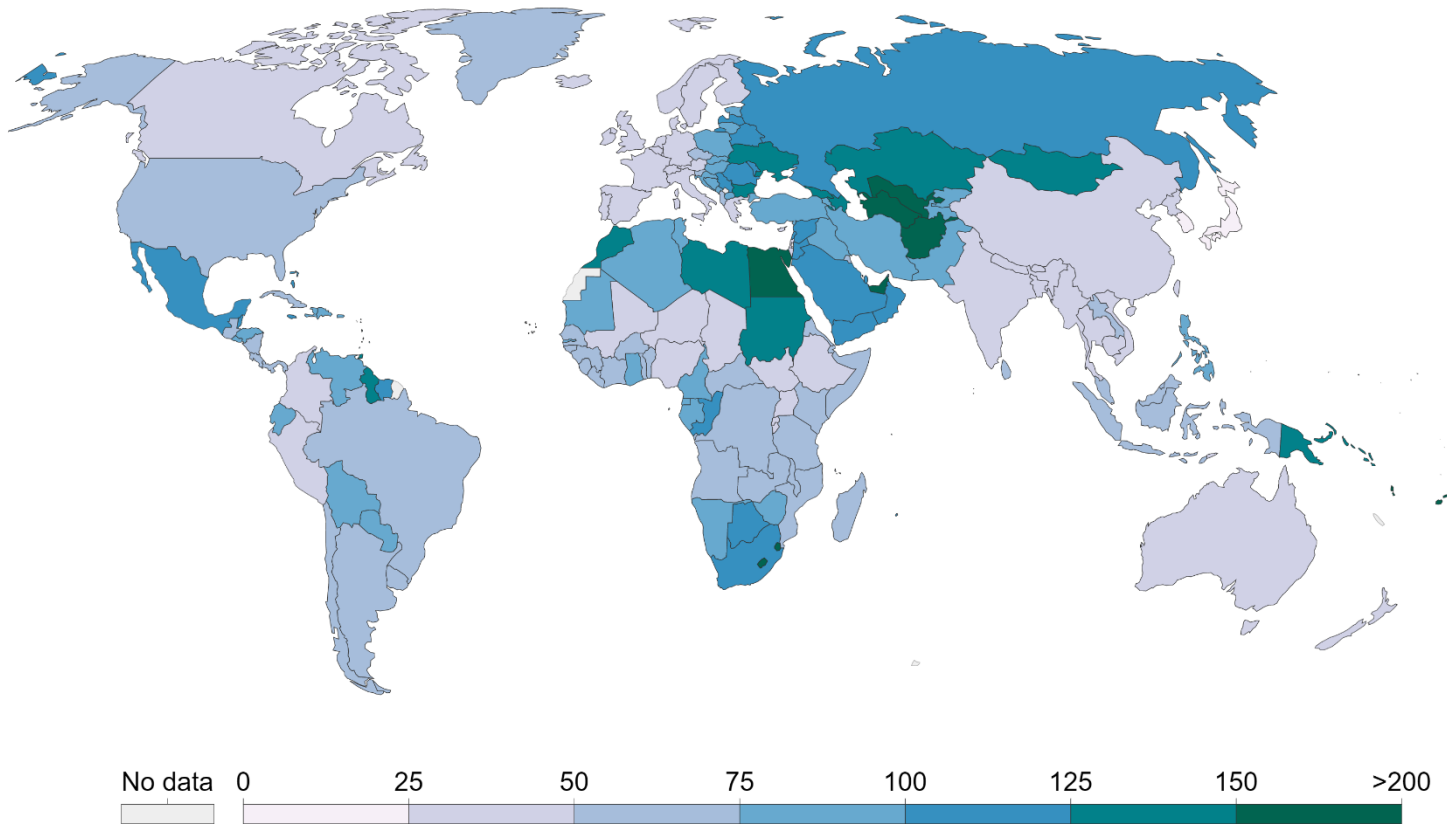
Our World in Data

No data   0   25   50   75   100   125   150   >200
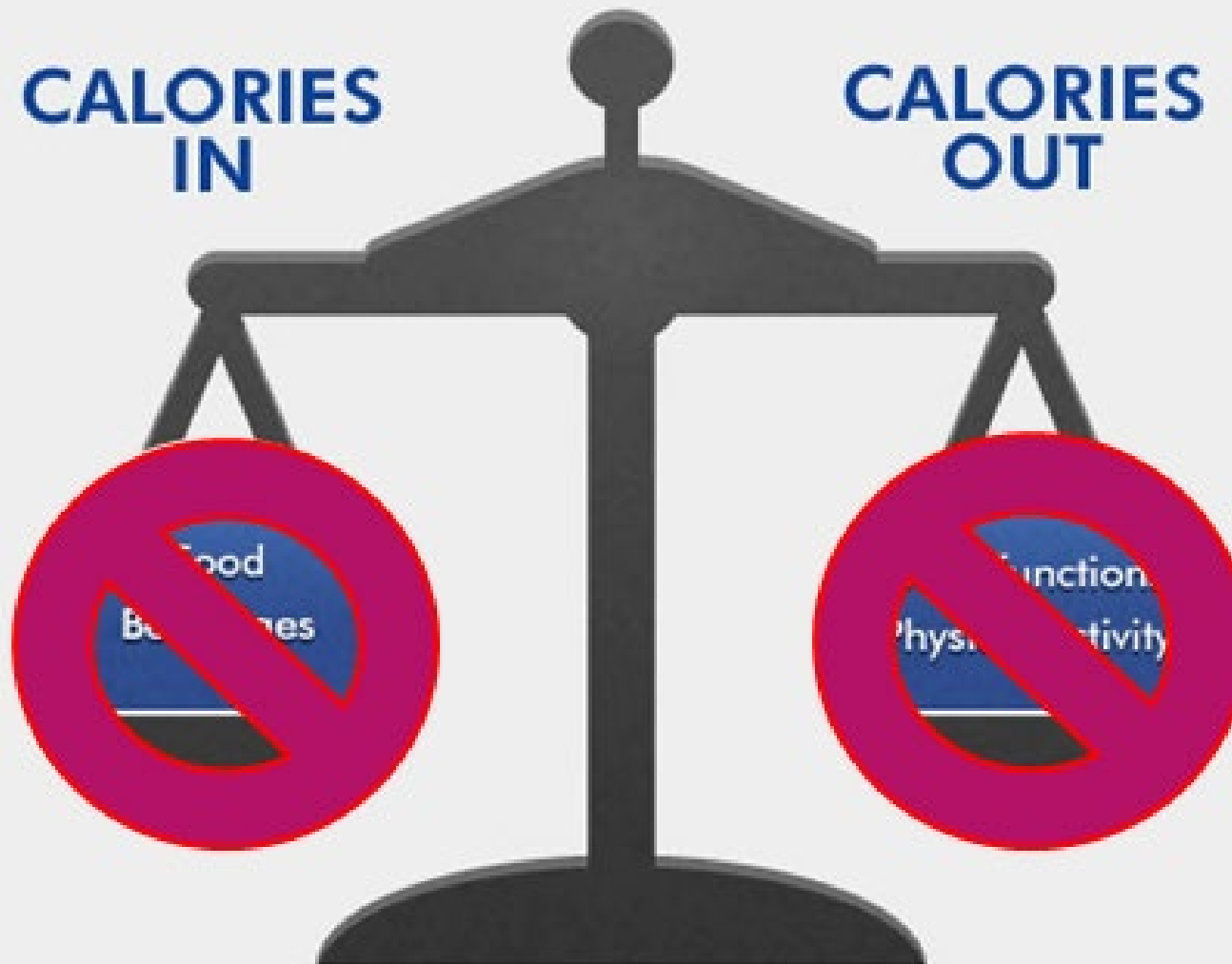
Death Rate from Obesity, 2017

Energy Balance (simple)
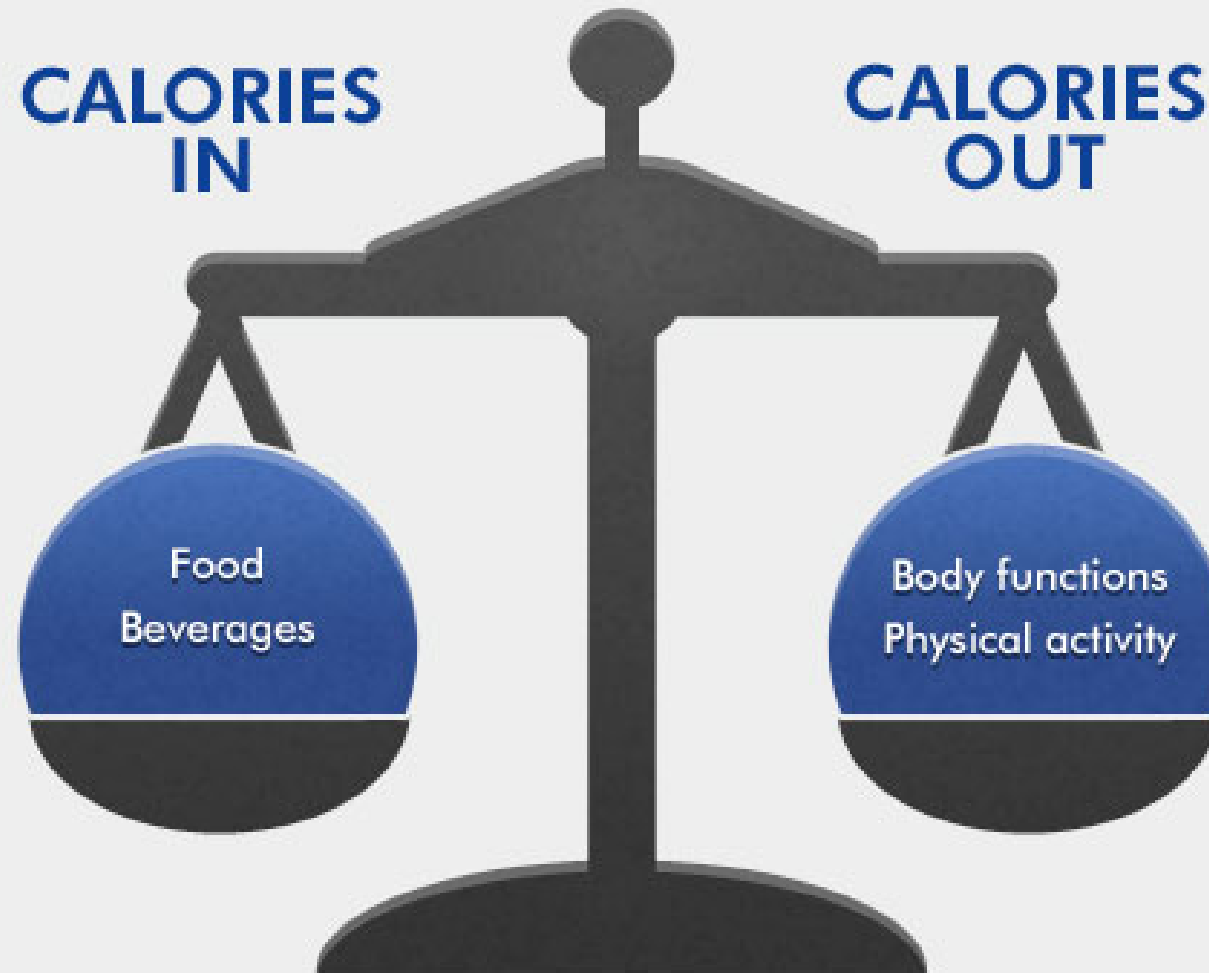
Energy Balance (simple)

Obesity: A Multi-factorial Disorder

Genetics | Environment | Development | Behavior

Regulation of Food Intake
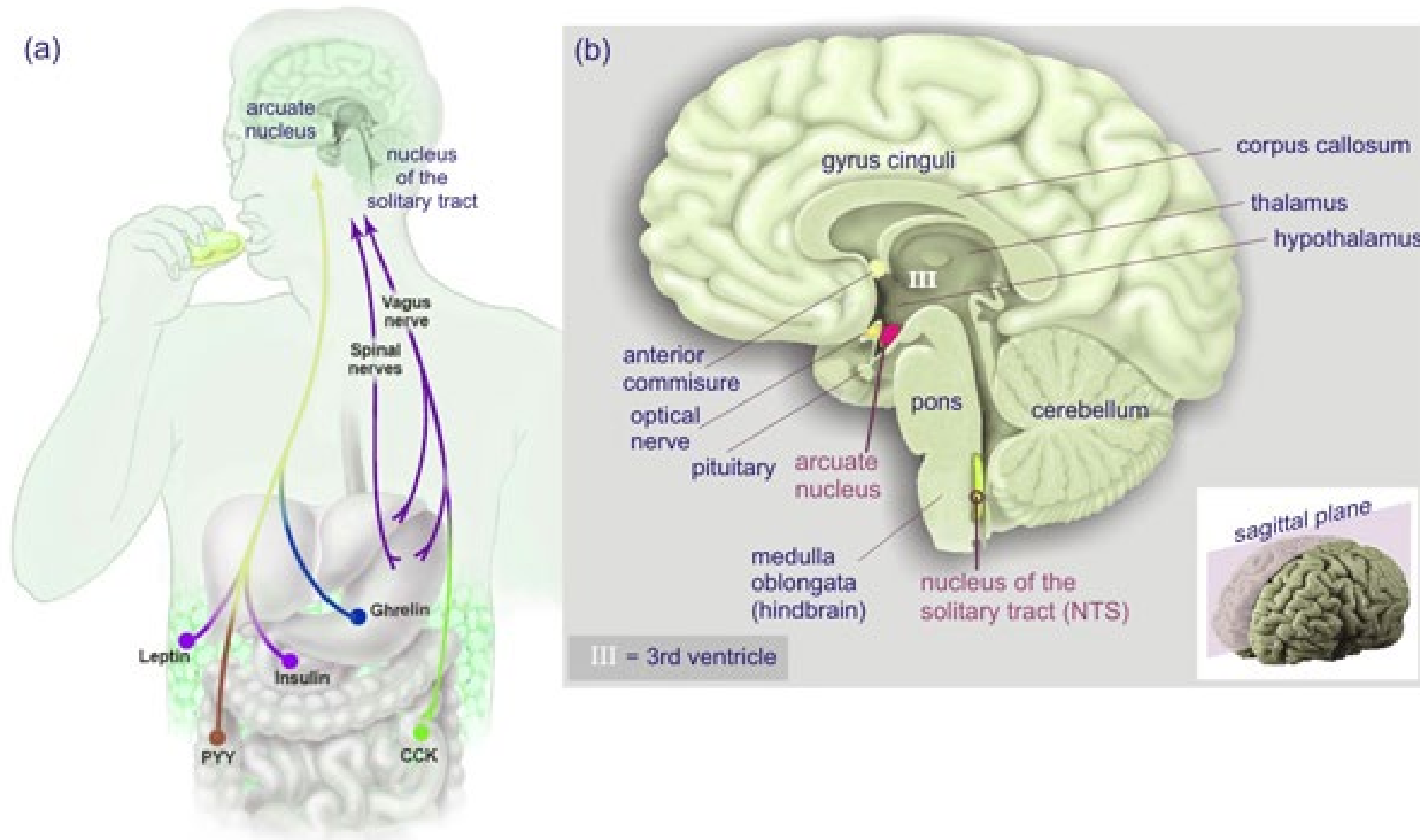
Regulation of Food Intake

Substance	Production Site	Effect (Relevant for Feeding)
Ghrelin (grow)	•Stomach (fundus region, entero-endocrine cells) •Neurons in the hypothalamus	Appetite (orexigenic)
Anandamide (endocannabinoide, ananda; bliss, delight + amide)	Small intestine	Appetite (orexigenic)
Insulin (insula; island or islet)	Pancreas (β-cells in islets of Langerhans)	•Satiety (anorexigenic) •glycogen and lipid storage
Leptin (leptos, thin)	•Adipocytes (long term) •Stomach (short term)	Satiety (anorexigenic)
CCK (cholecystokinin, "move the bile-sac")	Small intestine	•Early satiety (anorexigenic) •release of digestive enzymes from exocrine pancreas, bile from the gallblader and H+ from parietal cells in stomach
PYY (peptide tyrosine tyrosine)	•Ileum •colon	Satiety (anorexigenic)

Regulation of Food Intake
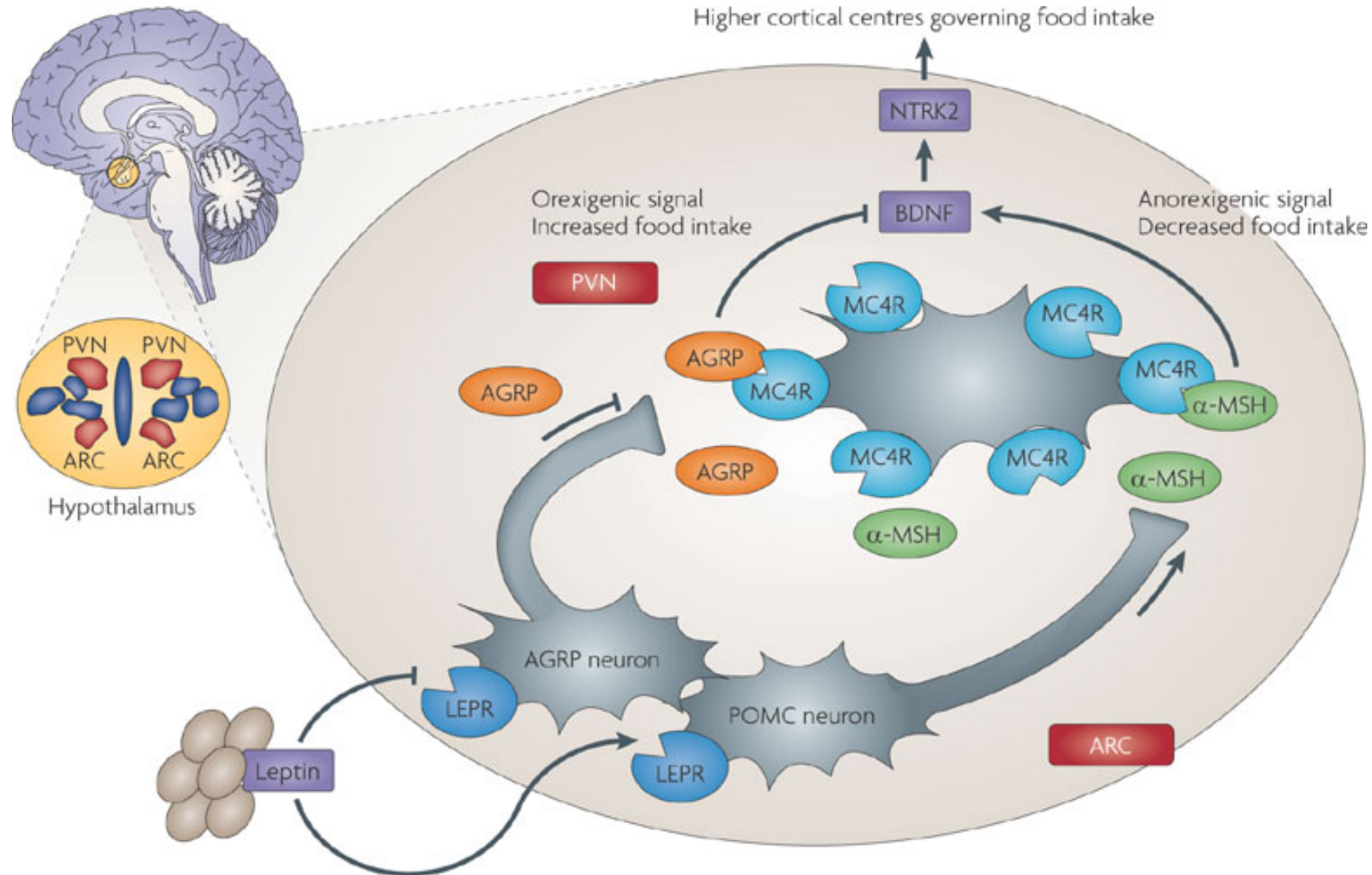
BDNF Regulation and Obesity
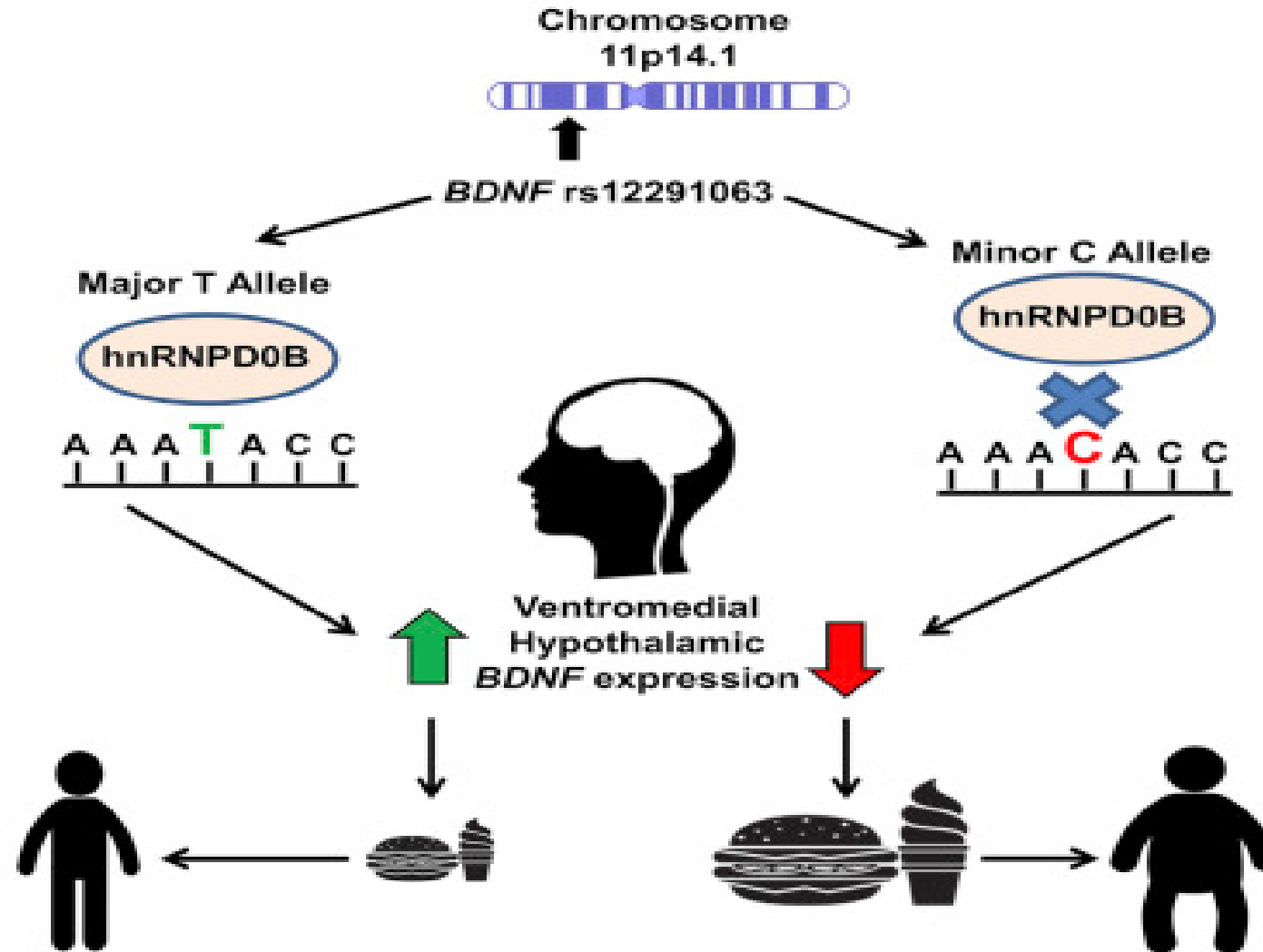
Development- Fetal Programming
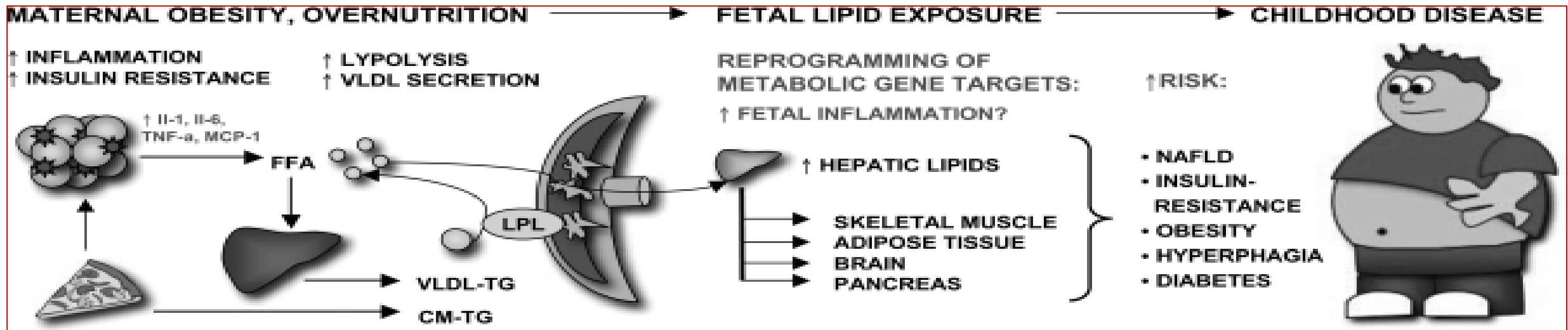
Anthropometric and Plasma Profile of Children Born BMS vs. AMS

	BMS (n=54)	AMS (n=57)	P-value
Male/Female	26/28	24/33	NS
Birth weight (kg)	3.3± 0.1	2.9 ± 0.1	0.003
Macrosomia	8 (14.8%)	1 (1.8%)	0.03
Age	16.6 ± 0.6 (6.8-25.5)	10.7 ± 0.5 (2.4-20.8)	<0.0001
BMI %	79.4 ± 3.4	68.4± 4.0	0.04
Weight (kg)	74.5 ± 4.5	46.5 ± 3.5	<0.0001
Body Fat %	29.7 ± 2.3	24.1 ± 2.1	0.08
Insulin (μU/ml)	21.1 ± 1.8	15.1 ± 1.5	0.01
Glucose (mmol/L)	5.08 ± 0.06	4.86 ± 0.05	0.008

Children Born AMS vs. BMS

▶ 3-fold⬇ prevalence of severe obesity (11 *vs.* 35%, *P* = 0.004)

▶⬆insulin sensitivity (homeostasis model assessment of insulin resistance index 3.4 ± 0.3 vs. 4.8 ± 0.5, *P* = 0.02)

▶ Improved lipid profile

  ▶ cholesterol/HDL cholesterol 2.96 ± 0.11 *vs* 3.40 ± 0.18, *P* = 0.03

  ▶ HDL cholesterol 1.50 ± 0.05 *vs.* 1.35 ± 0.05 mmol/liter, *P* = 0.04)

▶⬇CRP(0.88 ± 0.17 *vs.* 2.00 ± 0.34 µg/ml, *P* = 0.004)

▶⬇Leptin (11.5 ± 1.5 vs.19.7 ± 2.5 ng/ml, *P* = 0.005)

▶⬆ghrelin (1.28 ± 0.06vs.1.03 ± 0.06 ng/ml, *P* = 0.005)

Central Nervous System regulates weight

POTENTIAL* CONTRIBUTORS TO OBESITY
2015

Inside the Person

Outside the Person

Contributors to Energy Storage

Increased Intake
Intake & Expenditure (Or Unknown)
Decreased Expenditure

Inside the Person:

Disordered Eating (night eating syndrome, binge eating, "food addiction")
Hyper-reactivity to Environmental Food Cues
Delayed Satiety
Heightened Hunger Response
Emotional Coping

Age Related Changes (i.e. menopause, mobility decline, hormones)
Chronic Inflammation (i.e. altered insulin signaling and glucose homeostasis)
Pathological Sources of Endocrine Dysregulation (i.e. thyroid dysfunction, PCOS, Cushing's Syndrome)
Genetic & Epigenetic Factors
Central & Peripheral Regulators of Appetite & Adipose Tissue
Gestational Diabetes

Self-regulatory & Coping Deficits
Mood Disturbance (i.e. depression, anxiety, bipolar etc.)
Trauma History
Mental Disabilities

Thermogenesis
Physical Disabilities (i.e. functional impairments and regulatory dysfunction)
Social Anxiety (i.e. exercise avoidance)
Gut Microbiota
Pain Sensitivity

Outside the Person:

Environmental/ Chemical Toxins
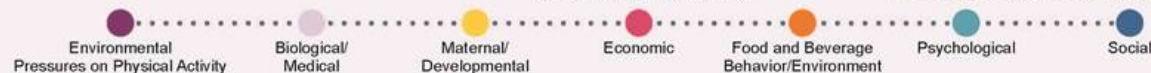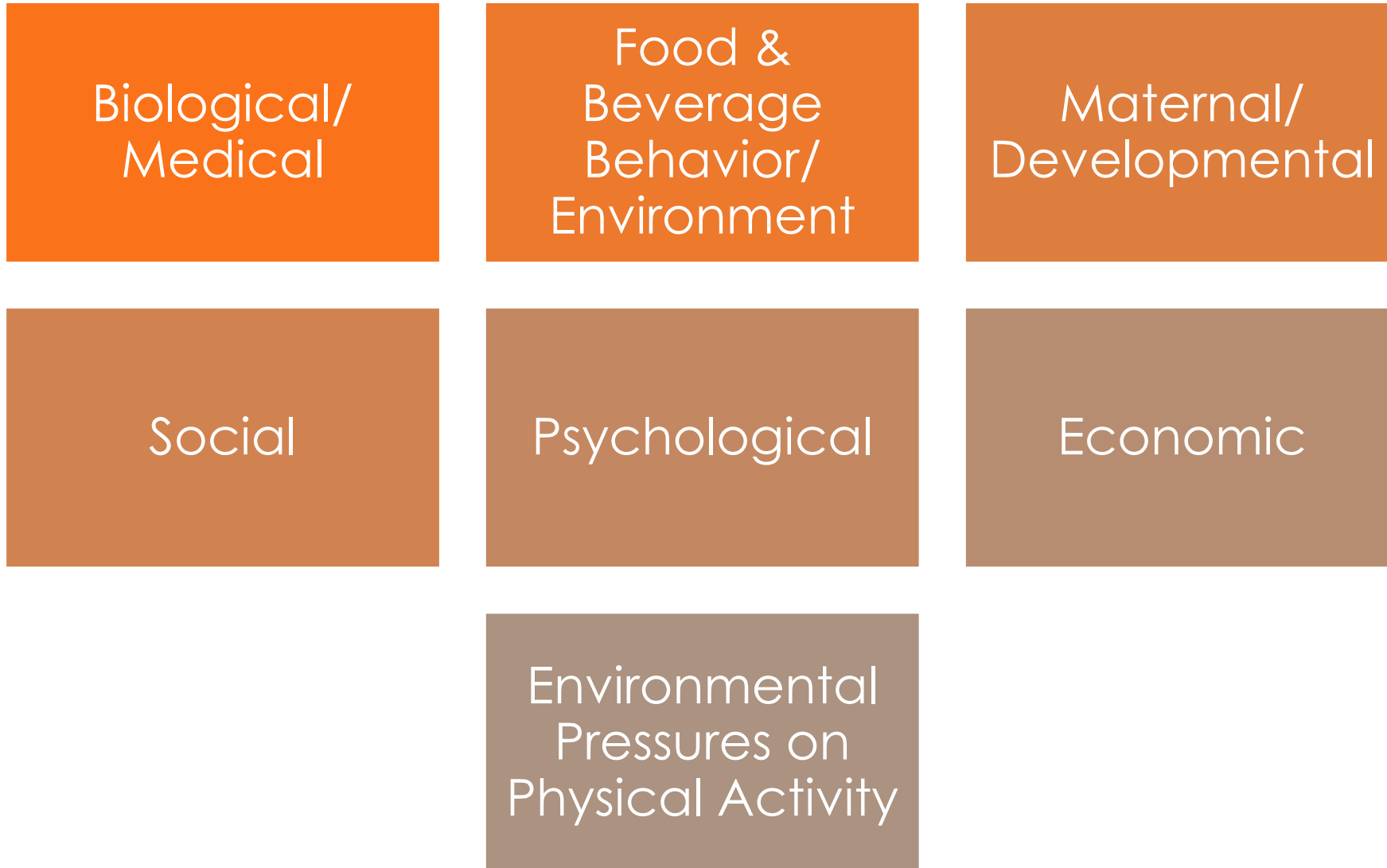Increased Availability of Energy Dense, Nutrient Poor Foods & Beverages
Lack of Nutritional Education
Diet Patterns
Larger Portion Sizes
Eating Away From Home
Skipping Meals
Lack of Family Meals
Eating as Recreation, Snacking, Special Occasions
Food Insecurity
Market Economy
Food Surplus
Pervasive Food Advertising

Maternal Employment
Breast Feeding and/ or Related Factors
Maternal Stress
Maternal Smoking
Maternal Obesity
Delayed Prenatal Care
Birth Order (first-born in family)
Having Children (for women)
Non-parental Childcare
Maternal Over-nutrition During Pregnancy
Birth by C-section
Infection (i.e. human adenovirus 36)
Weight Gain Inducing Drugs
Smoking Cessation
Sleep Deficits

Family Conflict
Weight Bias & Stigma (i.e. avoidance of medical care, self esteem, teasing history)
Social Networks
Entering Into a Romantic Relationship
Lack of Employer Preparedness to Assist with Obesity
Lack of Health Care Provider Support/Knowledge & Inadequate Access to Care
Stress
Child Maltreatment
Westernization & Economic Development
Low SES & Nutrition Support
Living in Crime-prone Areas
Weight Cycling (yo-yo dieting)

Consistent Temperature (i.e. air conditioning/heating, thermoregulation)
Decreased Opportunity for Non-exercised Based Physical Activity (i.e. driving vs. walking to work and school, sedentary jobs)
Increased Sedentary Time (i.e. inactive leisure "screen" time, inactive job requirements)
Labor Saving Devices
Built Environment (i.e. stairwell design/access, building design, absence of or poor sidewalks)
Pre-natal Air Pollution

MGH 1811
OBESITY SOCIETY
Research. Education. Action.
www.obesity.org

Contributor/Influencer

Environmental Pressures on Physical Activity
Biological/ Medical
Maternal/ Developmental
Economic
Food and Beverage Behavior/Environment
Psychological
Social

* Potential contributors indicate anything that has been put forth in the research literature as a question of investigation and is not intended to be a verification of whether or not; or the extent to which, each may or may not contribute.

Contributors/ Influencers to Obesity

Biological/ Medical	Food & Beverage Behavior/ Environment	Maternal/ Developmental
Social	Psychological	Economic
	Environmental Pressures on Physical Activity	

Contributors to Obesity- **Inside** the Person

↑Intake

- Hyper-reactivity to Environmental Food Cues
- Delayed Satiety
- Disordered Eating

↓Expenditure

- Gut Microbiota
- Thermogenesis
- Physical Disabilities

↑ Intake/ ↓Expenditure

- Genetic and Epigenetic Factors
- Age Related Changes
- Mood Disturbances

Contributors to Obesity- **Outside** the Person

↑Intake

- Environmental/ Chemical Toxins
- Pervasive Food advertising
- Large Portion Sizes

↓Expenditure

- Built Environment
- Sedentary Time
- Labor Saving Devices

↑ Intake/ ↓Expenditure

- Stress
- Weight Cycling
- Maternal/Paternal Obesity

Toddler's Bias and Maternal Anti-fat Prejudice

- Mother-child dyads (N=70)

- Older infants (M=11months) had a bias for looking at the figures with obesity

- Older toddlers (M=32 months) instead preferred looking at the average-sized figures

- Older toddlers' preferential looking was correlated significantly with maternal anti-fat attitudes

Weight Teasing in Adolescence and Weight Related Outcomes in Adulthood

Weight-based teasing in adolescence predicted higher BMI and obesity 15 years later

- BMI
- Binge Eating
- Dieting
- Unhealthy Weight Control
- Body Image

Peer Based and Family Based Teasing

Peer Based Teasing
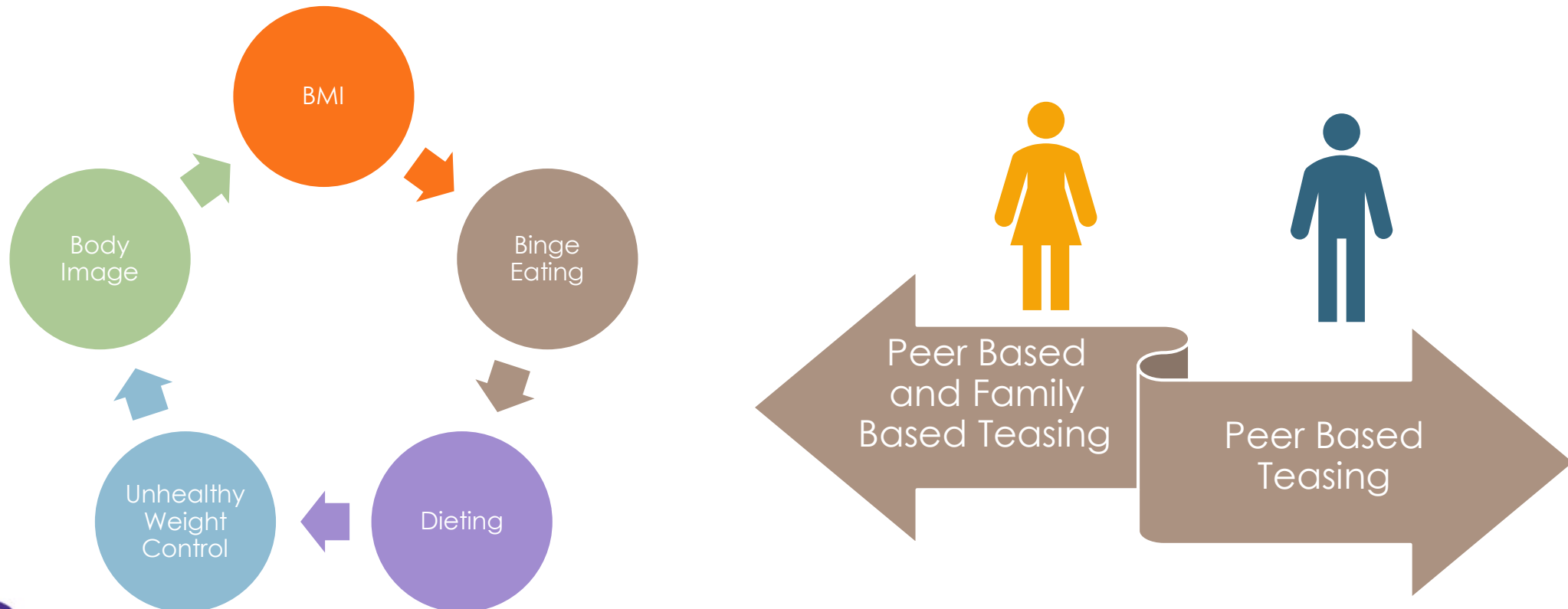
Prev Med. 2017 Jul;100:173-179.

Overcoming Weight Stigma in the Treatment of Obesity
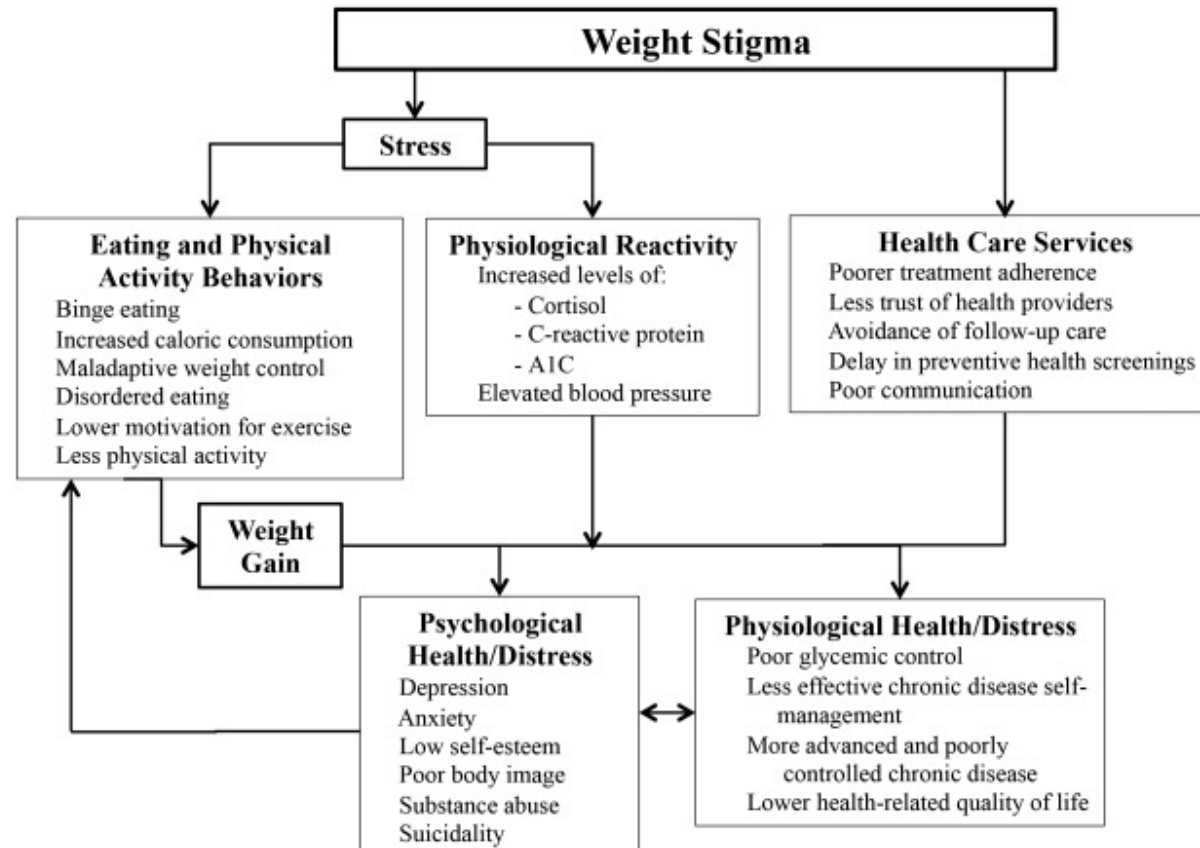
Guidelines for Selecting Obesity Treatment

BMI Category

Treatment	25-26.9	27-29.9	30-34.9	35-39.9	≥40
Diet, PA, & Behavioral Therapy	With co-morbidities	With co-morbidities	+	+	+
Pharmacotherapy		With co-morbidities	+	+	+
Weight Loss Surgery			With co-morbidities		

- Prevention of weight gain with lifestyle therapy is indicated in any patient with a BMI ≥ 25 kg/m2, even without co-morbidities, while weight loss is not necessarily recommended for those with a BMI of 25–29.9 kg/m2 or a high waist circumference, unless they have two or more co-morbidities.

- Consider pharmacotherapy only if a patient has not lost 1 pound per week after 6 months of combined lifestyle therapy.

The **+** represents the use of indicated treatment regardless of co-morbidities.

Common Weight Promoting Medications

- **Anti-psychotics**
  - Risperidone
  - Lithium
  - Quetiapine
  - Aripiprazole
  - Olanzapine
  - Valproic Acid
- **Anti-depressants**
  - Citalopram
  - Duloxetine
  - Venlafaxine

- **Sleep Agents**
  - Zolpidem
  - Eszopiclone
  - Trazadone
  - Zaleplon
- **Neuropathic Agents**
  - Gabapentin
  - Pregablin
- **β-Blockers**
- **Steroids**
- **Insulin**
- **Hypoglycemic Agents**

Treatment Strategy for Weight Promoting Medications

- ▶ Investigate whether medications are a likely source of weight gain in patients.

- ▶ If a weight promoting drug may be discontinued, discontinue the agent.

- ▶ If discontinuation of a weight promoting medication is not feasible, consider the use of anti-obesity pharmacotherapy for weight loss in conjunction with appropriate lifestyle changes.

Anti-obesity pharmacotherapy agents

▶ Most agents may be characterized into **3 primary groups**

1) Centrally acting medications that impair dietary intake

2) Medications that act peripherally to impair dietary absorption

3) Medications that increase energy expenditure

FDA Approved Anti-obesity pharmacotherapy agents

Drug class/name
CNS Stimulants/ Anorexiants: Phentermine *Phentermine/topiramate Diethylpropion Phendimetrazine Benzphetamine
Anti-Depressants/ Dopamine Reuptake Inhibitors/ Opioid Antagaonists: *Bupropion/ Naltrexone
Gastrointestinal Agents/Other: *Orlistat *GLP-1 agonists (liraglutide)

Other Anti-obesity pharmacotherapy agents

Drug class/name
Topiramate
Zonisamide
Bupropion
Metformin
Amylin agonist (pramlinitide)
SGLT2 Inhibitors (canagliflozin, dapaglifozin)

Criteria for Weight Loss Surgery

▶ Body Mass Index (BMI) ≥40 OR

▶ BMI of 35-39.9 + 1 serious co-morbidity

   ▶ Type 2 Diabetes Mellitus

   ▶ Coronary Artery Disease

   ▶ Obstructive Sleep Apnea

▶ Prior Unsuccessful Weight Loss Attempts

▶ Acceptable operative risks

▶ Ability to participate in treatment and long term follow-up

▶ An understanding of the operation and the lifestyle changes needed to sustain long term weight loss

Most Common Weight Loss Surgeries in the US

Roux-en-Y Gastric Bypass
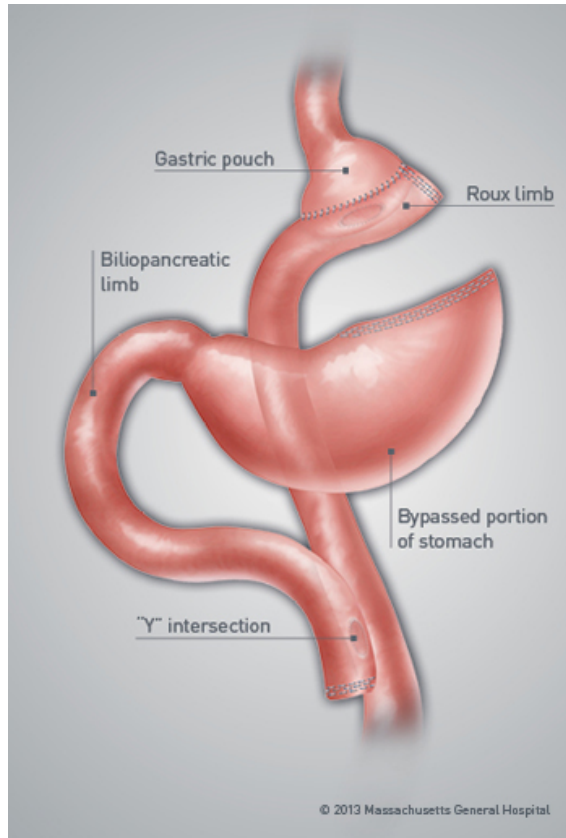
Vertical Sleeve Gastrectomy
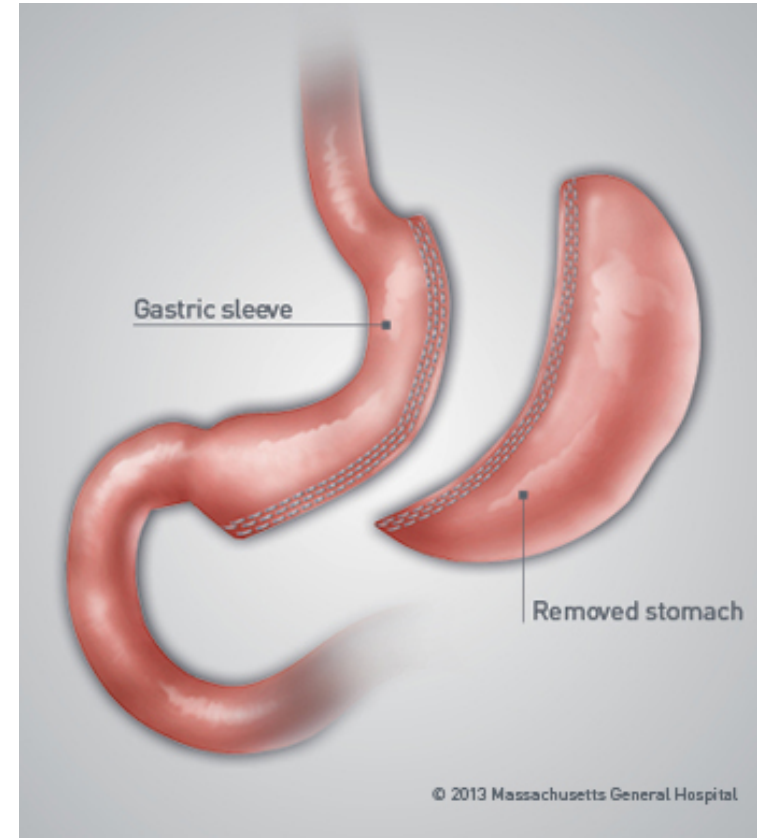
Case #1

▶ 54-year-old woman

▶ Past medical history:

    ▶ Untreated hypertension

    ▶ Migraine headaches

    ▶ GERD

    ▶ Irritable Bowel Syndrome

    ▶ Metabolic syndrome

▶ Retained 20 lbs with each of her 2 pregnancies

▶ Tried many commercial programs which lead to 20 lbs of unsustainable weight loss with each attempt

▶ Most significant weight loss with the use of phen-fen in the 1990's (~50 lbs over 6 months)

▶ Interested in weight loss medications + behavioral Tx

54-year-old woman
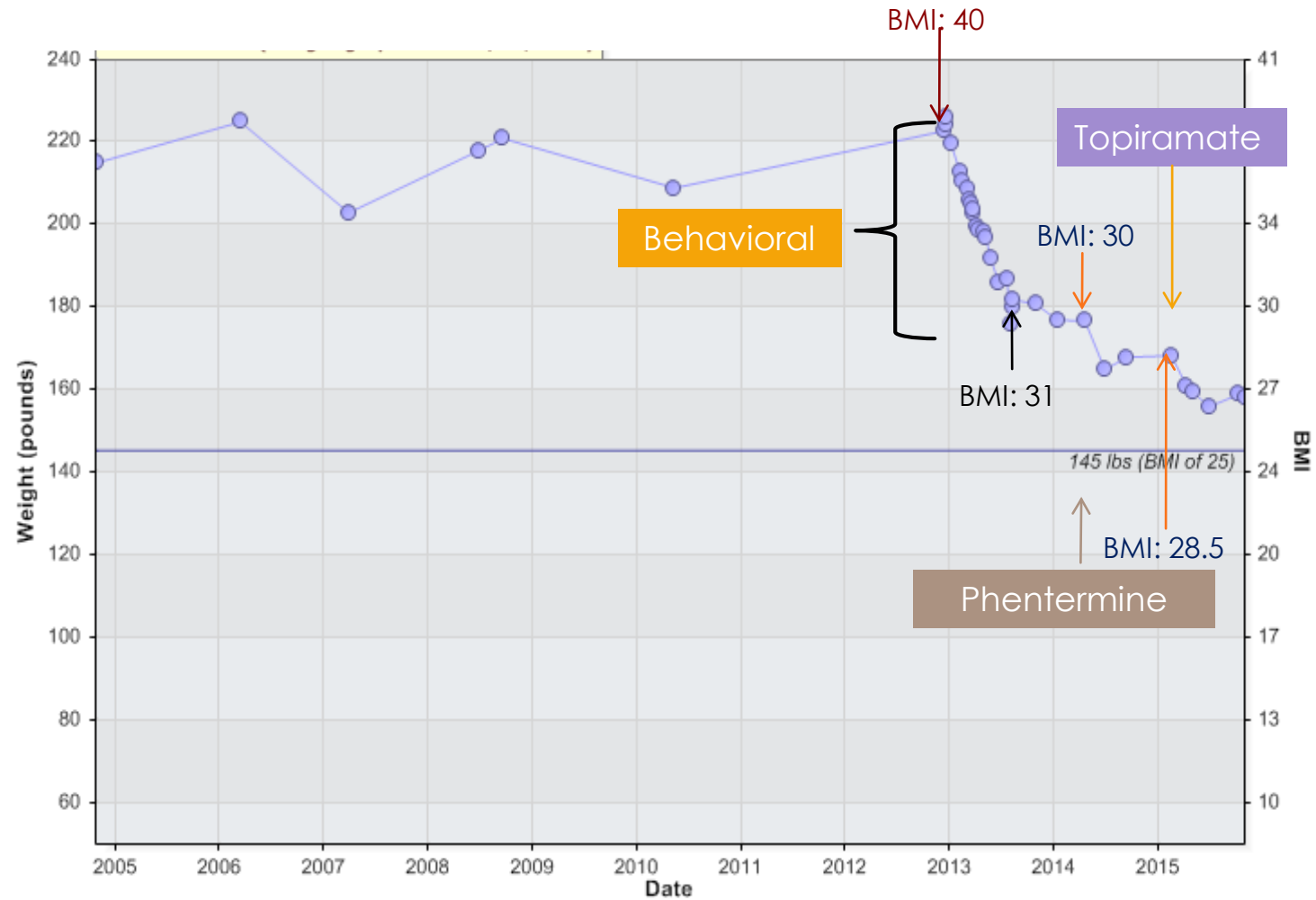
Case #2

- 57-year-old woman
- Past medical history:
  - Dyslipidemia
  - Breast Cancer
  - Hypertension
  - Depression
  - Pernicious Anemia
- Diet:
  - Breakfast: Brown Rice, Cashews, Goat Cheese
  - Snack: Denies
  - Lunch: Fish; may be on a sandwich with vegetables
  - Snack: Cheese and Crackers, Cashew nuts, Protein Bars
  - Dinner: Salad (Spinach) with cucumbers, tomatoes, goat cheese, peppers, vinaigrette
  - Snack: Cheese and Crackers, Cashew nuts, Protein Bars
- Activity: Exercise class (cardio interval circuit- 3 times per week, 1 hour); 2 videos 1/2 hour (low impact cardio); Yoga at night
- Sleep: 8 hours per night of restful sleep

57-year-old woman
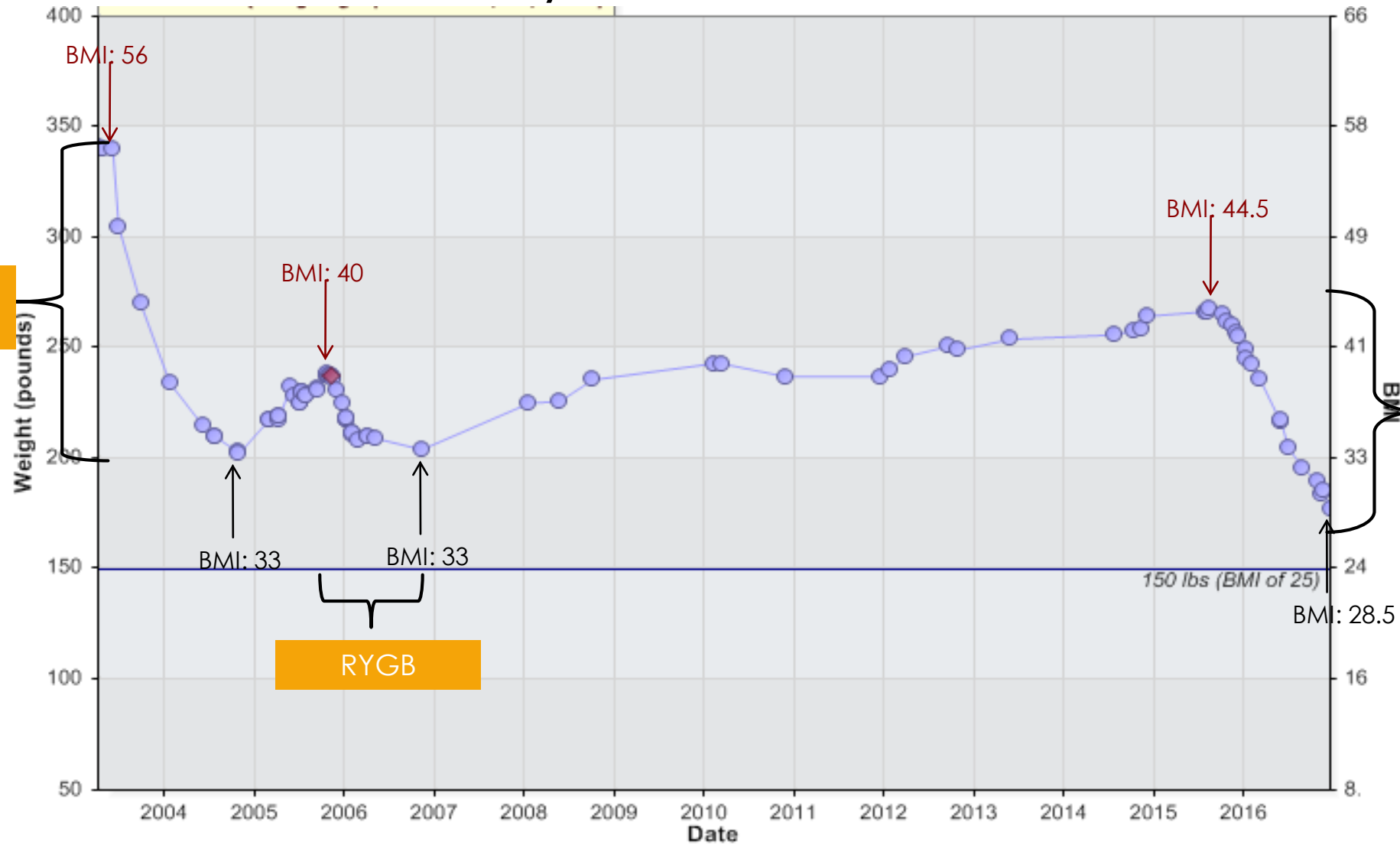
Case #3

- 46-year-old woman
- Past medical history:
  - Hypertension
  - Anxiety/ Depression
  - Asthma
  - Fibromyalgia
  - Bipolar disorder
  - Gastroesophageal reflux disease
  - Metabolic syndrome X
- History of being on several weight promoting: Ziprasidone, Quetiapine, Duloxetine, Citalopram, Fluoxetine, Zolpidem, Trazodone, Atenolol, Pregablin, and Nortriptyline
- Postpartum weight retention of 20 pounds
- Poor sleep- daytime hypersomnolence, snoring, morning headache

46-year-old woman
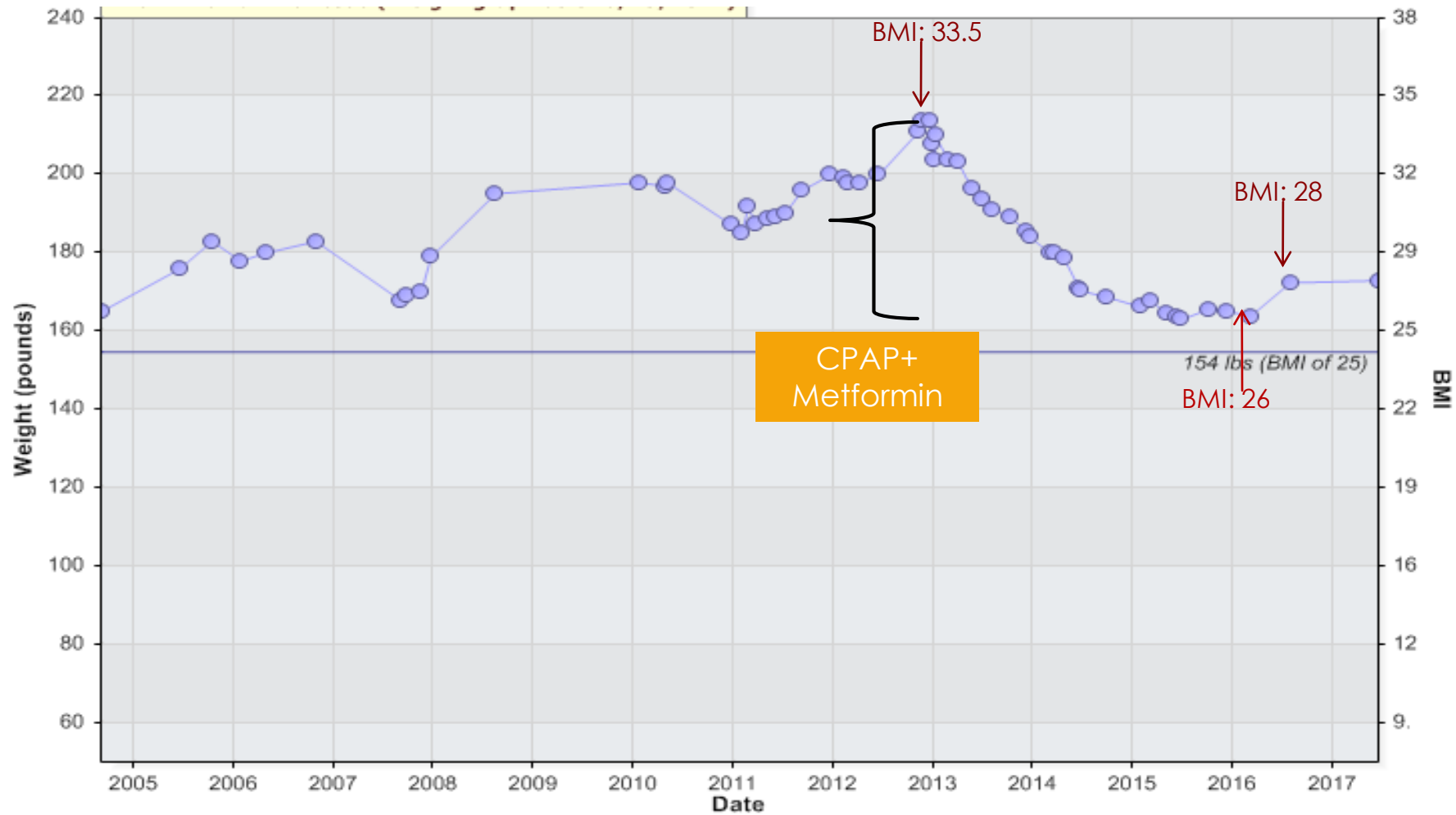
Ann Pharmacother. 2010 Apr;44(4):668-79
Am J Psychiatry. 2013 Sep;170(9):947-52.

Case #4

- 64-year-old man
- Past medical history:
  - Type 2 Diabetes Mellitus
  - Male hypogonadism
  - Vitamin D deficiency
  - Obstructive sleep apnea on CPAP
  - Dyslipidemia
  - Hypertensive disorder
  - Steatosis of liver
- Hunger: Normal to high on topiramate; liraglutide
- Satiety: Fills Quickly
- Physical Activity: Peloton- 3-4 times per week (45 minutes)
- Sleep: 7 hours on CPAP
- Stress: Normal

64-year-old man

At this time, he has lost 92.2% of his excess body weight and 22.4% of his total body weight
**(NADIR post op: Lost 81.5% of his excess body weight and 20.4% of his total body weight)**
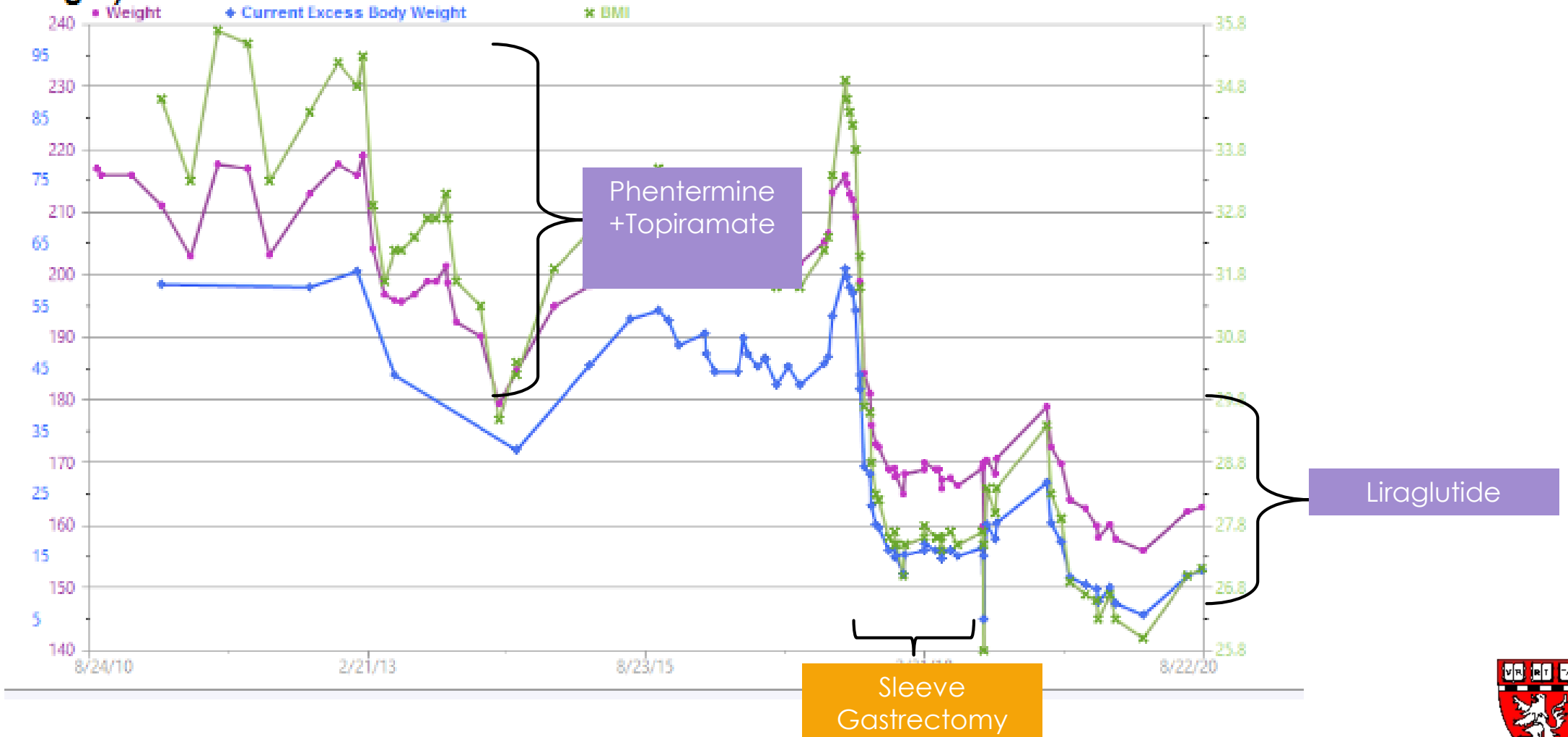
Case #5

- 36-year-old woman
- Past medical history:
  - Hypothyroidism
  - Dysthymia
  - Allergic Rhinitis
  - Chronic Back Pain
  - Migraine Headaches
- Diet:
  - Breakfast: Oatmeal and Egg Whites
  - Lunch: Salad with Chicken
  - Snack: Fruit (Less Recently)
  - Dinner: Fruit, Chicken, Rice, Broccoli, Increase in Plant Based Protein
- Activity: Cardio at gym- 5 days per week (elliptical)-1 hour; Walks at lunch time (45 minutes); strength training with 3 times per week- 1 hour
- Sleep: 6-7 hours per night of restful sleep

36-year-old woman
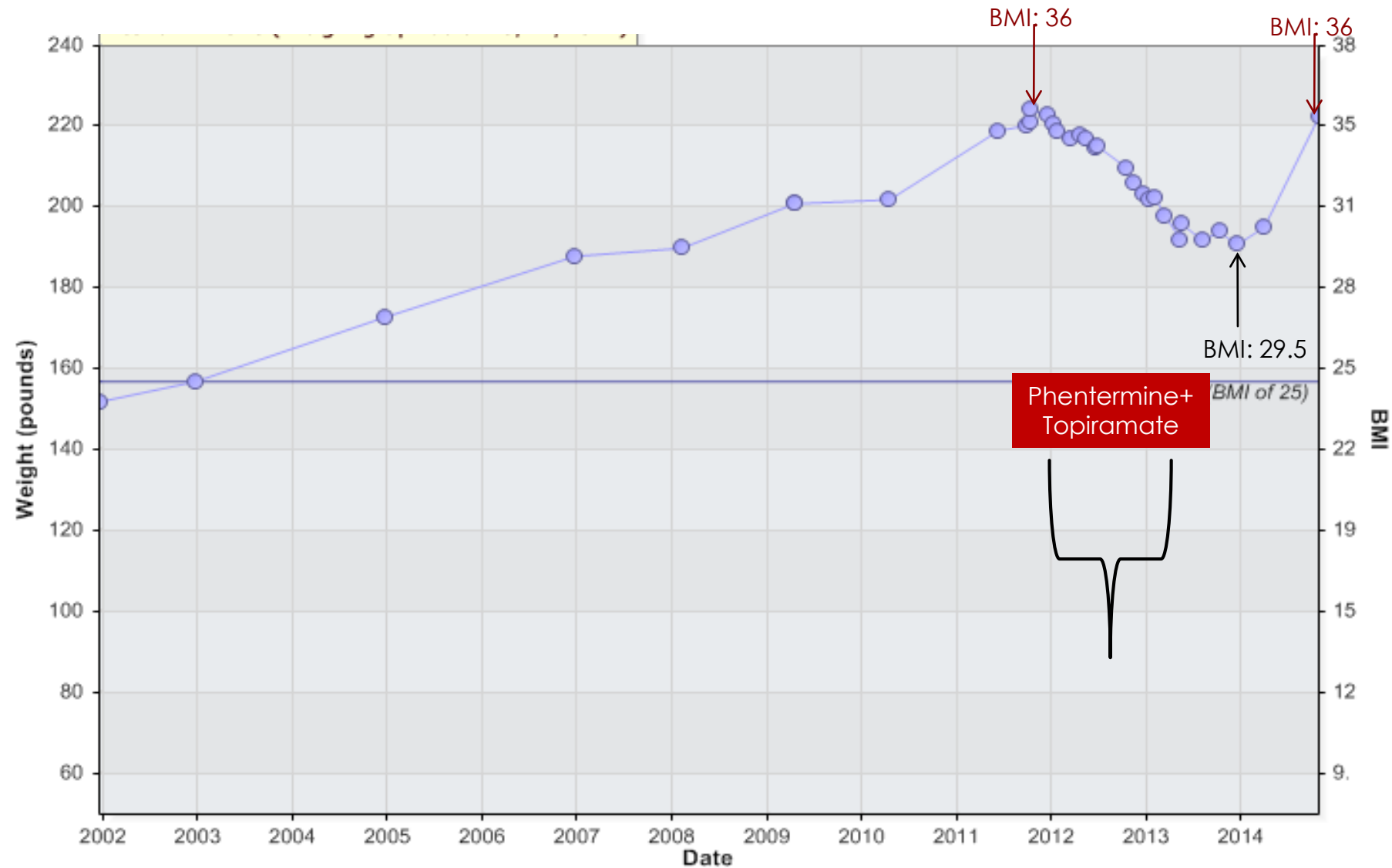
Summary

- ▶ Obesity is a multifactorial disorder that is syndemic
- ▶ Conventional weight loss consisting of diet and exercise should be 1st line
- ▶ Pharmacotherapy and/or bariatric surgery should be considered as an option for appropriate patients
- ▶ Weight bias is seen as early as infancy
- ▶ Maternal and Paternal anti-fat bias influences children
- ▶ Weight stigma has a negative impact on the health and psychological health of patients who struggle with obesity
- ▶ Obesity is a chronic disease which requires lifelong treatment

Thank You For Your Time

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