

# *IMPROVING WEIGHT LOSS MAINTENANCE: THE INTERNATIONAL WEIGHT CONTROL REGISTRY*

James O. Hill, PhD

Professor

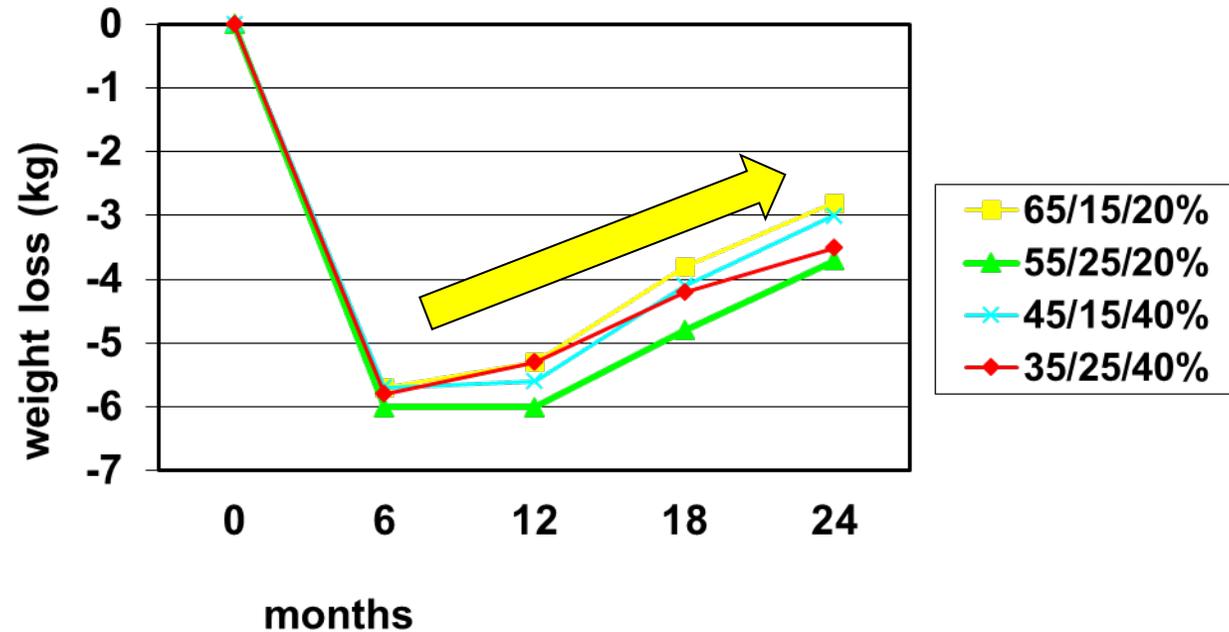
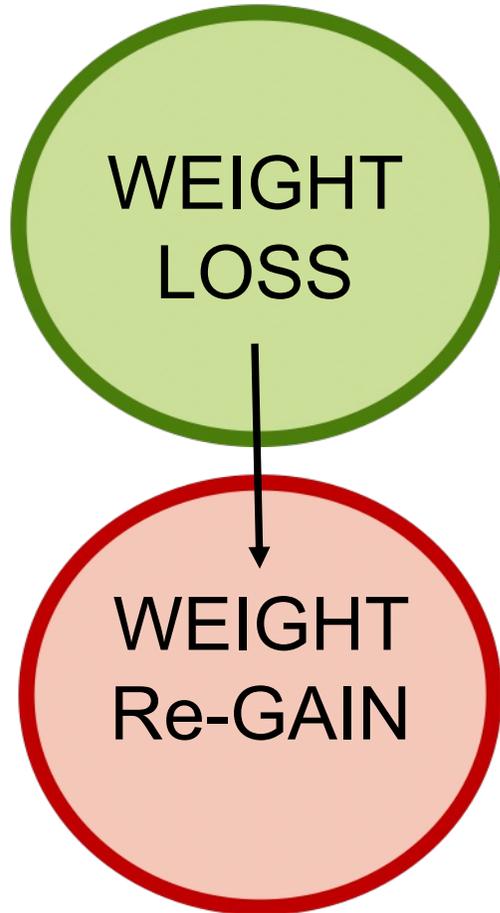
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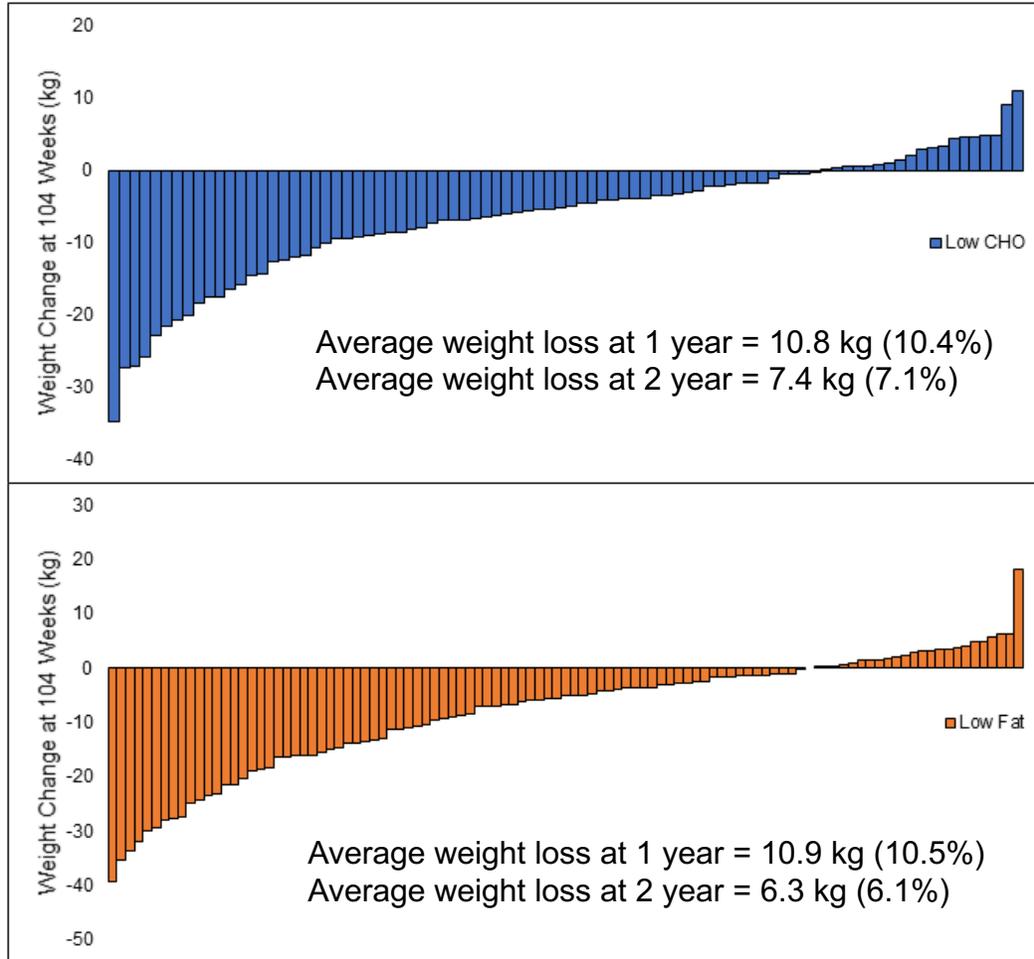
# THE PROBLEM

# COMPARISON OF WEIGHT LOSS DIETS WITH DIFFERENT COMPOSITIONS OF FAT, PROTEIN AND CARBOHYDRATES (N=811)



Sacks FS. et al. *NEJM* 2009;360(9) 859-873

# WHICH DIET WORKS BEST?



Sam Klein



Courtesy of Washington Univ website

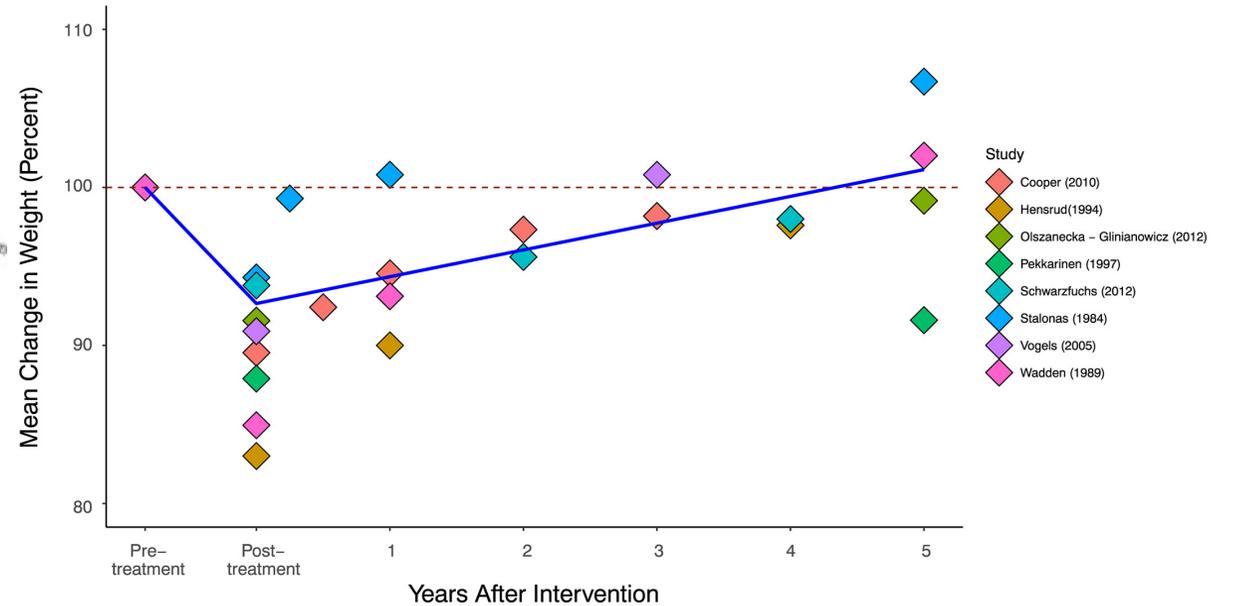
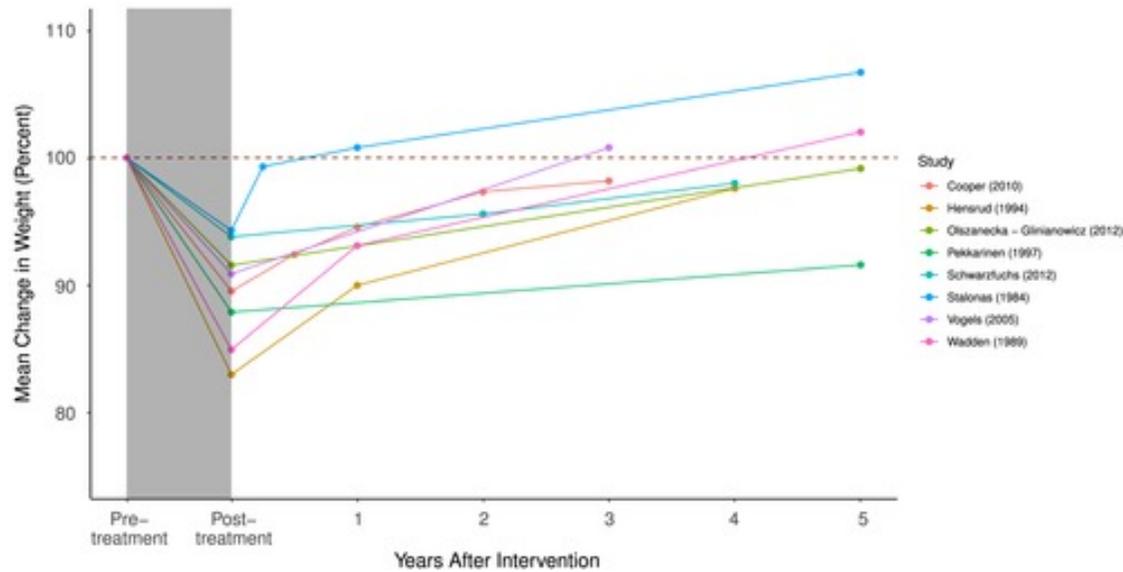
Gary Foster



Courtesy of WW website

Foster et al. Ann Intern Med. 2010.

# POOR LONG-TERM OUTCOMES



Nordmo, Danielsen, Nordmo Obesity Reviews 2019

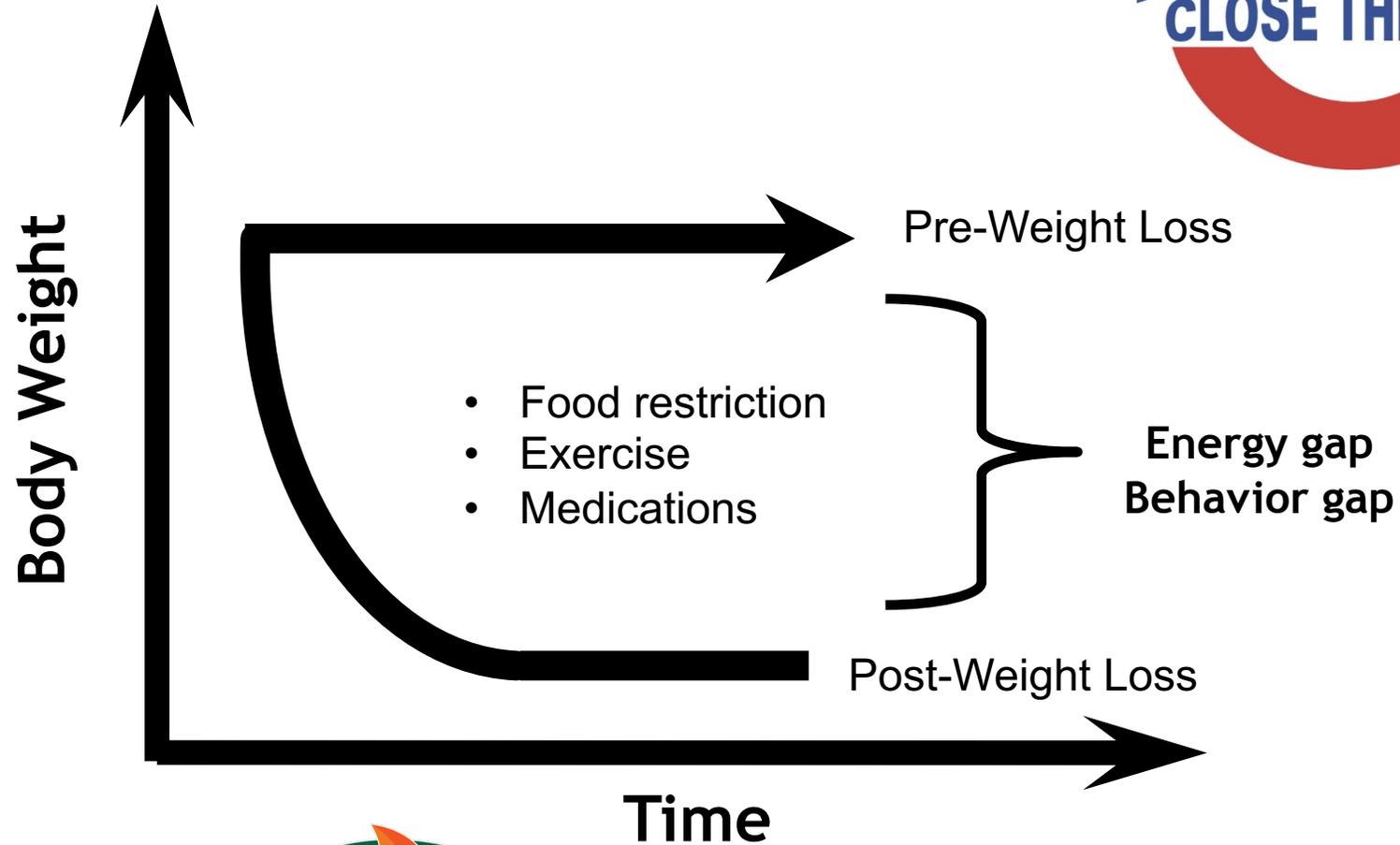
# WEIGHT LOSS AND WEIGHT LOSS MAINTENANCE ARE DIFFERENT PROCESSES

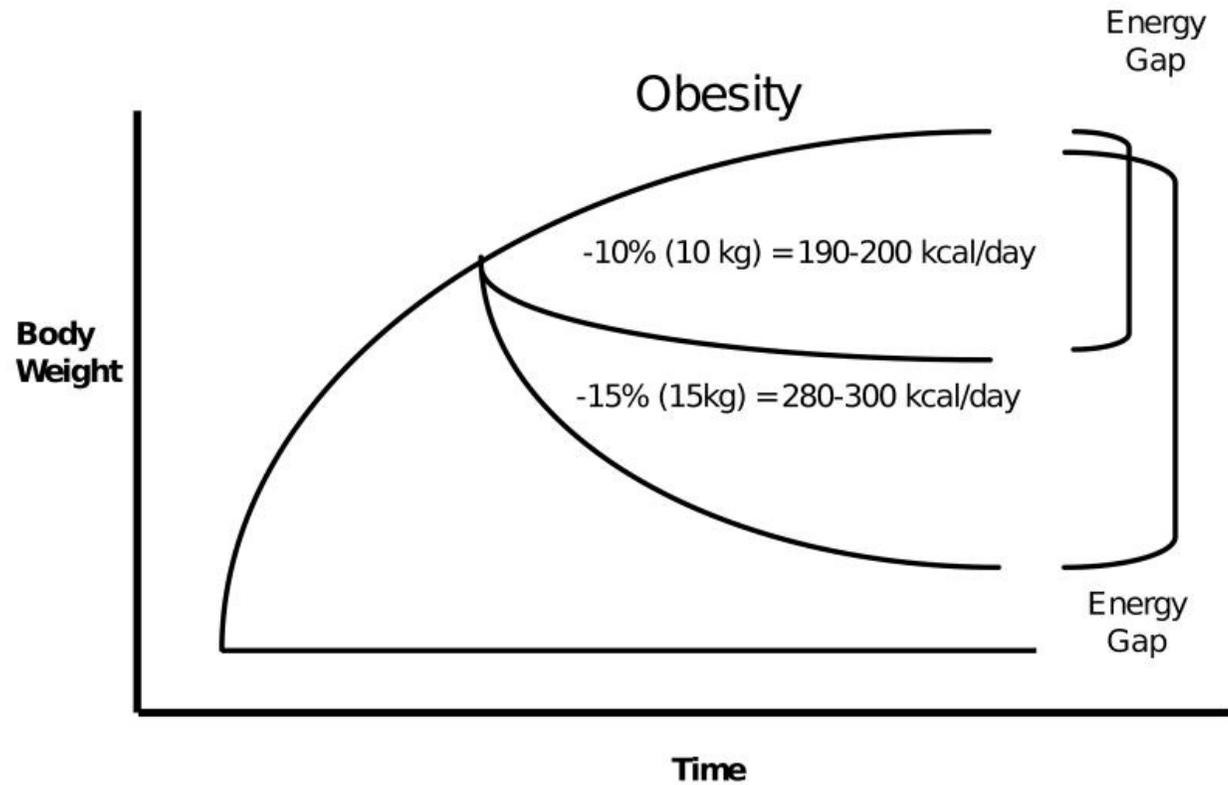
- Weight loss – acute; executive function; just produce negative energy balance
- Weight loss maintenance – chronic, more than executive function, exact achievement of energy balance
  
- We have lots of studies on weight loss, but few on weight loss maintenance

# WHY IS WEIGHT LOSS MAINTENANCE HARD?

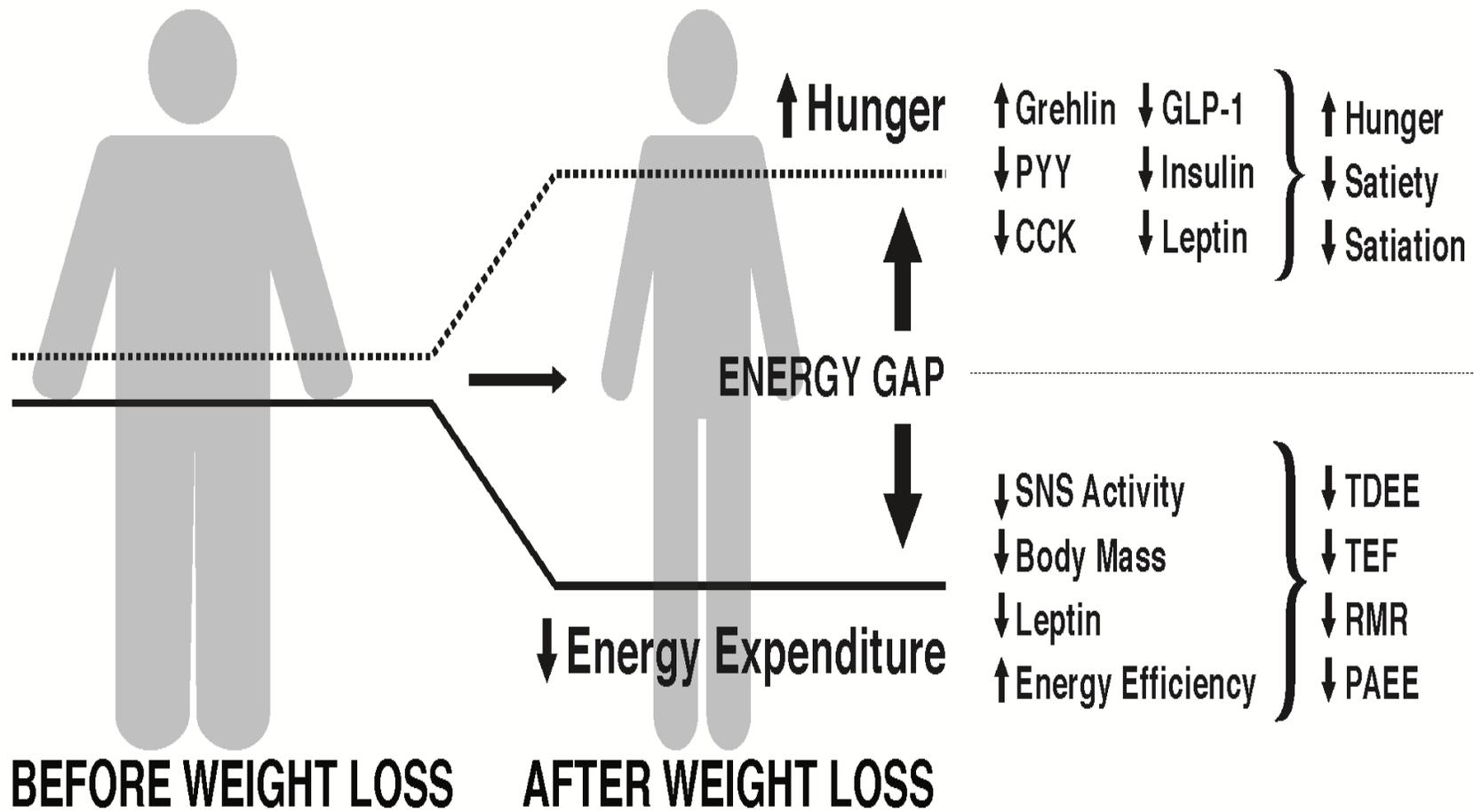
- Biological reasons
- Behavioral reasons
- Environmental reasons
- Other reasons?

# THE ENERGY GAP



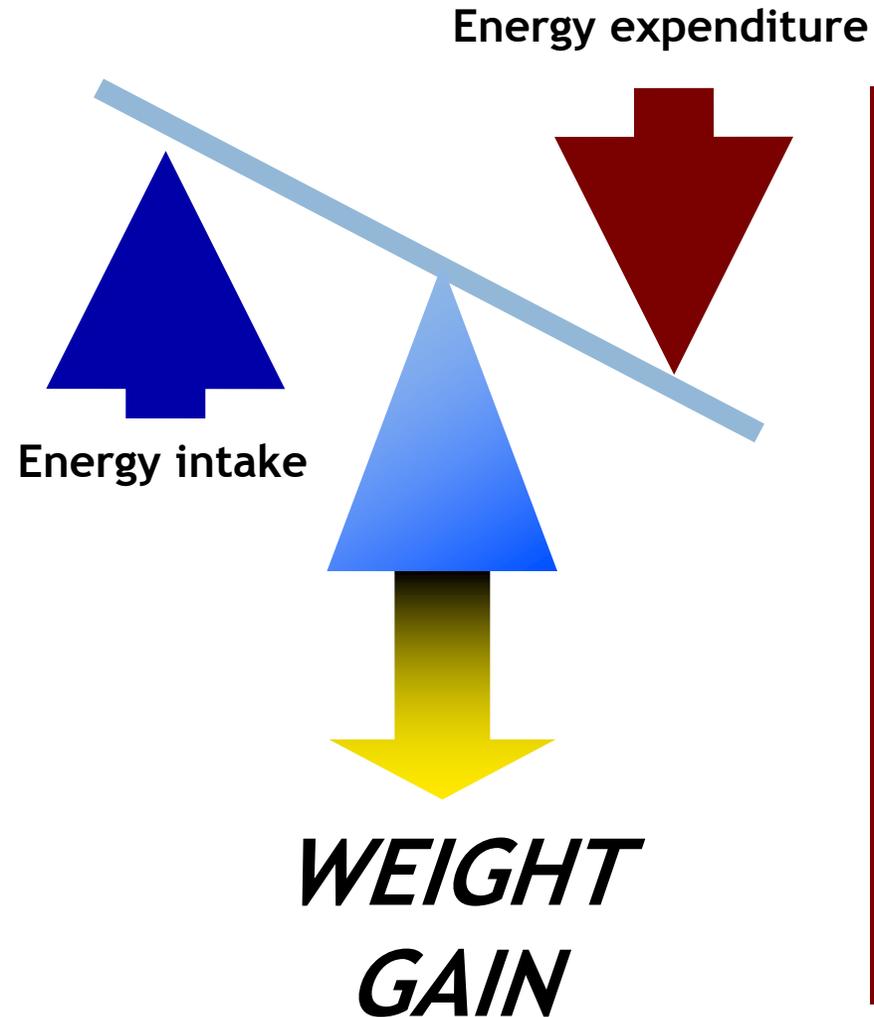


Example for 100 kg person



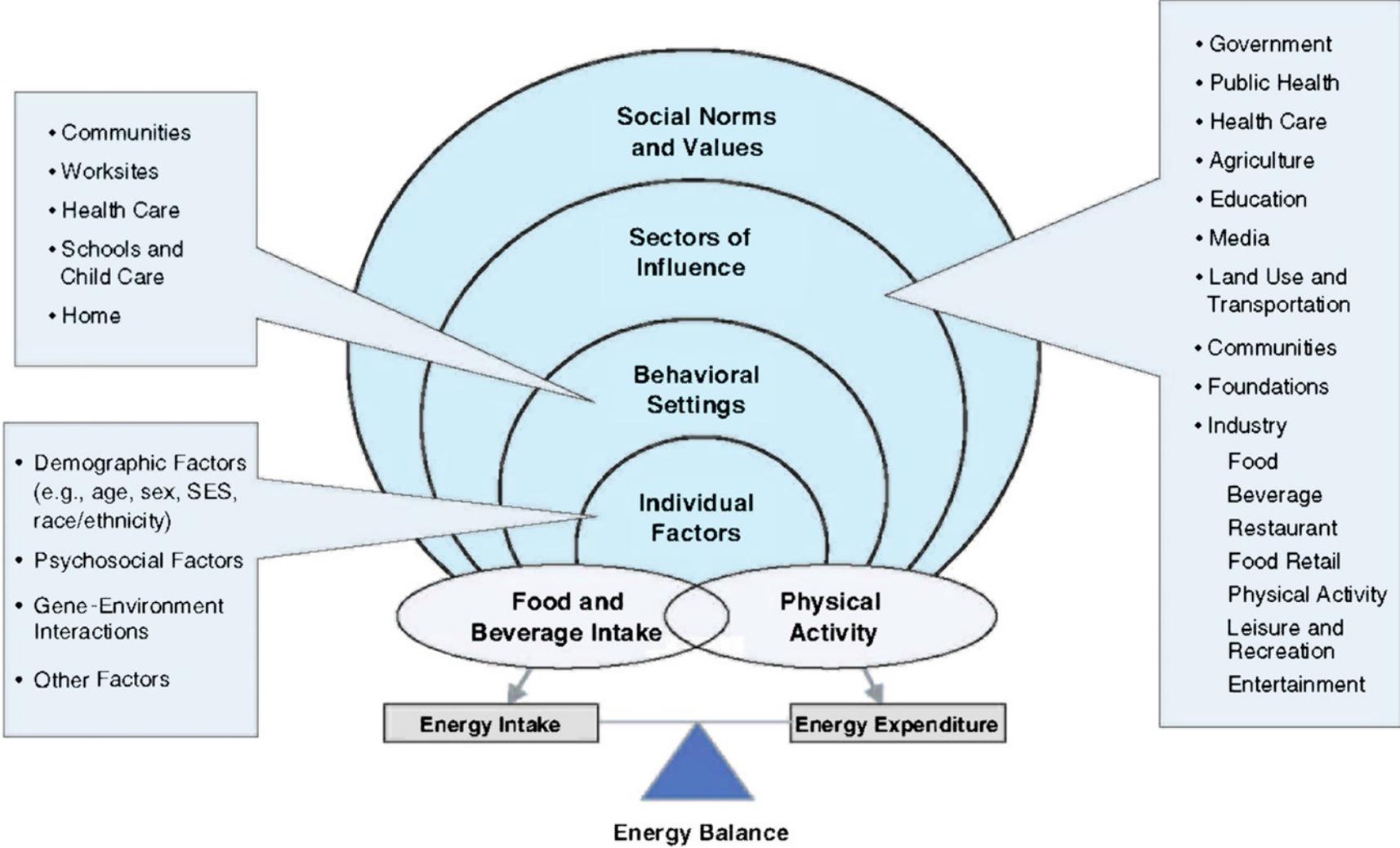
# MULTI-FACTORAL BEHAVIORAL CAUSES

- Portion size
- High energy density
- High glycemic index
- Soft drinks/"junk food
- In schools
- Added sugar
- Easy food access
- Low cost
- Variety
- Convenience
- Great taste
- Ads/marketing



- Sedentary workplaces
- Sedentary schools
- Activity "unfriendly" community design
- Automobiles
- Drive-through conveniences
- Elevators/escalators
- Remote controls
- Sedentary entertainment
- Labor saving devices
- Television/computer

# Socioecological Models



# THE ENERGY BALANCE SYSTEM

## Behavioral Factors

- Amount and composition of food intake
- Amount and type of physical activity
- Sleep

## Environmental Factors

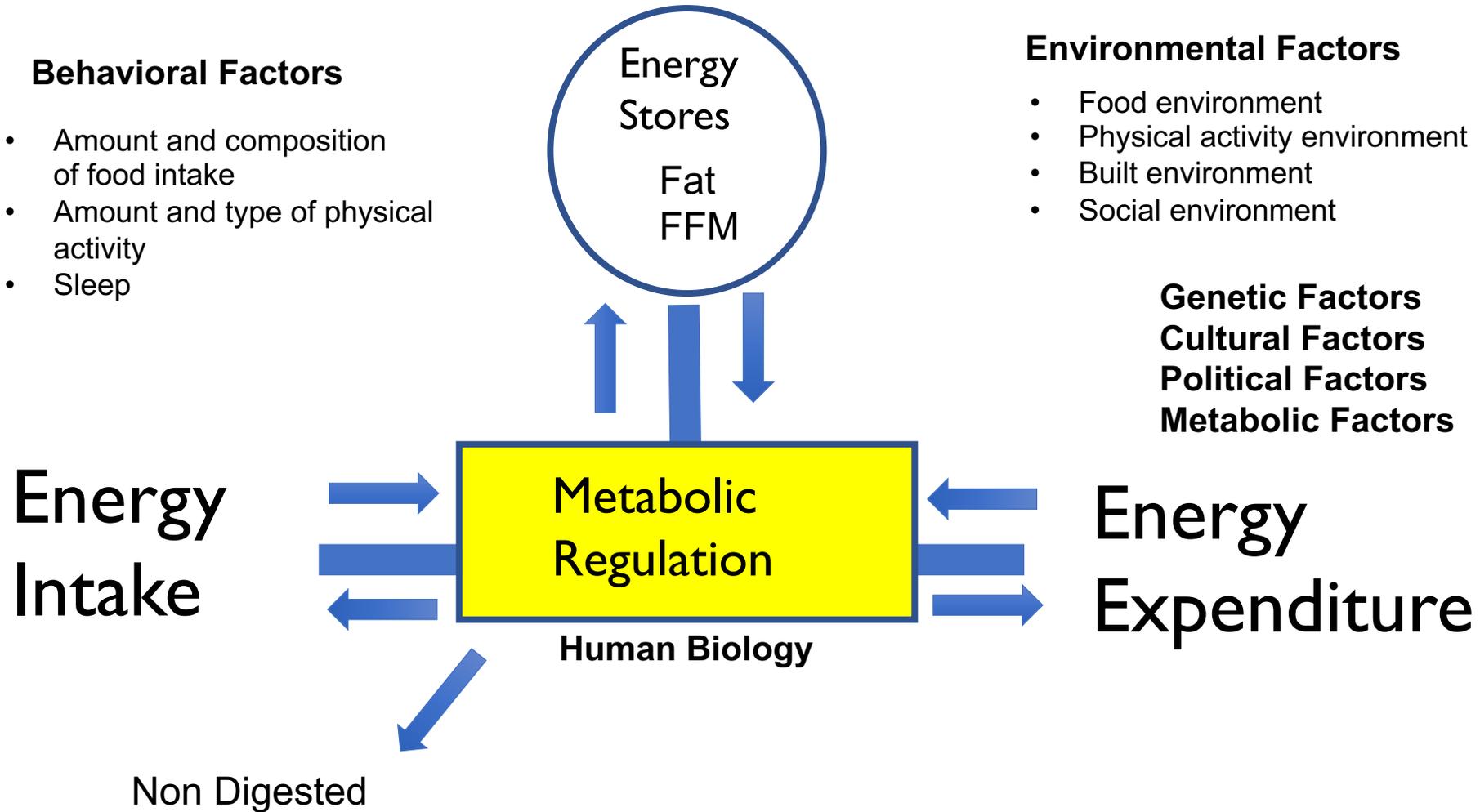
- Food environment
- Physical activity environment
- Built environment
- Social environment

## Genetic Factors

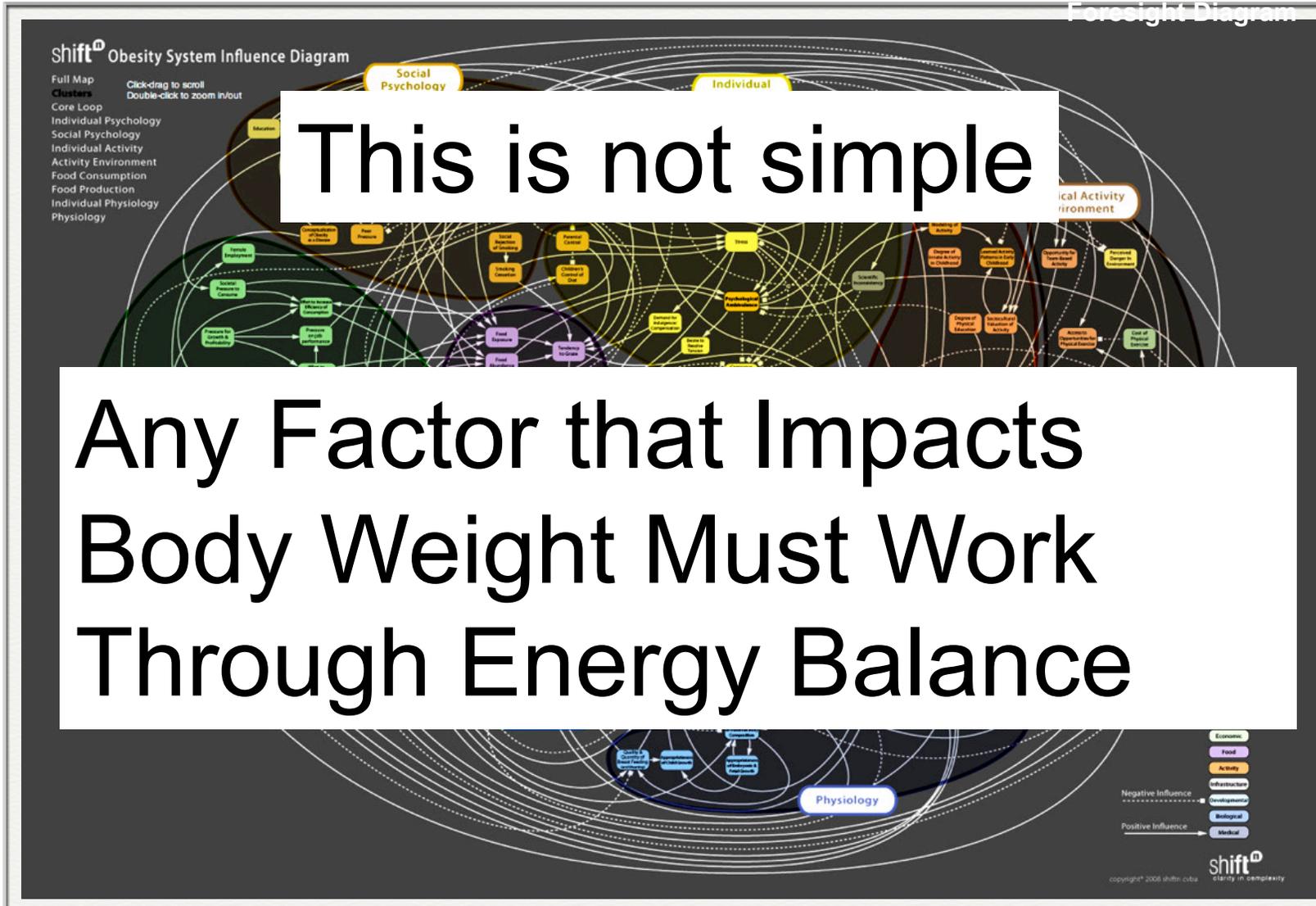
## Cultural Factors

## Political Factors

## Metabolic Factors



# THE ENVIRONMENT AND YOU: SYSTEMS



# THE NATIONAL WEIGHT CONTROL REGISTRY



**What can we learn from successful weight loss maintainers?**

# STATUS: MARCH 2020

- Mean (SD) weight loss at entry: 75.8 (40.0) lbs or 34.4 (18.1) kg
- Mean (SD) duration of weight loss at entry: 5.0 (6.5) years

# WHAT THEY DO: COMMONALITIES AMONG NWCR PARTICIPANTS IN WEIGHT MAINTENANCE

- Low fat diet, attention to calories
- High levels of physical activity
- Self-monitoring
- Behavioral consistency
- Dietary restraint
- Breakfast

## Effect of weight loss on other areas of life (n = 784)

<b>Area of life</b>	<b>Improved</b>	<b>No difference</b>	<b>Worsened</b>
	<b>%</b>	<b>%</b>	<b>%</b>
<b>Quality of life</b>	<b>95.3</b>	<b>4.3</b>	<b>0.4</b>
<b>Level of energy</b>	<b>92.4</b>	<b>6.7</b>	<b>0.9</b>
<b>Mobility</b>	<b>92.3</b>	<b>7.1</b>	<b>0.6</b>
<b>General mood</b>	<b>91.4</b>	<b>6.9</b>	<b>1.6</b>
<b>Self-confidence</b>	<b>90.9</b>	<b>9.0</b>	<b>0.1</b>
<b>Physical health</b>	<b>85.8</b>	<b>12.9</b>	<b>1.3</b>
<b>Interactions with</b>			
<b>Opposite sex</b>	<b>65.2</b>	<b>32.</b>	<b>0.9</b>
<b>Same sex</b>	<b>50.2</b>	<b>46.8</b>	<b>0.4</b>

# SUMMARY FROM NWCR

- Weight loss is different from weight loss maintenance
- Many diets work for weight loss; maintenance is hard
- Successful losers have some behaviors in common
- Success is associated with improved health and happiness

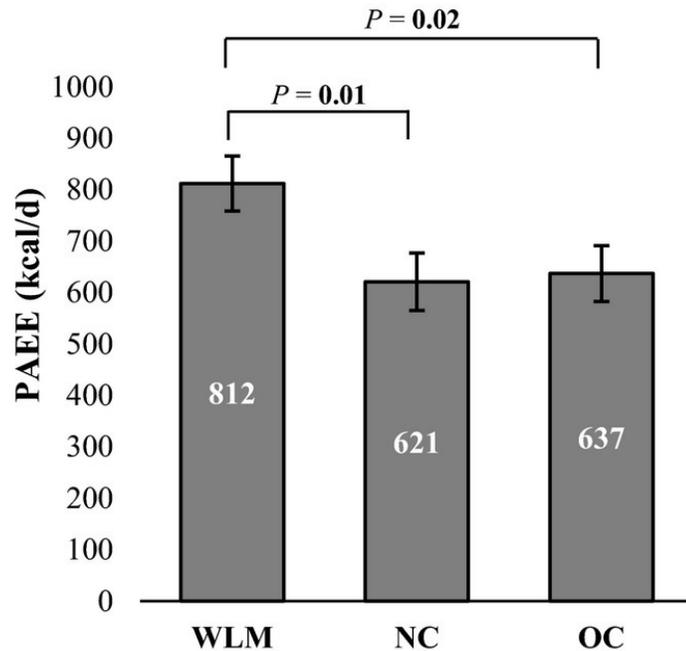
# DO SUCCESSFUL WEIGHT LOSS MAINTAINERS EXERCISE MORE?

## National Weight Control Registry (Hill & Wing)

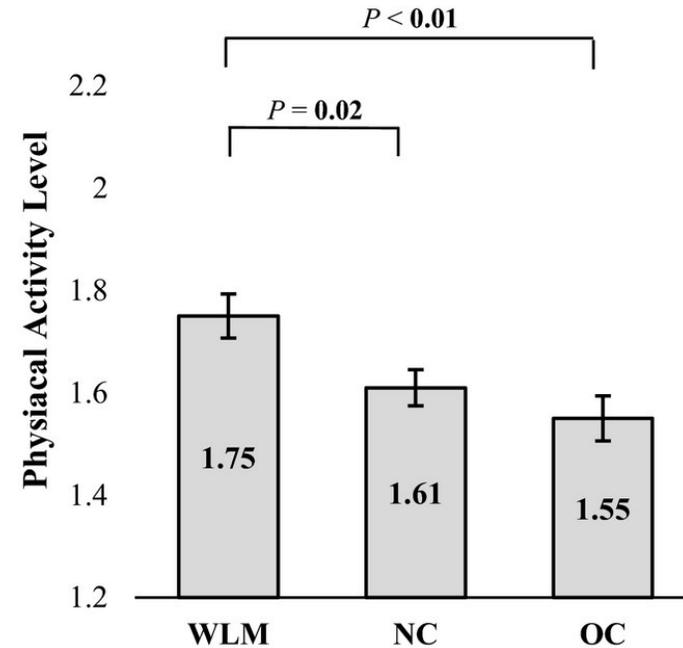
- Most (93%) exercise regularly
- Average is about 60 min/day
- Decrease in exercise associated weight regain

# DO SUCCESSFUL WEIGHT LOSS MAINTAINERS EXERCISE MORE?

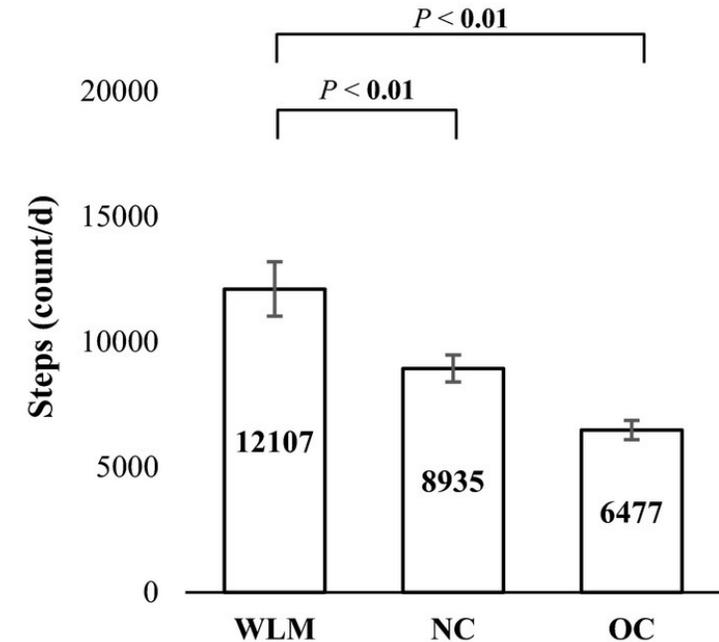
A. PAEE



B. PAL

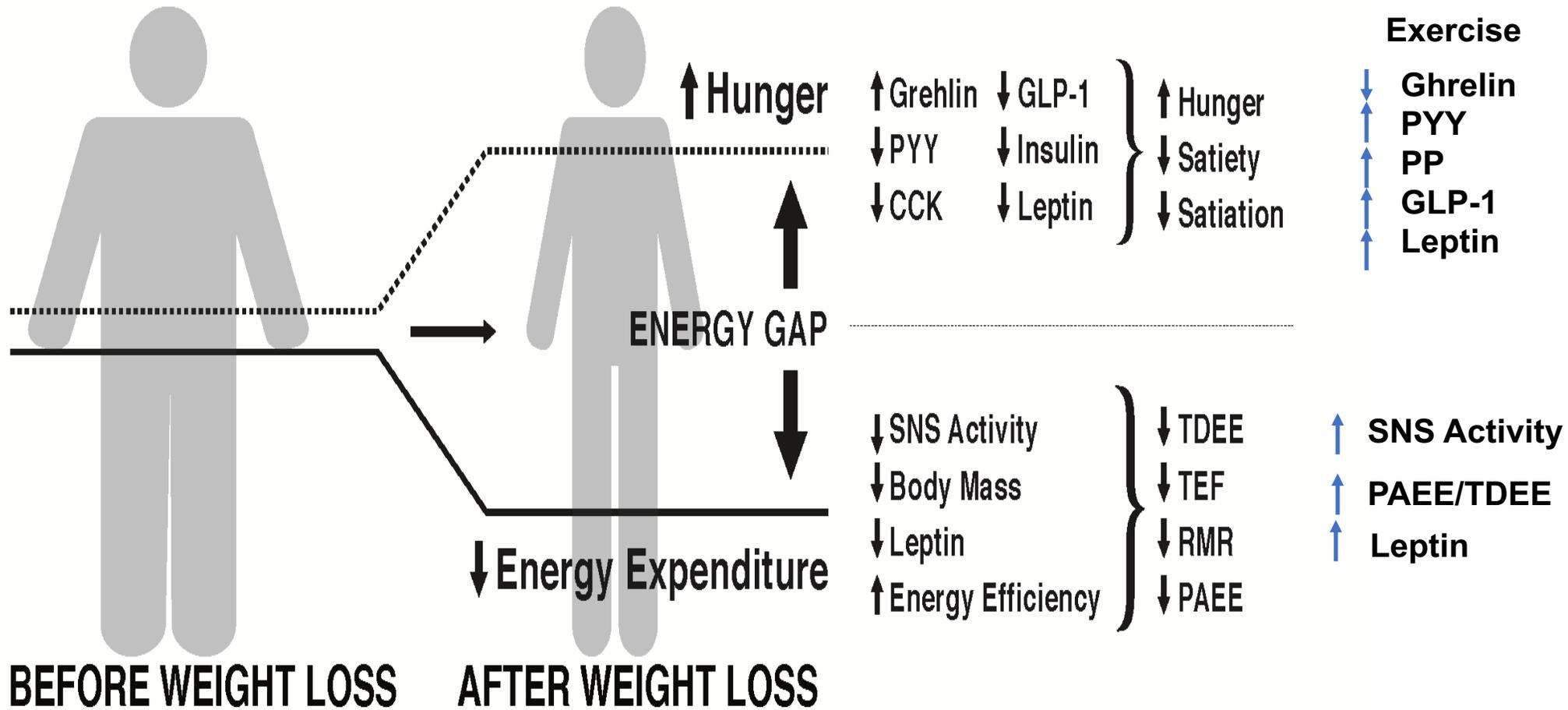


C. Steps

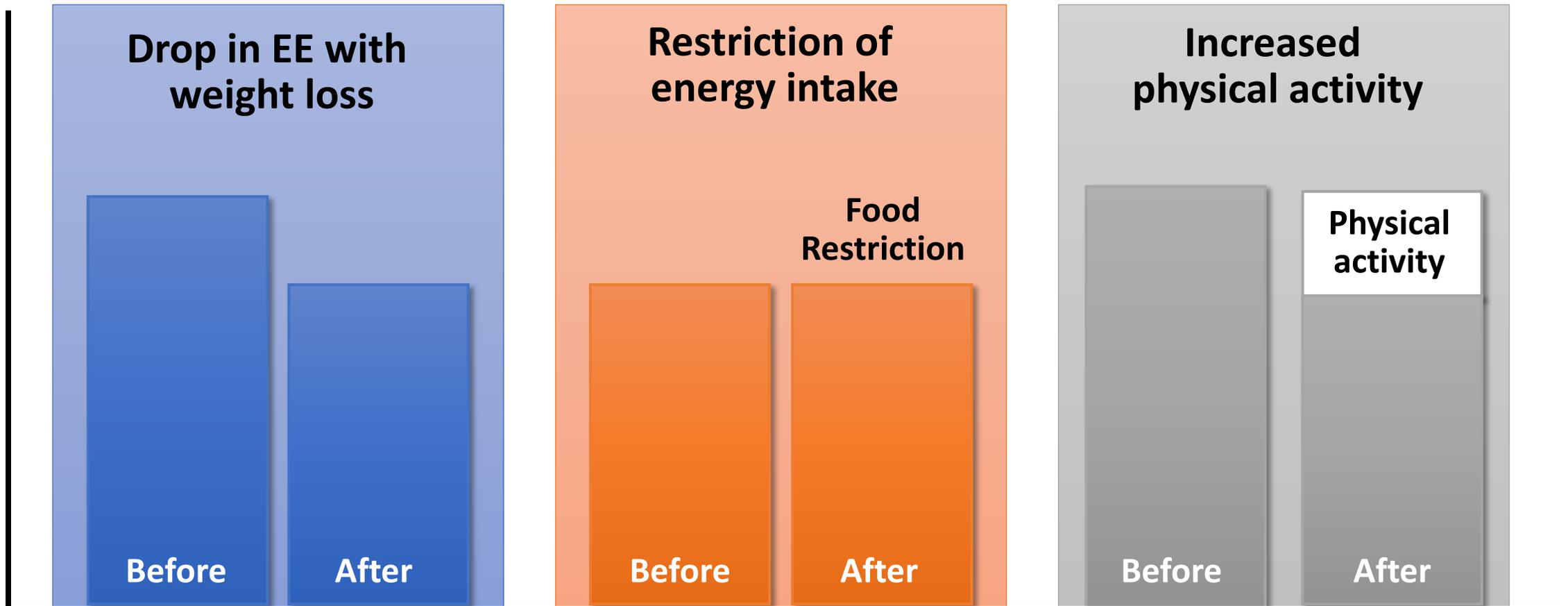


Ostendorf et al. Obesity 2018

# BENEFITS OF EXERCISE



# WEIGHT LOSS MAINTENANCE AT HIGH VS LOW ENERGY EXPENDITURE (EE)



# ENVIRONMENTAL FACTORS

Region	Obesity Rate (%)
U.S.	27.94
Midwest	29.91
South	29.85
Northeast	25.52
West	24.43

Source: NHANES

# ARE WE MISSING ANYTHING?

Other factors?

# INTERNATIONAL WEIGHT CONTROL REGISTRY

What can we learn by comparing successful with unsuccessful people?



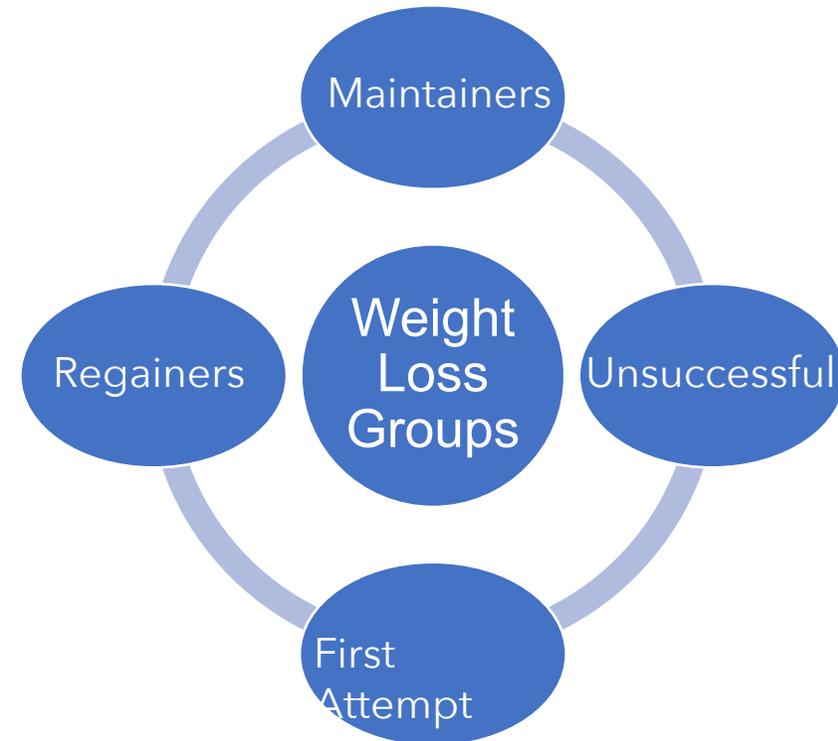
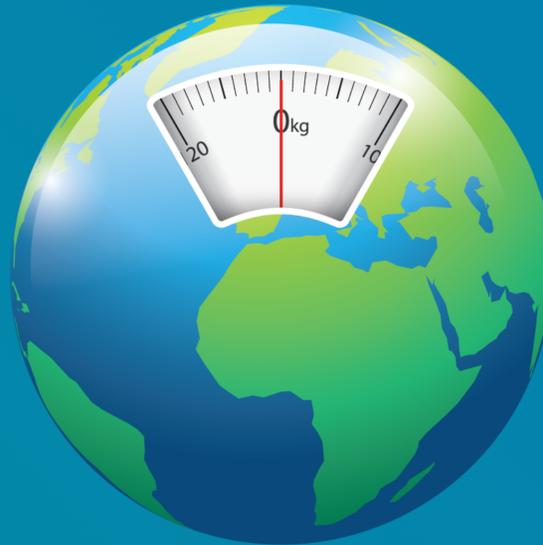
Home About IWCR ▾ Mission ▾ Press/Media ▾

JOIN US

Help change the world of weight loss science.

Share your journey with us and help change the world.

TELL ME MORE



# WHAT INFORMATION IS COLLECTED CURRENTLY?

Domain	Category	Instrument(s)
Biological	Anthropometry	Height, Weight History (Current, Highest Adult, and Lowest Adult)
	Overall Health and Wellbeing	36-Item Short Form Health Survey
Behavioral	Usual Dietary Intake and Diet Quality	Meal and Snack Patterns, Sugar Sweetened Beverage, Eating Away from Home Questionnaires
	Physical Activity and Sedentary Behavior	Wearable device data via Validic,, International Physical Activity Questionnaire
	Sleep Behavior	Medical Outcomes Survey Sleep Questionnaire and Morningness-Eveningness Questionnaire
Environmental	Objective Food, Physical Activity Environment	Home Zip Code, Address
	Self-Reported Food and Physical Activity Environment	Perceived Nutrition Environment Measures Survey, Neighborhood Environment Walkability Scale
	Socioeconomic and Social Status	Educational Attainment, Annual Household Income, Food Security
	Social Environment	Household Size, Marital Status, BMI of Spouse/ Partner, Weight-Related Social Norms Scale
Psychosocial	Food Cravings	Trait Food Craving Questionnaire – Reduced
	Dietary Restraint, Disinhibition, and Hunger	3-Factor Eating Questionnaire
	Stress Reactivity	Perceived Stress Reactivity Scale
	Motivation for Weight Management	Treatment Self-Regulation Questionnaire
	Motivation for Exercise	Exercise Identity and Behavioral Regulation
	Delay Discounting	5-Trial Adjusting Delay
	Life Course Trajectory	Life History Theory Questionnaire
	Self-Compassion	Self-Compassion Scale – Short Form
	Centered Identity – Resilience	Psychological Well-Being – Short Form

# HOW IS THE IWCR DIFFERENT?

- **Includes populations underrepresented in research**
  - Health disparity populations, individuals with disabilities, wide age range
  - Successful *and* unsuccessful (and aspirational)
  - Sufficient sample size to allow precision approach
- **Focus extends beyond just behavior**
  - Identify the contexts in which behavior occurs
  - Collect objective data remotely
- **Long-term follow-up**
- **Has flexibility to grow and evolve**
- **Established to foster team science and research training**
- **Builds partnership with target population**
- **Recruitment for sub-studies**

# THE IWCR CAN:

1. Test **specific hypotheses** about factors that impact weight management.
2. Use **discovery science** to develop new hypotheses for how combinations of factors in specific people in specific contexts are associated with successful weight loss maintenance.
3. Provide **long-term follow-up** for people who lose weight to facilitate the study of weight loss maintenance.



# EXAMPLE QUESTIONS

- What are the behaviors and psychological profiles and their combinations in people who are successful and unsuccessful at weight loss and maintenance in different environments?
- What contextual factors are associated with successful and unsuccessful outcomes for weight loss and maintenance among people with similar behavioral and psychological profiles and their combinations?
- What are the individual contextual, metabolic, microbiomic, and genotypic factors associated with successful and unsuccessful weight loss and maintenance among individuals selected from the various clusters?

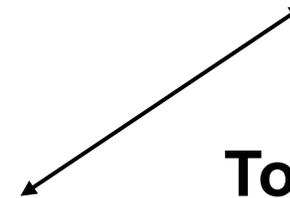
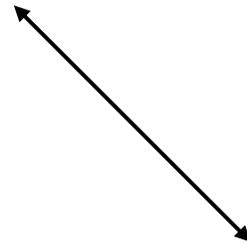
# DISCOVERY SCIENCE

**Learning Algorithms**  
Examples: natural language processing, clustering, neural networks, random forests

**Mechanistic Models**  
Examples: differential equations, agent based, network science



**Iterative process**  
designed to  
interrogate data and  
**discover**

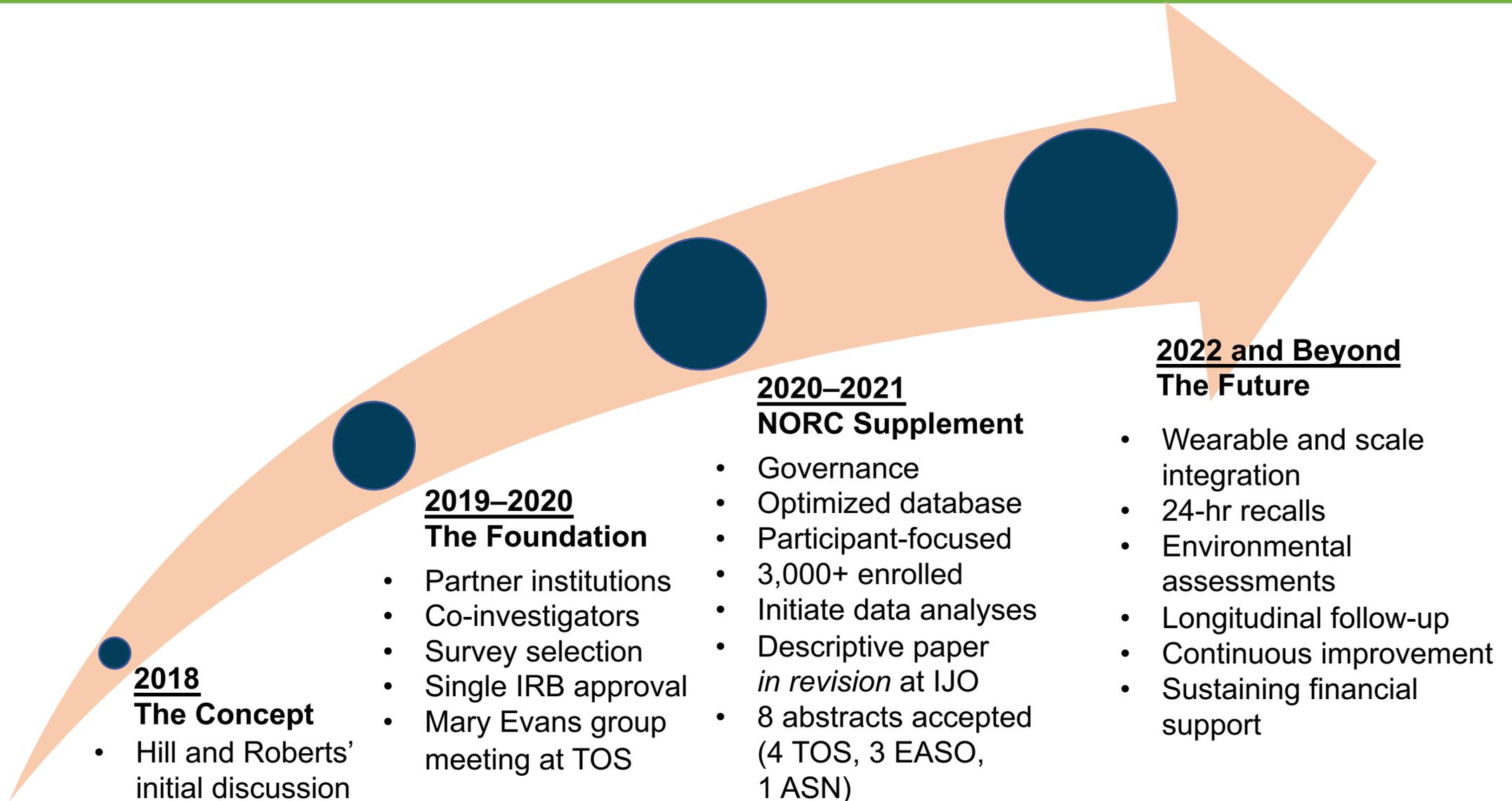


**Modeling Approach**  
Allows the data to speak  
Thrives from variability  
Generates hypothesis

Combines  
**Top-Down Modeling Approach**  
with  
**Bottom-Up Modeling Approach**  
used in the  
Precision Nutrition Study

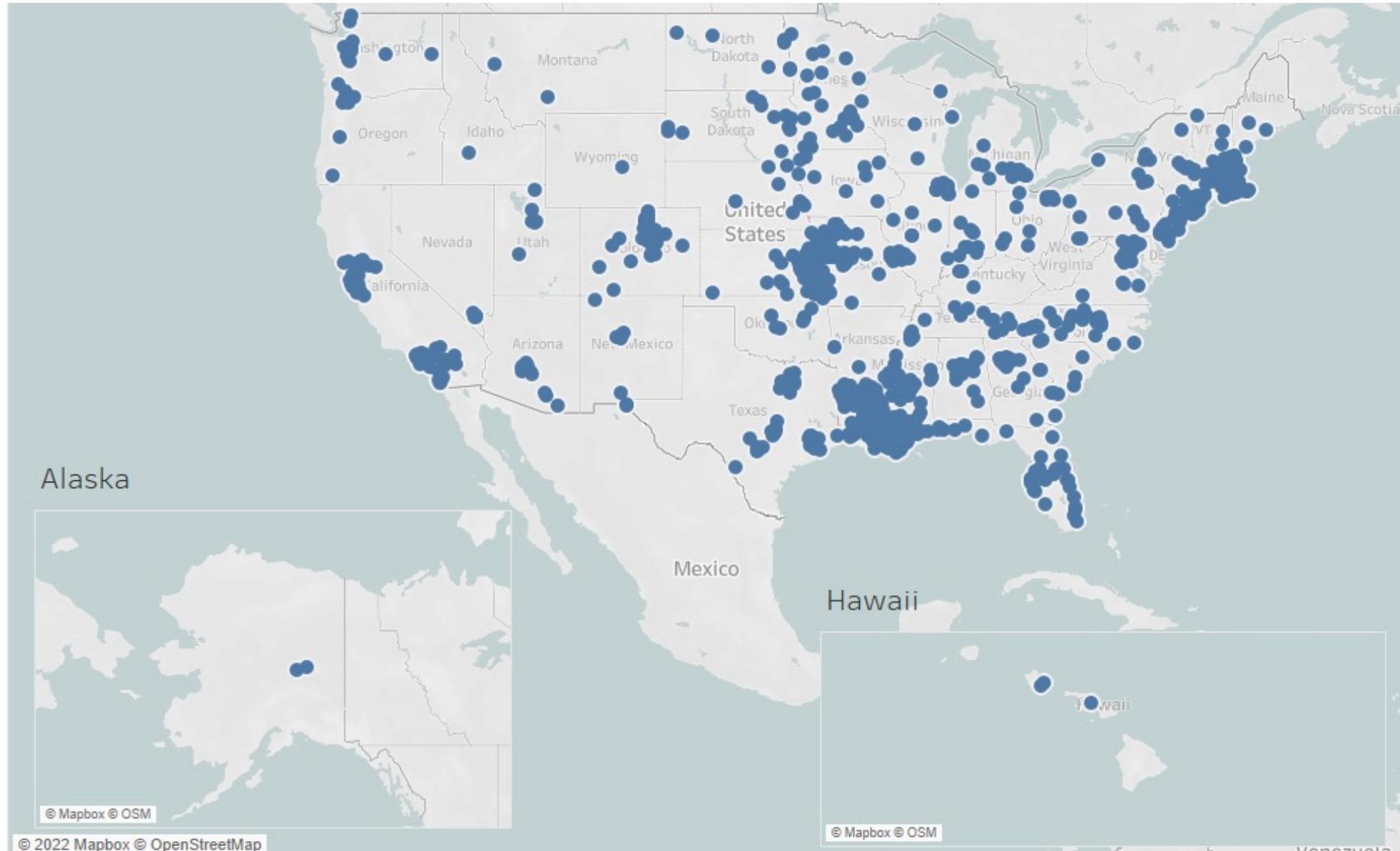
**Statistical Inference**  
(Examples: t-tests,  
regression, ANOVA)

# HISTORY OF THE IWCR

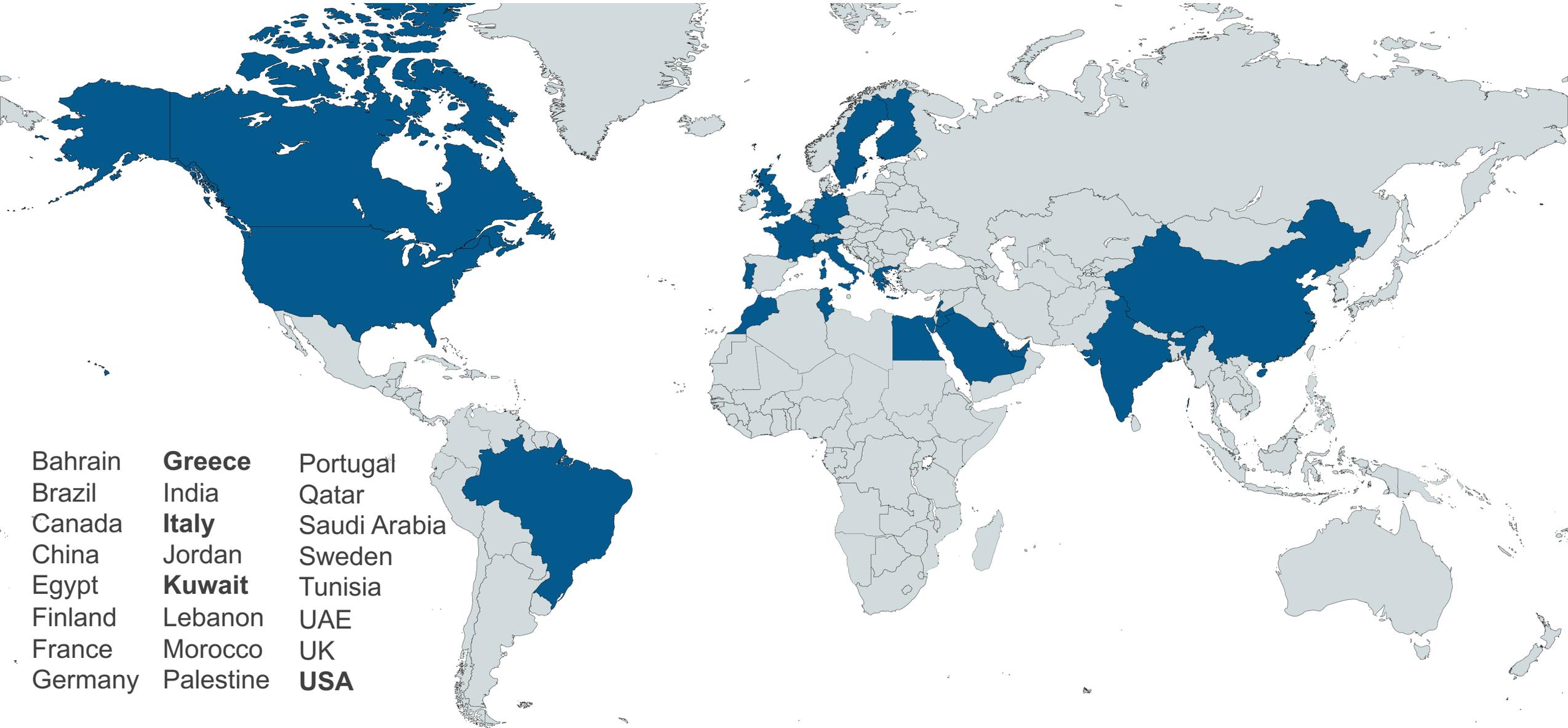




# U.S. ENROLLMENT BY ZIP CODE



# INTERNATIONAL SITES



# CURRENT ENROLLMENT: 3380

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/Not Reported	Female	Male	Unknown/Not Reported	Female	Male	Unknown/Not Reported	
American Indian/Alaska Native	4	1	-	4	-	-	-	-	-	9
Asian	35	18	-	-	-	-	2	1	-	56
Native Hawaiian or Other Pacific Islander	3	-	-	-	-	-	-	2	-	5
Black or African American	309	66	-	7	-	-	10	-	-	392
White	1,112	225	3	40	7	-	20	21	-	1,428
More Than One Race	30	4	-	13	1	-	3	-	-	51
Unknown or Not Reported	15	3	-	15	1	-	19	5	1,381	1,439
<b>Total</b>	<b>1,508</b>	<b>317</b>	<b>3</b>	<b>79</b>	<b>9</b>	<b>-</b>	<b>54</b>	<b>29</b>	<b>1,381</b>	<b>3,380</b>

Weight Loss Category	%
Maintained weight loss for at least 1 year	28
Lost weight but regained it	57
Tried unsuccessfully to lose weight	10
First attempt to lose weight	4
RUCA	%
Urban	90
Rural	10
Age	%
18-29	8
30-39	15
40-49	21
50-59	22
60-69	25
≥70	8

# IWCR PUBLICATIONS

- 1 published paper
- 12 manuscripts in progress
- >12 abstracts presented or submitted

# ALIGNMENT WITH NIDDK STRATEGIC PLAN

**Goal 1:** Advance understanding of biological and environmental contributions to health and disease

**Goal 2:** Advance pivotal clinical studies and trials for prevention, treatment, and cure in diverse populations

**Goal 3:** Advance research to disseminate and implement evidence-based prevention strategies and treatments in clinics and community settings, to improve the health of all people, more rapidly and effectively

**Goal 4:** Advance stakeholder engagement, including patients and other participants as true partners in research

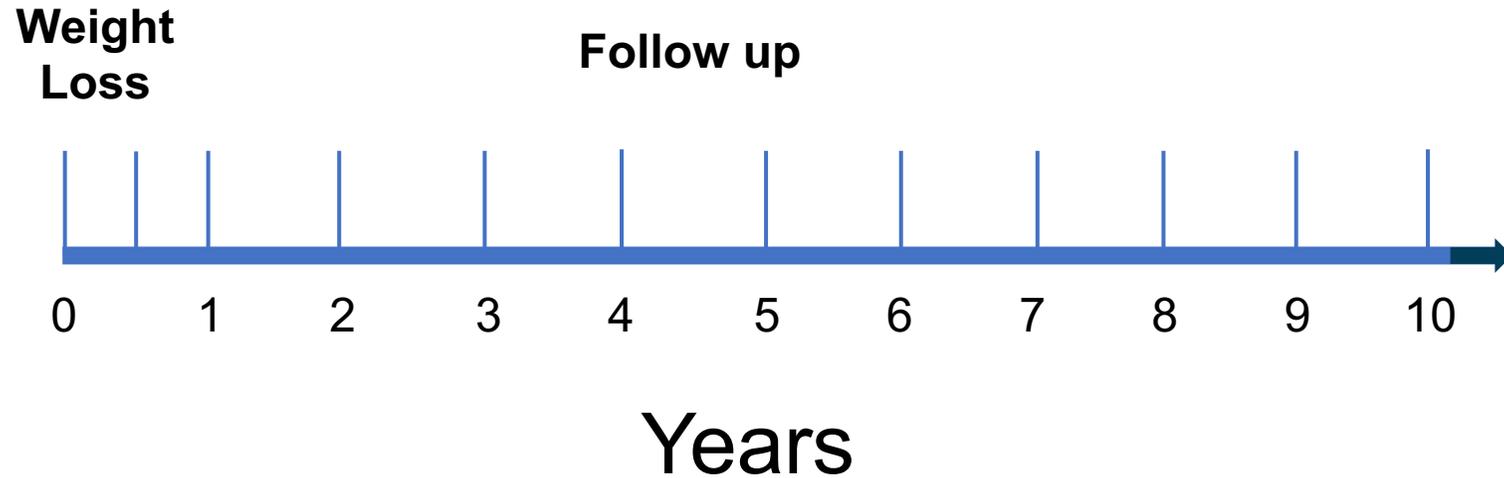
# TREATMENT OF OBESITY

Behavioral Treatment 7-10%

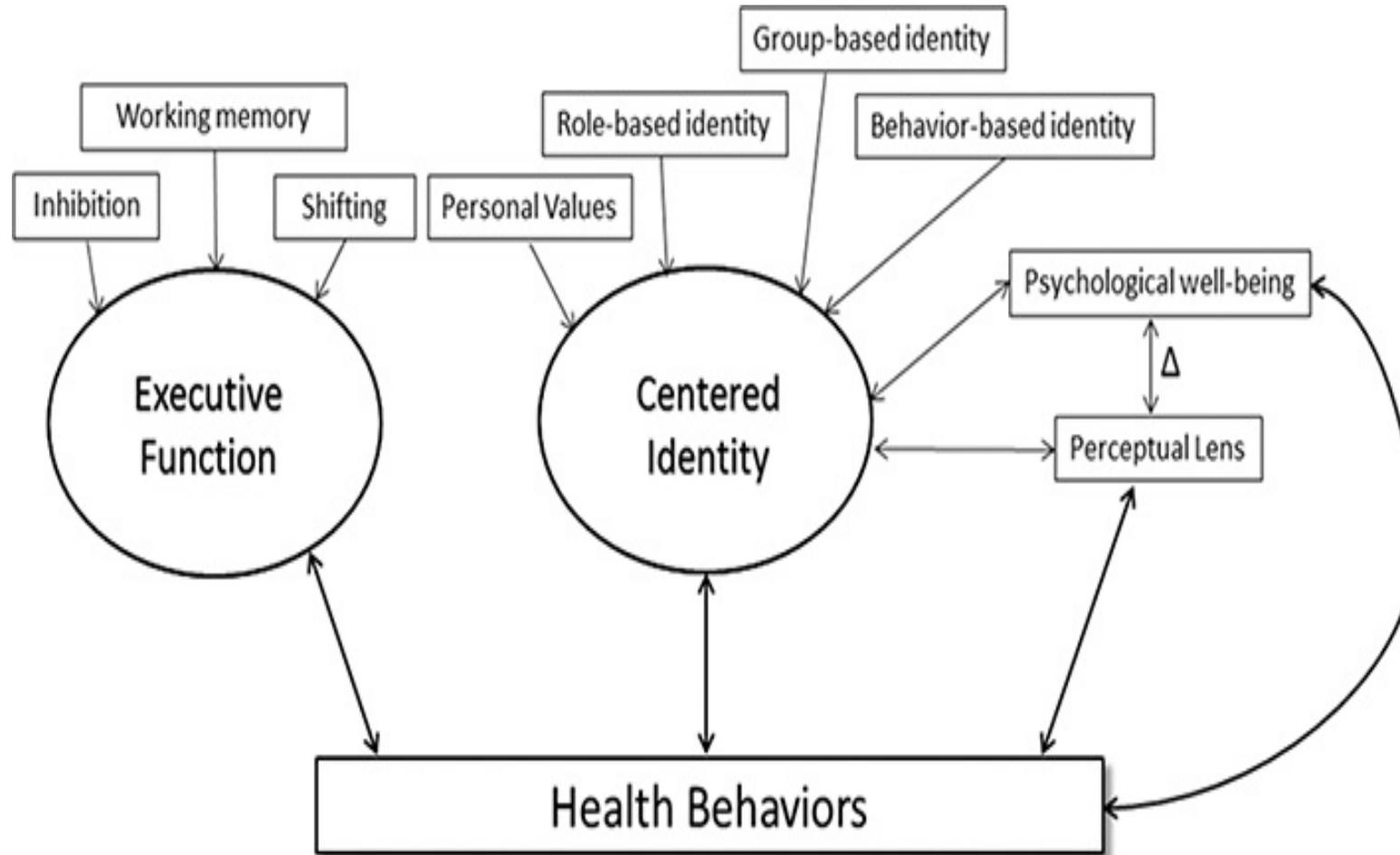
Pharmacological Treatment 5-20%

Surgery 30-40%

# LONG-TERM FOLLOW-UP



# MAINTAIN IT MODEL



# INVESTIGATOR RESOURCE NEEDS

1. Overall Project Leadership
  - Hill, Roberts – MPIs
2. Other Key Personnel
  - Data Support Team
  - Recruitment/Retention
  - Project Operations
3. Training/Development of Early Career Investigators and Investigators from Groups Underrepresented in Obesity Research
4. Graduate Students



# IWCR: A UNIQUE PLATFORM

- A volunteer-scientist partnership
- A global collaboration
- A precision approach to weight management
- Use of AI, Machine Learning, Modeling to develop new testable hypotheses about obesity treatment
- A virtual project that is consistent with the future of clinical research
- We welcome collaborators, new ideas, and support
- A resource for the obesity research community

[www.internationalweightcontrolregistry.org](http://www.internationalweightcontrolregistry.org)

# SUMMARY

- We can reliably produce weight loss, but not weight loss maintenance
- We do not completely understand reasons for weight regain after voluntary weight loss
- There is not likely to be a single strategy for weight loss maintenance
- Weight loss maintenance is difficult to study prospectively
- The IWCR can be a source of hypothesis generation to help develop prospective studies of weight loss maintenance

# University of Alabama at Birmingham

Thank You

