

# ENERGY BALANCE IN AN OBESE WORLD: SCIENCE & CLINICAL APPLICATIONS



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## LEARNING OBJECTIVES

- Define the concept of energy balance
- Recognize how the components of energy balance are interrelated
- Contrast approaches to treating vs. preventing obesity
- Describe how an understanding of energy balance can help us develop strategies to reduce obesity

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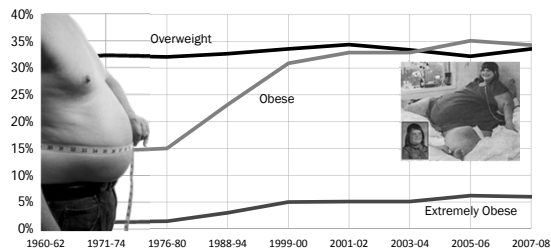
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## TRENDS IN OVERWEIGHT, OBESITY & EXTREME OBESITY, AGES 20-74 (NCHS)



Fryar CD et al. Centers for Disease Control and Prevention. Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960-1962 Through 2009-2010. National Center for Health Statistics. Last Updated: September 13, 2012. Available at [http://www.cdc.gov/nchs/data/hestat/obesity\\_adult\\_09\\_10.htm](http://www.cdc.gov/nchs/data/hestat/obesity_adult_09_10.htm). Accessed: December 15, 2012.

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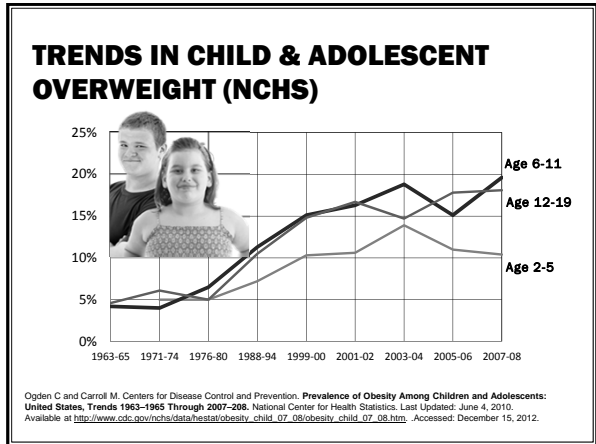
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### IS ENERGY BALANCE THE APPROPRIATE FRAMEWORK TO STUDY BODY WEIGHT REGULATIONS & OBESITY?

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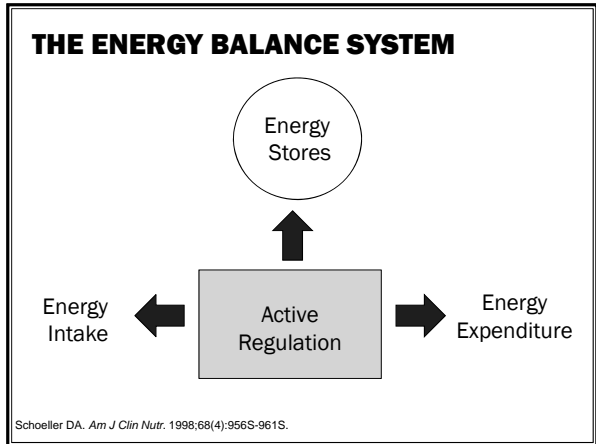
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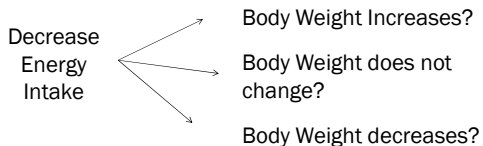
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### WHAT HAPPENS TO THE BODY WHEN FOOD INTAKE IS DECREASED?



Usual Physical Activity  
Metabolic Rate  
Food Intake

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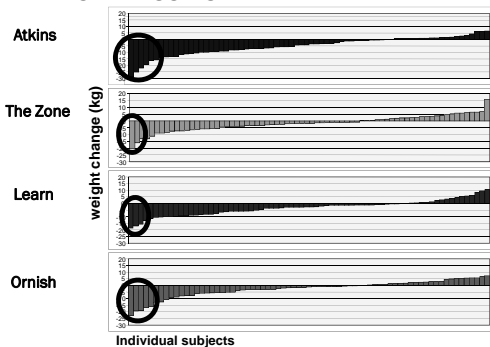
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### 12-MONTH NET WEIGHT CHANGE (kg) INDIVIDUAL RESULTS



Gardner CD, et al. JAMA. 2007;297(9):969-77.

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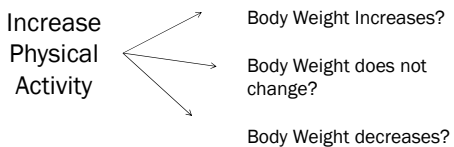
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### WHAT HAPPENS TO THE BODY WEIGHT WHEN PHYSICAL ACTIVITY IS INCREASED?



Usual Physical Activity  
Metabolic Rate  
Food Intake

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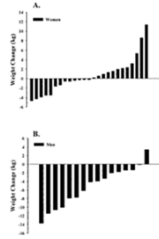
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**INDIVIDUAL & GENDER DIFFERENCES IN RESPONSE TO PA**

- Individual differences may be due to compensation from EI, metabolic rate, daily PA etc.
- Gender differences may be due to method of exercise prescription
- Traditional Rx (duration, frequency, intensity) favors men



Donnelly JE, et al. *Arch Intern Med.* 2003;163(11):1343-50.

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**WHY IS IT IMPORTANT TO STUDY ENERGY BALANCE?**

- Understand why we have high rates of obesity
- Help us understand that changing one component effects the others
- Help us interpret research results
- Develop most effective strategies to lower obesity rates

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**THE ENERGY BALANCE SYSTEM**

**Inherited Factors**

- Efficiency
- Adaptive thermogenesis
- Food preferences



**Environmental Factors**

- Food environment
- Physical activity environment

Energy Intake ←



→ Energy Expenditure

Schoeller DA. *Am J Clin Nutr.* 1998;68(4):956S-961S.  
Hill JO et al. *Circulation.* 2012;126(1):126-32.

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**IS IT USEFUL TO CONSIDER  
WHETHER THE OBESITY  
EPIDEMIC IS DUE TO  
INCREASED FOOD INTAKE  
OR DECREASED PHYSICAL  
ACTIVITY?**

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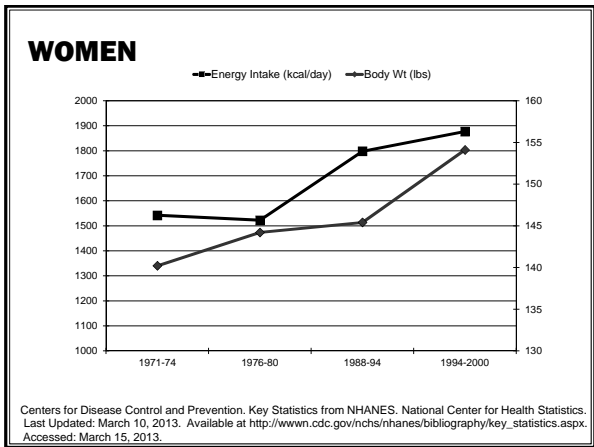
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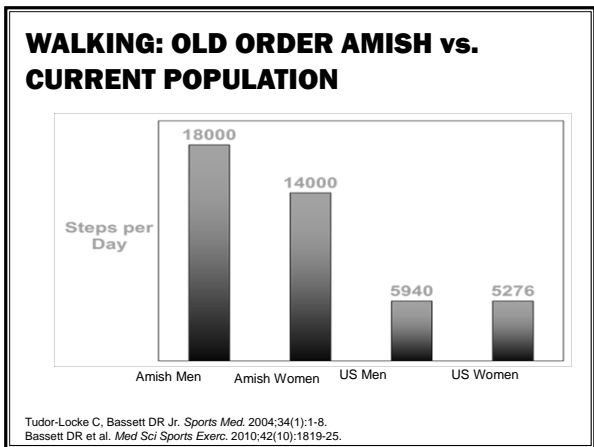
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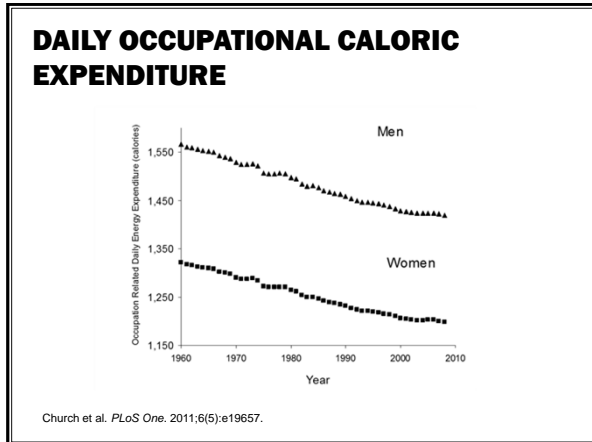
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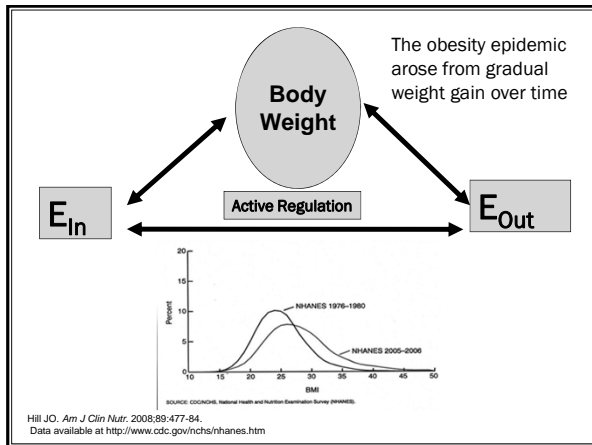
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**AN UNDERSTANDING OF ENERGY BALANCE CAN HELP US DEVELOP MORE EFFECTIVE STRATEGIES TO REDUCE OBESITY RATES**

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**EAT LESS  
&  
EXERCISE MORE**

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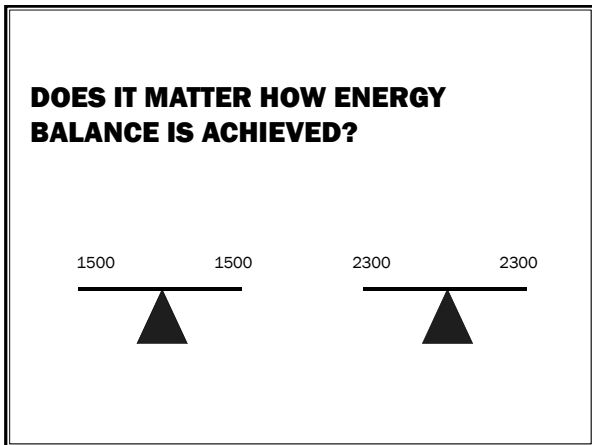
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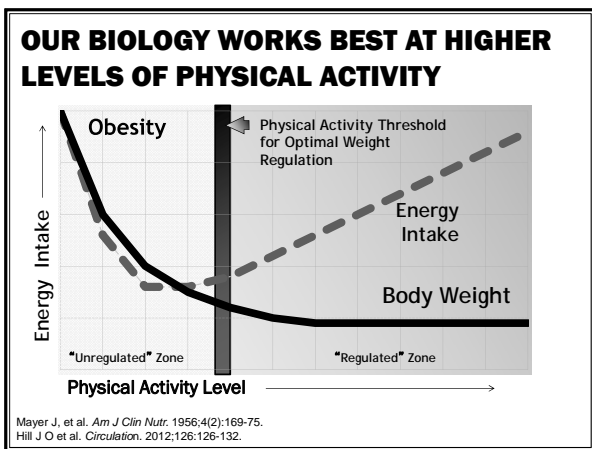
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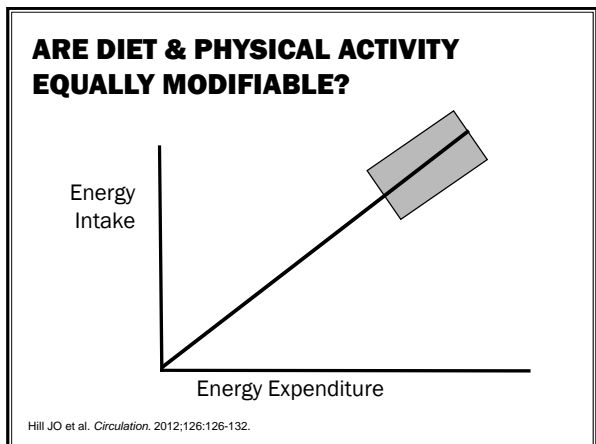
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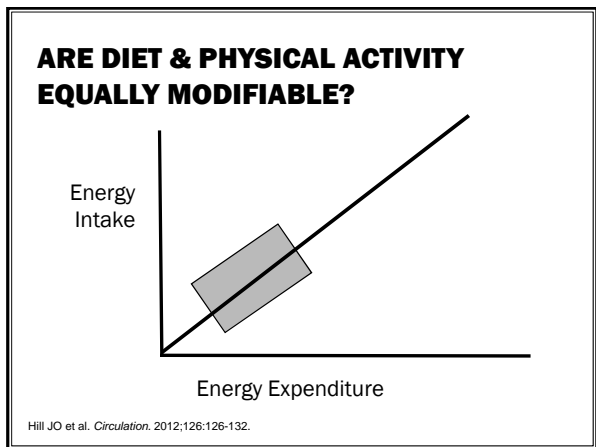
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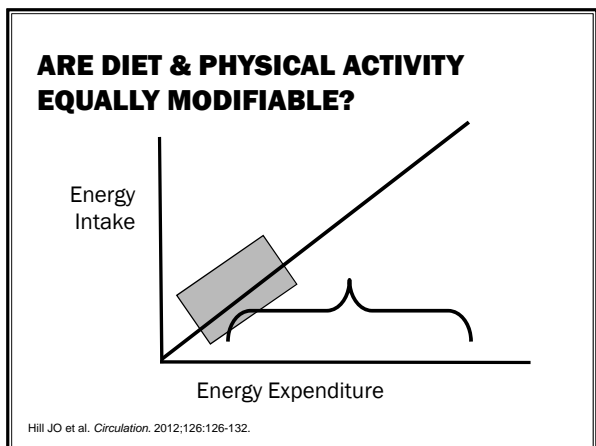
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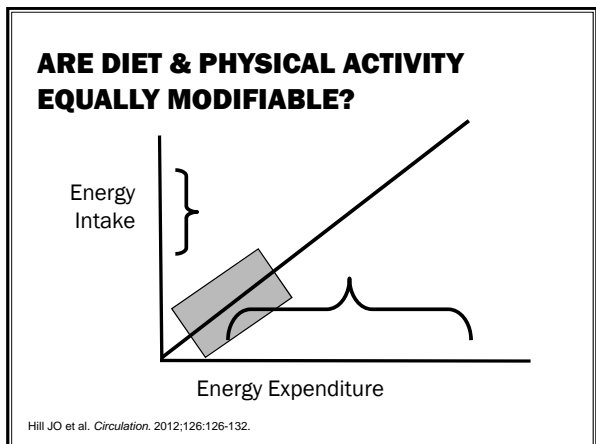
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### TREATMENT vs. PREVENTION

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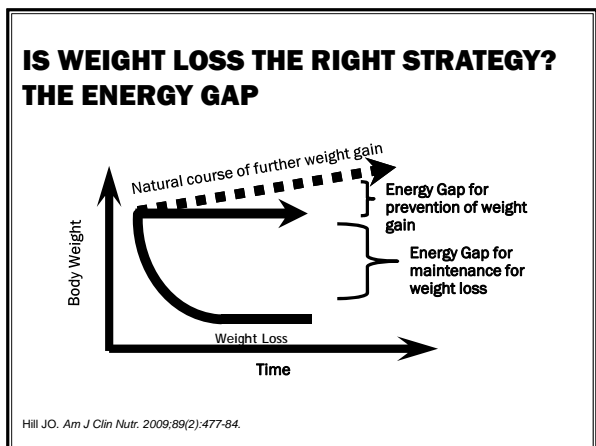
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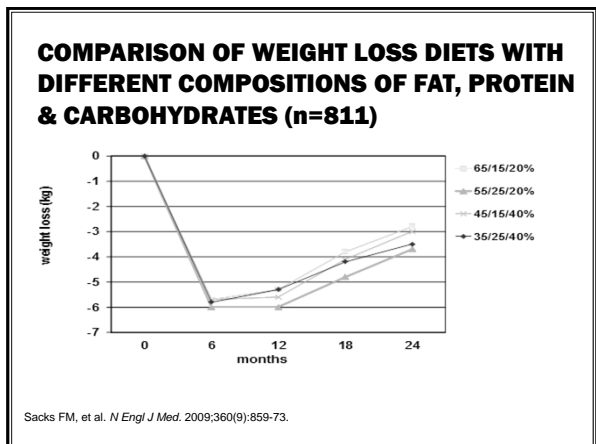
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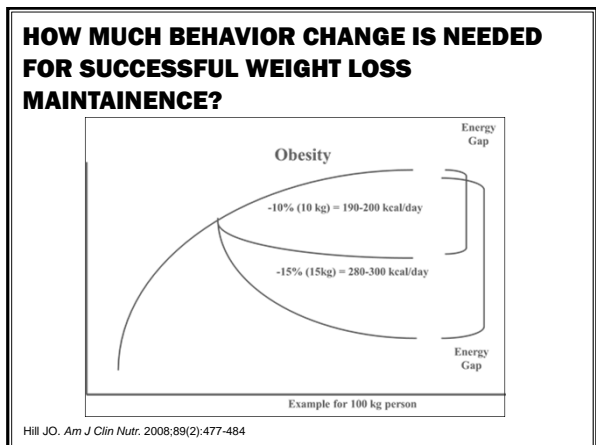
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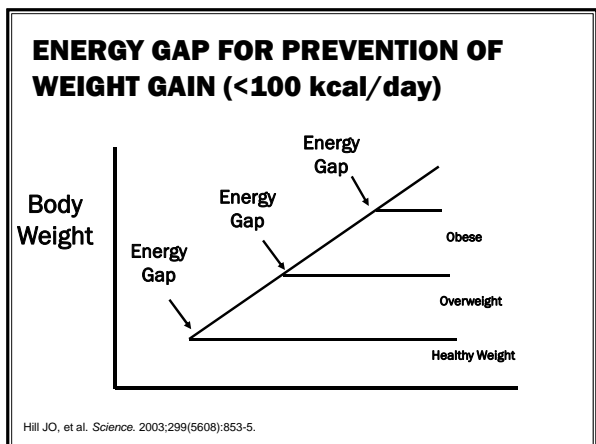
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# HOW TO APPROACH BEHAVIOR CHANGE: SMALL CHANGES

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**STARTING A MOVEMENT**

Source: America on the Move. Accessed 12/15/2012. <https://aom3.americaonthemove.org/>

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**DOES THE SMALL CHANGES APPROACH WORK?**

**America On the Move Family Studies**  
 Reduced weight gain in overweight children and parents over 16 weeks\*  
 Reduced weight gain in overweight children over 6 months\*\*

Group	Weight Gain (%)
Maintenance/Prevention	~55
Increase	~35

\*Rodearmel SJ, et al. *Obesity* (Silver Spring). 2006;14(8):1392-401.  
 \*\*Rodearmel SJ, et al. *Pediatrics*. 2007;120(4):e869-79.

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**America on the move**  
Steps to a Healthier Way of Life™

**National Step Survey, Harris 2003**  
**State Surveys- CO, TN, & AR, 2003-2006**

**AVERAGE STEPS PER DAY IN 4 SURVEYS**

	Men	Women	Average	% Obese
<b>U.S.</b>	5940	5276	5608	22.8
<b>Colorado</b>	6733	6384	6558	16.0
<b>Tennessee</b>	4547	4730	4638	25.0
<b>Arkansas</b>	5143	4822	4982	26.5

Wyatt HR, et al. Med Sci Sports Exerc. 2005 May;37(5):724-30.  
American on the Move Step Surveys. Available at  
<https://aom3.americaonthemove.org/about-us/science/aom-research.aspx#Surveys>. Accessed Dec. 20, 2012.

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**WHAT ROLE CAN SMALL CHANGES PLAY IF WE NEED A BIGGER SYSTEMIC CHANGE?**

- Set the table for bigger change...you have to start somewhere...
- Any change requires taking some risk...
- There are things we can do NOW that may slip by unnoticed...

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**PREVENTION vs. TREATMENT**

Both have advantages & disadvantages

Common required factors:

- Commitment
- Persistence
- Motivation

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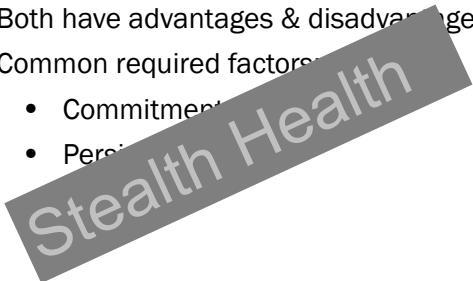
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**PREVENTION vs. TREATMENT**

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- Commitment
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**SHIFT THE STRATEGY**

- Change priority from “what’s easier, faster, cheaper” to “what’s better & healthier”
- Increase the perceived value of physical activity
- CDC: “kids should be active more than they’re sedentary”

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**EVERYONE HAS A JOB TO DO**

**Private sector**

- Healthier default choices in meals/options

**Local, state, federal**

- Mandatory PE in schools

**Individuals & families**

- Shift priorities – just a little at a time

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**THE “HEALTHY DEFAULT” APPROACH**

- Takes nothing away
- Makes it easier to make better choices
- Allows gradual changes at consumers’ own pace
- Allows consumers to feel empowered & successful, not deprived

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**DISNEY PARKS**

**How to do healthy defaults:**

- Menu boards that show only “better-for-you” choices
- Restaurants that bundle “better-for-you” complete meals
- Less healthful options only upon request

**Result: >6 in 10 parents choose the healthier default meals**

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**MCDONALD'S, BURGER KING, WENDY'S**

Better-for-you options are available, even in fast food restaurants:

- Lower-calorie Happy Meals: includes fresh fruit and low-fat milk
- Lower-calorie items & condiments (all 3)
- More sugar-free beverage choices (all 3)
- Example of gradual change (all 3):
  - Milk went from whole, to 2%, to 1%

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**STARBUCKS**

- Default milk is now 2%, fat-free milk in low-calorie specialty drinks
- Fat-free coffee drinks on menu boards
- Given specific names & identities
- No longer a "special order"
- Multiple sugar-free options

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**STATE, LOCAL APPROACH**

**Put the "physical" back into education**

- Mandate PE, grades 1-12
- Consider some level of PE in colleges/universities
- School drop-offs: designated 500 steps from school

**City planning & policies that encourage walking, biking, & activity**

- More communities within walking distance of stores
- More open space for parks, sidewalks, gardens
- Safe, well-lighted walking routes

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**PILOT PROGRAM IN DENVER: 5<sup>TH</sup> GEAR KIDS  
– KICKING HEALTH INTO HIGH GEAR**

- Aim is to empower kids with lifelong cognitive skills required to achieve energy balance and manage body weight
- Let kids practice these skills by being healthy consumers
- Let 5th gear kids deliver the message to others – family, peers, younger kids, etc.

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**STARTING AT HOME, HERE, NOW**

- Prepping consumers to make small changes
- Address the barriers (aka “fears”) to making changes
- Provide motivation: the key to sustained improvements

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**EDUCATING CONSUMERS ABOUT  
MAKING SMALL CHANGES – OR ANY  
CHANGES**

- Increase access to nutritious food
- Increase the perceived value of nutritious food
- Teach balance by using models they already know, i.e. a “calorie bank”
- Teach planned eating, not spontaneous food decisions

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**EDUCATING CONSUMERS ABOUT MAKING SMALL CHANGES – OR ANY CHANGES**

- Encourage a shift from dependence to independence
- Work for environmental and legislative changes, but don't wait for them

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**CONSUMERS NEED PREPARATION**

- Reassure that slow and steady is easier and better
- Would anyone notice a 5% reduction in calories?  
Examples:
  - 1 ½ oz. meat
  - ~1 slice of bread
  - 1 less tablespoon of fat/oil
- 1 small change per month is enough

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**CONSUMERS NEED PREPARATION**

- Some cognitive skill
- Forethought, not impulsivity,
- Planning of diet AND physical activity
- Learning patience
  - Results not immediate – it's OK
  - It's the journey, not the finish line
- Appropriate goals: better, not "perfect"

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**CONSUMERS NEED PREPARATION**

Energy balance requires a return of physical activity to daily life:  
A “new normal”

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**CASE EXAMPLE: MARSHA**

- 47-year-old mom of teens
- 248 pounds, BMI = 41
- Extremely sedentary
- Began a walking program
  - Walked around 1 city block each day
  - Every week she increased 1 block
  - Walking a mile/day within 6 weeks
  - Self-motivated by her success, translated into better eating habits

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**CASE EXAMPLE: JOSE**

- 13-year-old, BMI = 99<sup>th</sup> percentile, family history of Type 2 diabetes
- Leisure time is all sedentary
- Excessive total calories, lots of empty calories
- Made gradual changes:
  - sugar-free beverages
  - Began walking the ½ mile to school instead of taking bus
  - Joined by friends eventually
  - Replaced one snack daily with a favorite fresh fruit
  - Began walking home as well, walking to friends' homes, etc.
- 1 year later, BMI now reduced to 90<sup>th</sup> percentile

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**CONCLUSIONS**

- Energy balance is a framework that can be used to understand the interplay between energy intake, energy expenditure and energy storage that determines body weight.
- A better understanding of energy balance can help develop more effective strategies for reducing obesity rates in individuals and populations.

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**PROVIDE LIFELONG SKILLS FOR ACHIEVING ENERGY BALANCE TO OUR CHILDREN**

- Start early in teaching energy balancing skills
- Interaction of food and physical activity, weight gain/weight loss
- Genetic and environmental influence on energy intake and energy expenditure

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**STRATEGIES TO REDUCE THE OBESITY EPIDEMIC**

- Incorporate physical activity into the culture
- Implement gradual changes to reduce overeating (eat smarter)
- Focus on preventing excessive weight gain

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