



The Role of Physical Activity in Obesity Management

Edward R. Laskowski, M.D.

Co-Director, Mayo Clinic Sports Medicine Center
Professor, Department of PM&R
President's Council on Physical Fitness and Sports

laskowski.edward@mayo.edu

Disclosure

- Nothing to disclose
- No relevant financial relationships, off label, or investigational uses

Objectives

- Understand the breadth, scope, and ramifications of the current global epidemic of obesity and sedentary lifestyle
- Discuss the specific effects of aerobic exercise on obesity
- Discuss the specific effects of strength training exercise on obesity
- Discuss beneficial effects of exercise independent of weight loss

The Problem:

Almost two-thirds (67%) of American adults are overweight or obese.

In less than 30 years, the prevalence of overweight among children aged 6-19 has tripled.*



Source: NHANES 1976-1980 and 2003-2004

Causes of Death in the U.S. since 1990

- Tobacco use: 435,000
- Diet/PA: 400,000
- Alcohol 85,000
- Infection 75,000
- Toxic agents 55,000
- MVA 43,000
- STD 20,000
- Illicit drug use 17,000

U.S. Physical Activity Participation

- Adults: 70% reported that they **did not** meet the recommendation (at least 30 minutes of moderate activity most days of the week)*
- Children: 65% of high school students reported that they **did not** meet the recommendation (60 minutes of physical activity five or more days/week)**



*2005 National Health Interview Survey

Sitting Time: An Independent Risk Factor

- Association between the amount of **sedentary time** in an individual's life and their **overall metabolic risk**
- **independent** from time spent in moderate or vigorous activity
- standing and moving around and **spending less time sitting** produces **healthier blood lipid profiles and blood glucose levels** than those who meet minimum recommended activity levels but sit for prolonged periods

Hamilton, Healy 2008

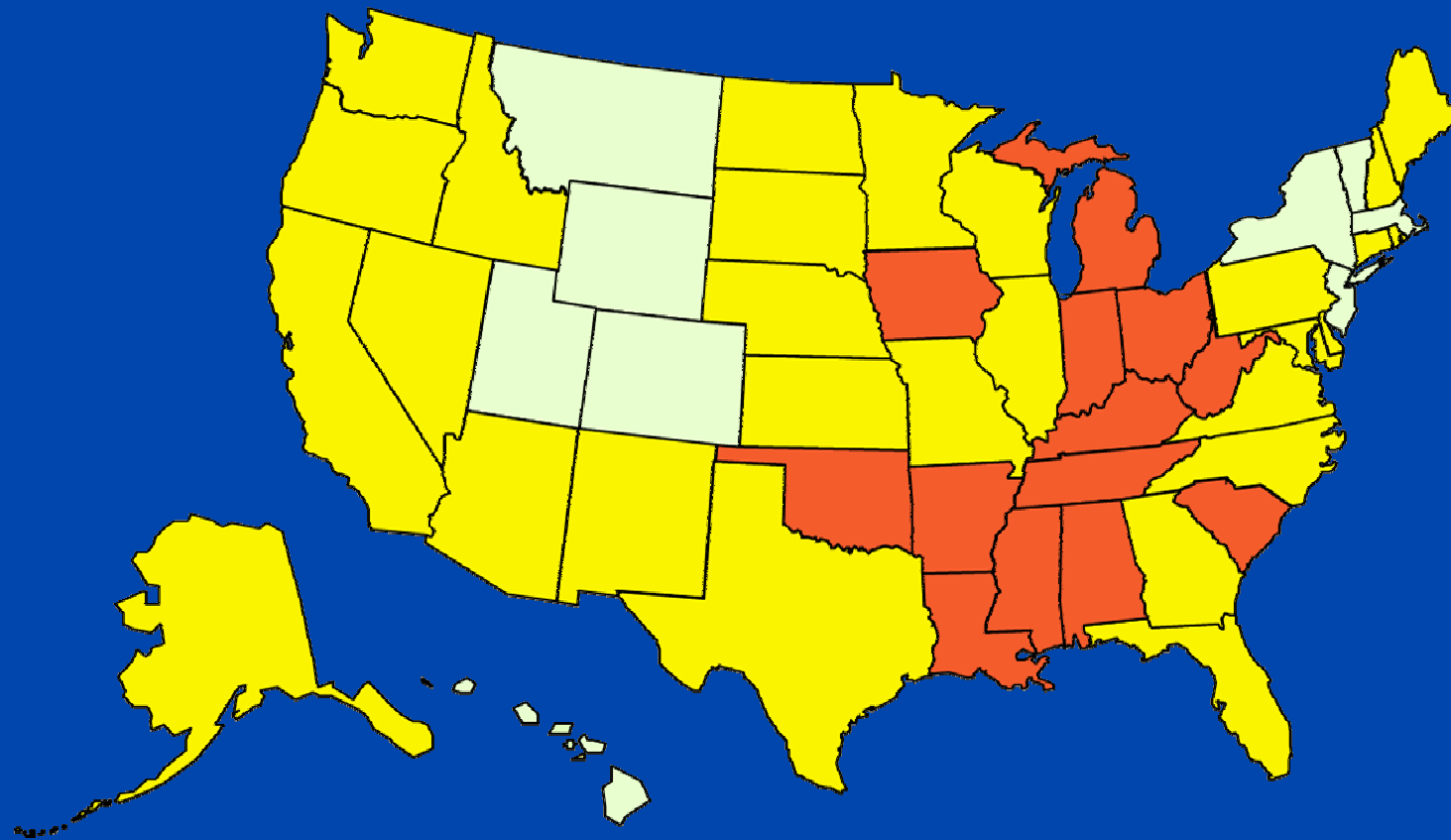
Dangers of Sedentary Living

Physical inactivity increases the risk of developing:

- Cardiovascular disease
- Type 2 Diabetes
- Obesity
- High cholesterol
- Hypertension
- High blood triglycerides
- Congestive Heart Failure
- Breast, Colon, Pancreatic, and Prostate Cancers
- Gallstone Disease
- Peripheral vascular disease
- Osteoporosis
- Stiff joints
- Anxiety and Depression
- Decreased cognitive function
- Sleep Problems
- Physical frailty
- Reduced quality of life
- Premature death



Prevalence* of Self-Reported Obesity Among U.S. Adults BRFSS, 2012 CDC



15%–<20% 20%–<25% 25%–<30% 30%–<35% ≥35%

What the future holds....

- Obese people in US will increase from **99 million in 2008** to **164 million by 2030**
- Obesity rate rise from **32% to 50%** for men
- Obesity rate rise from **45% to 52%** for women
- Cost to treat obesity related disease increase **\$66 billion per year** by 2030
- Disease burden: **7.8 million more cases DM**, **6.8 million more cases CAD and stroke**, **539,000 more cancers** by 2030

A Global Concern

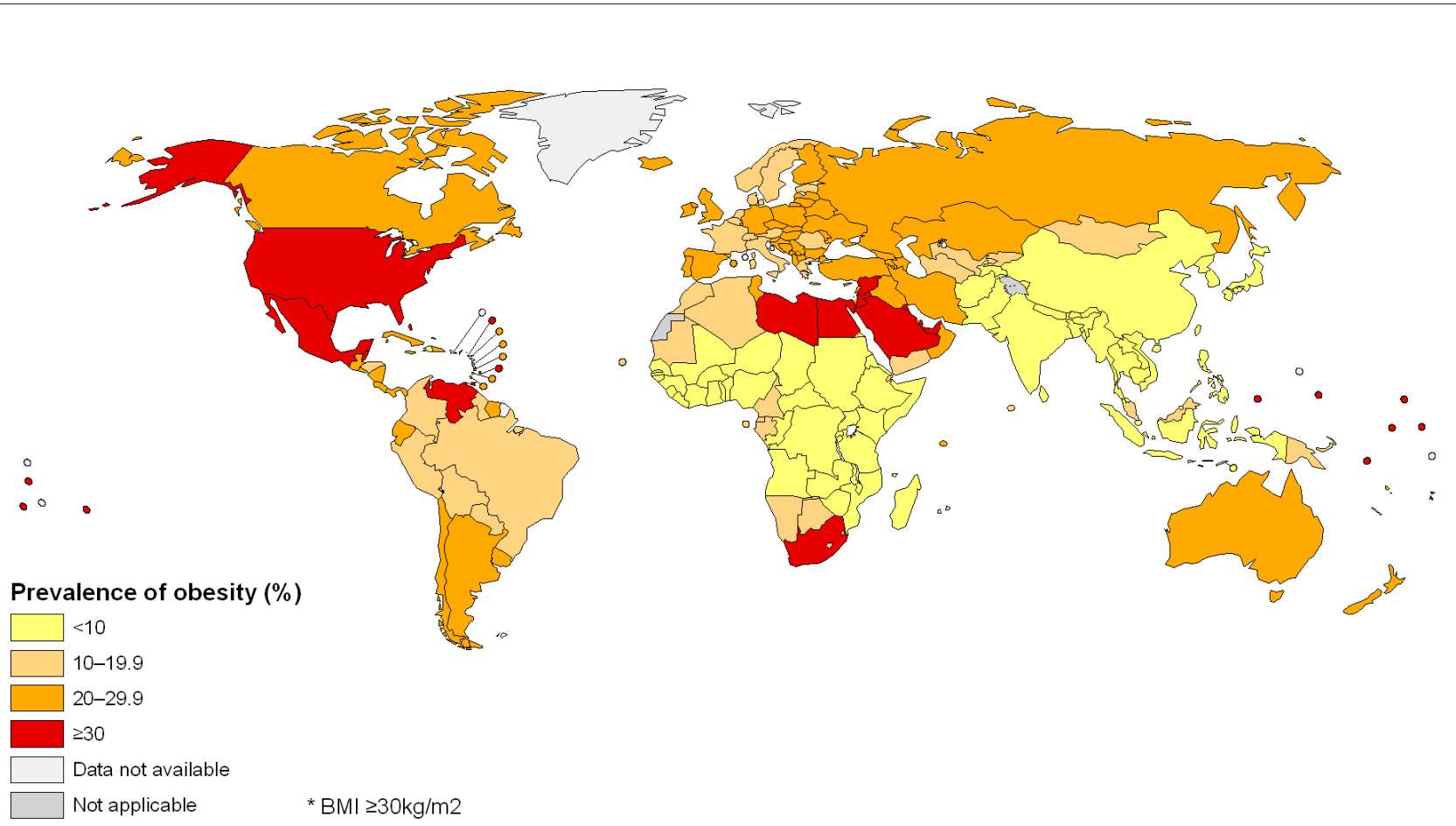
- Obesity in **China**:

“Major health concern” WHO, 2013

Obesity rates approaching **20%** in some
cities Levine, 2011

- More overfed than underfed in world today
WHO, 2013

Prevalence of obesity*, ages 20+, age standardized Both sexes, 2008



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information
and Geographic Information Systems (GIS)
World Health Organization



© WHO 2011. All rights reserved.

Morbidity of obesity

- **Type 2 DM:** weight gain of just **11 to 18 lbs** doubles risk
- **Osteoarthritis:** for every **2 lb** weight increase, risk of OA increases **9-13%**
- **Pregnancy:** obesity increases risk of gestational diabetes, labor and delivery problems, birth defects, HTN

Mortality as Consequence of Obesity in Adults

- **BMI 30-34.0: 200-300% higher** mortality than normal weight adults
- **BMI 25-29.9: 20-40% higher** mortality than normal weight adults

Adams et al, NEJM, August, 2006

- **20 years of life lost** due to obesity in certain age and racial/ethnic groups

CDC Economic Consequences of Obesity 2004

Cost of Overweight/Obesity

- \$98-147 billion
- \$250 billion with DM2
- Average annual health care cost is **36% higher** for an obese adult
- Obesity more expensive to treat than tobacco, alcohol abuse



How much is a healthy weight worth?

- Decrease heart disease: **\$14,990/yr** in hospital inpatient stays
- High cholesterol: **\$678/yr** in meds
- HTN: **\$559/yr** in meds
- Cancer: **\$23,184/yr** in hospital inpatient stays
- Joint problems/OA: **\$847/yr** in MD visits
- Pregnancy complications: **\$8717/yr**

Mayo Clinic Rochester data, 2013:

- Costs of smoking: \$1300/yr
- Costs of obesity/morbid obesity: \$1800/\$4000/yr
- Similar to other population data:

GWU School of Public Health
overweight/obesity: \$346/\$1474/yr

Is Obesity “Genetic?”

- Genetic factors can play a role in obesity development Maes, 1997
- PA associated with **40% reduction in genetic predisposition** as measured by number of gene risk alleles Li, 2010
- Adolescents meeting the PAG may **overcome the effect of the obesity associated gene polymorphism on obesity related traits**

Ruiz, 2010

Your Genes Are Not Your Fate

“Comprehensive lifestyle changes significantly increase telomerase activity and consequently telomere maintenance capacity in human immune-system cells”



Ornish D The Lancet Oncology,
Volume 9, Is 11 November 2008

Adult Minimum Physical Activity Needs

- 150 minutes moderate activity a week; 75 minutes vigorous activity
- Interval training effective
- Can “accumulate” activity throughout the day
- Strength training should also be included

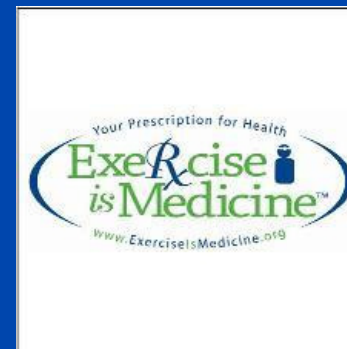


PA Guidelines HHS, Oct. 2008

Is Exercise Effective in the Treatment of Obesity?



- Complex problem to study: diet/caloric intake, duration of study, adherence to program, and type, volume, and intensity of exercise are all variables
- Weight loss achieved by change in energy balance: reduction in calories in, increase in calories burned, or both



Aerobic Exercise Effects

- Aerobic exercise alone produces weight loss, but **gains smaller (<3%) if not combined with calorie restriction** Moineddin 2012
- PA alone **less effective than diet alone or diet plus PA** Wing, Jakicic 1998
- **PA alone** has **not** been proven to produce significant weight loss, especially when “dose” of PA is similar to PAG of 150 minutes/week

Lee, JAMA, 2010



Aerobic Exercise Effects

- Single bout of aerobic exercise (2 hrs at 60% VO₂ max) reduced VLDL-TG **by 30%**
- Acute exercise **superior to calorie restriction** in lowering blood lipid levels, at least over the **short term** (MSSE, 2013)
- **2 hours PA** to see effect; 30 minutes not enough to improve plasma TG after single bout



Aerobic Activity and Weight Gain Prevention

- Women successful at maintaining normal weight and limiting weight gain over 15 years averaged **300 minutes/week** of moderate intensity activity Lee, JAMA, 2010
- **150 minutes PA/week not enough** to limit weight gain if **no caloric restriction**
- BMI >40: significant weight loss and reduction in cardiac risk factors with **diet and 300 min/week PA**, even when PA introduced after 6 months of 12 month study Goodpaster 2010

Aerobic Exercise and Weight Gain Prevention (Svetkey, JAMA, 2010)

- In BMI over 40: initial weight loss **greater if PA included at start**, but similar at end of 1 year
- Either early or late PA: **reduced visceral abdominal fat, hepatic fat, insulin resistance, and BP**
- Addition of PA produced **greater reduction in waist circumference and hepatic fat**
- Addition of **PA** promoted **greater weight loss**, no matter when introduced

The Effect of PA in the Prevention of Weight Gain

- Majority of individuals who lose weight are **not able to maintain** their weight loss Jeffery, 2000
- Problems with exercise **sustainability** and **compliance** well known Katan, 2009
- Home treadmills given free: initial 6 month weight loss could not be sustained at 2 years
Jakicic, 2008
- Weight **regain after weight loss**, regardless of behavioral interventions used to maintain weight loss Svetkey, JAMA, 2008

The Effect of Resistance Training on Weight Loss



- Resistance training **increases lean muscle mass** and **decreases fat mass** Avila, 2010
- Resistance training **increases insulin sensitivity** and **decreases LDL cholesterol** Ibanez, 2010
- In absence of aerobic activity, **resistance training plus dietary modification does not increase weight loss** compared to diet alone

Wing, 1998

Effect of Resistance Training on Weight Loss

- Performed 3 times per week, may **reduce the metabolic syndrome z-score**, with decreases in **fasting blood glucose**, improvement in **body composition and muscle strength**
- In people with **CAD**, strength training and aerobic training **more effective than aerobic alone** in improving **body comp and CV fitness**

Marzolini, 2012



Take Home Messages

- We are in the midst of a **global obesity epidemic**
- **Low levels PA** related to **weight gain** and **increased risk CV disease** in men and women
- Physical activity **reduces health care costs, missed work, and hospitalizations**
- Increased **sitting time** is an **independent risk factor** for the development of metabolic risk factors
- Most studies show that **exercise has a small, independent effect on body weight, typically less than 3% weight loss...** but has significant additive effect when combined with caloric restriction

Take Home Messages

- Exercise can help **sustain** long term weight loss and **minimize weight gain** over a lifetime, especially if volume in range of **300 min/week**
- **Strength training** independent of aerobic exercise has **not** been shown to produce additional weight loss compared to calorie restriction alone, but does **increase lean muscle and produce beneficial metabolic changes**
- Even in absence of weight loss, **exercise** has many cardiovascular and metabolic benefits, including **decrease in BP, harmful lipids and insulin resistance**

Thank you!!