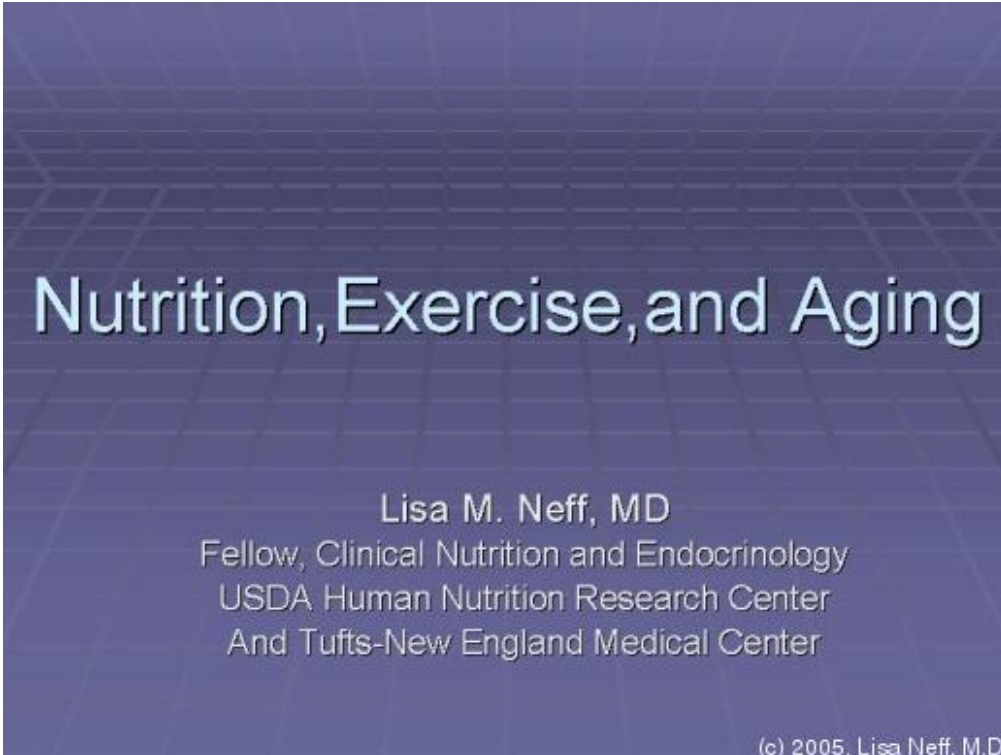


1. Nutrition, Exercise, and Aging

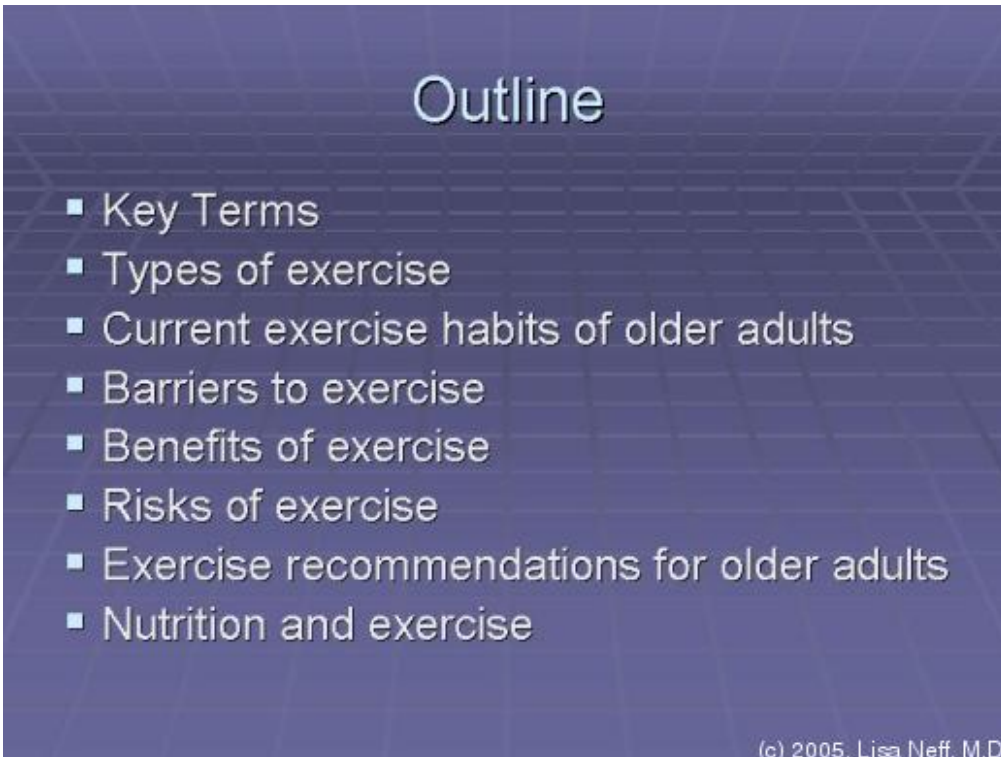


Nutrition, Exercise, and Aging

Lisa M. Neff, MD  
Fellow, Clinical Nutrition and Endocrinology  
USDA Human Nutrition Research Center  
And Tufts-New England Medical Center

(c) 2005, Lisa Neff, M.D.

2. Outline




Outline

- Key Terms
- Types of exercise
- Current exercise habits of older adults
- Barriers to exercise
- Benefits of exercise
- Risks of exercise
- Exercise recommendations for older adults
- Nutrition and exercise

(c) 2005, Lisa Neff, M.D.

3.

### Key Terms



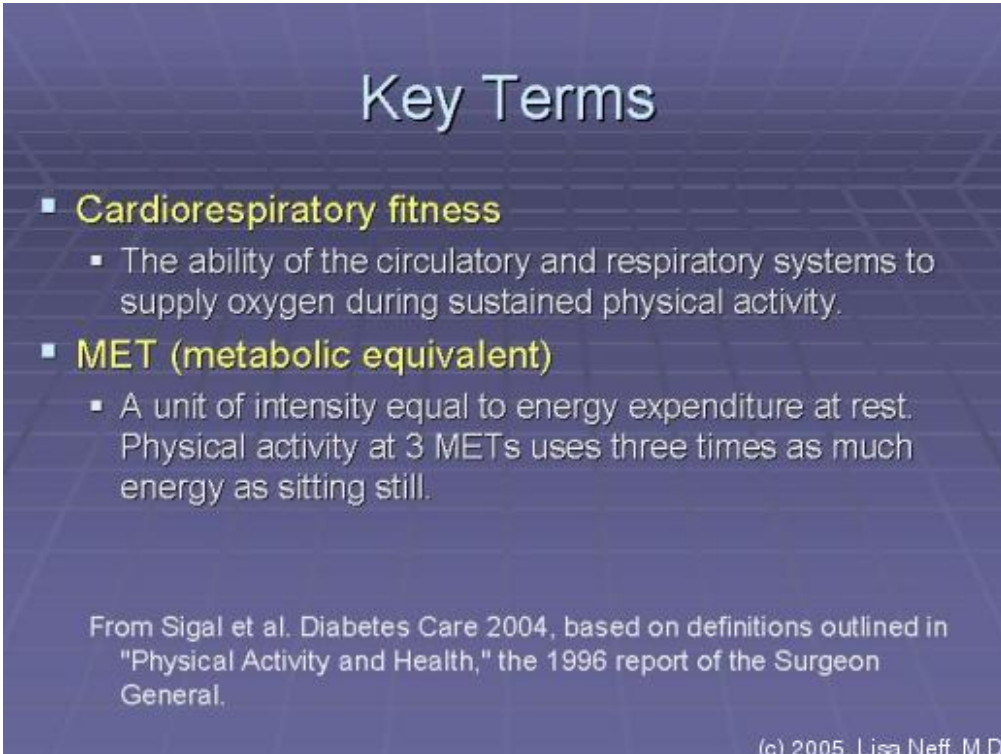
## Key Terms

- **Physical activity:** any bodily movement produced by skeletal muscles that results in energy expenditure
- **Exercise:** a type of physical activity that is planned and structured; done to improve or maintain physical fitness
- **Physical Fitness:** a set of attributes that includes cardiorespiratory endurance, muscle strength and endurance, flexibility, body composition, balance, agility, power, reaction time, speed and coordination

(c) 2005, Lisa Neff, M.D.

4.

### Key Terms



## Key Terms

- **Cardiorespiratory fitness**
  - The ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity.
- **MET (metabolic equivalent)**
  - A unit of intensity equal to energy expenditure at rest. Physical activity at 3 METs uses three times as much energy as sitting still.

From Sigal et al. Diabetes Care 2004, based on definitions outlined in "Physical Activity and Health," the 1996 report of the Surgeon General.

(c) 2005, Lisa Neff, M.D.

## 5. Types of Exercise

### Types of Exercise

- **Aerobic exercise**
  - Consists of rhythmic, repeated, and continuous movements of the same large muscle groups for at least 10 min at a time. Examples include walking, bicycling, jogging, continuous swimming, water aerobics, and many sports.
- **Resistance exercise (strength training)**
  - Activities that use muscular strength to move a weight or work against a resistive load. Examples include weight lifting and exercises using weight machines.
- **Flexibility training**
  - This is exercise (typically stretching) aimed at increasing or maintaining range of motion at joints.

(c) 2005, Lisa Neff, M.D.

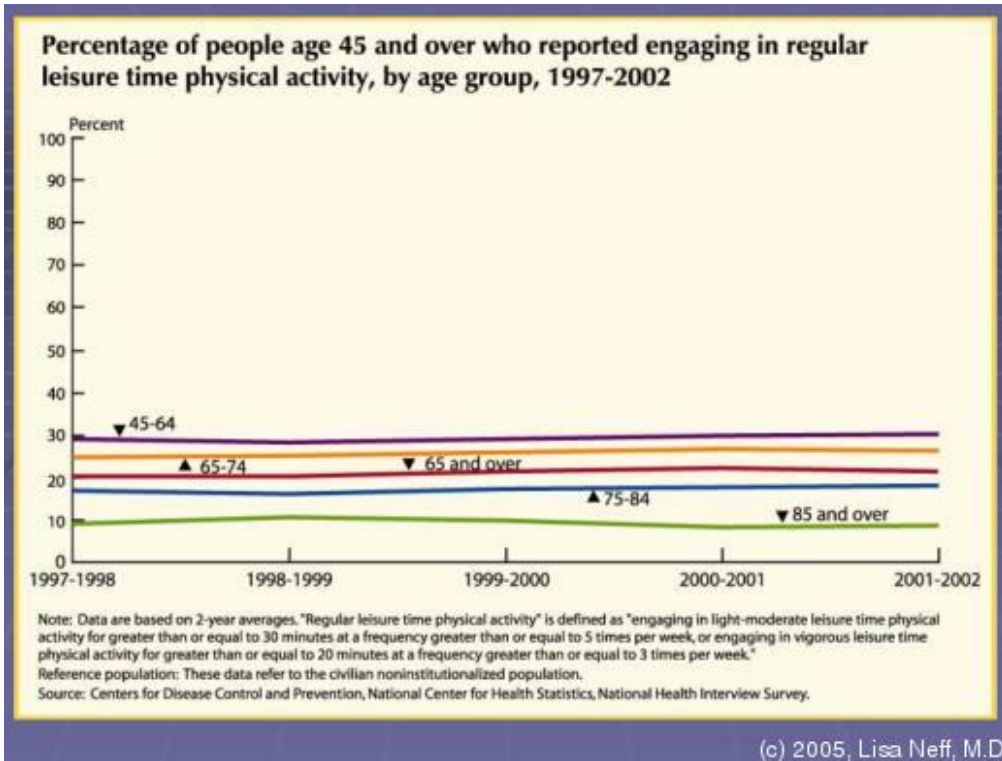
## 6. Current Exercise Habits of Older Americans

### Current Exercise Habits of Older Americans

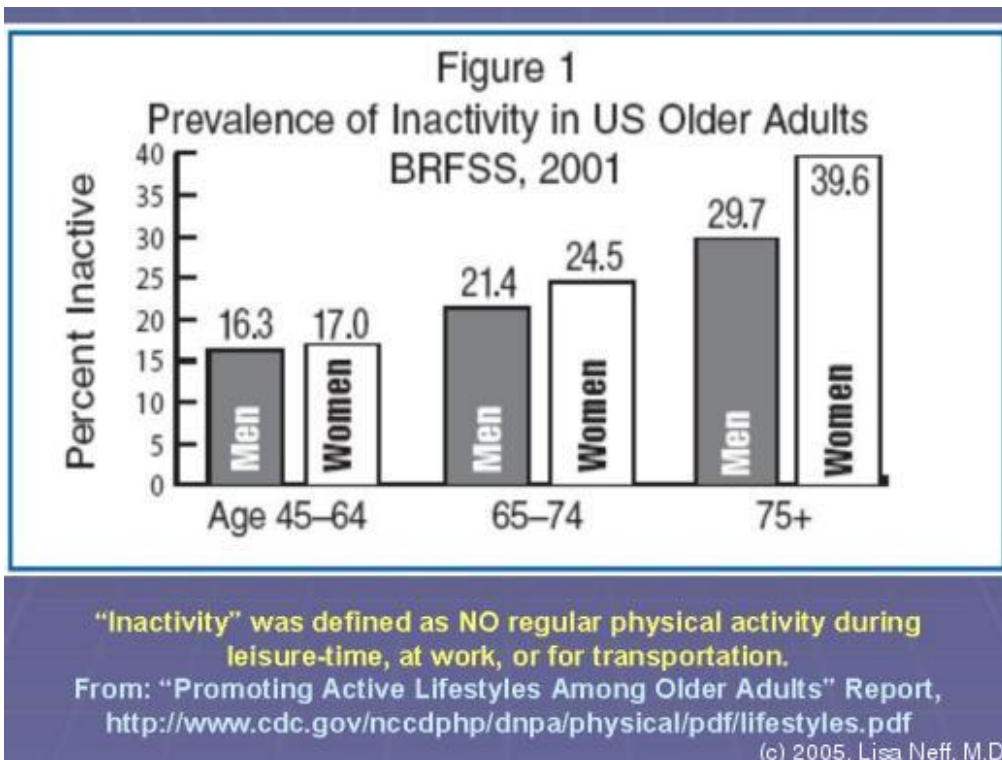
- Image removed due to copyright restrictions.

(c) 2005, Lisa Neff, M.D.

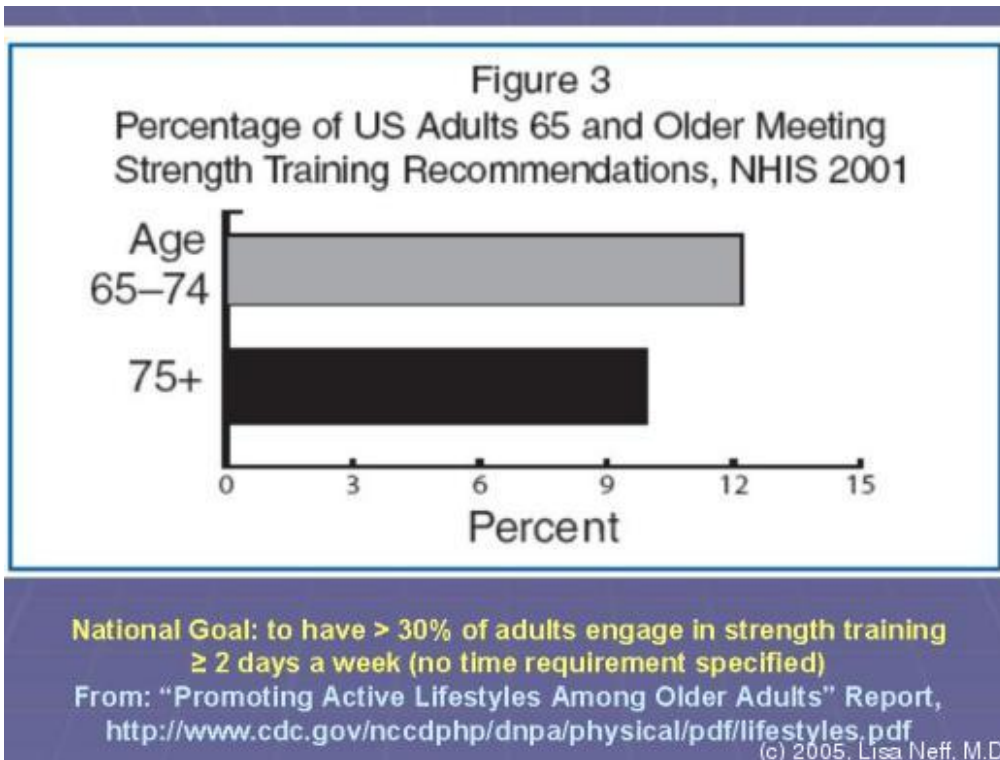
7. Nutrition and Exercise: Slide 7



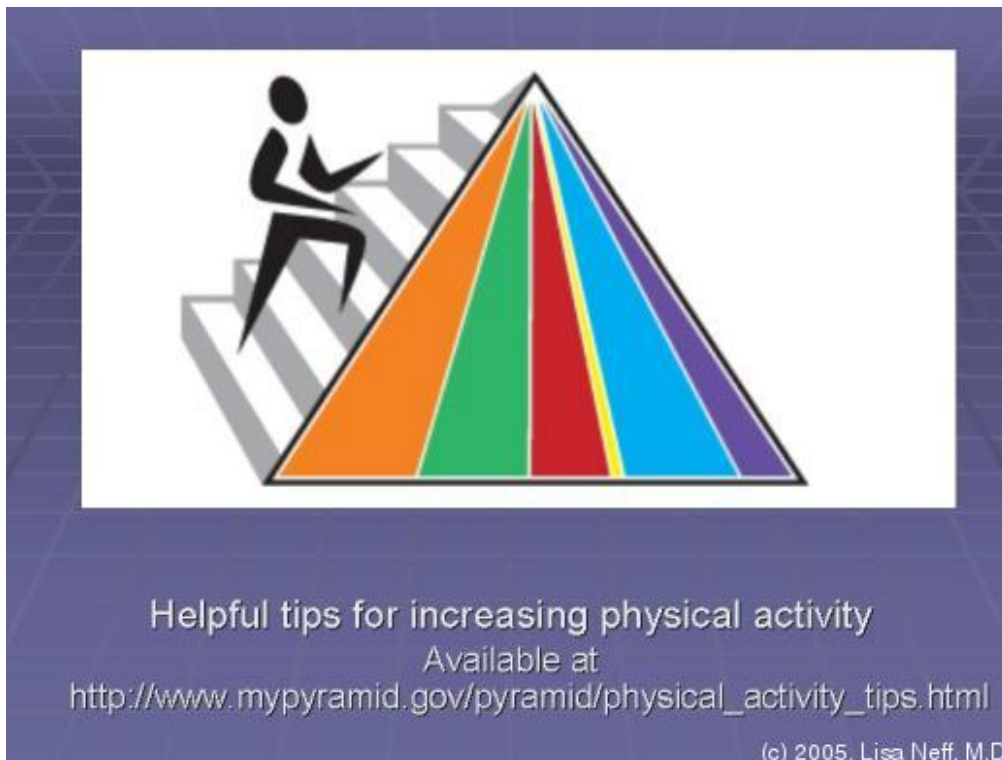
8. Inactivity



9. National Strength Training Goal



10. Nutrition and Exercise: Slide 10



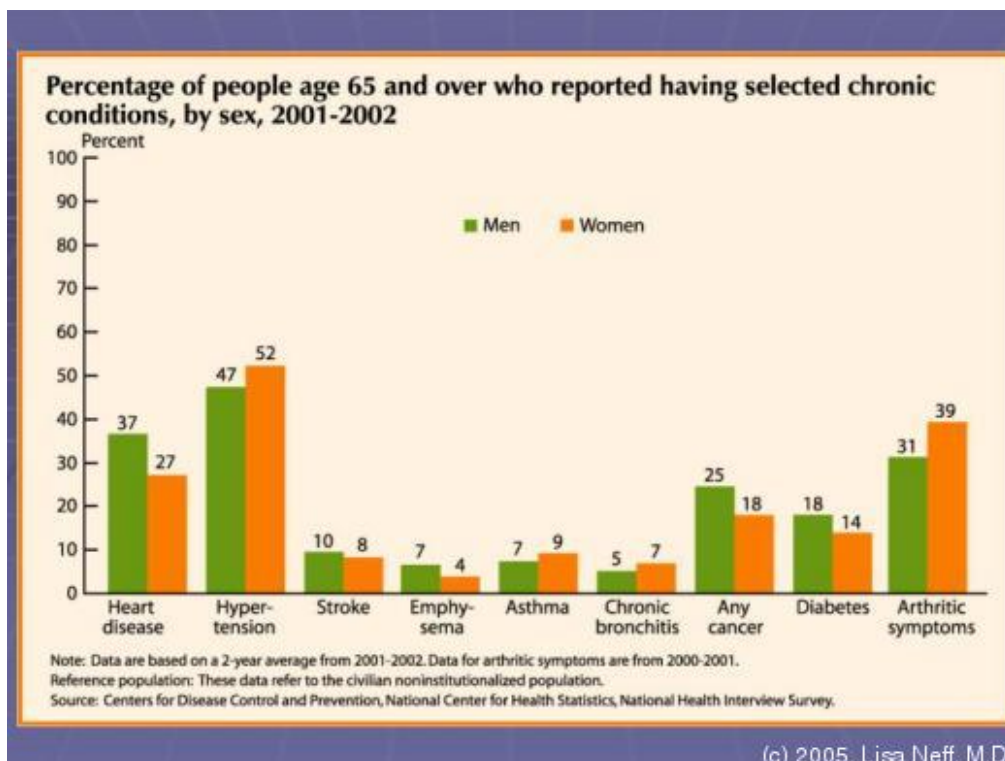
11. Barriers to Exercise(Perceived and Real)

## Barriers to Exercise (Perceived and Real)

- Time limitations
- Financial limitations
- Limited access to exercise facilities/other environmental factors
- Disease or disability
- Lack of knowledge about benefits of exercise
- Concern about risks of exercise / fear of injury
  - "I'm too old/sick to exercise"
- Habit

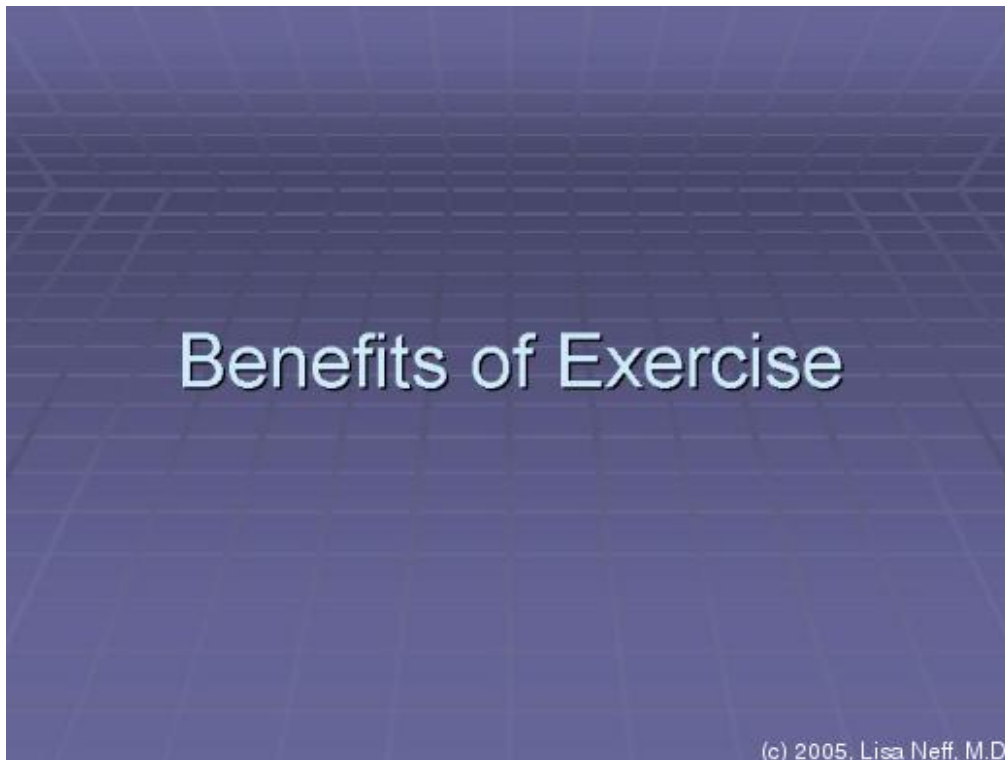
(c) 2005, Lisa Neff, M.D.

12. Nutrition and Exercise: Slide 12



13.

## Benefits of Exercise



14.

## Benefits of Aerobic Training

### Benefits of Aerobic Training

- **Cardiovascular Disease**
  - Aerobic exercise is associated with **decreased mortality and improved functional status** in patients with CVD and even those with stable heart failure (Smart & Marwick, Am J Med, 2004)
  - **Improves walking ability and functional status** in patients with CVD (Stewart et al, NEJM 2002)
- **Blood Pressure**
  - Chronically, aerobic exercise **reduces blood pressure** by 2-8 mmHg\* (Pescatello et al, J Med Sci Sports Exerc 2004)  
*\*can raise BP acutely*
- **Diabetes & Prediabetes**
  - Aerobic exercise **improves cardiorespiratory fitness, glycemic control, and insulin sensitivity**. Physically active diabetics have a **lower risk of mortality**. (Reviewed in Sigal et al, Diabetes Care 2004)

(c) 2005, Lisa Neff, M.D.

15. Benefits of Aerobic Training

## Benefits of Aerobic Training

- **Cancer**
  - Aerobic exercise **decreases symptoms** (such as nausea and depression) **and improves quality of life and cardiorespiratory fitness** in patients with cancer (Galvao, J Clin Oncol, 2005)
- **Arthritis**
  - 3 out of 4 RCTs show walking **reduces knee pain** due to arthritis (Roddy et al, Rheumatology 2004)
- **Bone Health**
  - Aerobic exercise **increases bone mineral density** (Bonaiuti et al, Cochrane Database)

(c) 2005, Lisa Neff, M.D.

16. Benefits of Aerobic Training

## Benefits of Aerobic Training

- **Insomnia/Disordered Sleep**
  - Aerobic exercise **improves sleep latency, duration, and quality** (Singh et al. Sleep 1997)
- **Cognitive Function**
  - Regular exercise is associated with a **reduced risk of cognitive impairment, dementia, and Alzheimer's Disease** (Laurin, Arch Neurol, 2001)
- **Mood**
  - Aerobic exercise *may* be as effective as some antidepressants in **reducing symptoms of major depression**, although additional RCTs need to be done (Blumenthal et al., Arch Int Med 1999)

(c) 2005, Lisa Neff, M.D.

17.

## Benefits of Aerobic Training

**Benefits of Aerobic Training**

- **Weight Maintenance**
  - After a single bout of aerobic exercise, **resting energy expenditure (REE) remains elevated for up to 48 hours** (~5-7% increase) (Jamurtas, Eur J Applied Physiol, 2004)
  - Without dietary changes, regular aerobic exercise usually results in **only modest weight loss**.
  - When added to a reduced-calorie diet program, aerobic exercise **increases fat loss**.
  - Exercise improves the odds of **maintaining weight loss** over time.  
(Miller, Int J Obes Relat Metab Disord, 1997)

(c) 2005, Lisa Neff, M.D.

18.

## Overweight and Obesity in Older Americans

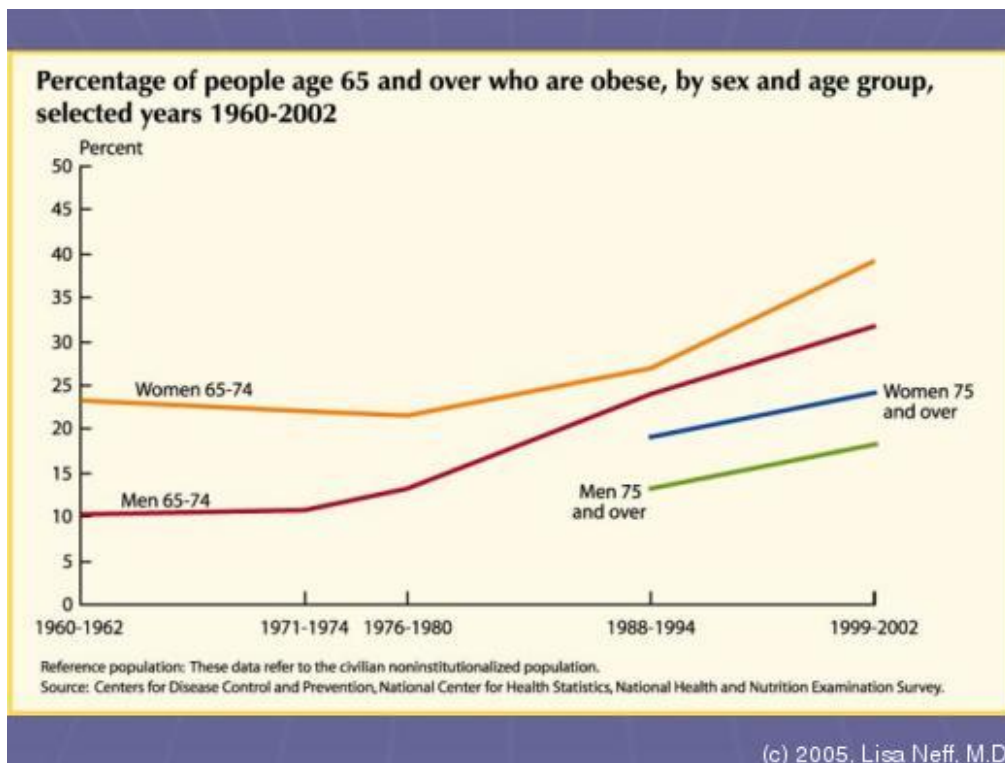
**Overweight and Obesity in Older Americans, Ages 65-74 yrs**

- **In 1960-1962:**
  - 18% of American adults ages 65-74 were obese
  - 55% were overweight
- **In 1999-2002:**
  - 73% were overweight or obese
  - 36% were obese.

From *Older Americans 2004: Key Indicators of Well-Being*  
(<http://www.agingstats.gov/chartbook2004/healthrisks.html>)

(c) 2005, Lisa Neff, M.D.

19. Nutrition and Exercise: Slide 19



20. Benefits of Resistance Training

## Benefits of Resistance Training

- **Sarcopenia**
  - Resistance training increases muscle strength and size, gait speed and stair-climbing power, even in frail institutionalized elderly > 90 yrs old. (Fiatarone, JAMA, 1990)
- **Arthritis**
  - In 16 out of 17 RCTs, RT decreased knee pain due to arthritis. In a study at Tufts, knee pain decreased by 43% (comparable to meds) and disability decreased (reviewed in Roddy et al, Rheumatology 2004)
- **Bone Health**
  - Resistance training 2 days/wk increased bone density (Nelson, JAMA, 1994)

(c) 2005, Lisa Neff, M.D.

21.

## Benefits of Resistance Training

**Benefits of Resistance Training**

- **Weight Maintenance**
  - A single bout of resistance training can **raise REE by 5-7% for up to 24 hours**. (Jamurtas, Eur J Applied Physiol, 2004)
  - Resistance training may **attenuate the loss of muscle mass that usually occurs with low-calorie diets** (Joseph, Diabetes Care, 2001)
- **Diabetes & Prediabetes**
  - Resistance training can **improve glycemic control and reduce the need for antidiabetic medications** (Castaneda, Diabetes Care, 2002)

(c) 2005, Lisa Neff, M.D.

22.

## Benefits of Resistance Training

**Benefits of Resistance Training**

- **Balance**
  - A combination of resistance training and flexibility training can **reduce the risk of falls** in older patients (Means, Am J Phys Med Rehab, 2005)
- **Depression**
  - Strength training may be as effective as some medications at **reducing symptoms of depression** in older adults (Singh et al. J Gerontol, 1997)

(c) 2005, Lisa Neff, M.D.

23.

## Benefits of Flexibility Training

**Benefits of Flexibility Training**

- When combined with resistance training, flexibility training **improves balance**
- When combined with resistance and/or aerobic exercise, flexibility training can **improve range of motion at joints and may theoretically improve daily functioning**
- *Few RCTs have looked at flexibility training alone; most studies have incorporated resistance training and/or aerobic exercise*

(ACSM Position Stand, Exercise and Physical Activity for Older Adults, 1998)

(c) 2005, Lisa Neff, M.D.

24.

## Risks of Exercise

**Risks of Exercise**

- Some types of exercise carry slightly more risk, such as skiing.

(c) 2005, Lisa Neff, M.D.

25.

## Risks of Exercise



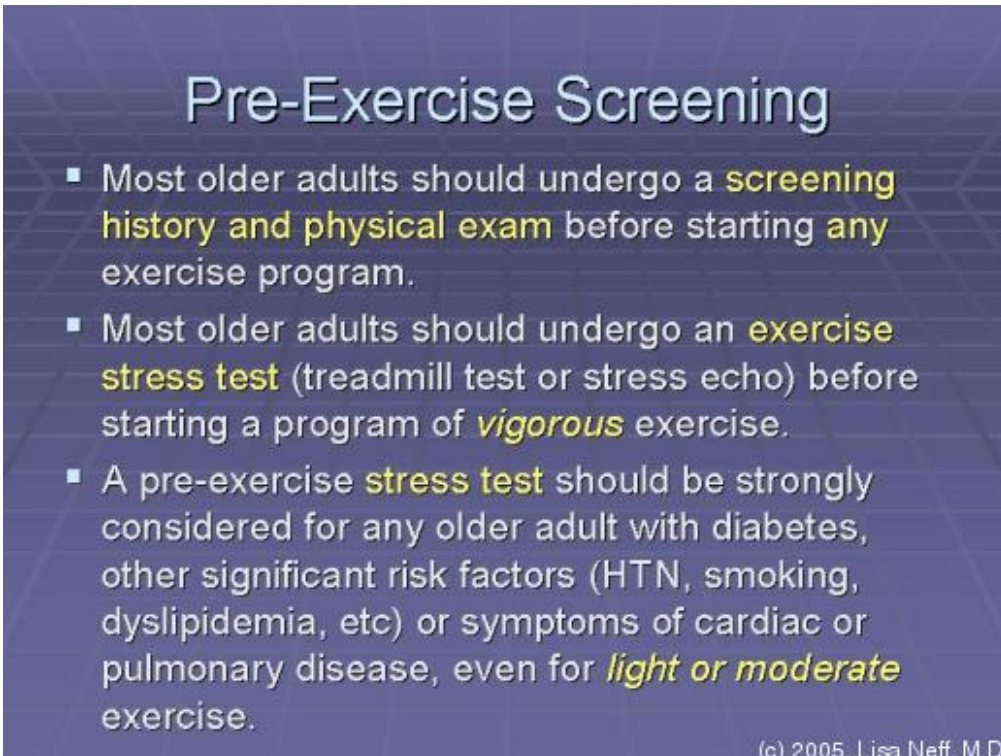
### Risks of Exercise

- **“The biggest risk to exercise is not starting...”** (American College of Sports Medicine)
- Musculoskeletal injuries
- Falls
- Increased blood pressure
- Adverse cardiac events (myocardial ischemia, infarction, cardiac arrhythmia)
- Hypoglycemia in patients on antidiabetic agents like insulin
- Death

(c) 2005, Lisa Neff, M.D.

26.

## Pre-Exercise Screening



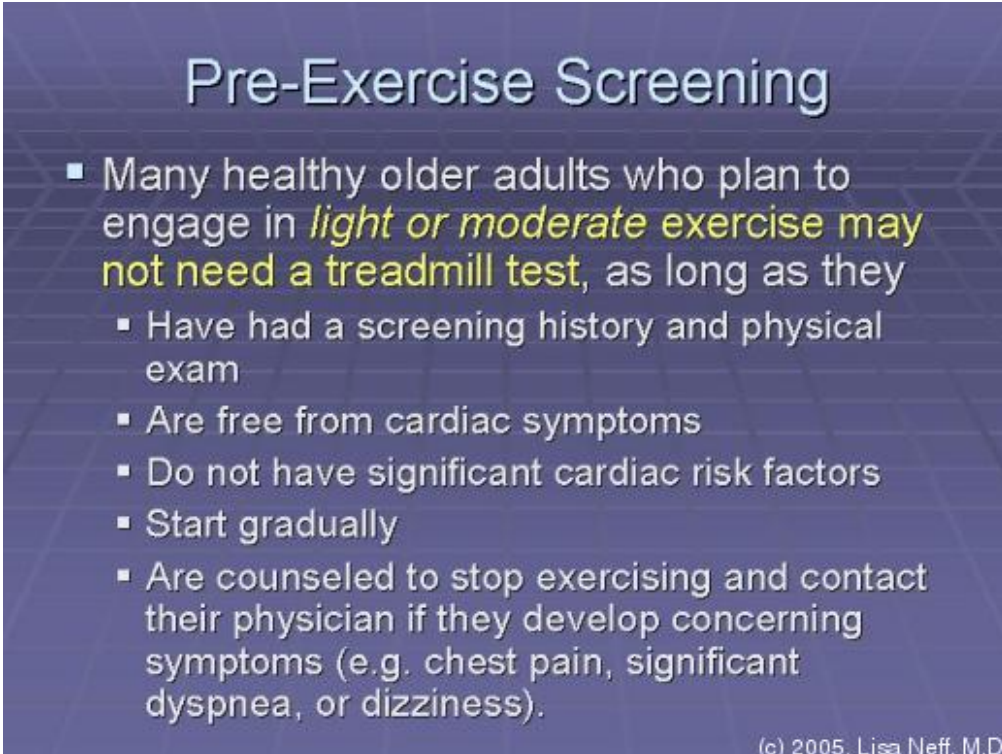
### Pre-Exercise Screening

- Most older adults should undergo a **screening history and physical exam** before starting any exercise program.
- Most older adults should undergo an **exercise stress test** (treadmill test or stress echo) before starting a program of **vigorous** exercise.
- A pre-exercise **stress test** should be strongly considered for any older adult with diabetes, other significant risk factors (HTN, smoking, dyslipidemia, etc) or symptoms of cardiac or pulmonary disease, even for **light or moderate** exercise.

(c) 2005, Lisa Neff, M.D.

27.

## Pre-Exercise Screening



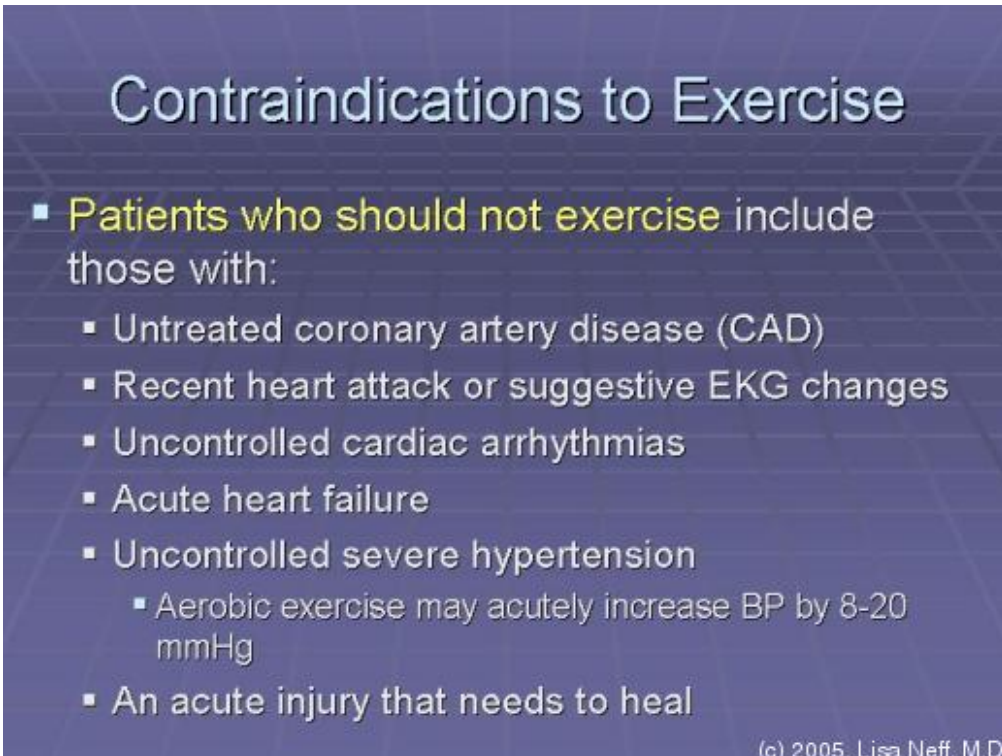
**Pre-Exercise Screening**

- Many healthy older adults who plan to engage in *light or moderate exercise* may **not need a treadmill test**, as long as they
  - Have had a screening history and physical exam
  - Are free from cardiac symptoms
  - Do not have significant cardiac risk factors
  - Start gradually
  - Are counseled to stop exercising and contact their physician if they develop concerning symptoms (e.g. chest pain, significant dyspnea, or dizziness).

(c) 2005, Lisa Neff, M.D.

28.

## Contraindications to Exercise



**Contraindications to Exercise**

- **Patients who should not exercise** include those with:
  - Untreated coronary artery disease (CAD)
  - Recent heart attack or suggestive EKG changes
  - Uncontrolled cardiac arrhythmias
  - Acute heart failure
  - Uncontrolled severe hypertension
    - Aerobic exercise may acutely increase BP by 8-20 mmHg
  - An acute injury that needs to heal

(c) 2005, Lisa Neff, M.D.

29.

## Who Can Exercise?


### Who Can Exercise? Almost Anyone!

- Patients with **arthritis** can exercise safely (may need to avoid high-impact activities).
- Once cleared medically, **patients who can probably exercise safely** (under medical supervision) include those with:
  - Treated, stable **CAD** or stable **heart failure**
    - Exercise should initially be **supervised** by a well-trained physical therapist or exercise physiologist
  - **Diabetes**
  - Exercise-induced **asthma**

(c) 2005, Lisa Neff, M.D.

30.

## Exercise Guidelines for Older Adults



### Exercise Guidelines for Older Adults

(c) 2005, Lisa Neff, M.D.

31. Recommended Levels of Physical Activity


## Recommended Levels of Physical Activity

- **Aerobic exercise**
  - Moderate aerobic activity for a combined total of at least **30 minutes most days of the week**
- **Resistance training**
  - Progressive resistance training for **20-30 minutes, 2 or more days a week**
- **Flexibility training**
  - Stretch major muscle groups and joints for **15-30 minutes at least 3 times a week** (preferably daily)

(c) 2005, Lisa Neff, M.D.

32. Recommendations: Aerobic Exercise

## Recommendations: Aerobic Exercise



(c) 2005, Lisa Neff, M.D.

33. Recommendations: Aerobic Exercise

**Recommendations:  
Aerobic Exercise**

- **Frequency:**
  - **Most days** of the week (at least 3-5 days)
- **Intensity:**
  - **Moderate** (to start, may work up to vigorous)
- **Duration** depends on the goal:
  - **30 minutes a day** to reduce the risk of chronic disease
  - **30-60 minutes a day** to prevent weight gain
  - **60-90 minutes a day** for weight loss and to prevent weight regain

(c) 2005, Lisa Neff, M.D.

34. What is Moderate Exercise?

**What is Moderate Exercise?**

- Burns 3.5-7 kcal/minute
- 3-6 METs
- Talk test: should feel some exertion but will be able to have a brief conversation
- 50-70% of maximal heart rate
  - **Maximal heart rate\* = 220 – age**
    - \* heart rate may not increase in individuals with some medical conditions or those on some common medications (such as beta-blockers)
- Use of the Borg scale (Rating of Perceived Exertion) is sometimes recommended

(c) 2005, Lisa Neff, M.D.

35. What is Moderate Exercise?

**What is Moderate Exercise?**

- **Some Moderate-Intensity Activities:**
  - Walking briskly
  - Golf, pulling or carrying clubs
  - Swimming, recreational
  - Mowing lawn, with a power mower (not riding)
  - Tennis, doubles
  - Bicycling 5 to 9 mph, level terrain, or with a few hills
  - Scrubbing floors, washing windows, house painting (using a brush)

(c) 2005, Lisa Neff, M.D.

36. What is Vigorous Exercise?

**What is Vigorous Exercise?**

- Burns >7 kcal/minute
- >6 METs
- Talk test: should not be able to carry on a conversation
- 70-85% of maximal heart rate
- **Some Vigorous-Intensity Activities:**
  - Racewalking, jogging or running
  - Swimming laps
  - Tennis, singles
  - Bicycling more than 10 mph, or on steep uphill terrain
  - Carrying or pushing furniture

(c) 2005, Lisa Neff, M.D.

37. Recommendations: Resistance Training



38. Recommendations: Resistance Training


## Recommendations: Resistance Training

- **Frequency:**
  - 2-3 days a week. Avoid overtraining (best to have 48 hours between sessions for muscle rest)
- **Intensity:**
  - Should be progressive.
  - Should include all major muscle groups (8-10 exercises).
  - Weight = 60-80% of one repetition maximum
  - Should be able to perform 8-15 repetitions in good form. If you can perform > 15 repetitions without resting, the weight is too light.
- **Duration**
  - 2-3 sets of 8-15 repetitions of 8-10 different exercises
  - Generally, 20-45 minutes per session

(c) 2005, Lisa Neff, M.D.

39. Recommendations: Flexibility Training

## Recommendations: Flexibility Training



(c) 2005, Lisa Neff, M.D.

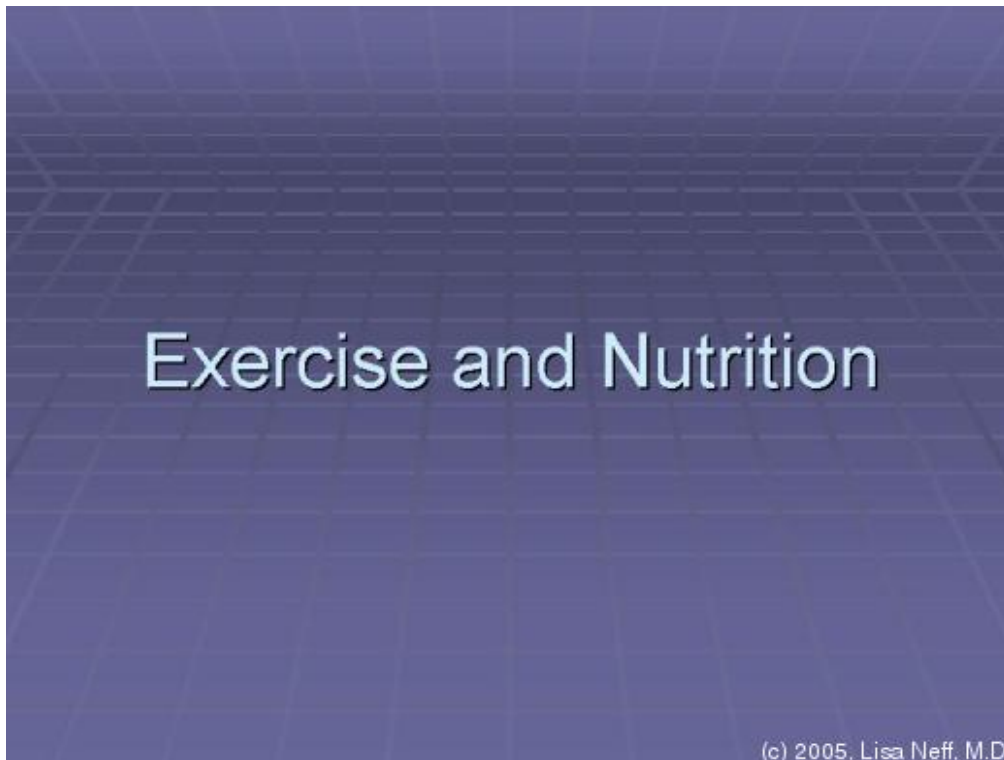
40. Recommendations: Flexibility Training

## Recommendations: Flexibility Training

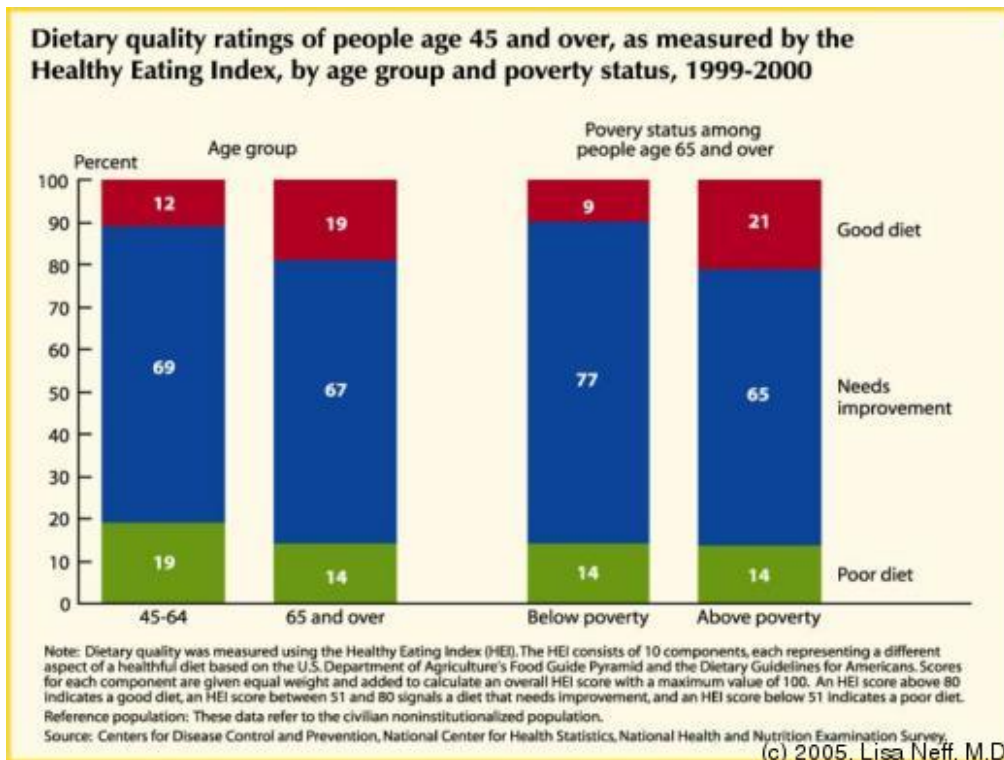
- **Frequency:**
  - At least 3 days a week, and preferably daily
- **Intensity:**
  - Stretch all major muscle groups and joints
  - May cause mild discomfort but should not cause pain
- **Duration:**
  - Hold each stretch for 10-30 seconds per stretch, for 3-5 repetitions
  - Total 15-30 minutes per session
  - Can also be combined with aerobic exercise or resistance exercise, e.g. by doing water aerobics, walking, tai chi, etc.

(c) 2005, Lisa Neff, M.D.

41. Exercise and Nutrition



42. Nutrition and Exercise: Slide 42



43. Effects of Exercise on Nutritional Requirements

### Effects of Exercise on Nutritional Requirements

- Exercise increases **energy expenditure and fluid requirements**
- **Carbohydrates** help maintain normal blood glucose levels during exercise
  - Athletes should consume a **minimum of 6 g CHO/kg/day**
- Athletes (old or young) need more **protein (1.2-1.4 g/kg/day)** than the current RDA (0.8 g/kg/day), *but most Americans already eat that much protein anyway.*  
(ACSN/ADA Position Statement, 2000)

(c) 2005, Lisa Neff, M.D.

44. Effects of Exercise on Nutritional Requirements

### Effects of Exercise on Nutritional Requirements

- **Micronutrient** needs may theoretically be somewhat higher in athletes
  - **Thiamin, riboflavin, B6, niacin, pantothenic acid and biotin** are involved in energy production during exercise
  - **Folate and B12** are required for production of RBCs and tissue repair
  - **Anemia** can impair athletic performance, so active adults should consume adequate **folate and B12** (and **iron**, although iron deficiency is rarely a nutritional issue in older adults and *is more likely to occur due to gastrointestinal blood loss*)
  - Most athletes will not develop deficiencies if they consume a varied diet containing the RDA for vitamins/minerals
  - Low-calorie, restrictive diets increase the risk of vitamin and mineral deficiencies.  
(ACSN/ADA Position Statement, 2000)

(c) 2005, Lisa Neff, M.D.

45.

## Summary


### Summary

- There are 3 main exercise modalities: aerobic exercise, resistance training, and flexibility training
- Regular exercise reduces the risk of many chronic diseases.
- Exercise has many beneficial effects on cardiovascular health, metabolism, body weight, bone and joint health, mental health, etc.
- The benefits of exercise usually outweigh the risks, even in the frailest elderly.

(c) 2005, Lisa Neff, M.D.

46.

"No one is too old..."



“No one is too old to enjoy the benefits of regular physical activity.”

-- US Surgeon General, 1996

(c) 2005, Lisa Neff, M.D.