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UMDNJ-New Jersey Medical School
UMDNJ-School of Public Health
Piscataway, NJ, November 30, 2011
10:30 am – 12:00 noon

May 10, 2011 Lecture Outline

1) Public health nutrition theory, concepts, & methods
2) Public health nutrition guidelines: Dietary Reference Intakes, 2010 Dietary Guidelines for Americans & Advisory Committee Report, Food Pyramids, Daily Values
3) Four public health nutrition challenges

CONCEPTS & CHALLENGES EMPHASIZED

Today’s Learning Objectives

Participants will be able to:
• Apply public health nutrition guidelines to specific problems & cases
• Discuss 4 current challenges & controversies in public health nutrition
Lecture Outline

1) Review of the Dietary Reference Intakes (DRIs)
2) 4 Challenges/Controversies:
   a) the new DRIs for vitamin D
   b) food fortification & supplements: risks & benefits
   c) copper deficiency from a consumer product
   d) obesity

1) REVIEW OF THE DIETARY REFERENCE INTAKES

DIETARY REFERENCE INTAKES

Quantitative estimates of nutrient intakes to be used for planning and assessing diets for apparently healthy people.
**Dietary Reference Intakes 1**

EAR - Estimated Average Requirement  
RDA - Recommended Dietary Allowance  
AI - Adequate Intake  
UL - Tolerable Upper Intake Level

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**Dietary Reference Intakes 2**

EAR: Amount of nutrient that meets requirements of 50% of healthy age/gender group  
RDA: RDA = EAR + 2 SD (EAR)  
RDA = 1.2 x EAR  
Meets requirements of 97-98%  
Goal for individual intakes  
Aim for this intake

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**Dietary Reference Intakes 3**

AI: Set instead of RDA if sufficient evidence not available to calculate RDA  
Goal for individual nutrient intakes  
Aim for this intake  
UL: Highest daily nutrient intake likely to pose no risks to almost all individuals.
Four Challenges/Controversies

# 1: The New DRIs for Vitamin D

Factors that Affect Vitamin D Nutriture

- Vitamin D in few foods, low in breast milk
- Age & skin pigmentation
- Sunlight exposure & intensity
- Weather & season of year
- Latitude & altitude
- Clothing/hats & sunscreen use
- Lactose intolerance
- Cystic fibrosis & other fat malabsorption diseases
Newark WIC Children-2002

<table>
<thead>
<tr>
<th>AGE</th>
<th>HISPANIC</th>
<th>AFRICAN-AMER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>1-3</td>
<td>29</td>
<td>20.6</td>
</tr>
<tr>
<td>4-8</td>
<td>22</td>
<td>15.6</td>
</tr>
<tr>
<td>ALL</td>
<td>51</td>
<td>36.2</td>
</tr>
</tbody>
</table>

2002 Mean Monthly Temperatures for Newark, NJ
Vitamin D Deficiency In Newark WIC Children

<table>
<thead>
<tr>
<th></th>
<th>AGE 1-3</th>
<th>AGE 4-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>78</td>
<td>63</td>
</tr>
<tr>
<td>% Low/Winter</td>
<td>5.1%</td>
<td>12.7%</td>
</tr>
<tr>
<td>% Low/Summer</td>
<td>1.3%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Low = serum 25 OH-D < 40 nmole/L (16 mcg/L)
Data from 2002 blood samples

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**Percentage of Children with Serum Concentrations of 25 hydroxy Vitamin D < 40.0 nmol/L**

- **Dec thru Mar**:
  - African-American: 8%
  - Hispanic: 4%
- **Jul thru Sep**:
  - African-American: 10%
  - Hispanic: 6%

**Percentage of Children with Serum Concentrations of 25 hydroxy Vitamin D < 80.0 nmol/L**

- **Dec thru Mar**:
  - African-American: 25%
  - Hispanic: 20%
- **Jul thru Sep**:
  - African-American: 15%
  - Hispanic: 10%
Setting the DRIs: General Challenges

- Isolating effects of a single nutrient
- Confounding effects of other nutrients & factors
- Multi-factorial etiology of many diseases
- Limited data from randomized-controlled trials

Setting the 2010 Vitamin D DRIs: Specific Challenges:

- Most clinical trials give vitamin D & Ca
- Lack of dose/response studies
- Sun exposure highly variable
- Skin pigmentation & sunscreen use
- Vitamin D endocrine system
- Uncertain cut-off for serum 25 OH-D
- Supplements widely prescribed by MDs
- Divergent opinion about risks & benefits

2010 Vitamin D DRIs

- Target criteria for EAR & RDA is promoting bone growth/maintenance
- Little evidence of other health benefits
- Set 20 mcg/L as cut-point for serum 25-hydroxy-vitamin D concentration
- Assumed minimal sun exposure
1997 vs. 2010 VITAMIN D DRIs

<table>
<thead>
<tr>
<th>AGE</th>
<th>1997 AI</th>
<th>2010 RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-50</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>51-70</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>&gt;70</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

Units are mcg/day; 1.0 mcg = 40 IU
Vitamin D DRIs were updated on 11/30/2010

2010 Vitamin D DRIs

- No benefits for serum 25-OH-D > 30 mcg/L; toxicity if > 50 mcg/L
- Overestimate of deficiency in USA from use of cut-points > 20 mcg/L by labs such as LabCorp (32 mcg/L)
- Mean USA serum 25-OH-D above 20 mcg/L, but intakes below RDAs

Challenge # 1

Setting the DRIs for some nutrients, such as vitamin D, is difficult and may be controversial.
Four Challenges/Controversies

# 2: Food Fortification & Dietary Supplements: Risks & Benefits

Food Fortification Guidelines

- Intake low in significant % of population
- Food consumed in significant quantities
- Nutrient imbalances do not occur
- Added nutrient stable in food as used
- Nutrient bioavailable from food item
- Reasonable insurance against excess intake


Challenge # 2

Food fortification has benefits & risks: Examples of iron & iodine
Iron Deficiency & Toxicity

- Deficiency
- Hereditary hemochromatosis

Prevalence of Iron Deficiency & Iron Deficiency Anemia in USA

<table>
<thead>
<tr>
<th>AGE/SEX</th>
<th>% DEFICIENT</th>
<th>% IDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 B</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>3-5 B</td>
<td>3%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>16-49 F</td>
<td>11%</td>
<td>3-5%</td>
</tr>
<tr>
<td>50-69 F</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>16-49 M</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>50-69 M</td>
<td>2%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: 1988-1994 NHANES III
**Iron Status of Elderly**

- 1016 subjects aged 67-96
- 14% of men had high iron stores with serum ferritin >300 mcg/L
- 12% of women had high iron stores: serum ferritin >200 mcg/L
- 3.3% had depleted Fe stores with serum ferritin < 12 mcg/L


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**Hemochromatosis**

- 1 in 10 NHW carriers of C282Y gene, 1 in 330 homozygotes
- Excess GI Fe absorption
- Men>women, age >35
- Signs: lethargy, abdominal pain
- Labs: high serum ferritin, >60% transferrin saturation, high liver Fe
- Liver cirrhosis/carcinoma, diabetes, cardiomyopathy, hypothyroidism

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**Iron Fortification of Foods in the United States**

- Good for young children, teenage girls, fertile and pregnant women
- Risks probably exceed benefits for most men & older people
- May increase rate of progression of hemochromatosis
- Iron supplements can be highly toxic
High Doses Of Iron

- UL: 40-45 mg/day
- to correct iron-deficiency anemia
- Symptomatic toxicity: 20-60 mg/kg
- FDA required warning ≥ 30 mg/dose: “Accidental overdose of iron-containing products (supplements) is a leading cause of fatal poisoning in children under 6”.

Global Impact of Iodine Deficiency

- 2.0 billion deficient
- 750 million with goiter
- 50 million mentally handicapped
- 100,000 cretinism births per year
- Loss of 10-15 IQ points in global population

Prevalence of micronutrient deficiencies in developing countries
Iodine & Cretinism

Diet Iodine in USA

- Urine I 55% lower since early 1970s
- % women age 15-44 years with moderate/severe deficiency (<50 µ = 17%
- About 50% of pregnant women < 150 µ urine iodine (WHO value): RDA = 220 µg/day
- Primary causes: “eating out” + less iodized salt use by food industry + lower dairy foods consumption

Iodine Deficiency and Goiter

2010 DGA Sodium Guideline

• Na intake reduced to <2300 mg/day to reduce risk of CVD; <1500 mg/day if AA, age 51+, hypertension, diabetes, or CKD
• May further decrease iodine intakes
Thyroid Disease in China after Salt Iodination in 1996

<table>
<thead>
<tr>
<th>INTAKE:</th>
<th>LOW</th>
<th>&gt;ADEQUATE</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subclinical</td>
<td>0.2%</td>
<td>2.6%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Hypo- Thyroidism</td>
<td>0.2%</td>
<td>0.5%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Autoimmune</td>
<td>0.2%</td>
<td>1.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data are incidence of new cases 1999-2004, n = 3018
Intake estimated from urinary iodine excretion:
Medians: LOW = 84, >ADEQUATE = 242, HIGH = 651 mcg/L

Iodine & Thyroid Cancer Risk

• Dietary I deficiency and goiter “probably” increase risk (follicular cancer)
• Dietary I excess “possibly” increases risk (papillary cancer)

AICR Reports: 1997 & 2007

Concept : Food Fortification

• Food fortification may benefit some members of a population, but provide no benefit or even adversely affect others in the population
Multivitamin/Mineral Supplements: 2010 DGAs

- Daily multivitamin/mineral supplement provides no health benefits to healthy Americans
- Individual nutrient supplements can benefit some subgroups (Ca, Fe, Vit D, Vit B₁₂)
- Supplements can have harmful effects and should be used “cautiously”: Zn, Vit E, Vit A, beta-carotene, etc.

Finland Study - ATBC
Randomized double-blind primary prevention trial
29,133 Finnish male smokers age 50-69
50 mg vitamin E, 20 mg β-carotene, both, placebo: 5-8 yr
β-Carotene: 8% increase in total mortality & 18% increase in lung cancer incidence
Vitamin E: reduced incidence of prostate cancer but more deaths from hemorrhagic stroke

SELECT Trial Plan
- Selenium & vitamin E prostate cancer prevention trial
- 32,400 men age 50+ (AA), 55+(white)
- 400 sites in USA, Canada
- 400 mg α-tocopherol, 200 mcg Se, both, or placebo
- 7-12 year follow-up (2001-2013)
SELECT Trial Update

- October 28, 2008: subjects told to stop taking supplements but continue study site visits
- Vit E/Se do not prevent prostate cancer
- Vit E may increase prostate cancer risk (RR = 1.13, p=0.06) & Se may increase diabetes risk (RR = 1.07, p=0.16)


Supplements & Mortality: Iowa WHS

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Adj HR v Non-Use</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamins</td>
<td>1.06</td>
<td>1.02-1.10</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>1.15</td>
<td>1.00-1.32</td>
</tr>
<tr>
<td>Copper</td>
<td>1.45</td>
<td>1.20-1.75</td>
</tr>
<tr>
<td>Iron</td>
<td>1.10</td>
<td>1.03-1.17</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.91</td>
<td>0.88-0.94</td>
</tr>
</tbody>
</table>

N = 38,700, 18 year follow-up with 15,600 deaths
Arch Intern Med 171: 1625-1633, 2011

Challenge # 2

Preventing deficiency and disease by use of food fortification & dietary supplements has risks as well as benefits.
Four Challenges/Controversies

# 3: Copper Deficiency from a Widely-Used Consumer Product

Worldwide Epidemiology of Trace Mineral Deficiencies

<table>
<thead>
<tr>
<th>Element</th>
<th>Population deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>3 billion+</td>
</tr>
<tr>
<td>Iodine</td>
<td>2 billion</td>
</tr>
<tr>
<td>Zinc</td>
<td>500 million +</td>
</tr>
<tr>
<td>Fluoride, selenium</td>
<td>substantial</td>
</tr>
<tr>
<td>Copper, chromium, manganese, molybdenum</td>
<td>unknown but likely low</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3-4 Billion +</td>
</tr>
</tbody>
</table>

Copper Deficiency

- Relatively uncommon?
- Labs: microcytic anemia, neutropenia, leukopenia, low serum Cu & ceruloplasmin
- Signs/Symptoms: anemia-related, myelopathy & neuropathy
Unexplained Anemia & Neutropenia

- Age 17 Texas male with fatigue, acne, headaches
- Anemia, neutropenia, leukopenia
- Serum folate & B₁₂ normal
- Fainting: brain MRI & EEG normal
- Serum copper = 10 mcg/dl (70-155)
- Serum cerulo. = 2 mg/dl (25-49)


Zinc-induced Anemia & Neutropenia

- 2 years high dose (≤ 300 mg/day Zn) for acne, UL = 34 mg/day
- Serum Zn = 199 mcg/dl (60-130)
- Clinically well 17 months after stopping zinc supplements w/o Cu supplements
- Labs at 17 months:
  - serum Cu = 66 (70-155), serum Zn = 71 (60-130), serum ceruloplasmin = 20 (25-49)


Grand Rounds Case: Myelopathy & Peripheral Neuropathy

- 60 yo F/neutropenia & normocytic anemia
- Serum B₁₂ slightly low
- Hx: partial gastrectomy 8 yr ago
- Hx: 30 mg zinc daily as supplement (UL = 40 mg/day)
- "Stocking-glove" paresthesias/numbness
- Abnormal gait
- Spine MRI: myelopathy

St Joseph Regional Medical Center, South Bend, November 15, 2006
**Myelopathy & Neuropathy of Copper Deficiency**

- Very low serum copper & ceruloplasmin
- Copper supplements corrected anemia & neutropenia
- Neurologic abnormalities persist
- Similar cases seen at Mayo Clinic
- Causes: GI disease or GI surgery, excess supplemental Zn, unknown
- May be co-existing vitamin B<sub>12</sub> deficiency


**Cause(s) of this Patient’s Severe Copper Deficiency?**

- Hx of gastric surgery
- Ingestion of below UL dose of Zn from supplements?
- Other causes

**Consumer and Dentist Public Health Advisories**

- Released by GlaxoSmithKline on 2/18/10
- Contain warnings about zinc content of “Poligrip” denture adhesives
- Ingestion can result in intakes well above zinc adult UL of 40 mg/day
- Discuss neurologic symptoms and provide directions to avoid use of excessive amounts
Outcomes of Severe Copper Deficiency in Adults

- Most have polyneuropathy and correctable pancytopenia
- Functional outcomes range from mild to walker/wheelchair dependent
- One reported case of blindness from optic nerve pathology
- Neurologic deficits sometimes improve with copper supplementation

P Hedera et al., NeuroToxicol, 30:996-999, 2009

Causes of Severe Copper Deficiency

- Malabsorption diseases
- By-pass & other gastric surgery
- High-dose Zn supplement use
- Other consumer products with high Zn levels: some denture creams, ingested post-1982 pennies, zinc lozenges
- Unknown

Challenge # 3

Common consumer products may cause unexpected nutritional risks.
Four Challenges/Controversies

# 4: Overweight & Obesity

<table>
<thead>
<tr>
<th>Classification</th>
<th>Principal cut-off points (BMI)</th>
<th>Additional cut-off points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Severe thinness</td>
<td>16.00–16.99</td>
<td>16.00–16.99</td>
</tr>
<tr>
<td>Moderate thinness</td>
<td>17.00–18.99</td>
<td>17.00–18.99</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.50–24.99</td>
<td>18.50–24.99</td>
</tr>
<tr>
<td>Overweight</td>
<td>≥25.00</td>
<td>≥25.00</td>
</tr>
<tr>
<td>Obese class I</td>
<td>≥30.00</td>
<td>≥30.00</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.00–39.99</td>
<td>35.00–39.99</td>
</tr>
<tr>
<td>Obese class III</td>
<td>≥40.00</td>
<td>≥40.00</td>
</tr>
</tbody>
</table>

Table 6.1.1: The international classification of adult underweight, overweight, and obesity

A body mass index (BMI) of between 18.5 and 24.9 is generally regarded as 'acceptable' or 'normal'. The 'underweight' or 'thin' range is a BMI of below 18.5; above 25, the common gradings for overweight and obesity are as shown above.

What Are Some Of The Advantages Of Obesity?
Advantages Of Obesity

Better able to survive famine (perfect survivor)
Can be an offensive lineman in NFL
Float better (distance swimmers)
Easier to stay warm
Greater bone mass & BMD

Disadvantages Of Obesity

Obesity a risk factor for:
- Heart disease
- Several cancers
- Diabetes (diabetes)
- Osteoarthritis
- Social concerns

USA BMI/Mortality Study

- 10-yr prospective study: n=527,000 with 61,000 deaths
- Mortality of never-smokers higher by 100-200% if obese & 20-40% if overweight based on age 50 BMI

New USA BMI/Mortality Study

- Pooled data from 19 prospective studies of 1.46 M white adults age 19-84 years
- Median follow-up of 10 yr, range 5-28 yr
- 160,000 deaths
- Used BMI = 22.5—24.9 as reference

A B de Gonzalez: NEJM 363:2211-2219, December 2, 2010
Korean BMI/Mortality Study

- 12-yr prospective study/n=1,200,000 age 30-95 with 82,000 deaths
- J-shaped association: risk of death lowest for BMI= 23.0-24.9
- BMI-related mortality declined with age


Food, nutrition, physical activity and the prevention of cancer: A global perspective, 2nd Ed. AICR, 2007

Body Fatness

- Mechanisms
  - inflammatory response
  - Increased circulating insulin, IGF and estrogen
  - Decreased insulin sensitivity
### Body Fatness, and the Risk of Cancer

In the judgement of the Task Force, the factors listed below modify the risk of cancer. Judgements are graded according to the strength of the evidence.

<table>
<thead>
<tr>
<th>DECREASES RISK</th>
<th>INCREASES RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lifestyle</strong></td>
<td><strong>Body Fatness</strong></td>
</tr>
<tr>
<td>Exercise</td>
<td>Cancer site</td>
</tr>
<tr>
<td>Smoking</td>
<td>Body fatness</td>
</tr>
<tr>
<td>Obesity</td>
<td>abdominopelvic</td>
</tr>
<tr>
<td>Metabolism</td>
<td>colorectal</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>breast (premenopausal)</td>
</tr>
<tr>
<td>Exercise</td>
<td>cancer site</td>
</tr>
<tr>
<td>Smoking</td>
<td>breast (postmenopausal)</td>
</tr>
<tr>
<td>Obesity</td>
<td>lung</td>
</tr>
<tr>
<td>Metabolism</td>
<td>abdominal</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>cancer site</td>
</tr>
</tbody>
</table>

- **Lifestyle** refers to lifestyle factors that reduce cancer risk.
- **Body Fatness** refers to factors that increase cancer risk.

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### How Many U.S. Cancer Cases are Caused by Excess Body Fat Alone?

<table>
<thead>
<tr>
<th>Cancer</th>
<th>U.S. Cancer Cases caused by excess body fat (estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>35% 3,800</td>
</tr>
<tr>
<td>Pancreas</td>
<td>20% 11,000</td>
</tr>
<tr>
<td>Stomach</td>
<td>21% 2,000</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>9% 13,100</td>
</tr>
<tr>
<td>Breast</td>
<td>17% 22,000</td>
</tr>
<tr>
<td>Endometrium</td>
<td>49% 25,700</td>
</tr>
<tr>
<td>Kidney</td>
<td>25% 10,900</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>102,800</strong></td>
</tr>
</tbody>
</table>

Over 100,000 cancer cases are preventable every year by maintaining a low body fat.

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### Incidence of Cancer

- **Prostate**
- **Pancreas**
- **Stomach**
- **Colon and rectum**
- **Breast**
- **Endometrium**
- **Kidney**
Contributors To Obesity Epidemic

- Diet energy & physical activity very important
- Other possible factors: lack of sleep, food endocrine disruptors, less variability of ambient temperature, decreased smoking, Rx drugs, higher gravida age, higher BMI = better reproductive fitness, assortative mating


Obesity & Assortative Mating

Men & women do not mate at random but consider phenotypic & cultural traits: height, personality, education, religion, politics, age, smoking, BMI

Simple Versus Complex Models

- Old theory: obesity develops when energy intake exceeds energy expenditure; occurs because humans are ‘perfect survivors’
- New theory: regulation of body weight is highly complex, involving more than 100 molecules (leptin, ghrelin, etc) & multiple factors
Energy Balance Basics

- Body “defends” current weight
- Small daily changes in energy intake and physical activity have big effects over time.

Long-Term Weight Gain

- Nurses Health Studies, n = 120,000 +
- Follow-up during 1986-2006
- Mean weight gain = 3.35 lb/4 years
- Gain: potato chips, TV, quit smoking
- Loss: fruits, nuts, exercise

NEJM 364: 2392-2404, 2011

Energy Balance Example

- EB = EI – EE = 0 (if in perfect balance)
- 1 pound = 3,500 kcal
- Add 2 cookies = 70 kcal/day
- Will gain 1 lb per 50 days = 7.3 lbs/year
Reduction of Hall Model to simpler 1 or 2 Compartment Models
A three compartment energy balance model

Body Composition Model
Modified Forbes Curve

Cause-Specific Deaths & BMI
- BMI/mortality associations for 2.3 million deaths
- Underweight (BMI ≤ 19.9) associated with higher non-cancer & non-CVD mortality
- Overweight (BMI = 25.0—29.9) associated with lower non-cancer non-CVD mortality and not associated with cancer & CVD mortality
- Obesity (BMI ≥ 30.0) associated with higher CVD and obesity-related cancer mortality (colon, breast, esophagus, uterus, ovary, kidney, pancreas)


**BMI & 30-Day Postsurgery Mortality**

<table>
<thead>
<tr>
<th>Q</th>
<th>BMI</th>
<th>% Died</th>
<th>AOR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;23.1</td>
<td>2.8%</td>
<td>1.40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2</td>
<td>23.1-26.2</td>
<td>1.8%</td>
<td>1.11</td>
<td>&lt;0.070</td>
</tr>
<tr>
<td>3</td>
<td>26.3-29.6</td>
<td>1.5%</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>29.7-35.3</td>
<td>1.4%</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>5</td>
<td>&gt;35.3</td>
<td>1.0%</td>
<td>0.91</td>
<td>NS</td>
</tr>
</tbody>
</table>

N = 189,533, Arch Surg, November 21, 2011

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**Weight Loss Disadvantages if “Overweight”**

- Loss of BMD & muscle mass
- Risk of “weight cycling”
- Compromised post-surgery & cancer recovery

Ideal BMI for each age range not known

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**Challenge # 4**

Reducing the prevalence of “obesity” in the USA population will be good for the public’s health but is very challenging.

Reducing the prevalence of those who are “overweight” will have benefits & risks.
1) Review the Dietary Reference Intakes (DRIs)

2) 4 Challenges/Controversies:
   a) the new DRIs for vitamin D
   b) food fortification & supplements: risks & benefits
   c) copper deficiency from a consumer product
   d) obesity