Overview of Current Issues in Nutrition

What are the questions?
What are the challenges?
How might risk assessment help?

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Outline

• Framing the questions
  – Types of risk
  – Food and nutrition variables
  – Population considerations
  – Outcomes

• Quantification of risk

• Challenges
Framing the Questions
Who poses questions about nutritional risk (U.S. context)

- IOM Food and Nutrition Board and related committees
- Dietary Guidelines Committees that are convened by the DHHS and USDA
- Disease-focused organizations such as the American Heart Association, American Diabetes Association, and American Cancer Society
- “Life stage interest groups”, e.g., AAP or the March of Dimes.
- Food safety agencies
- Food regulatory agencies
- The food industry
- Consumers
Risk Considerations

- Adequacy-Toxicity
- Food borne illness, including allergies
- Disease prevention and management (mid-range of continuum; harm or lack of benefit)
Population Considerations

- Life stage (growth; development; aging)
- Reproductive state
- Genetics
- Environmental stressors
- Behaviors (smoking)
- Health status
What should people eat to be or stay healthy?

Is this changing?

How does this vary among population groups and by life stages?

What is available for people to eat? Is it sufficient? Safe?

What new products can be developed?
How can products be improved?
What ingredients can be added?
What should be removed?

What and how are people eating?

Where are the potential harms in these patterns?

How should we react to new foods as they emerge?

- Food and Nutrition Board
- Dietary Guidelines Advisory Committee
- Disease Interest Groups
- Life Stage Interest Groups

- U.S.D.A.
- Food Industry
- Food scientists

- NCHS
- FDA
- NIH
- Health Researchers
Food and Nutrition Variables

- Macronutrients, fiber, and energy balance
- Vitamins in food—naturally occurring
- Vitamin added to foods or taken as supplements
- Minerals
- Minerals added to foods or taken as supplements
- Other naturally —occurring food constituents
- Contaminants, toxins, mutagens
- Other dietary supplements, e.g. botanicals
- Foods and beverages, food preparation, food processing, food groups, and whole dietary patterns
- Alcohol
Types of Variables: Constituents in Fruits and Vegetables

- Sulfides (allium)
- Carotenoids
- Flavonoids
- Glucosinolates/Indoles
- Phytoestrogens
- Isothiocyanates
- Phytosterols
- Protease Inhibitors
- Saponins

- Phenols
- Capsaicin
- Resveritrol
- Anthocyanins
- Tannins
- Terpenes
- Dietary fiber
- Vitamins/minerals
  - C, E, Folic acid, K, Se

Van Duyn MS and Pivonka E. J Am Diet Assoc 2000;100:1511-1521
LOGIC FRAMEWORK
ILLUSTRATING
CONCEPTUAL
APPROACH TO
NUTRITION &
COMMUNITY HEALTH:
Intake Variables and
Intermediate Outcomes

POPULATION FOOD INTAKE
Food Consumption Patterns
(e.g. fruits, vegetables)

Intake of Nutrients and Food
Components
- Vitamins
- Minerals
- Fiber
- Fats
- Other food constituents
- Dietary supplements
- Alcohol
- Energy balance

Physiologic
Indicators
- Growth
- Adipose tissue
- Musculoskeletal
- Gastrointestinal
- Metabolic
- Cardiovascular
- Reproductive
- Immunological
- Neurological

Life Stage
Requirements
- Pregnancy
- Lactation
- Childhood
- Adolescence
- Adulthood
- Older Adulthood

Genetics,
Co-morbidities

Physical
Activity
Patterns
Diseases of Interest

- Cardiovascular Diseases
- Cancers
- Type 2 Diabetes
- Obesity
- Dental Caries
- Osteoporosis
Example Of Diet-disease Pathways Explored For Cardiovascular Diseases

Dietary/lifestyle

- High cal diet
- High fat diet
- Dietary fatty acids
- Sedentary lifestyle
- Overwt, Obesity
- Abdominal/central obesity
- Weight history
- Na,K imbalance
- Vit C, Vit E; carotenoids; flavonoids
- Folic Acid, vit B6, B12
- Ca, Mg
- Fruits and veggies
- Alcohol, Cigarettes

Reversible intermediates

- Hypertension
- Left ventricular hypertrophy
- Heart rate
- EKG abnormalities
- Subclinical disease (atherosclerosis)
- Impaired glucose tol
- Type 2 diab. mellitus
- Hyperuricemia
- Elevated serum chol
- Elevated LDL-C
- Decreased HDL-C
- Elevated TG
- Plasma homocysteine
- Other risk factors

Morbid and fatal outcomes

- CHD
- Hypertensive heart disease
- Other CVD
- Ischemic Stroke
- Hemorrhagic Stroke

Adapted from Kumanyika and Adams-Campbell, 1991
# Cellular and Biochemical Mechanisms That Play a Role in the Pathogenesis of Major Chronic Diseases

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<th>Cancer</th>
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<td>Cell proliferation</td>
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<td>DNA modifications/mutations/genetic variation</td>
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A plus sign indicates association; minus sign, no specific body of evidence is available to suggest that a specific mechanism or pathway correlates with the indicated disease.

### Possible Matrix of Food and Nutrient Variables, by Type of Issue

<table>
<thead>
<tr>
<th></th>
<th>Macro nutrients</th>
<th>Vitamins</th>
<th>Minerals</th>
<th>Other Constituents</th>
<th>Pathogens; Contaminants</th>
<th>Supplements</th>
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</table>

1=adequacy or toxicity, both, or quality
2=foodborne illness and allergies
3=disease prevention and management
Quantification of Risk

Dietary Reference Intakes
Dietary Guidelines
Dietary Reference Intakes (DRI)

- Estimated Average Requirements (EAR)
- Adequate Intake (AI)
- Recommended Dietary Allowances (RDA)
- Tolerable Upper Intake Level (UL)
- Elements of adequacy and toxicity and disease prevention
- Age and gender groups

DRI Elements

- Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids
- Water, potassium, sodium, chloride, and sulfate
- Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc
- Vitamin C, Vitamin E, Selenium, and Carotenoids
- Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline
- Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride
2005 Dietary Guidelines Nine Focus Areas

- Adequate Nutrients within Calorie Needs
- Weight Management
- Physical Activity
- Food Groups to Encourage
- Fats
- Carbohydrates
- Sodium and Potassium
- Alcoholic Beverages
- Food Safety
# Common Themes in Recent Dietary and Lifestyle Recommendations

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<th>Recommendations</th>
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<th>AHA</th>
<th>ADA</th>
<th>AdiabA</th>
<th>NIH</th>
<th>AAP</th>
<th>USDA/HHS/FDA</th>
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<td>$ Calories to achieve desirable weight</td>
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<td>+</td>
<td>+†</td>
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<td>$ Total and saturated fat and cholesterol</td>
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<td>+‡</td>
<td>+§</td>
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<td>$ Variety of foods; emphasize plant sources</td>
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<td>+</td>
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<td>+</td>
<td>NR</td>
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*SOURCE: Deckelbaum et al, Circulation, July 1999*
Challenges
Issues to be addressed

• Inconclusive or absent data
• Adverse effects between adequacy and toxicity
• Biphasic or variable effects
• Food safety risks of recommended foods
• Evidence paradigms
  – for chronic disease outcomes
  – for risk defined by foods or dietary patterns
Research Needs Identified by 2005 Dietary Guidelines Committee

- Food components
- Vitamin D in vulnerable groups
- Vitamin E
- Added sugar
- Glycemic load
- Macronutrient ratio and body weight
- Contradictions, e.g., mercury in fish
- Food groups and whole diets

U.S. Dietary Guidelines Advisory Committee, 2005
Specific exposures
Diet and Chronic Disease

- Ecological, cross-sectional
- Cohort; case-control studies
- Clinical trials of efficacy
- Randomized effectiveness trials
- Meta-analyses

- Animal studies
- Biochemical studies
- Small scale clinical studies
Evolution of Evidence for Selected Nutrient and Disease Relationships
Committee on Examination of the Evolving Science for Dietary Supplements, Institute of Medicine

### INCREASED CERTAINTY
- Fluoride and dental caries
- Calcium and bone status
- Vitamin D and bone status

### DECREASED CERTAINTY
- Beta carotene and lung CA
- Vitamin C and gastric cancer
- Vitamin E and cancer

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<td>Calcium and bone status</td>
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<td>Vitamin D and bone status</td>
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<td>Folate and colorectal cancer</td>
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<tr>
<td>P</td>
<td>Vitamin E and prostate cancer</td>
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</table>

<sup>a</sup> = Diet and Health: Implications for Reducing Chronic Disease (NRC, 1989). <sup>b</sup> = Dietary Reference Intakes (DRI) report 2001. See text for description of types of studies.
Summary

• Questions are framed from several different perspectives
• Types of risk X number of variables X number of endpoints X interactions among these factors results in very complex questions
• Risk assessment approaches are being used where the questions relate to direct effects of single or relatively specific and selective exposures
• Applicability to circumstances of complex, common exposures and multiple possible endpoints is less clear