

From Farm to Fork: Practical Applications for Food Composition Data



Catherine E. Woteki, Ph.D., R.D.

Dean of Agriculture

Iowa State University



Nutrition Monitoring and Surveillance Systems in the United States

- Food availability and consumption
- Food composition data bases
- Nutrition status assessments
- Related health status measures
- Knowledge, attitudes and behaviors



USDA Data Systems

- National Nutrient Data Bank
- Food Supply - since 1909
- Household food use - 1933
- Individual food consumption -
 - Nationwide Food Consumption Survey 1977-78, 1987-88
 - Continuing Survey of Food Intakes by Individuals - since 1985

National Health (and Nutrition) Examination Surveys

NHES I	1960-62	18-79 yr	7,710 examined
NHES II	1963-65	6-11 yr	7,417
NHES III	1966-70	12-17 yr	7,514
NHANES I	1971-74	1-74 yr	20,749
NHANESII	1976-80	6 mo-74 yr	20,322
HANESIII	1988-94	>2 mo	30,818



National Health and Nutrition Examination Survey: 1995-Present

- Continuous data collection
- National probability sample of 5000 people
- Integrated CSFII dietary interview



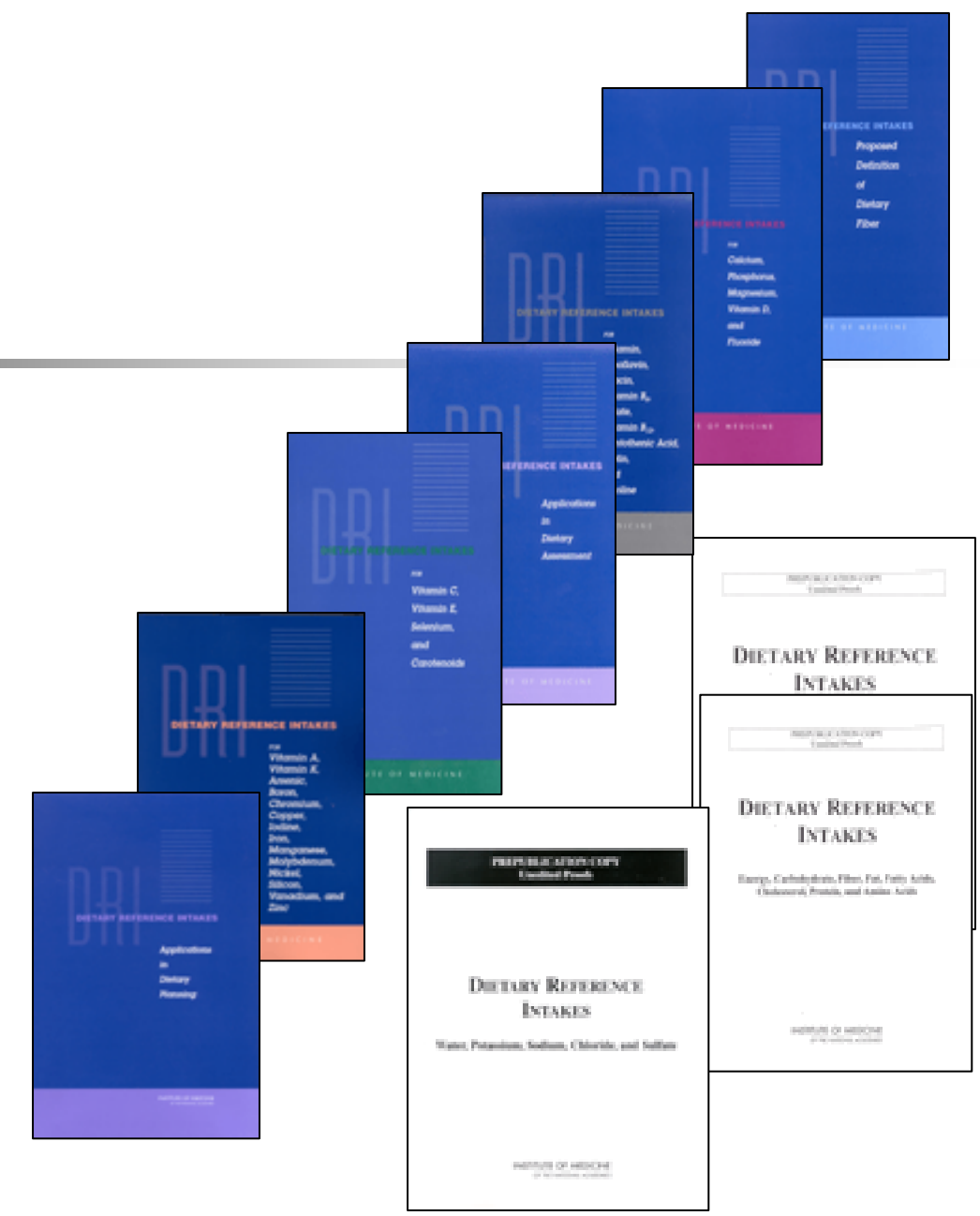
Uses: Public Policy

- Monitoring and surveillance
 - Comparison to norms
 - Comparison to goals
- Regulation
 - Exposure assessment
 - Food labeling
 - Enrichment/fortification
- Nutrition-related programs
 - Identify vulnerable populations
 - Plan interventions



Uses: Population Norms

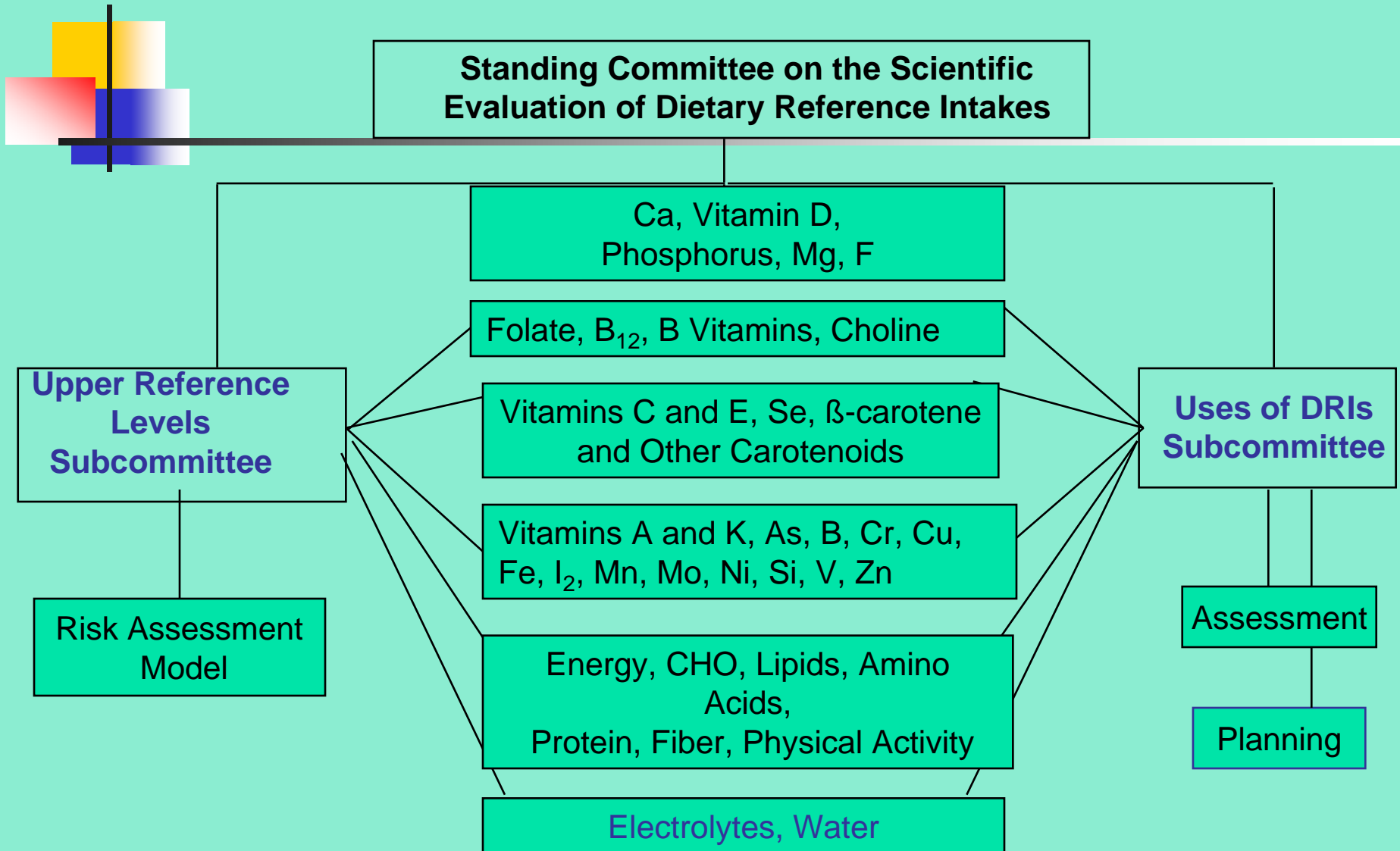
- Child growth charts
- Hematological, biochemical, and other indicators of health and nutritional status
 - Blood cholesterol
 - Iron status (hemoglobin, hematocrit, ferritin)
- Dietary Reference Intakes



Food and
Nutrition Board

DRIs Condensed
Version

Dietary Reference Intakes





Dietary Reference Intakes (DRI) Terms

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



Uses of Diet Monitoring Data in DRI's

- Dietary intake data
 - NHANES III
 - CSFII 1994-96
 - Total Diet Study 1991-97
 - Canadian Dietary Intake 1990



Uses of Dietary Data in DRI's

- Adequate Intakes (AI)
 - The recommended average daily intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group of apparently healthy people that are assumed to be adequate
 - Used when an RDA cannot be determined



AI's set for:

- Infants 0-6 mo and 7-12 mo
- Vitamin D
- Vitamin K
- Pantothenic acid
- Biotin
- Choline
- Calcium
- Chromium
- Fluoride
- Manganese



Example: AI for Vitamin K, adults

- Based on median intake data from NHANES III
- Highest intake value of 4 adult age groups, rounded to nearest 5 ug
- AI for men: 120 ug/day
- AI for women: 90 ug/day



Example: AI for vitamin K, children 1-18 yr

- Based on highest median intake for each age group reported by NHANES III
- AI for children
 - 1-3 yr: 30 ug/day
 - 4-8 yr: 55 ug/day
- Boys and girls
 - 9-13 yr: 60 ug/day
 - 14-18 yr: 75 ug/day



Example: AI for Manganese

- Based on median intakes observed in Total Diet Study
 - AI for men: 2.3 mg/day
 - AI for women: 1.8 mg/day



Research recommended to improve the uses of DRIs

- Improve estimates of nutrient requirements
 - Improve existing estimates of the EAR and RDA
 - Provide better information on requirements so it becomes possible to set an EAR
 - Improve estimates of the distribution of requirements



Research recommended to improve the uses of DRIs

- Improve the quality of dietary intake data
 - Statistical methods to reduce random error in dietary data
 - Why people under report food intake
 - Techniques to quantify supplement intake
 - Food composition databases updated to include forms and units in DRIs (dietary folate equivalents, mg of alpha-tocopherol)



What is risk assessment?

- Use of the factual base to define the health effects of exposure of individuals or populations to hazardous materials **and situations** (Source: National Research Council, Risk Assessment in the Federal Government: Managing the Process, 1983)

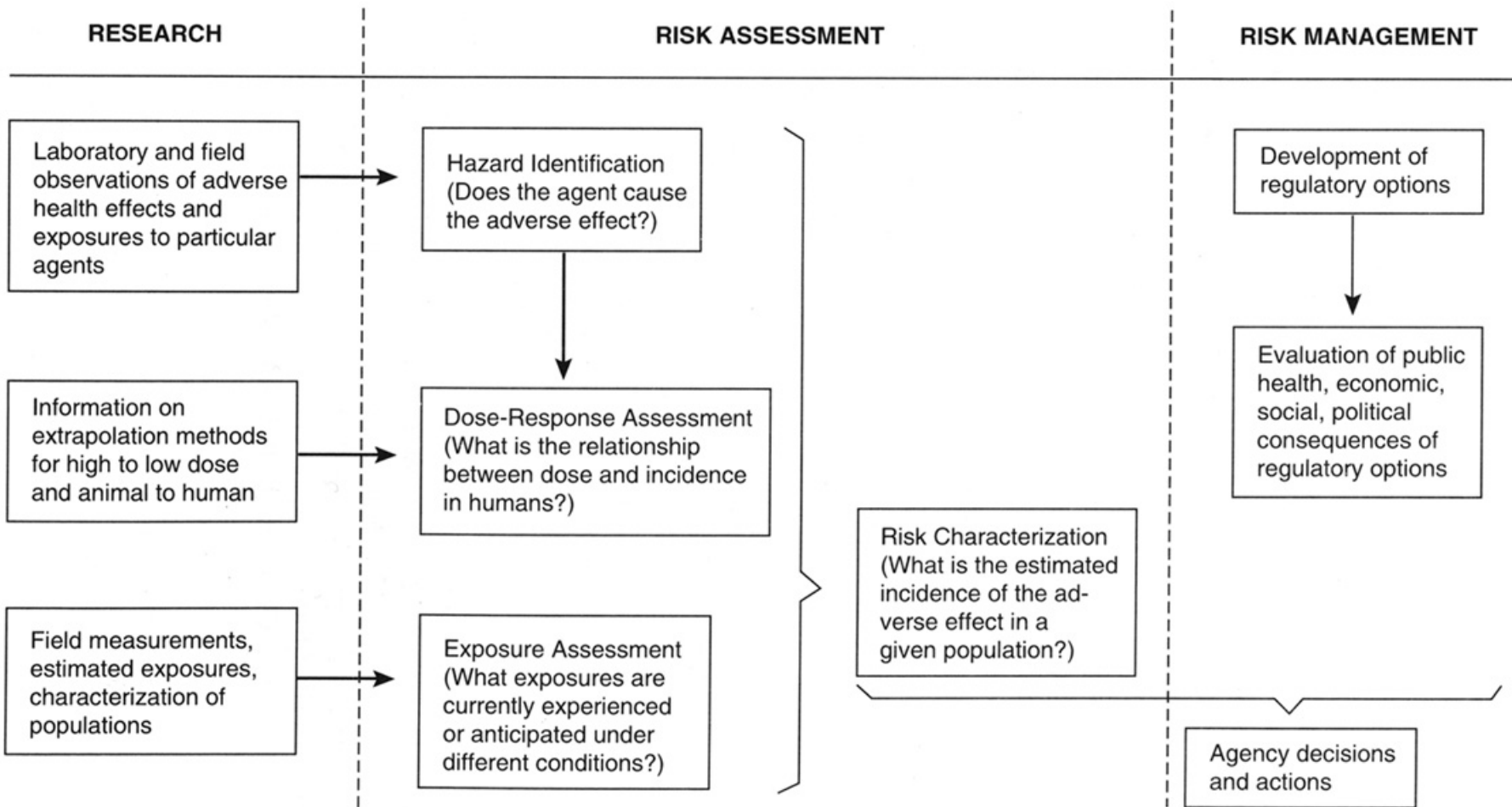


FIGURE 1-1. Elements of risk assessment and risk management, as depicted in *Risk Assessment in the Federal Government* (National Research Council, 1983:28).



Risk Analysis Paradigm

- Risk Assessment
- Risk Management: Process of weighing policy alternatives and selecting the most appropriate regulatory action, integrating the results of risk assessment with engineering and with social, economic and political concerns
- Risk Communication: Interactive process of soliciting community views and data to inform risk assessment and providing results



Exposure Assessment

- Measuring intensity, frequency, and duration of human exposures to an agent, or
- Estimating hypothetical exposures that might arise from the release of new agents into the environment
- Accounts for magnitude, duration, schedule and route of exposure, size, nature and classes of the human populations exposed, and uncertainties in the estimates



Policy Development:

Salmonella Enteritidis in eggs

- First farm to table quantitative risk assessment for a pathogen in a food
- FSIS - ARS - FDA - university team
- 5-compartment model



Risk Assessment: *S.E.* in eggs

- Five compartment model:
 - Hen house - # contaminated eggs
 - Retail - time/temperature abuse
-# contaminated eggs
 - Processing- # contaminated egg products
 - Preparation/consumption - # infectious doses
 - Health effects - expected # of illnesses,
hospitalizations, deaths



Risk Assessment: Policy Applications

- FDA requirement for safe handling labels on egg cartons
- FDA proposed rule on shell egg handling
- FSIS proposed rule on HACCP in egg processing



Challenges posed by microbial risk assessments

- Cooking temperatures and end points
- Microwaving vs. other methods providing more uniform heat
- Temperature abuse of food prior to preparation
- Unanticipated behaviors (cold hot dogs)



U.S. Government Sponsored Risk Assessments

- Microbiological
 - *E. coli* in ground beef
 - *Listeria monocytogenes* in RTE food
 - *Listeria monocytogenes* in deli meats
 - *Salmonella Enteritidis* in pasteurized eggs
 - *Salmonella Enteritidis* in shell eggs and egg products
 - *Vibrio* spp in seafood



U.S. Government Sponsored Risk Assessments

- Chemical

- Patulin in apple juice
- Dioxin
- PCB
- Organophosphate pesticides

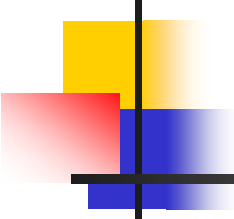
- Prion

- BSE in cattle



Codex Alimentarius Commission

- Joint Expert Meetings on Microbiological Risk Assessment
 - *Salmonella* spp in broilers
 - *S. Enteritidis* in eggs
 - *Listeria monocytogenes* in ready to eat food
 - *Campylobacter* spp in broilers
 - *Vibrio* spp in seafood



Impact of U.S. Nutrition Monitoring and Surveillance System

- Regulatory: 8 final rules and 89 proposed rules over 5 years
 - EPA: pesticides in food and water (Dietary Exposure Evaluation Model)
 - FSIS: nutrition labeling of chopped meat and poultry products
- New child growth charts
- New risk reduction programs (e.g. Cholesterol Education Program)



Nutrition Monitoring: A Statement from an ASNS Working Group

- Members: Ronette Briefel, Linda Meyers, Paul Jacques, Julie Mares-Pullman, Penny Kris-Etherton, Catherine Woteki (Chair)
- Agency Liaisons:
 - FDA: Beth Yetley
 - NCHS: Cliff Johnson & Margaret McDowell
 - ARS: Alana Moshfeqh & Johanna Dwyer
- Staff: Cathy Klein & Richard Allison



Food Safety Risk Analysis Clearinghouse

www.foodriskclearinghouse.umd.edu