

# WHAT IS PUBLIC HEALTH NUTRITION?

- Problems related to inadequate quantity and quality of the habitual diet
- Problems related to excessive intake of quantity of the habitual diet and food additives and supplements
- Food safety problems that affect the health and function of a large percent of the general population
- Nutrition problems prevented or ameliorated by identification of risk factors and early detection by screening when feasible, in contrast to only specific nutrient treatment
- Environmental and life style risk factors.
- Global warming, as well as natural disasters (flooding, droughts, civil strife, etc.)

# COMMUNITY-LEVEL NUTRITION EQUATION

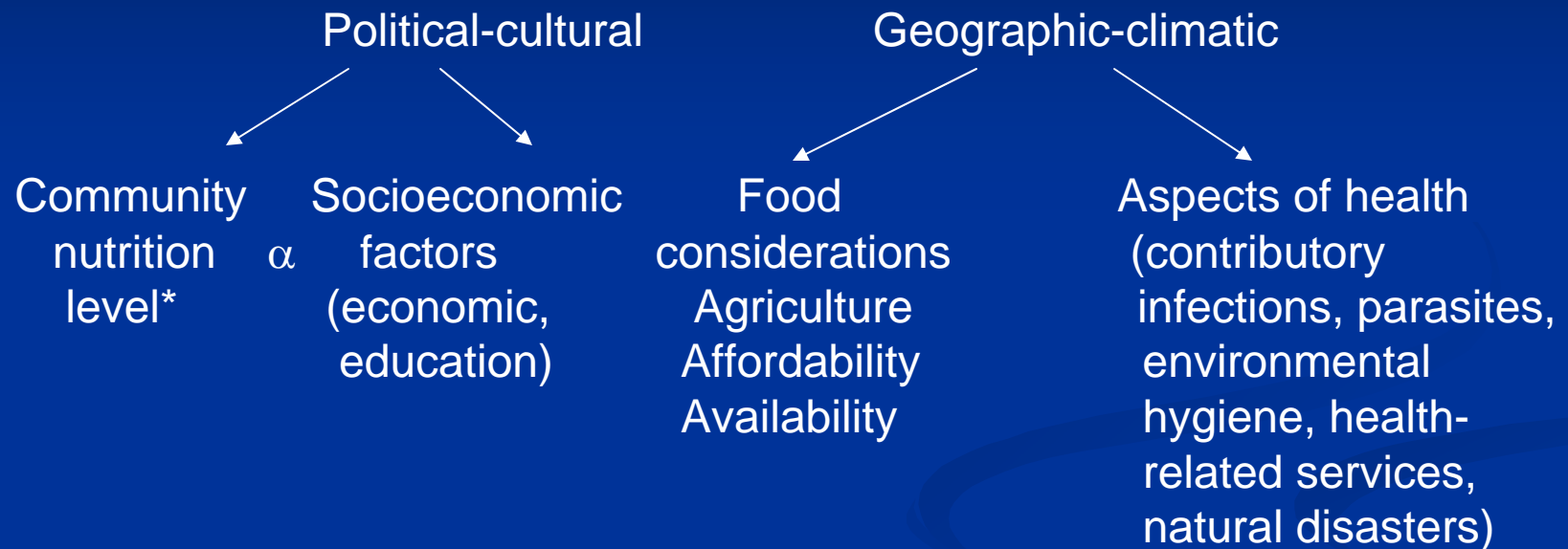
Will focus on interconnected areas of the world global outlook -- the Nutrition Transition

Developing countries with predominately poor people plus an increasingly wealthy, middle-class, urbanized population with adaptation of physical activity, stress, etc.), over-nutrition with high-energy diets, alcohol, high intake of refined sugars, etc.

AND

Industrialized, wealthy countries with growing disadvantaged populations with growing food security, income and hunger and malnutrition

# Community Nutrition Level Equation



Community nutrition level (CNL) 'equation'

\*Especially vulnerable groups

### Socio-economic factors

- Poverty, Education level, and Government policies, etc.
- Lack of nutrition information
- Cultural factors

### Food considerations

- Availability, accessibility, and affordability (3 A's)
- Consumption, Utilization, Negative Impact of Infection
- Adequacy- quantity and quality

### Aspects of health

- Co-existing infections and health-related services
- Environmental sanitation

### Demographic issues

- family size (i.e. children under 5)

### Geographic and climactic influences

- Global warming, flooding, drought, etc.
- Massive insect plagues
- Overgrazing

### Civil upheaval and strife: i.e. people forced to leave their farms

- massive migration to refugee camps

# EXCESSIVE INTAKE OF FOOD AND NUTRIENTS

- Food intake above physiological needs for normal function and growth in children
- Intake of vitamins, minerals and other micronutrients far in excess of nutritional needs

## EXAMPLES:

- ❖ Fast food addiction and calorie-dense snacks
- ❖ Megadoses of vitamins and other micronutrients and untested “natural supplements”

# INADEQUACY

- Low quantity of food to meet macro and micro nutrient requirements
- Poor absorption of nutrients
  - High phytate and fiber content of predominantly plant-based diets blocking micronutrient absorption.
  - Competition of nutrients (i.e., iron and zinc and iron and calcium)
- Infection and intestinal parasites
- Malabsorption due to enzyme deficiencies, structural damage to intestinal surfaces
- Drug-nutrient interactions, etc.

# OVERNUTRITION

## Obesity

Marked increase in obesity, particularly in urban areas of poor countries and the USA among poor populations.  
Childhood obesity leads to adult obesity

## Type II diabetes

Complications: cardiac morbidity

Retinal with blindness

Gangrene- i.e. amputations

Elevated cholesterol and triglycerides

Risk factors for cardiovascular diseases

# MAIN DEFICIENCY SYNDROMES AND CONDITIONS

## PROTEIN-ENERGY MALNUTRITION, from mild to severe

- KWASHIORKOR (protein deficiency: mainly seen in young children)
  - Low-serum albumin
  - Severe edema (hair discoloration and burn-like skin lesions)
  - Severe apathy and lethargy
  - Precipitated by measles or other severe infection
  - Abrupt weaning after birth of a new baby
  - Decreased cell-mediated immune function with high infection complications: return to normal with treatment
  - Rapid reversal of all signs and symptoms two weeks after with high protein diet
  
- MARASMUS (total energy depletion)
  - Seen in both young children and adults
  - Children alert, ravenous, and irritable
  - Often seen with HIV/AIDS, tuberculosis, malignancies, etc.
  - High energy and protein diet required over many months for recovery
  - Early weaning under 6 months with poor breast milk substitute major risk factor
  - Cognitive impairment



# More Main Deficiencies

- Stunting
- Mental deficiency as in iodine deficiency
- Iron deficiency (Anemia and Cognitive problems)
- Folate deficiency (Anemia and Risk of Neural Tube defects)
- B12 (Severe Anemia and Impaired Cognition)





# PRINCIPAL PROBLEMS IN THE SO-CALLED DEVELOPING COUNTRIES OR THE “EMERGING NATIONS”

(and to a lesser degree, in the industrialized nations)

## Maternal malnutrition with:

- Poor nutrition and anemia in preconception period and pregnancy
- Maternal depletion, poor pregnancy weight gain, and depletion of meager nutrient stores (fat and muscle mass, iron, calcium, zinc, vitamin A, etc.)
- Vitamin D and Calcium causing small pelvic outlet and from protein energy malnutrition
- Women “eat down” hoping to have small baby for easier delivery
- Low birth weight, mainly small for dates (i.e., low BW term newborns (high mortality, CNS damage, poor resistance to infection, possible risk for adult CV and diabetes (Barker’s Hypotheses))
- Breast milk may be deficient in vitamins (B12 ,folate, A, and other vitamins).
- Deficient milk output in severe malnutrition

# INFANT FEEDING

Exclusive breast feeding (EBF) for first 4-6 months

- Those not EBF have double the infant mortality rate as breast fed infants in developing countries

Breast milk

- Sterile with multiple anti-infective mechanisms
- Nutrients tailored to needs and developmental stage of infant
- Promotes brain and visual development
- Growth-stimulating factors of digestive tract
- Psychological benefits for maternal infant pair
- Few safe alternatives in poor countries and among HIV positive mothers.
- Enhances child spacing called “lactational ammenorrhä” (Suppresses ovulation —but imperfectly)

# WEANING CHALLENGE – FEEDING THE TODDLER

NEED TO ADD SOLID FOODS TO SUPPLY MORE ENERGY 6> MONTHS, PROTEIN, IRON, AND OTHER MICRONUTRIENTS

- AFTER ONE YEAR, CHILD OUTGROWS THE MILK SUPPLY

Need for energy-dense food (small stomachs!) with high-quality complete protein, energy, essential vitamins and minerals

- Iron, zinc, iodine, calcium, vitamins A, C, B, D, esp. B12
- Supplied by local legumes, cereals, dairy products, and need for modest amounts of animal foods; i.e., meat, fish, fowl

For vitamins C and A, use of green and orange fruit and vegetables.

NOTE: Death rates around weaning time 30-50-fold higher in developing countries than in rich nations, due to combination of malnutrition and infection

# MICRONUTRIENT DEFICIENCIES

## Iron deficiency – Global Problem

- Anemia
- Impaired cognitive function
- Decreased physical activity
- Decreased work capacity in older children and adults
- Decreased appetite
- Impaired cellular immune function and increased infections

Animal source foods needed- absorption from cereals and legumes increased when mixed with meat (any type)

# Vitamin A Deficiency

- Irreversible blindness
- Increased morbidity and mortality from infection, especially pneumonia and diarrhea
- Loss of structure and function of epithelial linings of the body
- Impaired cellular immune function
- Sources: preformed retinol from animal source foods - carotene from orange yellow red F and V
- Massive dosing with Vitamin A capsules (200,000 IU every 6 mos. in <5 y.o. children in developing countries effective)



# Zinc deficiency

- Part of many enzyme systems
- Stunting
- Loss of appetite associated with loss of taste
- Loss of resistance to infection
- Delayed puberty
- Impaired wound healing
- Decreased activity

## Sources:

Animal source foods (meat/fish) - cereal legumes mixed with meat and vitamin C will enhance absorption

## VITAMIN B12 DEFICIENCY

- Seen in vegetarians, or those on low animal source foods
- Key role
  - Brain and CNS development
  - Red blood cell formation
  - Immune function
- Recently found to play a role in brain development and cognitive function in children
- Low breast milk B12 is of risk to an infant

**Approach:** Promote animal source foods in diet, containing milk and/or meat of any variety

# Folic acid

- Neural tube defects from poor folate intake in first trimester of pregnancy
- Anemia (macrocytic)
- Sources: orange juice, meat (especially organ parts), dark green leafy vegetables
- Supplements required (400  $\mu\text{m}/\text{day}$ )
- Needed before women realizes she is pregnant (policy is for all young women to take folate daily and food fortification)

# Calcium

- Bone calcification
- Needed early and throughout life to prevent osteoporosis
- Prevents rickets post-weaning, even in tropics
- Prevents hypertension (especially in pregnancy)

Source: milk products, small fish

# Vitamin D Deficiency

- Vitamin D deficiency, now known to be widespread, both in developing and developed countries
- At risk groups: those with dark skin, and limited exposure of all to sunlight (fear of melanoma)
- Older recommendations for Vitamin D extremely low
- Vitamin D deficiency, and sub-clinical and clinical rickets seen in northern and extremely southern latitudes throughout the world
- Vitamin D plays a vital role in protection against malignancy, immune abnormalities, and other body functions (under active research)
- Prevention: Exposure to sunlight and Vitamin D supplementation

# Iodine Deficiency

- Iodine deficiency still a significant global problem, with negative socioeconomic impact
  - Impaired intellectual capacity, decreased productivity, marked growth retardation, and initiative
- Significant cause of poor pregnancy outcome, severely retarded infants, children, and adults
- Globally due to lack of iodine in the food, soil, and water supply
  - Seen in land areas away from the sea
  - Highly prevalent in mountainous areas receiving water from melted snow and ice
  - Entire food chain also affected with low iodine content

## Iodine Deficiency Disorders



Goiter



Cretinism

# Manifestations of iodine deficiency

- High pregnancy wastage, appearance of goiters in pregnant women, teenage girls > boys
- Severely affected infant at birth with cretinism
  - Severe growth and mental retardation- irreversible
  - Less severe forms of iodine deficiency
    - Poor growth and development
    - Poor school performance, and varying degrees of mild mental retardation
    - Poor pregnancy outcome
- Main approaches
  - Iodization of salt, universally
  - If commercial water not available, drops of iodine placed in household or school drinking water
  - Or iodine injections in oil annually or more frequently by oral pills
- Still an unsolved, but greatly improved, problem calling for collaboration between local populations, industry, and government
- In U.S.A., iodine deficiency mostly due to metabolic errors or thyroid disease
- Hyperthyroidism induced by excessive iodine intake

# Public health approaches to modifying intake in the prevention and control of micronutrient deficiencies

## Food-based (esp in poor countries)

### Dietary diversification

- Home gardening
- Nutrition education
- Development of high carotenoid varieties
- Raising of small animals (including fish) for milk, meat, and eggs for household consumption
- Greater sustainability through food-based approaches than relying on micronutrient distribution by pills, etc. particularly to rural and isolated communities



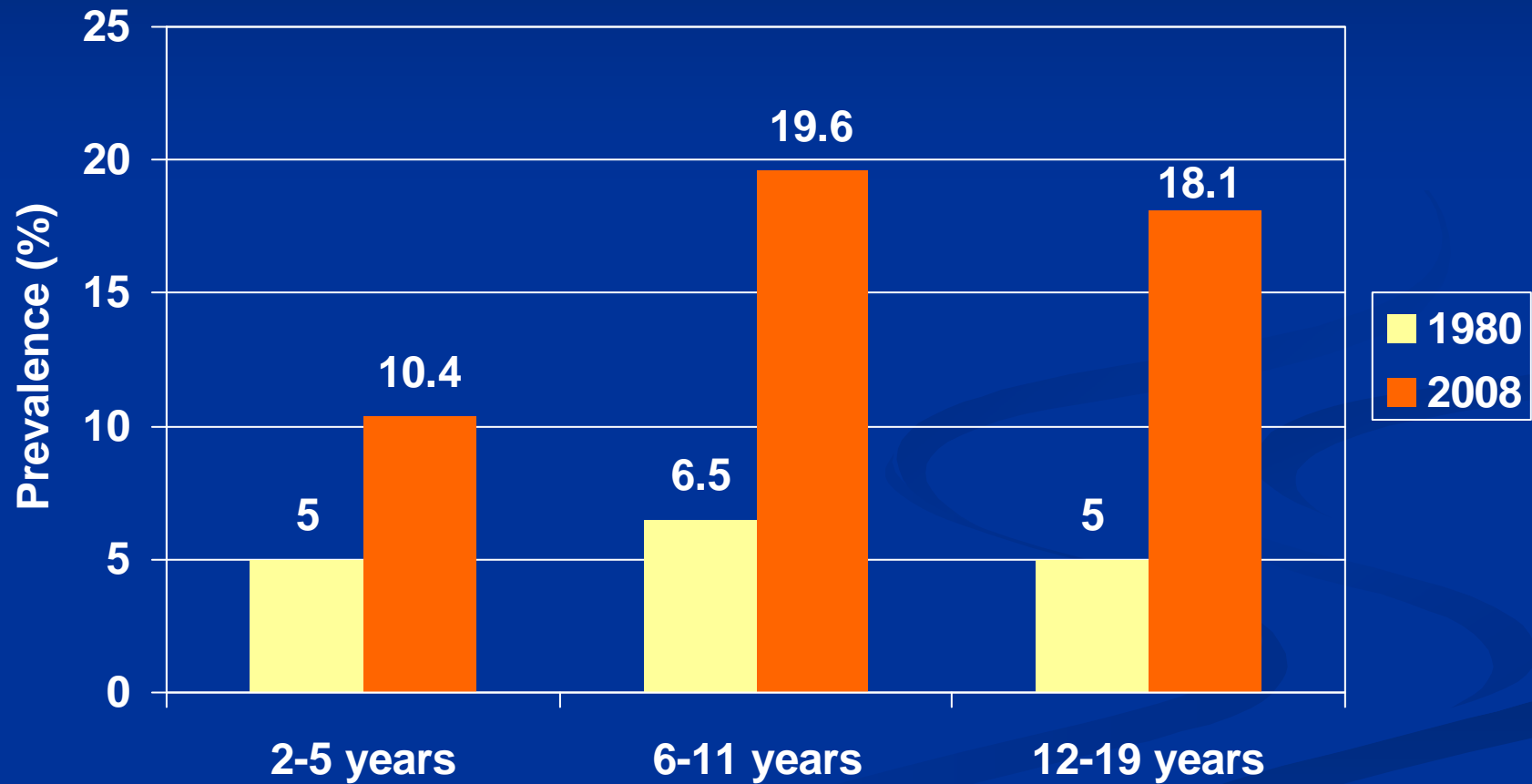
## Micronutrient Fortification (where feasible and affordable)

- Sugar, flour, margarine, edible oils, noodles, condiments i.e. soy, etc.

## Supplementation (particularly in developing countries)

- National immunization days and micronutrient distribution days
- Distribution through health centers, including mothers and children
- Postpartum supplementation
- Vitamin A capsule distribution programs in developing countries (mega-doses every 6 months for children under 5)

# Childhood Obesity- U.S.



Source: [www.cdc.gov/obesity](http://www.cdc.gov/obesity)

# Childhood Obesity - World

	Year of Survey	Age Range	Boys (%)	Girls (%)
<b>WHO Africa Region</b>				
Algeria	2006	6-10	10.3	8.7
South Africa	2001-2004	6-13	14.0	17.9
Zimbabwe	1990-2004	5-17	1.7	2.4
<b>WHO Americas Region</b>				
Bolivia (urban)	2003	14-17	15.6	27.5
Brazil	2002	7-10	23.0	21.1
Chile	2002	6	28.6	27.1
Mexico	2006	15-17	30.5	31.5
<b>WHO South East Asia Region</b>				
India	2002	5-17*	12.9	8.2
Sri Lanka	2003	10-15	1.7	2.7
Thailand	1997	5-15	21.1	12.6

\*5-15y for girls

Source: International Obesity Taskforce, 2010

(<http://www.ietf.org/database/documents/GlobalChildhoodOverweightMay2010.pdf>)

# Comments on childhood obesity

- Staggering economic and health burden and child and adult obesity in the U.S.A.
  - This proportionately high prevalence in lower socioeconomic groups i.e. Hispanic, African-American, and Native American populations
    - Poor neighborhoods have few safe parks or recreation areas for physical activity
    - Lacking in affordable food stores with nutritious, low-calorie foods, and abundance of fast food and junk food stores
    - School-based and after school physical activity programs
    - School food services, although improving, have a long way to go to offer nutritious, low-calorie foods
    - Salad bars are increasing and school meals are now healthier
    - Banning of vending machines for soft drinks and sweet snacks
- Type II Diabetes widespread in all obese groups, but now even in preteen children
  - Multiple, but inadequate, numbers of school and community programs in safe environments are increasing

# Nutrition transition in developing countries

- Double burden of malnutrition and over-nutrition and obesity in urban areas of developing countries
- Change in lifestyle and shift to cash economy, with movement to urban areas
  - No longer grow own food in cash economy, and relying on high-fat, street foods and fast foods
  - No longer access to fruits and vegetables, and milk produced on own homesteads
  - Decreased physical labor and physical activity in urban settings
  - Accompanying cardiovascular diseases with obesity, causing high mortality and morbidity among adults
  - Increased stress and alcohol consumption

# Fetal programming and origins of adult chronic disease

- The Barker Hypothesis (seen globally)
  - Intrauterine malnutrition with low-birth weight in numerous epidemiological studies, associated with increased risks of coronary heart disease, stroke, hypertension, and type II diabetes in surviving adults
  - Associations seen globally
  - Effects may be due to “fetal programming,” presumably due to insult at critical, sensitive periods in fetal development, with permanent adverse effects on structure, physiology, metabolism, and hormonal function
  - Adaptations invoked by maternal placental failure of nutrient supply to meet fetal demand.
  - Maternal body composition and nutrient balance before and during pregnancy of key importance, and under active research
- Barker Hypothesis has stimulated large number of studies on possible intrauterine mechanisms

# U.S. Federal Nutrition Assistance Programs

- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
  - Largest Nutrition Assistance Program Globally
  - Funded by USDA
  - Provides food assistance, nutrition education and referrals to health care services
  - Low-income (<185% FPL) pregnant, postpartum, and breastfeeding women and infants and children up to age 5 who are at nutritional risk
  - Broad reach – serves ~53% of all infants in the U.S.
  - New food package since 2009 to encourage breastfeeding and healthy eating

# U.S. Federal Nutrition Assistance Programs

- Supplemental Nutrition Assistant Program (SNAP, formerly Food Stamp Program)
  - Largest domestic program
    - 46 million Americans served in March 2012
  - Financial assistance for low-income families (<130% FPL) to purchase food items
    - Uses Electronic Benefits Transfer (EBT) cards
    - Benefits vary based on income and household size

\*\*\*Benefits now being significantly reduced  
by current congress\*\*\*