Exposure Assessment Concepts and Considerations for Community Health Studies

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Exposure Assessment

- Define Exposure—Contact between an Agent and a Receptor
- Pathways of Exposure
- Routes of Exposure


*Figure 1. Source to exposure to health effects pathway.*
Exposure Assessment

- Define Exposure: Contact between an Agent and a Receptor
  - Magnitude
    - Toxicity
    - Concentration
  - Frequency and Duration


Figure 1. Source to exposure to health effects pathway.
Unique Challenges - Community Settings

- In Contrast to Occupational Exposures Settings, in Communities
  - Exposures are Generally Lower and to Multiple Pollutants through Multiple Media
  - Populations are Diverse
  - Interest and Commitment Levels is Likely to be Different

Figure 1. Source to exposure to health effects pathway.
Unique Challenges - Exposure In Children

- Children’s Exposure Offers Unique Challenges
- In-Utero Exposure
- Incompletely Developed Systems
  - Susceptible to Specific Exposures
  - Modification of Developing Systems
  - Effects Can Occur Before a Woman Knows She is Pregnant

Methods for Exposure Assessment

- Questionnaires and Other Indirect Monitoring
- Environmental and Personal Monitoring
- Biomonitoring
Questionnaires and Other Indirect Monitoring

- **Information Often Obtained via Questionnaire**
  - Demographic Data
  - Lifestyle Information
    - Exercise Level
    - Dietary Information
  - Medical Information
  - Exposure Indices - Classification of Groups
    - Magnitude, Frequency, and Duration
    - Occupational Job/Exposure Matrix
Questionnaires and Other Indirect Monitoring

- Requires Expertise in Developing Questionnaire and in Administration
  - Wording of Questionnaires is Critical
  - Cultural Sensitivity
    - Specific to the Community under Investigation
  - Language Differences
Questionnaires and Other Indirect Monitoring

**Strengths**

- Relatively Inexpensive

- Large Distribution is Relatively Easy

- Can be Computerized and Carried out via Telephone
Questionnaires and Other Indirect Monitoring

- **Weaknesses**
  - Can be Burdensome if Long
    - 30-45 minutes is reasonable target
  - Recall Bias
  - Validity of Results is Difficult to Establish
Questionnaires and Other Indirect Monitoring

- **Other Indirect Monitoring** - Some Examples
  - Use of GIS Systems
    - Potential Exposure Mapping
    - Proximity to Sources
  - Videotaping
    - Follow Activities
    - Can Focus on Hard-to-Monitor Activities, e.g. Hand-to-Mouth Transfer in Children
Environmental and Personal Monitoring

- **Defined as:**
  - Measurement of a Chemical Agent or its Transformation Product in an Environmental Medium

- Can Aid in Tracking Movement of Pollutant from Sources through the Various Environmental Components to the Receptor

- Focus of Dr. Ozkaynak’s Talk

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Environmental and Personal Monitoring

- **Direct or Personal Monitoring**

- **Indirect or Microenvironmental Monitoring**

Environmental and Personal Monitoring

- **Direct or Personal Monitoring**
  - Outfit an Individual with a Monitor
    - Example: Air Sampler
  - Diet Sampling
    - Duplicate Diet
  - Hand Wipes
    - To Measure Contact
    - Is this Biological Sampling?
Environmental and Personal Monitoring

- **Indirect or Microenvironmental Monitoring**
  - **Area Monitoring**
    - Example: Air Sampler in Occupational or Residential Setting
  - **Diet Sampling**
    - Marketbasket
    - TDS/CSFII Type Sampling
  - **Surrogate Activities**
    - Scripted Activities
    - Cotton “Suits”
Biomonitoring

- Focus of Dr. Needham’s Talk

- Working Backwards from Effect
  - Once Exposure Occurs
    - Absorption, Distribution, Metabolism, and Elimination
  - Internal Dose

Biomonitoring

- **Internal Dose**
  - Measurement of Biological Impact can be effected through Biomonitoring
  - Proof that Exposure Has Occurred
  - Closer to Biologically Effective Dose

Biomonitoring

**Examples**
- **Blood and Serum Measurements**
  - Lead
  - Pesticides
  - Volatile Organic Compounds
- **Exhaled Breath**
  - VOCs
Biomonitoring

- **Examples**
  - **Urine**
    - Metabolites of Pesticides
    - Metals
  - **Saliva**
    - Parent Pesticides
  - **Hair**
    - Metals
    - Drugs of Abuse
Biomonitoring

- Information Obtained
  - In Addition to Exposure Information
    - ADME for Pharmacokinetics
    - Tie in with Toxicology
    - Tie in with Effects
Biomonitoring

- **Strengths**
  - Exposure Assured unlike Other Methods

- **Weaknesses**
  - Expensive
  - Relationship with Exposure/Sources Uncertain
    - Exposure/Effect versus Time of Measurement
  - Can be Intrusive
  - Inter-individual Variability
  - Methods Under Development
    - Dr. Needham’s Presentation
Some Final Thoughts

- Knowledge of Exposure is of Central Importance in Understanding the Impact of Pollutant Sources on Health
  - Particularly Important in Community Settings for which Exposures are to Multiple Chemicals and the Population is Diverse in Age, Susceptibility, and Health Status

- Methods Have Become Substantially More Sophisticated in the Last 20 Years
  - Monitoring Methods have Improved. Sampling Strategies are Better. Biomonitoring and Biological Effect are Now at the Forefront

- The Role of Biological Susceptibility and Interindividual Variability is the Driving Force for Much New Research
  - Biomarkers of Susceptibility are Becoming More of Interest