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**

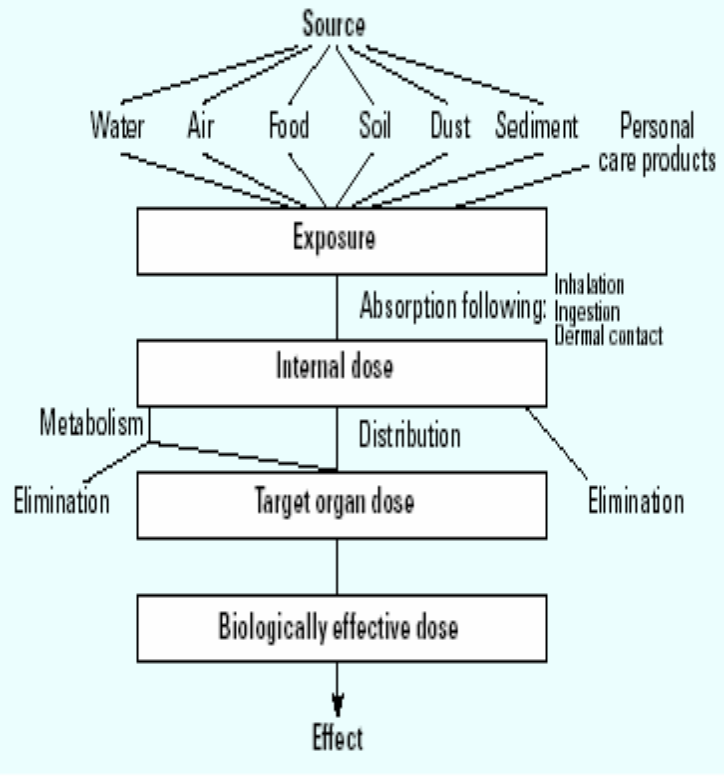
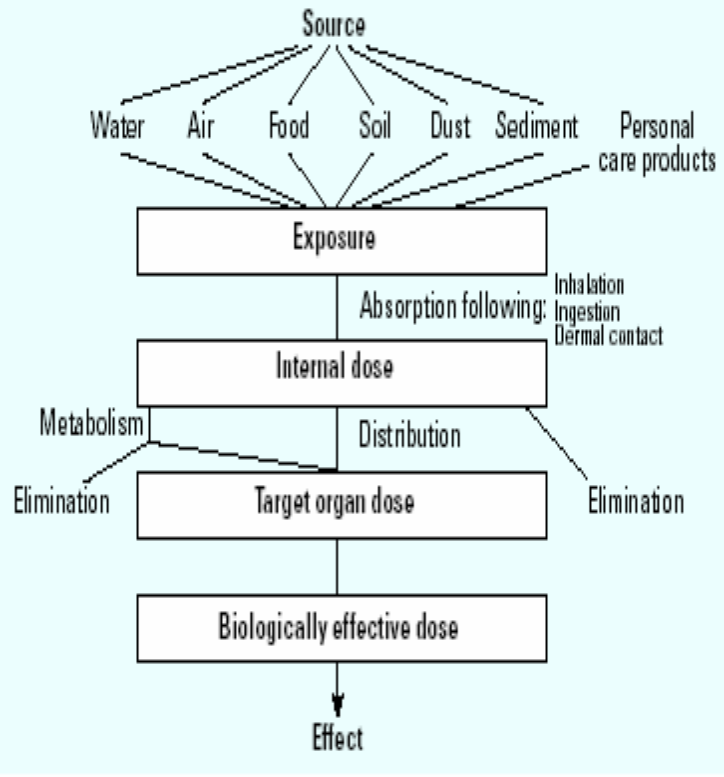


Figure 1. Source to exposure to health effects pathway.

- *Figure from Needham, et al. Environ Health Perspect* 113:1076–1082 (2005). doi:10.1289/ehp.7613 available via *http://dx.doi.org/* [Online 12 May 2005]

Exposure Assessment

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



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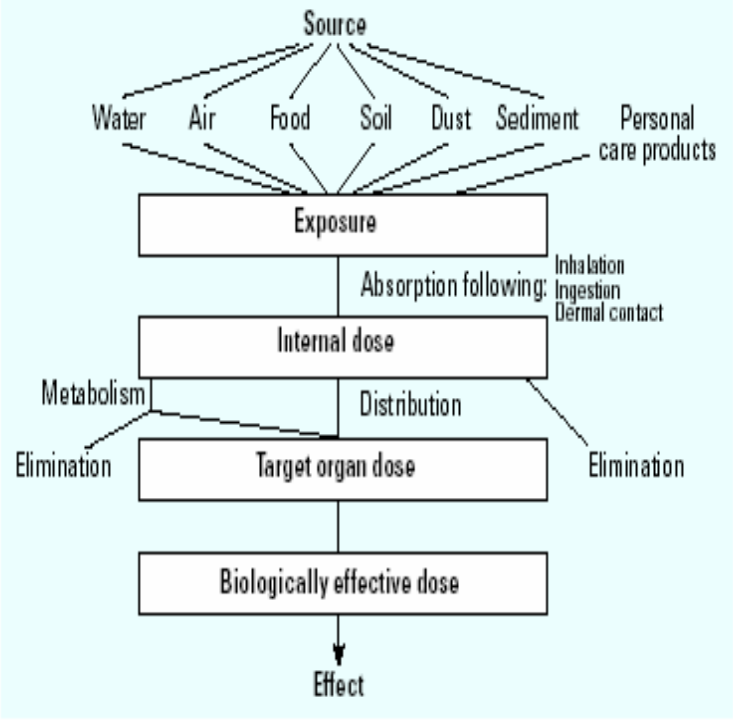
Unique Challenges- Community Settings

- **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**



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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**

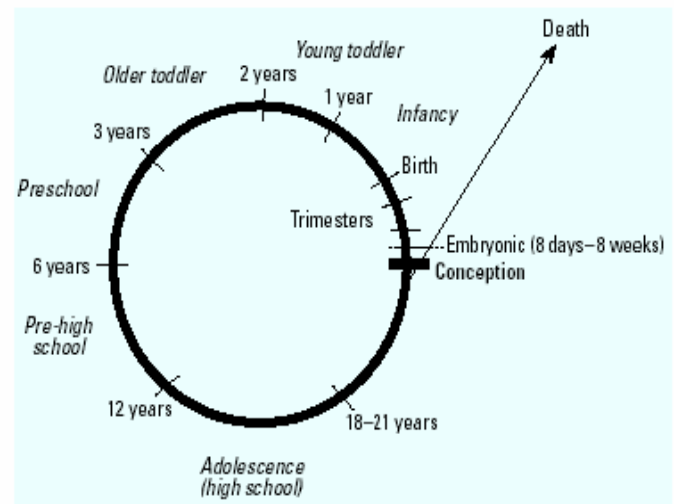


Figure 2. Life stages of interest in the NCS.

- ***Figure from Needham, et al. Environ Health Perspect* 113:1076–1082 (2005). doi:10.1289/ehp.7613 available via *http://dx.doi.org/* [Online 12 May 2005]**

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

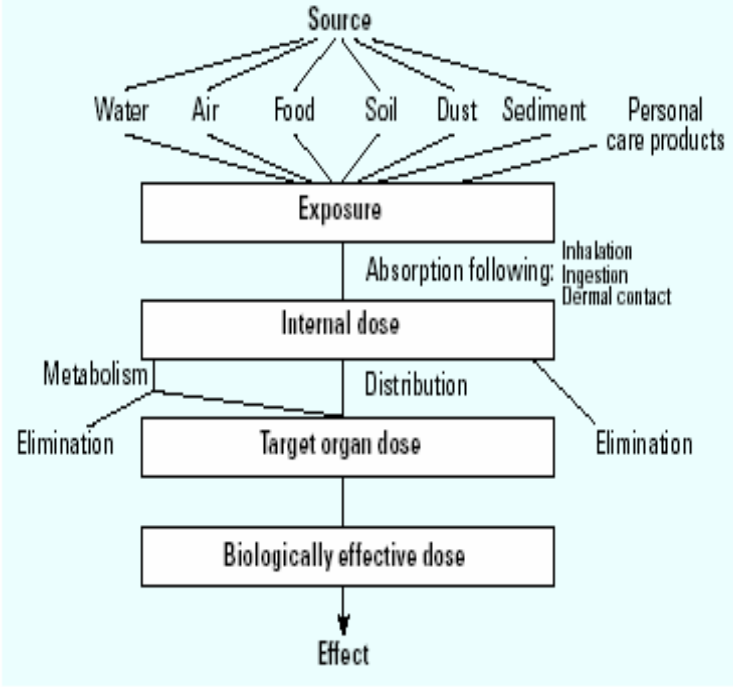
- **Weaknesses**
  - Can be Burdensome if Long
    - 30-45 minutes is reasonable target
  - Recall Bias
  - Validity of Results is Difficult to Establish

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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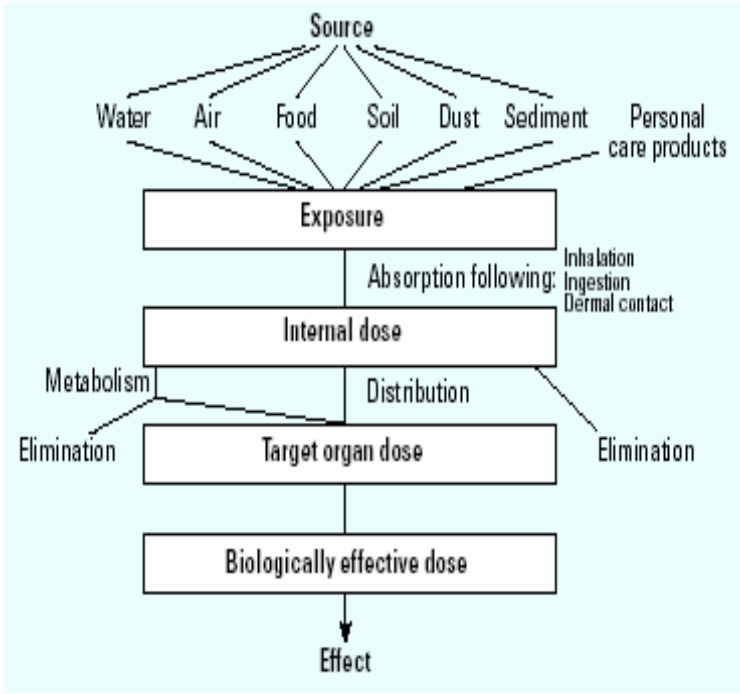
Environmental and Personal Monitoring

- **Direct or Personal Monitoring**

- **Indirect or *Microenvironmental* Monitoring**



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Environmental and Personal Monitoring

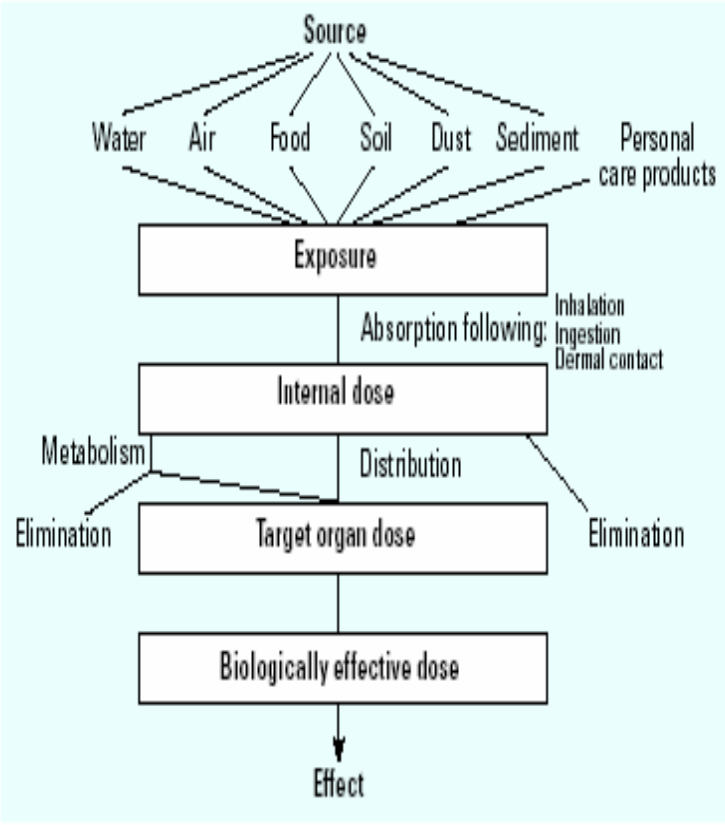
- **Direct or Personal Monitoring**
  - **Outfit an Individual with a Monitor**
    - **Example: Air Sampler**
  - **Diet Sampling**
    - **Duplicate Diet**
  - **Hand Wipes**
    - **To Measure Contact**
    - **Is this Biological Sampling?**

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**



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Biomonitoring

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

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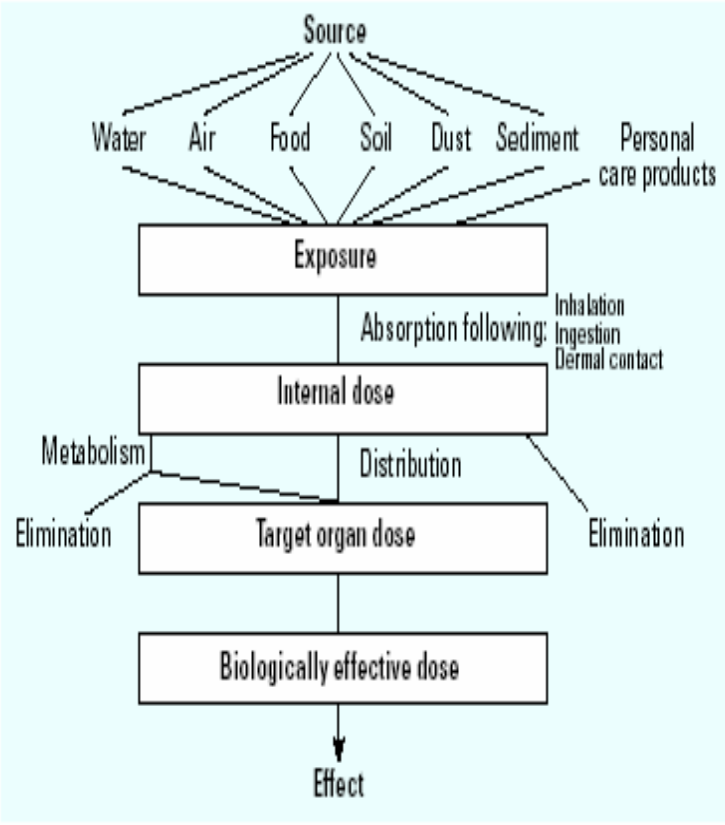

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Biomonitoring

- **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 n 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**