FREE WEBINAR

ENVIRONMENTAL HEALTH INVESTIGATIONS

Understanding Strategies to Address Environmental Exposures

12-1pm, Friday December 2nd 2016

HOUSEKEEPING ITEMS

Webinar Features

Audio is available via the Adobe Connect webinar room using your computer speakers. All participants are muted. The session is being recorded and will be available at www.healthoregon.org/ehap.

Submit questions in Q&A panel. They will be answered from 12:45-1:00pm. Please focus on questions related to the content of this session.

If you are having trouble with the webinar, please use the Q&A box or e mail nadege.dubuisson@state.or.us

MODERATOR
Nadege Dubuisson, MPH, CHES

OREGON ENVIRONMENTAL HEALTH ASSESSMENT PROGRAM

The Oregon Public Health Division's Environmental Health Assessment Program (EHAP) works with nearby communities and agency partners to assess and prevent human exposure to toxics found at Superfund and other contaminated sites.

MODERATOR
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WEBINAR OBJECTIVES

1. Provide information about the Environmental Health Assessment Program's approach.

2. Understand other key approaches and strategies and their strengths and weaknesses.

3. Demonstrate applied environmental investigation strategies.

MODERATOR
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Environmental Health Investigations:

Understanding Strategies to Address Environmental Exposures

December 2, 2016

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lambertw@ohsu.edu

Introduction

- Environmental pollution issues are inherently complex and involve a large number of highly technical considerations

- This talk is designed for the informed citizen who wishes to know more about the science of environmental public health, measurement of pollutant effects in the community, and how information can be used to design management strategies and policy

- The talk will focus on air pollution issues, but could be applied to contamination and exposure via other media (water, soil, food).

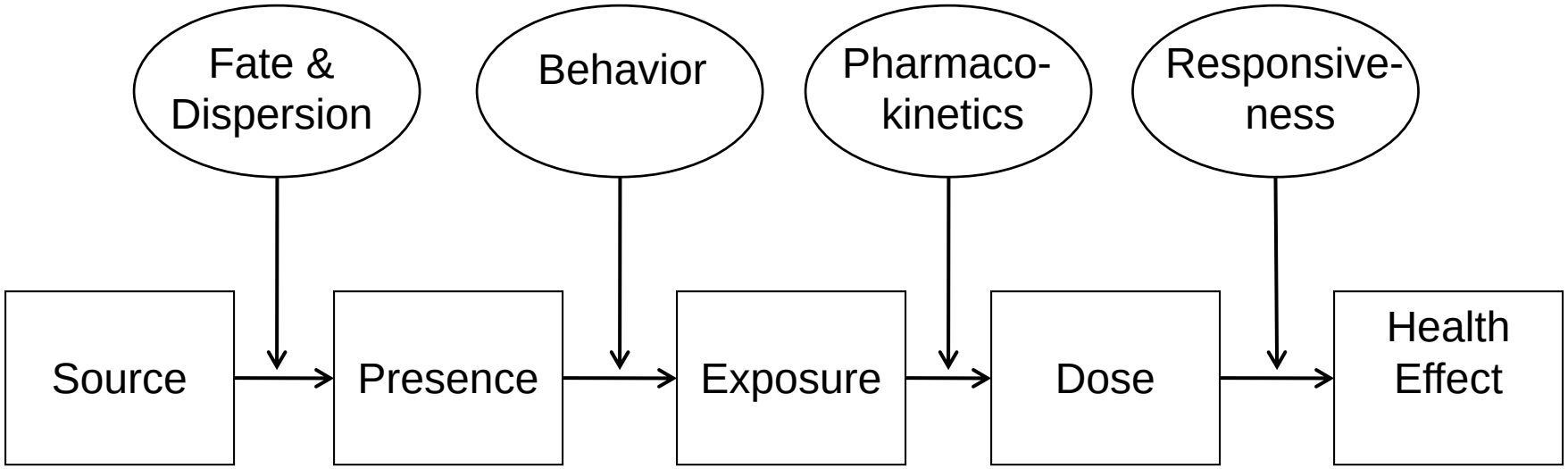
Upcoming OHA Handout

- OHA's Environmental Health Assessment Program (EHAP) is developing a handout to describe the major approaches to investigation of a specific contamination concern
- In this presentation I will provide detail and examples on the major approaches of environmental investigation
- However, first I will set the stage by presenting concepts of exposure and health effects, and public health system role in prevention of harm

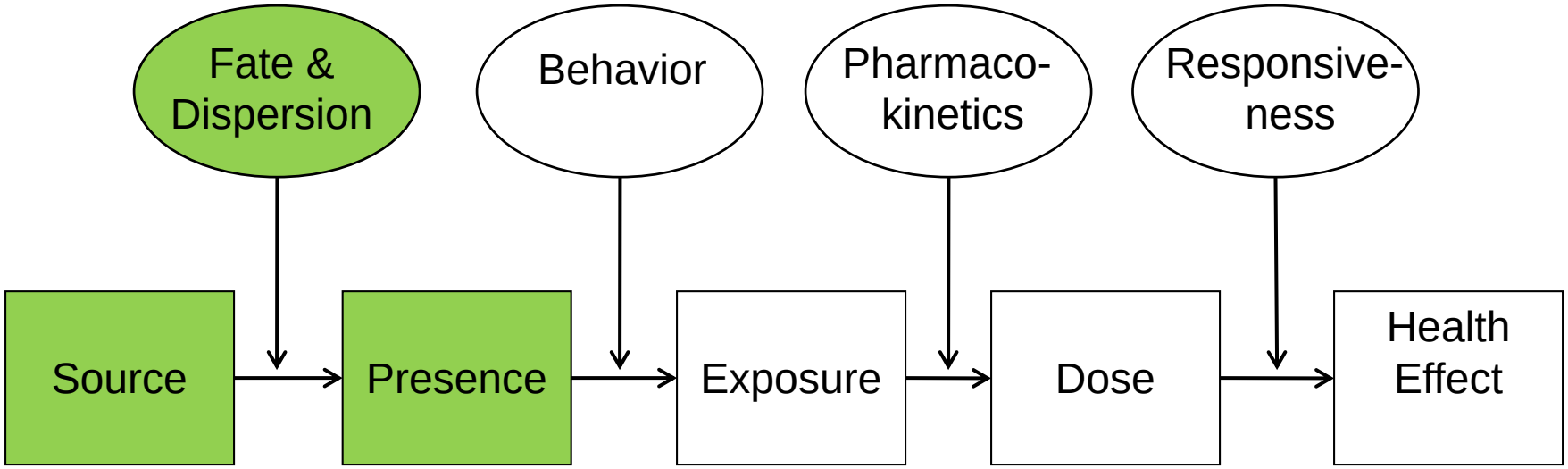
Part 1.
Concepts of Exposure, Health Effects, and Public Health Response

1. Biologic impact pathway
2. Strategies for prevention
3. Core functions of public health systems

The Biologic Impact Pathway



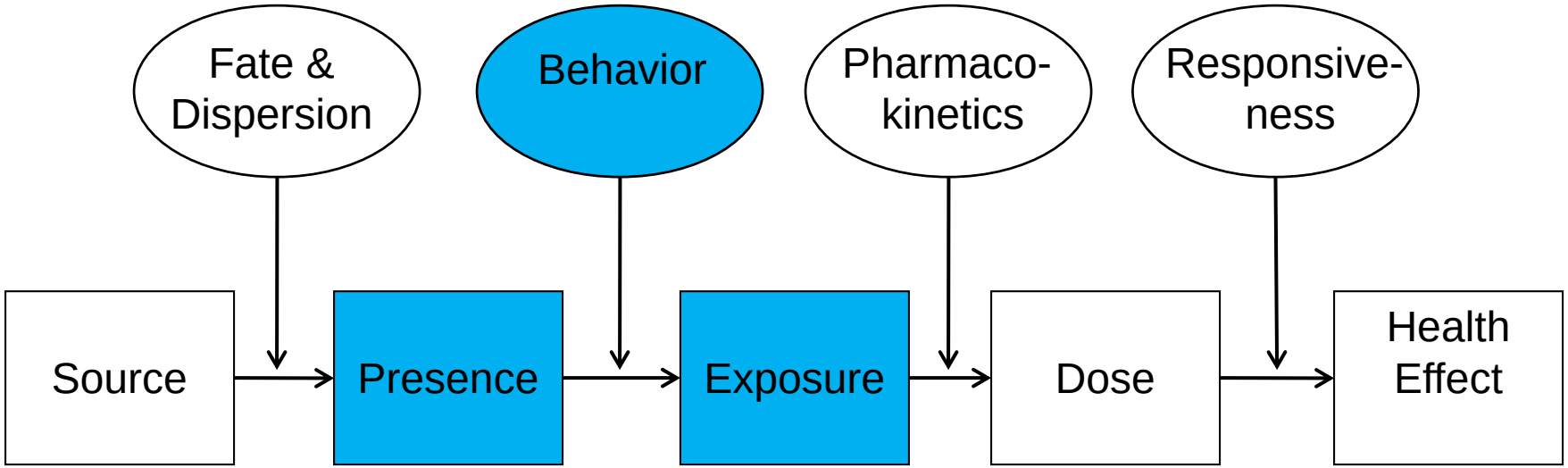
Dispersion
Transformation
Decay



Smokestack
Product
Tailpipe

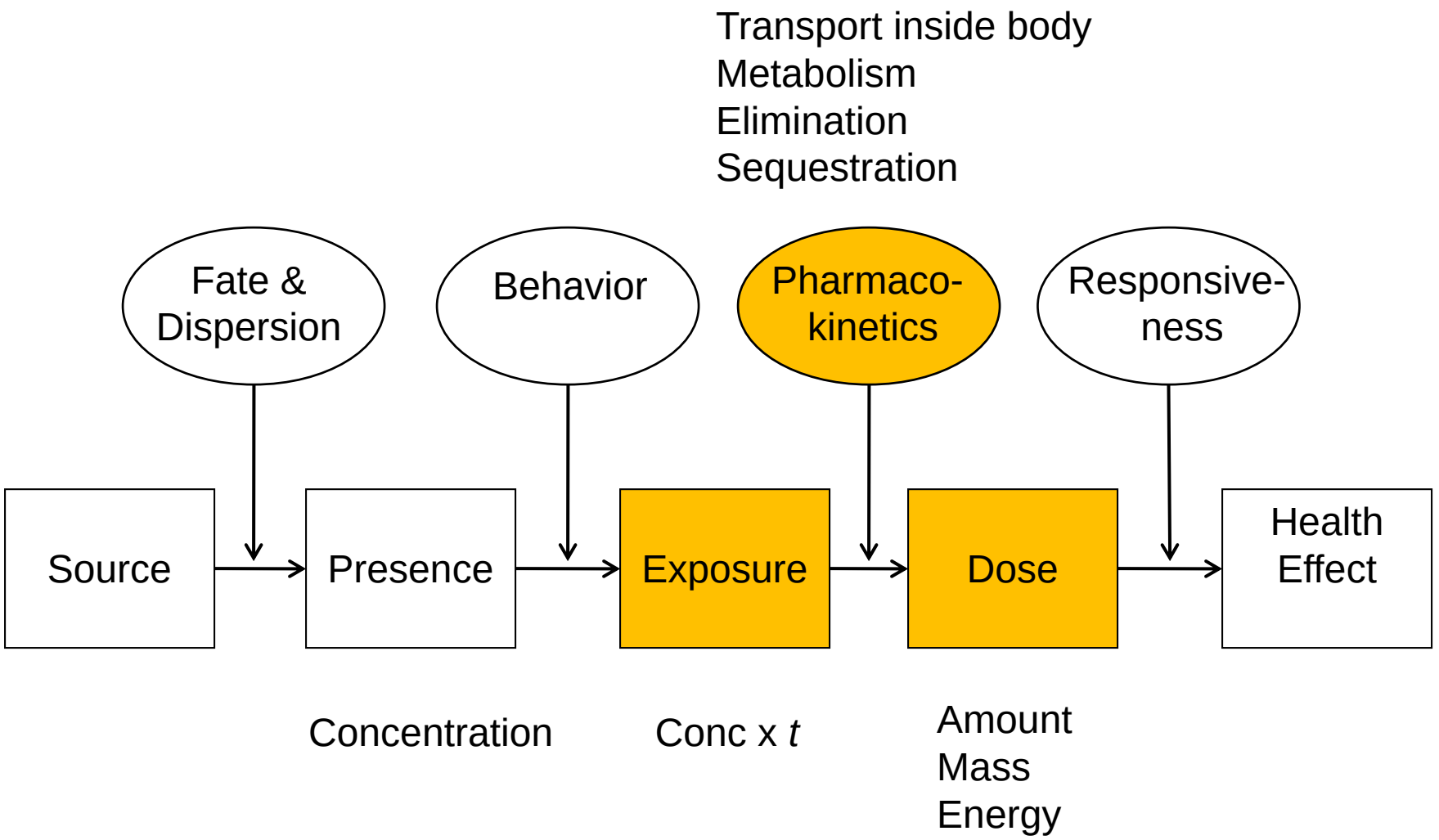
Concentration
Outdoors
Indoors
In-transit

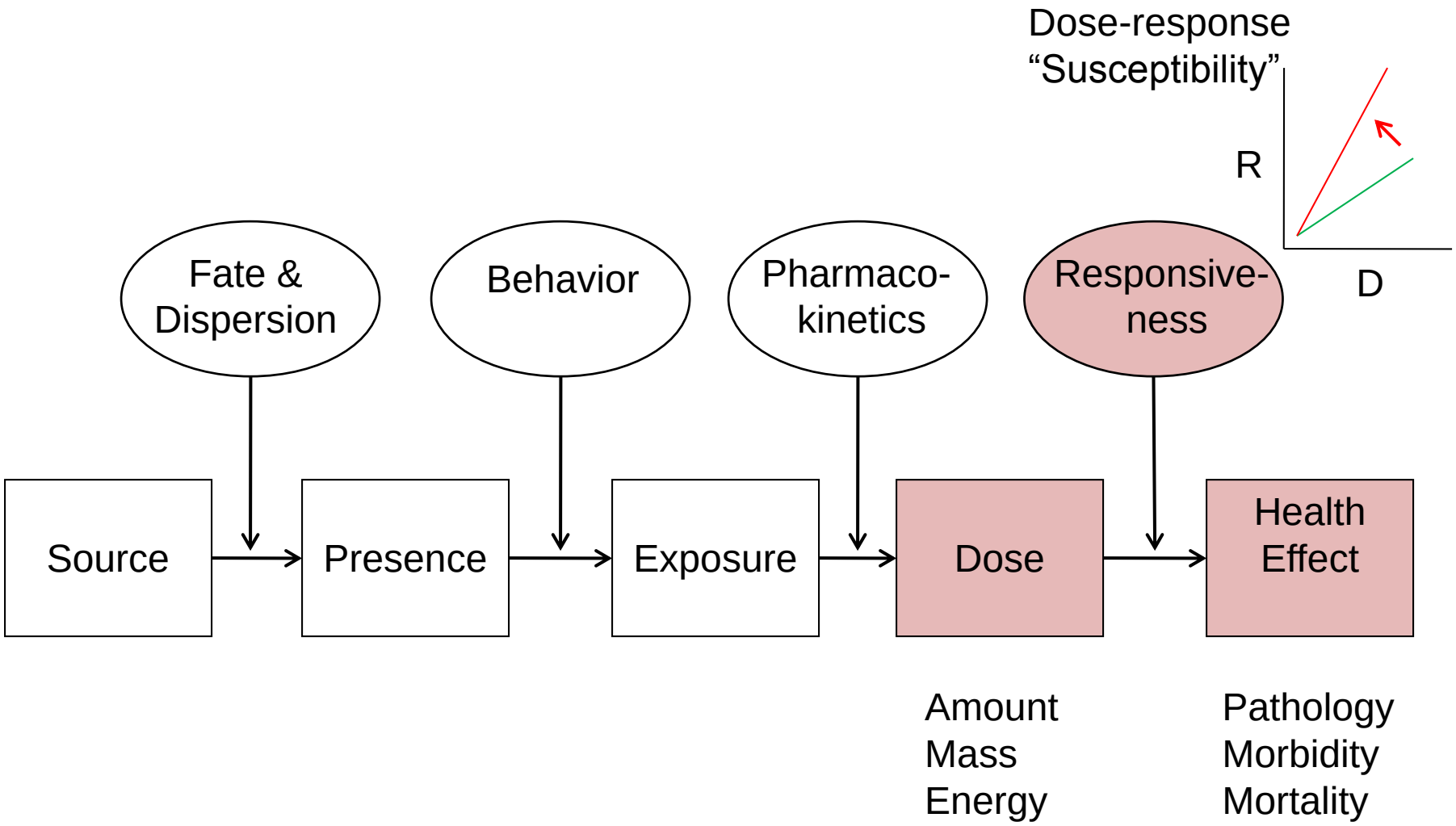
Time-activity patterns
Breathing rate



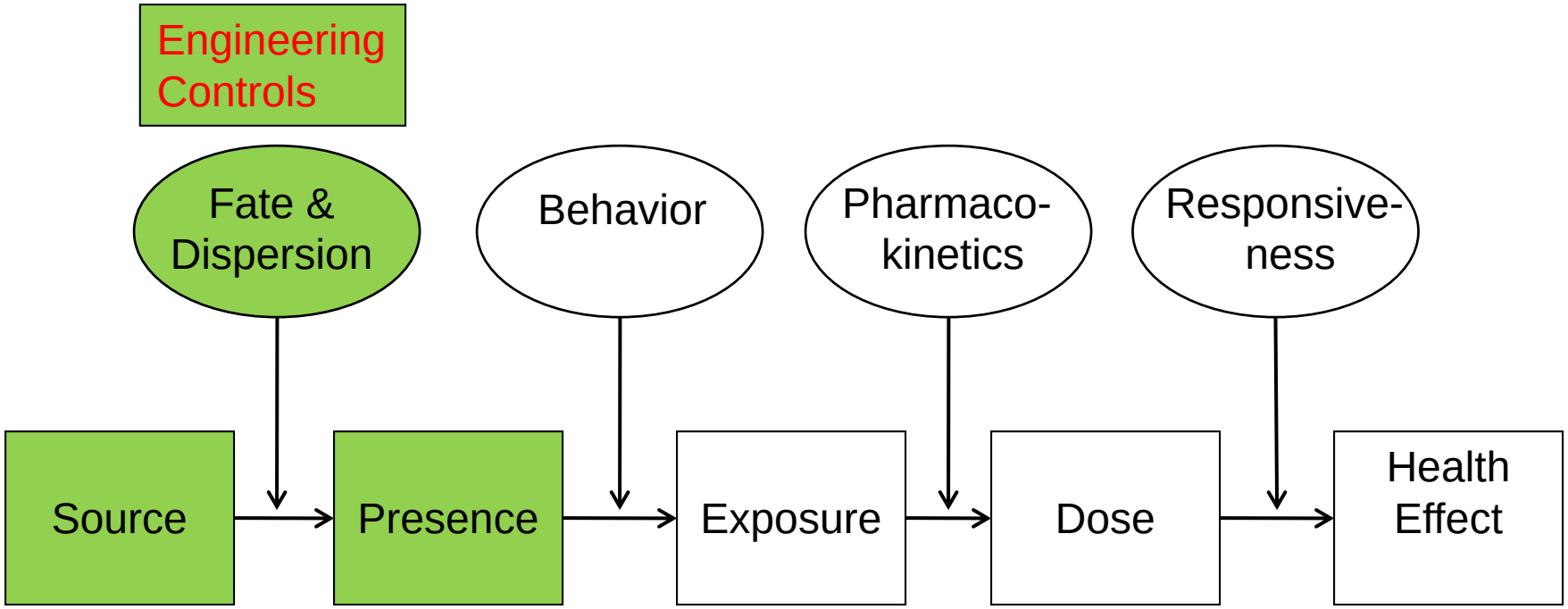
Concentration
- Outdoors
- Indoors
- In-transit

Conc x *t*


Transport inside body
Metabolism
Elimination
Sequestration
Fate & Dispersion
Behavior
Pharmaco-kinetics
Responsive-ness
Source
Presence
Exposure
Dose
Health Effect
Concentration
Conc x t
Amount
Mass
Energy

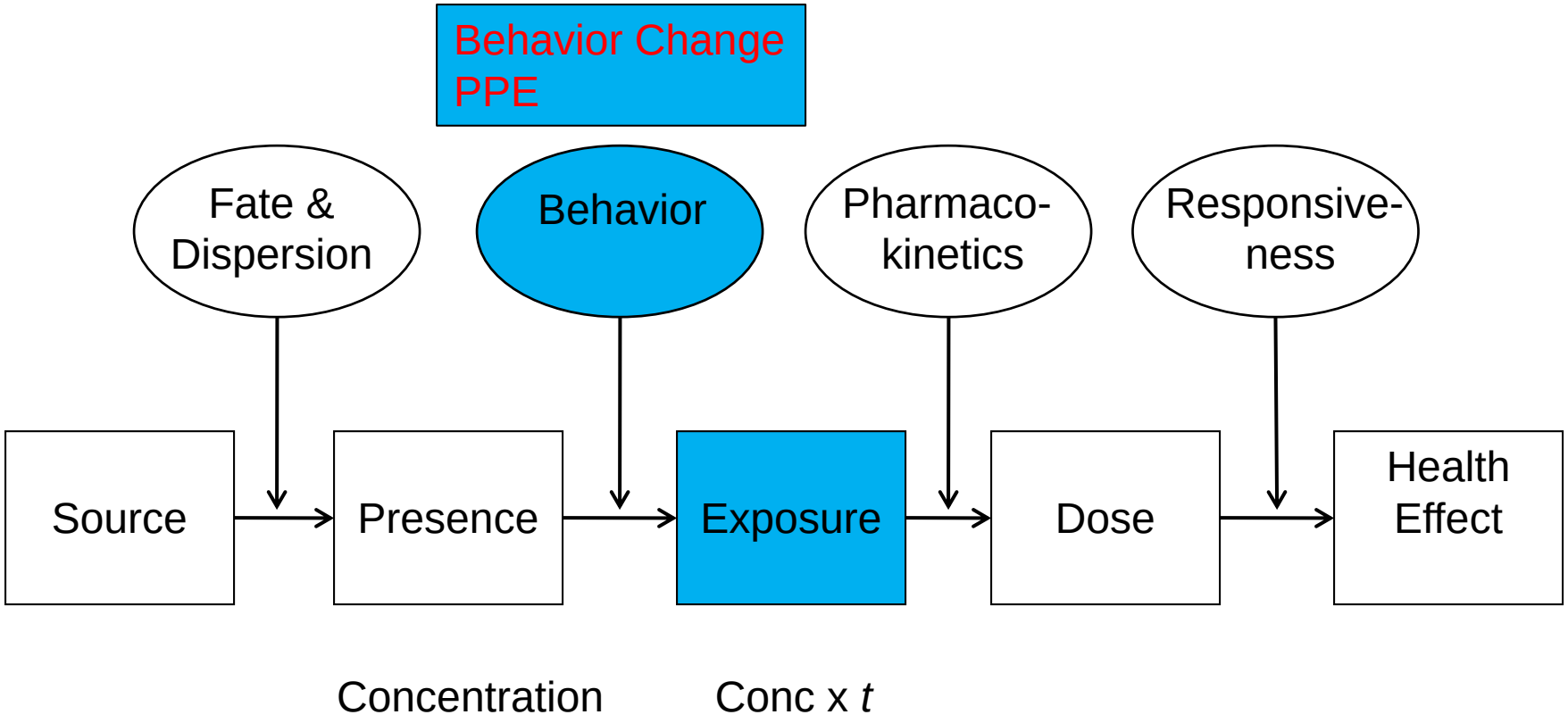

Dose-response
"Susceptibility"
R
D
Fate &
Dispersion
Behavior
Pharmaco-
kinetics
Responsive-
ness
Source
Presence
Exposure
Dose
Health
Effect
Amount
Mass
Energy
Pathology
Morbidity
Mortality

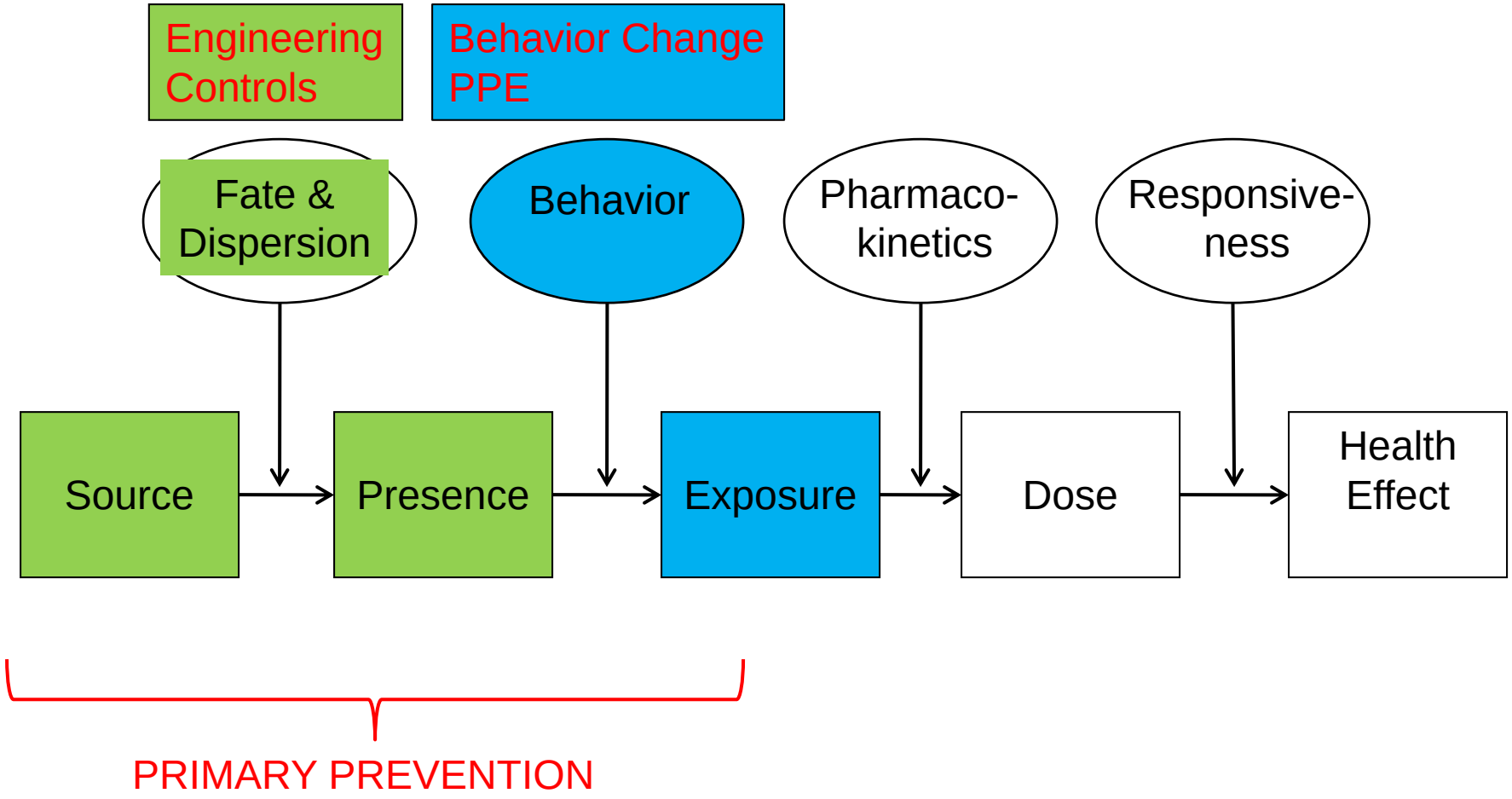
Opportunities for Intervention

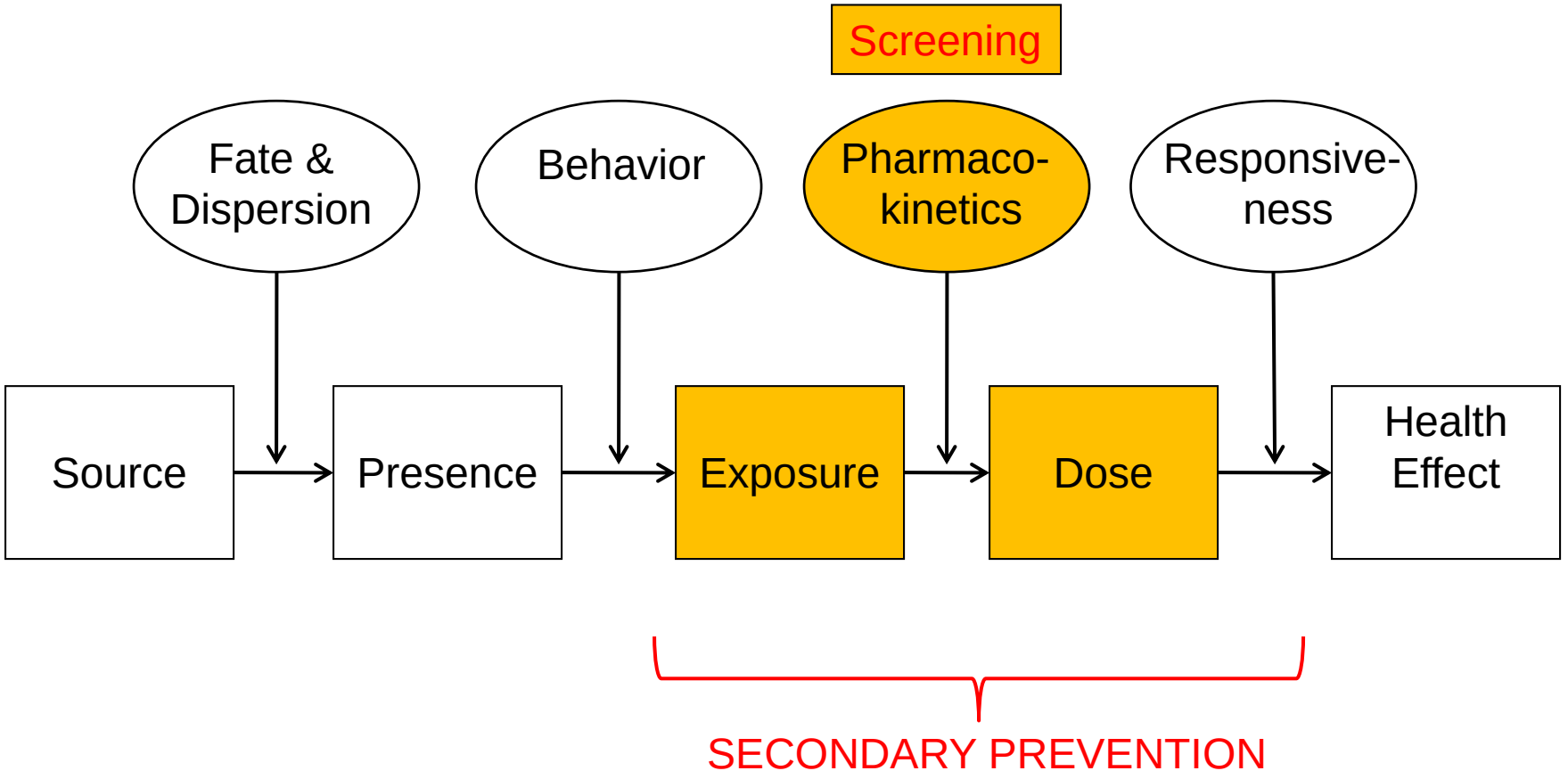


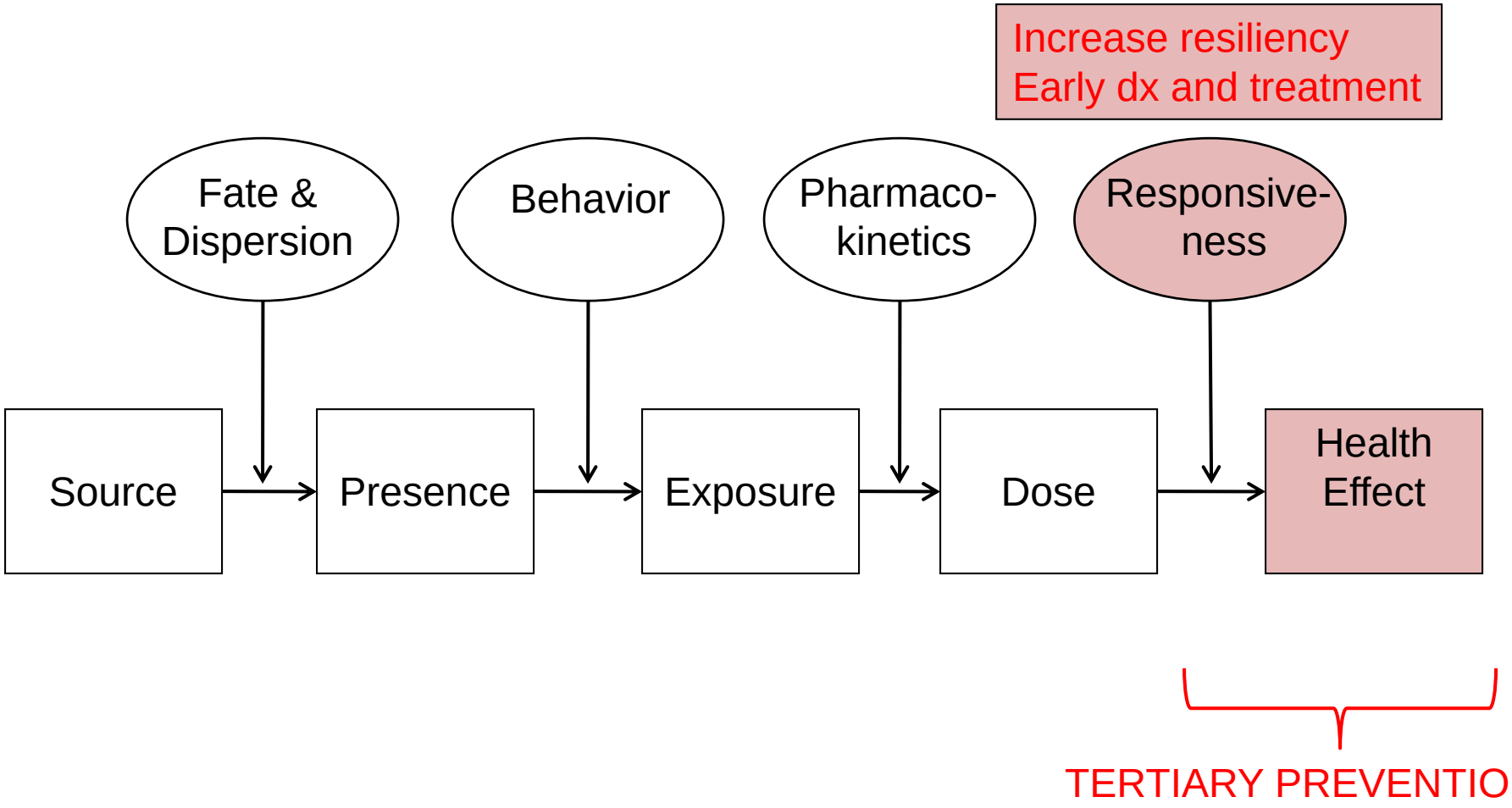
Smokestack
Product
Tailpipe

Concentration
- Outdoors
- Indoors
- In-transit


Behavior Change
PPE
Fate &
Dispersion
Behavior
Pharmaco-
kinetics
Responsive-
ness
Source
Presence
Exposure
Dose
Health
Effect
Concentration
Conc x t

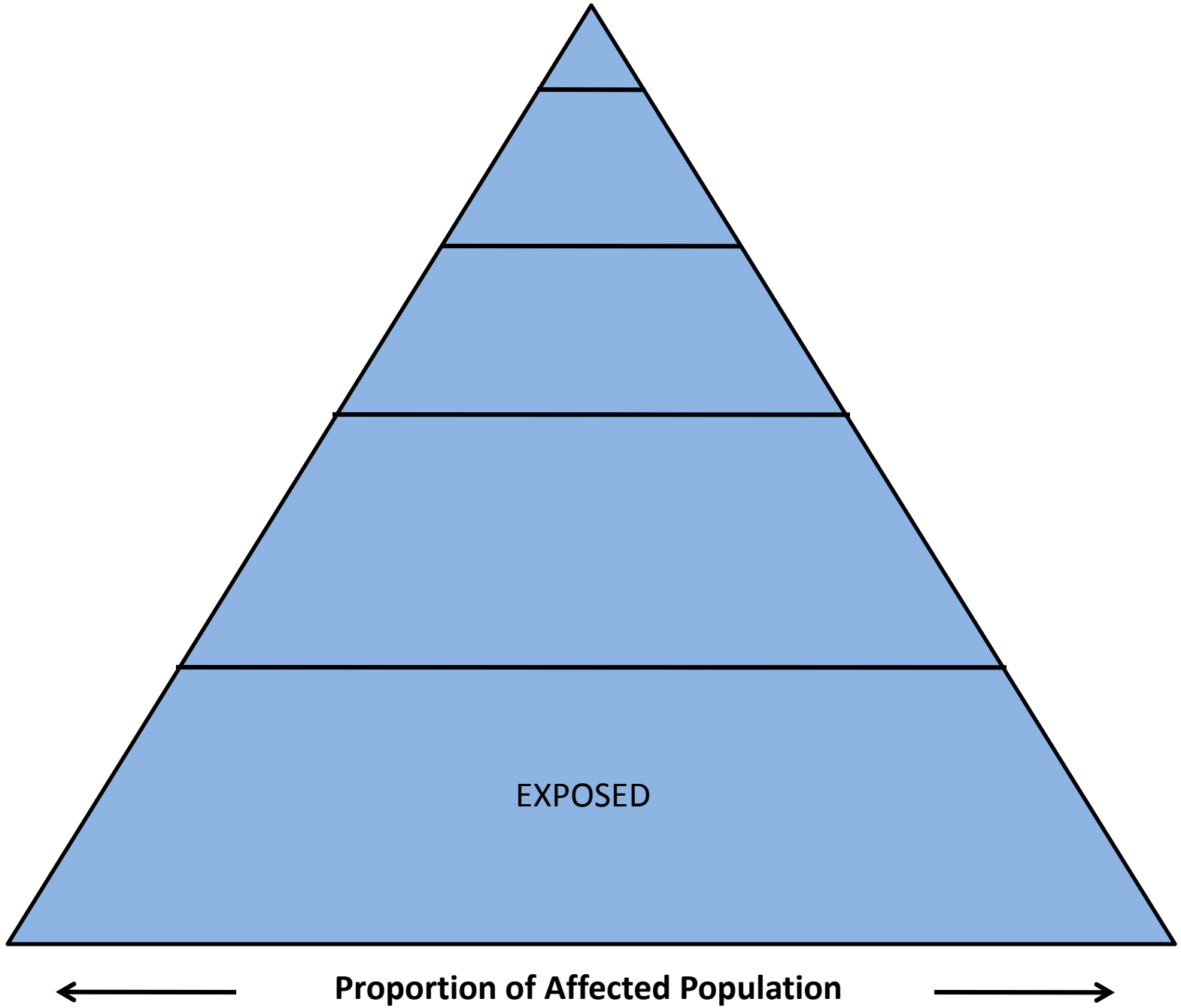

Engineering Controls
Behavior Change PPE
Fate & Dispersion
Behavior
Pharmaco-kinetics
Responsive-ness
Source
Presence
Exposure
Dose
Health Effect
PRIMARY PREVENTION

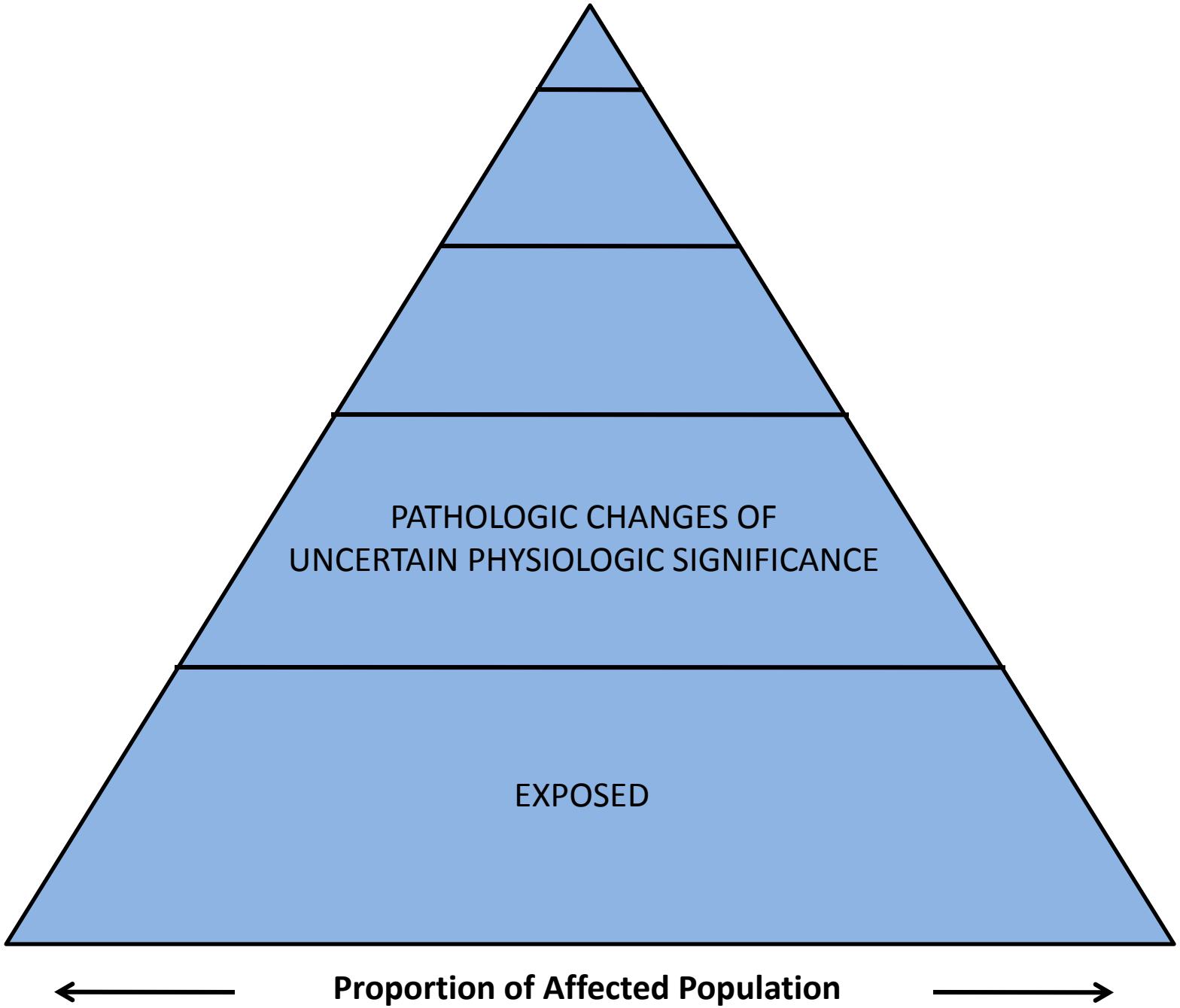

Screening
Fate & Dispersion
Behavior
Pharmaco-kinetics
Responsive-ness
Source
Presence
Exposure
Dose
Health Effect
SECONDARY PREVENTION

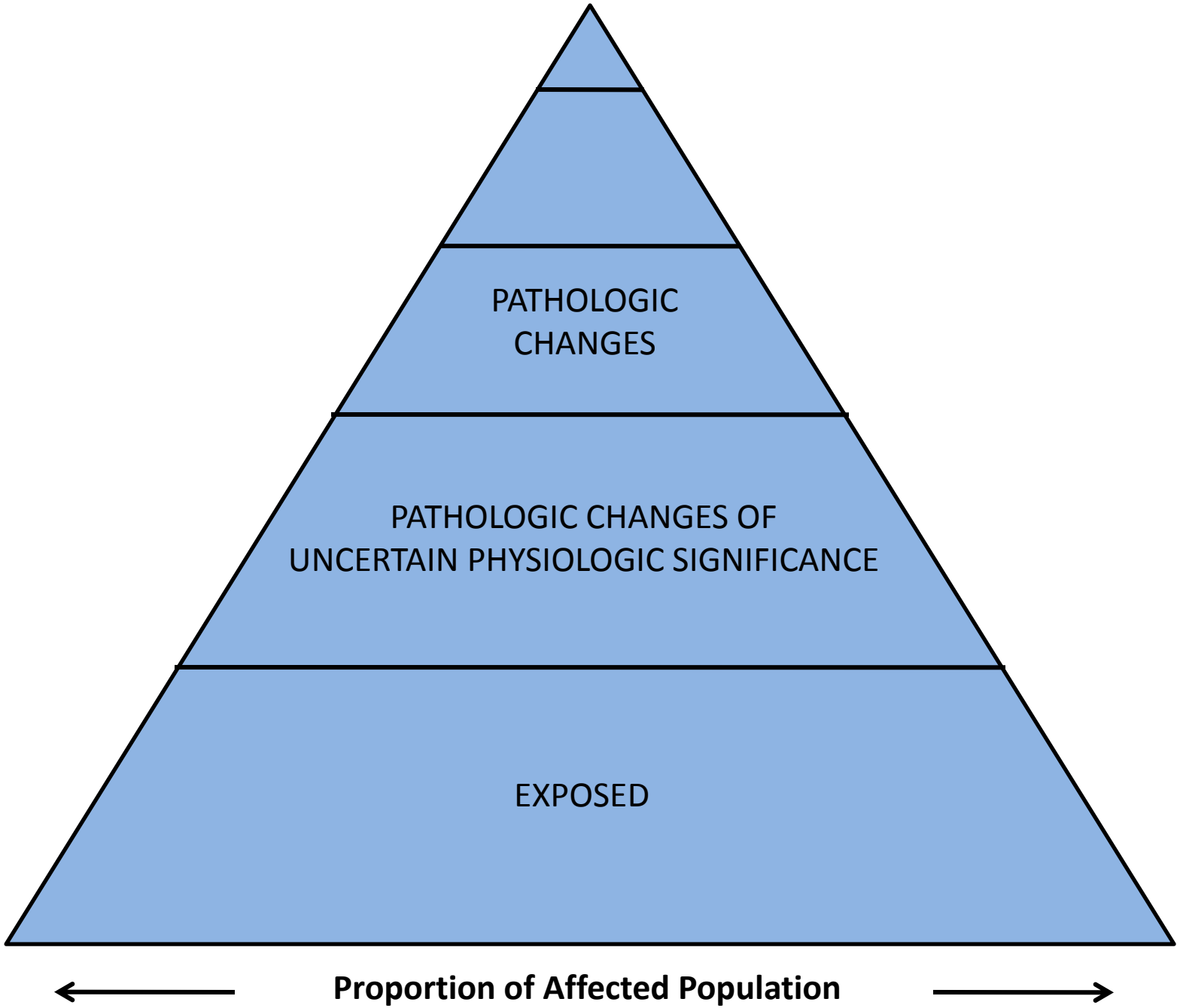

Increase resiliency
Early dx and treatment
Fate & Dispersion
Behavior
Pharmaco-kinetics
Responsive-ness
Source
Presence
Exposure
Dose
Health Effect
TERTIARY PREVENTION

Summary

1. PRIMARY – “At the source.” Reduce or eliminate the exposure.
2. SECONDARY – “Early detection of exposure before harm.” Identify exposed persons before illness/disease occurs.
3. TERTIARY – “Treat the illness/disease”. Treatment to slow or prevent progression; reduce the consequences of disease.


EXPOSED
Proportion of Affected Population


PATHOLOGIC CHANGES OF
UNCERTAIN PHYSIOLOGIC SIGNIFICANCE
EXPOSED
Proportion of Affected Population


PATHOLOGIC
CHANGES
PATHOLOGIC CHANGES OF
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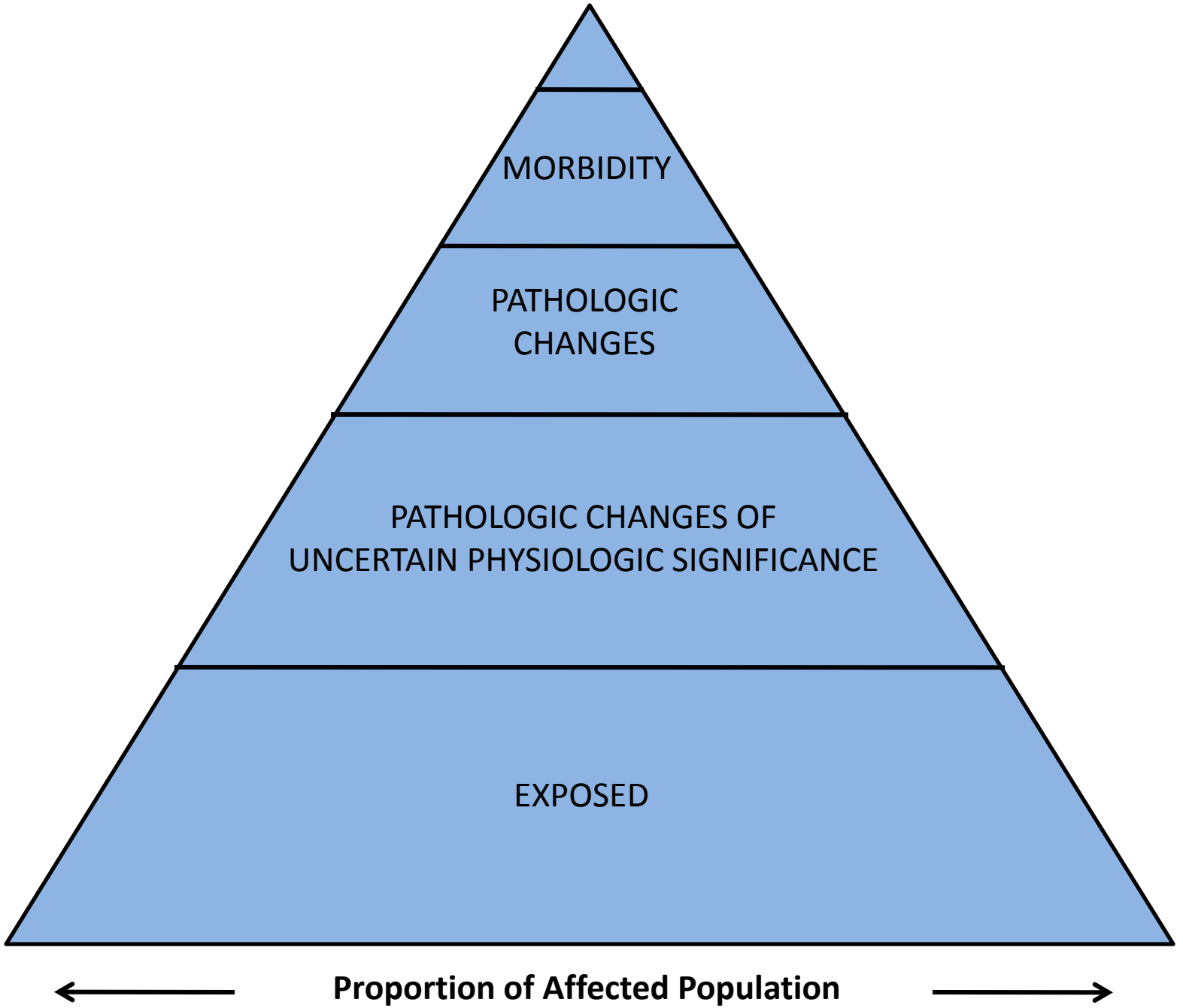
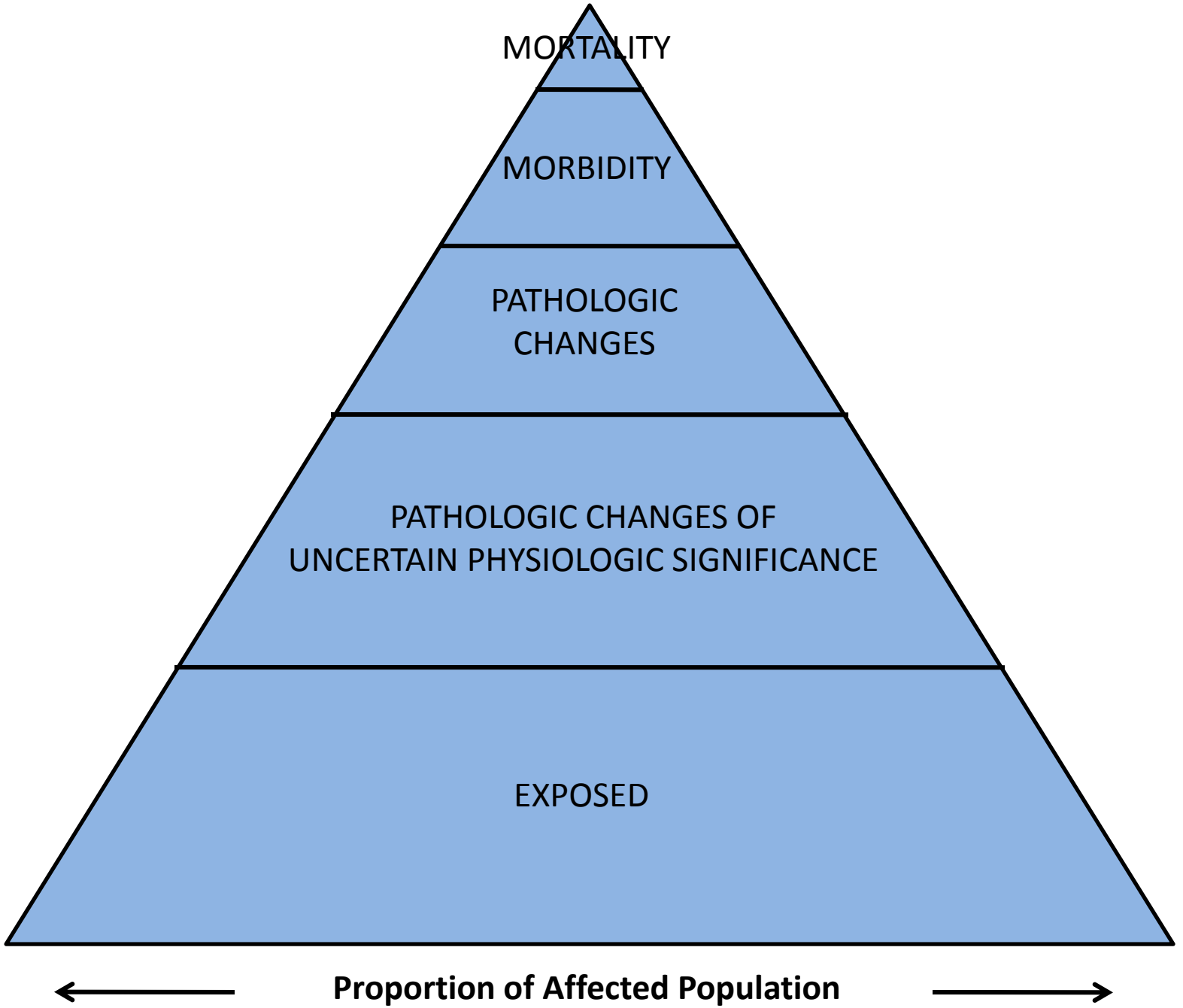
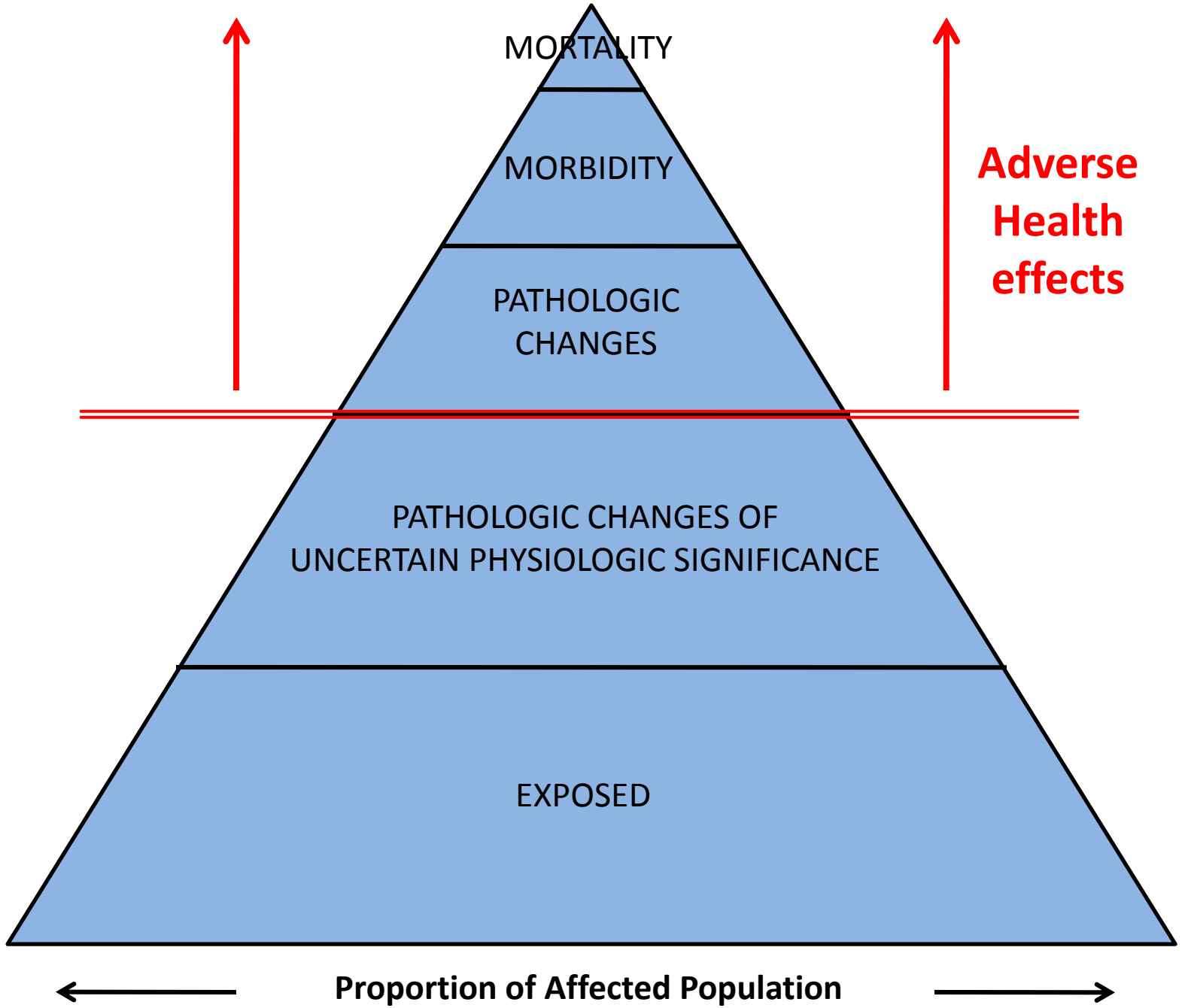
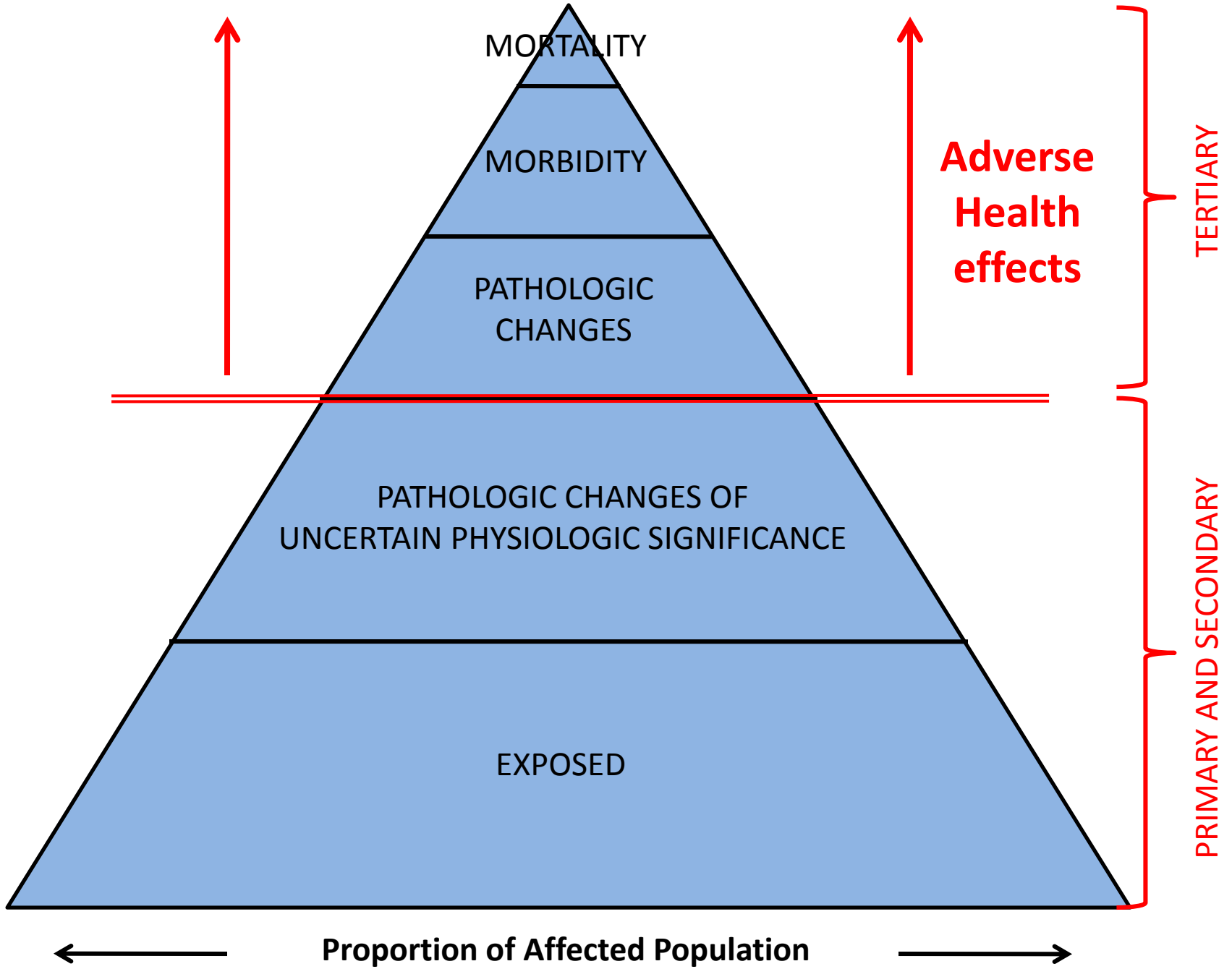

MORBIDITY
PATHOLOGIC CHANGES
PATHOLOGIC CHANGES OF UNCERTAIN PHYSIOLOGIC SIGNIFICANCE
EXPOSED
Proportion of Affected Population


MORTALITY
MORBIDITY
PATHOLOGIC CHANGES
PATHOLOGIC CHANGES OF UNCERTAIN PHYSIOLOGIC SIGNIFICANCE
EXPOSED
Proportion of Affected Population


MORTALITY
MORBIDITY
PATHOLOGIC CHANGES
PATHOLOGIC CHANGES OF UNCERTAIN PHYSIOLOGIC SIGNIFICANCE
EXPOSED
Adverse Health effects
Proportion of Affected Population


MORTALITY
MORBIDITY
PATHOLOGIC CHANGES
PATHOLOGIC CHANGES OF UNCERTAIN PHYSIOLOGIC SIGNIFICANCE
EXPOSED
Adverse Health effects
TERTIARY
PRIMARY AND SECONDARY
Proportion of Affected Population

The Core Functions of Public Health Systems

Community Diagnosis

-Surveillance
-Monitoring
-ID causes
-Research
-Evaluation

Community Diagnosis

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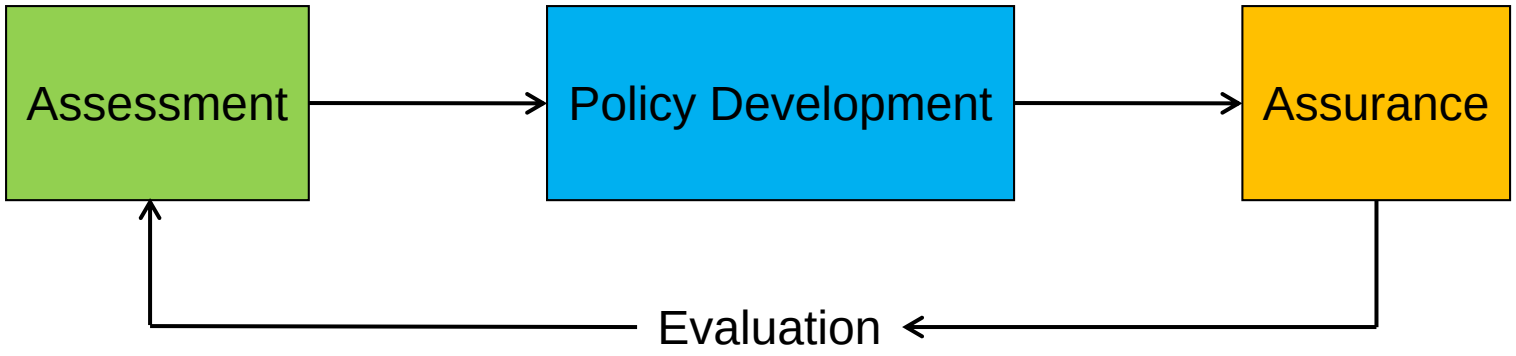
-Research
-Evaluation

Action

-Facilitate between public and private organizations
-Decisions
-Design program
-Apply technical knowledge



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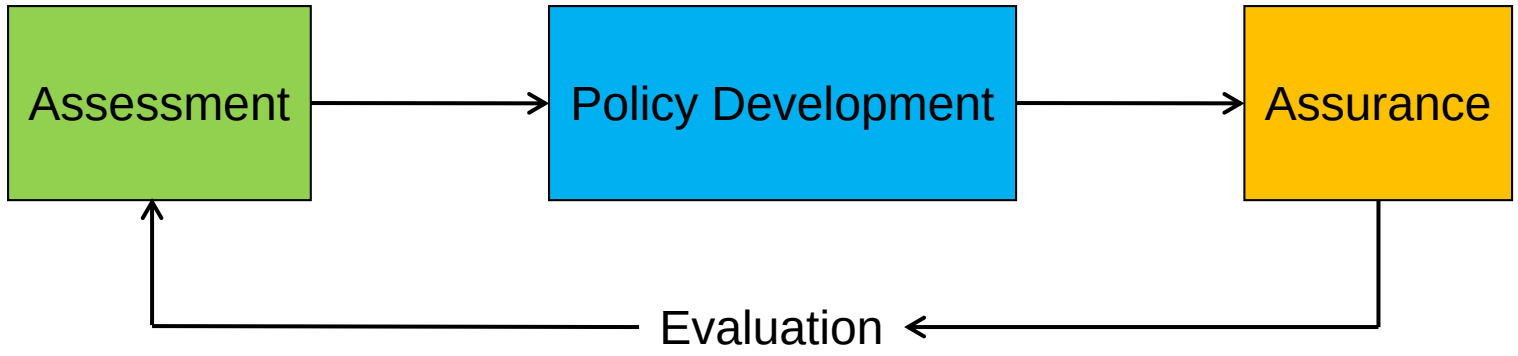
Exercise Authority

-Implementation of legislative mandates
-Maintain statutory responsibilities
-Maintain accountability
-Guarantee certain health services



Community Diagnosis

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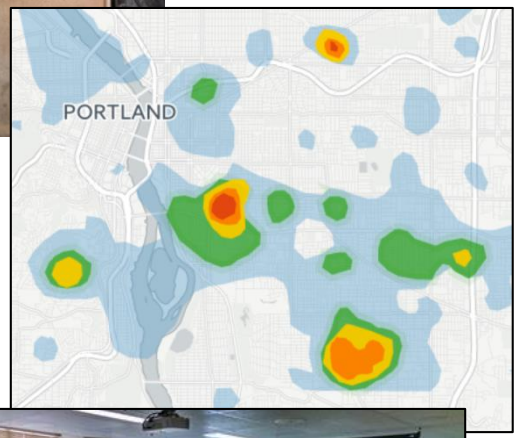
Example: Cleaner Air Oregon

1. Discovery of contamination
2. ID likely sources (artisan glass production facilities)
3. Mobilization of special air monitors
4. Soil sampling
5. Urinalysis
6. Compelled industrial sources to curtail use of metals
7. Interim and permanent regulations adopted
8. Continued air monitoring
9. Government facilitated public and industry discussions -> Cleaner Air Oregon



Part 2.
Types of Environmental Investigations

1. Public Health Assessments
2. Community Biologic Testing
3. Community Health Studies
4. Cancer Studies

1. Public Health Assessment

- Process is structured after investigation of hazardous waste sites
- Developed by ATSDR – Guidance Manual was updated in January 2005
- https://www.atsdr.cdc.gov/hac/phamanual/pdfs/phagm_final1-27-05.pdf
- Followed by State DOHs

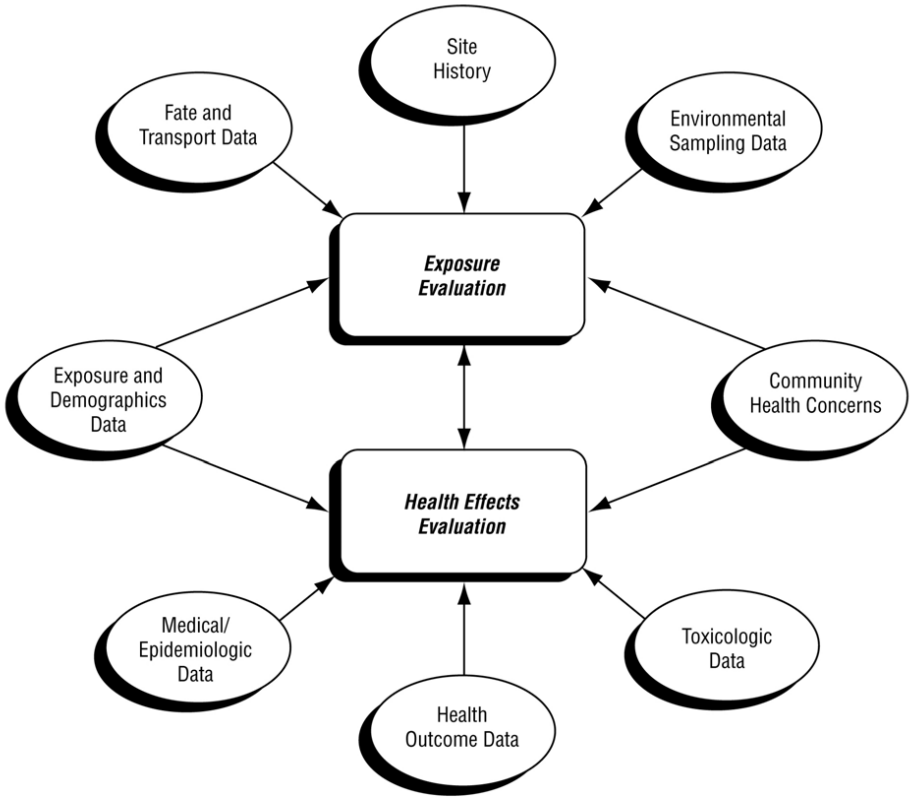
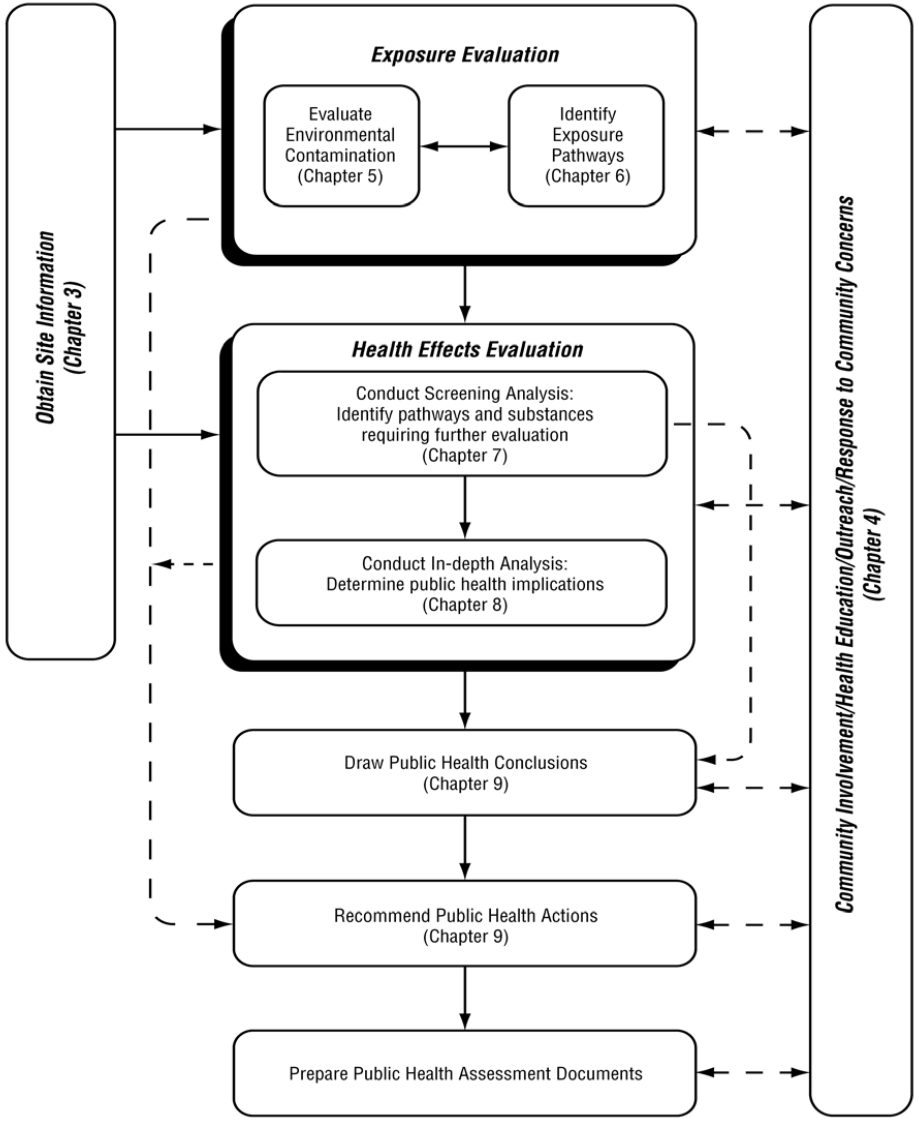


Figure 2-3. Information Needed To Evaluate Exposures and Health Effects

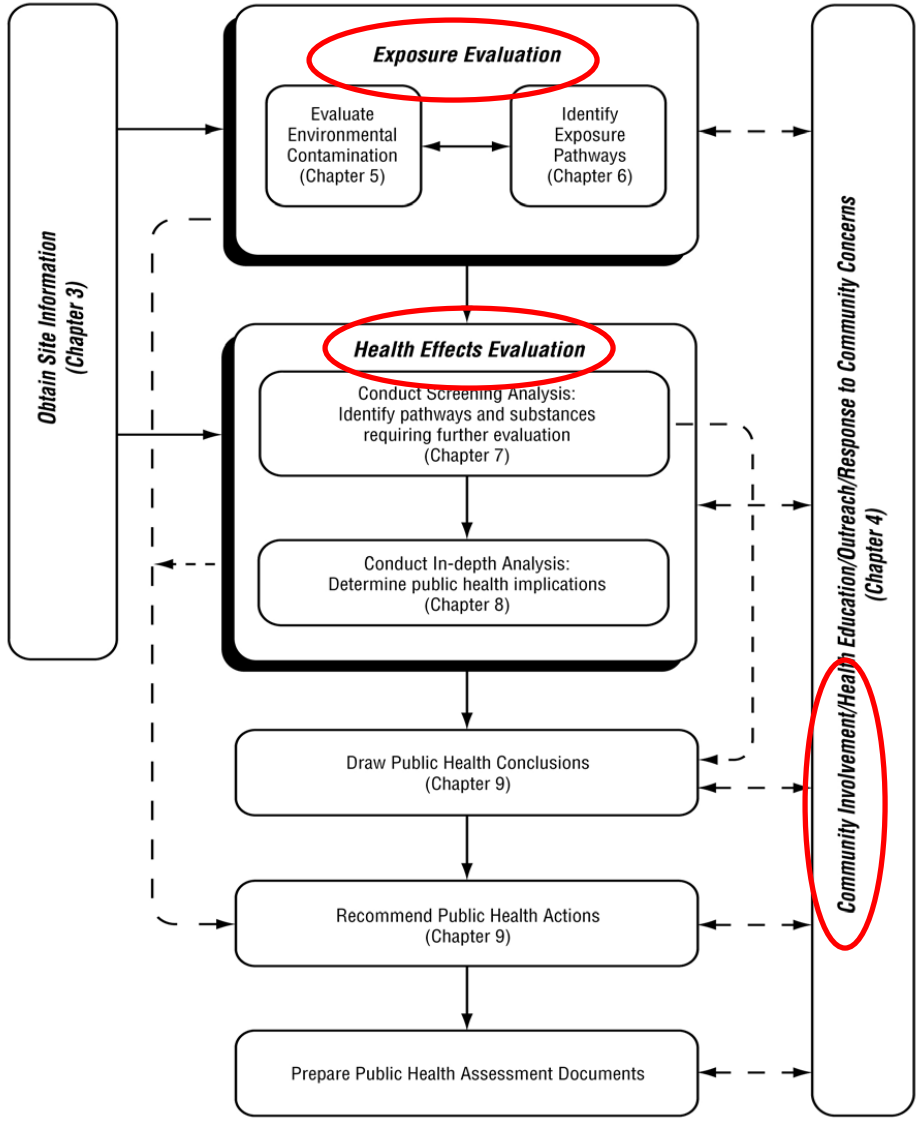
PHA is an assessment activity

- Intended to scope the citizens' concern
- Organizes situation specific data to determine the degree of population exposure and potential for harm
- Informs subsequent investigation, policy development, and assurance activities



The PHA Process

- Compiles existing data bases for analysis
- Two major steps:
  1. Exposure evaluation
  2. Health effects evaluation
- Site-specific exposure considerations are used
- Substance-specific information from toxicological and epidemiological literature is used
- Formal involvement of the community is considered standard practice



PHA

STRENGTHS

- Uses local air monitoring data quickly and specifically define the exposure potential
- Timely – This method can inform of risk to public before long-term health effects become evident
- Applies published scientific evidence (general causation) to the individual situation of the neighborhood residents to evaluate potential health risk

LIMITATIONS

- Existing data may not be complete or precise enough to derive confident answers
- Predicts potential risk for the neighborhood residents
- Risk estimate can only be appropriately applied to the overall group, and not to an individual within the group
- It is not possible to determine whether an individual's condition/disease is caused by the exposure

2. Community biological testing

- Measures body burden of chemical
- Represents dose over a specific time period, varying for each chemical
- Specimens:
  - Blood
  - Urine
  - Stool
  - Saliva
  - Breast milk
  - Hair, finger nails, teeth
- Non-invasive imaging

Biological Testing

STRENGTHS

- Provides precise evidence of exposure and potentially the degree of exposure for an individual
- Repeated sampling over time can provide more accurate information than estimates modelled from air monitoring data
- Can be spatially and temporally analyzed to evaluate trends
- For long-half life chemical compounds, can represent long-term exposure
- Generally the measure must be interpreted as an average over a time period and does not allow inference of short-term peak exposures

LIMITATIONS

- Invasive
- Can be costly
- Multiple analytic methods needed to address multiple chemical contaminants
- Samples must be carefully collected and handled to prevent contamination
- As in the clinical situation, elevated results must be confirmed (rule out false positives)
- The lower limit-of-detection may be above the environmentally relevant levels
- Reference levels for non-exposed populations may not be published
- Other sources of exposure can be present
- Short half-life in body can make unfeasible
- Privacy and security concerns must be addressed

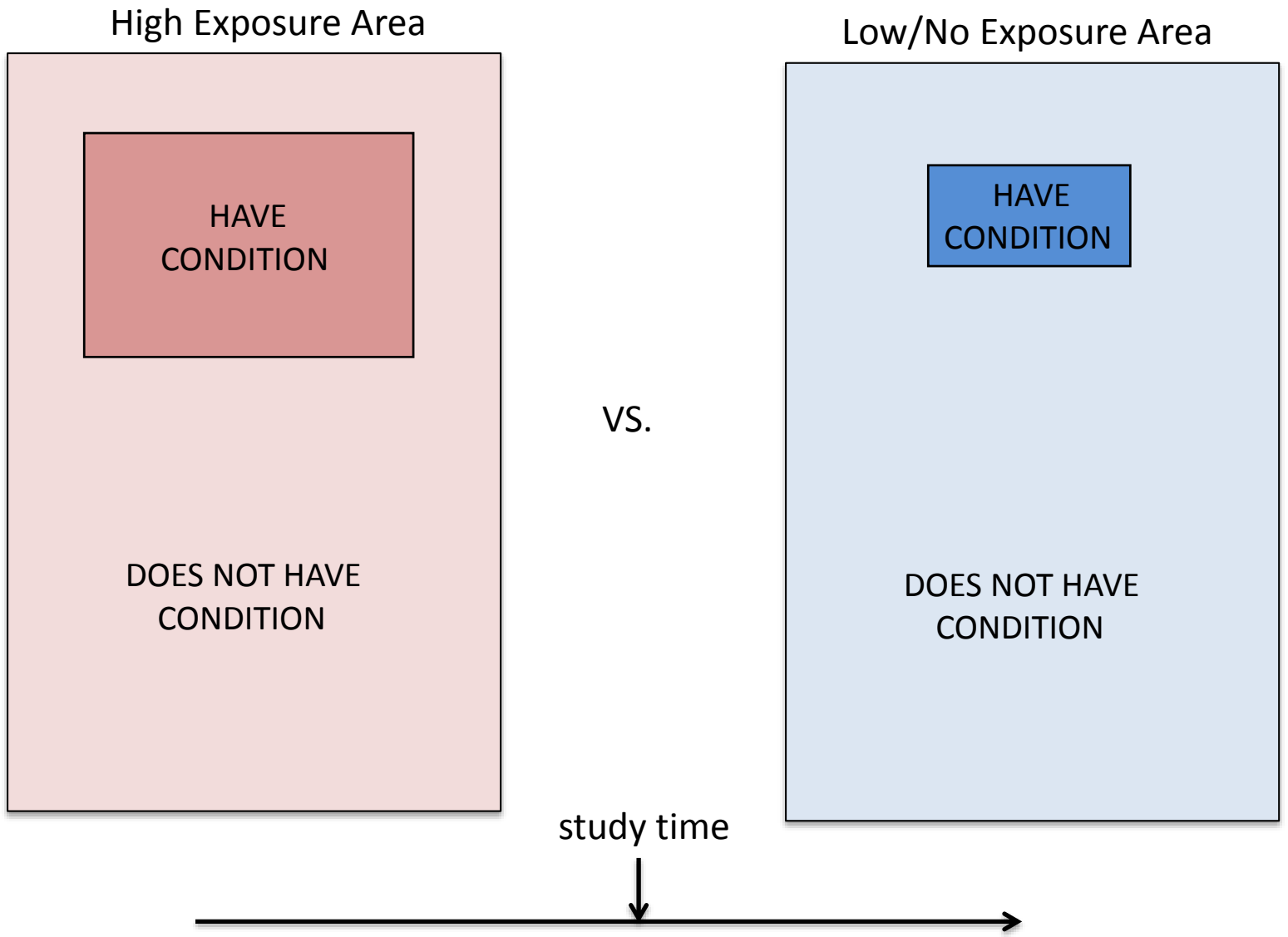
3. Community Health Studies

- Data are collected using methods beyond usual environmental and health monitoring
- These are considered to be epidemiologic studies
- They are “observational” and not true experiments
- Must be conducted very carefully to minimize bias, confounding, and chance variation
- Accurate and precise exposure assessment is essential in all of the following study designs

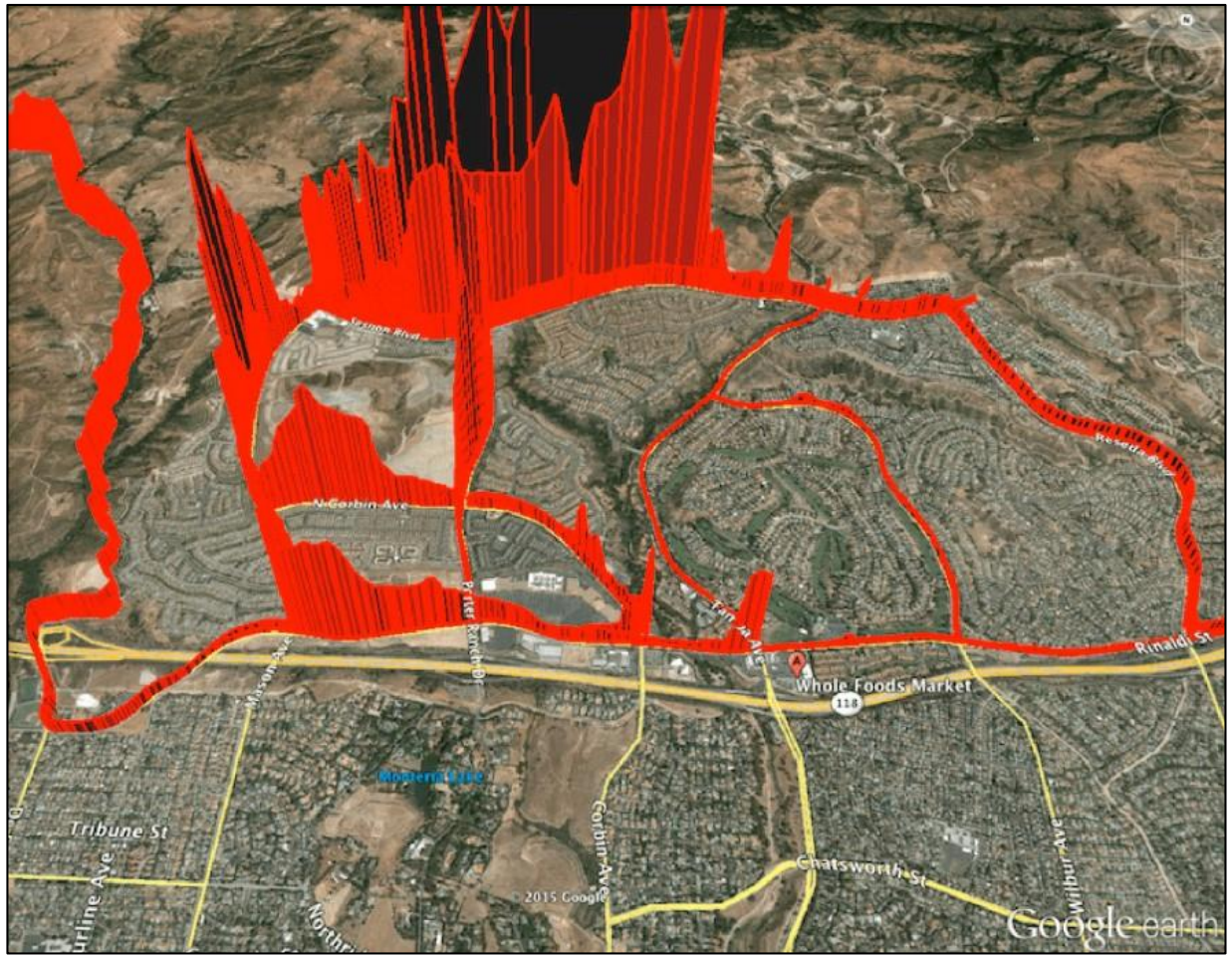
Epidemiologic Study Designs

- Measure exposure in time and place – <u>accuracy is essential in all of these designs:</u>
  - "Cross-sectional": Measure self-reported symptoms, illnesses, and disease conditions in exposed and unexposed neighborhoods
  - "Cohort": Measure over time for change in symptoms, illness, or new cases of disease
  - "Case-control": Compare diseased (cases) vs. healthy (controls) retrospectively for differences in past exposure

The Structure of Cross-Sectional Studies



Example 1: Natural gas leak



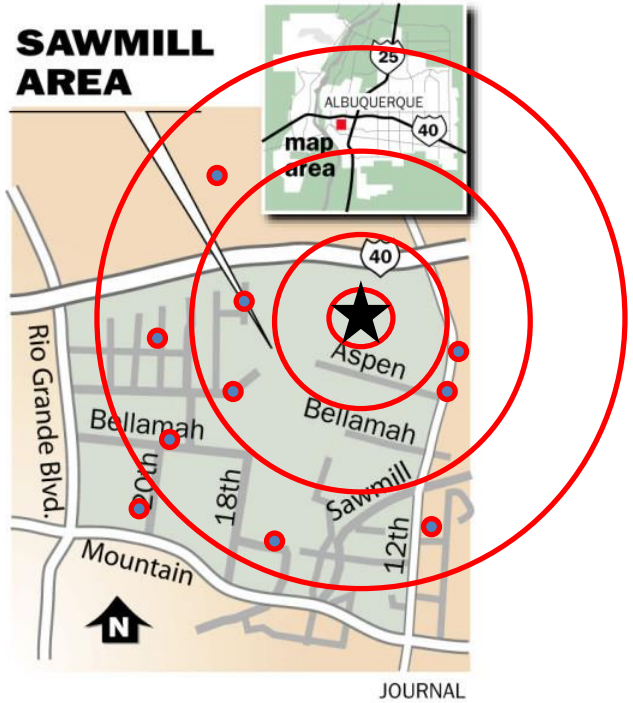
Porter Ranch, Southern California

http://inhabitat.com/activists-not-executives-arrested-over-aliso-canyon-methane-gas-leak/

Example 2: Albuquerque, New Mexico

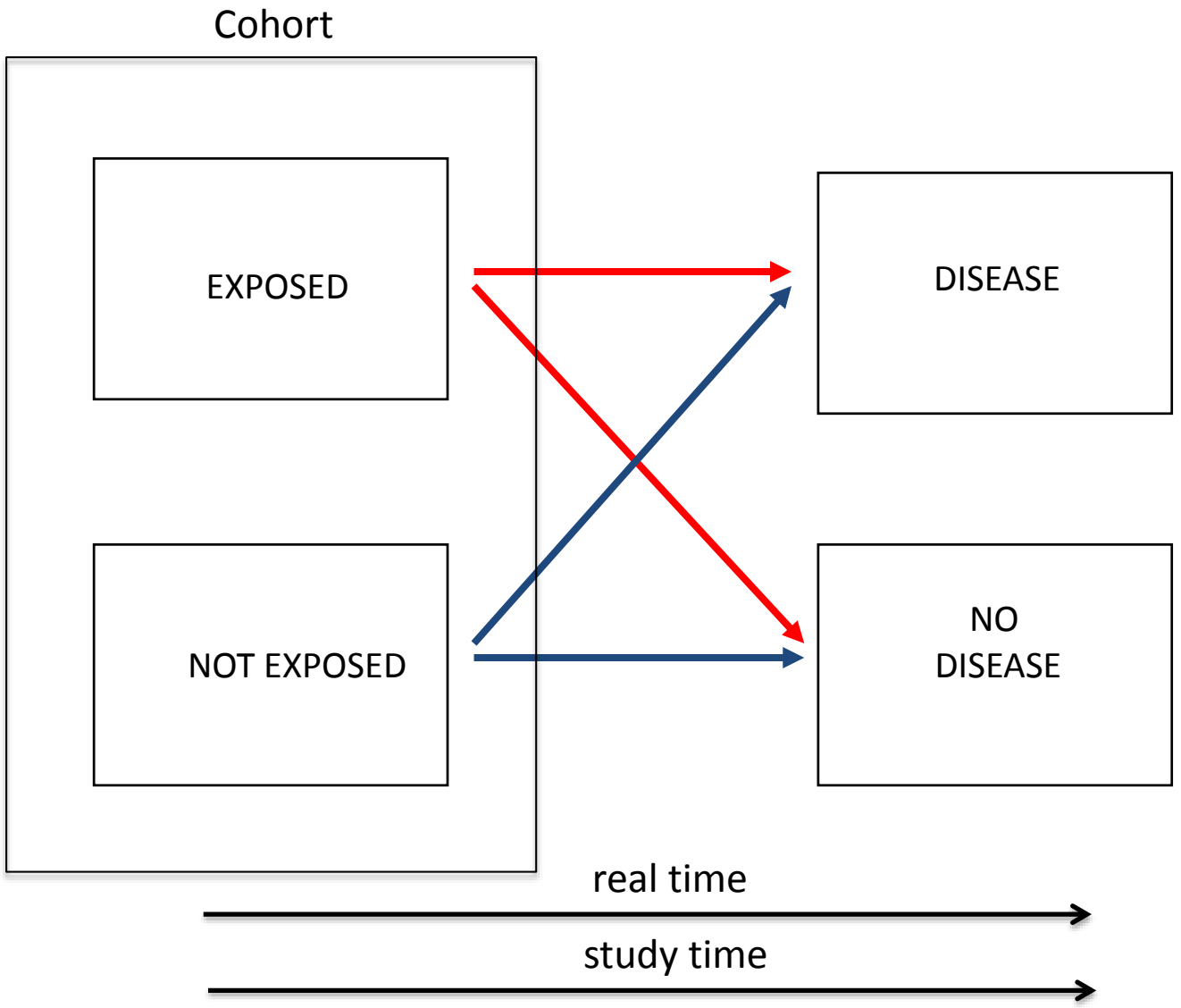
THEN (1995)

NOW (2016)



https://www.abqjournal.com/354227/sawmill-district-enjoying-renaissance.html

Cohort Studies



Cohort Studies

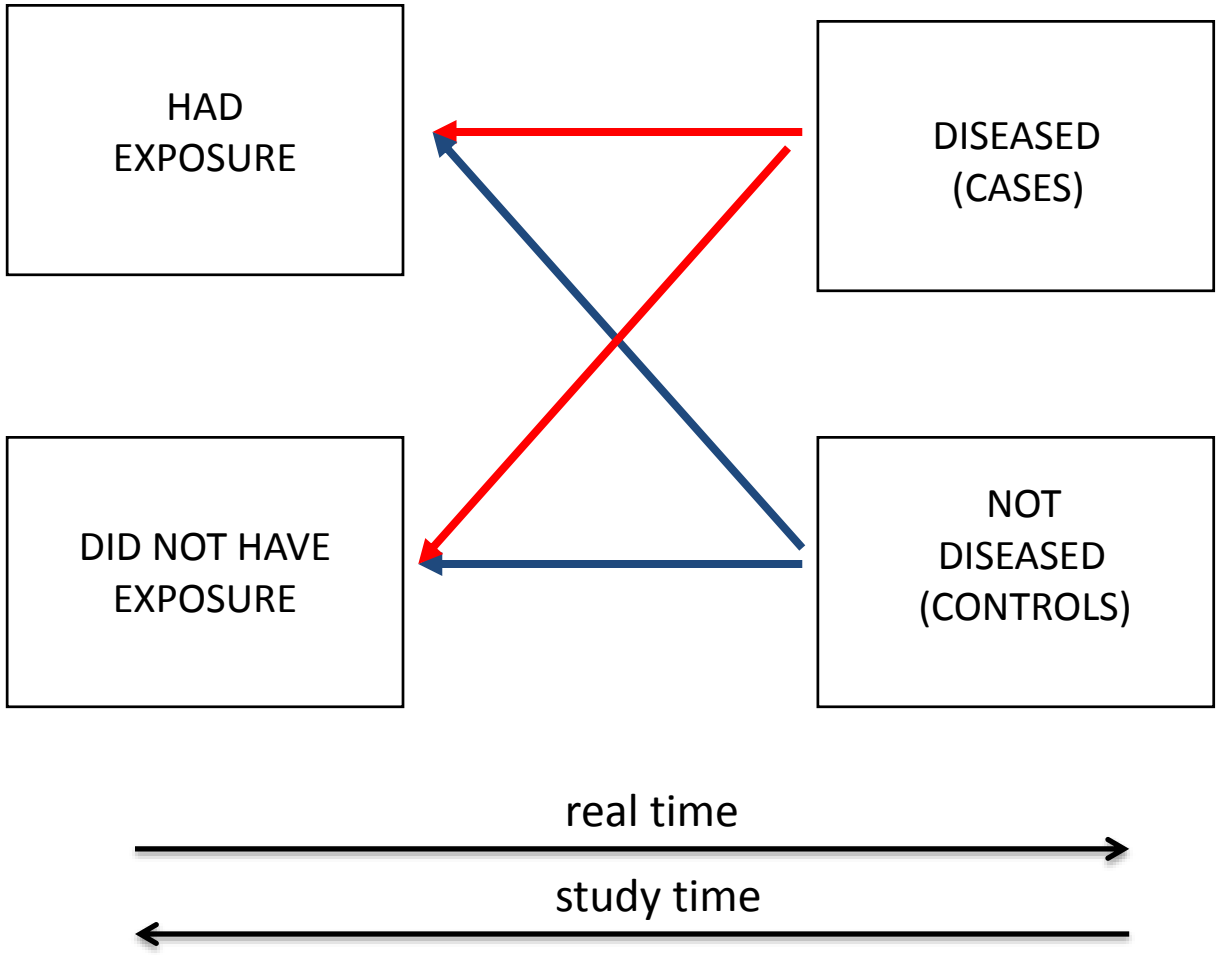
STRENGTHS

- Precise
- Measure incidence (new cases)
- Strong conclusions because you are confident the exposure occurred before the illness

LIMITATIONS

- Expensive and effort intensive
- Must wait for the development of illness
- Not efficient for rare illnesses because you must follow many people

Case-Control Studies



Case-Control Studies

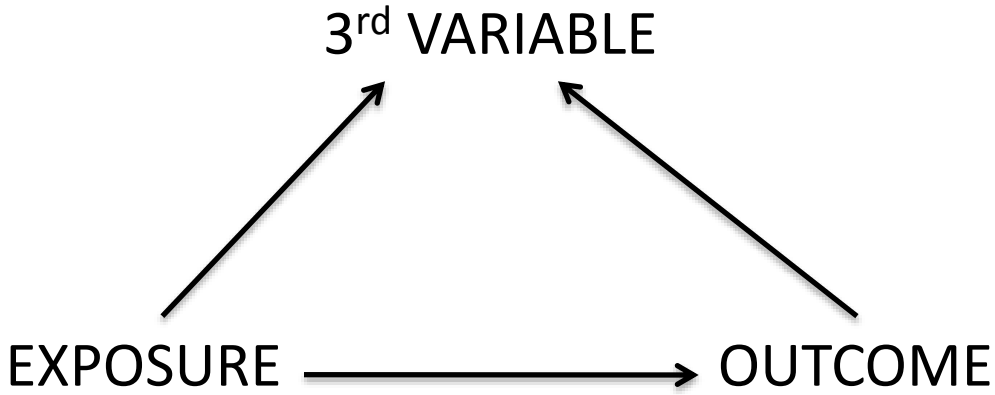
STRENGTHS

- Good for rare diseases
- Do not have to wait for the development of illness
- Small sample sizes
- Relatively less expensive

LIMITATIONS

- Must very carefully assemble control group to avoid selection bias
- Must careful measure past exposure to minimize misclassification
- Will not provide information on absolute risk (or incidence)

The Challenge of Confounding

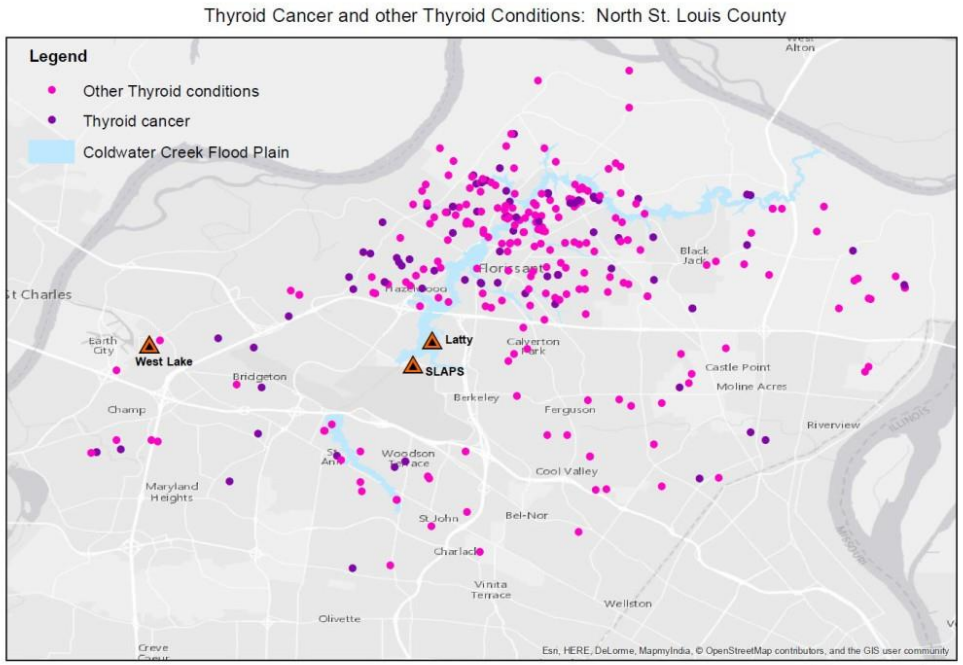


- Must control ("adjust") for third factors causing the disease, such as smoking or alcohol consumption
- Measurement of all variables, even "confounders" must be accurate and precise

4. Cancer Study Design Approaches

- Cancer is not one disease, but over 200 separate neoplastic diseases, each with its own set of causes
- Most cancers have multiple causes ("multifactorial in etiology")
- Epidemiologic studies must accommodate a latency of 5-15 years
- Most cancers are rare
- In small populations there may only be a few cases work with (small area analysis around a point source is challenging)
- Most research is performed by academic research universities with federal funding
- Cancer registry data is used (e.g., National Cancer Institute SEER Program)
  - OSCaR (Oregon State Cancer Registry)
  - >95% capture of malignant cancers
  - Date of dx, type, stage, demographics
- Cross-sectional designs are usually applied and local incidence rates are compared to published State or national incidence rates

Cancer Cluster Investigation



- A cluster is a “greater than expected number of cancer cases that occurs in a group of people in a geographic area over a period of time.” (CDC)
- Clusters that consist of one type of cancer, a rare type, or a type not usually observed in a demographic group might have a common cause.
- Even then it may not be associated with an environmental cause
- Must rule out alternative explanations (bias, confounding, chance)

Challenges of Cancer Cluster Investigations

- Small number of cases
- Chance (coincidental) grouping for reasons other than a common environmental cause
- Imprecise definitions of cancer
- Latency
- Change of residence (migration in and out)
- Most investigations do not demonstrate a clear association
- Can unintentionally raise fear and uncertainty of safety with social and economic impact

Summary

- Well established and validated scientific methods are used for routine monitoring of environmental hazards
- Environmental public health response to emerging issues requires technical expertise from biologists, chemists, toxicologists, and epidemiologists
- Public Health Assessments inform the decision to conduct additional investigations
- Multiple epidemiologic studies can be used, but there are trade-offs in cost and quality of information

Questions?

If your question is not answered during the time allotted, please contact us or check www.healthoregon.org/ehap sometime next week.

CONTACT EHAP-

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