

1st Annual Northwest Environmental Health Conference
“Bridging Research, Care, and Policy”

The why and how of “Prevention First”

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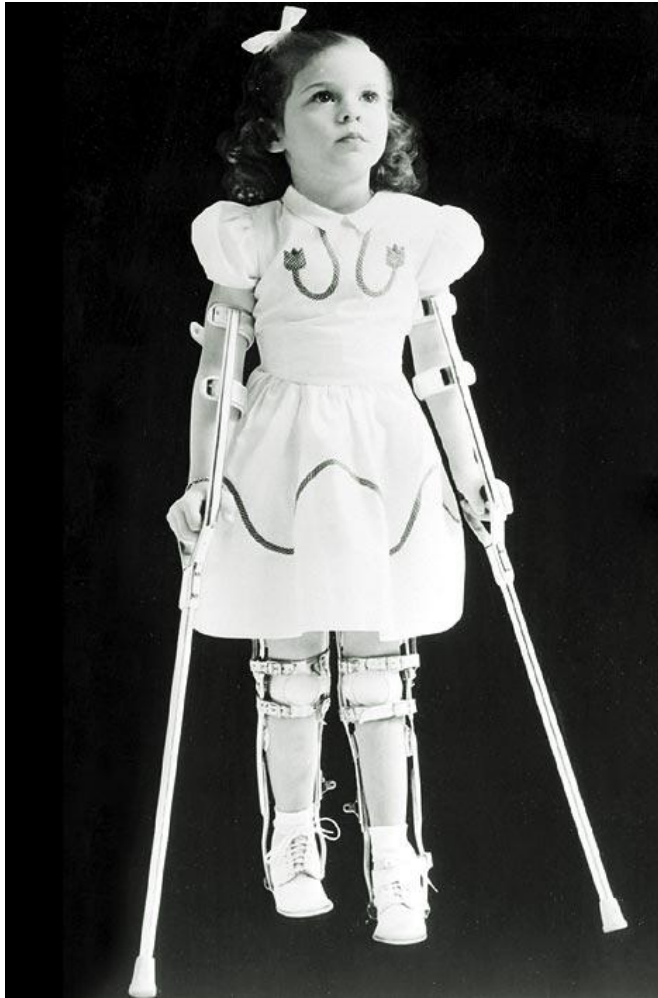
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- Understand the core functions of public health, as applied to environmental problems
- **Be awake!**

What is “prevention”?



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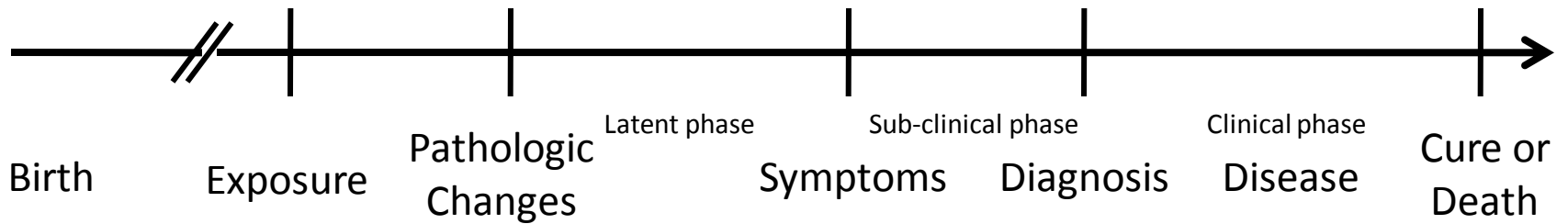
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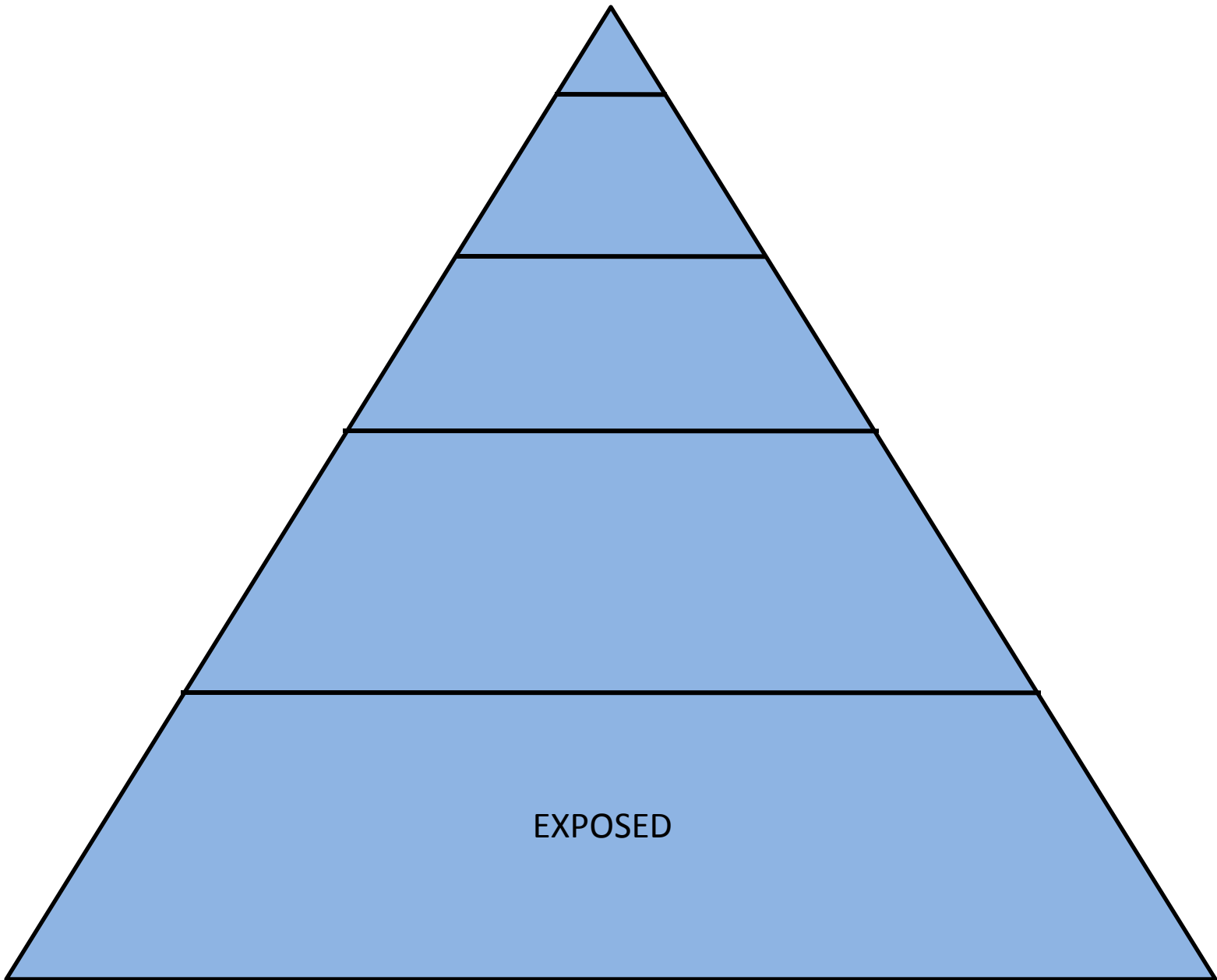
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 - **Some are still unknown**

Implications

- Public has high expectations for prevention programs
- Although complete eradication is not possible, many chronic diseases can be greatly reduced
- Prevention requires organized action at *both* the individual and community levels
- We must think in terms of populations, “attributable risk”, and “upstream” causes

Spectrum of disease



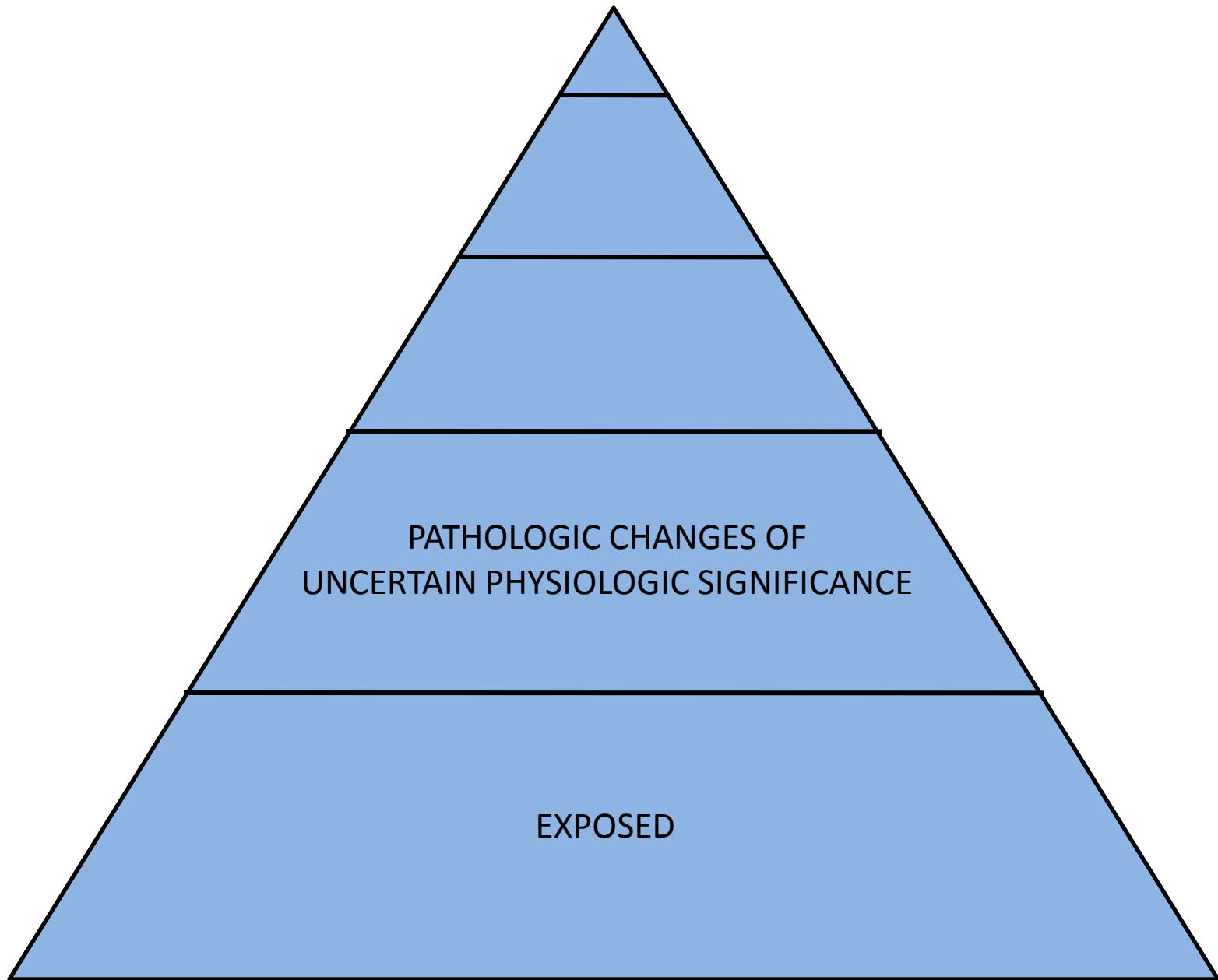


EXPOSED



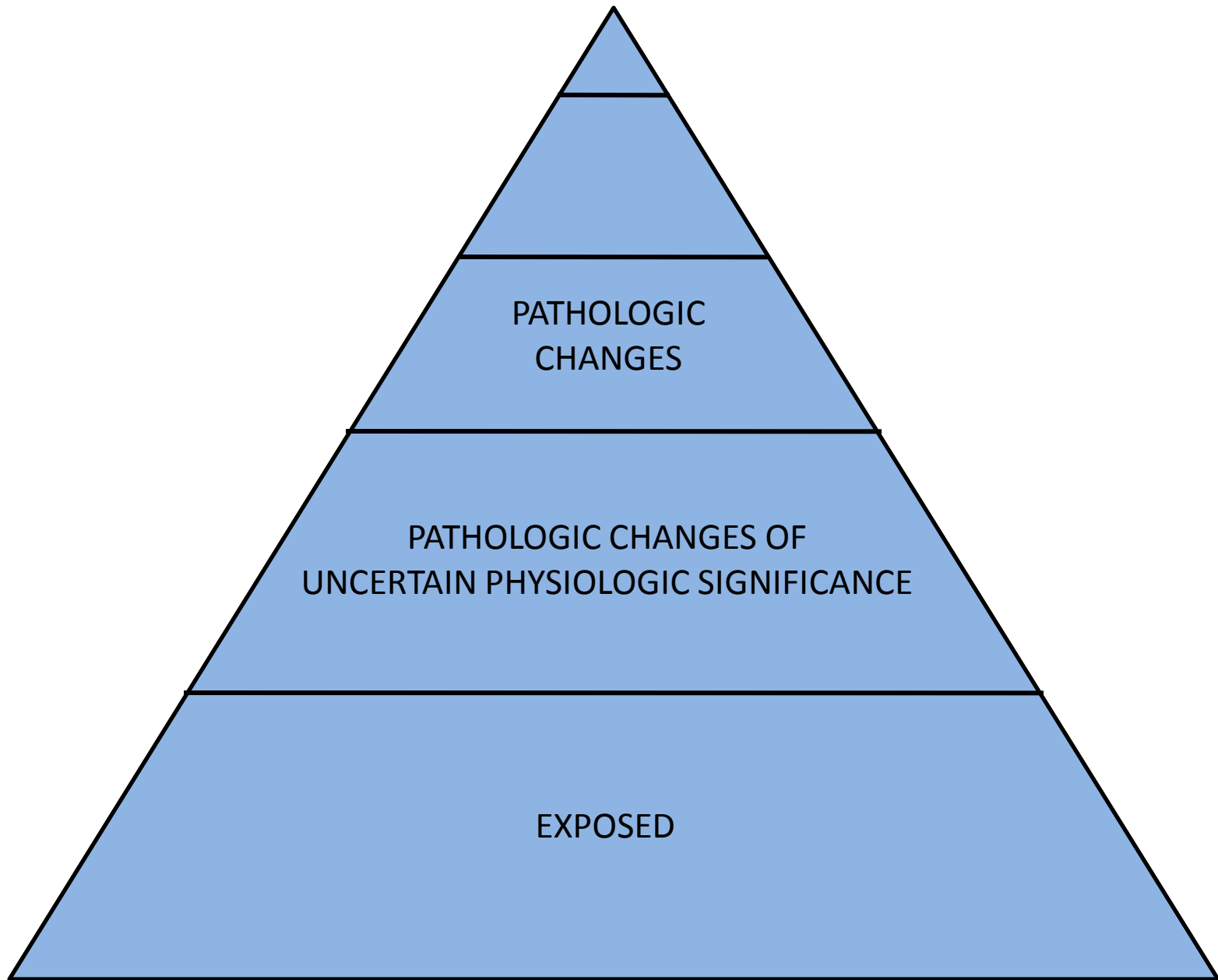
Proportion of Affected Population





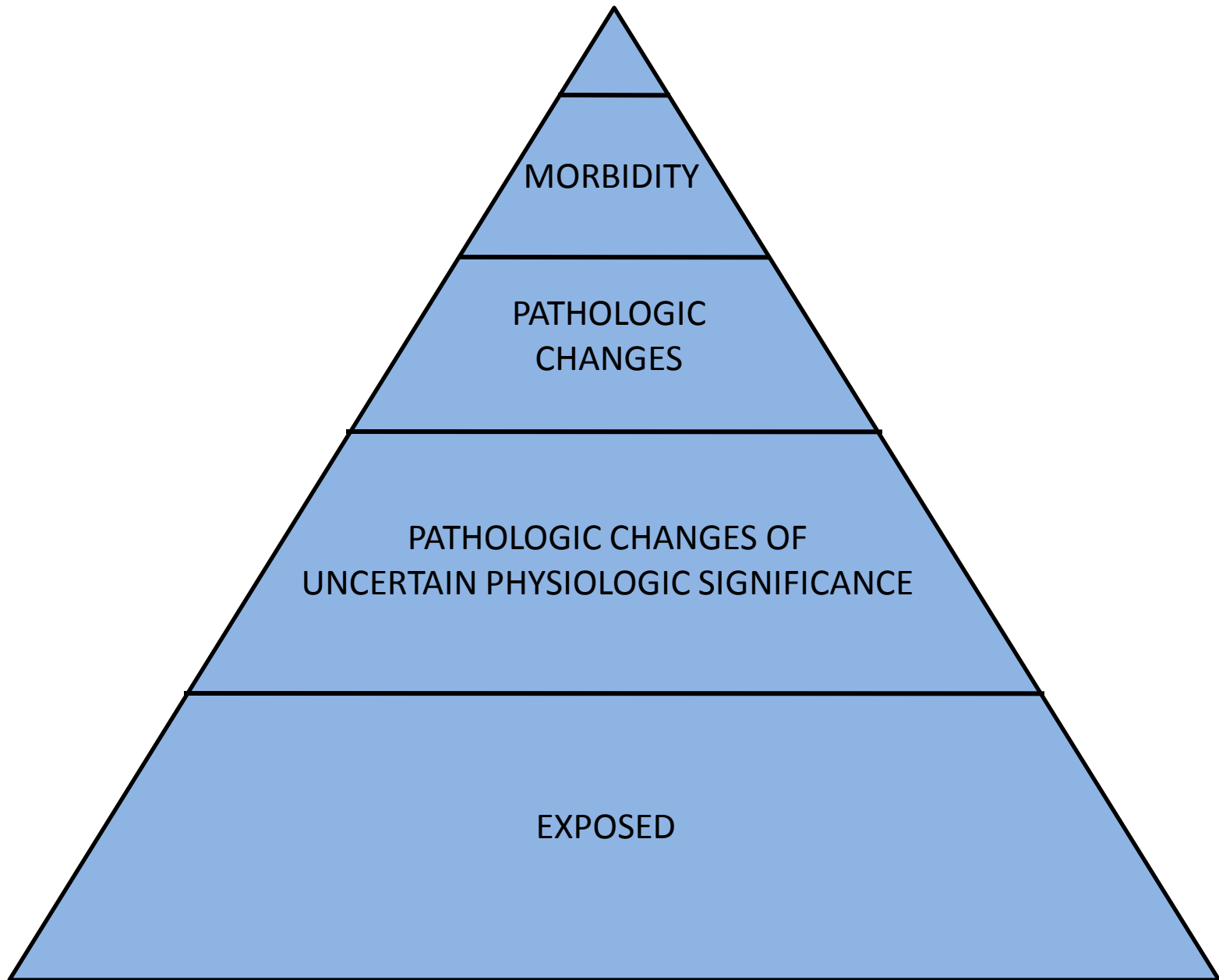
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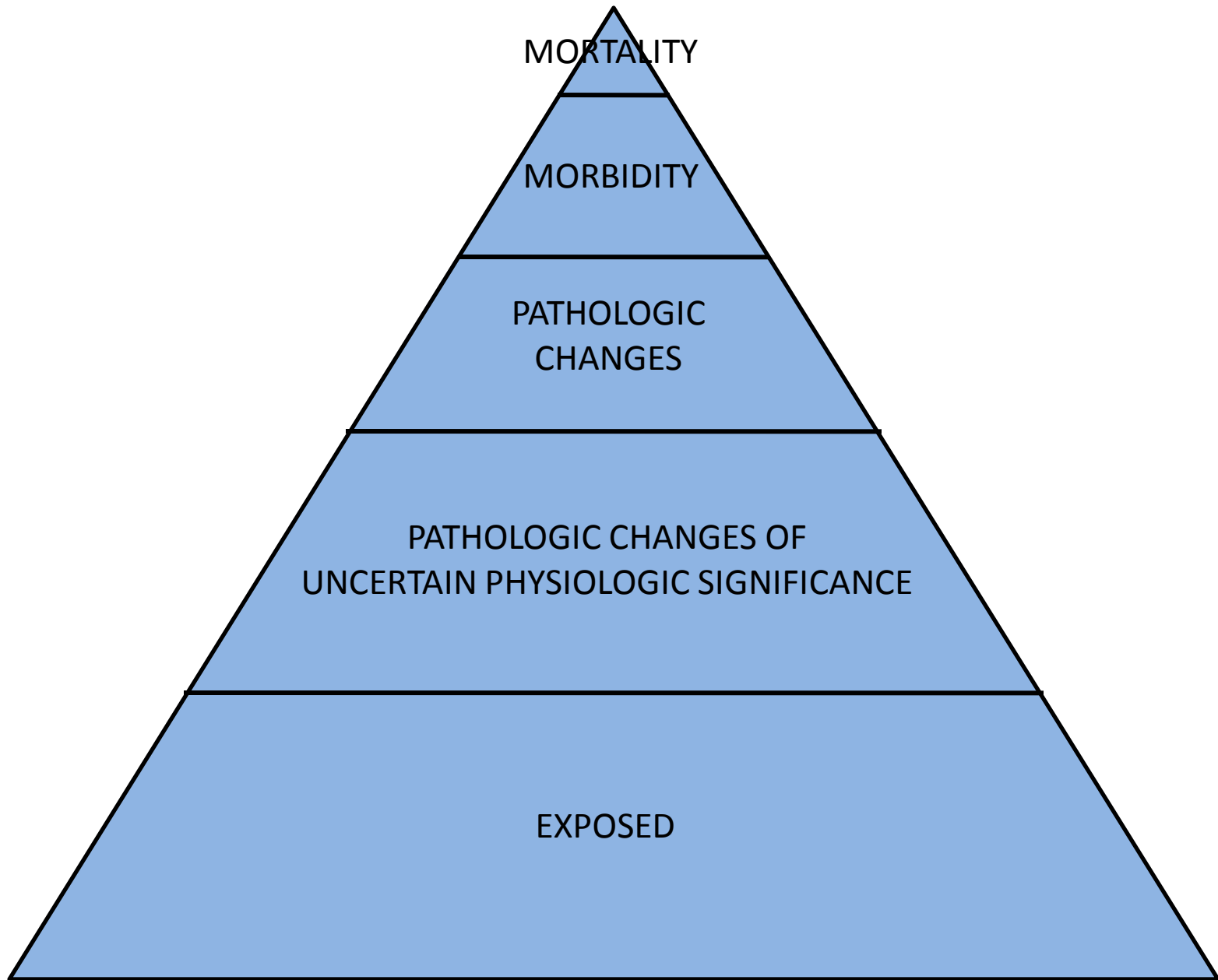
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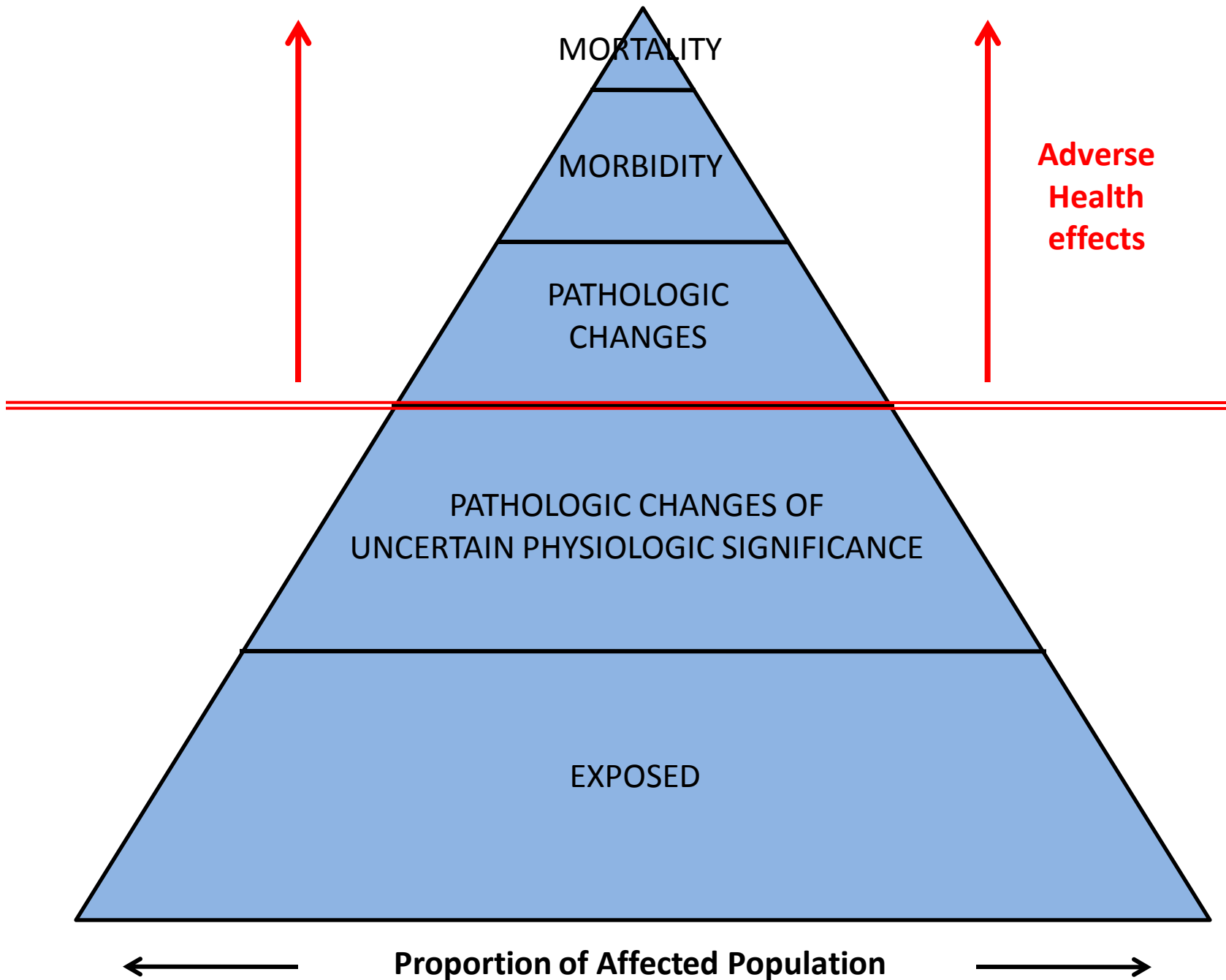
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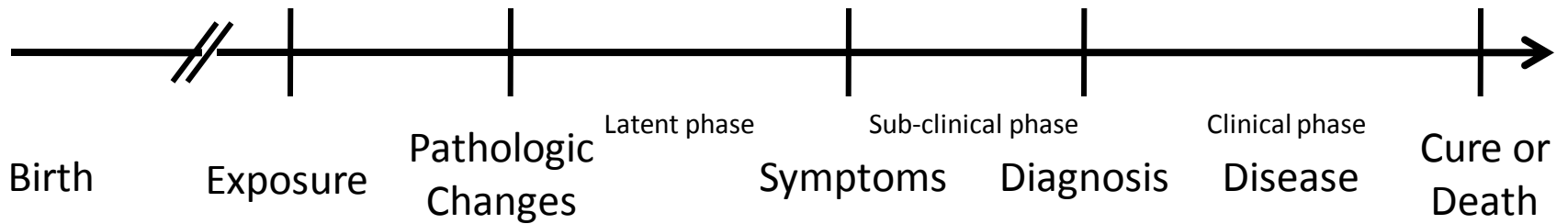
Secondary – early detection (screening)

Tertiary – treatment to slow or prevent progression, reduce the consequences of disease

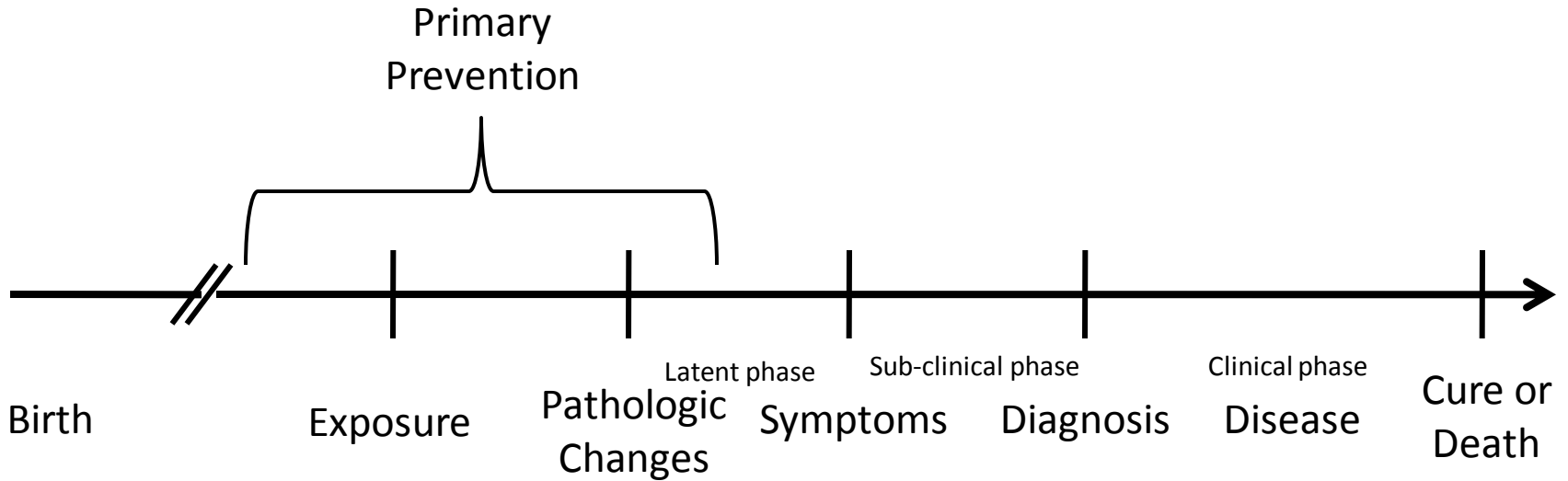
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- Prevention activities have multiple forms which are not always distinguished.
 - Primary – reduce or eliminate exposure
 - Secondary – early detection (screening)
 - Tertiary – treatment to slow or prevent progression, reduce the consequences of disease
- **Historically, most money is directed at screening and treatment, rather than reducing exposure to the hazard**

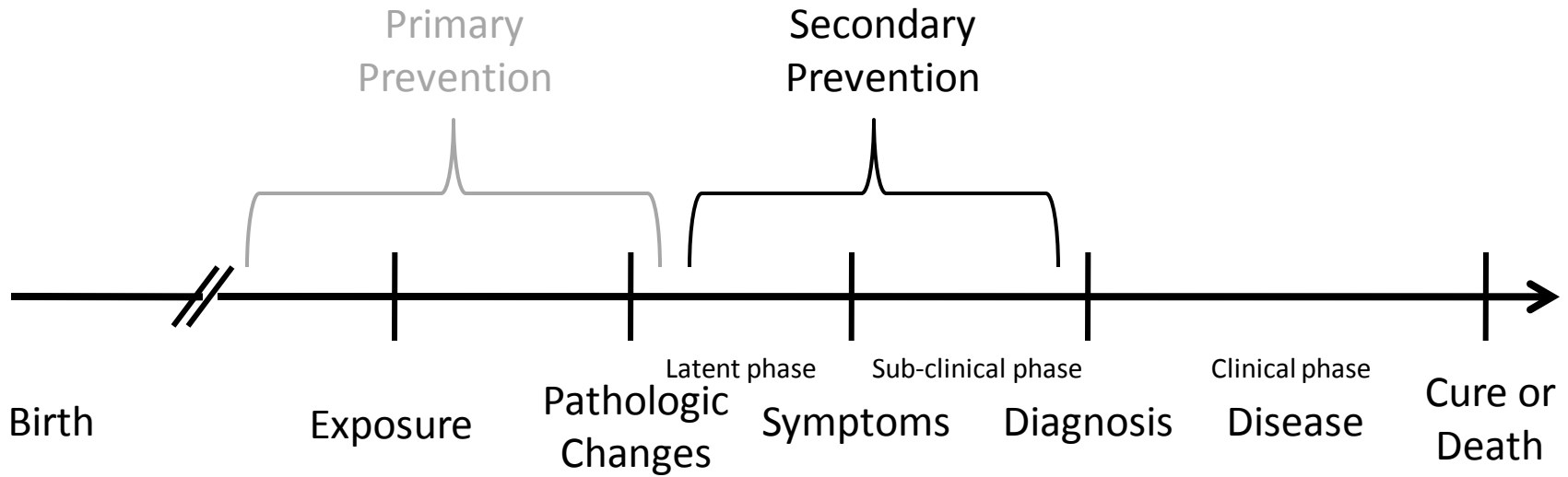
Spectrum of disease



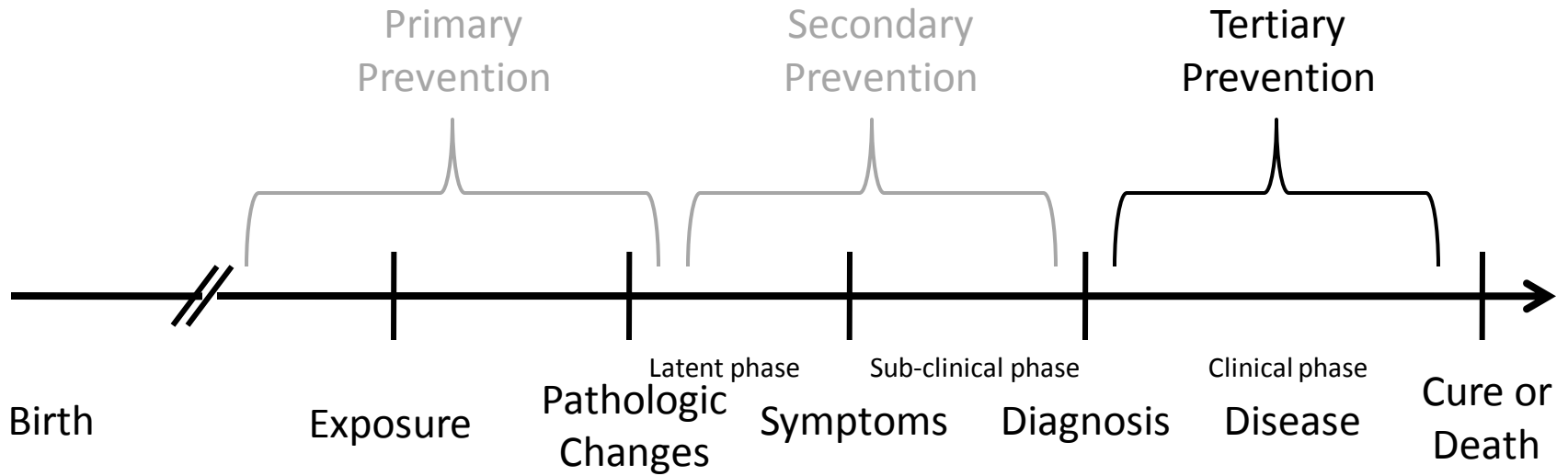
Primary prevention takes place “upstream”

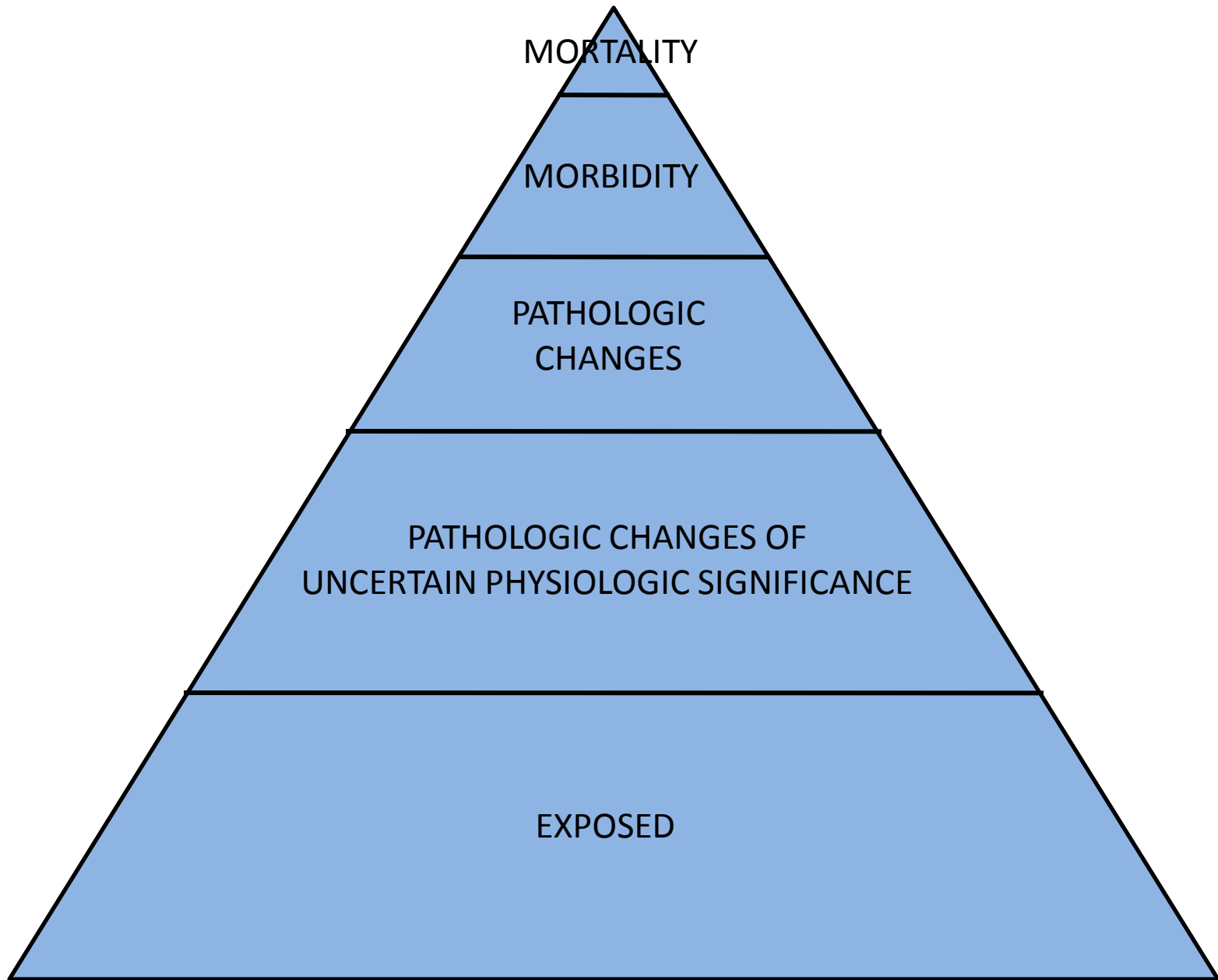


True secondary prevention (population screening) also occurs “upstream”



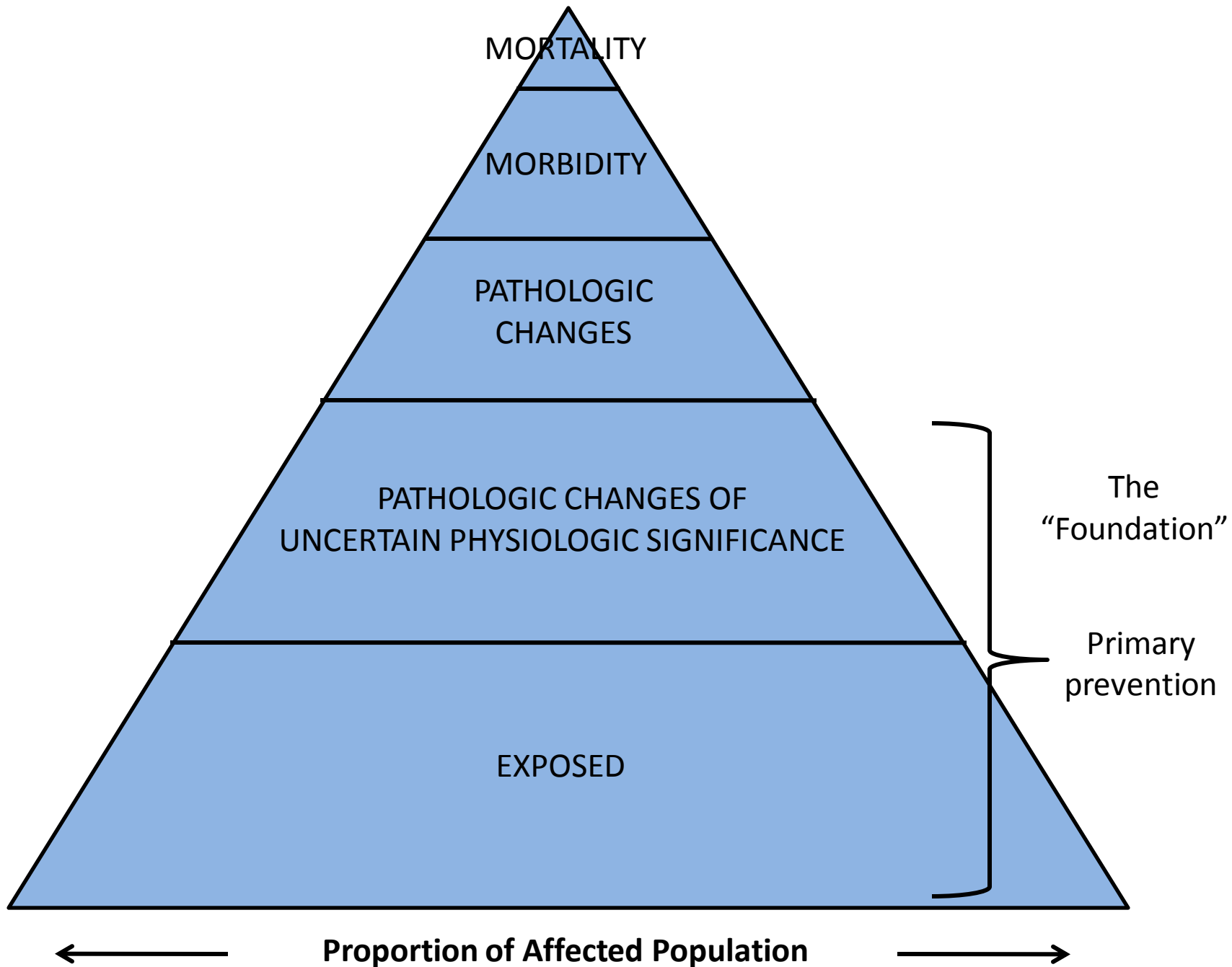
Tertiary prevention: “the horse is out of the barn”

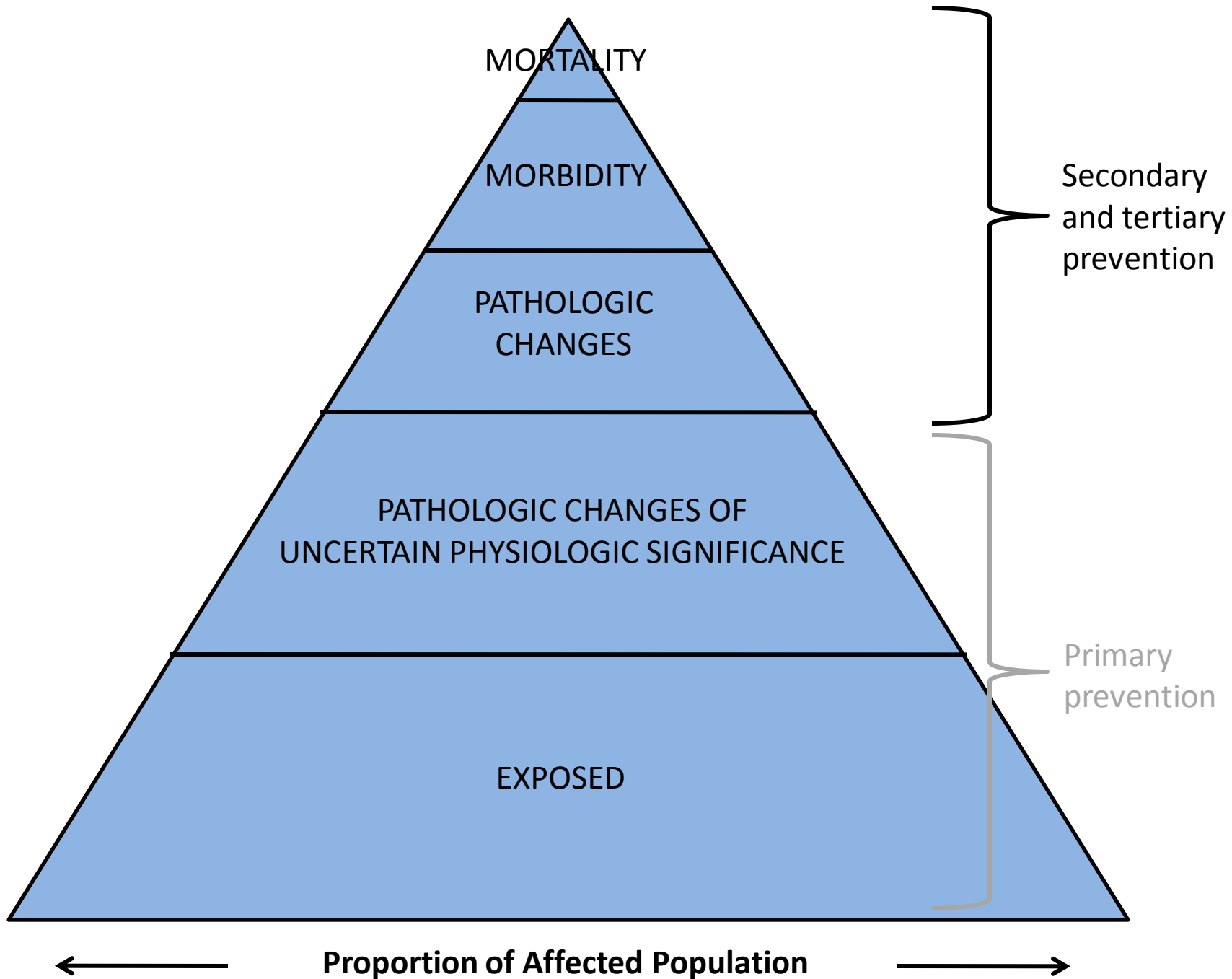




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Upstream vs. downstream: the cost-benefit advantage

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- **Clinic-based secondary prevention**
 - Increased short-run medical costs

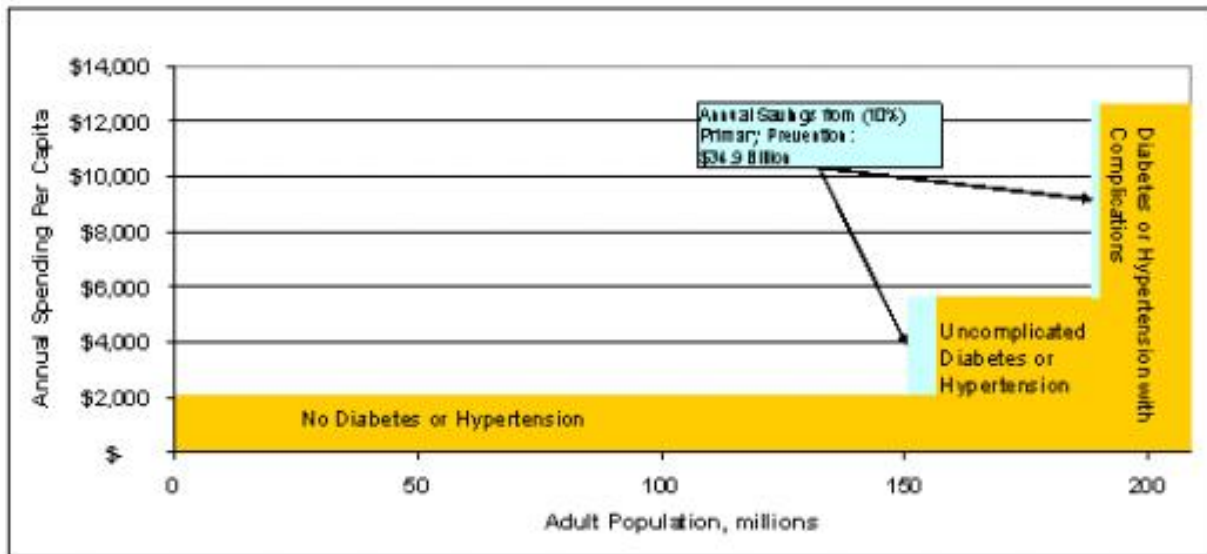
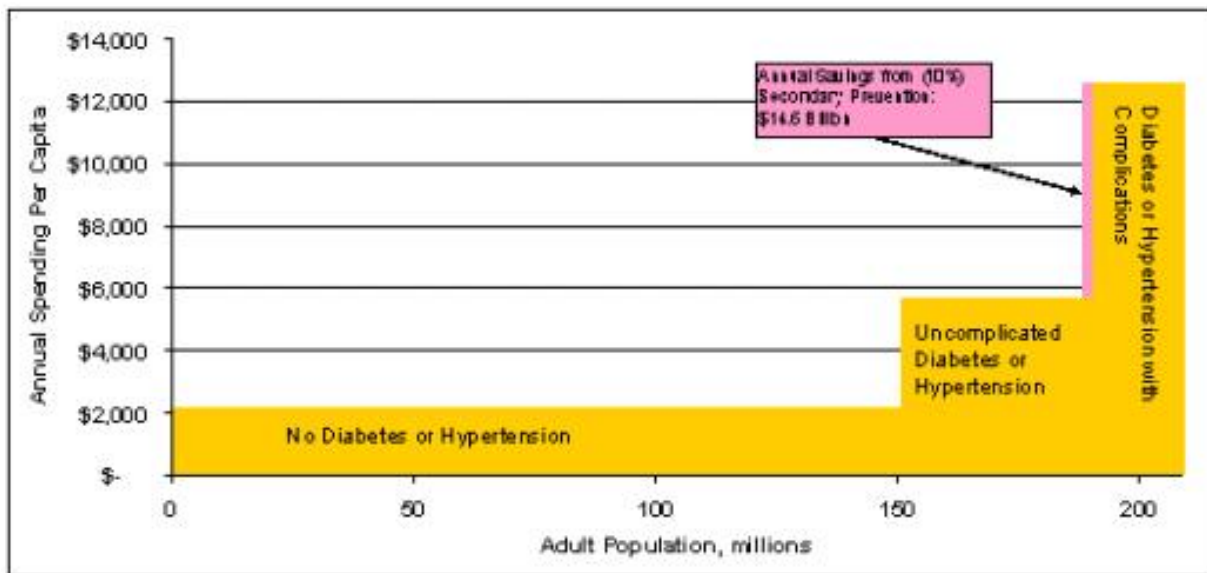
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- **Non-clinical primary prevention (including community-based programs)**
 - No increase in medical costs
 - Spillover effects to improved local quality of life and economic vitality

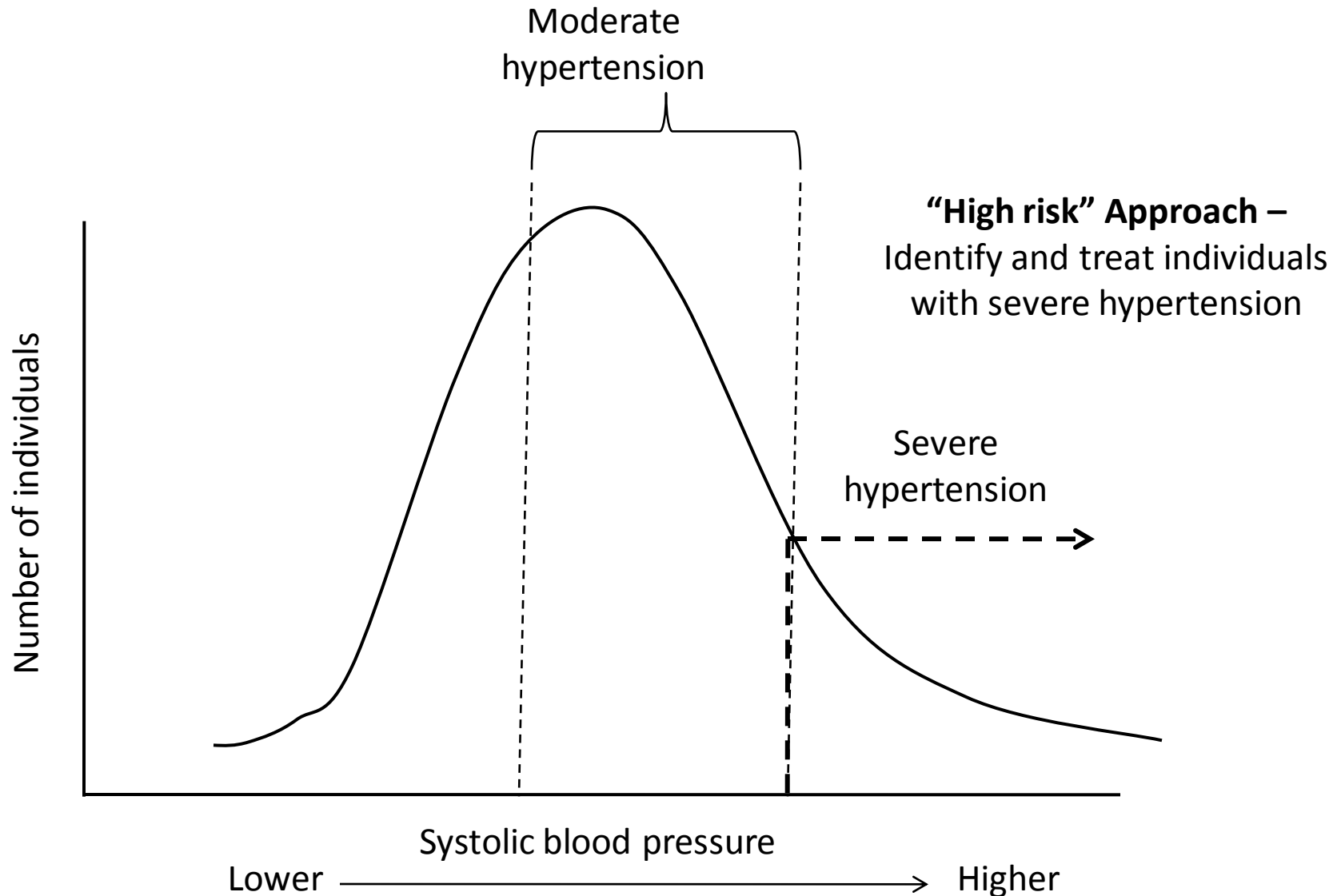
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- **So, what are the savings?**

Savings in primary vs. clinic-based secondary prevention (per capita 2004 dollars)

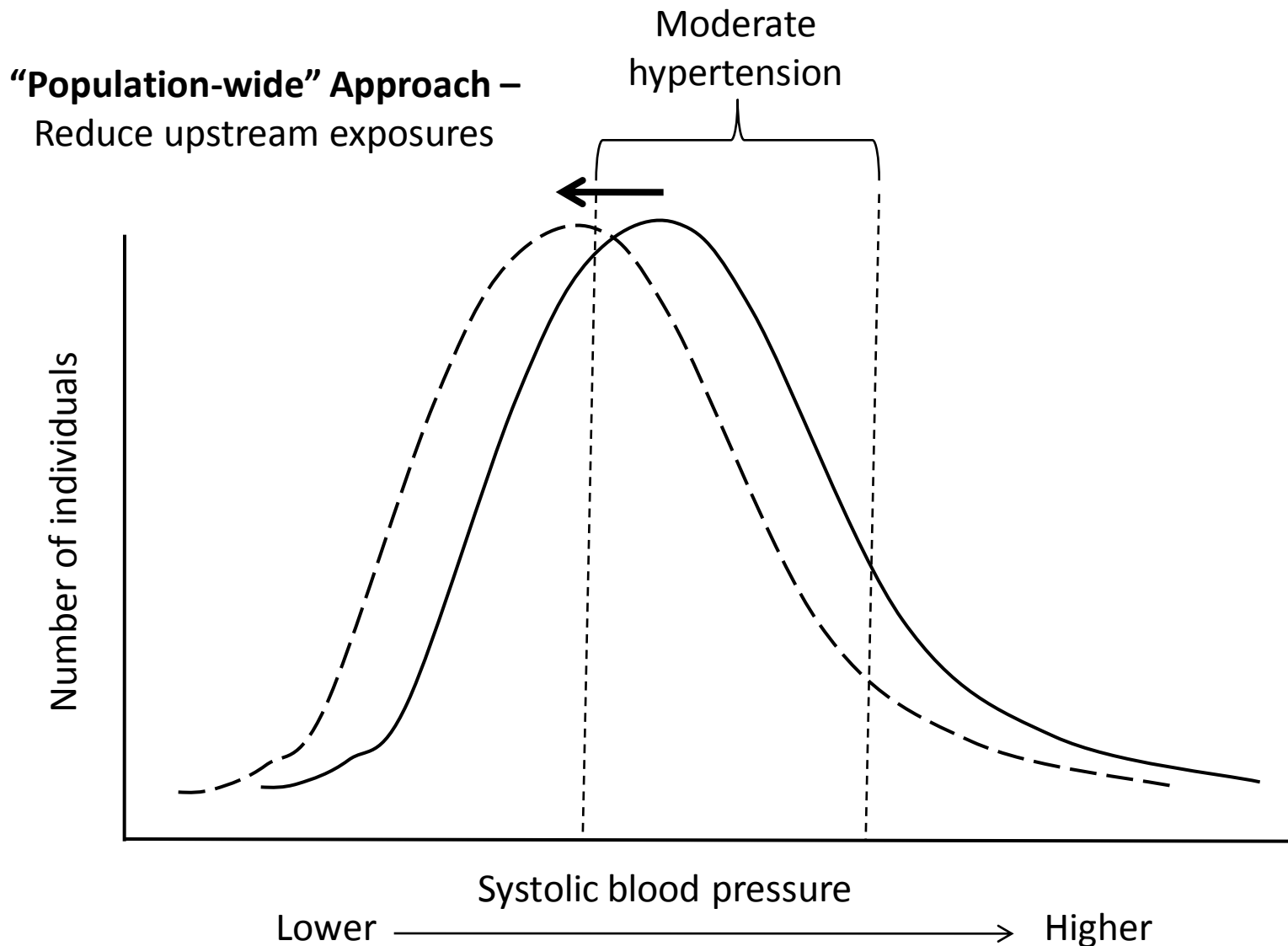


The “high risk” approach to prevention



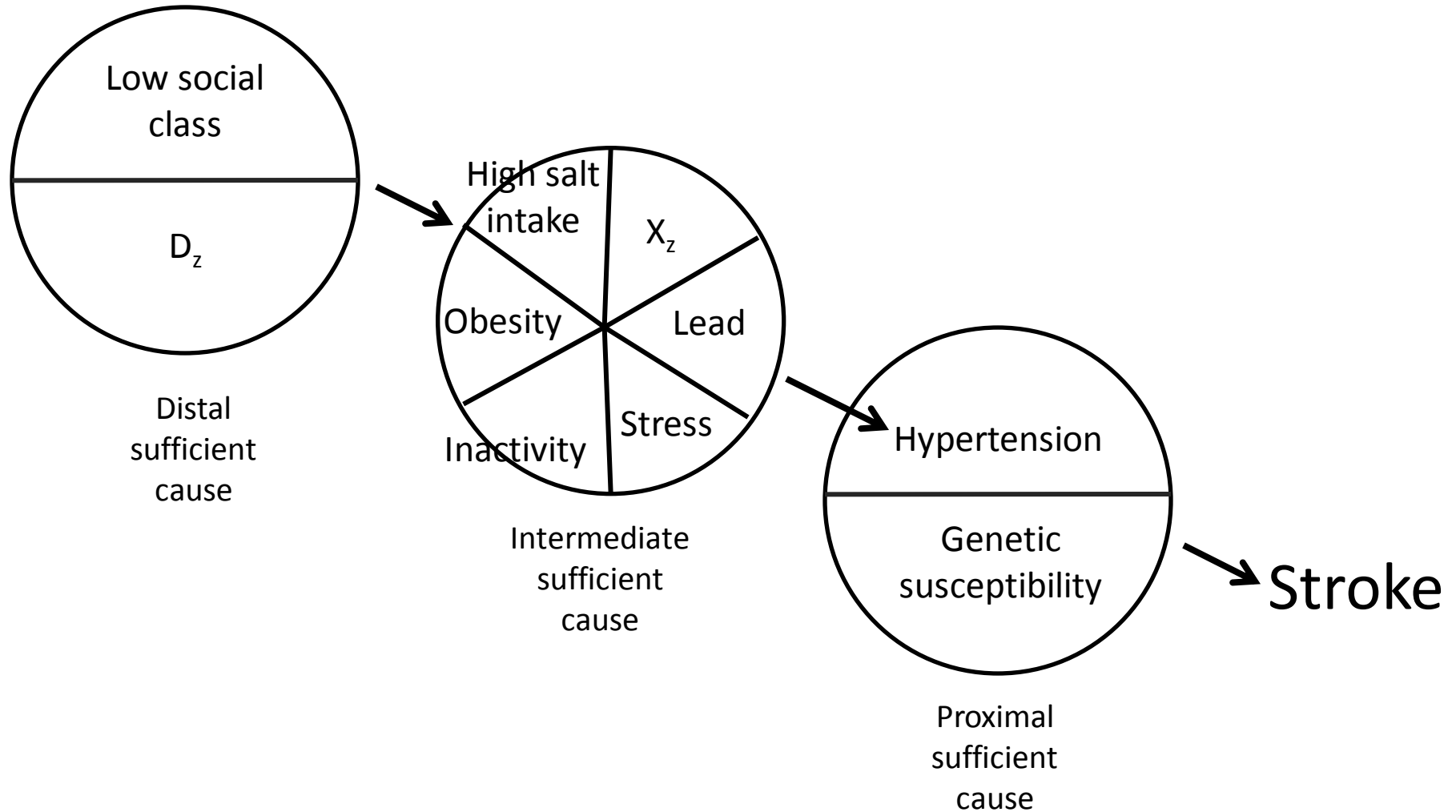
Adapted from Szklo and Nieto 2007

Primary prevention has bigger gains

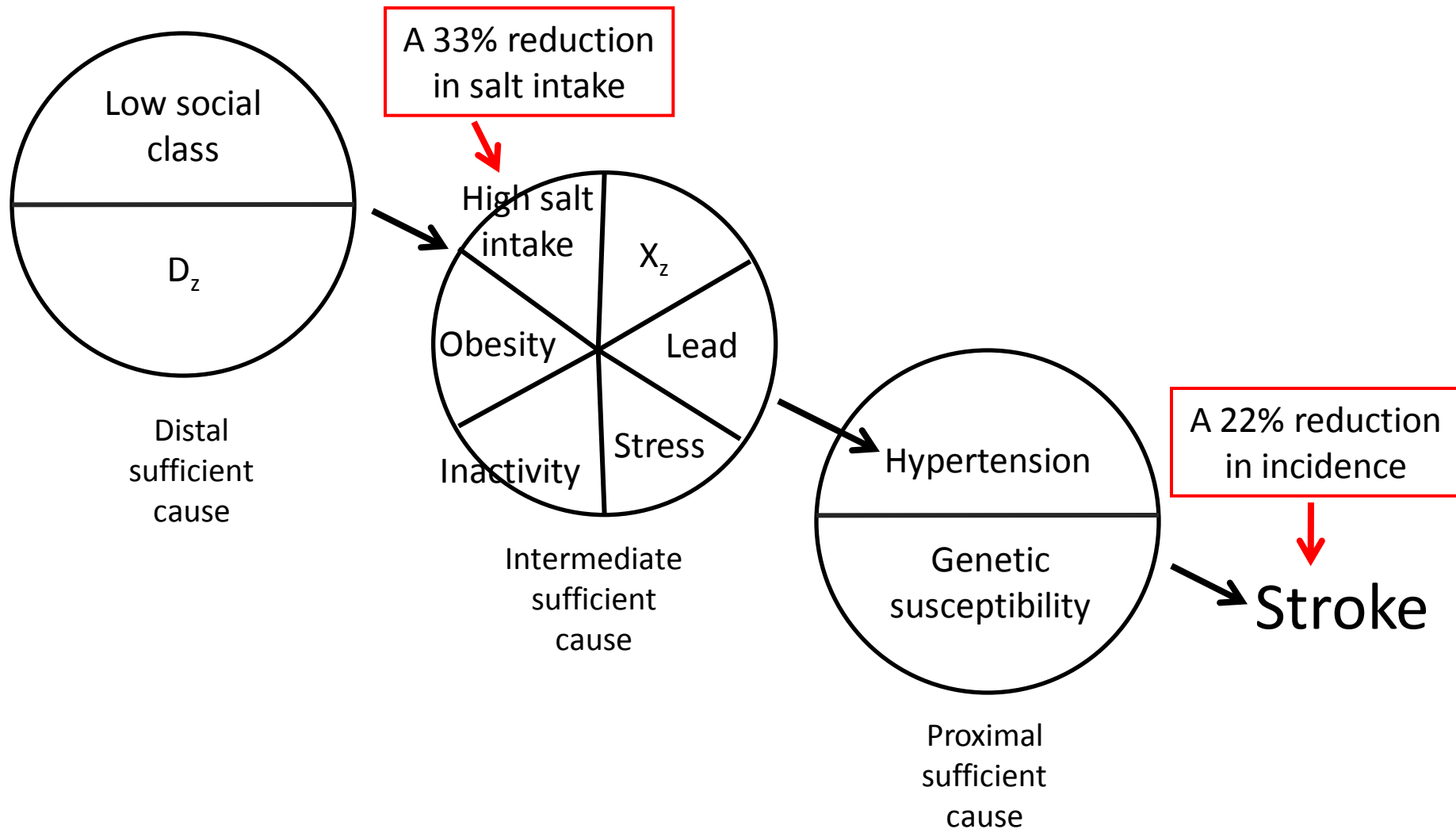


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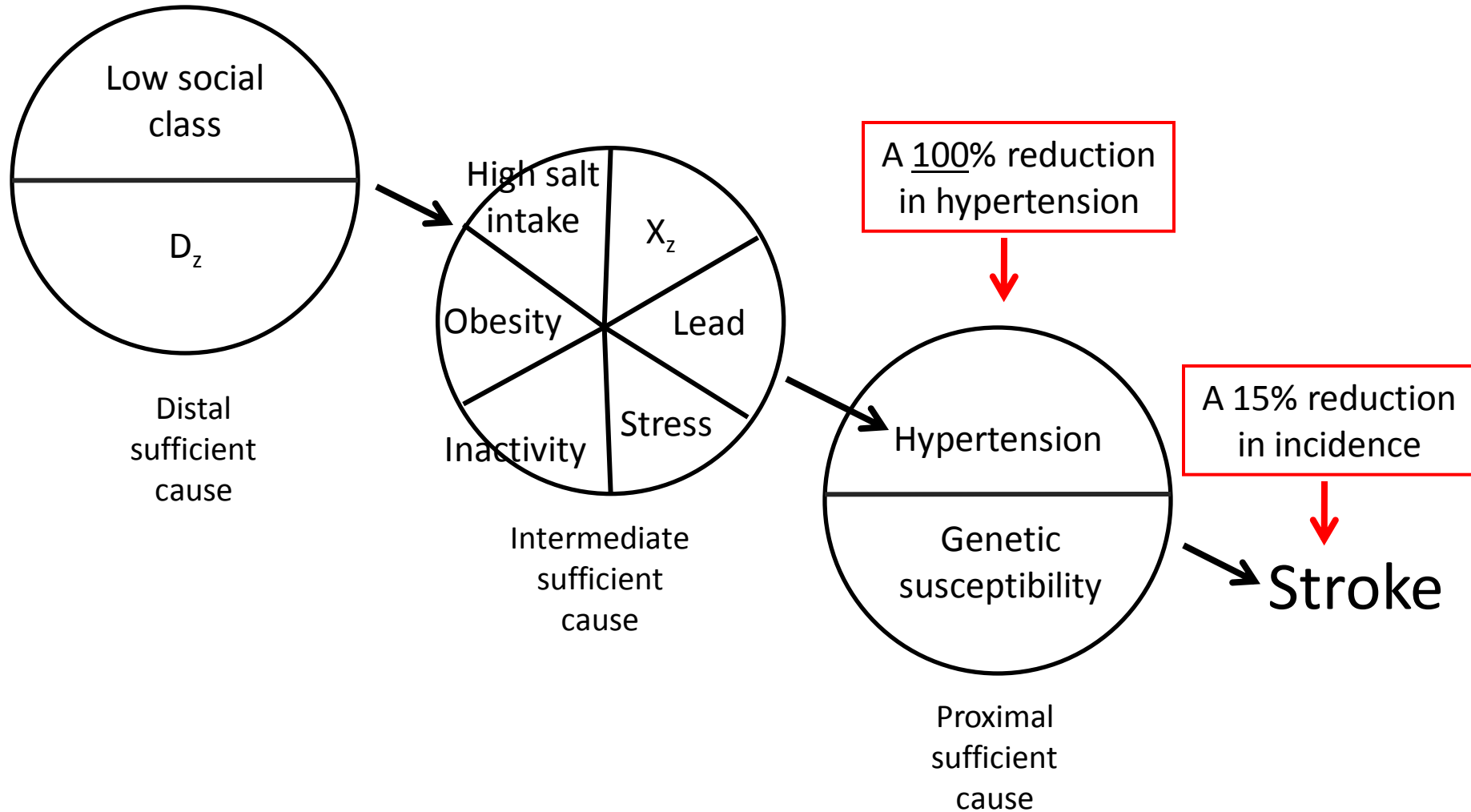
Proximate, intermediate, and distal causes



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- What proportion of disease D in the population is caused by exposure X_1 ?
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- **Calculated as: $(I_t - I_o) / I_t \times 100\% = \%PAR$**
where $I_t =$ *incidence in all persons, exposed plus non-exposed*
and $I_o =$ *incidence in non-exposed*

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- Epidemiologic research focuses on proximate causal components
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- The study of upstream causes may provide clues for the development of prevention strategies at the level of the total target population
- **Social epidemiology considers the interface between individual-level (usually proximate) and group-level (distal or intermediate) variables (multi-level or hierarchical models)**

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- **The spillover benefits will be less:**
 - Fewer new jobs overall
 - Many fewer jobs among low-income workers (community infrastructure, construction)

For greatest effect on population health and the economy

- Prevention funding should focus on primary prevention and be targeted to communities with the highest disease prevalence

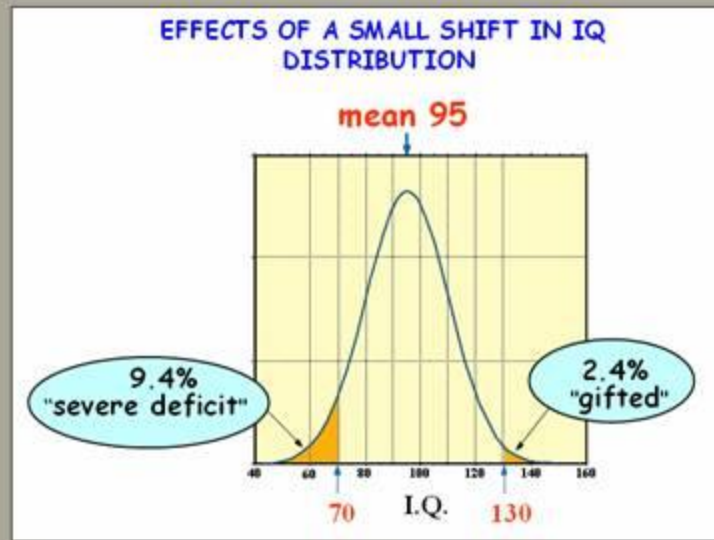
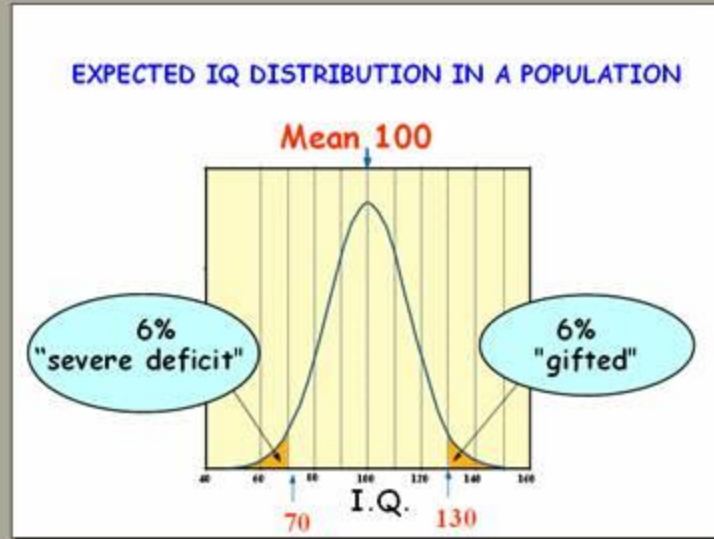
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 - Increased productivity at work and school from reduced disease

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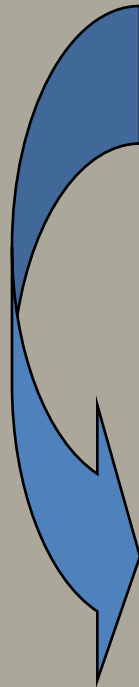
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- Evaluation should be built into all programs so policymakers can learn what works best where.

Are a Few IQ Points Significant?



57% increase
in special ed kids

60% decrease
in gifted kids



Economic Costs of Childhood Lead Poisoning in Washington State (Davies 2005)

| | Estimated # of 5-year Olds in WA (2004) | Total Expected Income (2004 \$billion) | Total Lost Expected Lifetime Income (2004 \$billion) |
|-------|---|--|--|
| Boys | 41,500 | 43.03 | 0.946 |
| Girls | 39,500 | 24.17 | 0.532 |
| Total | 81,000 | 67.2 | 1.478 |

Mean blood level for 5-year olds = 2.0 ug/dl

IQ loss of 0.46 points per ug/dl, yielding a reduction of 0.92 pts per child

Salkever's estimate of 2.39% reduction in lifetime earnings per IQ pt

Economic Costs of Environmental Disease in Washington State (Davies 2005)

| Disease/ Disability | Best Estimate (2004 \$m) | Direct Costs (2004 \$m) | Indirect Costs (2004 \$m) | Range (2004 \$m) | Basis |
|------------------------|--------------------------------|----------------------------|---------------------------------|---------------------|-------------------------------------|
| Asthma | 127.8 | 75.5 | 52.3 | 42.6-149.2 | WA DOH / WA Asthma Initiative |
| Cardio- vascular | 592.8 | 364.8 | 228.0 | 395.2-790.4 | NHLBI |
| Cancer | 203.5 | 74.4 | 129.1 | 81.4-407.2 | NHLBI |
| Lead | 1,500 | | 1,500 | | Landrigan |
| Birth defects | 5.5 | 1.5 | 4.0 | 5.5-10.9 | Waitzman |
| Neuro- behavioral | 305.6 | 265.9 | 39.7 | 152.8-611.1 | NHLBI |
| Total child | 1,875 | 310.6 | 1,565 | 1,600-2,200 | |
| Total child & adult | 2,734 | 782.1 | 1,953 | 2,800-3,500 | |

Biologic Impact Pathway



Biologic Impact Pathway

Dispersion
Transformation
Decay



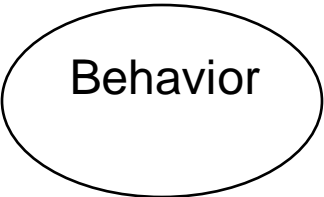
Product
Tailpipe
Smokestack
Outfall

Concentration

Biologic Impact Pathway

Dispersion
Transformation
Decay

Time-Activity
Diet
Ingestion
Breathing rate



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Tailpipe
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Concentration

Conc x *t*

Biologic Impact Pathway

Dispersion
Transformation
Decay

Time-Activity
Diet
Ingestion
Breathing rate

Transport in body
Metabolism
Elimination
Sequestration

Fate &
Dispersion

Behavior

Pharmaco-
kinetics



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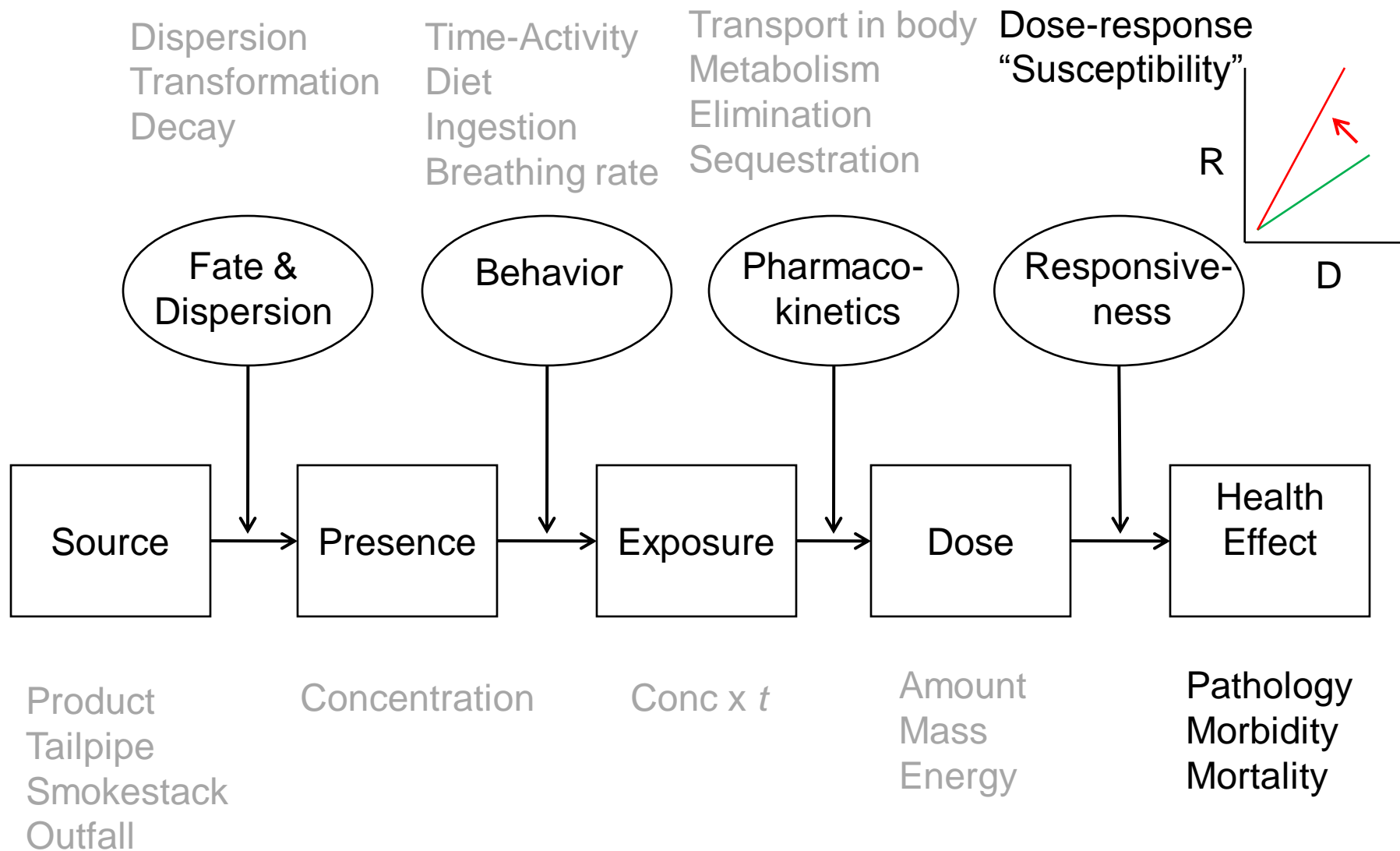
Concentration

Conc x *t*

Amount
Mass
Energy

Health
Effect

Biologic Impact Pathway



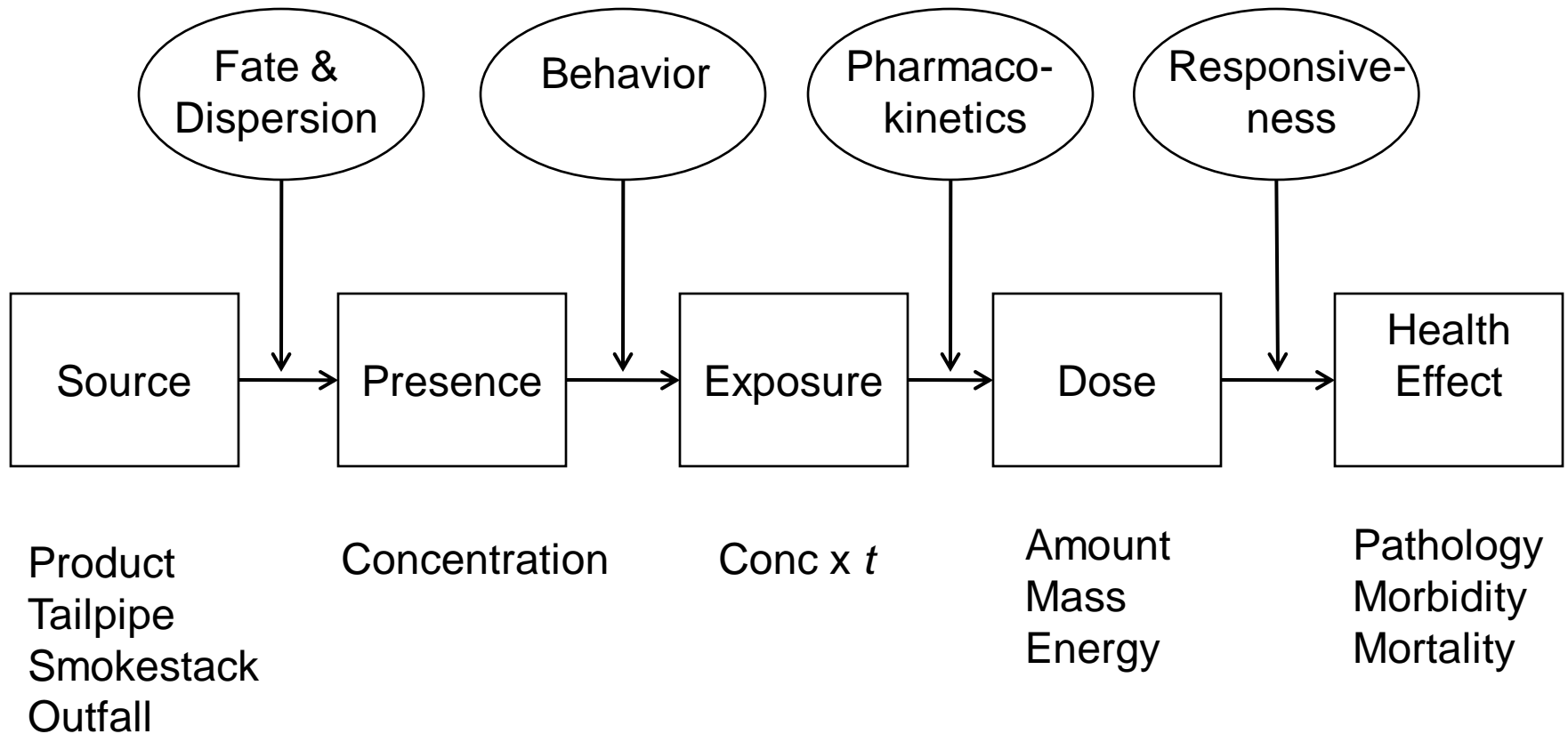
Strategies for prevention?

Dispersion
Transformation
Decay

Time-Activity
Diet

Transport in body
Metabolism
Elimination
Sequestration

Dose-response
Susceptibility



Strategies for prevention?

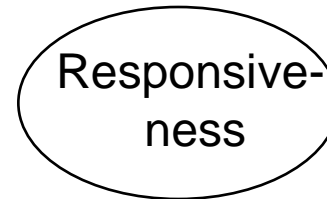
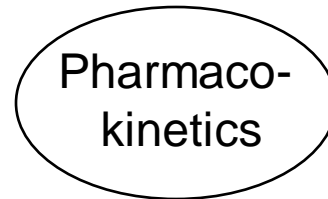
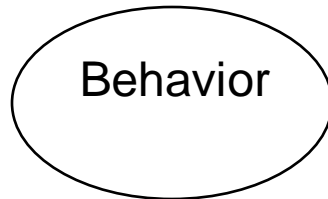
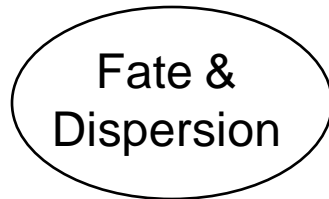
Dispersion
Transformation
Decay

Engineering
Controls

Time-Activity
Diet

Transport in body
Metabolism
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Concentration

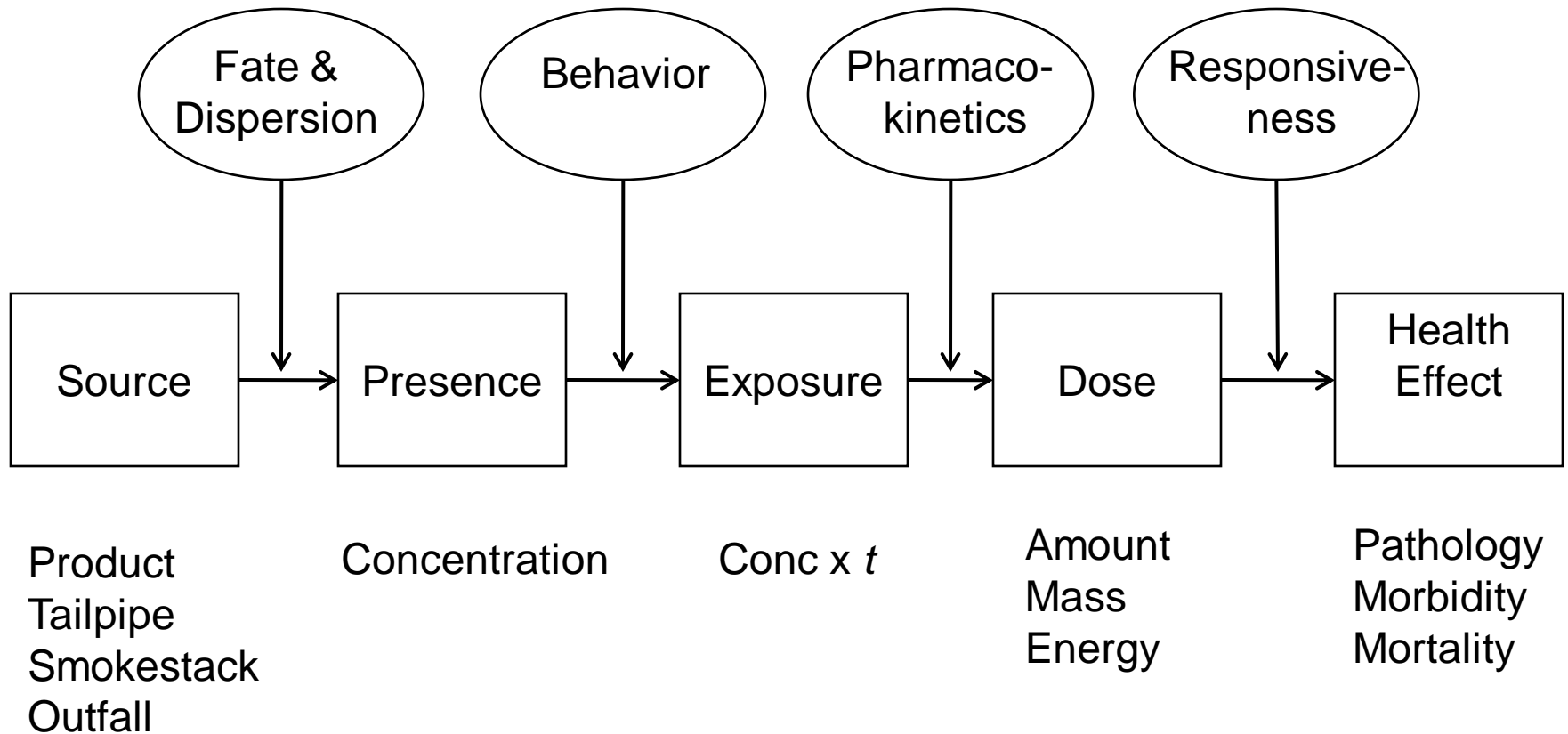
Conc x t

Amount
Mass
Energy

Pathology
Morbidity
Mortality

Strategies for prevention?

| | | | |
|-----------------------------|------------------------|-------------------|----------------|
| Dispersion | Time-Activity | Transport in body | Dose-response |
| Transformation | Diet | Metabolism | Susceptibility |
| Decay | | Elimination | |
| Engineering Controls | Behavior Change | Sequestration | |
| | PPE | | |



Strategies for prevention?

Dispersion
Transformation
Decay

Time-Activity
Diet

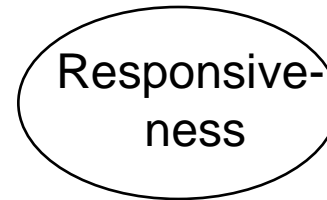
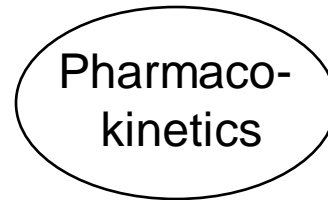
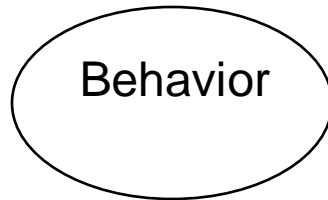
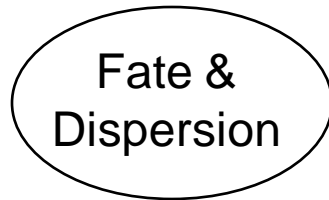
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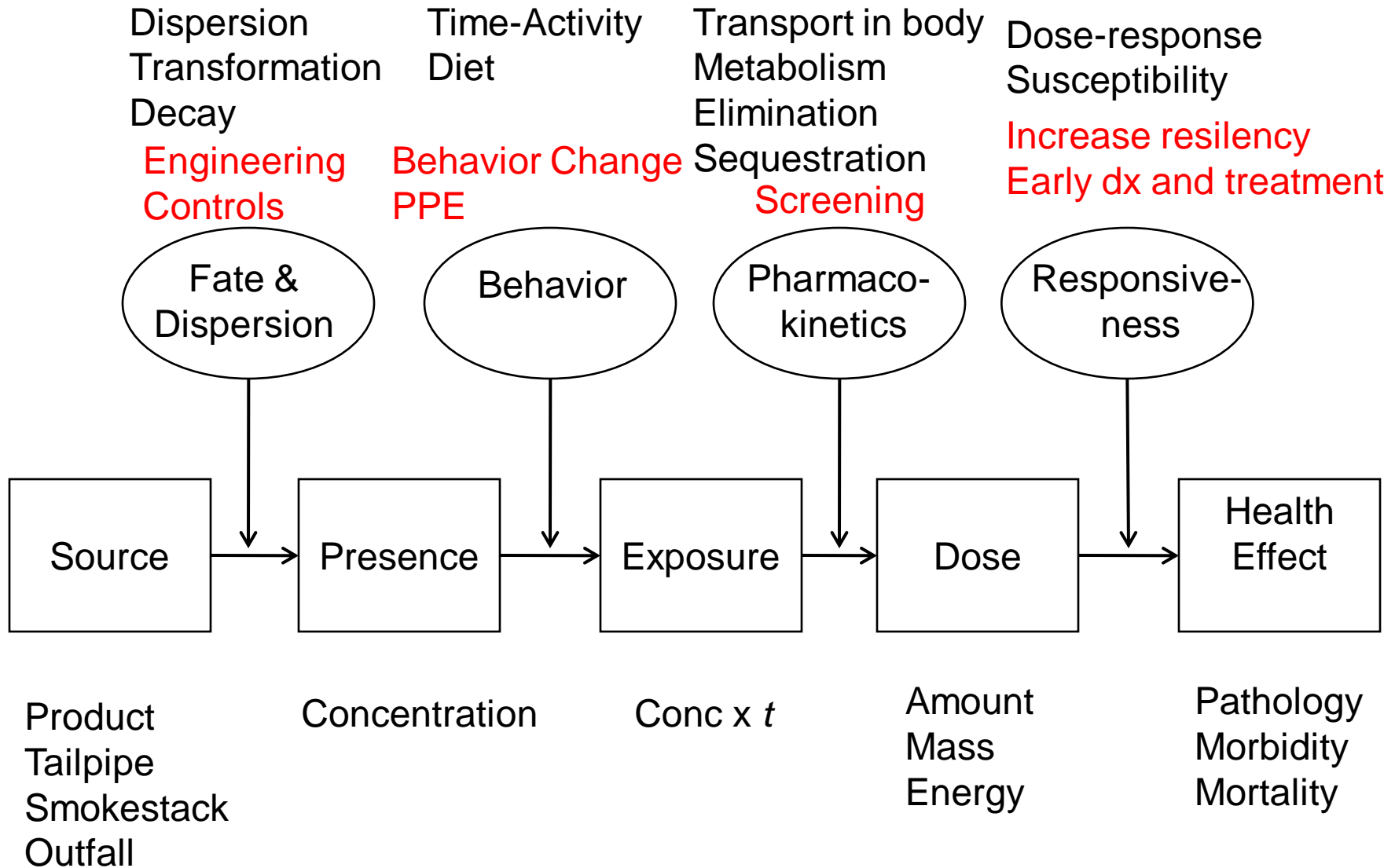
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Strategies for prevention?



The Government Role in Environmental Public Health



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Community

Diagnosis

- Surveillance
- Monitoring
- Id causes
- Research
- Evaluation

The Government Role in Environmental Public Health



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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

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- Understand the relative costs and benefits associated with levels of prevention
- Be able to apply the biologic impact pathway to analyze problems
- Understand the core functions of public health, as applied to environmental problems
- Be awake!