Children and Waterborne Disease: *What Are the Risks?*

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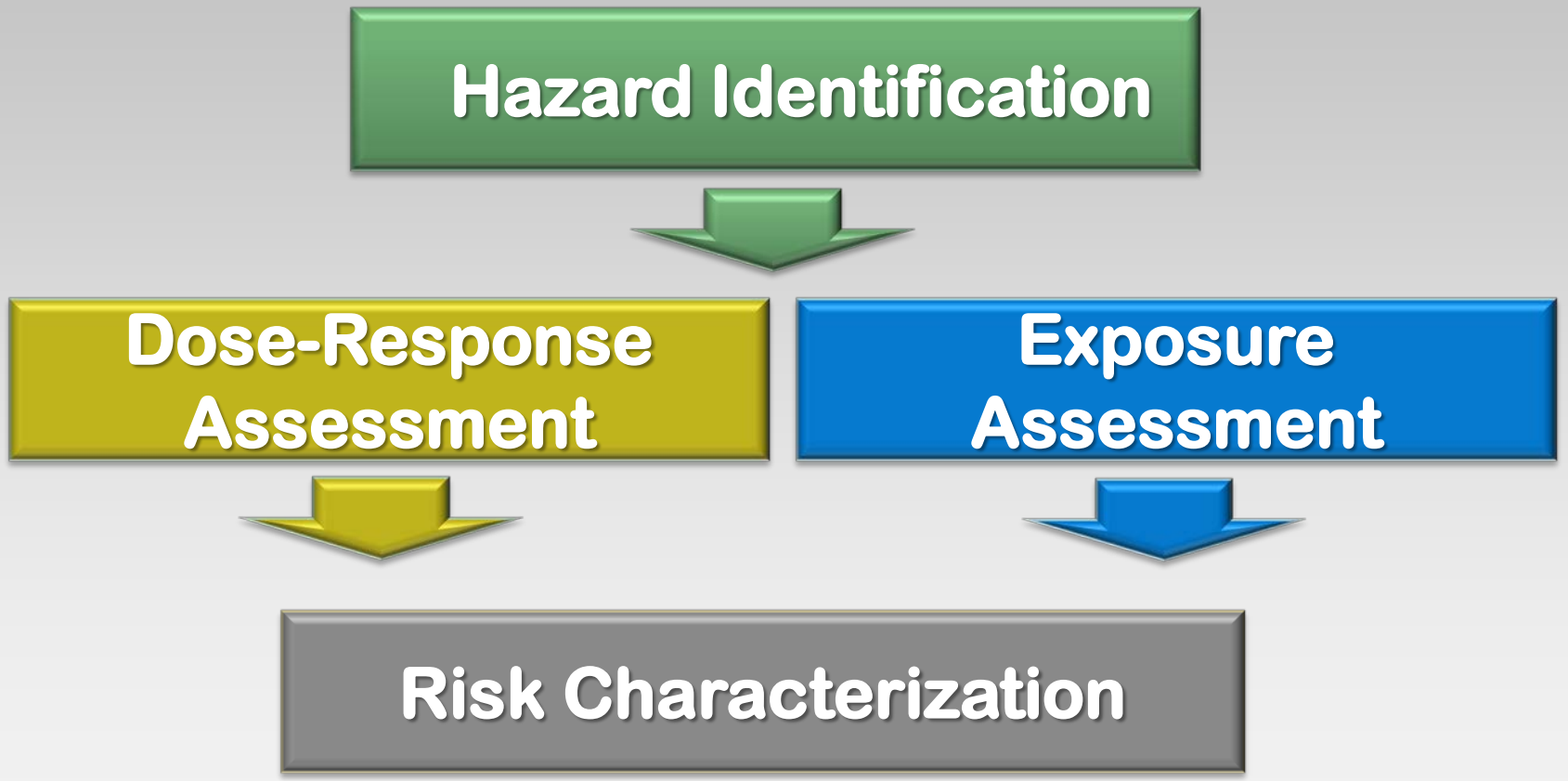
One in nine people worldwide lack access to “safe” drinking water

http://coniabjournal.com/friends-associates-enemies/

Worldwide, more than 800,000 people die each year due to diarrhea related to lack of quality water (that’s 2,300 people/day)

(Prüss-Ustün, 2014; WHO and UNICEF, 2014)

Risk Assessment



What is the risk of health problems in an exposed population?

Zero Risk Does Not Exist

http://myilluminateblog.com/hydrate/

Hazard vs. Risk

Hazard = Agent that may initiate an adverse response

Risk = Probability that something will happen

Risk Assessment Steps

Hazard Identification

Dose-Response Assessment

Exposure Assessment

Risk Characterization

Hazard Identification

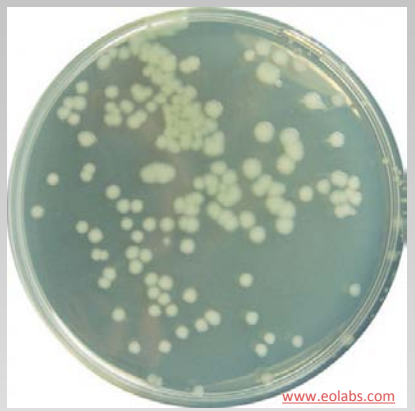
Identify All Possible Hazards

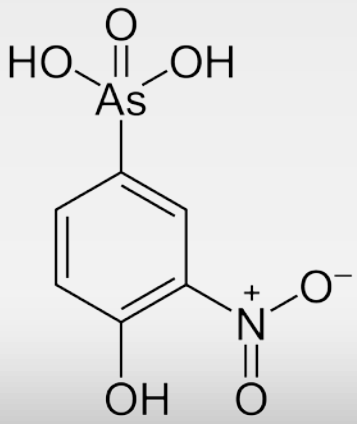
http://melbel.hubpages.com/hub/Sources-of-Water-Pollution-List

Waterborne Hazards

MICROBIALS

Bacteria
Viruses
Protozoa





CHEMICALS

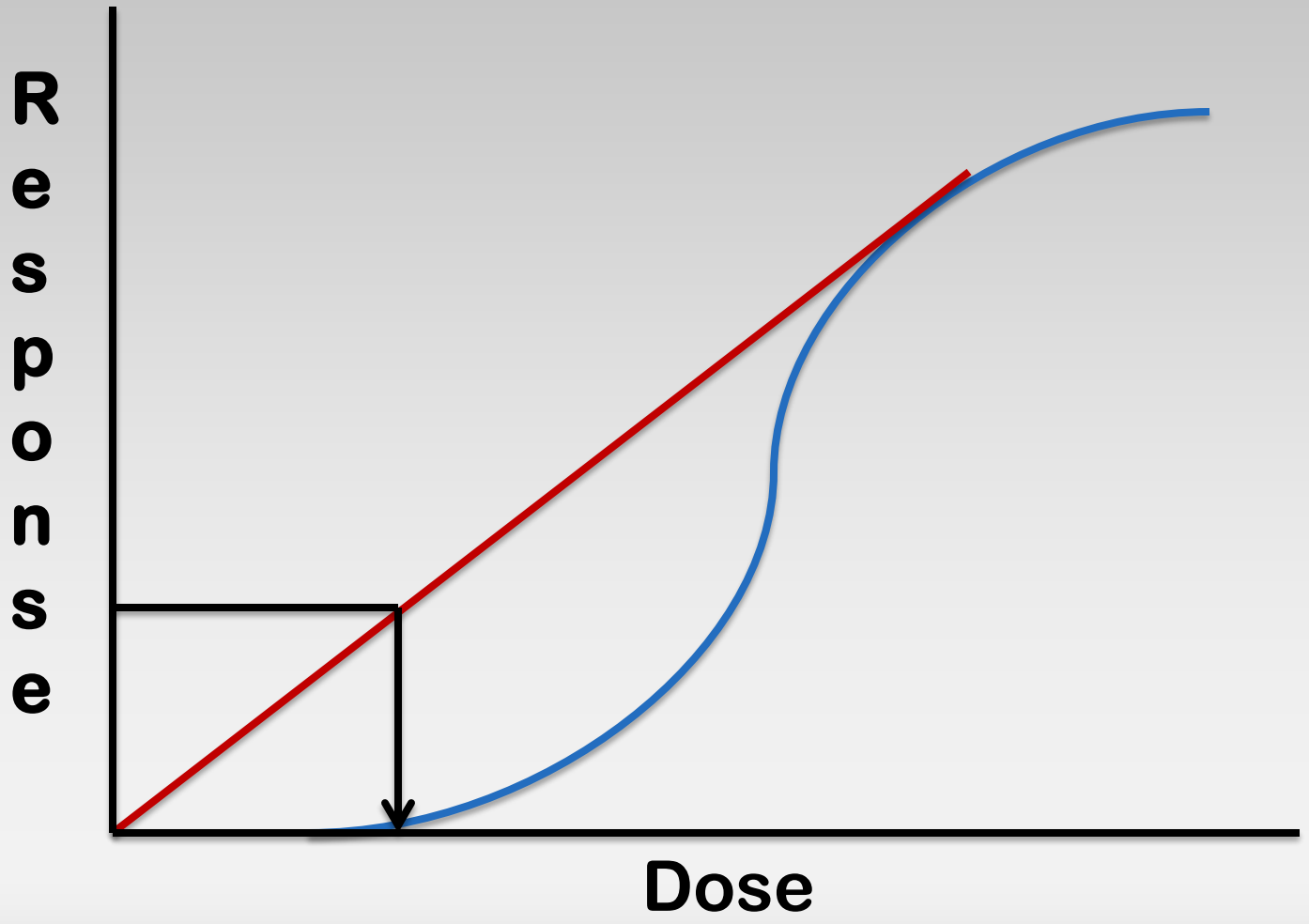
Arsenic
DBPs
Lead

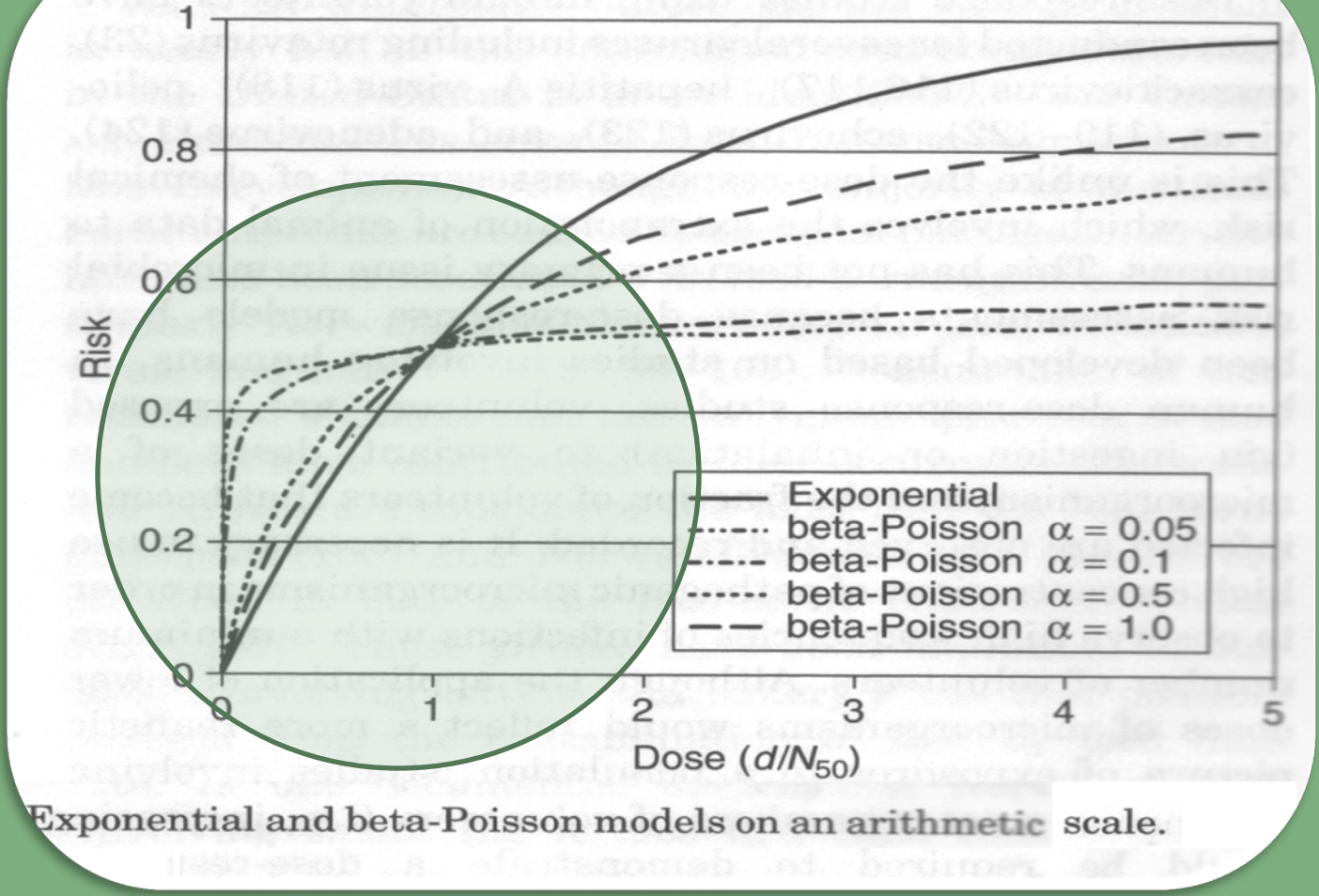
Dose-Response Assessment

What are the health problems at different exposures?

Is there a threshold effect?

Threshold and Linear Effects





Exponential and beta-Poisson models on an arithmetic scale.

Which fits the dose-response data better?

Haas et al., 1999

Exposure Assessment

Who is exposed?

How are they exposed?

How often are they exposed?

Exposures

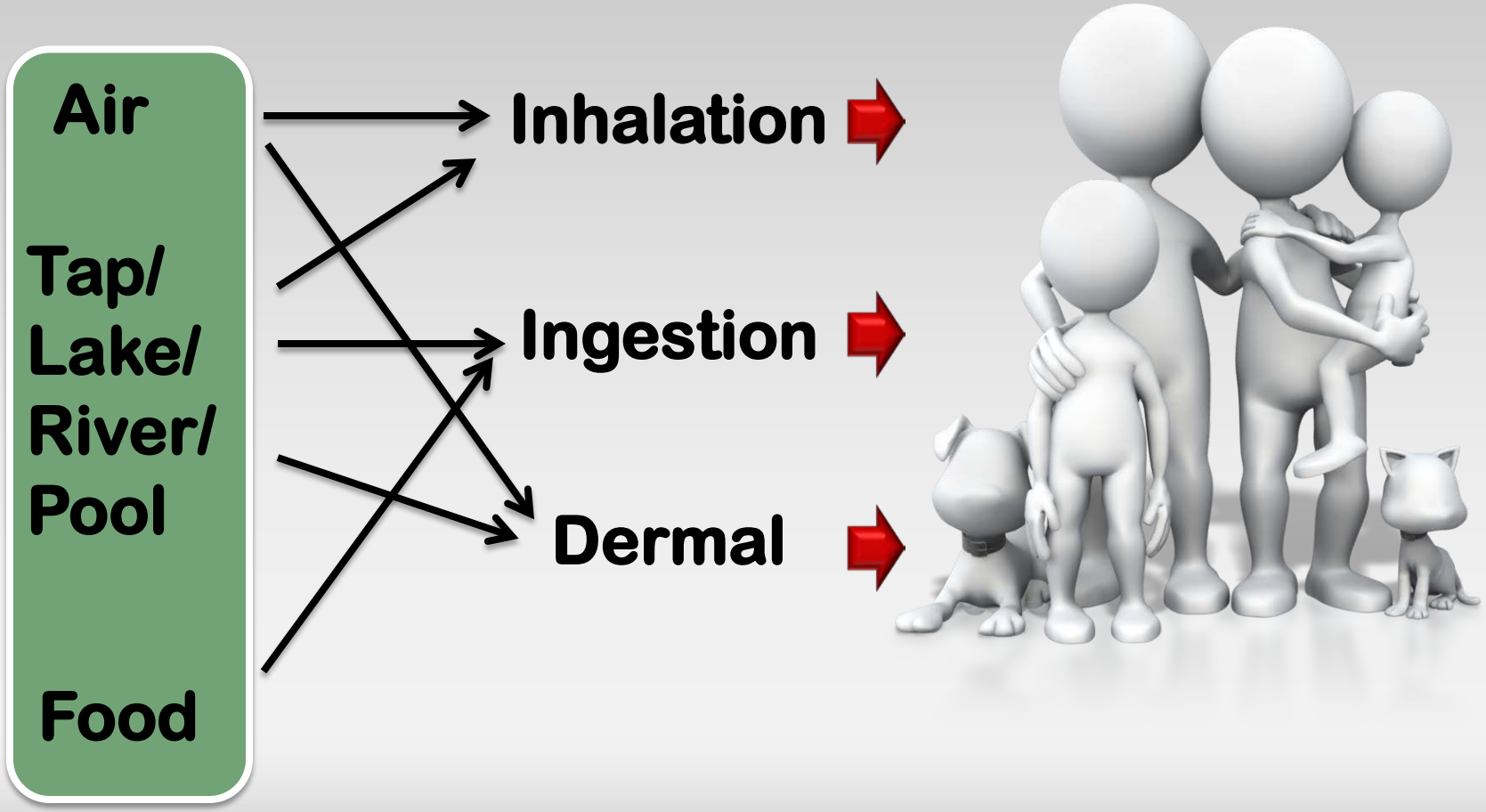








Source	Route of Exposure	Population Exposed



Risk Factors for Waterborne Disease Among Children

- Immature immune defense mechanisms
- Higher water ingestion rate
- Potentially greater exposure to waterborne hazards

Risk Assessment Parameters and Impact on Risk Estimate

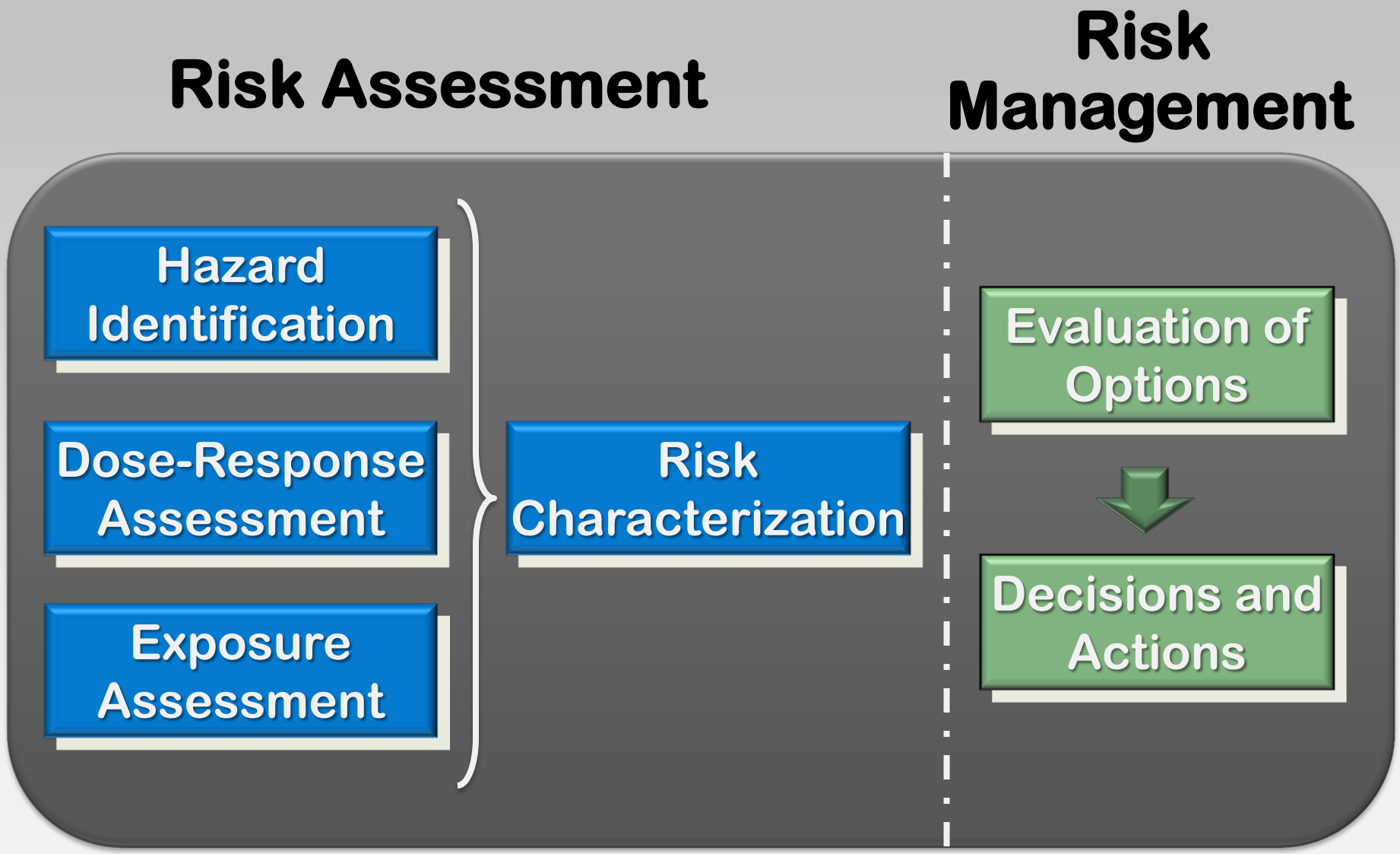
Parameter	Change	Risk Effect
Water Intake (liters)	↑	↑
Amount of Hazard in Exposure	↑	↑
Microbe Virulence	↑	↑
Immunity	↓	↑
Exposure Frequency and Duration	↑	↑
# Exposure Pathways	↑	↑

Risk Characterization

Interprets information learned through first three steps

Lists **assumptions** and **uncertainties**

Estimates human health effects resulting from exposure


Risk Assessment
Risk Management
Hazard Identification
Dose-Response Assessment
Exposure Assessment
Risk Characterization
Evaluation of Options
Decisions and Actions

Normal Life Stages

Should certain subpopulations . . .

pregnancy.lovetoknow.com

www.standrewsgetaways.com

www.livestrong.com

. . . not drink tap water?

Risk Communication

*Helping patients understand risk

cbttc.org

Future Approaches Addressing Children and Waterborne Disease

- Database development
- Epidemiological studies
- Clinical studies
- Informed risk assessments

Arends, 2013
http://ithirst.org/author/grant/page/2/