

# **Risk Communication in an Uncertain World**

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# Presentation Objectives

- ❑ Appreciate fully the concept of risk in relation to uncertainty
- ❑ Recognize "real" vs. "perceived" risk as a false dichotomy that must be replaced with a focus on the available evidence and how inferences about risk are made
- ❑ Understand the unavoidable tension between false positive errors and false negative errors when speaking about precaution



# Communication Failures

## Kaplan's theories of risk communication failure

(S. Kaplan. 1997. The Words of Risk Analysis. *Risk Analysis*. 17: 407-417.)

- ❑ Theorem 1: *50% of the problems in the world result from people using the same words with different meanings*
- ❑ Theorem 2: *The other 50% comes from people using different words with the same meaning.*



# What is Risk?

Risk is a 4 letter word that can cause much grief in environmental health

Dictionary definitions refer to concepts like:

- ❑ A chance of injury or loss
- ❑ The probability of that loss occurring
- ❑ The amount an insurance company may lose
- ❑ The person or thing involved in a loss
- ❑ imperil or endanger
- ❑ venture



# What is Risk?

- ❑ Opposite meanings between danger and venture
- ❑ Different perspectives between insurance risk managers and public health / environmental risk managers
  - ◆ The skydiver's anecdote
  - ◆ Opposite conclusions about a similar concept



# What Do I Mean by Risk?

RISK is a prediction or an expectation of danger comprised of the answers to several questions:

- ❑ What can go wrong?
- ❑ How likely is it?
- ❑ What are the consequences?
- ❑ Over what time frame?
- ❑ What matters most to those who are affected?



# What Do I Mean by Risk?

- ❑ a hazard (the source of danger)
- ❑ uncertainty of occurrence and outcomes (expressed by the probability or chance of occurrence)
- ❑ adverse consequences (the possible outcomes)
- ❑ a time frame for evaluation
- ❑ perspectives of those affected about what is important to them



# What Do I Mean by Risk?

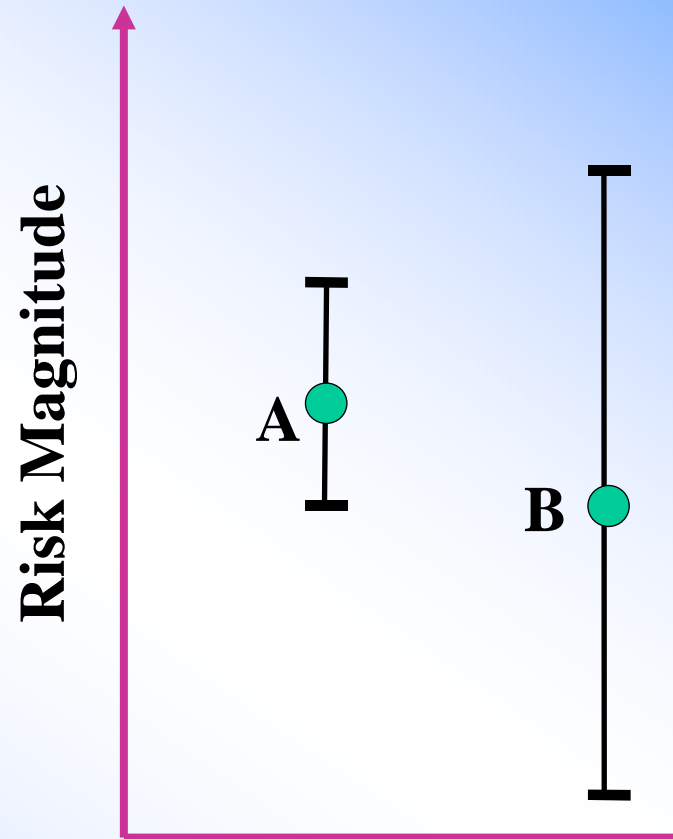
*Risk is the predicted or expected likelihood  
that a set of circumstances  
over some time frame  
will produce some harm  
that matters*



# Risk vs Uncertainty

uncertainty  
in risk estimates  
is inevitable:

BUT  
which is the  
greater risk,  
A or B?



# The Reality of Risk

- ❑ distinguishing “*perceived risk*” from “*real risk*” is often seen by health professionals as a prerequisite to rational discussion
- ❑ experts think they know the “*real*” risk
- ❑ dangers (hazards) can certainly be real
- ❑ consequences can certainly be real
- ❑ but risk also involves probability, i.e. How likely are the consequences from the dangers?



# What is Probability in Risk?

- To understand the **reality** we need to appreciate the Schools of Probability
  - ◆ Classical
  - ◆ Frequentist
  - ◆ Subjective (Bayesian)



# What is Probability in Risk?

## □ Classical probability

- ◆ *“the number of outcomes favourable to the event of interest divided by the total number of possible outcomes”*
- ◆ requires that all outcomes can be specified and counted
- ◆ very objective for things like games of chance
- ◆ virtually no application to health risk
- ◆ *“the probability of drawing the bullet from a ‘fair’ 6 chamber revolver in a game of Russian roulette is 1 in 6”*



# What is Probability in Risk?

## □ Frequency probability

- ◆ based on empirical observation of outcomes
- ◆ basis for actuarial analyses, foundations of insurance
- ◆ is largely objective, but presupposes possibility of exact replication and a stable world to apply to the future
- ◆ does not apply to unique events and is of limited value for rare events
- ◆ *“the annual probability of a random individual dying in a motor vehicle fatality in a given year in Canada is 1 in 8,000”*



# What is Probability in Risk?

## □ Subjective probability

- ◆ Probability estimates for real events cannot be measured in a strictly objective sense
- ◆ a degree of belief that a given event will happen, conditioned on our state of knowledge
- ◆ recognizes the uncertainty arising from our limited state of knowledge about nature
- ◆ subjective does not mean emotional, only inferential
- ◆ “*my probability of suffering brain cancer from using a cell phone < 1 in 1,000,000*”



# The Reality of Risk

- ❑ the probability component characterizes risk as a **prediction** that should not be labeled as “*real*”
- ❑ we should place more reliance on a risk prediction derived from quality evidence than from a guess
- ❑ health professionals need to focus on what is the quality of evidence and inference underlying any risk estimate
- ❑ unfounded claims to reality of risk estimates create distraction and guarantee conflict (e.g. spousal conversations)



# Comparative Risk Estimates

- look at the literature:

*“Using data from...method was used to estimate national and regional smoking attributable mortality (SAM) for 1991. The results indicate that 27,867 men and 13,541 women died as a result of smoking, including 171 children under the age of one.”* (Makomaski and Kaiserman, 1995, *CJPH*, **86**: 257-265)

- **What is wrong with this picture?**



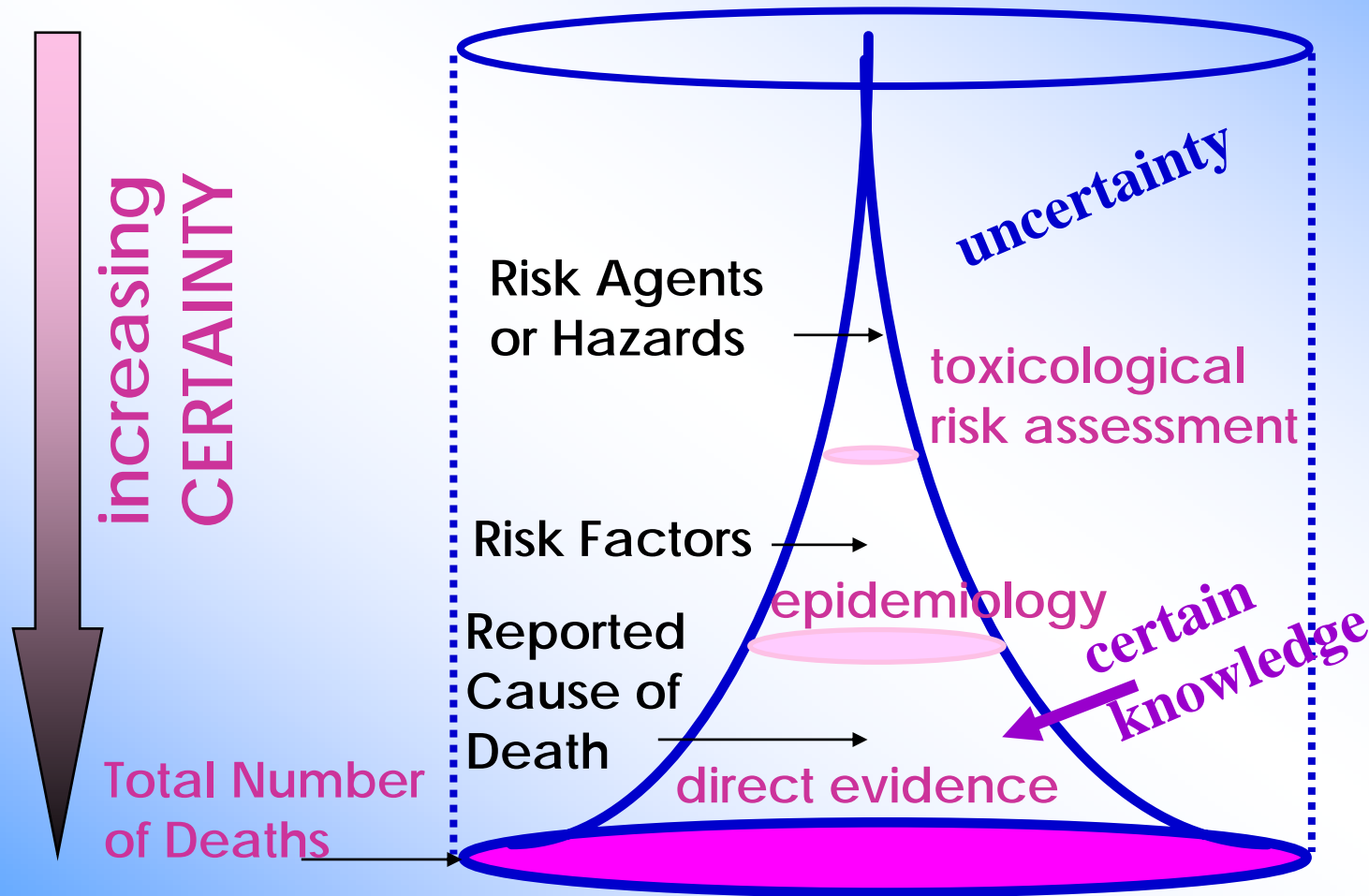
# Taxonomy of Risk Evidence

- ❑ there is a compelling need to consider the evidence and inference that underlies any risk estimate
- ❑ health risk estimates rely on an over-simplified model of causation
- ❑ health risk estimates have not paid enough attention to differences in uncertainty depending on the nature of the evidence



# Taxonomy of health risk evidence

Thomas, S. and S.E. Hrudey. 1997. Risk of Death in Canada. U of A Press.



# Another Reality

- ❑ cannot validate a risk prediction for an individual
- ❑ Canadian males in my age category run, on average, a 1 in 200 chance of death each year
- ❑ in the coming year, I will either survive or die, but neither outcome will validate this risk prediction
- ❑ only having >200 clones of me (raised identically to me) following identical behaviour over the coming year could test the prediction



## Harris accepts the blame

### Bin Laden probably dead, Musharraf believes

Provincial cuts, Koefoed brothers' mismanagement led to tragedy in Walkerton, report concludes



Folklore President  
views history fallow

### CONCLUSION

The report concludes that the tragedy in Walkerton was preventable and that the Koefoed brothers' mismanagement of the water system was a major factor. It also criticizes provincial cuts that led to the deterioration of the infrastructure.

The report also notes that the Walkerton water crisis was a result of a combination of factors, including the failure of the Koefoed brothers to properly maintain the water system and the impact of provincial cuts on the infrastructure.

### CONCLUSION

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## The moral stain of Walkerton



REGAN NEWS

The report also notes that the Walkerton water crisis was a result of a combination of factors, including the failure of the Koefoed brothers to properly maintain the water system and the impact of provincial cuts on the infrastructure.



# Did Risk Communication Play Any Role in Causing Walkerton?

- ❑ The Koebels testified that Walkerton consumers complained about their “pure” water being chlorinated
- ❑ The Koebels did not understand the risks of failing to disinfect Walkerton’s drinking water
- ❑ Walkerton operators minimized and avoided chlorination to avoid consumer complaints
- ❑ Fear of chlorine and disinfection by-products has contributed to a number of waterborne outbreaks



# The Challenge in Risk Management

- ❑ The risk management challenge is one of making sensible and appropriate decisions in the face of inevitable uncertainties.
- ❑ If there was no uncertainty, if all necessary evidence of impending danger was fully available and understood in a timely manner, then risk management could be reasonably straightforward.



# The Challenge of Risk Management

- ❑ In the absence of full and timely evidence of impending danger it is necessary to judge incomplete and inadequate evidence, often with an inadequate understanding of how all of the critical causal processes function.
- ❑ Two major types of failure can arise in the face of these uncertainties.



# The Challenge of Risk Management

- Type I failure is the decision to act as if danger was imminent when this assessment is NOT correct. Type I failure is a case of responding with unnecessary actions to a **false positive** warning.
- Type II failure is the decision not to act when danger IS TRULY imminent. Type II failure is a case of not responding because of a **false negative**, the absence of a warning when a warning is required or a failure to recognize and act on a valid warning.



# The Challenge of Risk Management

- ❑ Both failure modes have negative consequences.
- ❑ Steering a sensible course of action between these failure modes is the essence of effective risk management.
- ❑ This is challenging because it is impossible to simultaneously eliminate the chances of a false negative without increasing the chances of a false positive and vice versa.
- ❑ We cannot simultaneously eliminate any chance of following either failure mode.



# Risk Management and Precaution

- Taken in the context of drinking water safety, consider examples of:
  - ◆ a Type I error
  - ◆ a Type II error
  
- Taken in the context of drinking water safety, consider the consequences of:
  - ◆ a Type I error
  - ◆ a Type II error



# Risk Management and Precaution

- ❑ The challenge is to determine for each specific problem and decision, what is the appropriate balance to exert towards avoiding Type II errors without creating an unacceptable increase in Type I errors.
- ❑ The optimum balance will not always be clear and minor failures or near failures will occur from time to time as that optimum balance is being sought and re-adjusted.



# Risk Management and Precaution

- ❑ A balanced tension is preferable to an extreme stance of avoiding Type II failures with such zeal that Type I failures become inevitable.
- ❑ The balanced approach is one of continual and minor correction
- ❑ The misguided, overzealous approach to avoid Type II failure at all costs will ultimately invite catastrophic failures albeit in a less direct manner (i.e. overuse of the “Precautionary Principle”.)



# Conclusions

- ❑ fully explore the underlying concepts of risk
- ❑ explore uncertainty in relation to risk evidence
- ❑ focus on the evidence and the inference underlying risk predictions (forget “*real*” vs. “*perceived*”)
- ❑ ensure that risk communications and management decisions balance between the negative consequences of both Type I and Type II errors.

