Interpretation of Probability

February 14, 2013

March 28, 1982

CANCER RATE SPURS ANXIETY IN INDUSTRIAL BAY AREA

Special to the New York Times

RICHMOND, Calif., March 27— A high rate of lung cancer among white males in industrialized areas of Contra Costa County here has aroused alarm among residents and resulted in a state-financed study to determine the causes.

Residents fear that high levels of air pollution from five oil refineries and 37 chemical plants in this county in the San Francisco Bay area are in part responsible for the lung cancer rates, which are 40 percent higher in industrial sections of the county than in nonindustrial areas.

According to statistics of the National Cancer Institute, the lung cancer rate for white males nationwide averages 77.2 cases for 100,000 people. In Contra Costa, preliminary findings in the state Department of Health Services study show that 108 white males in 100,000 have lung cancer. The report also said that lung cancer rates in certain industrialized areas of the county were elevated for all races and sexes.

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Correlation is not causation

Solution: Controlled experiments

I didn't kill my babies

In November 1999 solicitor Sally Clark, 36, was convicted of one of the most horrific crimes any mother could imagine – the murder of her baby sons, Christopher, aged 11 weeks, and Harry, eight weeks...

When he died, a part of me died too

In 1999, UK prosecutors charged Sally Clark with murdering her two infant children, who had apparently both died in their sleep.

Her defense: sudden infant death syndrome

Expert witness:

P(1 child dying of crib death) = 1/8550

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P(both dying) = 1/8550^2 = 1/73 million

The probability she is innocent is 1 in 73 million.

Therefore, she must be guilty.

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What do you think?

Error 1:

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Error 2:

No reason to believe the probabilities are independent. (In fact, they likely aren't: susceptibility to SIDS is partly genetic.)

Summary

Risk = expected value of losses

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= P(loss) x amount of loss

Choose the option where you're likely to lose the least (i.e., smallest expected value of loss)

Risk = expected value of losses
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May be tricky

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Need to use consistent units.
Doesn't take into account loss-aversion.