Measures of Excess Risk

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Part 9

Observation of:

Positive association (increase in risk)

Negative association (decrease in risk)

May lead to an inference of

Causation

Protection

Among 2,970 diabetic patients on whom data on maximum weight were available, it was found that 62.0 percent of the men and 69.5 percent of the women had at some time been 11 percent or more overweight. Are persons 11 percent or more overweight at increased risk of developing diabetes?

Exercises – Measures of Excess Risk

A. In each of the following examples, estimate the rate of disease among "exposed" persons relative to the rate among those who were not exposed:

1. The incidence of endometrial cancer in postmenopausal women currently using unopposed estrogen therapy is 4.0 per 1000 woman-years, whereas in non-users the corresponding rate is 0.8 per 1000 woman-years.

Exposed = 4 / 1000 woman-years

Nonexposed = .8 / 1000 woman-years

Relative Rate = 4 /.8 = 5

Exercises – Measures of Excess Risk

A. In each of the following examples, estimate the rate of disease among "exposed" persons relative to the rate among those who were not exposed:

2. Of 50 Seattle residents who sustained a head injury in a bicycle crash, four were wearing a helmet at the time of the incident. Based on observations of Seattle bicycle riders, the expected number of helmet-wearers among these 50 would have been 14.

Cases – 4 / 50 exposed

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Cases – 4 / 50 exposed

Expected – 14 / 50

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Cases – 4 / 50 exposed

Expected – 14 / 50

Odds of exposure

Cases – 4 / 46

Expected – 14 / 36

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1) Odds ratio $= \frac{4/46}{14/36} = 0.22$

2) Odds ratio $= \frac{4/46}{140/360} = 0.22$

Exercises – Measures of Excess Risk

B. The following questions pertain to the data provided earlier on PHC mortality in relation to the presence in serum of HBsAg:

1. During the period of study, what was the difference in the mortality rate from PHC between HBsAg positive men and HBsAg negative men? (Assume the average length of follow-up was 3.3 years for both groups.)

Person-years

HBsAg+ : 3,454 x 3.3 years
= 11,398

Person-years

HBsAg+ : 3,454 x 3.3 years
= 11,398

HBsAg- : 19,253 x 3.3 years
= 63,535

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Person-years

HBsAg+ : 3,454 x 3.3 years
= 11,398

HBsAg- : 19,253 x 3.3 years
= 63,535

AR = 40/11,398 - 1/63,535
= 349.3 per 10^5 person-years

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Person-years

HBsAg+ : 3,454 x 3.3 years
= 11,398

HBsAg- : 19,253 x 3.3 years
= 63,535

AR = 40/11,398 - 1/63,535
= 349.3 per 10^5 person-years

AR% = $\frac{349.3}{350.9}$ = 99.5%

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Exercises – Measures of Excess Risk

B. The following questions pertain to the data provided earlier on PHC mortality in relation to the presence in serum of HBsAg:

2. By what amount could the mortality rate from PHC in male Chinese government employees be reduced if chronic infection with hepatitis B virus could be eliminated? By what fraction?

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PAR = $\mathbf{I} - \mathbf{I}_o$

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PAR = $\mathbf{I} - \mathbf{I}_o$

$\mathbf{I}$ = 41 / 74,933
= 54.7 per 10^5 person-years

$\mathbf{I}_o$ = 1.6 per 10^5 person-years

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PAR = $\mathbf{I} - \mathbf{I}_o$

$\mathbf{I}$ = 41 / 74,933
= 54.7 per 10^5 person-years

$\mathbf{I}_o$ = 1.6 per 10^5 person-years

PAR = 53.1 per 10^5 person-years

PAR% = $\frac{53.1}{54.7}$ X 100% = 97%

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Exercises – Measures of Excess Risk

B. The following questions pertain to the data provided earlier on PHC mortality in relation to the presence in serum of HBsAg:

3. In a male Chinese government employee who was HBsAg positive and who died of PHC, what is the likelihood that chronic infection with hepatitis B virus (and not some other causal pathway not involving infection with this virus) was responsible for the cancer?

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Exp = 4 / 1000 person-years

Non-exp = 0.8 / 1000 person-years

RR = 4 / 0.8 = 5

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Exercises – Measures of Excess Risk

C. The following is paraphrased from an article in the *British Medical Journal* (1998;316:1043-47):

> Although the relative risk of myocardial infarction associated with cigarette smoking is higher in women than in men, smoking may well cause a higher rate of myocardial infarction in men who smoke than in women who smoke.

Under what circumstance could this be true?

	I_o*	I_e	RR	AR
Men	5	10		
Women	2	6		

* per 1,000 person-years

	I_o*	I_e	RR	AR
Men	5	10	2	
Women	2	6	3	

* per 1,000 person-years

Exercises – Measures of Excess Risk

D. The following data document the incidence of lung cancer in the white population in five areas of the U.S. during 1984-86, by sex and histologic type of cancer:

	# of cases	% of total lung cancer	Rate*
Men			
Small cell	2,730	17.3%	14.5
Other	13,051	82.7%	69.6
Women			
Small cell	1,743	20.5%	7.4
Other	6,746	79.5%	28.3

* Per 1,000 person-years

Exercises – Measures of Excess Risk

Upon seeing the increased proportion of small cell lung cancers in women (20.5%, vs. 17.3% in men), a commentator speculated that "there may be a gender difference between men and women which makes the latter more prone to small cell lung cancer. Or, women could be smoking different cigarettes, or they may be smoking them in a different way."

Assume that the difference between 20.5% and 17.3% exceeds what could be expected by chance, given no true difference between men and women in the proportion of small cell lung cancer. Explain how such a difference could be present and yet it could also be true that women are not at higher risk of small cell lung cancer than are men.

Estrogen Plus Progestin and Colorectal Cancer in Postmenopausal Women

– N Engl J Med 2004;350:991-1004

"Use of estrogen plus progestin was associated with a decreased risk of colorectal cancer. However, colorectal cancers in women who took estrogen plus progestin were diagnosed at a more advanced stage then those in women who took placebo."

Question:

- Are users of estrogen-progestin hormone therapy at increased risk of regional or metastatic colorectal cancer?

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	E&P	Placebo
# of women	8506	8102
# of cases (total)	43	72
Localized	10	36
Regional / Metastatic	32 (76.2%)	34 (48.5%)
Missing	1	2

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Exercises – Measures of Excess Risk

E. Among 84 children greater than 12 months of age who were exposed to the varicella virus at a day-care center, 25 contracted varicella (N Engl J Med 2002;347:1909-15). There were no instances of illness in the 16 children who had previously had varicella. Among those who had not previously had the disease, 8 of 18 unvaccinated children developed varicella, as did 17 of 49 vaccinated children. (There was one child whose vaccination status was unknown.)

What was the efficacy of varicella vaccination in this population?

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Varicella Vaccine Efficacy

$$VE = \frac{I_{unvacc} - I_{vacc}}{I_{unvacc}} \times 100\%$$

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Varicella Vaccine Efficacy

$$VE = \frac{I_{unvacc} - I_{vacc}}{I_{unvacc}} \times 100\%$$

$$= \frac{8/18 - 17/49}{8/18} = 21.8\%$$

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Which measure of excess risk best addresses:

- Whether breast feeding by an HIV-positive mother increases her child's risk of becoming infected?
- The weighing of the risks and benefits of breast feeding by HIV-positive mothers?

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Can HIV infection be transmitted by breast feeding?

- Some babies have become infected with HIV after being nursed by women who acquired this infection after delivery.
- Prevalence of HIV in 2-year-olds of women infected prior to delivery
  - Breast-fed – 35%
  - Bottle-fed – 21%

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Cohort Study of the Efficacy of Pertussis (Whooping Cough) Vaccine†

- Study population – Household contacts of pertussis cases, ages 6-47 months, in 6 areas of Germany

	Attack rate*
Vaccinated (n=112)	12%
Unvaccinated (n=173)	64%

*** During 7-28 days following onset of cough in index case**
† Acellular vaccine

JAMA 1998; 275:37-41

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Does exposure to industrial substance 'S' cause bladder cancer?

Cohort	Deaths	Person-years	RR
Males			
S+	36	31,819	2.00
S-	45	79,631	
		111,450	
Females			
S+	2	4634	2.22
S-	8	41,187	
		45,821	
Total			
S+	38	36,453	2.38
S-	53	120,818	
		157,271	

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"Disguises" of RR

a) $\frac{\text{Observed cases}}{\text{Expected cases}}$

b) $\frac{\text{Observed deaths}}{\text{Expected deaths}}$ x 100 = SMR

c) $\frac{\text{Observed cases}}{\text{Expected cases}}$ x 100 = SIR

Vaccine efficacy =

$$\frac{I_{unvacc} - I_{vacc}}{I_{unvacc}} \times 100\%$$

$$VE(\text{polio vaccine}) = \frac{57/100{,}000 - 16/100{,}000}{57/100{,}000} \times 100\% =$$

=72%

Epidemiologic Perspectives

- Ed Boyko, MD, MPH, Seattle ERIC Director, interviews Tom Vaughan, MD, MPH, Head of the Epidemiology Program, Fred Hutchinson Cancer Research Center and Professor of Epidemiology, University of Washington, about his study on Body Mass Index and Risk of Adenocarcinoma of the Esophagus and Gastric Cardia .