

1. If you wish to investigate the association of cigarette smoking with bone mineral density (BMD), please answer the following questions. If you use some notations, please define them first.
  - (1) You want to recruit some smokers and some nonsmokers, and measure their BMD at hips. There are two commonly-used measures of central tendency, mean and median. Which one will you choose to describe the central tendency of the BMD of the two groups (smokers vs. nonsmokers)? Why? (5%)
  - (2) Please propose two measures to describe the dispersion of the BMD of the two groups. (5%)
  - (3) If you want to perform a statistical hypothesis testing to compare the BMD of the two groups, please state the null and the alternative hypotheses. (5%)
  - (4) If we can assume the BMD follows a normal distribution, and the sample sizes of the two groups are both 15, which test will you use to perform the statistical hypothesis testing? If the sample sizes of the two groups are both 150, which test will you use? (5%)
  - (5) Following part (3), how to estimate the minimum sample size required in order to achieve a power of 80%? (5%)
  - (6) If you finally find the subjects should be categorized as three groups: "current smokers"; "former smokers"; "never smokers", and you decide to compare the means of the BMD of the three groups. Which statistical method will you use? Please describe the assumptions for using this method. (5%)
  - (7) If gender (dichotomous) and age (continuous) are two important confounders in this study, and you decide to use a multiple linear regression model to compare the means of the BMD of the three groups while adjusting for gender and age. Please describe the regression model, the assumptions for using this model, and explain the meaning of each regression coefficient. (10%)
  - (8) If you dichotomize the BMD as "normal" and "low BMD", please describe how to use a 2-by-3 contingency table to test for the association between the BMD and the smoking status (categorized as three groups). Which statistical test will you use? Please describe the concept of this statistical test and its underlying assumptions. (5%)
  - (9) Following part (8), please describe a regression model to investigate the associations of cigarette smoking with BMD (dichotomized as "normal" and "low BMD"), while adjusting for gender and age. (5%)

2. A case-control study investigated asbestos exposure, lung cancer death, and cigarette smoking in men living in a community of with asbestos plant. Data appear in the table.

	Stratum 1 (smoker)		Stratum 2 (Nonsmoker)		All men in study	
	Asbestos (+)	Asbestos (-)	Asbestos (+)	Asbestos (-)	Asbestos (+)	Asbestos (-)
	Lung cancer (+)	75	5	5	10	80
Lung cancer (-)	20	80	18	72	38	152

- (1) Calculate the odds ratio for smokers. (4%)
- (2) Calculate the odds ratio for nonsmokers. (4%)
- (3) Calculate the overall odds ratio for the study. (4%)
- (4) Is there a synergistic relationship between smoking status and asbestos exposure on the mortality of lung cancer? (4%)

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3. A case-control study investigated the association between cigarette smoking and sudden cardiac death. Data were individually matched by their gender. The numbers of matched pairs are shown in the table.

Cases	Controls		Totals
	Smoking 1+ pack/day	Smoking <1 pack/day	
Smoking 1+ pack/day	2	36	38
Smoking <1 pack/day	8	34	42
Totals	10	70	80

- (1) Calculate the matched-pairs odds ratio for these data: (4%)
- (2) What are the odds that the controls smoke 1+ pack/day? \_\_\_\_\_ (4%)
- (3) What are the odds that the cases smoke 1+ pack/day? \_\_\_\_\_ (4%)
- (4) Using data from the table, unmatched the pairs and calculate an unmatched odds ratio. (4%)

4. In a cohort study, the incidence of coronary heart disease (CHD) in the exposed group (smoker) that is attributable to the exposure is calculated using the table.

	CHD develop	CHD does not develop	Total
Smoker	84	2916	3000
Nonsmoker	87	4913	5000

- (1) Calculate the incidence of CHD among smoker: (4%)
- (2) Calculate the incidence of CHD among nonsmoker: (4%)
- (3) How many percent of morbidity from CHD among smokers may be attributable to smoking and could presumably be prevented by eliminating smoking. (10%)

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