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DATA-DRIVEN LESSON PLANS IN NUTRITION AND PUBLIC HEALTH: A HANDBOOK

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4. ASSESSMENT OF CONFOUNDERS AND INTERACTIONS: AN ANALYSIS OF EPIDEMIOLOGICAL DATA

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Background

Confounding is a very important concept in epidemiology, because of its effect on distorting the association between exposure and outcome. The confounding effect or effect modification (interaction) must be considered when an extraneous variable affects the association between the exposure and the outcome of interest. The confounding effect can be controlled by planning the study well prior to data collection, or if the data is already collected we can control for the confounding effect by performing adjusted analysis using stratified or regression analysis.

Learning objectives

At the end of the lesson, the participants are able to:

1. understand the concept of confounding and interaction/effect modification
2. describe the principle and methods employed in controlling for confounding factors
3. identify a potential confounder
4. assess the occurrence of confounders and effect modifiers by means of statistical analysis

Usage within the curriculum

This lesson is part of the course "Analytical Epidemiology" for the Undergraduate Program in the Faculty of Public Health, Andalas University, given in semester VI. The data in this lesson is used by facilitators to support the lectures and tasks. This lesson may also be offered in a postgraduate program where participants may be given more independent tasks such as performing analysis and interpretation using raw data from actual surveys/studies with some statistical application such as R, Epi Info, SPSS, STATA, etc, as well as presenting the results in a plenary.

Eligibility of participants

The participants are undergraduate students at Faculty of Public Health majoring in Epidemiology. Participants should have a basic knowledge in biostatistics and epidemiology as well as a basic skills in using a statistical software.

Materials and resources

1. Presentation slides on "Confounding" and "Effect Modifier/Interaction"
2. An article about confounding
3. Dataset for lecture on Confounding: Lung Cancer.xls
4. Dataset for Task 2: CHD.xls
5. R software/Epi Info 7 (open source software)
6. Worksheet for Task 1 (Appendix 4.1)
7. Worksheet for Task 2 (Appendix 4.2)

Facilitators

The facilitators are the course coordinator(s).

Duration

This lesson is to be conducted for a total of 2 sessions, each 100 minutes.

Directions of class activities

1. In Session 1, facilitators complete the slide presentation on "Confounding". The dataset on Lun Cancer.xls is used as part of the lecture.
2. After the lecture, participants are required to study an article about confounding by Sonis (1998).
3. Participants are given individual take home assignments on Task 1 (Appendix 4.1) to compute and asse confounding in a given case study.
4. In Session 2, facilitators complete the slide presentation on "Effect Modifier/Interaction".
5. Participants are given individual take home assignments on Task 2 (appendix 4.2) based on the dataset CHD.xls using R software or Epi Info 7.

Evaluation of the participants

The evaluation of the participants in this lesson will contribute tothe overall final grade. The followin components are used:

- Individual tasks : 20%
- Midterm examination : 30%
- Final examination : 50%

All individual take home assignments are submitted through e-mail with the output files.

valuation of the lesson

valuation is done once at the end of the Semester. Students are requested to fill in a survey questionnaire to valuate the overall course. The results of the survey will be shared with the course coordinators and teaching eam for improvement.

eferences

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Appendix 4.1. Worksheet Task 1 on confounding

TASK 1

Name:
ID no:

A cohort study was conducted to assess the relationship between air contamination exposures (high exposure and low exposure) and the occurrence of bronchitis. It was believed that smoking status may be a confounder. Therefore, this study needs to find out if smoking status is a confounder in the air pollution-bronchitis association.

The total subjects in the study were 2648 and consisted of people who experienced and did not experience an occurrence of bronchitis. Around 1307 people were exposed to high air contamination. The study shows that 257 subjects had bronchitis. The proportion of subjects exposed to high air contamination but not having bronchitis was 1129/2391.

Questions:

subjects who had bronchitis and were not exposed to high air contamination?

1. Draw a 2x2 table to describe the relationship between air contamination exposure and bronchitis.

			Total
Total			

2. What is the proportion of subjects who were exposed to high air contamination and did not have bronchitis?

3. What is the proportion of subjects who had bronchitis and were not exposed to high air contamination?

4. Among subjects who did not have bronchitis, what is the proportion of them exposed to high air contamination?

5. Amongst the subjects who were exposed to high air contamination, what is the ratio of those who had or did not have bronchitis?

6. What is ratio of respondents who were exposed or not exposed to high air contamination who suffered from bronchitis?

7. What is the correct measure for association/risk in this study? Based on the relationship between levels of air contamination exposure and bronchitis, calculate the estimate of this association and interpret the results.

From the results above, stratification by smoking status was made to see whether or not it distorts the relationship between exposure of air contamination and bronchitis. It was found that the proportion of smokers was 1259/2648. Among subjects who had bronchitis in the smoker group, it was found that the ratio of subjects exposed and not exposed to high air contamination was 168/34. Meanwhile, among the non-smoker group, 259 subjects were exposed to high air contamination.

8. Create 2x2 table for each stratum/level based on the smoking status.

Stratum/level 1 =

			Total
Total			

Stratum/level 2 =

			Total
Total			

9. Among subjects who had bronchitis, how many were non-smokers?

10. Calculate the measure for association/risk in each stratum/level and interpret the results.

11. How is the relationship of smoking and bronchitis?

			Total
Total			

12. Is smoking an independent risk factor for bronchitis?

13. Is there a difference proportion of smokers by levels of air contamination exposure?

14. Is smoking a confounding factor to the relationship between air contamination exposure and bronchitis? Give your reasons.

Appendix 4.2. Worksheet Task 2 on confounding and interaction

TASK 2

Name:
No ID:

Dataset:
File name: CHD.xls (Microsoft Excel version 97-2003)

Variable: **Alcohol**:
1 = Alcohol drinker
0 = Non alcohol drinker

Smoking
1 = Smoking
0 = No smoking

Coronary:
1 = Coronary heart
0 = No coronary heart

According to the data obtained from a cohort study, one of the study objectives is to define the relationship between alcohol drinking and risk of coronary heart disease.

Use the dataset, and calculate risk estimation for the relationships below:

1. **Alcohol Drinking with Coronary Heart Disease**

		Coronary Heart Disease		
		+	-	Total
Drinking Alcohol	+			
	-			
	Total			

RR = OR=

2. Alcohol Drinking with Coronary Heart Disease among Smokers (Smoking=1)

		Coronary Heart Disease		
		+	-	Total
Drinking Alcohol	+			
	-			
	Total			

RR = OR=

3. Alcohol Drinking with Coronary Heart Disease among Non-Smokers (Smoking=0)

		Coronary Heart Disease		
		+	-	Total
Drinking Alcohol	+			
	-			
	Total			

RR = OR=

4. Smoking with Coronary Heart Disease

		Coronary Heart Disease		
		+	-	Total
Smoking	+			
	-			
	Total			

RR = OR=

5. Smoking with Coronary Heart Disease among Alcohol Drinkers (Alcohol=1)

		Coronary Heart Disease		
		+	-	Total
Smoking	+			
	-			
	Total			

RR = OR=

6. Smoking with Coronary Heart Disease among Non-Alcohol Drinkers (Alcohol=1)

		Coronary Heart Disease		
		+	-	Total
Smoking	+			
	-			
	Total			

RR = OR=

7. Alcohol Drinking with Smoking

		Coronary Heart Disease		
		+	-	Total
Alcohol	+			
	-			
	Total			

RR = OR=

8. **Perform adjusted analysis to see influence of smoking on the relationship between alcohol drinking and coronary heart disease, using stratified analysis. Calculate OR_{MH} (adjusted) using the formula below:**

$$OR_{MH} = \frac{\sum_i \frac{a_i d_i}{T_i}}{\sum_i \frac{bc_i}{T_i}}$$

Calculate:

i	$a_i d_i / T_i$	$b_i c_i / T_i$
1		
2		
Σ		

OR_{MH} =

OR_{CRUDE} =

Conclusions:

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