ADENIYI MOFOLUWAKE
MPH 510 -   APPLIED EPIDEMIOLOGY
Week 4 Assignment - Study Questions
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Answer to Chapter 6: Study Questions 5, 7-12

Answer to chapter 6 study question 5

If I am interested in conducting a case-control study of childhood leukemia and exposures to environmental toxins in utero, while selecting cases and controls for this case- control study, I go from effect (childhood leukemia) to cause (exposure to environmental toxins in utero) (Friis R., Sellers T., 2009 pg 263 & 247). I would start by selecting children with childhood leukemia as my cases and children without childhood leukemia as my controls. Amongst my cases; the children with childhood leukemia, I will determine children with childhood leukemia who have had exposure to environmental toxins in utero and children with childhood leukemia who have had no exposure to environmental toxins in utero. Amongst my controls; the children without childhood leukemia, I will determine children who are exposed to environmental toxins in utero but do not have childhood leukemia and children who are not exposed to environmental toxins in utero and do not have childhood leukemia.

I would define exposure and outcome factors by carefully measuring environmental toxins in utero (exposure) and childhood leukemia (outcome). I would neither manipulate the study factor nor, randomize the study subjects (Friis R., Sellers T., 2009 pg 245).

Using an ecological study design, I would use a group as my unit of analysis (Friis R., Sellers T., 2009 pg 249). I would assess the association between environmental toxins in utero and childhood leukemia within my study group by using a secondary data for example data collected by a health agency or government agency on childhood leukemia. I woul then assess the association between childhood leukemia and exposure to environmental toxins in utero (Friis R., Sellers T., 2009 pg 249).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 6 study question 7
Odds ratio for the following 2 by 2 table

Outcome

Yes   No

Factor
Yes   A = 37   B = 68
 No   C = 24   D = 121

The Odds ratio is AD/BC = 37 * 121/ 68 * 24 = 4477/ 1632 = 2.74
The odds ratio is 2.74.

Answer to chapter 6 study question 8

The table 2 by 2 below represents the association between vitamin deficiency and birth defects.
Exposure to neural tube defects is present in infants whose mothers reported no use of supplementary vitamins. The 137 control mothers who did not use a vitamin supplement are mothers whose infants were exposed to neural tube defects by not using a vitamin supplement but were not born with neural tube defects.

		DISESE STATUS		
		YES	NO	
				TOTAL
EXPOSURE STATUS	YES (exposure to neural tube defects present i.e., no use of supplemental vitamins) =	A (exposure to neural tube defects present and infants born with neural tube defects) = 84	B (exposure to neural tube defects present but, infants were not born with neural tube defects) = 137	A+B (total number exposed to neural tube defects) = 221
	NO (exposure to neural tube defects absent i.e., use of supplemental vitamins) =	C (exposure to neural tube defects absent and infants born with neural tube defects) = 105	D (exposure to neural tube defects absent and infants not born with neural tube defects) = 274	C+D (total number not exposed to neural tube defects) = 379

		A+C (total number of infants born with neural tube defects) = 189	B+D (total number of infants born without neural tube defects) = 411	N (sample total) = 600

Odds ratio between vitamin use and neural tube defects = AD/BC = 84*274/ 137*105 = 23016/14385 = 1.6.
The odds ratio between vitamin use and neural tube defects is 1.6.

Answer to chapter 6 study question 9

This table 2 by 2 below represents the association between job related exposure to welding fumes and chronic obstructive pulmonary disease (COPD)

		DISEASE STATUS		
		YES (patients with COPD)	NO (patients without COPD)	
				TOTAL
EXPOSURE STATUS	YES (occupational exposure present)	A (patients with COPD who have occupational exposure) = 37	B (patients without COPD who have occupational exposure) = 48	A+B (total number who have occupational exposure) = 85
	NO (occupational exposure absent)	C (patients with COPD who do not have occupational exposure) = 362	D (patients without COPD who do not have occupational exposure) = 752	C+D (total number who do not have occupational exposure) = 1114
		A+C (total number of patients with COPD) = 399	B+D (total number without COPD) = 800	N (sample total) = 1199

Odds ratio between job related exposure to welding fumes and COPD = AD/ BC = 37* 752/ 48 * 362 = 27824/ 17376 = 1.6.

The odds ratio between job related exposure to welding fumes and COPD is 1.6.

Answer to chapter 6 study question 10

In this hypothetical case-control study, the outcome is fatal automobile accidents while, the exposure is cell phone use by drivers. I would select patients with fatal automobile accidents (cases or outcomes) and without fatal automobile accidents (controls) and collect data about (exposures) past cell phone use by drivers that may have contributed to fatal automobile accidents.
The automobile accidents were fatal so the patients involved would have been hospitalized as a result, I would select my cases from the hospital. I would then have to select my controls from the hospital.
Difficulties in conducting this study will be;
- Deciding the diagnostic criteria from which to select the controls
- These hospital controls may not be a true representative of exposure rates in the target population (Friis R., Sellers T., 2009 pg 268).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 6 study question 11

In a case-control study of gynecologic cancer, I would exclude women who cannot develop this disease as controls because controls should be selected from the same population at risk of for the disease condition as the cases being studied (Friis R., Sellers T., 2009 pg 266). If women who cannot develop this disease are not excluded as controls, the control will not represent an ideal control for this case-control study. An ideal control "should have the same characteristics (should be similar in every respect to the case) except for the exposure of interest" (Friis R., Sellers T., 2009 pg 268, 265). If these women are not excluded as controls they will reveal what a normal or expected level of exposure should be in the absence of disease.

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 6 study question 12

   a. OR (low- fat diet and colon cancer) = 0.6

Low fat diet is associated with a lower risk of colon cancer. Low fat diet is a protective factor for colon cancer and is not a risk factor for colon cancer.

   b. OR (aerobic exercise and dental caries) = 1 (not significant)

Aerobics exercise is not a risk factor for dental caries.

   c. OR (exposure to side stream cigarette smoke and lung cancer) = 1.3
Exposure to side stream cigarette is a risk factor for lung cancer.

   d. OR (infectious diseases of the pelvis and ectopic (tubal) pregnancy) = 3.0

Infectious diseases of the pelvis are risk factors for ectopic (tubal) pregnancies. Infectious diseases of the pelvis are associated with thrice the risk of ectopic (tubal) pregnancy.

Answer to Chapter 7: Study Questions 5-8, 10-15

Answer to chapter 7 study question 5

The table below shows a cohort study illustrating the association of coffee drinking and anxiety in a population-based sample of adults.

DISEASE STATUS (anxiety)			
	YES (people who developed anxiety)	NO (people who did not develop anxiety)	
			TOTAL
EXPOSURE STATUS (coffee drinking)	YES (people who drink coffee)	A (people who drink coffee and develop anxiety) = 500	B (people who drink coffee but do not develop anxiety) = 9, 500	A+B (total number of people who drink coffee) = 10,000
	NO (people who do not drink coffee)	C (people who do not drink coffee and	D (people who do not drink coffee and do	C+D (total number of people who do

	develop anxiety) = 200	not develop anxiety) = 19,800	not drink coffee) = 20,000
	A+C (total number of people who develop anxiety) = 700	B+D (total number of people who do not develop anxiety) = 29,300	N (sample total) = 30,000

Relative risk of anxiety associated with coffee use = [A/ (A+B)]/ [C/ (C+D)]
= (500/ 10 000)/ (200/ 19 800) = 0.05/ 0.01 = 5.
The relative risk of anxiety associated with coffee use is 5.

Answer to chapter 7 study question 6

A case-control study is different from a retrospective cohort study in the following ways.

A case control study
- It has no longitudinal component (Friis R., Sellers T., 2009 pg 303).
- It begins with ascertaining study subjects on basis of disease status (Friis R., Sellers T., 2009 pg 303) going from effect to cause (Friis R., Sellers T., 2009 pg 263), cases and controls are selected and data about past exposures (exposures occurring prior to onset of disease) that may have contributed to disease is collected (Friis R., Sellers T., 2009 pg 295 & 303).
- It involves identified cases and controls only.
- Disease rates cannot be computed.
- The unit of observation and analysis are the individual.
- The method of data collection involves both primary and secondary sources (Friis R., Sellers T., 2009 pg 263 & 303).

A retrospective cohort study is
- It uses historical data to determine exposure level at some baseline in the pat and perform "follow up" for subsequent occurrences of diseases between baseline and the present (Friis R., Sellers T., 2009 pg 302).
- It goes from cause to effect (Friis R., Sellers T., 2009 pg 295), it starts with a group of subjects are at risk for the outcome but do not have a positive history of the outcome of interest (Friis R., Sellers T., 2009 pg 294)
- It mostly involves the collection of primary data though; secondary data sources are sometimes used.
- It includes at least two observational points, "one to determine exposure status and eligibility and a second (or more) to determine the number of incident cases that developed during the follow up" (Friis R., Sellers T., 2009 pg 295).
- It incorporates an entire cohort of study subjects (Friis R., Sellers T., 2009 pg 303).

Criteria that will influence me to select one over the other include;
- Availability of exposure data
- Size
- Cost
- Data collection
- Data management
- Follow up issues
- Sufficiency of scientific justification (Friis R., Sellers T., 2009 pg 303).
- Ability to calculate disease rates. Cohort studies allow calculation of disease rates (Friis R., Sellers T., 2009 pg 295)
- Ability to save time, with a retrospective cohort study, an extensive and large amount of follow up data may be accrued (Friis R., Sellers T., 2009 pg 302 & 303).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 7

Relative risk of 2.0 and 0.5 are different in strength of association. Relative risk of 2.0 means that the risk (rate) of disease among the exposed is twice as high as the risk of disease among the non exposed whereas, a relative risk of 0.5 means that the risk of disease among the exposed is half the risk of disease among the non exposed (Friis R., Sellers T., 2009 pg 308).

Answer to chapter 7 study question 8

I would advocate a cohort study. This is because a cohort study
- permits determination of risks directly,
- provides a stronger evidence of the association between an exposure and a disease than a case control study
- facilitates generalization of findings while a case control study is prone to errors
- allows examination of multiple outcomes
- Provides evidence about lag time between exposure and disease (Friis R., Sellers T., 2009 pg 318).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 10 – 15

Answer to chapter 7 study question 10

The following are approaches that can be employed to ensure compliance when linkage to a central disease registry is not an option;
- Use of follow-up mailings
- Use of phone calls
- Use of written invitations to return to study sites/ centers for subsequent medical evaluation, bio specimen collection etc by use of labor-intensive and persistent effort (Friis R., Sellers T., 2009 pg 305).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 11

Ecologic study
Strength / Advantage
- The unit of analysis is the group (Friis R., Sellers T., 2009 pg 249).
- It uses secondary data which has already been collected by other investigators, agencies, government etc.; this in turn saves time and cost (Friis R., Sellers T., 2009 pg 250).
- It can be applied in a wide range of situations (Friis R., Sellers T., 2009 pg 253)
- It is simple to conduct, quick and inexpensive.
- It represents a good approach for generating hypothesis when a disease is of unknown etiology (Friis R., Sellers T., 2009 pg 255).

Weakness/ Disadvantage
- The level of exposure for each individual in the unit being studied is unknown (Friis R., Sellers T., 2009 pg 250).
- It might mislead epidemiologists or researchers into reaching a wrong conclusion about the association between exposure and diseases (Friis R., Sellers T., 2009 pg 253).
- It is prone to ecologic fallacy "the bias that may occur because an association observed between variables on an aggregate level does not necessarily represent that association that exists at an individual level" (Friis R., Sellers T., 2009 pg 254).
- Accurate quantification of the exposure-disease associations are difficult because of the imprecision in the measurement of exposure.
- Availability of data and analytical approaches for incorporating them makes the ability to adjust for the influence of extraneous variables limited (Friis R., Sellers T., 2009 pg 255).

Cross sectional study
Strength/ Advantage
- It can be used to examine trends in disease or risk factors that can vary over time if it is repeated (Friis R., Sellers T., 2009 pg 260).
- It is used for collecting data to describe the magnitude and distribution of a health problem, data vital to planning health services and administration of medical care facilities.
- It allows assessment of various characteristics of a population.
- It examines quantitative factors that vary over time if it is repeated.
- It may generate new etiologic hypothesis that can be tested in future studies (Friis R., Sellers T., 2009 pg 262).
- It can be done with a broad(er) sampling frame (Friis R., Sellers T., 2009 pg 258).
- It provides a source of hypothesis for more detailed etiologic studies (Friis R., Sellers T., 2009 pg 259).
- It is used for planning interventions (Friis R., Sellers T., 2009 pg 260).

Weakness/ Disadvantage
- It cannot be used for studies of disease etiology.
- It is difficult to sort out factors associated with risk of disease from factors associated with survival like treatment and severity
- It does not have the ability to study disease of low frequency.
- Care needs to be taken about temporality issue, whether exposure or disease came first. This makes assertions about apparent cause-effect relationship tenuous (Friis R., Sellers T., 2009 pg 262).

Case control study
Strength/ Advantage
- It identifies possible disease etiologies by finding out how two groups differ. It compares frequencies of exposure among cases and controls while permitting inferences as to the basis for the differences in disease status.
- It is useful and efficient for evaluation of vaccine effectiveness, treatment efficacy, screening programs and outbreak investigations (Friis R., Sellers T., 2009 pg 263).
- It is explores in greater detail unusual clinical observations based on a small number of cases.
- When exploring a disease in which little is known about its etiology or etiology of rare diseases, the exposure data collected can cover a wide range of known and suspected factors (Friis R., Sellers T., 2009 pg 272 & 276).
- It can evaluate the efficacy of cancer screening programs (Friis R., Sellers T., 2009 pg 273).
- It is the method of choice in infectious disease research, research of outbreak of new and unusual diseases and in the investigation of the occurrence of antibiotic resistant organisms (Friis R., Sellers T., 2009 pg 275).
- It is cost effective, quick and easy to complete (Friis R., Sellers T., 2009 pg 276).

Weakness/ Disadvantage
- There is an uncertainty of the exposure-disease time relationship and the inability to provide a direct estimate of risk.
- It can be frequently difficult to determine the representativeness of the cases and controls selected for the study.
- It can be inefficient if the exposure is rare in the population. One may end up with a few exposed cases despite a large number of cases (Friis R., Sellers T., 2009 pg 276 & 318).
- It has a greater potential for error (Friis R., Sellers T., 2009 pg 318).

Cohort study
Strength/ Advantage
- It provides stronger evidence of an exposure-disease association.
- It provides evidence about lag time between exposure and disease.
- It facilitates generalization of findings.
- It allows examination of multiple outcomes if properly designed and executed.
- It increases the efficiency for rare exposures by selecting cohorts with known exposures for example, certain occupational groups (Friis R., Sellers T., 2009 pg 318).

Weakness/ Disadvantage
- It takes a considerable effort to conduct especially the ones that are purely prospective.
- It does not save time.
- It is large.
- Additional time passes by as one waits for outcomes to occur.
- It is more difficult to implement especially for rare diseases because of its large size and need for multiple observation points.
- Loss to follow up can limit the sample size for analysis and can raise questions about results if loss is high.
- Some exposures may change over time with long term follow up.
- Estimates of relative risk may be attenuated by misclassification of exposures.
- Ethical issues may arise if good data already indicates that a particular exposure is harmful and one does nothing to intervene with at risk subjects (Friis R., Sellers T., 2009 pg 262).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 12

I would conduct a nested case-control study of low socioeconomic status as a risk factor for teenage pregnancy by selecting a subset of the population from a cohort study (that provides data from an ongoing cohort study of the relationship between low socioeconomic status and teenage pregnancy) to comprise my control. I would use the cases of teenage pregnancy identified from the cohort study as my cases in my nested case-control studies (Friis R., Sellers T., 2009 pg 316).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 13

Cohort studies overcome the problem of temporality.
Temporality is the timing of information gathering, whether information about cause and effect was assembled at the same time point or whether the information was garnered before or after the information about the effect. Cohort studies overcome the foregoing problems associated with temporality of data collection (Friis R., Sellers T., 2009 pg 284). This is enabled by the variations in cohort study designs that depend on data collection on exposure and outcomes (Friis R., Sellers T., 2009 pg 301). These variations are;

- Prospective cohort studies

It is prospective; it determines disease incidence in the future by determining exposure levels at present (baseline) and following up for disease occurrence at some time in the future (Friis R., Sellers T., 2009 pg 301 & 302).

- Retrospective cohort studies

It is retrospective; it determines baseline exposure using historical data to determine exposure level at some baseline in the past, performing "follow – up" for subsequent occurrences of diseases between baseline and the present (Friis R., Sellers T., 2009 301 & 302).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 14
Practical issues that influence the design of a cohort study include:
- Availability of exposure data.
- Size and cost of the cohort.
- Data collection and management.
- Follow up issues.

- Sufficiency of scientific justification (Friis R., Sellers T., 2009 pg 303).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts

Answer to chapter 7 study question 15

Possible outcomes for cohort studies distinguishing between discrete events and disease markers include;
- Discrete events

Single events
- Mortality (age standardized annual death rates, annual age specific death rates)
- First occurrence of a disease or health-related outcome for example, cancer
    Incidence (density)
    Cumulative incidence (risk) e.g. cumulative incidence of diseases of specific time intervals e.g. five years
    Ratios (incidence density and cumulative incidence) (Friis R., Sellers T., 2009 pg 300).

Multiple occurrences, assessment of outcomes repeated occurrences of diseases for example, strokes and heart attacks.
- Of disease outcome
- Of transitions between states of health/disease
- Of transitions between functional states (Friis R., Sellers T., 2009 pg 300).

- Level of a marker for disease or state of health

- Change in a functional / physiologic/ biochemical/ anatomical marker for disease or health

Rate of change
- Patterns of growth and or decline
- "tracking" of markers of disease/ health

Change in level with time (age) (Friis R., Sellers T., 2009 pg 300).

References

Friis R., Sellers T., 2009 *Epidemiology for Public Health Practice* Jones and Bartlett Publishers Sudbury, Massachusetts