Research Methods and Analysis

Lecture 8

Analytic Experimental Studies
Cross-Sectional Study Design

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Observational

- Cohort
- Cross-Sectional
- Case Control
Cross-sectional is an observational study that collects data from whole study population at a single point in time to examine the relationship between disease and other variables. In another word, it provides a snapshot of the frequency of a disease or other health related characteristics in a population at a given point in time. This approach is utilized by researchers to assess the prevalence of a serious or a prolonged effect on the health of the population and particularly useful in informing the planning and allocation of health resources. The study may contain data from the past but it mainly rely on present data and could be expensive and my not appropriate for all research studies.
Purpose of Cross-Sectional Studies

To learn about the characteristics of a population at one point in time (like a photo “snap shot”).

In a cross-sectional study, the current or historical status of individuals is evaluated and may be examined in relation to some current or past exposure. These studies are obviously most useful for conditions that are not rapidly fatal, not terribly rare, and/or not routinely brought to medical attention (e.g., elevated blood pressure, elevated blood cholesterol, many psychiatric disorders, diet, subclinical infection, and serologic markers of previous infections). Since participants for a cross-sectional study are generally chosen without previous knowledge of their disease or exposure status, such studies can be used to estimate prevalence of both diseases and exposures and therefore to compute prevalence ratios and prevalence odds ratios. Among the more widely known cross-sectional studies are the periodic national household (interview) surveys by the U.S. National Center for Health Statistics (NCHS), the annual (telephone) Behavioral Risk Factor Survey conducted by the U.S. Centers for Disease Control and Prevention (CDC), and HIV prevalence studies. Sometimes the process of recruiting subjects to a follow-up study (e.g., the Lipids Research Clinics Coronary Primary Prevention Trial prevalence study) serves as a cross-sectional study. The cross-sectional NCHS NHANES (National Health and Nutrition Examination Survey) study became a follow-up study when respondents were re-examined ten years later, creating the NHANES Follow-up Study.
Design of a cross-sectional study
No comparison group.

Cross-Sectional Study measures

Prevalence of a condition:
\[ \text{Prevalence} = \frac{\text{number of existing cases}}{\text{size of population (or population count)}} \]
A cross-sectional study can be used to look at the association between obesity and television watching. A sample of people from the population that you are interested in, can be polled and asked about their height/weight ratio and the number of hours of television the person watches each week. This study will give insight as to whether obesity and television watching are associated, but it will not help to determine which might cause the other. In other words, it is not known if obesity causes more television watching or if more television watching causes obesity. It may therefore be difficult to work out whether the disease or the exposure came first, so causation should always be confirmed by more rigorous studies. The collection of information about risk factors is also retrospective, running the risk of recall bias.
Types of cross-sectional study

Descriptive
A cross-sectional study may be purely descriptive and used to assess the frequency and distribution of a particular disease in a defined population. For example a random sample of schools across London may be used to assess the burden or prevalence of asthma among 12-14 year olds.

Analytical
Analytical cross-sectional studies may also be used to investigate the association between a putative risk factor and a health outcome. However this type of study is limited in its ability to draw valid conclusions about any association or possible causality because the presence of risk factors and outcomes are measured simultaneously. It may therefore be difficult to work out whether the disease or the exposure came first, so causation should always be confirmed by more rigorous studies. The collection of information about risk factors is also retrospective, running the risk of recall bias.
When is a Case-Control Study Warranted?

• To formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.
• To select and use appropriate statistical methods to analyze data.
• To develop and evaluate inferences and predictions that are based on data.
• To estimate prevalence of a health condition or prevalence of a behavior, risk factor, or potential for disease.
• To learn about characteristics such as knowledge, attitude and practices of individuals in a population.
• To monitor trends over time with serial cross-sectional studies.
Advantages and Disadvantages

Advantages

• Does not require follow-up and is therefore less costly and quicker than other designs.
• Are often representative of a population, rather than a smaller sub-population.
• The prevalence of disease or other health related characteristics are important in public health for assessing the burden of disease in a specified population and in planning and allocating health resources.
• Its validation is not an issue.
• Good for descriptive analyses and for generating hypotheses.

Disadvantages

• Not suitable for studying rare diseases or diseases with a short duration.
• Susceptible to bias due to low response and misclassification due to recall bias.
• Its confounders maybe unequally distributed between groups.
• Only a snapshot: the situation may provide differing results if another time-frame had been chosen.
• Its differences may be due to age/time effects.
• There inter-subject variability exists, making it harder to detect a difference.
• It shows association but not causation.
Real-life Example # 1

There is a common notion that beer drinkers are, on average, more 'obese' than either nondrinkers or drinkers of wine or spirits. This is reflected, for example, by the expression 'beer belly'. However, the few studies on the association between consumption of beer and abdominal obesity produced inconsistent results. We examined the relation between beer intake and waist–hip ratio (WHR) and body mass index (BMI) in a beer-drinking population.

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Real-life Example # 2

Prevalence and Risk Factors of Mycobacterium Tuberculosis Infection Among Prisoners in Kabul Central Prison (Puli Charkhi), Afghanistan

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Abstract

Background. Afghanistan has the second highest tuberculosis (TB) burden in the Eastern Mediterranean Region with 76,000 new cases and 20,000 deaths each year. Among the highest risk settings for TB acquisition and transmission are prisons. There is a paucity of data to inform evidence-based design of health policies to control TB in prisons. This study aimed to determine the prevalence and relevant risk factors of TB in Kabul Puli Charkhi Prison.

Methods. A cross-sectional study was conducted in Kabul Central Prison from January to September 2006. Using a structured questionnaire and tuberculin skin test (PPD), a total of 250 prisoners were selected using a stratified random sampling technique. Those who were sentenced to death, had less than 3 months remaining of their sentence, had a previously confirmed case of TB, or were pregnant, were excluded.

Results. The prevalence of TB infection was 55.7% (132/237) among the prison population. Using comparison analysis of two outcome groups (positive and negative PPD), we found that age (odds ratio (OR) = 4.14), income (OR = 7.62), duration of incarceration (OR = 2.62), accommodation area (OR = 3.51), personal hygiene (OR = 15.13), content of food (OR = 5.58) and low-grade fever (OR = 3.25) were positively associated with TB infection.

Conclusion. To control TB in this environment, attention should be given to high risk groups such as those in low socio-economic classes, the elderly, and low-weight individuals. Rebuilding of damaged prison facilities and better distribution of prisoners will prevent overcrowding and decrease the likelihood of TB transmission. Improving the quality of food and hygiene would also reduce the level of infection. Based on preliminary findings of this study, the National TB program has strengthened its existing activities in prisons and has made a commitment to establish a comprehensive TB center.

Abstract

Background. The knowledge and attitudes of healthcare workers regarding HIV infection are important factors influencing the readiness of people living with HIV to access care, and the quality of the care they receive. In addition to factors such as stigma and bias, how healthcare workers perceive their own risks in relation to caring for HIV-positive patients may potentially influence their willingness to provide care and their attitudes towards HIV-infected patients. In Afghanistan, there is a lack of information on the prevalence of HIV in general population. The country, however, has many risk factors that could facilitate HIV transmission.

Objective. To assess HIV-related knowledge, attitudes, and risk perception amongst healthcare workers in Afghanistan national and regional hospitals

Methods. A cross-sectional survey among healthcare workers was conducted in five large hospitals selected in Afghanistan. Approval was obtained from the Institutional Review Board of the Ministry of Public Health of Afghanistan and interviews were voluntary. Data analysis was conducted using STATA 11.0 to calculate frequencies and to perform cross-tabulation and logistic regressions with adjusted odd ratio and 95% confidence interval in order to detect statistical significance on differences in knowledge and attitude among healthcare workers in the targeted hospitals.

Results. Among 741 healthcare workers who participated in the study, 34.4% (255) correctly identified all correct modes of HIV transmission and 32.1% (238) correctly identified all incorrect modes of HIV transmission. Only 10.4% (77) correctly identified both correct and incorrect modes of HIV transmission. Nurses 12.3% (27) were most knowledgeable by correctly identifying all correct and incorrect modes of HIV transmission. The majority of healthcare workers expressed a willingness to care for people living with HIV. While 88% of healthcare workers believed that it is necessary to take extra infection precautions for people living with HIV, 76% presumed that people living with HIV should be nursed separately from other patients.

Conclusion. Nearly 2 of every 3 Afghan healthcare workers in this sample lacked basic knowledge about the routes of transmission of HIV. These findings provide support for both improving the education of current healthcare workers, and integrating teaching modules that include the topics of disease transmission, clinical care, and universal precautions into curricula of health educational institutions.
Association of hypometabolism and amyloid levels in aging, normal subjects.


Abstract

**OBJECTIVE:** We evaluated the relationship of amyloid, seen on Pittsburgh compound B (PiB)-PET, and metabolism, seen on [18F]-fluorodeoxyglucose (FDG)-PET, in normal subjects to better understand pathogenesis and biomarker selection in presymptomatic subjects.

**METHODS:** Normal participants (aged 70-95 years; 600 with PiB-PET, FDG-PET, and MRI) were included. We performed a cross-sectional evaluation and subcategorized participants into amyloid-negative (<1.4), high-normal (1.4-1.5), positive (1.5-2.0), and markedly positive (>2.0) PiB standardized uptake value ratio groups representing different levels of amyloid brain load. Associations with metabolism were assessed in each group. Relationships with APOE ε4 carriage were evaluated.

**RESULTS:** Hypometabolism in "Alzheimer disease (AD)-signature" regions was strongly associated with PiB load. Hypometabolism was greater with more positive PiB levels. Additional, more-diffuse cortical hypometabolism was also found to be associated with PiB, although less so. No hypermetabolism was seen in any subset. No significant incremental hypometabolism was seen in APOE ε4 positive vs -negative subjects.

**CONCLUSIONS:** Hypometabolism in PiB-positive, cognitively normal subjects in a population-based cohort occurs in AD-signature cortical regions and to a lesser extent in other cortical regions. It is more pronounced with higher amyloid load and supports a dose-dependent association. The effect of APOE ε4 carriage in this group of subjects does not appear to modify their hypometabolic "AD-like" neurodegeneration. Consideration of hypometabolism associated with amyloid load may aid trials of AD drug therapy.

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References


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