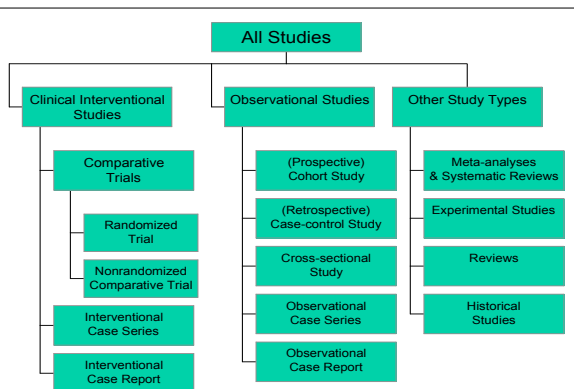# Cross-sectional studies

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Cross-sectional (XS) studies

- **Where comparative XS studies fit in the spectrum of research designs**
- **Present a XS study on Somali IOP**
- **Examine weaknesses of XS studies in general and the Somali study in particular (interactive session)**

All Studies

- **Clinical Interventional Studies**
  - Comparative Trials
    - Randomized Trial
    - Nonrandomized Comparative Trial
  - Interventional Case Series
  - Interventional Case Report
- **Observational Studies**
  - (Prospective) Cohort Study
  - (Retrospective) Case-control Study
  - Cross-sectional Study
  - Observational Case Series
  - Observational Case Report
- **Other Study Types**
  - Meta-analyses & Systematic Reviews
  - Experimental Studies
  - Reviews
  - Historical Studies

The Time Dimension

- **Most studies observe what happens over time (often too short a time)**
  - RCTs and NRCTs
  - Prospective cohort studies
  - Case-control studies
- **But some study a single point in time**
  - Cross-sectional studies
  - Some observational reports/series

Frozen in time: XS studies

- **Usually not a specified moment, e.g. 2/26/05 at 11:00 a.m.**
- **Usually defined as a time point for data collection**
  - Time of first exam
  - Time of diagnosis
  - Time of treatment, e.g. surgery

What's confusing

- **Time can be a feature in XS studies**
  - Data is collected over time
    - Baltimore eye survey or LALES
  - A past historical even can be a variable, including how long ago it was
    - History of trauma or smoking history
  - The study group may be stratified with a time variable
    - Freshman vs. senior medical students

XS study uses

- **Status of something at a point in time**
- **Correlations among things at a point in time**
- **Inferences about time (usually weak)**
  - Correlated items may have no causal relationship to each other
  - Confounders are common and often hidden from view

Hidden confounders

Study: attitudes about honesty with patients

Survey: 1st and 4th year medical students

Finding: 4th year students are less honest

Conclusion: 4th year students are less idealistic, and more pragmatic

Hidden from view: New 'honesty' module in first year curriculum started last year

XS studies—two flavors

- **Population-based**
  - ◆Provides prevalence data
  - ◆Identifies risk factors
  - ◆Easier to generalize results
- **Non-population-based, e.g. clinic patients**

Advantages of non-population-based XS studies

- **Practical**
  - ◆ Can do it NOW
- **Economic**
  - ◆ Very cost-efficient
- **Easy to manage**
  - ◆ Fellows/residents can do them

Intraocular Pressure in a Somali Population Living in the United States

Russell W. Read MD, Philip P Chen MD, Anuja Bhandari MD, Richard P Mills MD MPH, Grace Cinciripini MD, Christopher C. Taylor MD

University of Washington, Seattle

Journal of Glaucoma 2003; 12:365-369.

How the study was conceived

- A resident noticed that he was seeing a large number of Somali immigrants in clinic
  - Because of readily available interpreters, patients knew to come there
- **The resident thought their IOPs were lower than average because he kept getting single digit values**
- A literature search found 4 studies with higher IOPs in people of African descent and one with no difference, but none with lower IOPs in ethnic Africans

Methods

- **Selection of study group of Somalis**
  - Searched eye clinic appointment records from July 1996-March 1998 (21 month period)
  - Names identified by clinic staff as typical of Somali descent
  - Clinic records reviewed
    - Documented complete eye exam visit
    - Self-identification of being of Somali origin
    - 30 years of age or older

Methods

■ **Selection of a comparison group of Caucasians**
  ◆ Searched eye clinic appointment records from same day as a Somali clinic visit
  ◆ Names identified as typical Caucasian
  ◆ Age and gender matched to the chosen Somali
  ◆ Clinic records reviewed to verify complete eye exam was done, self identification as Caucasian, and 30 years or older

Methods

■ **Exclusion criteria (patients)**
  ◆ Failure to complete a comprehensive eye exam
  ◆ Documentation of difficult tonometry
  ◆ Use of systemic medications affecting IOP
  ◆ Glaucoma diagnosis
  ◆ Known positive HIV status

Methods

■ **Exclusion criteria (eyes)**
  ◆ History of ocular trauma or surgery
  ◆ Use of topical medication affecting IOP
  ◆ Active uveitis at time of examination

Methods

- **Data extracted from each patient's chart**
  - Age and gender at time of exam
  - Ocular and systemic diagnoses
  - Medications taken
  - Intraocular pressure (IOP)
    - Mean of all clinic visits during 21 month period, for each qualifying eye
    - Mean of both eyes, or IOP of qualifying eye
  - No corneal thickness data available

Methods

- **Statistical analysis (p < .05 significance level)**
  - Independent sample 2-tailed t test for differences in IOP and age (continuous variables)
  - Fisher exact test for differences in gender and presence of diabetes (categorical variables)
    - chosen over chi-square because of possible small cell numbers in diabetes)
    - probability of getting our results among all the permutations of 2x2 tables with the same totals

Results

- **Somalis**
  - 172 had appointments
  - 114 actually came to the clinic
  - 63 met the inclusion criteria
    - 6 excluded
      - 2 had glaucoma
      - 3 had difficult tonometry
      - 1 had intraocular surgery
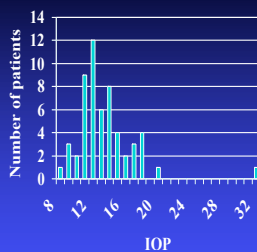 - 57 comprised the Somali group

Results

- **Caucasians**
  - 57 age and gender matched to Somalis
    - Seen on same day as the paired Somali
  - Age match was good (p = .84)
    - Somalis: 48.5 +/- 12.2 years
    - Caucasians: 48.1 +/- 11.3 years
  - Gender match imperfect (p = .09)
    - 39 female Somalis; 29 female Caucasians

Power calculation

- **The sample size had 90% power to detect a 1.8 mmHg difference in IOP**
- **Power dropped to 60% to detect a 1.2 mmHg difference in IOP**
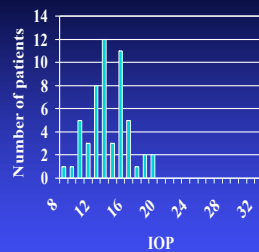- **2-tailed alpha level = .05**

Somali IOP distribution   Caucasian IOP distribution

Mean = 13.76 +/- 3.63   p = .77   Mean = 13.94 +/- 2.78
After removing outlier
Adj mean = 13.44 +/- 2.69   p = .17   Mean = 13.94 +/- 2.78

Bias in XS studies

- **Selection (including self-selection)**
- **Detection (including measurement)**
- **Attrition (lost by inclusion/exclusion)**
- **Others?**

Selection bias: Somali study

- **Patients made appointments because they had a complaint, so abnormal eyes are over-represented**
  - ◆ Excluded if dx or tx affected IOP
- **Not all Somali or Caucasians have names that sound Somalian or Caucasian**
- **Matching routine for Caucasian sample**
  - ◆ Not random
  - ◆ Re-matching required if not eligible
- **Others?**

Detection bias: Somali study

- **Non-standardized IOP measurement**
- **Multiple untrained examiners**
  - ◆ Considerable variation in precision
  - ◆ But two groups examined on same day
- **Examiners had no knowledge of hypothesis (hurray!—an advantage of retrospective studies)**

Attrition bias: Somali study

- **Did inclusion and exclusion criteria differentially affect the Somalis and the Caucasians?**
  - ◆Data were kept only on the Somalis
  - ◆Could this have somehow confounded the IOP distributions?
- **Others?**