Refresher on Research Methodology

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Disclosures

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Outline

• Study design
• Error/bias
Study design

Descriptive
- Case report
- Case series
- Rates

Analytic
- Randomized
- Non-randomized
  - Cohort
  - Case-control
  - Cross-sectional
  - Quasi
  - Longitudinal

Adapted from Koepsell & Weiss, Epidemiologic Methods
Dependent variable

Disease
Outcome

Response variable

Exposure
Intervention
Predictor
Risk-factor

Independent variable
Randomized Trial

Intervention A → Outcome(s)

Intervention B → Outcome(s)

Time

↑ Study conception
Randomized Trials

- Equipoise
- Intention-to-treat
- Surrogate endpoints
- Non-inferiority
“We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.”
A Randomized Trial Comparing Lung-Volume–Reduction Surgery with Medical Therapy for Severe Emphysema

National Emphysema Treatment Trial Research Group*
Randomized Trial

Intervention A → Outcome(s) → Intervention B → Outcome(s)

Time

↑ Study conception

Detry, JAMA, 2014
Intervention

Surrogate Endpoints

Outcome of Interest

Adapted from Fleming TR, Health Affairs, 2005
MORTALITY AND MORBIDITY IN PATIENTS RECEIVING ENCAINIDE, FLECAINIDE, OR PLACEBO

The Cardiac Arrhythmia Suppression Trial
Intervention

Surrogate Endpoints

Outcome of Interest

Adapted from Fleming TR, Health Affairs, 2005
A = B
Comparison of On-Demand vs Planned Relaparotomy Strategy in Patients With Severe Peritonitis
A Randomized Trial

van Ruler, JAMA, 2007
van Ruler, JAMA, 2007
On-Demand

0%  +5%

-20%  -7.5%  0%  +5%

Planned
On-Demand vs Planned: 0% +5% -5.0%
Prospective Cohort Study

Intervention A → Outcome(s)

Intervention B → Outcome(s)

Time

↑ Study conception
Retrospective Cohort Study

Intervention A → Outcome(s)

Intervention B → Outcome(s)

Time

Study conception
Surgeon Specialty and Long-Term Survival After Pulmonary Resection for Lung Cancer
Retrospective Case-Control Study

Exposure(s)  ←  Outcome A
Exposure(s)  ←  Outcome B

Time

Study conception
PATIENT SAFETY

Risk Factors for Retained Instruments and Sponges after Surgery

Gawande, NEJM, 2003
Prospective Case-Control Study

Exposure(s) → Outcome A

Exposure(s) ← Outcome B

Time

↑
Study conception
Error

- Systematic error
  - Bias
    - Conservative
    - Anti-conservative
  - Random error
    - Chance
Bias

- Confounding
Confounder

Intervention

Outcome
Management of pleural space infections: A population-based analysis
Ventilator

Non-operative

Mortality

Farjah, J Thorac Cardiovasc Surg, 2007
Bias

- Confounding
- Misclassification
Surgeon Specialty and Long-Term Survival After Pulmonary Resection for Lung Cancer
Bias

• Confounding
• Misclassification
• Selection bias
Selection Bias

- Inclusion/exclusion bias
- Self-selection/referral bias
- Healthy volunteer bias
Bias

- Confounding
- Misclassification
- Selection bias
- Information bias
Information Bias

• Recall bias
• Interviewer bias
PATIENT SAFETY

Risk Factors for Retained Instruments and Sponges after Surgery
Bias

- Confounding
- Misclassification
- Selection bias
- Information bias
- Missing data
Missing data

- Missing completely at random (MCAR)
- Missing at random (MAR)
- Missing not at random (MNAR)
Bias

- Confounding
- Misclassification
- Selection bias
- Information bias
- Missing data
- Intention-to-treat analysis
- Per-protocol analysis
- Chance (random error)
A Randomized Trial Comparing Lung-Volume–Reduction Surgery with Medical Therapy for Severe Emphysema

National Emphysema Treatment Trial Research Group*