For Those Who Seek to Study:

How to Do Research in IPAC

Jocelyn Srigley, MD, MSc, FRCPC
Director, PHSA Infection Prevention and Control
Medical Microbiologist, BC Children's & Women's Hospitals

@JocelynSrigley

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Disclosures

- No conflicts of interest

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Learning Objectives

- To review what research is and why we should do it
- To learn the principles of research study designs
- To understand the steps involved in doing research

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WHAT IS RESEARCH AND WHY SHOULD WE DO IT?

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Questions for the Audience

- Who is currently involved in research?
- Who would like to be more involved in research?
- What is research?

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What Is Research?

- "Systematic inquiry to describe, explain, predict, or control an observed phenomenon" (Center for Innovation in Research and Teaching)
- Most of what we're doing in our daily work lives is potentially research!
  - Surveys, focus groups, etc.
  - Interventions
  - Quality improvement
  - Evaluations

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Challenges with the IPAC Literature

- Analysis of 41 IDSA guidelines published between 1994-2010
- Classified 4,218 individual recommendations based on overall quality of evidence:
  - I – RCT
  - II – non-randomized trial or observational
  - III – case reports, expert opinion

Arch Intern Med 2011;171(1):18-22

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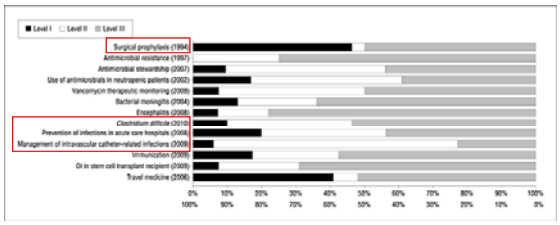

Arch Intern Med 2011;171(1):18-22

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Barriers to Research

- No time
- No money
- Not sure what to research
- Not sure how to do research
- What's in it for me?

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Reasons for Doing IPAC Research

- Improve the quality of IPAC literature
- Share successes and failures in order to improve quality of care
- Personal satisfaction
- Networking – e.g. conferences
- Opportunities – e.g. recognition, invitations, promotions

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HOW DO I CHOOSE A STUDY DESIGN?

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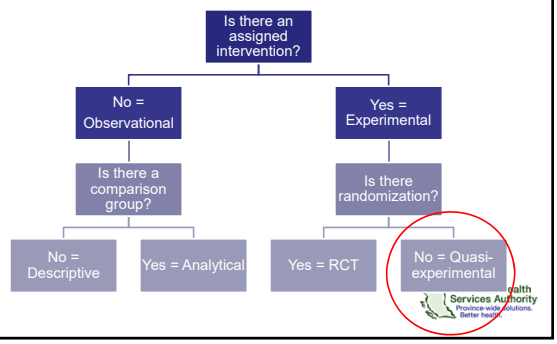
Overview of Study Designs



Quasi-Experimental Studies in IPAC

- Systematic review to assess the use of quasi-experimental studies in 4 major ID/IPAC journals from 2013-2014
- 173 quasi-experimental IPAC studies (7%) were published over 2 years
- Proportion doubled compared to 2003-2004 review
- 44% used the weakest study design, compared to 53% in previous review
- Only 3% justified the use of quasi-experimental design and 39% used correct terminology

Alsaggaf et al, *Infect Control Hosp Epi* 2018

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Before-After Study

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Example: Before-After

- Setting
  - 250-bed community hospital in Quebec
- Intervention
  - All inpatients received education and twice daily hand sanitizer for ~1 year
- Outcome
  - Nosocomial MRSA rates
  - Decreased from 10.6/1,000 admissions in the year before to 5.2/1,000 during intervention

Gagne et al, *J Hosp Infect* 2010

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Did the Intervention Work?

- AKA internal validity
- Other possibilities ("threats to internal validity"):
  - Confounding
  - Selection bias
  - History
  - Maturation
  - Regression towards the mean
  - Diffusion
  - Compensatory rivalry/resentful demoralization
  - Experimenter bias

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How to Strengthen Internal Validity

- Change the measurements
- Change the way the intervention is implemented
- Add a control group
- Change the statistical analysis

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Change the Measurements

- Double pretest

- Nonequivalent dependent variable

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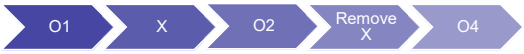
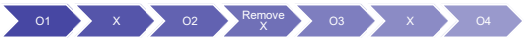
Change the Implementation of the Intervention

- Removed treatment



- Repeated treatment



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Example: Before-After with Repeated Treatment

- Setting
  - ~2300 postpartum women on a maternity ward in Germany
- Intervention
  - Patients provided with ABHR at bedside x 10 months, then withdrawn x 2 months and reinstated x 2 months
- Outcome
  - Puerperal mastitis
  - Decreased from 2.90% in controls to 0.66% in intervention patients (p<0.0001)

Peters et al, *Geburtshilfe Frauenheilkd* 1992

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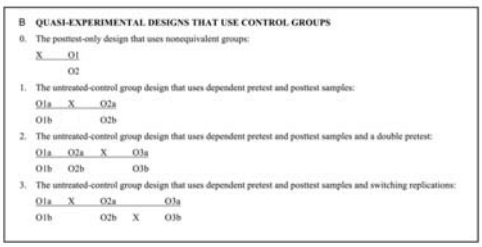
Add a Control Group

- Comparison group; not randomized



B QUASI-EXPERIMENTAL DESIGNS THAT USE CONTROL GROUPS

0. The posttest-only design that uses nonequivalent groups:

X O1
O2

1. The untreated-control group design that uses dependent pretest and posttest samples:

O1a X O2a
O1b O2b

2. The untreated-control group design that uses dependent pretest and posttest samples and a double pretest:

O1a O2a X O3a
O1b O2b O3b

3. The untreated-control group design that uses dependent pretest and posttest samples and switching replications:

O1a X O2a O3a
O1b O2b X O3b

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Alsaggaf et al, *Infect Control Hosp Epi* 2018

Example: Controlled Before-After

- Setting
  - 785 patients on 2 neurosurgical units in Vietnam
- Intervention
  - Inpatients on 1 unit given alcohol-based hand rub (ABHR) and education
- Outcome
  - Surgical site infections
  - Decreased from 8.3% to 3.8% on intervention unit and increased from 7.2% to 9.2% on control unit (p=0.04 for comparison between units)

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Thu et al, *Infect Control Hosp Epi* 2007

Statistical Analysis

- Statistical significance
  - How likely is it that the results are due to the intervention rather than random chance?
- Options
  - No statistics
  - 2-group tests
  - Regression analysis
  - Time series analysis

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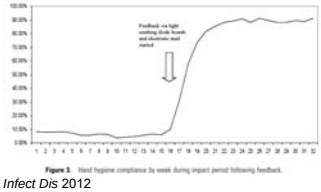
Example: Time Series Analysis

- Setting
  - Medical ICU
- Intervention
  - Video monitoring system for hand hygiene compliance
- Outcome
  - Hand hygiene compliance increased from 6.5% to 81.6%



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Armellino et al, *Clin Infect Dis* 2012

Randomized Controlled Trial

- Gold standard of study designs
- Participants randomly assigned to intervention vs. control
  - Controls for potential confounding factors
- Can randomize individuals or clusters
- Challenges
  - Logistically more complicated
  - Requires more participants
  - May not be ethical to withhold an intervention

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Stepped Wedge Cluster RCT

- AKA "evaluation by rolling deployment"
- Clusters are randomized to the order in which they receive the intervention
  - All begin as control and all end with the intervention implemented
- Benefits
  - Improved internal validity compared to quasi-experimental designs
  - Deploy an intervention to all groups in a fair way

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Ellenberg, *J Am Med Assoc* 2018

Example: Stepped Wedge Cluster RCT

- Setting
  - BC Children's & Women's Hospitals
- Interventions
  - Standard patient hand hygiene intervention (posters, education)
  - Front line ownership intervention (positive deviance)
- Outcome
  - Patient hand hygiene rates
  - Increased from 9.16% at baseline to 13.85% in the post-intervention period
  - Both interventions led to increases, but only statistically significant in the front line ownership group

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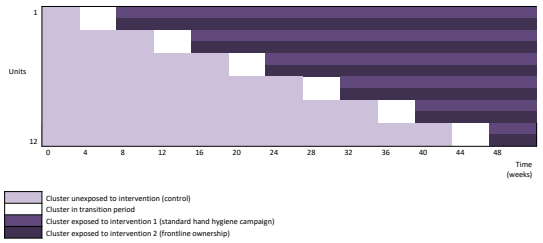
Wong et al, Quality Forum 2018

Study Design



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WHAT STEPS ARE INVOLVED IN DOING RESEARCH?

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Steps

1. Identify the problem
2. Literature review
3. Define the research question
4. Decide on the research design
5. Determine methods – participants, procedures, analysis
6. Implementation and measurement
7. Analysis
8. Knowledge translation

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Do I Need Ethics Approval?

- Quality improvement projects do not need research ethics board (REB) approval
- Research projects do require REB approval
- When in doubt, ask!

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Statistics Resources

- University – statistics courses
- Research institute
- Epidemiologists
- Online tools
  - E.g. www.openepi.com

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Tips

- Find good collaborators
- Communicate early and often
- Document everything
- Expect it to take longer than you think

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Conclusions

- Much of what we do in IPAC on a daily basis is potentially research
- A few simple steps can make a project more rigorous
- Resources are available to help those who are interested in giving research a try

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Questions?

jocelyn.srigley@cw.bc.ca

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