Convincing Health System Leaders to Invest in Integrated Care: How to Conduct Research Using Clinical and Cost Outcomes

Marcia H. McCall, PhD, MBA, LPCA, Counselor
Faculty Disclosure

The presenter of this session has NOT had any relevant financial relationships during the past 12 months.
Conference Resources

Slides and handouts shared by our conference presenters are available on the CFHA website at https://www.cfha.net/page/Resources_2019 and on the conference mobile app.
At the conclusion of this session, the participant will be able to:

• Develop ideas for turning integrated care value propositions into convincing effectiveness research with clinical and cost outcomes.

• Identify the steps of the research process and how you might apply them to your own ideas.

• Discover types of clinical and cost data available in major health systems.


Learning Assessment

• A learning assessment is required for CE credit.

• A question and answer period will be conducted at the end of this presentation.
Session Outline

- Making the research case for health system investment
- Selecting theoretical frameworks
- Forming research hypotheses and conceptual models
- Choosing a research design and clinical and cost variables
- Selecting patient populations with inclusion/exclusion criteria
- Using statistical analyses to test hypotheses
Program Investment Decision-Making by Health System Leaders

Leaders make investment choices among alternative programs, as budgets are limited.

Choices influenced by...

- Research evidence
- $$$ available to invest
- Expected benefits
- Strategy
- Culture
- Stakeholder pressure
- Fairness
- Precedents
Making Investment Proposals to Health System Leaders

Support investment proposals – value propositions – with research evidence

**Effectiveness:** evidence from real-world environments

**Efficacy:** evidence from controlled environments (*not a focus today*)

**Economic value:** assessment of costs and/or benefits
Why Research Evidence?

• A pilot study: 10 inpatients with disordered substance use who received bedside counseling in an integrated care unit vs. 7 patients with disordered use, also on the unit but not counseled

• Over the next several months, per chart review
  • 4 of the 10 counseled patients returned to the health system as inpatients or emergency patients, only 1 still using substances
  • 5 out of the 7 comparison patients returned, all still using substances

• Wow!! We got a new counselor position with this. But wait…
Why Research Evidence?

What else might explain the outcomes?

- The researcher was biased during patient selection and/or data gathering
- The two groups of patients differed in important ways that led to different outcomes
- The outcomes occurred by chance
- The outcomes occurred for reasons other than the counseling interventions

We need to **apply the scientific method with research steps** to have confidence in our conclusions.
What Research is Needed?

From the National Academy of Medicine
“...traditional approaches to clinical research are straining to keep pace with the demands. The gap might even be growing between the evidence we have and the evidence we need for best care. Improvements in electronic records and computing power, as well as novel research designs, offer the prospect of drawing real-world practice and new evidence development much closer together.”

(National Academy of Medicine, 2019)
Suggested Approach to Integrated Care Research

Follow the scientific method
Use retrospective clinical data that is already available
Focus on system-critical clinical and cost outcomes
Research Steps for Effectiveness and Economic Research

After the **question** is defined, the **literature** is reviewed and the **rationale** is established for the study...

- Theoretical framework
- Research hypotheses
- Conceptual model
- Research design
- Variables
- Patient populations
- Statistical analyses

Illustrated using an SBIRT research study
Theoretical Framework

A way to organize and understand theoretical explanations and prior research for the mechanisms underlying phenomena
SBIRT Study
Theoretical Framework
Texas Christian University Model for Substance Use Treatment
(simplified)

Simpson, 2004
Research Hypotheses

Given the initial question, literature review, rationale, and theoretical framework – what is predicted about the study’s outcome(s)?
SBIRT Study Research Hypotheses

1. Patients receiving counselor-provided SBIRT in inpatient integrated care settings experience fewer hospitalizations and emergency department visits compared to patients not receiving interventions, controlling for substance use type and severity.

2. Hospitalization and emergency department visit outcomes for these patients vary across clinical services.

3. Counselor-provided SBIRT interventions are associated with reduced economic costs from the health system perspective.
Conceptual Model

Given the theoretical framework and hypotheses, what is the model for the study?
Conceptual Model for SBIRT Study

- **Substance Use**
- **Hospitalization with Integrated Care Team**
- **Counselor SBIRT Intervention**

Program attribute: Clinical service by location

Patient attributes: Substance use severity and type, propensity score

- **Reduced Use**
  - Yes
  - Fewer, less costly hospitalizations and ED visits

- **Same or increased use**
  - No
  - Same or increased hospitalizations and costs
Which research model from the quantitative approaches might be best for testing the research hypothesis(es)?
SBIRT Study Research Design

Difference-in-Differences: Interactions of time with predictor variables demonstrates treatment effects

**Time**: Hospitalizations and ED visits one year prior to and one year subsequent to intervention hospitalization
Variable Selection

• What are the clinical and cost outcomes of interest?
  • Consider what matters to health system leaders

• What might be predicting the outcome(s)?
  • Intervention variable (treatment)
  • Other variables that could influence the outcome(s)

• Using retrospective clinical data, what outcome and predictor variables are accessible and measurable?
SBIRT Study Outcome Variables: Hospitalizations and ED Visits Counts and Costs

• People with alcohol and drug problems overuse hospitalizations and emergency department (ED) visits, which are among the most expensive medical services...

• ...but typically are not investigated in SBIRT research, which had relied on self-reported outcomes

Agley et al., 2014; Cornett & Latimer, 2011; Glass et al., 2017; Hankin et al., 2013; Hoffman & Cronin, 2015
# SBIRT Study Treatment Variable: SBIRT Interventions by Professional Counselors

<table>
<thead>
<tr>
<th>SBIRT Brief Intervention Manual</th>
<th>Professional Counseling Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Empathy</strong>, rapport, trust, non-judgmental approach</td>
<td>Foundation in <strong>empathy</strong>, unconditional positive regard, and working alliance</td>
</tr>
<tr>
<td>Management of <strong>resistance</strong> and readiness to change</td>
<td><strong>Person-centered, motivational interviewing, Gestalt, psychodynamic</strong> and related theories and techniques</td>
</tr>
<tr>
<td><strong>Assessment</strong> and feedback</td>
<td>Training in <strong>assessment</strong>/feedback and mental health conditions commonly co-occurring with substance use</td>
</tr>
</tbody>
</table>

*Babor & Higgins-Biddle, 2001; Bordin, 1979; CACREP, 2015; Crits-Christoph, Johnson, Gibbons, & Gallop, 2013; Gehart, 2016; Rogers, 1961; Van Horn et al., 2015; Veach et al., 2018; Watts, O'Sullivan, & Chatters, 2018*
SBIRT Study Patient Variables: Severity, Type of Use

• SBIRT interventions efficacious only for alcohol misuse
• Inconclusive for drug misuse or disordered drug use
• Inconclusive for disordered alcohol use

SAMHSA, 2013
SBIRT Study Patient Variable: Propensity Score

**Purpose:** create a *propensity score* for each patient to balance intervention and comparison groups; the scores are added to the hypothesis-testing models as a covariate

**Attributes:** age, gender, ethnicity, marital status, risk of mortality, severity of illness, insurer, calendar quarter
SBIRT Study Program Variable: Inpatient Clinical Service

Patient outcomes may differ by clinical service due to physician training and medical approach for treating people with substance misuse and disordered use
Measuring Variables: SBIRT Study Clinical and Cost Data Sources

- **Treatment intervention predictor**: manually-entered program data in Excel spreadsheets
- **Outcomes and other predictors**: EPIC System as fed to data warehouses
  - Research
  - Enterprise
  - Data Analytics
Measuring Variables: SBIRT Study Clinical and Cost Data Sources

• Only Data Analytics had charge, payment, and cost data
  • Hospital Account Record
  • Nearly 900 variables including CPT, ICD-10, admitting service, treating provider
  • Total charges, payments, and write-offs
  • Total costs, fixed/variable costs, and direct/indirect costs

• Getting access: Independent Contractor and Business Associate Agreements
<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td><strong>Counts and Costs</strong></td>
<td>Combined for hospitalizations + ED visits, pre and post intervention</td>
<td>Data analytics system using “trigger event”</td>
</tr>
<tr>
<td>Predictor</td>
<td><strong>Intervention</strong></td>
<td>Binary: yes/no</td>
<td>Program data</td>
</tr>
<tr>
<td>Predictor</td>
<td><strong>Time</strong></td>
<td>Binary: pre/post</td>
<td>Calculated variable</td>
</tr>
<tr>
<td>Predictor</td>
<td><strong>Substance use severity</strong></td>
<td>Categorical: no use (category 0) → disordered use (category 3)</td>
<td>Data analytics system using ICD codes</td>
</tr>
<tr>
<td>Predictor</td>
<td><strong>Substance use type</strong></td>
<td>Categorical: no use (0) → disordered use (3)</td>
<td>Data analytics system using ICD codes</td>
</tr>
<tr>
<td>Predictor</td>
<td><strong>Propensity score</strong></td>
<td>Balancing on covariates</td>
<td>Calculated variable</td>
</tr>
<tr>
<td>Grouping</td>
<td><strong>Clinical service</strong></td>
<td>Categorical: patients assigned to services and in beds on or off home units for each service</td>
<td>Program data and data analytics system</td>
</tr>
</tbody>
</table>
Which populations should be included in the study given the theoretical framework, research hypothesis(es), conceptual model and selected variables?

Is there a representative, accessible population available through retrospective selection?
SBIRT Study Setting
Burns, General Medicine, and Trauma inpatient services
SBIRT Study Sample: Inclusion and Assignment

Patients admitted to integrated care services and identified for SBIRT

Exclusion criteria applied

- Known or likely use
- Patient not screened for use during admission

Intervention Group

- Session < 15 minutes
- Age < 18
- Unable to be counseled: experienced cognitive deficits, refused counseling, left hospital against medical advice

Comparison Group

- One or more counseling sessions during hospitalization totaling at least 15 minutes
- No intervention due to timing issues

- No intervention due to timing issues
Statistical Analyses

Given the research design and the characteristics of the data, what are the appropriate statistical analyses to use?
Dataset Development
Outcome Variable: Counts
Outcome Variable: Costs

Costs of Hospitalizations and ED Visits (Pre and Post)
Statistical Model for Count Data

• **Mixed effects negative binomial model**
  • Clinical service as grouping variable (random effect)
  • Prevalence of zero values suggests non-normal distributions of error terms and residuals

• **Robust standard errors** option
  • Reduce risk of Type I error (finding differences when there are none; “false positives”)

*Cameron & Trivedi, 2009; Long & Freese, 2014; Stata, 2017*
Statistical Model for Cost Data

- Under development: two-part model
  - Predict zero vs. non-zero outcomes using logistic regression
  - Predict cost outcomes using generalized linear modeling with non-zero outcomes
The SBIRT Study Findings: Count Outcomes
Result: On average, patients receiving counselor-provided SBIRT interventions experienced **22% fewer subsequent hospitalizations and emergency department visits** than patients not receiving interventions.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention</th>
<th>n</th>
<th>Incident Rate Ratio</th>
<th>p-value</th>
<th>95% CI Min</th>
<th>95% CI Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>No</td>
<td>618</td>
<td></td>
<td>Reference category</td>
<td>.003**</td>
<td>.658</td>
</tr>
<tr>
<td>Count</td>
<td>Yes</td>
<td>1,577</td>
<td>.777</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Test of Hypothesis 2: -2 Log Likelihood

<table>
<thead>
<tr>
<th>Model</th>
<th>-2 Log Likelihood*</th>
<th>Change in df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Effects</td>
<td>-4933.464</td>
<td></td>
</tr>
<tr>
<td>Mixed Effects</td>
<td>-4708.709</td>
<td>5</td>
</tr>
<tr>
<td>Absolute Difference</td>
<td>224.755</td>
<td>5</td>
</tr>
</tbody>
</table>

*pseudolikelihood for mixed effects

**Result:** Hospitalization and emergency department visit outcomes for these patients **vary across clinical services**

Difference in -2 log likelihood of 224.755 exceeds the critical value of $X^2_{(.05, df=5)} = 11.0705$
Test of Hypothesis 2: Empirical Bayes Means of Random Effects

- Means ranging from -1.1 for Burn patients housed on the Burns unit to +1.2 for Medicine patients on the Medicine units
- Supports the finding that outcomes vary across services
Acknowledgements

University of North Carolina at Greensboro, NC
• Dr. Carrie Wachter Morris, Counseling
• Dr. Kelly Wester, Counseling
• Dr. Jeremy Bray, Economics
• Dr. Richard Luecht, Educational Research Methodology

Wake Forest School of Medicine, Winston-Salem, NC
• Dr. Laura Veach, General Surgery and Psychiatry
• Dr. Kevin High, Executive Vice President
Session Survey

Use the CFHA mobile app to complete the survey/evaluation for this session.
Join us next year in Philadelphia, Pennsylvania! Thank you!
Theoretical Frameworks for Individual Behavior Change

Social Cognitive
- Social Cognitive Theory
- Self-Regulation Model
- Health Belief Model
- Relapse Prevention Model

Other
- Transtheoretical Model
- Theory of Planned Behavior

Bandura
Leventhal
Rosenstock
Prochaska
Ajzen
Marlatt

Theorists:
- Bandura
- Leventhal
- Rosenstock
- Prochaska
- Ajzen
- Marlatt