Using Data to Improve Performance

Martha Sylvia, PhD, MBA, RN

“The focus for (DNP) faculty and students should be on the translation of evidence to improve the quality of care and patient outcomes”

(AACN, 2006)

Demonstrating “improvement” implies an understanding of:

- How to **define** improvement
- How to **measure** improvement
- How to **analyze** data for improvement
- How to **demonstrate** improvement

The DNP Need for Data Management Knowledge and Skills

Clinical Data Management

- Translational science
- Evaluation
- Biostatistics
- Population Health
- Prevention
- Data Collection Systems
- Economics
- Finance
- Risk Management
- Quality Improvement
- Epidemiology

AACN, 2006
Clinical Data Management (CDM)

“The process of planning, designing, collecting, cleansing, manipulating, analyzing, and reporting data generated in the assessment, development, delivery, and evaluation of health-related interventions, products, and services.”

Phases of CDM

Overview of data types and statistical tests
Overview of statistical software package
Documenting data management processes
Creation of a baseline data set and data dictionary
Principles of data governance
Maintenance of data integrity
Techniques for data manipulation
Techniques for exploratory data analysis
Identification of confounding
Creation of tables and graphs
Measurement of outcomes
Adjustment for confounding
Techniques for written, oral, visual presentation
Online Synchronous Help Sessions

Meets students individual needs for assistance in a collaborative learning environment; while also demonstrating application of a broader array of skills and techniques that go beyond each student’s individual project.

• Online, synchronous, optional
• Offered weekly with two time options
• Led by course instructors
• Recorded and accessible to students
• Students submit questions to discussion board prior to each session
• Students encouraged to answer each other’s questions
• Demonstration of techniques using statistical software with real data
Practice Example of Process: Guided Care Pilot (GCP)

- Nurse-led, patient centered, comprehensive evidence-based project incorporating 7 successful innovations in chronic care:
  - Disease management
  - Case management
  - Self management
  - Geriatric evaluation and management
  - Transitional care
  - Lifestyle modification
  - Caregiver education and support

Planning

- What is your evidence-based project question?
- What is the design of your analysis?
  - Unit of analysis:
    - Groups/events
  - Eligibility criteria
  - Description of “intervention” and assignment of intervention group
  - Aims/outcomes/measures
  - Descriptive variables
  - Independent (IV) and dependent variables (DV)
  - Statistical tests/models
  - Power
# GCP: Planning

## Project Purpose
To improve quality and decrease costs for community dwelling elders living with chronic illness at high risk for high healthcare expenditures

## Define and Describe Population
2 groups of patients >=65, highly morbid, community dwelling, of 4 primary care providers (randomized) in same office

## Aim: The GC group will have less costs than the comparison group

## Outcomes: All costs of health care services

## Measures: Mean costs over 6 months by group

## Calculation: Sum of costs by group/total number of patients by group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Data Source</th>
<th>Possible Range of Values</th>
<th>Level of Measurement</th>
<th>Statistical Test</th>
</tr>
</thead>
</table>
Based on previous reports the GC mean costs were estimated at $5000 and the UC mean costs were estimated at $7102 in the 6-months post intervention with equal SDs of $6063. Using a two-sample t-test with an alpha of 0.05 and power set at 0.80 the estimated sample size needed to see statistically significant differences at the 0.05 level is 135 in each group.

Data Collection

- **New data sources, some considerations:**
  - Procedures for survey administration or other newly created data fields
  - Validation of conditions under which data was collected
  - Quality checks during collection

- **Existing data sources, some considerations:**
  - Conditions under which the data was collected
  - Definitions of fields
  - Request for data from other sources: details, details…
  - Information that can be calculated/derived from existing data

- **Planning for final data structure:**
  - Systems for data entry/import
  - Unique identifiers for unit of measurement
  - Rows and columns
  - Longitudinal vs. cross sectional
Data Cleansing

- Importing data into SPSS or other similar software:
  - Variable and value definitions, labels, etc.
- Running descriptive statistics on each variable looking for:
  - Missing values: setting rules
  - Text in number fields and vice versa
  - Erroneous values
  - Values outside of set range of expected
  - Looking for duplicate cases
  - Combinations of values that should not occur
Data Manipulation

- Creating final analysis data set
  - Merging/aggregating files
  - File restructuring
    - Transposing, cases to variables and vice versa
  - Transforming values
    - Calculating new values using functions
    - Recoding values
    - Banding values
    - Manipulating character values
    - Date and time values
  - Creating a data dictionary
GCP: Data Collection/Cleansing/Manipulation

Administrative Enrollment Files
- Gender
- Age
- Ethnicity
- Time enrolled in plan

Administrative Claims Files
- Medical Payments
- Pharmacy Payments
- Diagnoses/Services for morbidity determination

Clinical Management Files
- Time in program
- Dose of program
- Clinical indicators

Analysis File

Exploratory Data Analysis

- Explore and describe distribution of independent and dependent variables
- Describe groups/events
- Explore differences in “other factors” between groups/events
- Determine confounding of relationship between independent and dependent variables
# GCP: Exploratory Data Analysis

<table>
<thead>
<tr>
<th>Demographics</th>
<th>GC (n=63)</th>
<th>UC (n=65)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>76.1 (6.15)</td>
<td>75.8 (6.53)</td>
<td></td>
</tr>
<tr>
<td>% Female</td>
<td>60.3%</td>
<td>47.7%</td>
<td></td>
</tr>
<tr>
<td>ACG-PM*</td>
<td>0.34 (0.22)</td>
<td>0.20 (0.14)</td>
<td></td>
</tr>
</tbody>
</table>

**Health Status**

<table>
<thead>
<tr>
<th>Condition</th>
<th>GC (n=63)</th>
<th>UC (n=65)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># Chronic Conditions (max = 9)</td>
<td>2.95 (1.54)</td>
<td>2.85 (1.31)</td>
<td></td>
</tr>
<tr>
<td>Ischemic Heart Disease</td>
<td>52.2%</td>
<td>49.2%</td>
<td></td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>31.7%</td>
<td>21.5%</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>88.9%</td>
<td>86.1%</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>30.2%</td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>49.2%</td>
<td>46.1%</td>
<td></td>
</tr>
<tr>
<td>Parkinson’s Disease</td>
<td>1.6%</td>
<td>7.7%</td>
<td></td>
</tr>
<tr>
<td>Dementia</td>
<td>7.9%</td>
<td>13.8%</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>12.7%</td>
<td>18.5%</td>
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<tr>
<td>COPD</td>
<td>20.6%</td>
<td>21.5%</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically Significant p<0.05

**Expanded Diagnostic Categories (EDCs) from ACG methodology used to define disease categories
GCP: Exploratory Data Analysis

ACG–PM Distribution by GC Assigned and UC Assigned Groups
GCP: Exploratory Data Analysis

Costs per Member for 6-month Period
Unadjusted

GCP: Exploratory Data Analysis

Costs by ACG-PM Cutoff GC Assigned and UC Assigned

Outcomes Data Analysis

- Final determination of statistical tests/models
- Statistical testing of outcomes measures
- Statistical testing of outcomes measures adjusting for confounding
Reporting and Presentation

- Relevance and importance to stakeholders
  - Common methods used to display certain representations of data
    - Tables, graph types, flow charts, etc.
  - Summarizing:
    - Tables, graphs, diagrams
    - Written and oral presentation of findings
GCP Outcomes Data Analysis and Reporting

GC vs UC: Costs at ACG-PM Cut Points
Adjusted for Age, Gender

Mean (SD)
GC  $4586 ($7512)
UC  $5964 ($8904)

Increased Rigor of Capstone Projects

- Students demonstrate the ability to:
  - Create and implement an evaluation plan
  - Apply concepts of sample size determination using power analysis
  - Describe techniques for data cleansing and manipulation
  - Use exploratory data analysis techniques to understand population attributes and sampling bias
  - Appropriately apply statistical techniques to adjust for bias
  - Present project results in a meaningful way
Summary

- Scholarly DNP projects using evidence-based practice frameworks require strong data management skills for management and evaluation.
- This clinical data management process provides a methodical and rigorous approach to meet this challenge.
Questions?
Contact Information
Martha Sylvia, PhD, MBA, RN
Assistant Professor
Johns Hopkins University School of Nursing
525 N. Wolfe St. Room 456
Baltimore, MD 21205-2110
443-287-8529
msylvia1@jhu.edu