Data Analytics: The DNP’s Powerful Tool in the Quest for Innovation in Practice

Martha Sylvia, PhD, MBA, RN
2017 National DNP Conference
Objectives

• At the end of this presentation, the DNP will be able to:
  • Describe analytics in the context of the current healthcare climate
  • Describe the evolution of analytic applications in DNP practice since the inception of the DNP
  • Apply analytic solutions to understand the impact of health disparities on healthcare outcomes
  • Articulate the multiple ways in which data and analytics can be used to advance DNP innovations
The new Digital Health Care Milieu

EHRs  Web-Portals  PHRs

CDS / POE

Claims / MIS / HIS

Integrated Delivery System/ ACO/ Virtual Network

Practice Team

Community/ Population

Family

PH/ HR IT

Biometric/ Telemed

Secure Messaging

ICT / wireless & wired

e-mail / internet/ Social networks

M-health Apps

Source: Weiner 2012

Source: Jonathan Weiner, Center for Population Health IT Johns Hopkins Bloomberg School of Public Health
ForestVue Healthcare Solutions

"Seeing beyond the trees..."

Diagram showing the transformation process with access information, enhanced access and continuity, improved population health, performance and population management, and CQM data enabling outcome improvements. The diagram also highlights stages of using technology: Stage 1 MU (2011), Stage 2 MU (2014), Stage 3 MU (2016), and future. Key elements include:

- Use technology: Patient informed, Structured data capture, Care coordination: Patient engagement, Clinical Decision Support.
- Transformation: Case management & longitudinal view, Patient centered, team based care, Robust CDS (evidence based medicine & practice goals).
# Healthcare Analytics Adoption Model

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 8</td>
<td>Personalized Medicine &amp; Prescriptive Analytics</td>
</tr>
<tr>
<td></td>
<td>Tailoring patient care based on population outcomes and genetic data. Fee-for-quality rewards health maintenance.</td>
</tr>
<tr>
<td>Level 7</td>
<td>Clinical Risk Intervention &amp; Predictive Analytics</td>
</tr>
<tr>
<td></td>
<td>Organizational processes for intervention are supported with predictive risk models. Fee-for-quality includes fixed per capita payment.</td>
</tr>
<tr>
<td>Level 6</td>
<td>Population Health Management &amp; Suggestive Analytics</td>
</tr>
<tr>
<td></td>
<td>Tailoring patient care based upon population metrics. Fee-for-quality includes bundled per case payment.</td>
</tr>
<tr>
<td>Level 5</td>
<td>Waste &amp; Care Variability Reduction</td>
</tr>
<tr>
<td></td>
<td>Reducing variability in care processes. Focusing on internal optimization and waste reduction.</td>
</tr>
<tr>
<td>Level 4</td>
<td>Automated External Reporting</td>
</tr>
<tr>
<td></td>
<td>Efficient, consistent production of reports &amp; adaptability to changing requirements.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Automated Internal Reporting</td>
</tr>
<tr>
<td></td>
<td>Efficient, consistent production of reports &amp; widespread availability in the organization.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Standardized Vocabulary &amp; Patient Registries</td>
</tr>
<tr>
<td></td>
<td>Relating and organizing the core data content.</td>
</tr>
<tr>
<td>Level 1</td>
<td>Enterprise Data Warehouse</td>
</tr>
<tr>
<td></td>
<td>Collecting and integrating the core data content.</td>
</tr>
<tr>
<td>Level 0</td>
<td>Fragmented Point Solutions</td>
</tr>
<tr>
<td></td>
<td>Inefficient, inconsistent versions of the truth. Cumbersome internal and external reporting.</td>
</tr>
</tbody>
</table>
Precision Health

Precision health includes genomics and other physiological, psychological, environmental, and ethical factors that are central to the development and testing of individualized treatments for persons, families, and communities and is one of the most exciting areas of science.

Nurses should be at the forefront of precision health efforts and certainly integral to interdisciplinary teams exploring how to best tailor diagnostics and interventions to individualized patient factors.

Courtesy of: Debra E. Lyon, RN, PhD, FAAN, Thomas M. and Irene B. Kirbo Endowed Chair, Executive Associate Dean, University of Florida College of Nursing

Devon et. al. "Setting nursing science priorities to meet contemporary health care needs." Nursing Outlook 64(4): 399-401
Shattering a Paradigm!

“Precision health offers the promise of tailoring treatment to individuals based on their genetics, lifestyle, and environment”

Courtesy of: Debra E. Lyon, RN, PhD, FAAN, Thomas M. and Irene B. Kirbo Endowed Chair, Executive Associate Dean, University of Florida College of Nursing
Which emerging technologies are you planning to invest in in 2017?

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

“Practice-focused (DNP) graduates are prepared to generate new knowledge through innovation of practice change, the translation of evidence, and the implementation of quality improvement processes...to improve health or health outcomes.

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
- Epidemiology
- Quality Improvement
- Risk Management
- Finance
- Economics
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.”

### Table 1. Competencies and Methodologies used in the Data Management Domains of the DNP Including a Comparison to a non-DNP Domain

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical design/methods</td>
<td>Descriptive</td>
<td>Dashboards; business reports</td>
<td>Quasi-experimental; observational</td>
<td>Randomized control trial</td>
</tr>
<tr>
<td>Purpose for using data</td>
<td>Target high-risk groups for intervention</td>
<td>Intervention development;</td>
<td>Process and outcomes measurement</td>
<td>Test hypotheses</td>
</tr>
<tr>
<td>Types of data</td>
<td>Administrative; electronic medical record;</td>
<td>Rapid cycle improvement</td>
<td>Administrative;</td>
<td>Data collected under rigorous protocol procedures</td>
</tr>
<tr>
<td>Data collection/source</td>
<td>lab; radiology; survey; publicly available</td>
<td>Administrative; electronic medical record; workflow documents</td>
<td>Data collected under rigorous protocol procedures</td>
<td>Research database</td>
</tr>
<tr>
<td>Level of data cleaning</td>
<td>Extensive</td>
<td>Multiple existing databases;</td>
<td>Extensive</td>
<td>Minimal</td>
</tr>
<tr>
<td>Level of data manipulation</td>
<td>Extensive</td>
<td>spreadsheets; paper</td>
<td>Extensive</td>
<td>Minimal</td>
</tr>
<tr>
<td>Statistical techniques</td>
<td>Weighting; risk adjustment; percentages;</td>
<td>Trend/time series analysis;</td>
<td>Parametric and nonparametric tests of means and proportions; adjustment for confounding/bias</td>
<td>Parametric tests of means and proportions</td>
</tr>
<tr>
<td>Consumers of results</td>
<td>Executive leadership; administrators;</td>
<td>percentages; means</td>
<td>Stakeholders internal and external to the organization including executive leadership; administrators; program developers; other similar organizations</td>
<td>DNP; clinicians; executives; administration; other consumers of research</td>
</tr>
</tbody>
</table>

*References are noted in text.*

Evaluating Quality of DNP Scholarly Work

• Based on the Uncertainty, Pace, Complexity Model
• Complexity and Relationship to Quality Targets
  • Innovation
  • Design
  • Statistics
  • Translation Framework
• Outcomes of Project
  • Innovation Novelty, Complexity, Pace
  • Technologic Uncertainty
  • Business Goal
  • Customer
  • Strategic Goals
Evaluating Quality of DNP Scholarly Work

• Quality Relative to Cohort
• Quality Relative to Target
• Financial Impact
• System Impact
<table>
<thead>
<tr>
<th>Desired Project Outcomes</th>
<th>Rank (1 = Most Important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application and translation of evidence into practice</td>
<td>1.4</td>
</tr>
<tr>
<td>Improved population</td>
<td>2.8</td>
</tr>
<tr>
<td>health/clinical outcomes</td>
<td></td>
</tr>
<tr>
<td>Evaluation of existing systems</td>
<td>4.0</td>
</tr>
<tr>
<td>or practice</td>
<td></td>
</tr>
<tr>
<td>Improved organizational outcomes</td>
<td>4.6</td>
</tr>
<tr>
<td>Improved experience of care</td>
<td>5.1</td>
</tr>
<tr>
<td>Analysis or change to health policy</td>
<td>5.3</td>
</tr>
<tr>
<td>Reduced cost</td>
<td>7.1</td>
</tr>
<tr>
<td>Publication</td>
<td>7.3</td>
</tr>
<tr>
<td>Generation of new knowledge</td>
<td>7.4</td>
</tr>
</tbody>
</table>

**Note.** DNP, Doctor of Nursing Practice.

Ranked by importance from 1 (most important) to 9 (least important).
Question
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
Poverty
Access to Care
Environmental Exposure
Racism

Why is he looking at risk factors and behaviors when the key lies in social determinants?

Looking in a different place for the key.
Health Disparities vs. Health Inequities

• “...simple differences in health are necessary but not sufficient.” (Adler, 2006)

• “unnecessary and avoidable;... unfair and unjust.

• Equity in health implies that everyone should have a fair opportunity to attain their full health potential and ... that no one should be disadvantaged from achieving this potential...” (Whitehead, 1992)
Healthy People 2020

• 1 of 4 Overarching Goals:
  • Achieve health equity, eliminate disparities, and improve the health of all groups.

• Healthy People 2020 defines a health disparity as “a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion.”

http://www.healthypeople.gov/
Question
Life Expectancy at birth, by Hispanic origin, race, and sex, US, 2010

Life Expectancy by Poverty

Growing Disparities

New research has found that differences in life expectancy for richer and poorer Americans have grown in the last two decades.

Life expectancy at birth, by socioeconomic groups

<table>
<thead>
<tr>
<th>BOTH SEXES</th>
<th>MEN</th>
<th>WOMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989-1991</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980-1982</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most deprived | Least deprived  | Most deprived | Least deprived  | Most deprived | Least deprived

Source: Gopal K. Singh and Mohammad Siahpush, using data from Department of Health and Human Services

THE NEW YORK TIMES
The DNP Skill Set and Analytics: Tackling Health Disparities

• Leadership in HealthCare Organizations for Advanced Analytics and Informatics Infrastructure

• Understanding, Prioritizing, and Implementing Data Infrastructures to Promote Data Availability for Measuring Disparities

• Designing evidence-based translation work to account for health disparities

• Using analytic techniques to account for health disparities

• Recognizing analytic results that introduce bias and have unintended consequences for those with health disparities
  • These types of analytic results lead to policies which can lead to systematic discrimination in healthcare delivery
Question
EXHIBIT 1

Completeness of data on health plan members' race, ethnicity, and language needs, by plan type, 2015

- Complete (plan had known data for >95% of its membership)
- Partially complete (plan had known data for 50–95% of its membership)
- Incomplete (plan had known data for <50% of its membership)

Medicare plans (n = 507)
- Race
- Ethnicity
- Spoken language
- Written language
- Other language needs

Medicaid plans (n = 237)
- Race
- Ethnicity
- Spoken language
- Written language
- Other language needs

Commercial plans (n = 413)
- Race
- Ethnicity
- Spoken language
- Written language
- Other language needs

Source: Authors' analysis of data from the Healthcare Effectiveness Data and Information Set, 2015. Note: Spoken language is the language preferred for speaking; written language is the language preferred for reading; other language needs include information such as primary language spoken at home.

Infrastructure Matters
Conceptual model for the “Maryland Population Health Information Network” (M-PHIN) in Support of the new “All Payer” Population-Based Global Budget Hospital Payment System

Source: Hadi Kharrazi, Center for Population Health IT Johns Hopkins Bloomberg School of Public Health
Conceptual Model: Accountable Care Communities

Individual Factors and Behaviors
Social Support and Family
Healthcare and Community Organizations and Infrastructure
Policy and Environmental Context

Shared Data
Shared Financing
Shared Leadership

Service and Accountability Integrator

Reduced duplication and inefficiency in services
Enhanced Effectiveness
Improved quality, coordination and communication

Improved Health Outcomes

Sherry, MK; Wolff, JL; Baltrech, J; DuGoff, E; Davis, K; Anderson, G. Bridging the Silos of Service Delivery for High-Need, High-Cost Patients. Journal of Population Health Management. Online before print: March 23, 2016
Question
Analytic Technique: Risk Adjustment

“Accounting for patient-related factors before examining outcomes of care” lezoni, 2013

• Factors
  • Genetics
  • Demographics
  • Clinical factors
  • Psychosocial, socioeconomic, and environmental factors
  • Health-related behaviors and activities
  • Quality of life, attitudes, perceptions
Figure 17.2 - Florence Nightingale visualized causes of death throughout the Crimean War with the invention of the coxcomb graph.

Source: (Nightingale, 1858)
## Mortality per Cent. in the principal Hospitals of England. 1861.

<table>
<thead>
<tr>
<th>Number of Special Inmates on the 8th April, 1861</th>
<th>Average Number of Inmates in each Hospital</th>
<th>Number of Deaths registered in the Year 1861</th>
<th>Mortality per Cent. on Inmates</th>
</tr>
</thead>
<tbody>
<tr>
<td>12709</td>
<td>120</td>
<td>7227</td>
<td>56.87</td>
</tr>
<tr>
<td><strong>In 106 Principal Hospitals of England</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 London Hospitals</td>
<td>4114</td>
<td>176</td>
<td>3828</td>
</tr>
<tr>
<td>12 Hospitals in Large Towns</td>
<td>1870</td>
<td>156</td>
<td>1555</td>
</tr>
<tr>
<td>25 County and Important Provincial Hospitals</td>
<td>2348</td>
<td>90</td>
<td>886</td>
</tr>
<tr>
<td>30 Other Hospitals</td>
<td>1136</td>
<td>38</td>
<td>457</td>
</tr>
<tr>
<td>13 Naval and Military Hospitals</td>
<td>3000</td>
<td>231</td>
<td>470</td>
</tr>
<tr>
<td>1 Royal Sea Bathing Infirmary (Margate)</td>
<td>133</td>
<td>133</td>
<td>17</td>
</tr>
<tr>
<td>1 Dane Hill Metropolitan Infirmary (Margate)</td>
<td>108</td>
<td>108</td>
<td>14</td>
</tr>
</tbody>
</table>
Outcome of Care: BMI

“A measure of body fat based on height and weight that applies to adult men and women”

- **NIH BMI Calculator**
- (Weight in Pounds/Height in Inches$^2$) * 703
- **BMI Categories:**
  - Underweight = <18.5
  - Normal weight = 18.5–24.9
  - Overweight = 25–29.9
  - Obesity = BMI of 30 or greater
History of BMI Development

• Developed in Belgium in Early 19th Century, by Quetelet, a mathematician
• Developed the equation by creating a formula that matched the data collected in Belgium
• Developed to understand aggregates of people to measure trends in a population
• Warned “It is very misleading when applied to individuals”

BMI as an Outcome: Not so Simple

- Relationships between BMI and fatness and BMI and morbidity vary across populations

- Some Chinese and South Asian populations increased chronic disease risk occurs at lower BMI

- BMI does not give a measure of intra-abdominal (visceral) vs. lower body fatness
  - High visceral fat is independently linked to chronic illness risk and cancer
  - High lower body fat relative to waist is associated with lower chronic illness risk
  - At any BMI Females have a greater proportion of body weight as fat and a greater proportion of lower body fat than males

BMI as an Outcome: Not so Simple

• Classification of childhood obesity using BMI problematic
  • Variability of growth rates of children within and between populations
  • BMI changes with age
  • Many health effects of childhood obesity experienced in adulthood

• Inverted relationship between social class and obesity
  • In affluent nations minority populations and rural communities show the highest rates of obesity

• There is great diversity in obesity-related genotypes
  • Phenotype dependent on many factors
  • Natural selection for the capacity to save and store energy in different populations, geographic areas, and different kinds of environmental pressure

### Table 1: Characteristics of Large Firms Offering Health Benefits and Workplace Wellness Programs and Number of Covered Employees

<table>
<thead>
<tr>
<th></th>
<th>Percent of Large Firm Wellness Programs</th>
<th>Covered Employees (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>100</td>
<td>46.8</td>
</tr>
<tr>
<td><strong>General Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependents eligible to participate in wellness program (2013)</td>
<td>65</td>
<td>31.7~</td>
</tr>
<tr>
<td><strong>Health Screenings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer HRA</td>
<td>50</td>
<td>32.0</td>
</tr>
<tr>
<td>Offer biometric screening</td>
<td>50</td>
<td>30.7</td>
</tr>
<tr>
<td>Offer HRA or biometric screening</td>
<td>64</td>
<td>37.5</td>
</tr>
<tr>
<td>Offer HRA and biometric screening</td>
<td>36</td>
<td>25.1</td>
</tr>
<tr>
<td><strong>Incentives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentive to participate in wellness programs, HRA, or biometric screening (combined)</td>
<td>46</td>
<td>32.6</td>
</tr>
<tr>
<td>Incentive to participate in wellness programs</td>
<td>31</td>
<td>24.1</td>
</tr>
<tr>
<td>Incentive to complete HRA</td>
<td>31</td>
<td>24.4</td>
</tr>
<tr>
<td>Incentive to complete biometric screening</td>
<td>28</td>
<td>22.7</td>
</tr>
<tr>
<td>Incentive to complete either HRA or biometric screening</td>
<td>39</td>
<td>29.7</td>
</tr>
<tr>
<td>Amount of incentive to participate in wellness programs, HRA or biometric screening (combined)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• $1 to $500</td>
<td>19</td>
<td>13.3</td>
</tr>
<tr>
<td>• $501 to $1,000</td>
<td>6</td>
<td>7.1</td>
</tr>
<tr>
<td>• &gt;$1,000</td>
<td>5</td>
<td>3.5</td>
</tr>
<tr>
<td>Require HRA to join health plan</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Require biometric screening to join health plan</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Financial incentive to meet biometric outcome</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>Amount of incentive to meet biometric outcome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• $1 to $500</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>• $501 to $1,000</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>• &gt;$1,000</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*Covered employee refers to covered by the group health plan, not necessarily participating in the wellness program.
**Large firms have 100 or more workers. Estimates are based on all large firms offering wellness programs. Only firms which offer biometric screening or HRAs are asked about their use of financial incentives for completing those activities.
--- Estimates, including those of covered workers, based on 2013 Employee Health Benefits Survey.
--- Excludes firms which have incentives for meeting biometric outcomes tied to other wellness activities.

Summary

• Describe analytics in the context of the current healthcare climate
• Describe the evolution of analytic applications in DNP practice since the inception of the DNP
• Apply analytic solutions to understand the impact of health disparities on healthcare outcomes
• Articulate the multiple ways in which data and analytics can be used to advance DNP innovations
Martha Sylvia, PhD, MBA, RN
ForestVue Healthcare Solutions
915 Folly Rad, #83
Charleston, SC 29412
(843) 375-8300
Martha.Sylvia@forestvue.com