Applying Statistical Models to Inform Improvement

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Presentation Overview

• Overview of Nova Scotia Health Authority
  • Evidence Informed Decision Making
  • NSHA Performance and Analytics
• Pilot Project
  • Application of a Statistical Methodology
  • Lessons Learned
• Spread and Sustainability
Nova Scotia Health Authority

- Hospitals, community health centres and other locations: 145
- Active research projects: 1,297
- Inpatient beds: 3,554
- Births: 3,677
- Home care clients: 29,676
- Mental Health and Addictions clients: 44,300
- Surgeries: 69,811
- Emergency visits: 600,095
- Outpatient visits: 3,665,113
- Diagnostic imaging exams: 1,052,868
- Meals served: 3,357,696

Nova Scotia Health Authority Management Zones

- Western
- Northern
- Eastern
- Central
- City/Town with regional hospital
In the sphere “best available evidence” NSHA aims to understand problems and inform decisions through use of:

- Applied analytics
- Descriptive
- Inferential
- Predictive
Data Extraction and Staging
Data extraction, aggregation and data mining methods organize the data and make it possible to identify patterns and relationships that would not otherwise be visible.

Data Linkage
Allows related information from one data source to be linked to information from another data source. Using the linked data makes it possible to gain a more comprehensive understanding.

Descriptive Analytics
Summary of historical data to yield useful information and possibly prepare the data for further analysis. Reporting and data visualization may be applied to yield more insight.

Inferential Analytics
Examines data and relationships to answer the question “Why did it happen?”, or “What might happen?”.

Performance Measurement
Regular measurement of outcomes and results, which generates reliable data on access, efficiency and outcomes for NSHA programs.

Applied Analytics
Utilizing advanced statistical methods and innovative tools to create iterative, scalable and operational solutions, applying theory to the practice of health system planning and management.
Pilot Project
Analytics to Inform Improvement
Pilot Project Aim

Nova Scotia Health Authority identified five pilot units to conduct a multi-dimensional integrated analysis of qualitative and quantitative evidence to optimize resources and enhance overall system performance.

The pilot project aimed to provide evidenced-based information utilizing a Patient/Population, Provider, and System framework to:

• meet our population health needs;
• deliver quality, safe, and cost-effective services;
• ensure a sustainable number and mix of health human resources;
• enable teams to work collaboratively and to optimal scope of practice;
• have the budget and resources to meet staffing requirements; and
• manage overtime and purchased service usage
Our Approach

Multi-dimensional analysis of qualitative and quantitative evidence

Concurrent analyses focused on Patient Population and Care Needs, Practice Context, Model of Care, Provider Requirements and System Drivers

UNIT ASSESSMENT
Engage with unit leaders and staff, complete literature reviews/environmental scans, analyze unit data to assess the staffing model based on patient, provider and system frameworks

UNIT VARIANCE ANALYSES
Apply statistical methodology to identify drivers of financial variance. Where OT and ST were modeled as a function of workforce, unit workload, temporal and patient demographic variables

UNIT REVIEW / SUMMARIZATION
Review analysis methodology and findings with unit leadership to confirm accuracy of data and assumptions and prepare detailed summary of method, results and recommendations.

RECOMMENDATIONS
Comprehensive analysis and interpretation undertaken by team to produce unit specific recommendations for service area.

IMPLEMENTATION
Develop implementation strategy for approved recommendations
Methodology

• Data Sources:
  • workforce information (e.g., FT/PT, provider type)
  • staffing volumes & schedule (shift mix, times)
  • patient demographics
  • utilization and patient flow data
  • financial data (OT, Sick time, premiums, purchased service, unfunded FTE, overall variance)

• Statistical Method
  • Logistical Regression
  • Dependent Variables: Sick time over 4% ; Overtime over 1.5%
Lessons Learned

Integration of Multiple Sources of Evidence
Leverage varied sources, quantitative and qualitative

System Planning
Consider system level planning & transformation; socio-political context

Translating Information into Action
Share findings in a meaningful way; establish implementation teams, build action plans; re-evaluate

Statistical Findings
Sum of variables explained ~ 43% or less of variance; data limitations; daily variance vs system factors
Spread & Sustainability

Analytics to Inform Improvement
• Apply analytics to address the business problem
  • Move to foresight
• Communicate findings
• Build data literacy
• Integrate analytics into an evidence-based improvement strategy
NSHA Analytics Case Studies

1. Utilization Volume Modelling & Forecasting
   - Business Problem: Lack of forecasts of health system utilization to support planning
   - Solution: Patient volume forecasting based on time based model
   - Business Value: Enhanced forecasts leading to operational improvements and improved patient experiences

2. Predicting Patient Flow
   - Business Problem: Develop model to predict arrival rate, type and patient path and package information into actionable insight for leaders
   - Solution: Machine Learning Proofs of Concept to apply power and scale to complex problem
   - Business Value: Translating predictive analytics into a change in practice at site level

3. Population Based Utilization Projections
   - Business Problem: Lack of forecasts of health system utilization to re-development support planning
   - Solution: Population based projections based on Re-development model
   - Business Value: Population based projections to support robust decision making
THANK YOU

Questions?