Utilizing a Data Strategy to drive the Analytics Program at Massey Cancer Center

Predictive Analytics World Healthcare
September 28, 2015

Presented by Dr. Brian Cassel, Ph.D.
Lewis A. Broome
Session Abstract

Utilizing a Data Strategy to drive the Analytics Program at Massey Cancer Center

Hear a case study from the Massey Cancer Center on utilizing a data strategy to drive their analytics program; example outcomes include gathering the data needed to make the case for creating, sustaining and expanding palliative care services. Many healthcare organizations struggle with palliative care. By using data, palliative care programs can grow and advance. These case studies will highlight using analytics to improve outcomes, improve care delivery, and reduce costs. We will provide key insights and lessons learned from laying the groundwork for using analytics to improve cancer and palliative care from success stories.
Session Presenters

J. Brian Cassel, PhD
Assistant professor, Hematology/Oncology & Palliative Care
Associate director, cancer informatics core
Massey Cancer Center
Virginia Commonwealth University
Brian.Cassel@VCUhealth.org

Lewis A Broome
Chief Executive Officer
Data Blueprint
Richmond, VA
lbroome@datablueprint.com
Palliative care – a critical piece of cancer care

- Palliative care specialist teams work alongside oncologists
- Provide additional layer of support
- Focus on prognosis, communication, goals of care, and symptom assessment & management
- 60% of US hospitals have PC
- 78% - 98% of cancer centers have inpatient PC, but only 22% - 59% have outpatient
- PC achieves the “Triple Aim” – it improves outcomes (quality of life, symptoms, survival), enhances satisfaction, and decreases costs

Sources: “Palliative care growth trend continues, according to latest CAPC analysis”. Available from: https://www.capc.org
Palliative care – the impact is significant

• Estimated 4.03 million patients who might benefit from inpatient PC services are not being served
• These 4.03 million patients could expect savings of $2,131 per admission, at $8.59 billion annually.
• Estimated 5.8 million individuals who might benefit from community-based PC are not being served
• These 5.8 million individuals could expect an average reduction in health care costs ($18,140 per) is estimated at $106.6 billion, annually.

Sources:
Palliative care is unfolding in three steps

1. Inpatient programs – late 1990’s forward – passive, reactive, waiting for patients to be admitted and referred

2. Outpatient programs – 2007 forward – earlier in disease course, meeting patients in ambulatory settings and home

Role of data in deciding what PC to provide, and to whom

<table>
<thead>
<tr>
<th>Phase</th>
<th>Decision to be made</th>
<th>Data Needed</th>
<th>Data Management</th>
<th>Analytic capability</th>
<th>Subject matter expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – inpatient</td>
<td>Yes/No, $</td>
<td>Inpatient fiscal</td>
<td>Ad hoc</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2 – outpatient</td>
<td>Yes / No, How, How much, $</td>
<td>All settings, death date</td>
<td>Tactical</td>
<td>✓✓✓</td>
<td>✓✓✓</td>
</tr>
<tr>
<td>3 – proactive</td>
<td>When to proactively trigger PC for Mrs. Smith</td>
<td>Clinical, utilization , robust models</td>
<td>Strategic</td>
<td>✓✓✓✓</td>
<td>✓✓✓✓</td>
</tr>
</tbody>
</table>
This revolution is data driven

- The financial / business case must be demonstrated
- The clinical & financial imperatives must be aligned for a given setting and patient population
- Financial / economic context
- Healthcare often takes the form of a business in the US
- The US healthcare system is deeply rooted in the fee-for-service, third-party reimbursement model
- Toward the end of life, patients tend to use a lot of healthcare services
- Palliative care often takes a “less is more” approach
“Healthcare’s disintegration is not yet every man for himself, but it is every discipline for itself, every guild for itself. As a result, we tend to assume today that one guild’s solution cannot be another’s. We assume that either we will preserve quality or cut costs; that patients will get what they ask for or that science will prevail; that managers will run the show or that doctors will be in control; that the bottom line is financial or moral.

“Nothing comprehensive is possible if it fails to make sense to any of the key stakeholders. At least four parts of our [health] system need to share in the solution—[a common answer] or the system will fall apart. Whatever “escape fire” or revolutionary innovation we create has to make sense in the world of science and professionalism, in the world of the patient and family, in the world of the business and finance of health care, and in the world of the good, kind people who do the work.

“I think the toughest part of this may be in terms of the business and financing of care. There is a tendency to assume that financial success—e.g., thriving organizations—and great care are mutually exclusive. However, we will not make progress unless and until these goals become aligned with each other.”

Phase 1: Inpatient palliative care
Consulting firm: “Close down PC program”

- VCU Massey opened one of first Palliative Care Units in the nation in May 2000.
- Consultants recommended closing it in 2002 because PCU cases cost a lot more than reimbursement.
- Detailed financial analyses of PCU patients, compared to other EOL admissions, convinced consultants that the unit produced significant cost-reduction.
- Unit stayed open; financial analyses became core part of training curriculum for > 1,000 other programs in the country.
### Final Days

Unlikely Way to Cut Hospital Costs: Comfort the Dying

Cost-avoidance in drugs (-77%), labs (-95%), imaging (-95%), supplies (-60%).

#### Care, Not Cure

Average cost for terminally ill patients in palliative and nonpalliative programs during their final five days at one hospital

<table>
<thead>
<tr>
<th></th>
<th>NON-PCU</th>
<th>PCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drugs and chemotherapy</td>
<td>$2,267</td>
<td>$511</td>
</tr>
<tr>
<td>Lab</td>
<td>1,134</td>
<td>56</td>
</tr>
<tr>
<td>Diagnostic imaging</td>
<td>615</td>
<td>29</td>
</tr>
<tr>
<td>Medical supplies</td>
<td>1,821</td>
<td>731</td>
</tr>
<tr>
<td>Room &amp; nursing</td>
<td>4,330</td>
<td>3,708</td>
</tr>
<tr>
<td>Other</td>
<td>2,152</td>
<td>278</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$12,319</strong></td>
<td><strong>$5,313</strong></td>
</tr>
</tbody>
</table>

Note: PCU stands for palliative care unit. Each figure represents average cost of last five days for a cancer patient aged 65-plus, prior to in-hospital death. Figures are for 2001 and 2002.

Source: Virginia Commonwealth University medical center
8-hospital study of cost reduction

Cost Savings Associated With US Hospital Palliative Care Consultation Programs

R. Sean Morrison, MD; Joan D. Penrod, PhD; J. Brian Cassel, PhD; Melissa Caust-Ellenbogen, MS; Ann Litke, MFA; Lynn Spragens, MBA; Diane E. Meier, MD; for the Palliative Care Leadership Centers’ Outcomes Group

**Background:** Hospital palliative care consultation teams have been shown to improve care for adults with serious illness. This study examined the effect of palliative care teams on hospital costs.

**Methods:** We analyzed administrative data from 8 hospitals with established palliative care programs for the years 2002 through 2004. Patients receiving palliative care were matched by propensity score to patients receiving usual care. Generalized linear models were estimated for costs per admission and per hospital day.

**Results:** Of the 2966 palliative care patients who were significant reductions in laboratory and intensive care unit costs compared with usual care patients. The palliative care patients who died had an adjusted net savings of $4908 in direct costs per admission ($P = .003$) and $374 in direct costs per day ($P < .001$) including significant reductions in pharmacy, laboratory, and intensive care unit costs compared with usual care patients. Two confirmatory analyses were performed. Including mean costs per day before palliative care and before a comparable reference day for usual care patients in the propensity score models resulted in similar results. Estimating costs for palliative care patients assuming that they did not receive palliative care resulted in projected costs that were

The challenge (and success) is knowing what questions to ask of the data

- How do PC-relevant cases compare to others in terms of costs and PC use?
- What are the daily costs before and after PC encounter?
- What are the costs, quality metrics, and involvement of PC in final months of life?
## Role of data in deciding what PC to provide, and to whom

<table>
<thead>
<tr>
<th>Phase</th>
<th>Decision to be made</th>
<th>Data Needed</th>
<th>Data Management</th>
<th>Analytic capability</th>
<th>Subject matter expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – inpatient</td>
<td>Yes/No, $</td>
<td>Inpatient fiscal</td>
<td>Ad hoc</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2 – outpatient</td>
<td>Yes / No, How, How much, $</td>
<td>All settings, death date</td>
<td>Tactical</td>
<td>✓ ✓ ✓</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>3 – proactive</td>
<td>When to proactively trigger PC for Mrs. Smith</td>
<td>Clinical, utilization, robust models</td>
<td>Strategic</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>
Phase 2. Community-based PC

- Brumley (2007) RCT demonstrating impact of home-based PC on reducing hospital costs
- Temel (2010) RCT demonstrating impact of early clinic-based PC on quality of life, depressive symptoms, and survival
- Higginson (2009) RCT demonstrating impact of early PC in home & community settings, improving caregiver burden and reducing costs
Phase 2. Community-based PC
Making the “business case” requires better institutional data & analyses

• What are utilization, costs, revenue of PC-relevant patients in months prior to death?
• Which patients are receiving palliative care, and when?
• How many patients could be met earlier by PC proactively?
• What would it take to provide PC for them?
• Data challenges: Need to know date of death, and to use population health / longitudinal analytic approach
Data Strategy Framework

**Business Vision**
- Organization Mission
- Strategy & Objectives
- Organizational Structures
- Performance Measures

**Current State**
- Organizational / Readiness
- Business Processes
- Data Management Practices
- Data Assets
- Technology Assets

**Solution**
- Business Needs Analysis
- Map Needs & Current Capability
- Capability Targets (w/ Bus. Case)
- Implementation Tactics

**Road Map & Execution**
- Leadership & Planning
- Project Development & Execution
- Cultural Readiness

**Business Needs**

**Business Value**

**Existing Capabilities**

**New Capabilities**
Data Strategy Choices

Q1
Keeping the doors open (little or no proactive data management)

Q2
Increasing organizational efficiencies/effectiveness

Q3
Using data to create strategic opportunities

Q4
Both (Optimized)
Dealing with Cultural Readiness

Culture is the biggest impediment to a shift in organizational thinking about data.
Framework for Current State Assessment

- Organization & Readiness
- Business Processes
- Technology Assets & Practices
- Data Assets
- Data Mgmt. Practices
- Org. Goals and Objectives

- Enables
- Provides Context
- Enables
- Enables
- Enables
- Measures

Enables

Informs
Current State – What We Typically See
PC programs struggling to get good information

Source: VCU / PC Insights survey, 2015, n=54 PC clinical leaders
Solution: Massey Data Analysis System (MDAS)

VCUHS Internal Data Sources – linkable at patient level

External Data Sources

VCU Patient Satisfaction

Bone Marrow Transplant DB
- Clinical data on donors & recipients

Outpatient Pharmacy DB
- Drug Utilization Details

Hospital billing claims
- IP & OP encounter data
- Cost, charge, reimbursement, & utilization data
- ICD-9 diagnosis, CPT procedure, UBC revenue codes

Physician billing claims
- IP & OP encounter data
- Utilization & charge data
- ICD-9 diagnosis, CPT procedure codes

Clinical EMR systems
- Lab & chemistry results
- Patient height, weight, BMI
- Orders and prescriptions
- Radiation doses and tissues treated

Intellimed / VHHA / Truven
- IP data for VA, NC, MD hospitals
- Can expand to other states as well (AHRQ-HCUP)

Public Health Data
- BRFSS
- SEER
- VCR
- Vital Statistics

Social Security
- Dates of death
- Linkable to VCUHS data

VCU Cancer Registry
- Site, stage, pathology details
- Initial Treatment

Palliative Care Program
- Consultations / encounters
- Reason, place, disposition

UHC
- IP data for Academic Medical Centers
- ICD-9, CPT, DRG codes, costs, LOS, mortality, re-admits

Appointment data
- From IDX, actual vs. scheduled

US Census
- Population Data

Bone Marrow Transplant DB
- Clinical data on donors & recipients

Outpatient Pharmacy DB
- Drug Utilization Details

Appointment data
- From IDX, actual vs. scheduled

Hospital billing claims
- IP & OP encounter data
- Cost, charge, reimbursement, & utilization data
- ICD-9 diagnosis, CPT procedure, UBC revenue codes

Physician billing claims
- IP & OP encounter data
- Utilization & charge data
- ICD-9 diagnosis, CPT procedure codes

Clinical EMR systems
- Lab & chemistry results
- Patient height, weight, BMI
- Orders and prescriptions
- Radiation doses and tissues treated

Intellimed / VHHA / Truven
- IP data for VA, NC, MD hospitals
- Can expand to other states as well (AHRQ-HCUP)
Frequency of hospitalizations

Admissions spike in final month of life
Analysis of decedent admission patterns, VCU, FY10-12

- Kidney
- Liver
- Neuro
- HIV
- COPD

Frequency of hospitalizations:
- 6 mo: 140
- 5 mo: 153
- 4 mo: 191
- 3 mo: 224
- 2 mo: 295
- 1 mo: 758

Chart shows the frequency of hospitalizations over the final month of life for various conditions.
Annual Medicare inpatient net margin by month

Total loss these 2 conditions, 2 months preceding death = $900,000 annually

Role of data in deciding what PC to provide, and to whom

<table>
<thead>
<tr>
<th>Phase</th>
<th>Decision to be made</th>
<th>Data Needed</th>
<th>Data Management</th>
<th>Analytic capability</th>
<th>Subject matter expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – inpatient</td>
<td>Yes/No, $</td>
<td>Inpatient fiscal</td>
<td>Ad hoc</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2 – outpatient</td>
<td>Yes / No, How much, $</td>
<td>All settings, death date</td>
<td>Tactical</td>
<td>✓ ✓</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>3 – proactive</td>
<td>When to proactively trigger PC for Mrs. Smith</td>
<td>Clinical, utilization, robust models</td>
<td>Strategic</td>
<td>✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>
Phase 3. Proactive

How do we identify the next patient who will need PC, before it’s “too little, too late”?

• Redesign from cancer data mart to enterprise data warehouse

• Build out foundational data management capabilities

• Easy integration of clinical (biometric, biomarker, laboratory, orders, prescriptions) and utilization / fiscal data

• Incorporate external data if possible via health information exchanges or payer data

• Robust statistical modeling that is setting and population-specific
Prognostic scoring systems for phase I

- **RMH model:** ↓ albumin, ↑ LDH, > 2 met sites
- **Fussenich EJC 2011:** ↑ LDH, anemia, ↓ sodium
- **Han BJC 2003:** poor PS, ↑ WBC, ↑ hemoglobin, ↑ >1 mets
- **Janisch Cancer 1994:** poor PS, ↑ platelets, ↓ albumin, non-GU/GYN ca, prior cisplatin
- **Penel IND 2008:** ↓ lymphocytes, ↓ albumin
- **Wheler Cancer 2009:** thromboembolism, ↑ platelets, liver mets
- **Wheler CCR 2012:** ↑ LDH, ↓ albumin, >2 mets, poor PS, GI tumor.

RMH: Royal Marsden Hospital. LDH: Lactate dehydrogenase. PS: performance status. WBC: white blood cells. GI: gastro-intestinal
Median Overall Survival (months) from beginning of phase I trial treatment

- Low Risk: 7.6 months
- Medium Risk: 8.6 months
- High Risk: 5.7 months

Studies:
- Arkenau BJC 2008
- Olmos CCR 2011
- Janisch Cancer 1994
- Jones Ca Chemo Pharma 2011
- Chau BMC Cancer 2011
- Arkenau Oncology 2009
- Han BJC 2003
- Olmos JCO 2012
- Hong CCC 2012
- Penel IND 2008
- Fussenich EJC 2011
- Bachelot Annals Oncol 2000
- Garrido-Laguna Cancer 2012
- Arkenau JCO 2009
- Wheler CCR 2012
- Wheler Cancer 2009
- Yamamoto IJO 1999
Similar interests between phase I trialists and palliativists – but for different reasons

Ideal for Phase I and appropriate for *primary or generalist* palliative care

Adequate for Phase I and ideal for *specialist* palliative care

Too late for phase I, adequate for SPC (though suboptimal)
2.5% and 5.0% weight loss for cancer pts

Cancer - Avg % Weight Loss per Patient by Month to Death
Each disease slightly different

Cancer All Ages

CHF All Ages
Challenges for predictive analytics for PC

• Data
  – Easy and complete access to clinical data
  – Clinical data surprisingly messy!
  – Integration of clinical & utilization data
  – Access to death data
  – Access to utilization & clinical data outside of your own institution

• Non-Data
  – How to trigger / prompt? Who should receive?
  – How integrate PC referral into clinical workflow?
  – Do we have enough PC specialist time available?
Overcoming the challenges at Massey

• Start by understanding what questions need to be answered – focus on what’s important
• Take a crawl, walk, run approach
• Think and plan strategically about data solutions
• Understand the current environment – what to leverage and gaps to close
• Implement foundational data management capabilities for scalability and repeatability
• Make solutions easy to use – integrate into workflows