Optimizing the Treatment Planning Process

Systems Engineering Tools for Treatment Planning
Process Optimization in Radiation Medicine

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SESSION LEARNING OBJECTIVES

1. Gain familiarity with the workflow of modern treatment planning process.
2. Understand the scope and challenges of managing modern treatment planning processes.
3. Gain familiarity with Six Sigma approaches and their implementation in the treatment planning workflow.
   - Summary of our initiatives at North Shore-LIJ
   - Lean 6s reducing Overhead: Head & Neck Process Illustration
   - 6σDMAIC in Treatment Process: Safety, Quality

Disclosures

• None
Radiation Medicine at North Shore-LIJ

- A blend of Academic, Private and Community Based Practice
- 8 Locations, 16 Radoncs, 7 dosimetrists, 18 physicists, >100 staff;
- 2800 consults/yr; 200 patients/day
- Various treatment platforms
  - Trubeam, EX series, Gamma Knife, Cyberknife, Tomotherapy, Zeiss, HDR, PSI, SRT, Xofigo ….
- Paperless and Quality Checklist (QCL) Driven since 2007

A Head and Neck Problem (2011)

- Can we reduce wait time while absorbing increased volume?
- Simple High Impact Solutions?

A Rising Caseload

- Wait Time to Treatment: Getting Longer

Net Work Days

Caseload

Average Interval

(CT to TX start head and neck cases)
What is Lean Six Sigma?
- collaborative team
- improve performance
- remove overhead

Kaizen H&N Project
1. Gather the Team
2. Process Mapping
3. Defect Identification
4. Defect Stratification
5. Prioritization Matrix
6. Implement Solutions

Solutions

Short Term
- Place scanner by nurse's WS
- Merge outlook/Mosaic schedules
- Appointment Checklist
- Morning Huddles – SMART Rounds
- Recruitment of PA

Long Term
- Velocity Purchase [Contours, Fusion]
- Development of Whiteboard
Quick Results .. Sustained...

1. Early Response to Solutions for MD, 1 Tx machine

16 --> 14 day turnaround despite 2.5X increase in volume for MD

SIX SIGMA DMAIC INITIATIVES

Enhance Safety, Quality
In Treatment Planning Workflow

The Radiation Medicine System
The value added by the system depends on how well the parts are interconnected (Rechtin, 2000)

• Tasks Accomplished
  — Incorporated many recommendations
  — Paperless EMR across Health System
  — Quality Checklist Process (QCL) Driven

• Opportunity to become evidence/outcome driven
  — Performance metrics on process steps
  — Mean, standard deviation
  — Measurable, analyzable and potentially controllable
  — Amenable to 6 sigma process control
  — All sites, locations

A 6 sigma opportunity!

Shifting Focus to 6σ

• Focuses on quality by identifying & mitigating causes of defects and minimizing variability in processes.
  — Define, Measure, Analyze, Improve and Control Quality [DMAIC]

<table>
<thead>
<tr>
<th>DMAIC</th>
<th>6σ Impact</th>
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<tbody>
<tr>
<td>Define</td>
<td>High Risk Steps</td>
</tr>
<tr>
<td>Measure</td>
<td>Upper six - Limit (USL)</td>
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<tr>
<td>Analyze</td>
<td>Lower six - Limit (LSL)</td>
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<tr>
<td>Improve</td>
<td>Defect</td>
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<tr>
<td>Control</td>
<td>Target</td>
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What are the high risk steps?

• Moving toward safer radiotherapy requires active surveillance of associated failures, causes and effects, & evidence-based mitigation
  — Surveillance may be reactive (incident learning) or proactive (FMEA etc)
  — Assumption: every effect has cause(s); every cause may have an effect(s)
  — Must used combined approach, neither is independently sufficient
**DEFINE:**

High Risk Steps

<table>
<thead>
<tr>
<th>Combined Procedures</th>
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<tbody>
<tr>
<td>Treatment Planning</td>
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<tr>
<td>Prescription</td>
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<tr>
<td>To Consent</td>
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<tr>
<td>Path Review (before Six)</td>
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<tr>
<td>Contour</td>
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<tr>
<td>Plan Completed</td>
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<tr>
<td>2nd Plan Check</td>
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<td>MRT GA</td>
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<tr>
<td>Lateality (start D1)</td>
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<tr>
<td>1st Day Physic Check</td>
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**Baseline High Risk Tasks**

- Metadata for QCL at baseline:
  - 40% of QCL were delayed
  - 70% of contours and plan tasks were delayed
  - Majority of patients had some QCL delayed, yet staff rushed to ‘get it done’
  - Large variability in staff performance on QCL

We were at higher risk than perceived

**MEASURE**

Three Main Causes for Failures

1. Timeliness & accuracy of high-risk-process steps
   - 40% variances germinated from issues clustered around tasks
   - Requisite information at the right time from the right source
   - Ineffective handoffs/communications, coordination
   - Not just staff delinquencies

2. Cultural pathogens
   - Delay, Rushed Processes (75% of pts with QCL delays not delayed)
   - Experience based rather than evidence based directives

3. Variability
   - Handful of staff: ++ high-risk task delays/issues >> pt volume/complexity
   - More patient effects – delays, safety events

Call for Better Standards, process interlocks, peer review, coordination
**Risk Mitigation Strategies**

<table>
<thead>
<tr>
<th>INITIATIVE</th>
<th>SEVERITY</th>
<th>LIKELIHOOD</th>
<th>DETECTABILITY</th>
<th>METRIC</th>
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<tbody>
<tr>
<td>Care Pathway Standardization</td>
<td></td>
<td></td>
<td>X</td>
<td>Compliance Rate</td>
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<tr>
<td>Toxicity Scale Standardization</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Inter-rater reliability kappa</td>
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<td>Pre Tx Planning Peer Review (SMART Rounds)</td>
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<td></td>
<td>X</td>
<td>MD GPA on Peer Review</td>
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<td>No Fly Policy</td>
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<td></td>
<td>X</td>
<td>Delay Rates</td>
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<td>Electronic Whiteboard</td>
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<td></td>
<td>X</td>
<td>Incident Reporting Rates</td>
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<tr>
<td>Monitoring High Risk Task Operation</td>
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<td></td>
<td>X</td>
<td>Z-scores</td>
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**Common Terminology Criteria for Adverse Events (CTCAE)**

Version 4.02

**Improve**

- EBRT Management
- Incident Reporting
- Plan Census
- SMART Rounds
- HDR Management
- 1st Day Physics Check

**Reduce Variability**

**Peer Review Interlocks Before TX Planning**

**Process Interlocks Before Treatment**

**Whiteboard: Coordination & Transparency in Workflow**
SUSTAINED OUTCOMES

• Compliance with directives
   Increased to 97%

• Inter-rater reliability for toxicity grading
   Kappa scores improved by a factor of 2

• GPA on pre-Tx planning contour/Rx peer review
   10% drop in cases presenting with issues

• Proactive and No-Fly Treatment Delay Rates
   No Fly rates dropped by 4X; Proactive delays ~ 6-8%

• Incident Reporting Rates
   Reporting for Tx Planning ↑ more in 9 months than previous 6 years

• Operational Z-scores
   Increased from 1.3

SUMMARY

• 6s tools led to workflow and safety culture improvements
   Provided a structured framework to guide quality management & report regularly
   Sustained improvements over the past 5 years of implementation in our department.

• Driving initiatives has challenged traditional norms of operations
   Such as expediting treatment initiation in delay-rushed environments
   Sustaining care pathways that are more experience based than evidence-based

• Implementation has met with substantial cultural barriers
   Working practices evolve over decades, and changing them creates uncertainty
   The inertia of sustaining past cultures and arguments for not changing tend to perseverate
   Direct persuasion only goes so far.

• Other centers could institute these initiatives without replicating formative effort, yet for others there may be value in validating this work

REFERENCES

Thank You!
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