The Value of a Dosimetrist in a Value Based Healthcare Environment

Matthew Palmer, MBA, CMD

Background

2000 – 2003 Brachytherapy Dosimetry
New Technology Clinical Implementation

2003 – 2010 External Beam Dosimetry
New Technology Product Development

2010 – 2014 Supervisor, Proton Therapy
New Technology Adoption

2014 – 2018 Administration, Development & Operations
Justification of New Technology- Admin, Economics & Policy
Disclosers

- No Financial Benefit

Rising Healthcare Cost
Healthcare Cost vs. Life Expectancy

Transition to Value Based Models

- Pay for volume
- No quality measured

- Quality per click
- Process improvement

- Quality outcomes of episodes
- Whole system improvement

Fee For Service

Care Coordination

 THEN NOW FUTURE

### Fee for Service to Fee for Value

<table>
<thead>
<tr>
<th>Volume</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providers make money by negotiating higher rates and performing as many services as possible.</td>
<td>Providers make money by not only providing services, but other results valued by the industry, such as quality, efficiency, wellness, care coordination, and prevention.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vendors</th>
<th>Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payers see providers as vendors</td>
<td>Payers begin to see providers as partners</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revenue</th>
<th>Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providers see every touch as revenue</td>
<td>Providers see every touch as an expense to be managed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provider Based Claims</th>
<th>Evidence Based Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most providers have little regard for evidence-based medicine</td>
<td>Providers care a great deal about evidence-based medicine</td>
</tr>
<tr>
<td>Payers primarily pay providers based on claims</td>
<td>Payers pay providers based on claims plus many other inputs (few of which are automated)</td>
</tr>
</tbody>
</table>

### Value Based Model – Current Status

- **2018**: 35% of the population managed by value-based models.
- **Value-based Reimbursement Agreements**: Align financial incentives with clinical outcomes.
- **Consume Transactional Data**: Support Payment Reform, Intervene: Change Care Delivery, Expand to Other Partners, Integrate & Share.
Value Based Model - Provider Risk

“At Risk” Example
Cardiac Catheterization – Fixed Fee + Performance Based Fee that was “at risk” based on the achievement of the following pre-determined metrics

- Employee Satisfaction – 5%
- Patient Satisfaction – 5%
- Quality of Care – 30%
- Cost Reduction – 60%
What is Value?

- How is quality defined?
- What metrics are used to define quality?
- How is cost defined?
- What outcomes are most important?
- What are the parameters of the outcomes?
- How is value defined by the patient?
- How much is the patient willing to pay for value?

Stakeholders’ Perspective

The Value Equation

- Service (perceived)
- Guideline-based therapies
- Low toxicities
- Improved Survival
- Improved Quality of Life

VALUE

Outcomes + Patient Experience

Cost

Direct Costs + Indirect Costs

- Access to Care (time)
- Best Supportive Care
- Avoidance of hospital days
- Avoidance of emergency department visits
- Lower site-of-care costs
- Reduced medically unnecessary care @ EOL

Image Courtesy: http://www.healthcareitnews.com/sponsored-content/solving-healthcare-value-equation-0

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Cancer’s Impact on Employers

Direct Costs

- Escalating cancer care expenditures

Indirect Costs

- Absenteeism
- Presenteeism
- Caregiver burden / reduced productivity

Survivorship Costs

- Increase in cancer survival rates
- Increase in healthcare utilization during treatment & follow-up
- Maintenance therapy costs

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Cancer’s Impact on Employers

Full Cost of Poor Health to Employers

30%
Personal Health Costs

> Medical Care
> Pharmaceutical Costs

70%
Health-Related Lost Productivity Costs

> Presenteeism
> Absenteeism
> Overtime
> Turnover
> Temporary Staffing

> Working Slowly
> Late Deliveries
> Replacement Training
> Customer Dissatisfaction
> Variable Product Quality

Measurement of Value?

1. How do patients know if their healthcare is good care?
2. How do providers pinpoint the steps that need to be improved for better patient outcomes?
3. How do Insurers and employers determine whether they are paying for the best care that science, skill and compassion can provide?
4. How do we figure out which measures can give us the biggest return in better quality of life for patients?
5. Who sets the priorities, and how carries them out?

Source: National Quality Forum
1. Process Measures
2. Outcome Measures
3. Patient Experience Measures
4. Infrastructure Measures
5. Composite Performance Measures

Source: National Quality Forum

Visualizing Quality

Quality Frameworks

Institute of Medicine (IOM) Framework

1. **Safe**: Avoiding harm to patients.
2. **Effective**: Providing services based on scientific knowledge to all who could benefit.
3. **Patient-centered**: Providing care that is respectful to individual patient preferences, needs, and values.
4. **Timely**: Reducing waits and sometimes harmful delays.
5. **Efficient**: Avoiding waste, including waste of equipment, supplies, ideas, and energy.
6. **Equitable**: Providing care that does not vary in quality.
**IOM Framework – Radonc Focus**

1. **Safe**: Effective Treatment Plans, Achieve dose constraints, ROILS, QA Methods, Toxicity review board
2. **Effective**: Research, Publications, Treatment Planning Development and Improvement
3. **Patient-centered**: Dosimetric plan analysis to determine optimal plan per patient, Plan analysis tools
4. **Timely**: Contouring & Treatment planning time
5. **Efficient**: Operational Process Improvement = Cost reduction
6. **Equitable**: Treatment plan standardization

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**Incident Learning**

- The Patient Safety and Quality Improvement Act of 2005 established essential legal protections in the US to allow for the collection and analysis of medical incidents nationwide.
- RO-ILS is actively collecting, analyzing, and reporting patient safety events.
- Learned experiences from the collected data are used to design systems not only optimized for efficiency but also for error minimization and elimination.

**How can/do Dosimetrist Contribute to Radiation Safety?**

- Safe, Deliverable Plans
- Report Errors & Mistakes
- Report Often
- Education & Training
- Implement New Guidelines & Procedures
**Dosimetry Operational Recommendation**

**Safety**

**Goals of Radiation Therapy**

1. Maximize disease control
2. Minimize both early and late side effects
3. Preserve organ function
4. Preserve quality of life
5. Minimize extraneous radiation dose to the patient
What is an Optimal Plan?

100% of prescribed dose to entire tumor volume and zero dose elsewhere (not attainable).

Physician believes that a better plan exists and that through more effort (and perhaps experience) it can be found.

Characteristics of the best “achievable” plan are unknown.

Lack of universally accepted criteria/metrics for defining the “best” plan for each type of cancer.

PlanIQ™, Courtesy of Ben Nelms, PhD
Optimal Treatment Plan?

Limitations of Achieving the Optimal Plan

1. Time, Distance, Shielding
   - Time - Rush to get the patient started
   - Distance - Planner knowledge and experience gap
   - Shielding - Blocked from seeing the optimal plan

1. Lack of established benchmarks

2. Patients uniqueness

3. Disease specific exposure (Recall)

1. Knowledge gap due to advancements in technology
Knowledge Based Class Solutions

• Systematic way of applying a technique for a specific site that is consistent, robust and helps produces a clinically acceptable plan more efficiently.

Benefits of Class Solutions

• Increase the standard of care for all patients
  – Define an optimal plan by defining benchmarks specific to the clinical site
  – Reducing the significance of disease-specific experiences for IMRT treatment planning

• Elimination of trial-and-error optimization process
  – Reduces the need for experienced based knowledge retrieval
  – More time spent optimizing plan rather than doing plan setup

• More time for advanced optimization
  – Continually improve plans beyond established benchmarks
Fundamental Principles for Improvement

- All results are determined by inputs with some degree of uncertainty.
- To improve results, you have to focus on the inputs, modify them, and control them.
- Variation is everywhere, and it degrades consistent, good performance.
- Valid measurements and data are required foundations for consistent, breakthrough improvement.
- Only a critical few inputs have significant effect on the output. Concentrate on the critical few.

Modified 6-Sigma - DMAICM

- Define the problem and the objectives
- Analyze the process. Define factors of influence.
- Assure that improvements will sustain.
- What do we need to improve? Can we measure this?
- Identify and implement improvements.
- Periodically evaluate process and track results.
Class Solution Development

**D DEFINE**
Define Questions and Outline the Project.

**M MEASURE**
Define Parameters, Statistics and Collect the data.

**A ANALYZE**
Analyze the data and rank results based on prioritized parameters. Establish benchmarks.

**I IMPROVE**
Validate on cohort and evaluate if statistical improvement is evident.

**C CONTROL**
Construct controlled study to evaluate results with and without solution.

**M MONITOR**
Conduct periodic post-implementation studies to measure improvements.

Continual Process Improvement

**Before Class Solutions...**

**Performance Metrics →**

**Effects of Class Solutions...**
- Higher mean performance
- Less variability
- Better “best”
- Better “worst”

Image Courtesy: Ben Nelms, PhD
Variability in Conformality Index for 29 patients in the Lt Frontal region for dose ranges from the Rx → 20Gy

Define Benchmarks for Planning

Image Courtesy:

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Identifying Drivers of Quality

Start by identify a patient cohort to analyze, preferably more than 25 patients.

Important to delineate patients with same disease and same characteristics

Good initial evaluation parameters- Prescription and tumor position, Examples...

- **Spine**- Rx, location (c-spine, t-spine, l-spine), tumor shape (horseshoe, paraspinal, donut, question mark)
- **Liver**- Rx, location (lateral, medial, middle)
- **Brain**- Location (right or left), Region (frontal, temporal, etc.)
Identifying Drivers of Quality

Ask questions that help define potential statistical relationships, i.e. Geometric and/or Anatomical.

- What are the important anatomical structures?
- Do any anatomical structures impose geometrical limitations?
- What are the difficulties or limitation during optimization?
- What makes one plan different than the other for the same site?

Identifying Drivers of Quality

Ask detailed questions that are disease specific:

- **Prostate:** What is the achievable dose gradient through the rectum?
- **Brain:** How can we reduce the volume of 30Gy? How can we make the integral dose as conformal as possible? What are the factors that influence the brain mean dose?
- **Lung:** What is the relationship between the tumor volume and lung volume and are these volumes correlated to the total lung mean dose?
- **Esophagus:** How do we reduce the heart dose? Does the tumor length impact the lung dose?
- **Spine:** What is the achievable dose gradient between the CTV and spinal cord?
Identifying Drivers of Quality

Are there ways to divide the anatomy or dosimetric relationships into components that help explain the dosimetric results?

- **Lung**: Uninvolved lung vs. Lung Dose & Lung Involvement vs. Mediastinal Involvement
- **Spine**: Cord position vs. CTV vs. Achievable dose gradient
- **Brain**: 30Gy planar symmetry vs. PTV
- **Esophagus**: Lung Dose vs. PTV border to Carina & Uninvolved Heart vs. Heart Dose.

Lung - % Uninvolved Lung

PTV divided into two components
- Mediastinal Involvement
- Treated Lung

**Mediastinal Structure** is defined by the tissue in the middle of the lungs and includes the heart, esophagus, major vessels/arteries, anterior vertebral body

**Uninvolved Ipsilateral Lung** is the amount of lung outside of the PTV
Spine – Achievable Dose Gradient

- A: Spinal Cord Diameter
- B: CTV to Cord distance
- Cord position correlated to % coverage

Brain – 3D Planar Measurements

Measure the distance from the PTV Border (Black) and the 30Gy Isodose line (Yellow) in all Planes.
Esophagus – Distance to Carina

DPC
Find the carina bifurcation.
Count the number of slices between superior border of PTV and carina. (+ inferior/ - superior)
DPC = No. of slices * slice thickness.

%UIH
PTV typically overlaps Heart.
Create a Heart – PTV structure.
%UIH = (Heart – PTV)/Heart Vol.

Patient Specific Benchmarks

Analyze the data and rank results based on prioritized parameters.

- Define benchmarks after data analysis of prioritized statistics.
- Benchmarks will help the treatment planner define if their plan is "optimal".
- Benchmarks should define the range of achievability.
- Can be segmented based on sub-categories.
% UIL correlated with ILMD

The ILMD correlated with TLMD

The ILMD correlated with 5Gy - 30Gy for Ipsi. Lung

Mediastinal Involvement (ccs) correlated with CLMD

The CLMD correlated with volumes of 5Gy - 20Gy Contra. Lung

\[
TLMD = Rx \times \left( 1.22 \times \frac{TxILV}{TLV} \right) + \left( (0.38 - 0.07 \times \text{Superior}) - (0.14 \times \text{Apex}) \right) \times \frac{IL-PTV}{TLV} + \left( 0.437 \times \frac{(Med/1000) + (0.04 \times V_{\text{Post}})}{CLV} \right) \times \frac{CLV}{TLV}
\]

Actual MLD (Gy) vs. Predicted MLD (Gy)
Correlation = 0.91, p-value < 0.001

Predicted MLD – Observed MLD (Gy)
Break down of absolute differences
Lung – Pt. Specific Benchmarks

IMRT Lung Estimator Statistical Model Validation

Actual vs. Predicted Total Lung Mean Dose Based on Statistical Model (Post Optimization)

- Mean Prescription: 66Gy → 70Gy (37%) > 70Gy
- Mean Total Lung Mean Dose: 18Gy → 18Gy
- Actual vs. Predicted Estimator Value: ~4 cGy (OE)
Spine – Pt. Specific Benchmarks

Dose Gradient Cord Expansion (mm) based on Dose Fall-off (Gy) (Rx- Cord Tolerance)

<table>
<thead>
<tr>
<th>Dose Fall-off</th>
<th>General Limitations</th>
<th>DG_Exp (mm)</th>
<th>DG_Cord (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Gy</td>
<td>10</td>
<td>8.10</td>
<td>5.10</td>
</tr>
<tr>
<td>2 Gy</td>
<td>12</td>
<td>6.95</td>
<td>6.95</td>
</tr>
<tr>
<td>3 Gy</td>
<td>14</td>
<td>7.90</td>
<td>7.90</td>
</tr>
<tr>
<td>5 Gy</td>
<td>16</td>
<td>6.90</td>
<td>6.90</td>
</tr>
</tbody>
</table>

Dose Gradient Cord Expansion (mm) = DG_Cord (mm) - (Fall-off (Gy) * 2 Gy)

Planning CTV (pCTV) = CTV – DG_Cord

pCTV Goal: > 97% coverage
Brain – Pt. Specific Benchmarks

Conformality Index

3D Planar Measurements

Esophagus – Pt. Specific Benchmarks

DPC (cm) & TLMD (cGy)

%UIH (%) & Heart Mean Dose (cGy)
Standardized Treatment Planning

Validate the consistency and robustness of the class solutions.

- Validate on cohort and evaluate if statistical improvement and consistency is evident.
- If the results are statistically better and robust from patient to patient, then the class solutions are finalized.
- Evaluating the effectiveness and efficiency of the class solutions in a clinical setting.
- 8-10 dosimetrist and physicist with varying degrees of experience planned 3 cases with and without the class solutions.
- Evaluated years of experience vs. plan quality and treatment planning time for each plan.
Lung – Class Solution

Equitable

Lung – Class Solution Impact

Photons
Lung Estimator Highlighted cases that were not fully optimized
Reoptimized all of the cases
Data was significantly more consistent
Average TLMD: 1817 → 1690 (-127)

Protons

<table>
<thead>
<tr>
<th>Original 18 Gy Cases</th>
<th>Reoptimized 18 Gy Cases</th>
<th>Difference 18 Gy Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLMD</td>
<td>ILMD</td>
<td>CLMD</td>
</tr>
<tr>
<td>8</td>
<td>116</td>
<td>114</td>
</tr>
<tr>
<td>11</td>
<td>186</td>
<td>160</td>
</tr>
<tr>
<td>14</td>
<td>190</td>
<td>193</td>
</tr>
<tr>
<td>4</td>
<td>387</td>
<td>369</td>
</tr>
<tr>
<td>9</td>
<td>159</td>
<td>174</td>
</tr>
<tr>
<td>18</td>
<td>361</td>
<td>260</td>
</tr>
<tr>
<td>17</td>
<td>320</td>
<td>234</td>
</tr>
<tr>
<td>Mean</td>
<td>1346</td>
<td>2720</td>
</tr>
</tbody>
</table>

| TLMD: -209 cGy | ILMD: -378 cGy | CLMD: -6 cGy |

Image Courtesy: © 2017 The University of Texas MD Anderson Cancer Center. All rights reserved.
**Spine – Class Solution Impact**

- Avg. Time Reduction = - 128.2 minutes
- Avg. MU Reduction = - 1703 MUs = - 2.8 minutes

**Brain – Class Solution Impact**
**Brain – Class Solution Impact**

- < 2 Months Experience
- **Total Lung**
  - Mean: -134 cGy
  - V5: -0%
  - V10: -4%
  - V20: -5.8%
- **Heart**
  - Mean: -81 cGy
  - V20: -2.3%
  - V30: -2.6%
  - V40: -2.6%
- **Liver**
  - Mean: -751 cGy
  - V30: -6.3%
  - V40: -1.4%

**Esophagus – Class Solution Impact**

- Cohort of patients randomly selected from clinical database
- Reoptimized blindly with class solutions, benchmark calculator, and objectives
- Compared Clinical Plans to Class Solution Plan

**Scatter Plot**

- Time (minutes)
- Dosimetrists Yrs of Experience

**Table**

<table>
<thead>
<tr>
<th>Scratch Plan</th>
<th>Mean 1</th>
<th>Mean 2</th>
<th>Mean 3</th>
<th>Mean 4</th>
<th>Mean 5</th>
<th>Heart Time</th>
<th>Mean 1</th>
<th>Mean 2</th>
<th>Mean 3</th>
<th>Mean 4</th>
<th>Mean 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Eye</td>
<td>132</td>
<td>136</td>
<td>135</td>
<td>134</td>
<td>133</td>
<td>40</td>
<td>-134</td>
<td>-81</td>
<td>-751</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R Eye</td>
<td>132</td>
<td>136</td>
<td>135</td>
<td>134</td>
<td>133</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bil Max</td>
<td>136</td>
<td>131</td>
<td>137</td>
<td>136</td>
<td>135</td>
<td>40</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Brain V5</td>
<td>136</td>
<td>137</td>
<td>136</td>
<td>136</td>
<td>135</td>
<td>40</td>
<td></td>
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<tr>
<td>Brain V20</td>
<td>136</td>
<td>137</td>
<td>136</td>
<td>136</td>
<td>135</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain V30</td>
<td>136</td>
<td>137</td>
<td>136</td>
<td>136</td>
<td>135</td>
<td>40</td>
<td></td>
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</tr>
</tbody>
</table>

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Continual Improvement

Conduct periodic post-implementation studies to measure effectiveness of class solutions.

- Evaluate patients that were treated with or without the class solutions after implementation.
- Periodically evaluate to see if benchmarks and or solutions need to be readdressed and/or improved.
- Investigate the clinical impact, ie dose escalation, survival, toxicity reduction.

Lung – Grade 3 Pneumonitis

- Evaluation of Treatment-related Pneumonitis Advanced Stage NSCLC
  - 151 Patients
  - Median Dose- 63Gy
  - Rate of Grade ≥ 3 TRP [3D-CRT- 32%, IMRT- 8%]

- New Study: 7 (8%) patients of 84 had Grade ≥ 3 Pneumonitis
- Lung Mean Dose Estimator used to to analyze plan quality
- Plans reoptimized to see if suggested objectives could be met
- Dose statistics reviewed for these patients
Lung – Grade 3 Pneumonitis

Potentially link between sub-optimal plans and G ≥ 3 Pneumonitis?

Average drop in ILMD -331 (Pop.: 85)

5 of the 7 had the largest drop in IL $V_{20}$: -11% (Pop.: -1.9%)

Other 2 patients had IL Vol. (cc) of 1013 & 1091 (Pop.: 1460)
Brain – Dose Escalation

- 57 Gy
- 90 Gy

Equitable

Esophagus – Dose Escalation

MDACC Patterns of Failure Study

- 15/66 (23%) pts failed in GTV
- 2/66 (3%) pts failed in CTV without GTV
- 1/66 (1.5%) pts failed in PTV only
- 4/66 (6%) pts failed outside PTV as site of first failure alone
- 2/66 (3%) failed outside PTV simultaneously with in-field failure.
- No patients failed in non-targeted esophagus
- Median dose at site of failure: 5250 cGy
## Esophagus – Dose Escalation

**Dose Volume Histogram**

<table>
<thead>
<tr>
<th>Organ</th>
<th>IMRT- SIB</th>
<th>VMAT- SIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver Mean</td>
<td>769</td>
<td>704</td>
</tr>
<tr>
<td>Heart Mean</td>
<td>1948</td>
<td>1839</td>
</tr>
<tr>
<td>Total Lung Mean</td>
<td>825</td>
<td>788</td>
</tr>
</tbody>
</table>

## Equitable

**Esophagus – Dose Escalation**

- **IMRT- SIB**: 63 Gy
- **VMAT- SIB**: 63 Gy
Summary

1. **Safe**: Knowledge and experience to design safe, effective, and deliverable treatment plans thus reducing toxicities and treatment errors.

2. **Effective**: Intimate knowledge of treatment planning challenges are key for driving improvement in quality.

3. **Patient-centered**: Utilization of patient specific constraints are key for developing personalized optimal plans.

4. **Equitable**: Benchmarks and metrics with standardized class solutions shift treatment planning focus to optimization, i.e. beating the benchmarks.

5. **Timely**:

6. **Efficient**:

Healthcare Disruptors

1. **Genetics & Gene Therapies**
   - Liquid Biopsies
   - CAR T-cell therapy
   - CRISPER

2. **Shifts in Site of Care**

3. **Artificial Intelligence (AI)**
Emerging AI in Radiation Oncology

1. Has not been fully exploited due to technical hurdles and hardware limitations in the past.

2. Increasing and promising applications of machine learning algorithms involving big data in Radiation Oncology due to recent developments in computer technology.

3. Goal is to expand personalized radiotherapy worldwide.

Reference: Frontiers, April 2018

Source: https://www.frontiersin.org/research-topics/6126/machine-learning-with-radiation-oncology-big-data
## Emerging AI in Radiation Oncology

Big Data in Radiation Oncology may include:

- Radiomics and quantitative imaging
- Knowledge-based treatment planning
- Treatment response prediction via machine learning
- Clinical decision support via machine learning
- Comparative effectiveness research in radiation oncology
- Bioinformatics for improved quality of care
- Motion compensation and correction via machine learning
- Automated image registration and contouring
- Radiogenomics
- TCP and NTCP modeling
- Cancer registries and classification
- Tracking big organ dose data for patient safety in radiation therapy
- Machine learning models for early cancer prediction and prevention
- Natural language processing of EMR data

1. In this study we compared individually-generated IMRT plans from RTOG 0539 to Automated Class Solution plans, blindly created for the same cohort.

2. We used multi-criteria (MCA) plan quality metrics for plan assessment and comparison approved by consensus by all MDs.

3. A total of 86 (45 Group II, 41 Group III) planning CT scans and associated ROI's were imported.

4. The CS plans were generated by 3 dosimetrists in an average of 27.8 minutes per plan to obtain a clinically acceptable plan that complied to protocol requirements.
Radonc Vendors – Artificial Intelligence

Timely

Varian and Ping An Sign Memorandum of Understanding to Expand Access to High Quality Cancer Care in China

Varian and Ping An Health have signed a memorandum of understanding to explore a strategic partnership for expanding access to cancer care at a local facility in Shenzhen, Guangdong, China. The companies will investigate the utilization of artificial intelligence, smart technology and big data to develop a cost-effective cancer care system for a greater number of people in China, and close to where they live.

Elika taps IBM Watson Health to bring AI to comprehensive oncology field

STOCKHOLM, January 30, 2018 – Elika (OTCQB: EIIQ) today announced that it is collaborating with IBM Watson Health, a part of IBM to deliver a comprehensive, AI-driven solution for oncology. Elika plans to roll out the IBM Watson for Oncology (https://www.ibm.com/watson/health/oncology) platform, which is built on Watson oncology software, in the later half of 2018. Under this agreement, Elika will roll out Watson for Oncology beginning in early 2018 as a clinical decision support solution for Elika’s digital oncology software, including the HealthSoft Oncology Information System. Elika also intends to offer both solutions in most markets around the world including the U.S., Brazil, certain major European and Asian markets, as well as in Latin America.
Non-Radonc Vendors Investing in AI

*Imaging, Contouring & Treatment Planning*

**Timely**

**Microsoft**

**Google**

**DeepMind Health**

**IBM Watson Health**

*Calculate patient-specific toxicity risks*
- Patient’s overall risk of toxicities
- Identifies a patient’s overall risk of toxicities and provides breakdown of risk for many common radiation toxicities associated with the given diagnosis.
- Risk is determined by an advanced predictive model trained on past plans that combines the patient’s attributes and medical history with the details of the current cancer diagnosis.
- Several plans are generated based on past plans with similar characteristics.
- Each plan has an assessment of toxicity and cure probabilities.
- Final checks are made to ensure that the planned is predicted to have high cure probabilities and low toxicity probabilities.

**Design personalized radiation treatment plans**

**Predict outcomes for proposed treatment plans**

*Artificial Intelligence + Clinical Decision Support*

*Precision Radiation Oncology: Predictive Analytics for Personalized Data-Driven Treatment Planning*
Radonc Value Based Models

1. PROMETHEUS Group & Roswell Park/Blue Cross
2. 21\textsuperscript{st} Century Oncology (TDABC)
3. United Healthcare & MDACC
4. University of Texas System, MDACC & BCBS-TX
5. CMS/CMMI
6. ASTRO

ASTRO RO-APM Timeline

- Stakeholder meeting re: Revised RO-APM Concept
- Meeting with CMMI re: Revised RO-APM Concept
- Participated in CMMI Stakeholder meeting
- Submitted RO-APM Concept Paper
- CMMI Issues Episode Alternative Payment Model for Radiation Therapy Services

2015
- ASTRO APM Work Group
  - PAMPA Passage – Froze rates thru 2018 and required CMMI to report on RO-APM

2016
- Stakeholder meeting re: RO-APM Concept
- CMMI meeting re: RO-APM Concept

2017

Courtesy: Anne Hubbard, ASTRO Director of Health Policy
ASTRO RO-APM

Guideline-Driven Radiation Oncology APM

- Guidelines adherence will improve quality and reduce unnecessary care and waste
  - ASTRO and NCCN guidelines, as well as Choosing Wisely guidance
- Standard APM payment framework applicable to all disease sites
- Applicable in Freestanding and Hospital Based Settings
- Quality Measures
  - MIPS Radiation Oncology Measures Set
  - APEX Accreditation or equivalent standards
  - Measures that determine compliance with guidelines
- Certified Electronic Health Records Technology

Courtesy: Anne Hubbard, ASTRO Director of Health Policy

ASTRO RO-APM

ASTRO APM Payment Framework

Define Disease Group and Episode
- Disease site
- Include all XRT services
- Establish standard regimen options


Apply adjustment for geographic & practice variation

Apply a 3% discount

Medicare’s Target Price

Prospectively Paid to Radiation Oncologist at onset of Episode
ASTRO RO-APM

RO-APM – Key Components

- Designed to protect access to care and improve quality of care
- Stabilizes payment rates over a five year period
- Voluntary alternative to MIPS
- Provides Radiation Oncologists with an opportunity to actively participate in an APM
- Aligns with OCM
- Awards 5% Advanced APM participation bonus

APM Summary

1. APM should be as inclusive and operate as simple as possible
2. Build evidence-based/consensus-based clinical guidelines for all radiation oncology cases
3. Quality measures should emphasize process & outcomes
4. Payment schedule includes all common cancer diagnoses and services
5. Agreements with multi-year terms with annual payer-provider reviews

Constantine Mantz Chief Medical Officer 21st Century Oncology
## APM Summary

1. Utilization is assessed against contractual benchmarks (based on NCCN and other ASTRO guidelines) to evaluate for appropriate resource utilization
2. Any new radiotherapy services are considered annually for inclusion
3. Physicians are in the best position to develop APMs that will promote care quality and efficient resource utilization
4. **Operational Efficiencies** - to reduce existing administrative and direct practice and improve revenue cycles times and payment predictability

---

## Importance of Operational Cost w/ APMs

1. How much does it cost to deliver 1 fraction?
2. Why? Defines Value to the provider/center, to the patient and to the healthcare system
Time Driven Activity Based Costing

TDABC Project Strategy

- Divide Division
  - Decide how to split up the Division into pieces
  - (Clinical Service, Treatment Modality, Diagnosis, etc.)

- Plan
  - Detailed Project Plan with tasks and dates for each of the pieces

- Pre Work
  - General Process Map for each piece

- Edit Map
  - Meet with multidisciplinary group of people who do the work and edit process map

- Validate Map
  - Validate the specific map with the corresponding team

- Resources
  - Assign Labor Resources to each task

Courtesy: Ben Frank, Provision & Nick Olivieri, MDACC
TDABC Process Map Example

1. Delineate OARs
2. Physics Consult
3. Primary Treatment Planning
4. Proton Physics Check
5. Preliminary Evaluation and Approval
6. Request IMRT / VMAT / Proton QA
7. Generate POF (Dark Room)
8. Generate Independent MU Check
9. Setup for IGRT / Motion Management
10. Final Dosi Checks and Edits
11. Transfer Plan Parameters and Images to Mosaic
12. Setup Mosaic Parameters (Trt. Cal., QCL, etc.)
13. Reschedule Weekly Ses (when appropriate)
14. Sign and Date Rx and Plan
15. Final Coordination of Txt Scheduling
16. Clinical Trial Documentation

Efficient

TDABC Resources, Time, and Cost

Create Process Map → Calculate Resources → Enter Data Into Master File → Repeat for Each Process

Drop In

All Modalities

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<th>Process Step Frequency</th>
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<th>Resources Frequency</th>
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<th>Max Time</th>
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Efficient: Courtesy: Ben Frank, Provision & Nick Olivieri, MDACC

TDABC Resources, Time, and Cost: Courtesy: Ben Frank, Provision & Nick Olivieri, MDACC
What if Scenarios

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| TDABC Application |

Comparative costs of advanced proton and photon radiation therapies: lessons from time-driven activity-based costing in head and neck cancer

*Understanding protons costs will become even more important as healthcare shifts transition to value-based purchasing.

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The Value of a Dosimetrist

1. Healthcare is changing
2. Dosimetrists are central to radiation oncology
3. Dosimetrist's role in safety, quality, and process improvement are key to value
4. Embrace change and contribute to the solutions
5. Demonstrate your value
6. Important to position the field now for the future

Advancing the Dosimetry Profession

1. Perfect Position to be Radiation Oncology Physician Assistant
2. Clinical Education & Background Foundation
3. Technology and trends are changing in RO (SBRT/Hypofractionation, Imaging, Automation, AI)
4. Hospitals and Physicians want to reduce their administrative burden (contouring, image review, treatment planning, etc.) to focus on clinical care.
5. Insurance burden is increasing for all types of treatments
Clinic Program Manager

- Requires strong clinical oncology, dosimetry, and insurance (not necessary) background in order to be an advocate during the insurance authorization process.
- Management of the team during the insurance authorization process from start to finish.
- The physicians’ primary administrative point of contact.
- Work closely with the physician to develop a clinical strategy and advocacy for each patient.
- Perform or provide advice for Peer-to-Peers
- Involved in health policy initiatives with state commissioners and employer based plans.

Clinic Program Manager

- Receive Insurance 101 training
- Learning the keys for success for a hospital in a pay for value environment
- Additional responsibilities in development:
  - Attend new patient clinics
  - Assistance w/ physician documentation (draft consult note)
  - Comparative planning for insurance purposes
Clinic Program Manager Impact

Closing Remarks

1. Valuable clinical knowledge that can’t be replaced
2. Key position in the radiation oncology workflow
3. Responsible for Outcomes
4. Innovators
5. Analytical
6. Focused on Safety and Quality
Conclusions

Dosimetrists have all the skills to be successful in a value based healthcare environment!

Participate in quality and new technology initiatives to show your value!

Support change, new technology, innovation, automation so you are part of the solution!

AAMD

Recommendation- Plan for the future now!
Develop Professional Growth and Educational Models for a future Advanced Practice Dosimetrist role.

Questions?

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mpalmer@mdanderson.org