Quality and safety analytics as a pathway to evidence-based therapy practice

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Disclosures

• AHRQ R18 HS022204-01
• NCI UG3 CA211310-01
Adherence to best practices
PRACTICAL Radiation Oncology Physics

A Companion to
GUNDERSON TEPPER’S
CLINICAL RADIATION ONCOLOGY

Sonja Dieterich, Ph.D.
Eric Ford, Ph.D.
Daniel Pevard, MS, DABR
Jing Zeng, MD

ELSEVIER
Examples: Good adherence

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosimetry equipment is calibrated every two years by an accredited dosimetry calibration laboratory.</td>
<td>1.03</td>
</tr>
<tr>
<td>Pre-treatment patient-specific dose verification is performed for IMRT QA</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Original Report

Patterns of practice for safety-critical processes in radiation oncology in the United States from the AAPM safety profile assessment survey

Eric C. Ford PhD\textsuperscript{a,\,*}, Derek Brown PhD\textsuperscript{b}, Holly Donaldson MPH\textsuperscript{c}, Anne Greener PhD\textsuperscript{d}, Michael O’Neill MD\textsuperscript{e}, Steven Sutlief PhD\textsuperscript{b}, Michael Woodward\textsuperscript{f}, Ellen Yorke PhD\textsuperscript{g}, Peter Dunscombe PhD\textsuperscript{h}
What is Medical Physics 3.0?
Redefining and Reinvigorating the Role of Physics in Modern Medicine
QA circa 2017
Institutional patient-specific intensity-modulated radiation therapy quality assurance does not predict unacceptable plan delivery as measured by IROC Houston’s head and neck phantom

Stephen F. Kry, PhD, Andrea Molineu, MS, James Kerns, MS, Austin Faught, Jessie Y. Huang, Kiley Pulliam, MS, Jackie Tonigan, MS, Paola Alvarez, MS, Francesco Stingo, PhD, and David S. Followill, PhD

1IROC Houston, Department of Radiation Physics, The University of Texas MD Anderson Cancer Center, Houston, Texas
2The University of Texas Health Science Center Houston, Graduate School of Biomedical Sciences, Houston, Texas
3Department of Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, Texas
Figure 5.
ROC curves for the ion chamber (a), film (b), and MapCheck (c), devices, indicating the...
Quality & Safety Analytics

**Practical Tools**

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<th>Task</th>
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Carlone et al., Med Phys, 40, 042103 (2013)
## Quality & Safety Analytics

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Risk Matrix

- Occurrence: Miscommunication about repeat irradiation case.
- Severity: Wrong treatment location
### FMEA Risk Priority Number

The Risk Priority Number (RPN) is calculated using the formula:

\[ RPN = S \times O \times D \]

- **S** (Severity): How severe the consequence of the failure would be if it occurs.
- **O** (Occurrence): How likely the failure would occur.
- **D** (Detectability): How likely the failure would be detected if it occurs.

The diagram illustrates the relationship between these factors in a 3D space, with severity on one axis, occurrence on another, and detectability on the third.
The report of Task Group 100 of the AAPM: Application of risk analysis methods to radiation therapy quality management

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+ 10 institutional series reports dating back to 2009
FMEA of New(ish) SBRT service

Yang et al. Med Phys, 42(6), 2777-2785, 2015
# FMEA of New(ish) SBRT service

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Severity</th>
<th>Occurrence</th>
<th>Detectability</th>
<th>RPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscommunication about repeat treatment case</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>294</td>
</tr>
<tr>
<td>Wrong treatment location. Human error in identifying location in imaging system.</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>96</td>
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<td>Plan review</td>
<td>Plan quality metrics</td>
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<td></td>
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Pre-treatment IMRT QA
Online CT: check by physician
Port films: check by therapist
Timeout by the therapist
Port films: check by physician
In vivo diode measurements
Checklist
Chart rounds
Online CT: check by therapist
SSD check
Online CT: check by physician
Pre-treatment IMRT QA

Efficacy of Physics Plan Review

Gopan et al. Med Phys 2016
Plan Quality

H&N

Clinical plan
Parotid DVH
Replan

Wu et al. Med Phys, 36, 5497 (2009)

Prostate

$\Delta NTCP_{LO} = 13.3\%$

Gr. 2+ Rectal NTCP

“low-quality” plans

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<td>Safety-profile, accreditation</td>
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Potential risks associated with the introduction of new clinical systems and processes are assessed prior to implementation.

Physician peer review of new treatment plans occurs within the first week of treatment.

The Radiation Oncology Department formally reviews reports of near-misses.

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<td>Potential risks associated with the introduction of new clinical systems and processes are assessed prior to implementation.</td>
<td>2.34</td>
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<tr>
<td>Physician peer review of new treatment plans occurs within the first week of treatment.</td>
<td>2.43</td>
</tr>
<tr>
<td>The Radiation Oncology Department formally reviews reports of near-misses.</td>
<td>2.59</td>
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Examples: Less adherence
The RO-ILS mission is to facilitate safer and higher quality care in radiation oncology by providing a mechanism for shared learning in a secure and non-punitive environment.

Launched: June 2014
Measuring health of your ILS system

Goal: high reporting volume!

Reports per month vs. Months elapsed

Nyflot et al. Prac Rad Onc 2015
Measuring health of your ILS system

- Engagement across professional groups

Nyflot et al. Prac Rad Onc 2015
Measuring health of your ILS system

Nyflo et al. Prac Rad Onc 2015
Measuring health of your ILS system

- 85% of reports come from three people
- 8 people have submitted <8 reports in 2 years
Where are errors occurring, being identified?

Things you don’t know

Things you know
Safety Profile Assessment

92 questions
4 topic areas

- Institutional Culture
- Quality management
- Managing change and innovation
- Performance indicators
Conclusions
As important to assess what you’re do as it is to do it!
Acknowledgments

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Michael Gensheimer, MD
Aaron Kusano, MD
Casey Bojchecko, PhD
Alan Kalet, PhD
Mark Phillips, PhD
Joshua Carlson
Olga Gopan, PhD
Matt Nyflot, PhD
Jing Zeng, MD
Ralph Ermoian, MD
Gabrielle Kane, MD