Continuous Safety Improvement
Through Incident Learning

Lulu Jordan B.S. R.T.(T) & Josh Carlson B.S.
No Disclosure Statement

AAMD Annual Meeting
Disclosure: Lulu Jordan B.S. R.T.(T) & Josh Carlson B.S.

With respect to the following presentation, there has been no relevant (direct or indirect) financial relationship between the party listed above (and/or spouse/partner) and any for-profit company in the past 24 months which could be considered a conflict of interest.
Why study near misses?

1. Improve patient care
2. Improve operations
3. Provides an administrative metric
4. Recommended at the society-level
Noncompliance with radiotherapy (RT) protocol guidelines has been linked to inferior clinical outcomes. We performed a meta-analysis of cooperative group trials to examine the association between RT quality assurance (QA) deviations and disease control and overall survival (OS).
Patient Care

Seriously non-compliant (12% of plans)

Peters et al. JCO, 28(18), 2996, 2010
NUMBER OF REPORTS vs. NUMER of patient safety incidents

\[ R^2 = -0.33 \quad p<0.001 \]
Improved Operations

- Complex technology
- Complex process

Improved Operations

[Logos of various companies: Cerner, Epic, Elekta CMS Software, MOSAIQ, Prism RTP system, MIM Software, RayStation, Pinnacle3]
Administrative Metrics

Near Miss Reports

2014

- Dosimetrist: 46%
- Therapist: 24%
- Physicist: 23%
- Attending Physician: 6%
- Other*: 1%

Graphs showing incident count and average NMSI for the year 2014.
Societal Recommendations

• **AAMD Ethical Standards**
  A CMD shall always promote the safety and welfare of his or her patients by performing medical dosimetry procedures safely and with reasonable skill...

• **ASTRO report 2012**
  Safety is No Accident: A Framework for Quality Radiation Oncology and Care. Zeitman A, Palta J, Steinberg M. ASTRO; 2012

• **AAPM white-paper 2012**

• **ASRT safety white-paper**
Societal examples

Aviation

Nuclear power

Manufacturing

Healthcare

ACCIDENTS
IN NORTH AMERICAN MOUNTAINEERING 2012

Climbing
Why track near-misses and incidents?

FALL ON ROCK, ANCHOR FAILURE – UNFINISHED KNOT
Virginia, Blue Ridge Parkway, Ravens Roost,
During the mid-afternoon on June 15, Jonathan Sullivan (20) fell approximately 100 feet to his death at Ravens Roost Overlook along the Blue Ridge Parkway.

He and two partners had been top-rope climbing since 11:30 a.m. The group was top-roping. Sullivan made it about 100 feet when he paused to rest before the fall. Each had taken falls throughout the day and the top-rope system had functioned properly.

Analysis
According to reports, it was Sullivan’s first day climbing outdoors. Investigators said the probable cause of the fall was the failure of a knot securing the one-inch tubular webbing anchor sling. The single sling anchor (non-redundant) extended from a large tree to the cliff edge. Evidence suggested that the person constructing the top rope anchor placed a “temporary” knot or hitch in the webbing to hold it in place but became distracted and never finished tying the knot to complete the anchor. Amazingly, others climbed and were lowered on the route without incident throughout the day. This incident illustrates the importance of a redundant anchor system and the need to check the anchor prior to climbing. (Source: Tony Gonzalez – on www2.wsls.com/news and Kurt Speers – Blue Ridge Parkway)
Each department should have a department-wide review committee which monitors quality problems, near-misses and errors.

Employees should be encouraged to report both errors and near-misses.

Near-misses should be addressed with a similar vigor as that applied to errors, and reported through the Quality Assurance Committee.

Zietman et al. 2012
Quality/Safety Improvement

ACT

PLAN

STUDY

DO

W. Edwards Deming
Active incident learning improves the culture of safety
Why study near misses at the University of Washington?

• Why are we depending on the Radiation Therapists to be the gatekeepers?
• Do we really want to wait that late in the process to keep the patient safe?
• Why isn’t staff getting feedback when near misses happen?
RT Process Map

- Complex process
- Complex technology

“Swiss Cheese” model of accidents
University of Washington
Near Miss program

• Establish leadership support
• Assess your Safety Culture
• What should be reported?
• How will you collect the Data?
• How will you review incidents?
• How will you give feedback?
• How are we doing after 2 years
University of Washington Near Miss program

- Establish leadership support
- Assess your Safety Culture
- What should be reported?
- How will you collect the Data?
- How will you review incidents?
- How will you give feedback?
- How are we doing after 2 year
University of Washington Near Miss program

- Hospital Leadership
- Physician Leadership-CSI Seattle
- Multidisciplinary team
  - Medical Director
  - Physicist
  - Technical Manager
  - IT Manager
  - Nursing Manager
  - Resident
University of Washington Near Miss program

• Establish leadership support
• Assess your Safety Culture
• What should be reported?
• How will you collect the Data?
• How will you review incidents?
• How will you give feedback?
• How are we doing after 2 year
Tools for measuring your safety culture

• Agency for Healthcare Research and Quality

Hospital Survey on Patient Safety Culture.
Medical Office Survey on Patient Safety Culture

• AAPM Task Group on Prevention of Errors
  Safety Profile Assessment
Department Safety Survey

- Combined AHRQ and Johns Hopkins questions.
- Conducted: February 1 to March 1, 2012
- Encouraged all staff to participate through emails, meetings and 1/1 rounding.
- 78% response rate
# CSI Meeting

## 2012

Total responses (N): 68 Did not respond: 0

<table>
<thead>
<tr>
<th>Numeric value</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Administrative Assistant/Fiscal Specialist</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>Administration/Management</td>
<td>4</td>
<td>5.88%</td>
</tr>
<tr>
<td>3</td>
<td>Attending/Staff Physician</td>
<td>6</td>
<td>8.82%</td>
</tr>
<tr>
<td>4</td>
<td>Dietician / Social worker</td>
<td>1</td>
<td>1.47%</td>
</tr>
<tr>
<td>5</td>
<td>Dosimetrist</td>
<td>4</td>
<td>5.88%</td>
</tr>
<tr>
<td>6</td>
<td>MA</td>
<td>2</td>
<td>2.94%</td>
</tr>
<tr>
<td>7</td>
<td>Physician Assistant/Nurse Practitioner</td>
<td>1</td>
<td>1.47%</td>
</tr>
<tr>
<td>8</td>
<td>PSS/PCC</td>
<td>7</td>
<td>10.29%</td>
</tr>
<tr>
<td>9</td>
<td>Physicist</td>
<td>9</td>
<td>13.24%</td>
</tr>
<tr>
<td>10</td>
<td>Radiation therapist</td>
<td>18</td>
<td>26.47%</td>
</tr>
<tr>
<td>11</td>
<td>Registered Nurse</td>
<td>5</td>
<td>7.35%</td>
</tr>
<tr>
<td>12</td>
<td>Resident Physician/Physician in Training</td>
<td>7</td>
<td>10.29%</td>
</tr>
<tr>
<td>13</td>
<td>Other:</td>
<td>4</td>
<td>5.88%</td>
</tr>
</tbody>
</table>
Self Assessed Patient Safety Grade

Overall Patient Safety Grade

A=EXCELLENT
B=VERY GOOD
C=ACCEPTABLE
D=POOR
E=FAILING

AHRQ (%)
UWMC (2012)
Barriers to Reporting

Error Reporting Concerns (2012)

- Effect on Department Reputation: 31%
- Provoking Retribution from Colleagues: 35%
- Embarrassment in Front of Colleagues: 37%
- Admitting Liability: 25%
- Getting My Colleagues in Trouble: 49%
- Departmental or Professional Sanctions: 34%
### Similar Results to AHRQ

<table>
<thead>
<tr>
<th>Statement</th>
<th>UWMC 2012 (%)</th>
<th>AHRQ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEN AN EVENT IS REPORTED, IT FEELS LIKE THE PERSON IS BEING WRITTEN UP, NOT THE PROBLEM.</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>PATIENT SAFETY IS NEVER SACRIFICED TO GET MORE WORK DONE</td>
<td>59</td>
<td>64</td>
</tr>
<tr>
<td>WHEN A LOT OF WORK NEEDS TO GET DONE QUICKLY, WE WORK TOGETHER AS A TEAM TO GET WORK DONE</td>
<td>88</td>
<td>86</td>
</tr>
</tbody>
</table>

*UWMC 2012 (%) and AHRQ (%) indicate the percentage of respondents who agree with the statements.*
Sources of Error

<table>
<thead>
<tr>
<th>Source of Error</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOO HIGH A WORKLOAD</td>
<td>19</td>
</tr>
<tr>
<td>INSUFFICIENT TRAINING</td>
<td>12</td>
</tr>
<tr>
<td>TECHNICAL FAILURES (HARDWARE AND SOFTWARE)</td>
<td>12</td>
</tr>
<tr>
<td>FAILURE TO FOLLOW STANDARD OPERATING PROCEDURES</td>
<td>16</td>
</tr>
<tr>
<td>COMMUNICATION FAILURE</td>
<td>55</td>
</tr>
</tbody>
</table>

Percentage (%)
University of Washington
Near Miss program

- Establish leadership support
- Assess your Safety Culture
- What should be reported?
- How will you collect the Data?
- How will you review incidents?
- How will you give feedback?
- How are we doing after 2 year
University of Washington
Near Miss program

• **What should be reported?**

• Everything

• Near miss data is important for patient safety

• “Employees should be encouraged to report both errors and near-misses.”
Who should use the system?
• Everyone in the department

Why put in a near-miss report?

... Why NOT
“GPS made me do it”

KOMO4 news, June 15th, 2011
“GPS made me do it”

KOMO4 news, June 15th, 2011
What should I report?

A few examples:
• Contrast not ordered.
• Patient not given proper prep information for simulation.
• Set-up instructions from simulation not complete.
• Nursing handoff to floors. Medication documentation.
• Use of wrong CT data set in Pinnacle (e.g. multiple scans).
• Wrong trial transferred from Pinnacle to Mosaiq.
• Wrong shift at machine. Setup to wrong marks.
University of Washington
Near Miss program

• Establish leadership support
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Near Miss Documentation

Patient Name: John Doe

Date of Discovery: 2/10/12

Staff Involved: Joanne A. Howard CMD

What Happened:
I planned the IMRT portion of his treatment for the resection & it should have been planned for the surgery. C. Steve noted this when he was doing the QA. I fixed everything on Monday 2/18/12.

Suggestions for prevention:
Check the beam spreadsheet to make sure that all the machines match & add this to my checklist that I have.
Electronic CSI report system

- Rolled out Feb 16th 2012
CSI=Near Miss
University of Washington
Near Miss program

• Establish leadership support
• Assess your Safety Culture
• What should be reported?
• How will you collect the Data?
• How will you review incidents?
• How will you give feedback?
• How are we doing after 2 years
Weekly CSI Review

• Safety Committee
  – Medical director
  – Physicist
  – Technical Manager
  – IT Manager
  - Nurse Manager
  - Resident
  - Dosimetrist
  - Chief Therapist

• CSI submissions range from 10-40 items.

• Tag, set severity level

• Triage for root cause analysis.
Pathway of a Report

Report Submitted <1 min → Supervisor Review ~15 min → Safety Committee Review 1 hour / week

Apparent cause and track → Root-cause Analysis ~5 hours

Implement Corrective Actions → CSI meeting
<table>
<thead>
<tr>
<th>Incident_ID</th>
<th>Report_DtTm</th>
<th>Title</th>
<th>MyStatus</th>
<th>MRN</th>
<th>LastName</th>
<th>FirstName</th>
<th>assignedTo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1479</td>
<td>9/6/2013 9:37 AM</td>
<td>Drs not sent to MQ for VSIM</td>
<td>Act</td>
<td></td>
<td></td>
<td>Ford</td>
<td></td>
</tr>
<tr>
<td>1480</td>
<td>9/6/2013 11:30 AM</td>
<td>Physician availability</td>
<td>Act</td>
<td></td>
<td></td>
<td>Kane</td>
<td></td>
</tr>
<tr>
<td>1481</td>
<td>9/6/2013 5:41 PM</td>
<td>Density override for skin structure skin outside n</td>
<td>Act</td>
<td></td>
<td></td>
<td>Sponseller</td>
<td></td>
</tr>
<tr>
<td>1482</td>
<td>9/9/2013 10:43 AM</td>
<td>Iso pair fields created by dosi were 18K. Verified</td>
<td>Act</td>
<td></td>
<td></td>
<td>Sponseller</td>
<td></td>
</tr>
<tr>
<td>1483</td>
<td>9/9/2013 11:03 AM</td>
<td>The way these decub TBI beams are created, we have</td>
<td>Act</td>
<td></td>
<td></td>
<td>Ford</td>
<td></td>
</tr>
<tr>
<td>1484</td>
<td>9/9/2013 2:04 PM</td>
<td>Pt was 1 hour late getting into the sim from clinic</td>
<td>Act</td>
<td></td>
<td></td>
<td>Kane</td>
<td></td>
</tr>
<tr>
<td>1485</td>
<td>9/9/2013 3:20 PM</td>
<td>No setup Photos taken</td>
<td>Act</td>
<td></td>
<td></td>
<td>Holland</td>
<td></td>
</tr>
<tr>
<td>1486</td>
<td>9/9/2013 3:32 PM</td>
<td>Iso pair fields created by dosi at 18 MV instead of</td>
<td>Act</td>
<td></td>
<td></td>
<td>Unassigned</td>
<td></td>
</tr>
<tr>
<td>1487</td>
<td>9/10/2013 8:58 AM</td>
<td>The pentaguide data needed to perform my CBCT warm</td>
<td>Act</td>
<td></td>
<td></td>
<td>Unassigned</td>
<td></td>
</tr>
</tbody>
</table>
445  Carina contour on wrong dataset

Assigned To: nyfot

Status: Complete

Category Tags
#CBCT #ChecklistDosi #PriorTx #RCA #StandardPlan #WrongDataset

Severity: 1 - Not Assigned
Near Miss Rating: 4 - Critical
Where Originated: 1.2 - Diagnosis definition inclu
Where Found: 5.10 - Image-guided verification

9/10/2012 1:01:26 PM - howajosh: Pt had critical structures contoured on the wrong data set. The critical structures were recomputed on the right data set. Everything was sent to the machine for treatment. I got called to the machine to look at a CBCT on the pts first treatment. The carina contour didnt match. I give a lot of props to the therapist who were on the machine for not using the contour and looking at the anatomy of the pt. I went back to look over the plan and the carina had be contoured on a different data set. I corrected this and resent the carina.-JH

9/13/2012 12:25:11 PM - eford: Reviewed at CSI. Matt and LULU to look at possible RCA.

10/10/2012 4:34:15 PM - nyfot: Discussed at CSI meeting
Safety Principles

- **Automate** when appropriate – include use of forcing functions
- **Standardize** – reduce reliance on memory
- **Use checklists**
- **Reduce** the number of steps and handoffs
- **Add redundancy** (double checks) for high risk processes

*Institute for safe medical practices*
RCA Overview

• Identify teams
• Gather data and formulate a chronology.
• Investigate the timeline of the incident
  • Interview involved staff
  • recording all relevant information..
  • Pull data as needed from Mosaiq, Pinnacle, and other clinical computer systems.
  • Do not “troubleshoot” at this point. “… Just the facts, Ma’am”.
• Identify Care Delivery Problems (what went wrong)
• Identify contributory factors
• Develop action plan
Incident Learning Root Cause Analysis

Incident report: __141__
Patient Name: __see incident sheet_
Incident title: __CT origin Taken off after iso center marked_
Report date: __5/29/2012__
Investigative team: Lulu Jordan, Aaron Kusano, Josh Howard

Instructions:

Note: __Root-cause analysis approach based on the “London Protocol” (see Sally Taylor-Adams, Charles Vincent, et al. Imperial College of London).__

1. Identify team
2. Gather data and formulate a chronology.
   - Investigate the timeline of the incident, recording all relevant information. Interview involved staff. Pull data as needed from Mosaiq, Pinnacle, and other clinical computer systems. Do not “troubleshoot” at this point. “…just the facts, Ma’am”.
3. Identify Care Delivery Problems (what went wrong) and Contributory Factors (why it went wrong)
4. Identify contributory factors on causality table from AAPM
5. Develop action plan

2. Chronology:

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Staff involved</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/26/2012</td>
<td>Sim(MR)</td>
<td>CT sim of patient of spine. CT origin set and marked on skin in blue. Isocenter picked and marked on skin in black.</td>
</tr>
<tr>
<td></td>
<td>Sim</td>
<td>CT origin erased from patients skin per protocol as pt had iso center marked. Drs. not aware that CT origin was erased.</td>
</tr>
<tr>
<td></td>
<td>Volumes/phy</td>
<td>When planning, it was seen that the initially chosen iso center would not allow for coverage of inferior portion of disease to be encompassed in one field. Drs. moved iso center so that everything could be encompassed in one field. <strong>Drs not completely certain but thought this was discussed with therapy team</strong></td>
</tr>
<tr>
<td></td>
<td>Dosimetry (JH)</td>
<td>Patient planned according to new iso center with shifts from CT origin</td>
</tr>
</tbody>
</table>
|           | Treatment      | Therapists discussed with SIM team about marking the iso (meaning new iso), SIM commented that iso had already been marked (old iso). When filmed it become clear that there was a discrepancy at the time that IMPAC was checked it was not entirely clear what source of discrepancy
Physician present and observed film, after phone discussion with dosimetry the confusion about old/new iso was identified. It was discovered that the CT origin was erased. Shifts had to be determined from Original iso center, correct field treated.

Note: Types are TASK, TEAM, ORGANIZATIONAL/MANAGEMENT, PATIENT, INDIVIDUAL, ENVIRONMENT

### 3. Care delivery problems and contributory factors

<table>
<thead>
<tr>
<th>Type</th>
<th>Care Delivery Problem (what)</th>
<th>Contributory Factors (why)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>Iso center changed during planning</td>
<td>Not all of the tumor was covered</td>
</tr>
<tr>
<td>Task</td>
<td>CT Origin was erased</td>
<td>Typical process when iso set in sim is to erase ct origin</td>
</tr>
<tr>
<td>Team</td>
<td>Communication</td>
<td>Physician did not communicate iso change</td>
</tr>
</tbody>
</table>
1. Organizational Management
   a. Planning for program maintenance/expansion
      i. Inadequate Human Resources
         1. Inconsistent with prof. recommendations
         2. Inconsistent with vendor specs
         3. Inconsistent with regulations
         4. No provision for more activities
   b. Policies, Procedures, Regulations
      i. Relevant policy nonexistent
         1. Policy not implemented
         2. Policy inadequate
         3. Policy not followed
         4. External regulation not followed
         5. Conflicting policies.
   b. Training
      i. Facility training inadequate
      ii. Vendor provided training inadequate
      iii. Inadequate assessment of staff competencies
      iv. Lack of continuing education
   c. Communication
      i. Poor, incomplete, unclear or missing
      ii. Inadequate communication patterns designed
      iii. Inappropriate or misdirected communication
      iv. Failure to request needed information
      v. Medical records/incorrect/incomplete/absent
      vi. Lack of timeliness
      vii. External factors
      viii. Verbal instructions inconsistent w/ doc/n't
   d. Physical Environment
      i. Physical environment inadequate
      ii. Distractions
      iii. Interruptions
   e. Leadership and external issues
      i. Inadequate safety culture
      ii. Failure to remedy past known shortcomings
      iii. Environment not conducive to safety
      iv. Hostile work environment
      v. Inadequate supervision
      v. Lack of peer review

2. Technical
   a. Acceptance testing and commissioning
      i. Not following explicit referral to best-practice documents (AAPM TG reports, ASTRO, ACR, IPEM, COMP, etc.)
      ii. Lack of independent review
      iii. Lack of review of pre-existing reports
      iv. Lack of effective documentation (vendor or self)
   b. Equipment design and construction issues
      i. Inadequate policies and procedures for quality assurance and quality control
      ii. Poor human factors engineering
      iii. Interoperability problem
      iv. Networking problems (IT)
      v. Software operation failure
      vi. Poor construction (physical)
   c. Equipment maintenance issues
      i. Failure to report problems to vendor
      ii. Failure to follow vendor notices (field change orders)
      iii. Failure to provide adequate preventive maintenance
      iv. Failure on the vendor’s part to share failure/safety issues in a timely manner
      v. Unavailability of local and field support as needed
   d. Environment (within the facility)
      i. Ergonomics (room layout, equipment setup)
      ii. Machine collision issues (room specific)
      iii. Environment (water, HVAC, electrical, gas)
      iv. IT infrastructure and networking issues (including compliance to expected security and capacity standards)
      v. Delay in corrective actions for facility problems

3. Human behavior involving staff
   a. Acting outside one’s scope of practice
   b. Slip causing physical error (failure in performance of highly developed skills as intended or maintained)
   c. Poor judgment (e.g., failure to carry out quality control on a patient due to time limitation)
   d. Language and comprehension issues
   e. Intentional rule violations (sabotage/criminal acts, criminal intent, intentional violation)
   f. Negligence (risk behavior, poor judgment in failure to address issues or extreme demands, lack of vigilance, recklessness)

4. Patient focused circumstances
   a. Misleading representation
   b. Cognitive performance issues
   c. Non-compliance
   d. Language issues and comprehension
   e. Patient medical condition (inability to be positioned or remain still)

5. External Factors (beyond Facility Control)
   a. Natural environment
   b. Hazards

6. Procedural issues
   a. Failure to detect a developing problem
      i. Environmental masking
      ii. Distraction
      iii. Loss of attention
      iv. Lack of information
   b. Failure to interpret the nature of the developing problem
      i. Inadequate search
      ii. Missing information
      iii. Incorrect information
      iv. Expectation Bias
   c. Failure to select the correct rule to address problem
      i. Incomplete or faulty rule
      ii. Old or invalid rule
      iii. Misapplication of a rule
         1. Similarity bias/Stereotype fixation
         2. Familiar pattern not recognized
         3. Familiar association short-cut
   d. Failure to develop an effective plan
      i. Information not seen or sought
      ii. Inappropriate assumptions
      iii. Information misinterpreted
      iv. Side effects not adequately considered
      v. Mistaken options
   e. Failure to execute the planned action
      i. Stereotype take-over/faulty triggering
      ii. Plan forgotten in progress
      iii. Plan misinterpreted
      iv. Plan too complicated (bounded reality)

7. Other
University of Washington Near Miss program

• Establish leadership support
• Assess your Safety Culture
• What should be reported?
• How will you collect the Data?
• How will you review incidents?
• How will you give feedback?
• How are we doing after 2 years
Feedback

• Staff meetings/process improvement meetings
  – Reminders
  – Policies
  – Procedures Task forces
• Monthly Continuous Safety Improvement meeting
  - Topics/trends
  - RCAs
  - Successes
• Compression plate to limit breathing motion
• Used for SBRT
• Important settings:
  size of plate, number on compression screw
CSI 1018

Issue: SBRT patient had 4 different compression plate numbers documented.

1. The patient was simulated on February 13, 2013.
3. During the patient set-up there was conflicting documentation of the compression plate numbers.
   - SBRT set-up page read-181
   - SBRT immobilization Photo shows 181.
   - Site set-up said-195
   - The attending physician’s notes said-198
CSI 1018

SBRT Setup

BlueBag used: 2 varus
Position of Indexing bars: -2, 1 A, 9
Manifold tube length: N/A
Manifold Cushion location: N/A
Diaphragm control: Location 1A Screw Length L4 Plate size Small Pressure 181
BodyFix Coversheet pressure: N/A

Planner:
Isocenter Shift:
Setup AP SSD @ Treatment ISO:
Therapist notes:

This document status is {Object.Status} and is electronically signed by {Object.Sanct_ID*PnF_NameFL}, on {Object.Sanct_Date@d01b} at {Object.Sanct_Time}. 
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   - Site set-up said-195
   - The attending physician’s notes said-198
4. Sim was called to consult on the patient set-up and said it was 181 due to the compression the patient was able to handle during the simulation. 195 and 198 too tight.

5. The team decided to go with the 198 from the attending physician notes.

6. The CBCT showed a drastic difference between the simulation scans and dry run scans.

7. The team decided to use 185.
Process Improvement

- Documentation-merged the SBRT set-up sheet with the site setup.
- Standardization-developed a standardized way to document in site set up for all patients.
- Education- Lock site set up in simulation after documentation.
- Reminders-Trust your photos from sim.
- **Do not use physician notes!**
CSI 1018

Site Setup Standardization

Purpose:
- To set a standard practice for using the Site Setup feature in MOSAIQ. This will provide a consistent method for inputting each patient's setup information and also will maintain a historical record of shifts made during a course of treatment.

Creating Site Setup:
- Please see "Site Setup" document for workflow and details.

Standard format of setup information:

```
<table>
<thead>
<tr>
<th>Patient Orientation</th>
<th>Machine</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head in, Supine</td>
<td>Precise</td>
<td>UV/IRIT Std</td>
</tr>
<tr>
<td>Verify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance</td>
<td></td>
<td>UV/IRIT Std</td>
</tr>
</tbody>
</table>
```

- a) Table set-up
- b) Alignment instructions to include AP SSD for daily check
- c) Imaging & SSD information
- d) Documenting shifts
- e) Record AP SSD

Do not delete Sim setup notes

March 2012
University of Washington Near Miss program

- Establish leadership support
- Assess your Safety Culture
- What should be reported?
- How will you collect the Data?
- How will you review incidents?
- How will you give feedback?
- How are we doing after 2 years?
Number of Near Miss Reports

Near Miss Reports

Number of Near Miss Reports

- 2012-3: 1
- 2012-4: 10
- 2012-5: 47
- 2012-6: 72
- 2012-7: 72
- 2012-8: 81
- 2012-9: 76
- 2012-10: 64
- 2012-11: 81
- 2013-1: 56
- 2013-2: 78
- 2013-3: 78
- 2013-4: 72
- 2013-5: 82
- 2013-6: 57
- 2013-7: 86
- 2013-8: 141
- 2013-9: 147
- 2013-10: 76
- 2013-11: 83
- 2013-12: 86
- 2014-1: 100
- 2014-2: 104
- 2014-3: 108
- 2014-4: 152
- 2014-5: 120
University of Washington
Near Miss program

Safety Culture Survey

- 2012 Response Rate: 78%
- 2013 Response Rate: 80%
- 2014 Response Rate: 87%
Overall Patient Safety Grade

A=Excellent    B=Very Good    C=Acceptable    D=Poor    E=Failing

2012%  2013%  2014%
Barriers to Reporting

- The effect it may have on our departments' reputation
- Provoking retributions from colleagues
- Embarrassment in front of colleagues* P=0.02
- Admitting Liability
- Getting my colleagues in trouble * P=0.01
- Departmental or Professional Sanctions

2012 2013 2014
Number of reports respondents said they filed in past 12 months

- **21 or more**: 9 in 2014, 8 in 2013, 0 in 2012
- **11 to 20**: 9 in 2014, 6 in 2013, 0 in 2012
- **6 to 10**: 18 in 2014, 11 in 2013, 0 in 2012
- **3 to 5**: 18 in 2014, 15 in 2013, 6 in 2012
- **1 to 2**: 27 in 2014, 27 in 2013, 37 in 2012
- **None**: 32 in 2014, 37 in 2013, 57 in 2012
### Survey Results: UWMC

<table>
<thead>
<tr>
<th>Statement</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this unit, we discuss ways to prevent errors from happening again</td>
<td>66%</td>
<td>81% *</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>p&lt; 0.01</td>
</tr>
<tr>
<td>After we make changes to improve patient safety we evaluate their</td>
<td>46%</td>
<td>66% *</td>
<td>66%</td>
</tr>
<tr>
<td>effectiveness.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have confidence that my error/near miss reports get used to improve our</td>
<td>53%</td>
<td>74% *</td>
<td>78%</td>
</tr>
<tr>
<td>system.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CSI Successes

- Pediatric TBI program – technical revamp
- Transfer patients from outside facilities
- Contrast issues and patient prep
- Isocenter placement process change
- Procedures for ABC
- Treatment plan sign-off and MOSAIQ lock
- Diode sign-off and RadCalc
- IQ scripting purchased for improved communication
University of Washington
Near Miss program

- Establish leadership support
- Assess your Safety Culture
- What should be reported?
- How will you collect the Data?
- How will you review incidents?
- How will you give feedback?
- How are we doing after 1 year
Identifying Areas Of Improvement by analyzing CSI Reports
The Management Tool

• Capable of organizing and managing large number of reports.
• Database structures based on consensus recommendations
• Non discoverable
• Customizable
• Secure
• Tracks changes
NMSI

• “How bad would it be if the near-miss were not caught?”
  – Useful indicator of problem areas

• Scale from 0—4:
  – None, Mild, Moderate, Severe, Critical

• Reports scored at weekly meeting
  – at least one representative from physician, physics, and dosimetry/therapy group

• Reports tagged with categories
<table>
<thead>
<tr>
<th>Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>4DCT</td>
</tr>
<tr>
<td>ABC</td>
</tr>
<tr>
<td>anesthesia</td>
</tr>
<tr>
<td>Assessments</td>
</tr>
<tr>
<td>AttendingAvailibility</td>
</tr>
<tr>
<td>Billing/Insurance</td>
</tr>
<tr>
<td>Bolus</td>
</tr>
<tr>
<td>Brachytherapy</td>
</tr>
<tr>
<td>Calypso</td>
</tr>
<tr>
<td>CBCT</td>
</tr>
<tr>
<td>ChangeToPlan</td>
</tr>
<tr>
<td>ChecklistDosi</td>
</tr>
<tr>
<td>ChecklistMD</td>
</tr>
<tr>
<td>ChecklistPCC</td>
</tr>
<tr>
<td>ChecklistPhysCheck</td>
</tr>
<tr>
<td>ChecklistPSS</td>
</tr>
<tr>
<td>ChecklistSim</td>
</tr>
<tr>
<td>ChecklistTherapist</td>
</tr>
<tr>
<td>ClinicalSet</td>
</tr>
<tr>
<td>Collision</td>
</tr>
<tr>
<td>Commissioning</td>
</tr>
<tr>
<td>Communication</td>
</tr>
<tr>
<td>Consent</td>
</tr>
<tr>
<td>DelayForPt-ClinicallyRelevant</td>
</tr>
<tr>
<td>DelayForPt-Inconvenience</td>
</tr>
<tr>
<td>documentation</td>
</tr>
<tr>
<td>DRR-ISO-Port</td>
</tr>
<tr>
<td>education/training</td>
</tr>
<tr>
<td>Electrons</td>
</tr>
<tr>
<td>EmergentTx</td>
</tr>
<tr>
<td>Facilities</td>
</tr>
<tr>
<td>FilmAndTx</td>
</tr>
<tr>
<td>follow through</td>
</tr>
<tr>
<td>FSRT</td>
</tr>
<tr>
<td>GammaKnife</td>
</tr>
<tr>
<td>GoodCatch</td>
</tr>
<tr>
<td>HighDoseLowFraction</td>
</tr>
<tr>
<td>ImplantDevice</td>
</tr>
<tr>
<td>infection control</td>
</tr>
<tr>
<td>Inpatient</td>
</tr>
<tr>
<td>IsocenterConcerns</td>
</tr>
<tr>
<td>Isomark/Vsim</td>
</tr>
<tr>
<td>ITSystems</td>
</tr>
<tr>
<td>Late RTP</td>
</tr>
<tr>
<td>Late Work</td>
</tr>
<tr>
<td>LinacProblem</td>
</tr>
<tr>
<td>Localization</td>
</tr>
<tr>
<td>MeetingCandidate</td>
</tr>
<tr>
<td>MiM</td>
</tr>
<tr>
<td>MultipleSiteTx</td>
</tr>
<tr>
<td>NeutronTx</td>
</tr>
<tr>
<td>Orders</td>
</tr>
<tr>
<td>Overrides</td>
</tr>
<tr>
<td>Pain</td>
</tr>
<tr>
<td>PatientCare</td>
</tr>
<tr>
<td>PatientInfo</td>
</tr>
<tr>
<td>PatientPrep</td>
</tr>
<tr>
<td>PatientSetup</td>
</tr>
<tr>
<td>PatientTransport</td>
</tr>
<tr>
<td>Pediatrics</td>
</tr>
<tr>
<td>Pinnacle</td>
</tr>
<tr>
<td>PlanningError</td>
</tr>
<tr>
<td>PriorTx</td>
</tr>
<tr>
<td>ProcessImprovement</td>
</tr>
<tr>
<td>protons</td>
</tr>
<tr>
<td>PSN</td>
</tr>
<tr>
<td>Queue</td>
</tr>
<tr>
<td>RCA</td>
</tr>
<tr>
<td>Resim/Replan</td>
</tr>
<tr>
<td>RC-ILS</td>
</tr>
<tr>
<td>Rx</td>
</tr>
<tr>
<td>SBRT</td>
</tr>
<tr>
<td>Scheduling</td>
</tr>
<tr>
<td>Simulation</td>
</tr>
<tr>
<td>Site Setup</td>
</tr>
<tr>
<td>Standardization</td>
</tr>
<tr>
<td>StandardNaming</td>
</tr>
<tr>
<td>StandardPlan</td>
</tr>
<tr>
<td>TBI</td>
</tr>
<tr>
<td>ToAutomate</td>
</tr>
<tr>
<td>TreatmentDevice</td>
</tr>
</tbody>
</table>
UW incident review

Keyword tagging
Freeform categorization
No limits on # of tags
Searchable in DB

Near Miss Severity Index
4: Critical
3: Severe
2: Moderate
1: Mild
0: None

• Categorization and scoring
  – Track and correlate uncommon incidents
  – Prioritize most serious interventions
  – Measure improvement
  – Input into national system
# Reports with highest average NMSI

<table>
<thead>
<tr>
<th>Tag</th>
<th>n</th>
<th>average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong Dataset</td>
<td>8</td>
<td>3.38</td>
</tr>
<tr>
<td>Isocenter Concerns</td>
<td>24</td>
<td>3.00</td>
</tr>
<tr>
<td>Patient Setup</td>
<td>26</td>
<td>2.69</td>
</tr>
<tr>
<td>Prior Radiation Treatment</td>
<td>28</td>
<td>2.64</td>
</tr>
<tr>
<td>Standardizing Plans</td>
<td>12</td>
<td>2.58</td>
</tr>
<tr>
<td>Standardizing Sim</td>
<td>24</td>
<td>2.29</td>
</tr>
<tr>
<td>Unnecessary Dose</td>
<td>8</td>
<td>2.25</td>
</tr>
<tr>
<td>Electrons</td>
<td>17</td>
<td>2.24</td>
</tr>
<tr>
<td>Resim/Replan</td>
<td>28</td>
<td>2.18</td>
</tr>
<tr>
<td>Clinical Set</td>
<td>18</td>
<td>2.17</td>
</tr>
<tr>
<td>Collision</td>
<td>10</td>
<td>2.10</td>
</tr>
<tr>
<td>ChecklistSim</td>
<td>38</td>
<td>2.08</td>
</tr>
<tr>
<td>ChangeToPlan</td>
<td>109</td>
<td>2.03</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>23</td>
<td>2.00</td>
</tr>
</tbody>
</table>
Iso center concerns

- Improved access to schedule simulations.
- We eliminated an appointment for the patient.
- Improved communication.
- Improved team time utilization
ISOcenter Concerns
Prior RT Results

Results

• 19 near-miss incidents related to repeat irradiation
  - 11 (59%) due to incorrect information in patient chart due to old treatment plan
    • 4 (21%) isocenter concerns
    • 4 (21%) related to wrong image set
    • 10/11 caught at pre-treatment imaging (last check before beam-on)
  - 5 (26%) related to difficulty obtaining prior radiation records
  - 3 others: naming confusion, prior tattoo, photon/electron issues
### Average Severity Score by Origination

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Assessment/Orders</td>
<td>1.46</td>
</tr>
<tr>
<td>Simulation</td>
<td>2.00</td>
</tr>
<tr>
<td>Treatment Planning/Contouring</td>
<td>1.56</td>
</tr>
<tr>
<td>Pre-Treatment Plan Checks</td>
<td>1.38</td>
</tr>
<tr>
<td>Treatment Machine/Therapist Chart Check</td>
<td>1.39</td>
</tr>
<tr>
<td>Equipment Issues</td>
<td>1.25</td>
</tr>
<tr>
<td>Other</td>
<td>0.95</td>
</tr>
</tbody>
</table>
Origination of Reports (n=1377)

- Treatment Planning/ Contouring: 34.57%
- Simulation: 12.06%
- Patient Assessment/ Orders: 15.69%
- Equipment Issues: 13.36%
- Post-Treatment Check: 0.07%
- Treatment Machine/ Therapist Chart Check: 10.75%
- Pre-Treatment Plan Checks: 5.52%
- Other (including 1.21): 7.99%
**Origination of Errors within Treatment Planning (n=476)**

- 3.16 Plan information transfer: 34.87%
- 3.11 Dose Distribution Calculation: 14.50%
- 3.1 Delineation of Targets: 16.60%
- 3.13 Preliminary evaluation of treatment plan by physician: 4.20%
- 3.14 Iteration of treatment plan: 2.73%
- 3.10 Dose distribution optimization: 4.20%
- 3.15 Final plan approval and prescription by physician: 3.99%
- 3.7 Selection of template or other auxiliary instruments: 1.68%
- 3.17 Other: 0.21%
- 3.1 Registration of image sets: 0.63%
- 3.2 Delineation of Target(s): 1.26%
- 3.3 Delineation of organs-at-risk: 0.21%
- 3.4 Preliminary prescription parameters, constraints & 3.5 Selection of applicator: 0.63%
- 3.9 Physics consult: 0.21%
- 3.11 Dose distribution calculation: 0.21%

*3.11: Dose Distribution Calculation had higher severity score of 1.78 versus 1.52 (p=.05)*
Analysis: automated DosiCheck

Have identified 308 incidents as candidates for automated end-of-planning checks

<table>
<thead>
<tr>
<th>Category</th>
<th>Problem</th>
<th>Automated Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus</td>
<td>Bolus improperly specified in Tx field</td>
<td>Check Field:Bolus against known entries</td>
</tr>
<tr>
<td>CBCT</td>
<td>CBCT not exported to MQ or planned for machine without CBCT</td>
<td>Check Orders:CBCT and D&amp;I:CBCT, Field:Machine</td>
</tr>
<tr>
<td>Patient Setup</td>
<td>Field specified as prone instead of supine</td>
<td>Check Field:Orientation and SiteSetup:Orientation</td>
</tr>
<tr>
<td>Tx Plan ≠ Rx</td>
<td>Planned for incorrect fractions or dose</td>
<td>Check Rx:Fractions, Rx:Dose and TxCalendar:Sessions, D&amp;I:Dosimetry</td>
</tr>
</tbody>
</table>

Nyflot et al, ASTRO 2013
Detection Point of Errors (n=1377)

- Treatment Machine/Therapist Chart Check: 50.18%
- Pre-Treatment Plan Checks: 20.77%
- Treatment Planning/Contouring: 17.43%
- Simulation: 6.54%
- Post-Treatment Check: 2.03%
- Equipment Issues: 0.29%
- Other (including 1.21): 1.67%
- Patient Assessment/Orders: 1.09%
Projects Developed from CSI

• Automation Projects
  – Dosimetry Plan Check
  – Clinical planning constraints
  – Patient check-in

• Standardization Projects
  – Simulation
  – Nurse Handoff
  – Scheduling
  – Site setup
  - Treatment Calendar
  - Outside records
  - Plan/Image Archive
  - Patient ID Photos
Process Improvement

Simulation
- Immobilization
  - Head and neck
  - Sarcoma-iterative
  - Lung
  - Brain
- Scanning Parameters
- SBRT simulation/immobilization
- Isocenter placement in simulation
- Iso marking
- ABC
- Merkel Cell group
- Eye shields, contrast
- Simulation Manual-creating

Dosimetry
- SBRT planning
- Isocenter placement
- Prescription standardization
- Pinnacle standardization
- Neutron planning
- Merkel Cell group
- Prostate Seed Protraction
- Dosi Manual-creating
- Prostate Seed Protraction

Treatment
- Therapy Group:
  - TBI: Pre-treatment check list, Patient setup
  - Bolus-storage, usage and cleaning
  - Site setup standardization
  - Reading of SSD and action plan
  - Imaging-Vsim, CBCT, preport daily
  - KV Imaging
  - Therapy Manual-creating a Wiki
Conclusions

• Implementation of safety processes is coming
  – Society recommendations
  – National reporting systems
  – Billing pressures

• Near-miss incident review is extremely high-yield for our institution
  – Improved care
  – Improved safety culture
  – Quantitative metrics for evaluation and correlation
Facilitate safer and higher quality care in radiation oncology by providing a mechanism for shared learning in a secure and non-punitive environment.
Acknowledgments

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