Strategies for Quality Improvement based on RO-ILS

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We cannot Change Human condition, but we can change the conditions under which humans work

Active failures- Swat one by one
Still keep coming

Create effective defenses- Drain the swamp
(Ever present Latent conditions)

BMJ. 2000 Mar 18; 320(7237): 768–770. **Human error: models and management** James Reason, professor of psychology

Quality Management

Quality Management – *All* activities designed to achieve the desired quality in treatments.

Quality Control – Activities that force specific quality on a process.

Quality Assurance – Activities that demonstrate the level of quality of a process.

Courtesy: Bruce Thomadsen

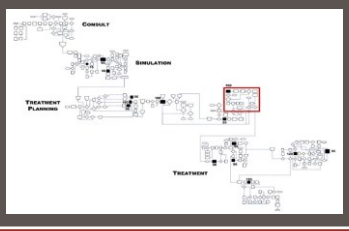
When QC in RT?

- Just before treatment?
- At every step?
- At critical steps?

Consultation → Simulation → Contouring → Planning → Treatment

Ford et al. Int J Rad Onc Biol Phys 74 (2009) 852 - 858

When QC in RT?



When QC in RT?

- QC potentially resource intensive
- Balance between rework and unnecessary QC
- If QC is not catching anything question its utility
- If QC is catching many things question QA and QM
- Every patient or a sampling of patients
  - In RT tendency is to QA/QC everything

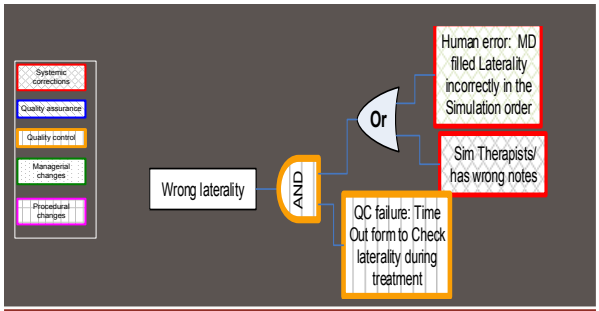
When QC in RT?

- It is difficult for individual clinics to prioritize their QA/QC/QM activities if the broader field and community is still struggling with what to prioritize
- Prioritization requires data
- Evidence based medicine is becoming mainstream, RT QA/QC need to embrace the same approach

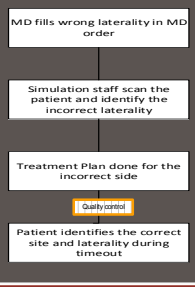
Example 1: RO-ILS – Laterality

39yo Female patient. While the therapist was setting up for the patient, he noticed that all of his paperwork (prescription (which was signed and filled-out (to the wrong side)), and his personal notes taken during sim) indicated a left trigeminal neuralgia. However the plan was for a right side Trigem. The therapist actually crossed "left" off his notes, thinking it was wrong, and wrote "right". The treatment plan was not yet signed. While the patient was here, during the standard timeout, the patient was questioned which side and she said "left". The patient's primary Rad Onc was not in the office for the treatment, and was called to ask about this discrepancy. And while the patient does have trigeminal neuralgia on both sides, it is more pronounced on the patient's left - which is what the Doctor intended to treat.

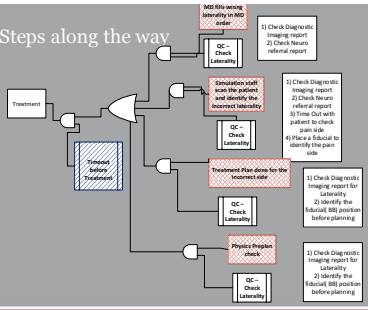
•Caught: Time Out..
•Missed: MD, Sim therapist, Dosimetrist, Physics Precheck



Laterality



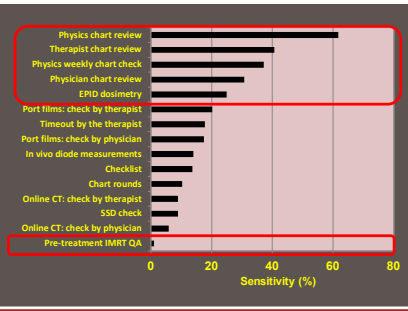
Add QC Steps along the way



Example: QA\QC Check Effectiveness

- An analysis of the effectiveness of common QA/QC checks
- IRB between Johns Hopkins University & Washington University
- Both institutions started incident learning systems (ILS) at the same time
- Data:
  - Incident reports: 2007-2011
  - 4,407 reports
  - 292 (7%) "high potential severity"

Ford *et al* Int. J. Radiat. Oncol. Biol. Phys., 84(3), 263-269, (2012).



- Staff were encouraged to report any quality or safety concerns in real-time.
- Events were analyzed to assess the utility of safety barriers.
- A formal continuous quality improvement program was created to address reported events and make improvements.

Results:

- The calculated utility of safety barriers was highest for those embedded into the pretreatment quality assurance checks performed by physicists and dosimetrists (utility score 0.53; 93 of 174) and routine checks done by therapists on the initial day of therapy.
- Therapists and physicists reported the highest number of good catches(24% each).

Ref: The association between event learning and continuous quality improvement programs and culture of patient safety. Mazur et al. *Prac. Radiat. Oncol* (2015)5,286-295

QM Tools

Table 2. Ranking of QM tools based on the effectiveness, in part following the suggestions of ISMP.[19]

0. Environment problem correction (Not tool)
- Sound Control
- Visual Control
- Cleaning
- Neatening
- Isolation
- Environmental Design

1. Forcing functions and constraints
- Interlock
- Barriers
- Computerized order entry with feedback

2. Automation and computerization
- Bar codes
- Automate monitoring
- Computerized verification
- Computerized order entry

3. Protocols, standards, and information
- Check off forms
- Establishing Protocol / Clarify Protocol
- Alarms
- Labels
- Signs
- Reduce similarity

4. Independent double check systems and other redundancies
- Redundant measurement
- Independent review
- Operational Checks
- Comparison with standards
- Increase monitoring
- Add status check
- Acceptance test

5. Rules and policies
- External Audit
- Internal Audit
- Priority
- Establishing / Clarify Communication Line
- Staffing
- Better Scheduling
- Mandatory Pauses
- Repair
- PMI (Preventive Maintenance Inspection)
- Establish and Perform QC and QA (Hardware and Software)

6. Education and Information
- Training
- Experience
- Instruction

RO-ILS events – Physician related

Prescription and Simulation orders:

- 64 Physician related error (incorrect target or dosing pattern prescribed)
- 29 mismatch between the dose and fractionation pattern in the plan
- 3 cases it was clear from the narrative that the planner misunderstood the physician' s intent and wrote the prescription for the physician to approve.
  - In 15 cases the reason for the difference was unexplained.
  - In 8 cases the physician either slipped in writing the prescription or later changed their mind and that was not communicated.

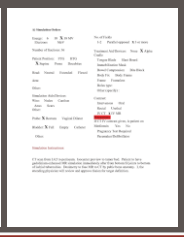
Treatment Planning:

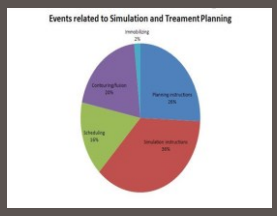
- 12 Problem with the imaging used for planning,
- 4 Problems with image fusion (done poorly or with the wrong dataset)
- 5 Plan done on the wrong CT dataset.
- 88 Poor plan quality

Possible Interventions

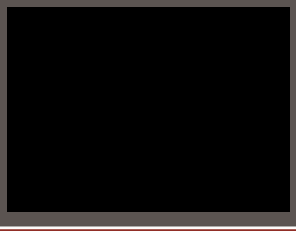
- First correct any environmental problems – that usually is a relatively inexpensive but effective operation.
- Then consider the key core components identified by TG 100
  - Training
  - Communication
  - Standardized policies and procedures
- Make sure resources are allocated as needed (i.e., staffing and equipment.

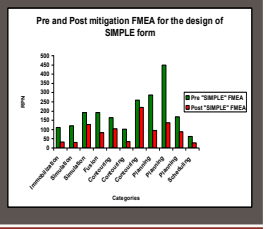
Example 1: Simulation and Treatment Planning Instructions



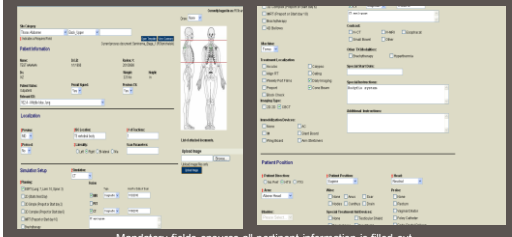


FMEA



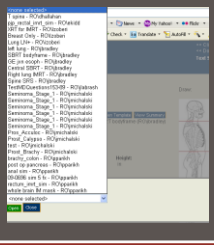


Simulation Orders



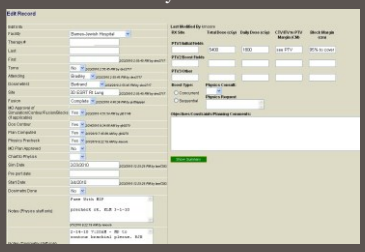
Mandatory fields ensures all pertinent information is filled out

Treatment Planning Instructions



Summary

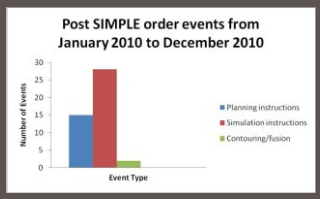
Dosimetry board



The prescription orders get populated from the electronic MD treatment planning orders and any change will get reflected on the dosimetry board

Post SIMPLE order

- Automation
- Standardization
- Mandatory Fields & Context Sensitive Logic
- Ability To Store Templates

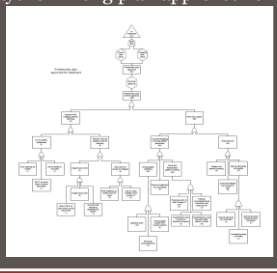


Establish the Failure Propagation Pattern

This is the fault tree analysis.

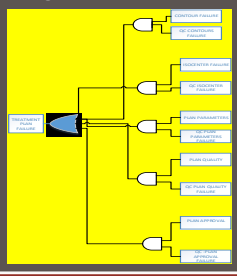
- For the fault tree
  - Begin at the failure
  - Ask what are all the possible causes
  - Relate the causes through logical gates
  - For each cause, ask what would be the cause
  - Repeat as needed

Error Pathways for wrong plan approved for treatment

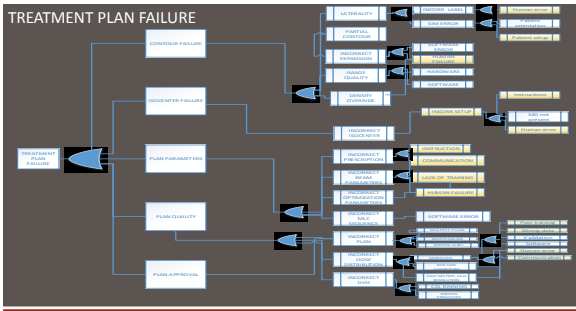


Gary Ezzell – Mayo Clinic Arizona

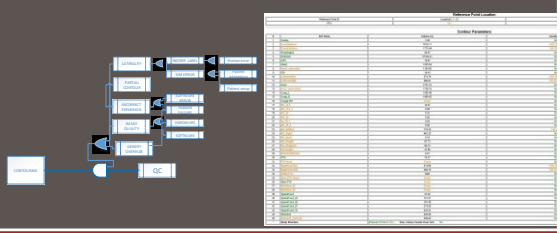
Example 2: Treatment Planning Process



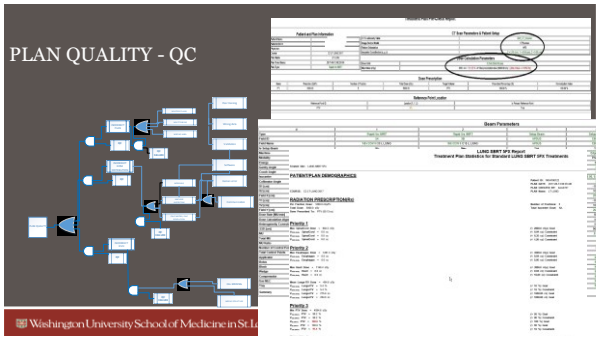
TREATMENT PLAN FAILURE



CONTOURING PROCESS AND QC



PLAN QUALITY - QC

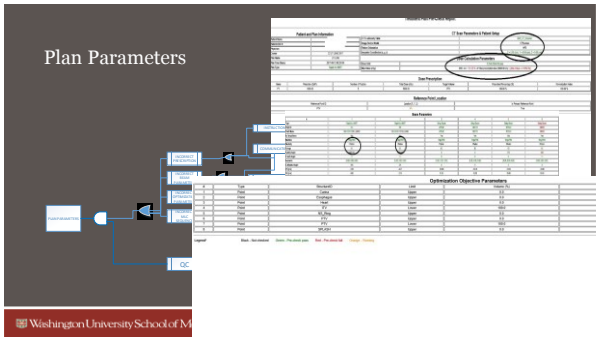


ISOCENTER CHECK

CT Scan Parameters & Patient Setup	
CT To eDensity Table	BJH_CT_Scanner
Image Device Model	CTScanner
Patient Orientation	HFS
Isocenter Coordinates (x, y, z)	X = 1.50 (cm), Y = -3.50 (cm), Z = -2.00 (cm)

QC

Plan Parameters

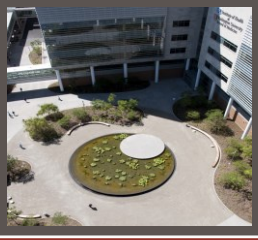


QC

Conclusions

- QM program design largely dependent on local medical physicist
- Use Process Tools like FMEA, Fault Tree Analysis to evaluate the process.
- QA/QC is critical.
- Utilizing the QM tools like barriers, Automation, Standardization, independent checks, policies and procedures, routine in-service and training helps in eliminating inconsistencies
- Understanding of technologies, procedures, and critical failure points crucial for safe and quality treatments
- Good to create your own database with RO-ILS or a similar tool
  - a. Keep track of the errors happening in your clinic
  - b. Attack the most serious and the most common

Acknowledgements



- RO-HAC Members
- Bruce Thomadsen
- Sasa Mutic
- Eric Ford
- RO-ILS

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