TG275 AND BEYOND: PLAN CHECKS IN THE MODERN AGE

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AAPM SPRING CLINICAL MEETING 2017

CONFLICTS OF INTEREST

- None

DISCLOSURES AND ACKNOWLEDGEMENTS

- Member of TG275
- Some Material and Slides Provided by Other TG275 Members
  - Eric Ford
  - Anne Greener
  - Luis Fong de los Santos
  - Perry Johnson
  - Debbie Schofield

OBJECTIVES

- To discuss the current state of physics plan and chart checks
- To show how physics plan and chart checks relate to error management
- To demonstrate the use of TG-100 Methodology to assess physics plan and chart check processes
- To share TG-275's experience to date
- To initiate discussion on the role of physics plan and chart checks in quality management and systems thinking

OUTLINE

- Justification and Need
- Background and Team
- Charge and Scope of TG-275
- Error Management
- TG-275 Initial Tasks
- Current Guidelines
- Survey of Current Practices
- TG-275 Risk Assessment (FMEA)
- Survey/FMEA Crosswalk
- Work in Progress
- Summary of TG275
- Systems View/Quality Management

JUSTIFICATION AND NEED

Patient safety improvements in radiation treatment through 5 years of incident learning

Brenda G. Clark PhD [a,*], Robert J. Brown RTT [a], Jodi Ploquin MS [b], Peter Dunscombe PhD [c]

Practical Radiation Oncology (2013) **3**, 157–163

www.practicalradonc.org

2013

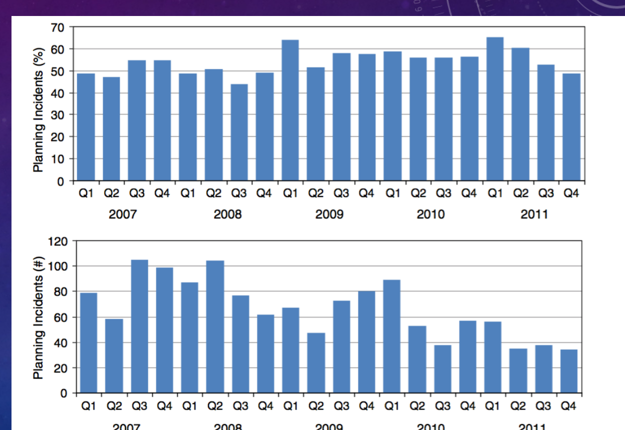


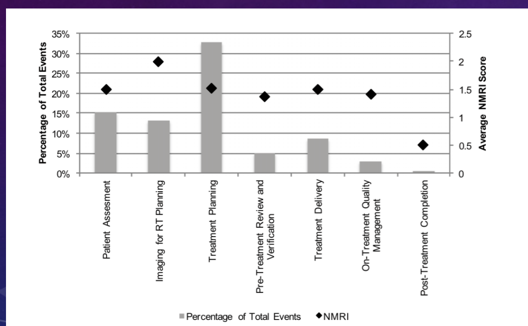
Figure 3 Incidents originating in treatment preparation (planning) as a percentage of the total number of incidents reported (top) and in absolute terms (bottom).

JUSTIFICATION AND NEED

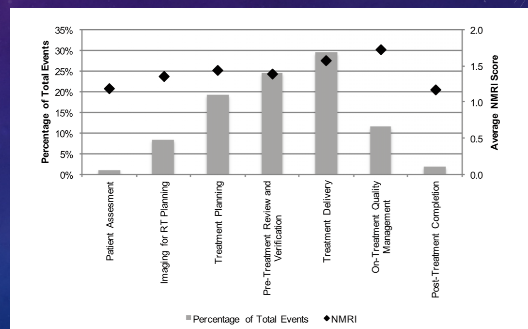
Targeting safety improvements through identification of incident origination and detection in a near-miss incident learning system

Avrey Novak, Matthew J. Nyflot, Ralph P. Ermoian, Loucille E. Jordan, Patricia A. Sponseller, Gabrielle M. Kane, Eric C. Ford, and Jing Zeng[a)]
Department of Radiation Oncology, University of Washington Medical Center, 1959 NE Pacific Street, Campus Box 356043, Seattle, Washington 98195

2016



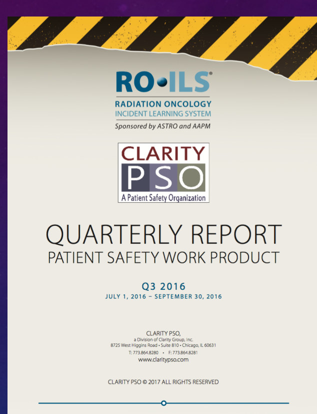
Error Origination



Error Detection

Medical Physics, Vol. 43, No. 9, September 2016

JUSTIFICATION AND NEED



Q3 2016

METRIC	AGGREGATE CURRENT QUARTER	AGGREGATE HISTORICAL SUM
Reported Events Therapeutic Radiation Incidents Other Safety Incidents Near Miss Unsafe Conditions Operational/Process Improvement	**274** 58 21 79 89 27	**2345** 645 171 773 695 61
Most Commonly Identified Workflow Step Where Event *Occurred*	**Treatment Planning:** 30% (83/274)	**Treatment Planning:** 28% (662/2345)
Most Commonly Identified Workflow Step Where Event was *Discovered*	**Treatment Delivery Including Imaging (e.g. at the machine):** 28% (77/274)	**Pre-treatment QA Review (e.g. Physics Plan Check):** 25% (580/2345)

JUSTIFICATION AND NEED

METRIC	AGGREGATE CURRENT QUARTER	AGGREGATE HISTORICAL SUM
Reported Events	**274**	**2345**
Therapeutic Radiation Incidents	58	645
Other Safety Incidents	21	171
Near Miss	79	773
Unsafe Conditions	89	695
Operational/Process Improvement	27	61
Most Commonly Identified Workflow Step Where Event *Occurred*	**Treatment Planning:** 30% (83/274)	**Treatment Planning:** 28% (662/2345)
Most Commonly Identified Workflow Step Where Event was *Discovered*	**Treatment Delivery Including Imaging (e.g. at the machine):** 28% (77/274)	**Pre-treatment QA Review (e.g. Physics Plan Check):** 25% (580/2345)

JUSTIFICATION AND NEED

Quality Control Quantification (QCQ): A Tool to Measure the Value of Quality Control Checks in Radiation Oncology

Eric C. Ford, PhD,* Stephanie Terezakis, MD,* Annette Souranis,* Kendra Harris, MD,* Hiram Gay, MD,[†] and Sasa Mutic, PhD[†]

Volume 84 • Number 3 • 2012

International Journal of Radiation Oncology biology • physics

www.redjournal.org

2012

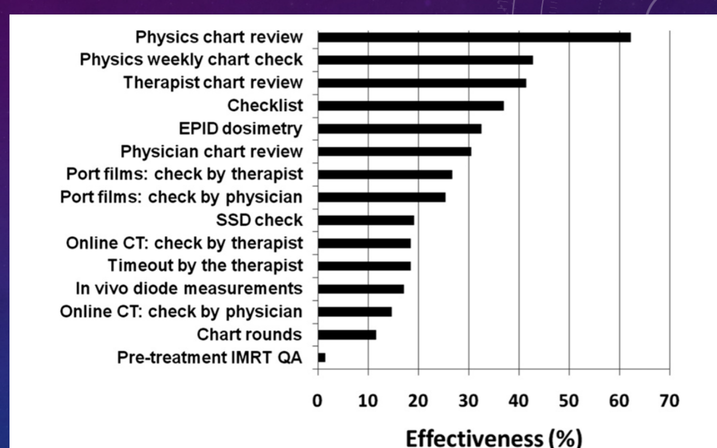


Fig. 2. Effectiveness of each individual quality control (QC) check for detecting the reported high severity incidents.

JUSTIFICATION AND NEED

The effectiveness of pretreatment physics plan review for detecting errors in radiation therapy

Olga Gopan, Jing Zeng, Avrey Novak, Matthew Nyflot, and Eric Ford[a)]
Department of Radiation Oncology, University of Washington Medical Center, 1959 NE Pacific Street, Box 356043, Seattle, Washington 98195

2016

- Based on Incidents from Departmental ILS
  - Sensitivity of 38% for physics plan review
  - Indicates the need to improve review performance

Med. Phys. 43 (9), September 2016

JUSTIFICATION AND NEED

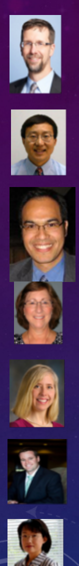
- Majority of errors occur in treatment planning process
- Room for improvement in physics plan check processes

INTRODUCTION

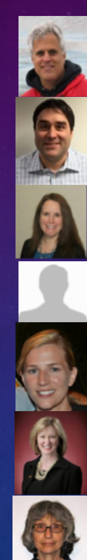
- TG-275: Strategies for Effective Physics Plan and Chart Review in Radiation Therapy
- April 2015
  - Approval by Therapy Physics Committee & Science Council
  - Assigned TG Number

⊞ Board of Directors [Status]
  ⊞ Science Council [Status]
    ⊞ Therapy Physics [Status]
      ⊞ Quality Assurance and Outcome Improvement SC [Status]
        ⊞ **Work Group on Prevention of Errors in Radiation Oncology** [Status]
          TG100 Method for Evaluating QA Needs in Radiation Therapy [Status]
          TG275 Strategies for Effective Physics Plan and Chart Review in Radiation

THE TEAM – TG275 MEMBERS



- **Eric Ford**, Chair
  - University of Washington
- **Lei Dong**
  - Scripps Proton Therapy Center
- **Luis Fong de los Santos**
  - Mayo Clinic
- **Anne Greener**
  - East Orange VA
- **Jennifer Johnson**
  - UT MD Anderson Cancer Center
- **Perry Johnson**
  - University of Miami
- **Grace Gwe-Ya Kim**
  - University of California, San Diego



- **James Mechalakos**
  - Memorial Sloan-Kettering Cancer Center
- **Brian Napolitano**
  - AAMD Representative, MGH
- **Stephanie Parker**
  - Novant Health, Winston-Salem, NC
- **Deborah Schofield**
  - Saint Vincent Hospital
- **Koren Smith**,
  - Mary Bird Perkins Cancer Center
- **Michelle Wells**
  - Piedmont Hospital, Atlanta, Ga
- **Ellen Yorke**
  - Memorial Sloan-Kettering Cancer Center

CHARGE OF TG-275

- To review existing data and recommendations
- Survey information on current practices
- Provide risk-based recommendations
- Provide recommendations to software vendors

SCOPE OF TG-275

- Types of Procedures
  - External Beam
    - Photon and Electron
  - Brachytherapy
  - Proton
- Types of Checks
  - Initial Plan/ Chart Checks
  - Continuing (Weekly) Physics Checks
  - End of Treatment Checks (EOT's)

CREW RESOURCE MANAGEMENT

https://openclipart.org

CREW RESOURCE MANAGEMENT (CRM)

- Introduced in 1979 – Air Safety
- Set of Training Procedures
- Used in Environments where Human Error can have devastating effects
- Evolved over time - Several “Generations”
- Has been adapted to other fields
  - Including Healthcare

1.Helmreich, R.L., & Merritt, A.C. (2000). Safety and error management: The role of Crew Resource Management. In B.J. Hayward & A.R. Lowe (Eds.), Aviation Resource Management (pp. 107-119).

https://openclipart.org

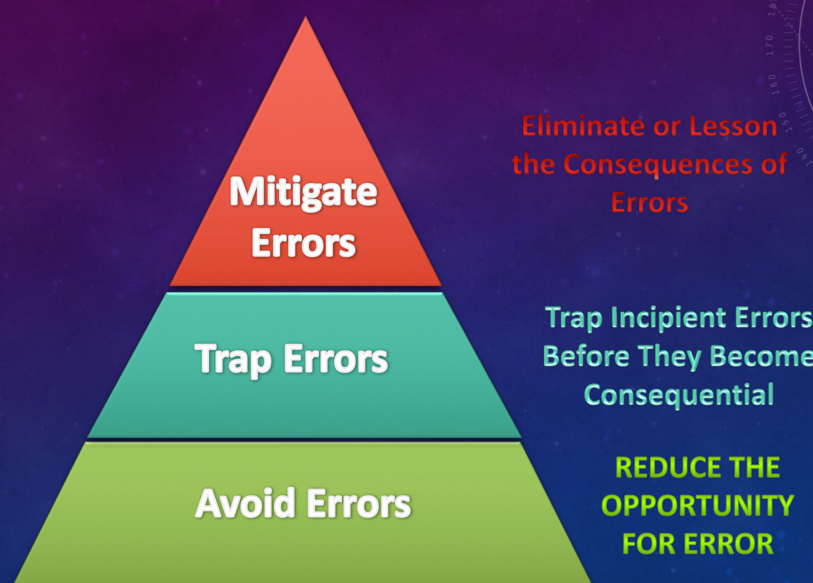
5TH GENERATION CREW RESOURCE MANAGEMENT

- ~ 1990 by Robert Helmreich
- Influenced by work of James Reason
- Focused on Error Management
- Underlying Premise that Human Error is:
    - Ubiquitous
    - Inevitable
    - Valuable source of information
- Set of Error Countermeasures
    - Three lines of defense
    - "Error Troika"

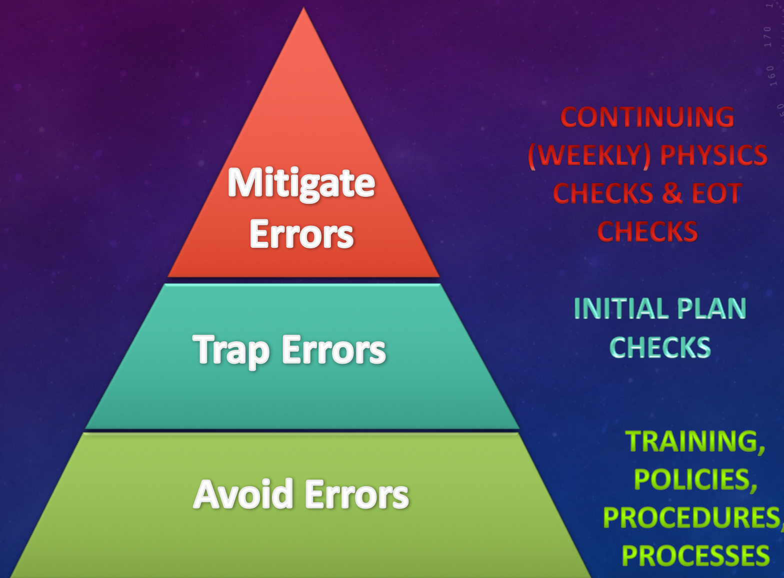
http://www.macleans.ca/wp-content/uploads/2009/01/090123_interview.jpg

1.Helmreich, R.L., & Merritt, A.C. (2000). Safety and error management: The role of Crew Resource Management. In B.J. Hayward & A.R. Lowe (Eds.), Aviation Resource Management (pp. 107-119).

ERROR TROIKA



ERROR TROIKA



TG275 INITIAL TASKS

- Literature Search
- Survey of Current Practices
- Risk Assessment Study for External Beam RT

TG Members Divided into Three Groups to Focus on Specific Tasks

PRIMARY GUIDELINE– TG-40 - 1994

TG-275 will apply TG-100 Methodology to Provide an Update to TG-40 Part VI Sections B & C

TG275 INITIAL TASKS

- Literature Search
- Survey of Current Practices
- Risk Assessment Study for External Beam RT

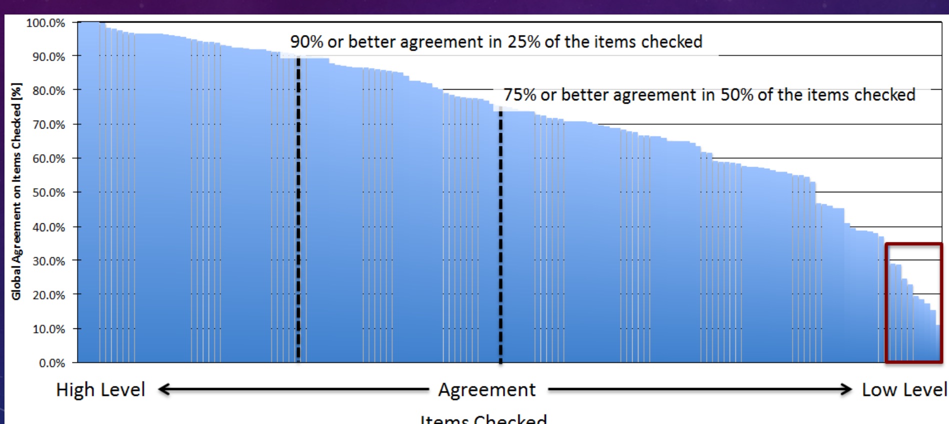
SURVEY OF CURRENT PRACTICES

- **55** Demographics Questions:
  - 18 -> General
  - 20 -> Initial Plan Check
  - 17 -> On-Treatment Chart Check
- **256** Items Check or Review:
  - 151 -> Initial Plan Check
  - 38 -> Proton Specific Initial Plan Check
  - 52 -> On-Treatment Chart Check
  - 15 -> End-of-Treatment Chart Check

SURVEY OF CURRENT PRACTICES

Items Checked during <u>Initial Plan Check</u> Process
Sorted By <u>Level of Agreement</u>

N = 151



TG275 INITIAL TASKS

- Literature Search
- Survey of Current Practices
- Risk Assessment Study for External Beam RT

FMEA – FAILURE MODES AND EFFECTS ANALYSIS

1. Map the process and identify major steps.
2. Identify failure modes for each step.
3. Identify cause(s) and effect(s) of failure mode.
4. Score FM's with respect to Severity (S), Occurrence (O), and (Un)Detectability (D)
5. Multiply S x O x D to determine RPN (Risk Priority Number)
6. Sort FM's based on RPN and Severity

WORKFLOW FOR TG275 RISK ASSESSMENT STUDY

1. Develop Online FMEA Tool on AAPM Website
2. Create Process Map
3. Create Database of Failure Modes
4. Enter Failure Modes and Causes into Online Tool
5. Score FM's using Abbreviated Scale
6. Analyze Results of 3 Point Scale FMEA

WORKFLOW FOR TG275 RISK ASSESSMENT STUDY

7. Remove Low Scoring FM's & Combine Causes for Remaining FM's
8. Score FM's using Standard 10 Point Scale
9. Analyze Results of 10 Point Scale FMEA
10. Correlate FM's with Survey Results
11. Develop Recommendations

1. ONLINE FMEA TOOL ON AAPM WEBSITE

- Web Based Online Tool
  - Eric Ford and AAPM IT Staff Developed
- Goal: Available for all AAPM Members

https://therandomhomeschoolspot.files.wordpress.com/2012/07/computer-clipart.gif

2. HIGH LEVEL PROCESS MAP

Patient Assessment → Simulation → Treatment Planning → Pre-Tx Review and Verification → Treatment Delivery → On-Treatment Quality Management → Post-Treatment Completion

3. CREATE DATABASE OF FAILURE MODES

- Experience of TG-275 Members
  - Individual Lists Generated by Each TG Member
- SAFRON
  - 51 Events identified
  - 38 FM/Cause Combinations Added to Database

http://www.clipartpanda.com/

IAEA SAFRON

https://rpop.iaea.org/RPOP/RPoP/Modules/login/safron-register.htm

3. CREATE DATABASE OF FAILURE MODES

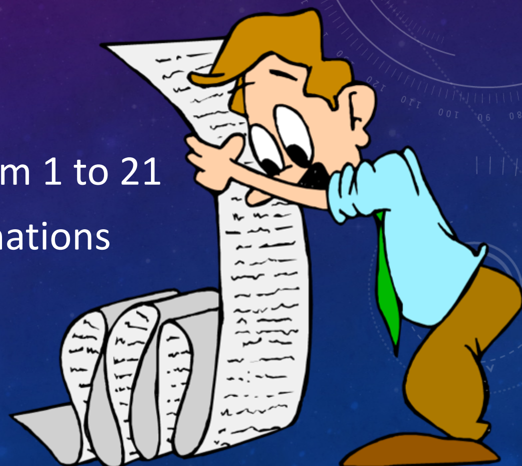
- Validation of Database Against RO-ILS
  - 113 Events Related to Physics Checks Identified by Eric Ford
  - List Compared to Database Generated by Task Group
    - Excellent agreement
    - 97 of 113 events already included in database
    - 10 new causes added to database
    - 2 new failure modes added to the database

https://www.astro.org/RO-ILS.aspx

RO•ILS RADIATION ONCOLOGY® INCIDENT LEARNING SYSTEM Sponsored by ASTRO and AAPM

3. CREATE DATABASE OF FAILURE MODES

- Final Database
  - 192 Failure Modes
  - Causes for each FM ranged from 1 to 21
  - Total of 594 FM/Cause Combinations



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4. ENTER FAILURE MODES AND CAUSES INTO ONLINE TOOL

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

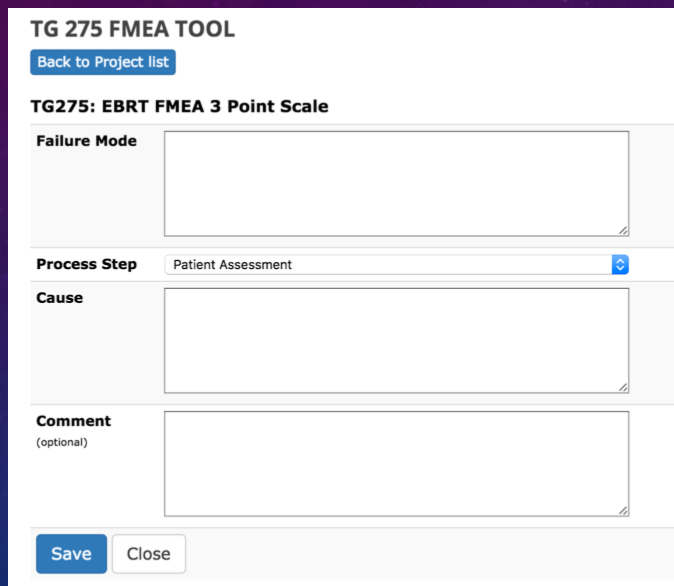
Home | Directory | Career Services | Continuing Education | BBS | Contact

- Main
- TG275 Committee Tree
- AAPM Home

TG 275 FMEA TOOL

ID	Project	Committee		
6	TG275: EBRT FMEA -10 Point Scale	TG275	Scores	Failure Mode
4	TG275: EBRT FMEA 3 Point Scale	TG275	Scores	Failure Mode

4. ENTER FAILURE MODES AND CAUSES INTO ONLINE TOOL



5. INITIAL SCORING USING ABBREVIATED SCALE

Severity

Severity	Description		
1	no harm or mild inconvenience	delete	Edit
2	medium severity	delete	Edit
3	very severe (hospitalization, death, high chance of recurrence)	delete	Edit

Enter new Severity | Add from template

Occurrence

Occurrence	Event Rate	Events Per Year		
1	very rare. almost never seen.	.	delete	Edit
2	sometimes occurs	.	delete	Edit
3	frequent	.	delete	Edit

Enter new Occurrence | Add from template

Detectability

Detect Number	Probability Undetected		
1	very rare. almost never seen.	delete	Edit
2	sometimes occurs	delete	Edit
3	frequent	delete	Edit

Enter new Detectability | Add from template

5. INITIAL SCORING USING ABBREVIATED SCALE

- Scoring Instructions
  - Enter scores based on experience at your institution
  - **Detectability score**:
    - Score this with the view of what is detectable PRIOR to the initial physics plan and chart review.
  - **Severity score**:
    - Score as if the failure goes all the way through to the patient.
    - Score for the most reasonably likely scenario
      - not the worst-case scenario
      - can almost always image a scenario where a failure mode propagates in a certain way as to become a severity of 10

5. INITIAL SCORING USING ABBREVIATED SCALE

- Individuals Entered Scores on the AAPM Website
- Scoring Open April 15 to May 9 2016
- Time Consuming Even With 3 Point Scale
  - ~ 3.5 hours
  - ~2.8 FM/min

http://www.picgifs.com/clip-art/computer/computers/clip-art-computers-255152.jpg

5. INITIAL SCORING USING ABBREVIATED SCALE

FM Order	95
Failure Mode	CT dataset Loaded from a different patient — Delete score | Save
Cause	incorrect scan sent from sim (scan completed with incorrect patient name and information)
Process Step	Treatment Planning
Comment	[+ Add]
Severity	3 very severe (hospitalization, death, high chance of recurrence)
Occurrence	Rate for 500 pts/year 1 very rare. almost never seen. | .
Detectability	Probability of detecting 2 sometimes occurs

6. ANALYSIS OF 3 POINT SCALE FMEA

- RPN Scores: 1 to 13.94
- Severity Scores: 1 to 3

5. INITIAL SCORING USING ABBREVIATED SCALE

FM Order	104
Failure Mode	Unintentional re-irradiation of a previously treated area
Cause	MD aware of prior rads but did not communicate
Process Step	Treatment Planning
Comment	[+ Add]

Individual Score

IndID	Name	Severity	Occurrence	Detectability
		3	1	3
		3	1	2
		3	1	2
		3	2	2
		3	1	3
		3	2	2
		3	1	3
		3	1	3
		3	2	3
		3	1	3
		3	3	3
		3	1	3
		3	1	2
		3	1	3

Consensus Final Score

Severity 3

Occurrence Rate for 500 pts/year 1.36

Detectability Probability of detecting 2.64

Highest Ranking Severity
S = 3

5. INITIAL SCORING USING ABBREVIATED SCALE

FM Order	111
Failure Mode	"Wrong" or inaccurate MD contours
Cause	Attending MD does not review resident contours
Process Step	Treatment Planning
Comment	[+ Add]

Individual Score

IndID	Name	Severity	Occurrence	Detectability
		3	2	3
		3	1	2
		3	2	3
		3	1	3
		3	2	3
		2	3	2
		3	2	3
		3	2	3
		3	2	3
		3	2	3
		3	1	3
		2	2	2
		3	1	3

Consensus Final Score

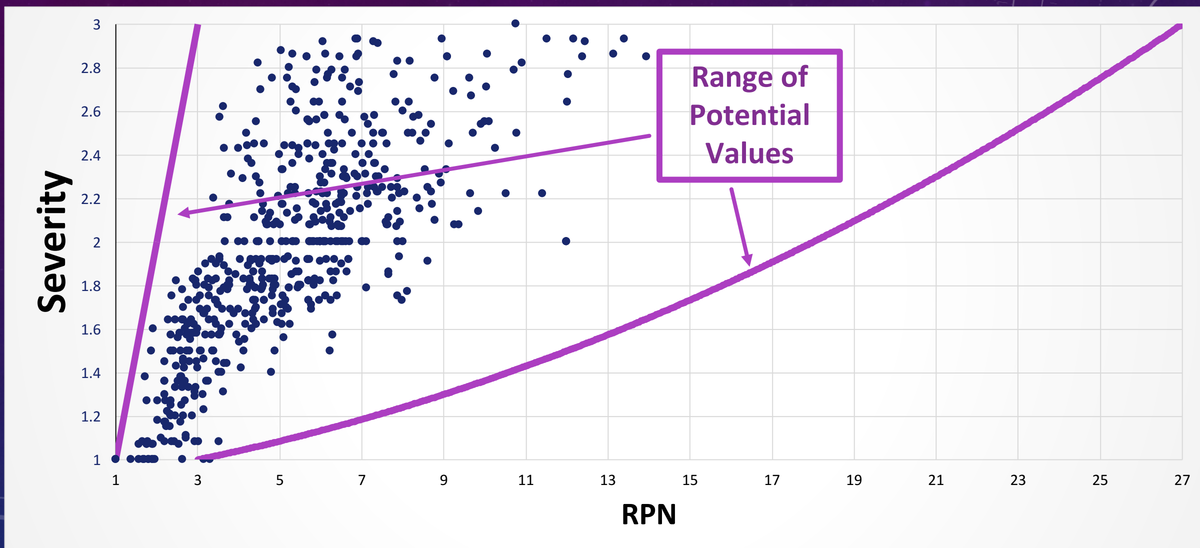
Severity 2.85

Occurrence Rate for 500 pts/year 1.77

Detectability Probability of detecting 2.77

Highest Ranking FM
RPN = 13.94

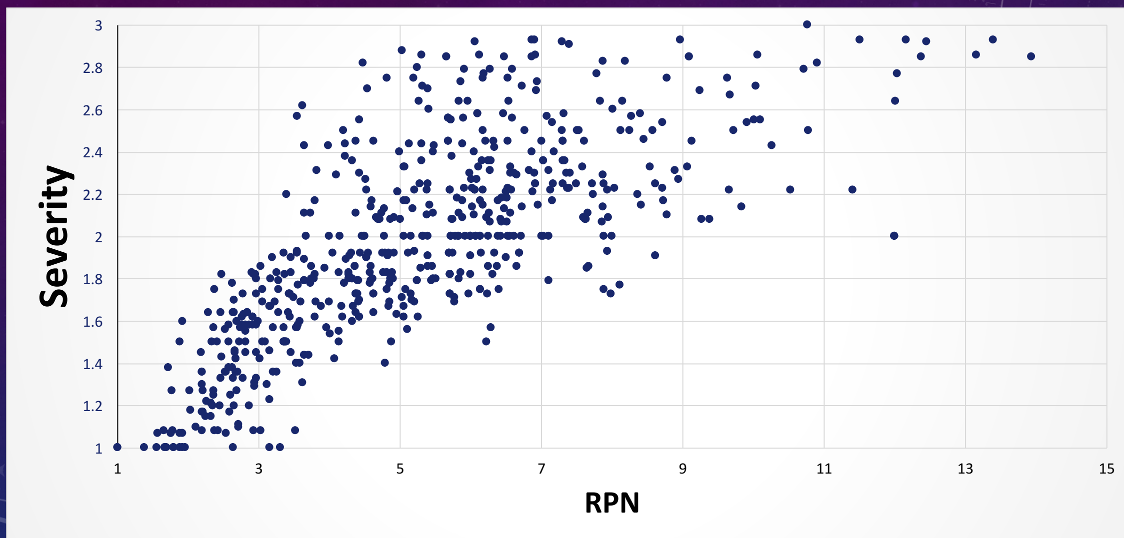
6. ANALYSIS OF 3 POINT SCALE FMEA



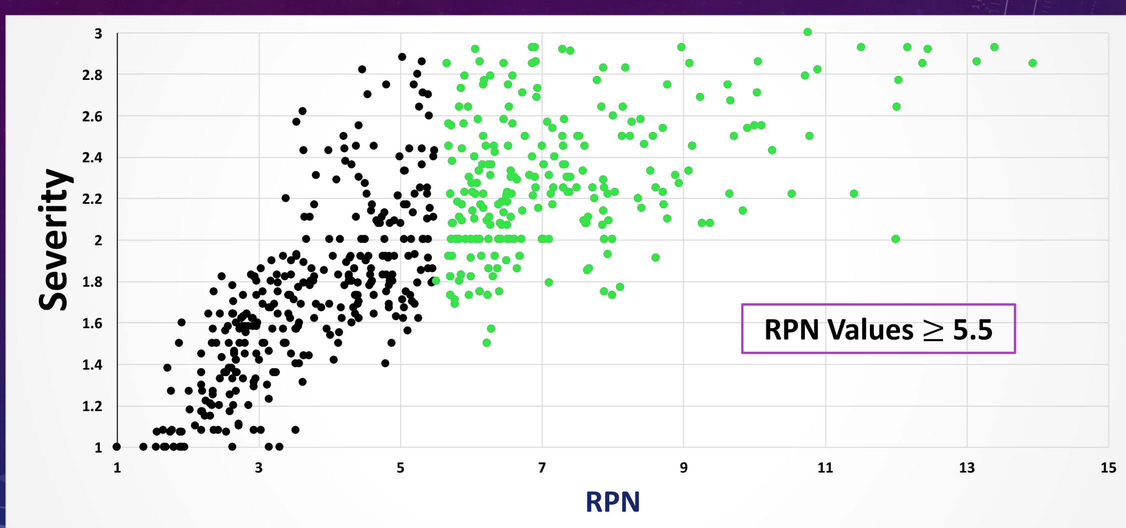
7. REMOVE LOW SCORING FM'S

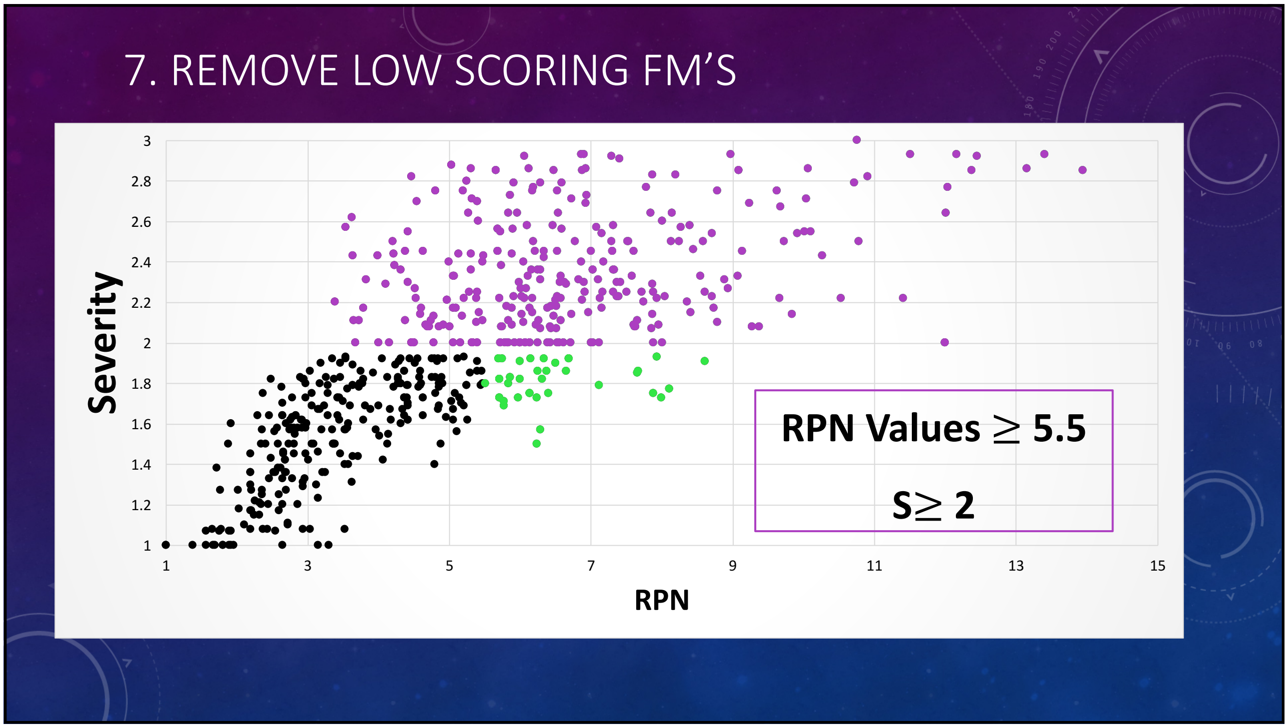
- Needed to Determine Threshold for Elimination of Low Scores
- Kept FM's with RPN ≥ 5.5 and S ≥ 2
- Eliminated ~ 40% of the scores

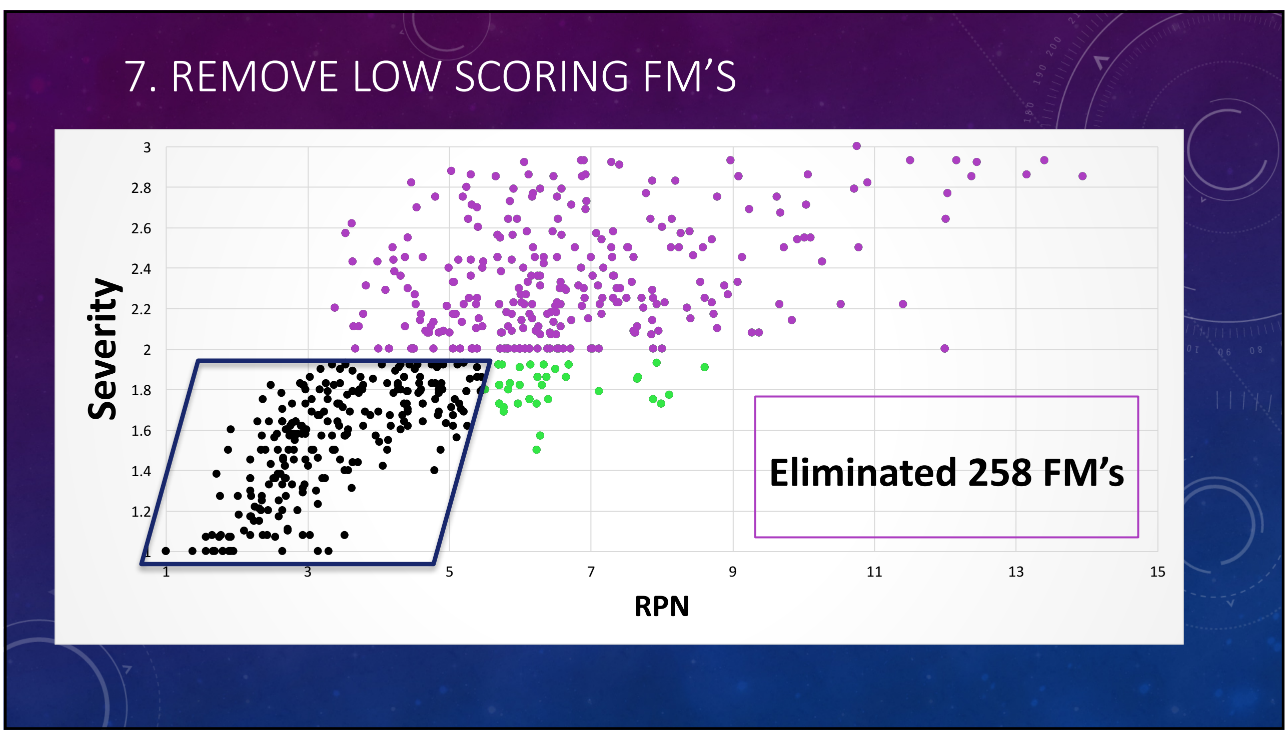
7. REMOVE LOW SCORING FM'S



7. REMOVE LOW SCORING FM'S




7. REMOVE LOW SCORING FM'S
Severity
RPN
RPN Values ≥ 5.5
S≥ 2


7. REMOVE LOW SCORING FM'S
Severity
RPN
Eliminated 258 FM's

7. REMOVE LOW SCORING FM'S

- Started with 594 Failure Mode/ Cause Combinations
- Eliminated 258 that Fell Below the Threshold
- 336 Remaining - Still too many
- Combined Causes for Many FM's
- Final Result for 10 Point Scale Scoring
  - 118 FM/Cause Combinations

8. SCORE FM'S USING STANDARD 10 POINT SCALE

- Scoring Open June 27- July 11, 2016
- 1 to 1.5 Hours to Complete Scoring
- ~1.3 FM/min

Total Time Scoring = 5 hours
If Only Used 10 Point Scale: ~ 7.5 hours
3 Point Scale Scoring Seems to Have Saved about 2.5 Hours

9. ANALYSIS OF 10 POINT SCALE FMEA

- RPN Scores: 30 to 261.33
- Severity Scores: 2.62 to 8.23

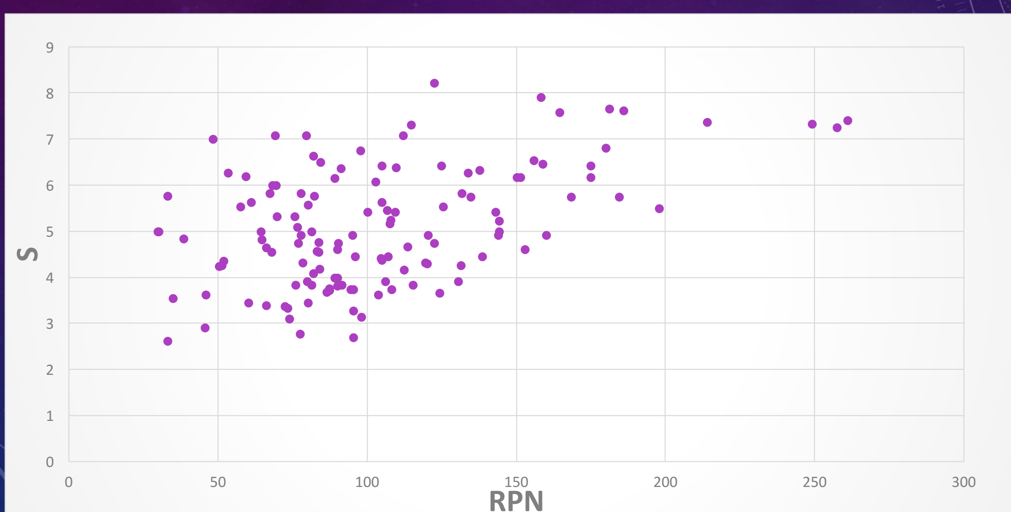
9. ANALYSIS OF 10 POINT SCALE FMEA

Failure Mode	Cause	Process Step	R	S	O	D
"Wrong" or inaccurate MD contours	Treatment Planning	Workflow/Communication Issue, e.g., Attending MD does not review resident contours, MD does not clearly identify dose levels, Incorrect CT dataset, Fusion incorrect or with wrong image set, Target motion not considered, Wrong set of contours imported	261.33	7.42	4.92	7.17

9. ANALYSIS OF 10 POINT SCALE FMEA

Failure Mode	Cause	Process Step	R	S	O	D
Very (dangerously) wrong preliminary prescription	Patient Assessment	MD confused or misinformed	122.54	8.23	2.62	5.69
Unintentional re-irradiation of a previously treated area	Treatment Planning	Communication/Workflow Issue: Patient did not or unable to disclose, MD did not request info, MD did not commicate prior tx info, Dosimetrist aware but did not take into account	158.33	7.92	3	6.67

9. ANALYZE RESULTS OF 10 POINT SCALE FMEA



10. CORRELATE FM'S WITH SURVEY RESULTS

- FMEA/ Survey ”Crosswalk”

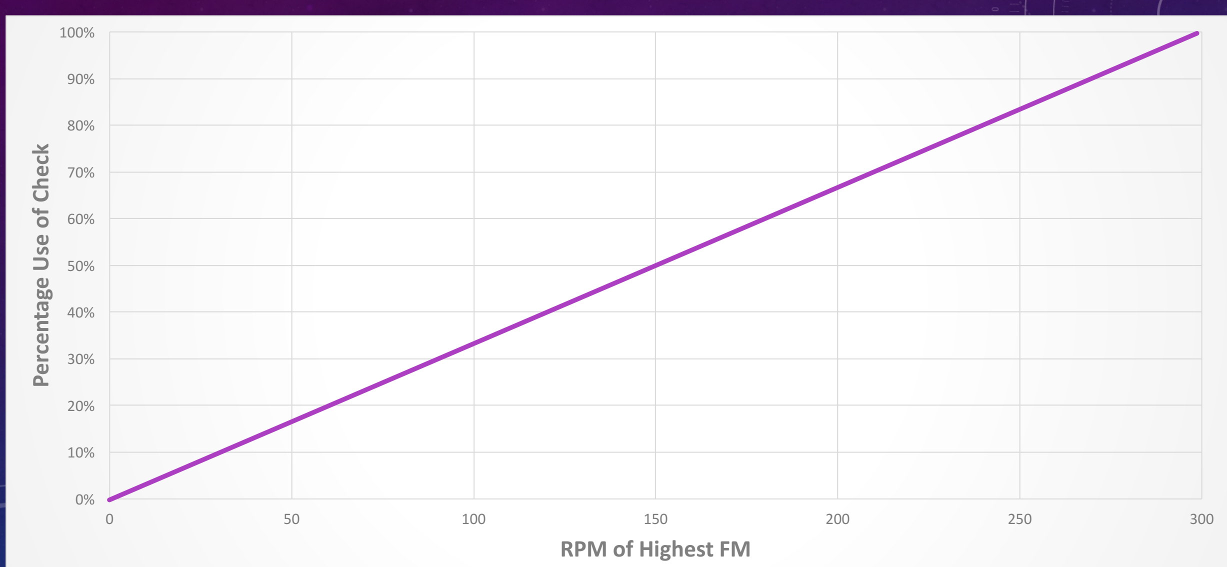
10. CORRELATE FM'S WITH SURVEY RESULTS

- 112 High Priority Failure Modes from FMEA
- 153 Checks from the Survey

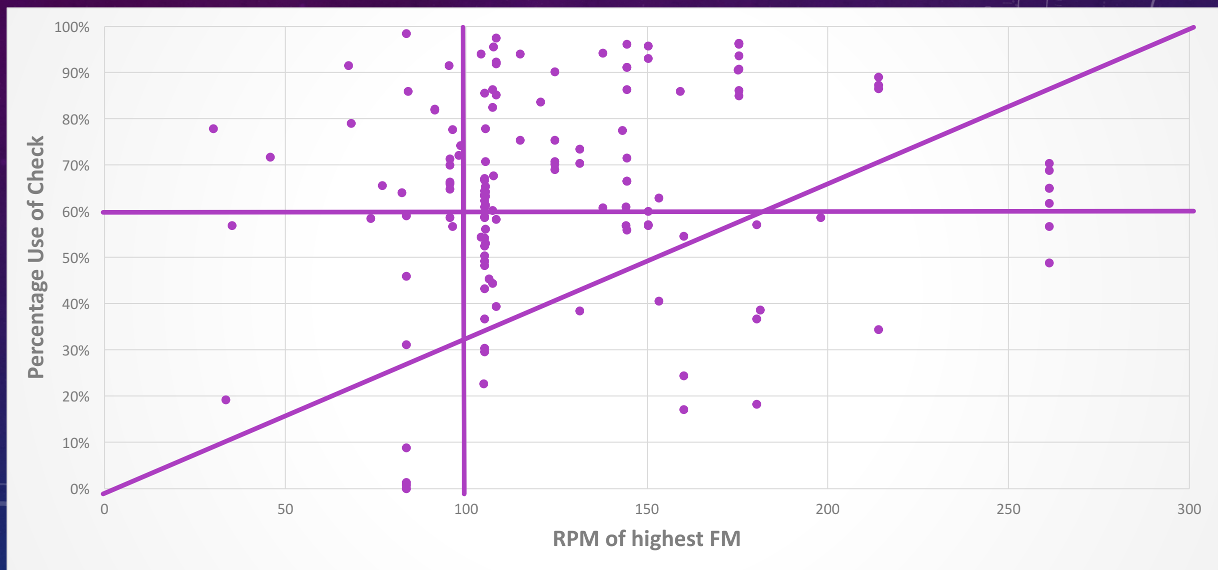
10. CORRELATE FM'S WITH SURVEY RESULTS

- Identified Failure Modes Potentially Found by Each Check
- Many Checks Could Address Multiple FM's
  - Ranged from 0 – 12
  - Average of 2.9 FM per Check
  - Identified Highest RPN FM per Check
  - Graphed Highest RPN per Check vs. % Use of Check

10. CORRELATE FM'S WITH SURVEY RESULTS



10. CORRELATE FM'S WITH SURVEY RESULTS



10. CORRELATE FM'S WITH SURVEY RESULTS

- Examples of High RPN FM's with High % Use of Checks
  - Special Considerations for radiotherapy (e.g. pacemakers, ICDs, pumps, etc.)
  - Previous radiotherapy treatments
  - Description of target location on physician planning directive (e.g. RUL Lung, H&N, L1-L4)

RUQ

10. CORRELATE FM'S WITH SURVEY RESULTS

- Examples of High RPN FM's with Low % Use of Checks
  - Final plan and prescription approval by physician
  - Image Guidance Imaging Technique
  - Prescription vs consult note

RLQ

11. DEVELOP RECOMMENDATIONS

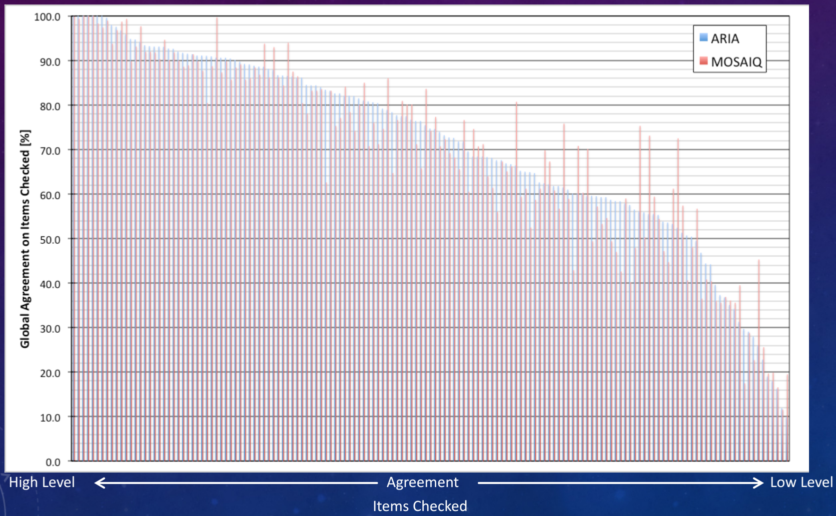
- Recommended Checks
- Recommend Items for Others to Check
- List of Items with Potential for Automation

Emphasis on Adaption Vs. Adoption

- TG275 Report will not be Prescriptive

11. DEVELOP RECOMMENDATIONS

Items Checked depending on the RadOnc Information System



Not a "One Size Fits All" Scenario

IN PROGRESS

- Weekly and EOT Chart Check FMEA
- Brachytherapy FMEA
- Proton Therapy FMEA

TG275 SUMMARY

- TG-275 has completed the External Beam Initial Physics Plan/Chart Check FMEA & Survey Crosswalk
- Currently Developing Recommendations
- Will Repeat the Same Process for Weekly/EOT, Proton, and Brachytherapy

WHERE DO WE GO FROM HERE?

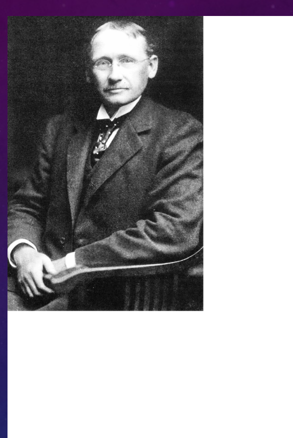
- Lessons from Manufacturing Quality Management
- Lessons from Systems Thinking
- Understand Role of Physics Plan Checks in Overall Treatment Planning Process

TREATMENT PLANNING AS MANUFACTURING PROCESS

Inputs → Process → Output → Inspection → Customer

Imaging Dataset → Treatment Planning → Treatment Plan → Physics Plan Check → Patients

MANUFACTURING QUALITY MANAGEMENT

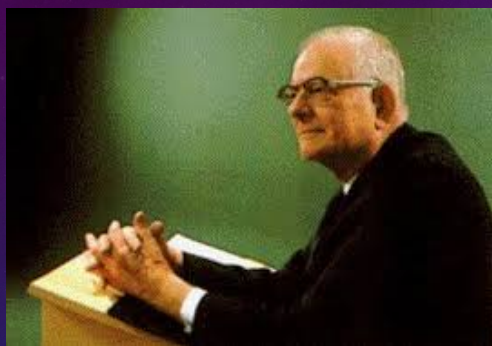


Frederick W. Taylor

- Start in Early 1900's
  - Scientific Management
  - Separated Planning from Execution
  - Focus on Efficiency
  - Quality in Hands of Inspectors
    - Employed hundreds of inspectors
  - Dramatically Increased Productivity
  - Eroded Quality – Excess Scrap
  - Failed to Exploit Most Valuable Resource
    - Knowledge and Creativity of Workforce

By Grap - Gaugler, Eduard (Hrsg.): Taylor, Frederick Winslow : The principles of scientific management ; Vademecum zu dem Klassiker der Wissenschaftlichen Betriebsführung. Düsseldorf: Verlag Wirtschaft und Finanzen, 1996., Public Domain,https://commons.wikimedia.org/w/index.php?curid=8682965

MANUFACTURING QUALITY MANAGEMENT



W. Edwards Deming

http://www.fda.gov/oc/initiatives/criticalpath/stanski/stanski.html

- 1950's - Post WWII Japan
- 1980 - Became known in US
  - Deming's 14 Points
  - Point 3: Understand Inspection
    - Does not add value
    - Rework expensive
    - Encourages Defects by Passing the Buck
  - Quality should be in the hand of the workers

MANUFACTURING QUALITY MANAGEMENT

Shigeo Shingo

http://www.shingoprize.org/about

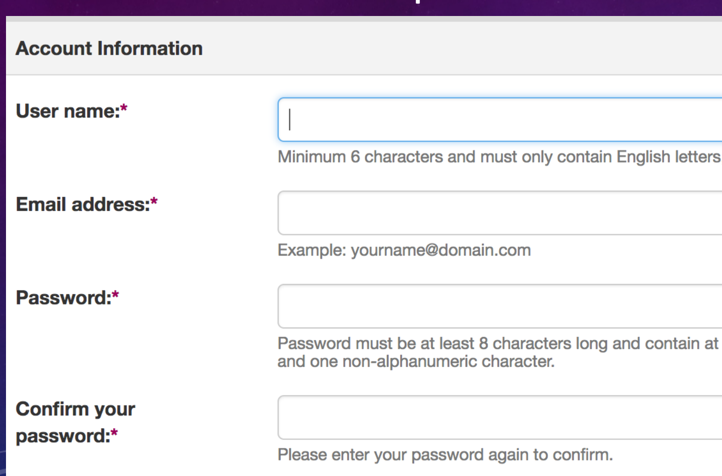
- 1960's – Japanese Industrial Engineer
- Zero Quality Control (ZQC)
  - Stop Errors at or Very Close to Source
  - Simple & Inexpensive Processes
    - Successive Checking
      - Checking prior work before continuing
    - Self Checking
      - Operators assess own work

MANUFACTURING QUALITY MANAGEMENT

- Poka-Yoke (POH-kah YOH-kay)
  - Simple tools to mistake proof processes
    - Uses Automatic Devices or Methods
  - Prediction or Detection

MANUFACTURING QUALITY MANAGEMENT

Prevention Example


Account Information

User name:*
Minimum 6 characters and must only contain English letters,

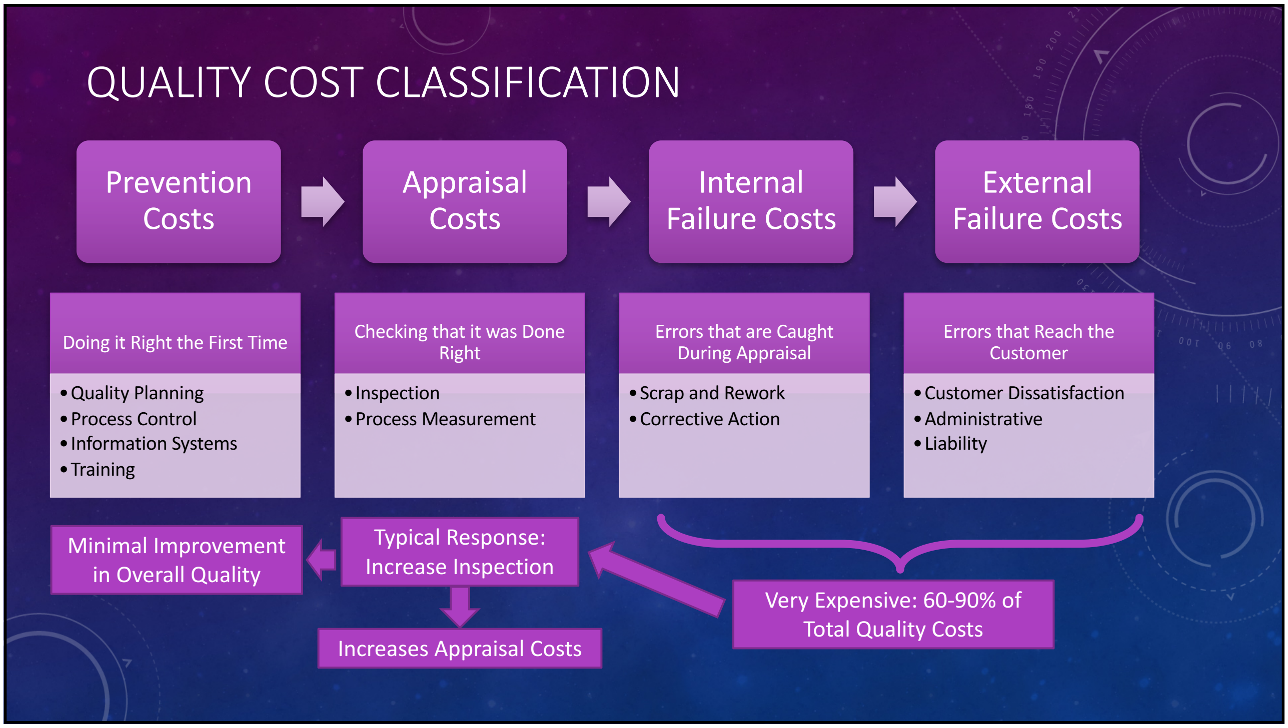
Email address:*
Example: yourname@domain.com

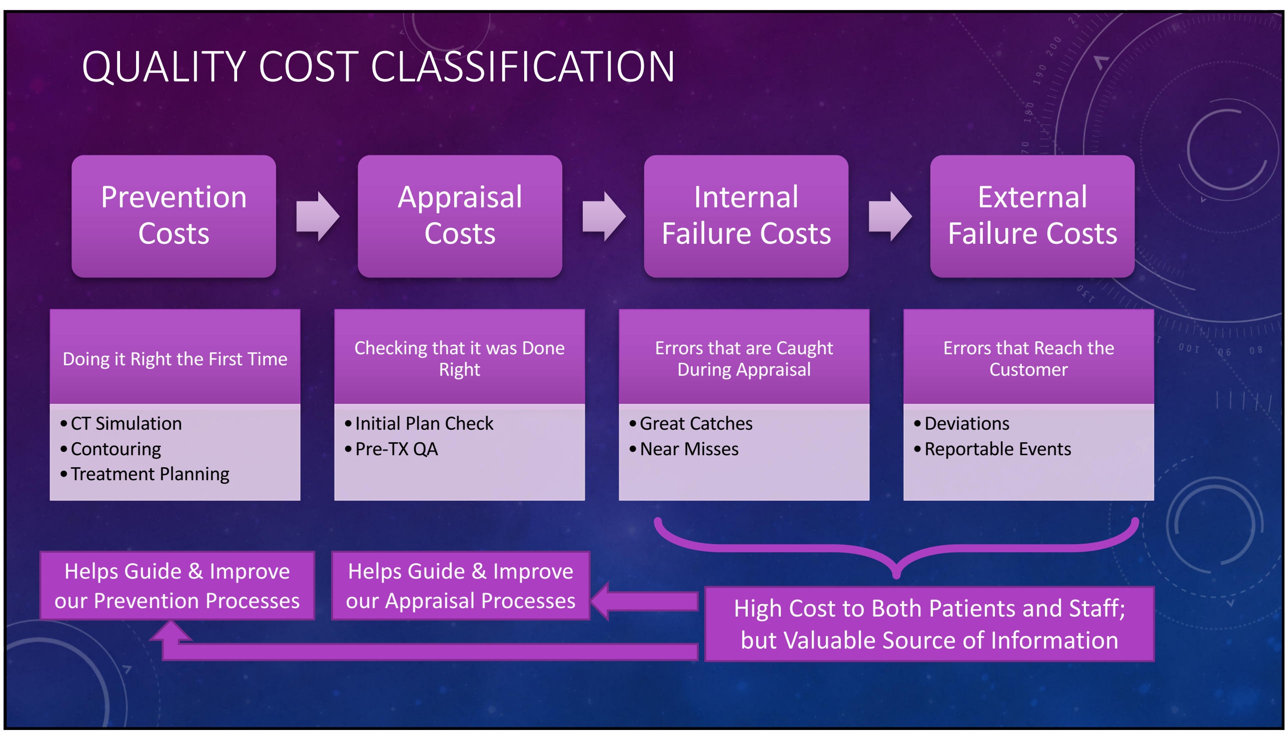
Password:*
Password must be at least 8 characters long and contain at
and one non-alphanumeric character.

Confirm your password:*
Please enter your password again to confirm.

Detection Example

https://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/cl
4/4_vclearance.htm


QUALITY COST CLASSIFICATION
Prevention Costs
Appraisal Costs
Internal Failure Costs
External Failure Costs
Doing it Right the First Time
• Quality Planning
• Process Control
• Information Systems
• Training
Checking that it was Done Right
• Inspection
• Process Measurement
Errors that are Caught During Appraisal
• Scrap and Rework
• Corrective Action
Errors that Reach the Customer
• Customer Dissatisfaction
• Administrative
• Liability
Minimal Improvement in Overall Quality
Typical Response: Increase Inspection
Increases Appraisal Costs
Very Expensive: 60-90% of Total Quality Costs


QUALITY COST CLASSIFICATION
Prevention Costs
Appraisal Costs
Internal Failure Costs
External Failure Costs
Doing it Right the First Time
• CT Simulation
• Contouring
• Treatment Planning
Checking that it was Done Right
• Initial Plan Check
• Pre-TX QA
Errors that are Caught During Appraisal
• Great Catches
• Near Misses
Errors that Reach the Customer
• Deviations
• Reportable Events
Helps Guide & Improve our Prevention Processes
Helps Guide & Improve our Appraisal Processes
High Cost to Both Patients and Staff; but Valuable Source of Information

CURRENT QUALITY MANAGEMENT PERSPECTIVE

- Inspection in Manufacturing
  - Judge quality of manufacturing
  - Discover and help to resolve production problems
  - Ensure that no defective items reach the customer
- Physics Plan Review
  - Assess overall quality
  - Identify and guide improvement opportunities in the planning process
  - Ensure that no errors reach our patients

QUALITY MANAGEMENT IN RADIATION ONCOLOGY

Quality Control Quantification (QCQ): A Tool to Measure the Value of Quality Control Checks in Radiation Oncology

Eric C. Ford, PhD,* Stephanie Terezakis, MD,* Annette Souranis,* Kendra Harris, MD,* Hiram Gay, MD,† and Sasa Mutic, PhD†

Volume 84 • Number 3 • 2012

International Journal of Radiation Oncology biology • physics

www.redjournal.org

2012

"Benefit to more upstream error proofing of products and processes"

QUALITY MANAGEMENT IN RADIATION ONCOLOGY

2012

- Hierarchy of Effectiveness
  - Reliance on policies and training
    - Usual but least effective approach
  - Best to “hardwire” the systems for success
    - Simplification
    - Standardization
    - Automation
    - Forced Functions

QUALITY MANAGEMENT IN RADIATION ONCOLOGY

- Standardization
- Automation
- Safety Barriers Placement Optimization
- Risk Assessment Approaches

STANDARDIZATION

- Reduces Variation and Random Error
- Pre-requisite to Automation

STANDARDIZATION

Standardizing dose prescriptions: An ASTRO white paper

Suzanne B. Evans MD, MPH [a,*], Benedick A. Fraass PhD [b], Paula Berner CMD, FAAMD [c], Kevin S. Collins PhD, RT(R)(T), CMD [d], Teamour Nurushev PhD [e], Michael J. O'Neill MD [f], Jing Zeng MD [g], Lawrence B. Marks MD [h]

pro — practical radiation oncology — www.practicalradonc.org

Practical Radiation Oncology (2016) **6**, e369–e381

AAPM Task Group 263: Tackling Standardization of Nomenclature for Radiation Therapy

C. Mayo, J.M. Moran, Y. Xiao, W.R. Bosch, M.M. Matuszak, L.B. Marks, R.C. Miller, Q.R.J. Wu, T.I. Yock, R. Popple, T.R. McNutt, N. Brown, A. Molineu, T.G. Purdie, E.D. Yorke, L. Santanam, P. Gabriel, J.M. Michalski, J. Moore, S. Richardson, R.A.C. Siochi, M. Napolitano, M. Feng, T. Fitzgerald, K. Ulin, W.F.A.R. Verbakel, M.S.U. Siddiqui, M.K. Martel, Y. Archambault, T. Morgas, J. Purcy, J.A. Adams, M. Ladra, B. Lansing, R. Ruo, A. Fogliata, C. Hurkmans

International Journal of Radiation Oncology biology • physics — Official Journal of the American Society for Radiation Oncology — ASTRO

Volume 93, Issue 3, Supplement, Pages E383–E384

AUTOMATION

- Driven by a need to increase efficiency
- Shortage of medical physicists entering the field
- Some items simply better to check using automated methods

AUTOMATION

- Poke-Yokes in Treatment Planning
  - Scripting
    - Standard ROI's based on treatment site
    - Standard Beam Arrangements
  - Forcing Functions
    - Display warning if importing images from incorrect patient
    - Display warning if adding a beam with different isocenter
  - Can you think of other current or potential Poke-Yokes?

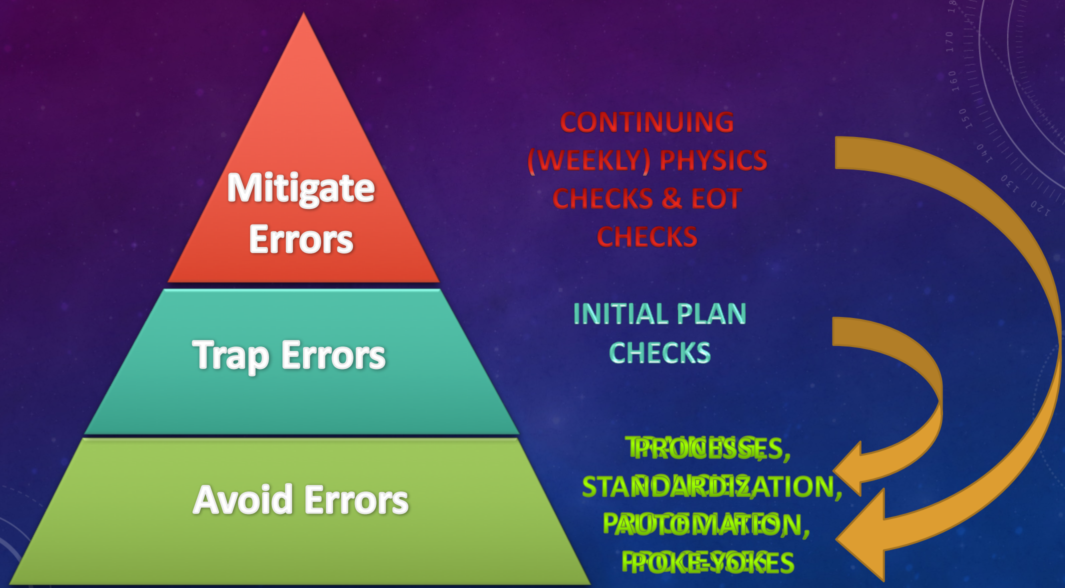
AUTOMATION

- Need to pay attention to location of automated safety barriers
  - Design safety into the process
  - Put barrier within or immediately following error prone process step
  - Put safety into the hands of the planner
  - Reduce “scrap” or re-work

RISK ASSESSMENT – TG100

- Process Map
  - Need to understand the process
  - Incorporate EVERYONE involved in the process
- FMEA
  - Identify and Rank Failure Modes for Each Process Step
- Fault Tree Analysis
  - Links Process Map and Failure Modes
  - Guides Optimal Placement of Safety Barriers

ERROR TROIKA



QUALITY MANAGEMENT TAKE HOME

- Need to Take a Systems View
- Understand & Capitalize on Interconnections
- Appreciate the Role of Physics Plan Checks in Overall Process

QUALITY MANAGEMENT TAKE HOME

- Physics Plan Checks are Important Piece of Puzzle!
- However they should not replace "Doing it Right the First Time"

https://pixabay.com/en/photos/puzzle/

THE END

- Thank you for your time and attention!

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