Scripting and **Automation** for **Efficient** and **Effective** **Chart Checks** in a **Pinnacle/Mosaiq** Environment

Badal Juneja
Leonard Kim
Michael Walsh

MD Anderson Cancer Center Cooper

1

Scripting and **Automation** for **Efficient** and **Effective** **Chart Checks** in a **Pinnacle*/Mosaiq** Environment

* Pinnacle/RayStation

MD Anderson Cancer Center Cooper

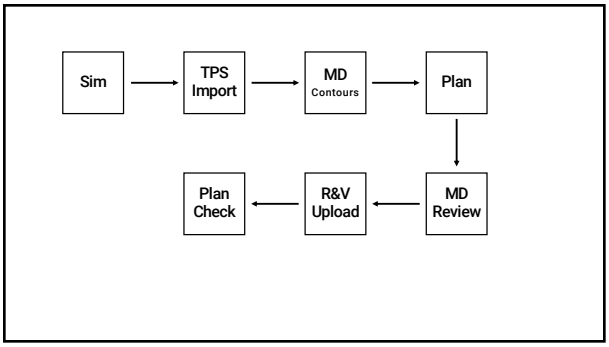
2

3

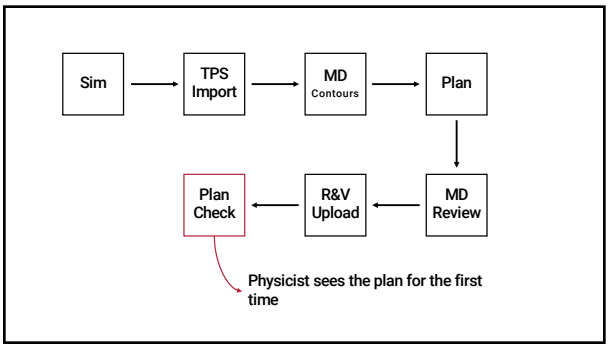
- ✓ What?
- ✓ Why?
- ✗ How?

juneja-badal@cooperhealth.edu

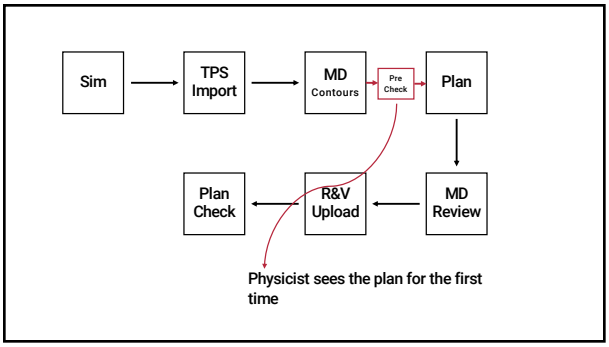
4



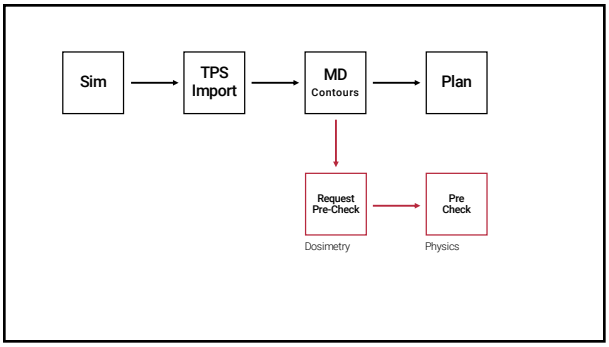
5



6



7



8

What do we check?

- Check orders and simulation note and verify against treatment planning images (e.g. immobilization, compression, breath hold, PET/CT)
- Verify image orientation (supine or prone only)
- Check volumes (e.g. expansions/crops, target dose labeling vs. prescription)
- Verify necessity and accuracy of density/material overrides
- Verify patient support structure location
- Verify patient support structure accuracy
- Check DVH scorecard against prescription note
- Verify correct CT-density table used
- Verify treated area is immobilized
- Check CT field of view and extent (e.g. no patient cut-off)
- Verify correct outside-patient air threshold
- Verify localization point matches tattooed isocenter
- Verify accurate application of bolus
- Check appropriate location of isocenter relative to target
- If multi-target, assess number of isocenters to be used
- Verify same isocenter used for all beams
- Verify same machine used for all beams
- Evaluate possibility of collision
- Verify correct isocenter and dose calculation point
- Check for appropriate beam energy
- Verify 6 MV used for VMAT beams
- Check naming convention (including laterality, orientation)
- Verify partial arcs are used on correct side
- Verify arc directions are correct
- Verify sagittal arcs move away from patient's head
- Verify appropriate collimator angles for VMAT beams
- Check dose grid coverage
- Verify correct dose grid resolution
- Verify dose engine
- Verify homogeneity correction

9

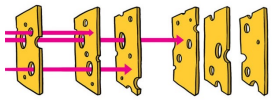
"Implementation and Evaluation of a TG-275 Key Recommendation: An Additional Early Physics Check" — Table 1

Institutional Pre-Check	Examples of downstream effects	Earliest rework step required	Part of automated pre-check script	Corresponding TG-100 Pre-Check item
Check orders and simulation note and verify against treatment planning images (e.g. immobilization, compression, breath hold, IV/CT)	Inaccurate treatment delivery	Simulation		Documentation of isocenter coordinates, measurements, patient positioning, etc. from the simulator is provided
Verify image orientation (supine or prone only)	Inaccurate treatment delivery	Simulation		Images verified for correct orientation
Check volumes (e.g. expansion/crops, target dose labeling vs. prescription)	Inaccurate treatment delivery	Contouring		Organs at risk are contoured according to departmental guidelines
				Expansion of GTV to CTV follows site-specific protocols; automated margins worked correctly, variations noted
				Expansion of CTV to PTV follows site-specific protocol; automated margins worked properly, variations noted
				Boolean structure checks: input to structures checked, regions created visually reviewed
				Correctness of all 3-D representations (voxel descriptions, surfaces, etc.) is verified
Verify necessity and accuracy of density/material overrides	Inaccurate dose calculation	Planning		Image artifacts (e.g., contrast, metal) corrected per department protocols
Verify patient support structure location	Inaccurate dose calculation	Planning		Patient support devices (e.g., immobilization, skin markers, couches) are correctly included or excluded
Verify patient support structure accuracy		Planning	X	
Check DVH scorecard against prescription note	Suboptimal treatment delivery Inaccurate treatment delivery	Planning		Treatment planning instructions are clear and unambiguous
				Preliminary prescription written
				Optimization goals and limits are specified, and applicable departmental or other protocols are used
				Special instructions are written as in the department policy
				Initial directive includes statement of previous treatment, review of previous treatments requested; the prescription accounts for any previous treatments

Source: https://doi.org/10.1016/j.prro.2022.05.011

10

Are we **adding** or **replacing** a check?



11

FMEA: RPN = O · S · D

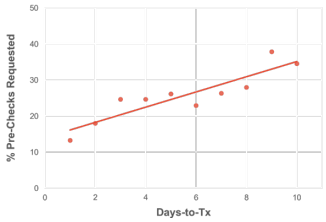
O – Occurrence

S – Severity

D – Detectability (lack of)

12

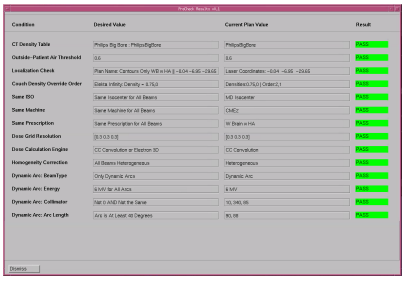
When Dosimetrist had more time to plan, they asked for more pre-checks



Source: https://doi.org/10.1016/j.prro.2022.05.011

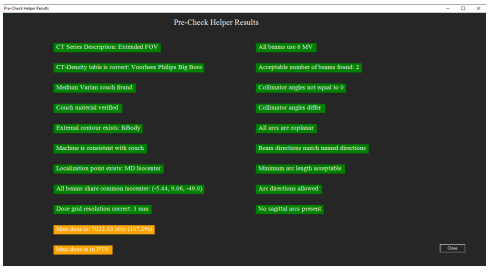
13

Pre-check Helper — Pinnacle



14

Pre-check Helper — RayStation

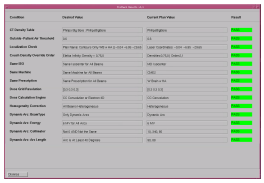


15

16

Interpretable Results

Show the current values and expected values when possible



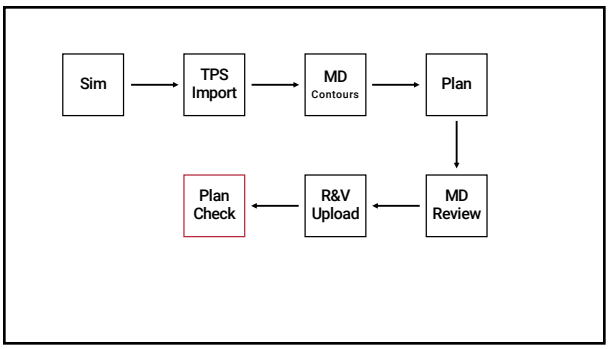
Use colors to draw attention to problem areas

17

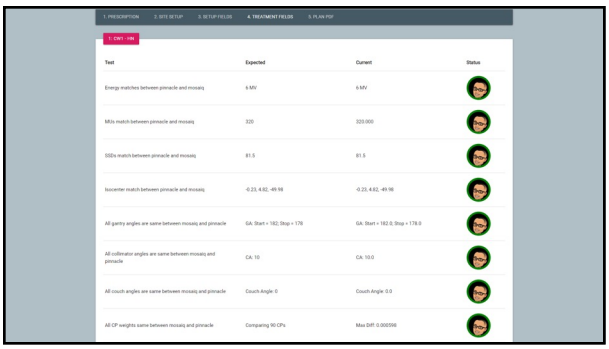
While automation holds great promise for improving the efficiency and effectiveness of plan and chart review, it is important to be aware of its limitations. If it is not properly implemented or tested it could lead to errors being **systematically unidentified**.

— TG 275

18



19



20

“What gets measured gets managed.”

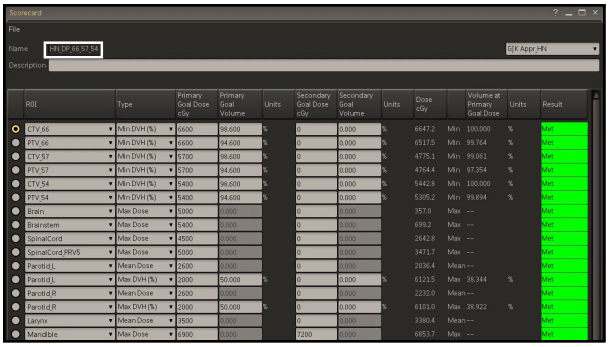
— Peter Drucker

21

What do you check?

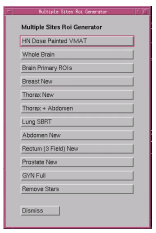
- Check orders and simulation note and verify against treatment planning images (e.g. immobilization, compression, breath hold, PET/CT)
- Verify image orientation (supine or prone only)
- Check volumes (e.g. expansions/crops, target dose labeling vs. prescription)
- Verify necessity and accuracy of density/material overrides
- Verify patient support structure location
- Verify patient support structure accuracy
- Check DVH scorecard against prescription note
- Verify correct CT-density table used
- Verify treated area is immobilized
- Check CT field of view and extent (e.g. no patient cut-off)
- Verify correct outside-patient air threshold
- Verify localization point matches tattooed isocenter
- Verify accurate application of bolus
- Check appropriate location of isocenter relative to target
- If multi-target, assess number of isocenters to be used
- Verify same isocenter used for all beams
- Verify same machine used for all beams
- Evaluate possibility of collision
- Verify correct isocenter and dose calculation point
- Check for appropriate beam energy
- Verify 6 MV used for VMAT beams
- Check naming convention (including laterality, orientation)
- Verify partial arcs are used on correct side
- Verify arc directions are correct
- Verify sagittal arcs move away from patient's head
- Verify appropriate collimator angles for VMAT beams
- Check dose grid coverage
- Verify correct dose grid resolution
- Verify dose engine
- Verify homogeneity correction

22



23

Auto-naming contours based on TG-263 guidelines

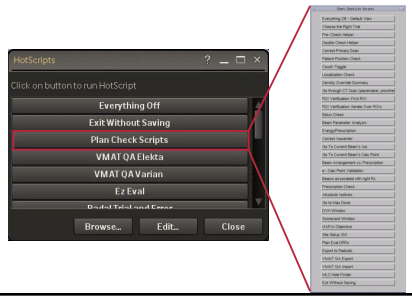


24

Checklists!

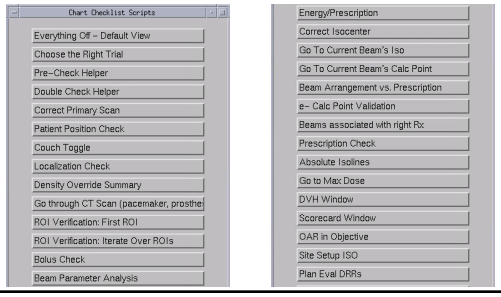
25

Plan Check Scripts as Checklist



26

Plan Check Scripts as Checklist



27

Just Take the First Step

28

29

Thank You!

MD Anderson Cancer Center | Cooper

30