Practical Implementation of TG 263's Standardized Nomenclatures Across Multiple Radiation Oncology Practices

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Atrium Health
Levine Cancer Institute

Nomenclature and Big Data – TG 263 and the Future
2019 AAPM Spring Clincal Meeting
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At the conclusion of this presentation, the participant will be able to:

- Describe Task Group 263's goals and recommendations
- Review clinical examples and receive guidance for gaining efficiencies across multiple software platforms used during the radiation therapy process across a multi-facility practice
- Explore the use of metrics designed to quantify efficiency gains realized by implementing the Task Group's recommendations

SAMs

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Disclosures

- None

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- Why Standardize?
- Challenges in a multi-facility community-based practice
- Case Study: Standardized Clinical Treatment Planning Standards
  - SBRT Lung

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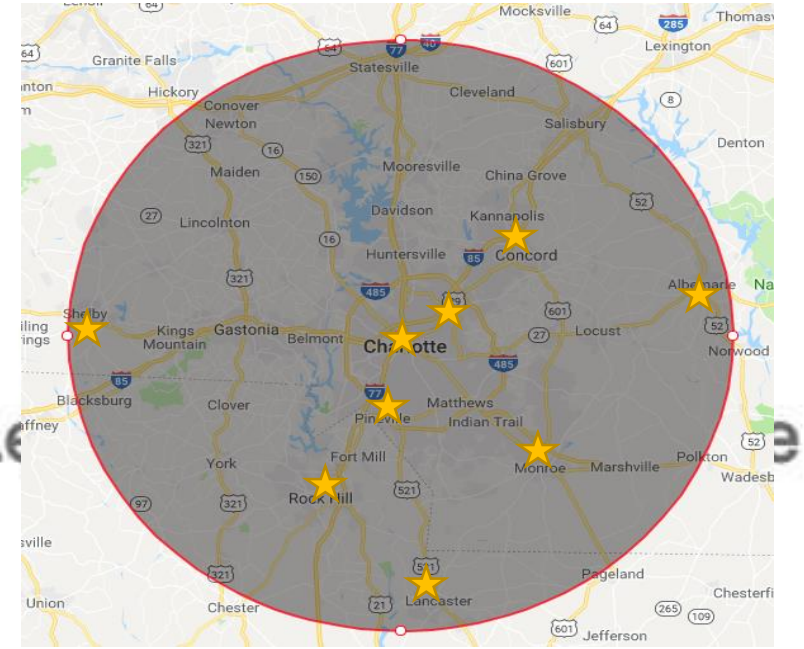
Mocksville
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Lincolnton
Concord
Huntersville
Shelby
Kings Mountain
Gastonia
Belmont
Charlotte
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Norwood
Blacksburg
Clover
Matthews
Indian Trail
York
Fort Mill
Monroe
Marshville
Polkton
Rock Hill
Pageland
Union
Chester
Lancaster
Jefferson

LCI Rad Therapy By the Numbers:

9 physical locations

6 single-linac facilities & 3 multiple-linac sites

350+ patients daily

> 2000 special procedures annually

Multisite American College of Radiology (ACR) Accreditation

AAPM Task Group 263

- Report issued in 2017
- 57 stakeholders
  - Physicists, Physicians, Dosimetrists, Members of Cooperative group trials, AAPM, DICOM working group, ASTRO, IHE-RO
- Develop consensus position on nomenclature for use in clinical trials, data-pooling initiatives, populations-based studies and routine clinical care by standardizing:
  - Structure names across platforms
  - Nomenclature for dosimetric data
  - Templates for clinical trials groups and users
  - Formalism for nomenclature schema for the future

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Critical Review

American Association of Physicists in Medicine Task Group 263: Standardizing Nomenclatures in Radiation Oncology

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Supplementary material for this article can be found at www.redjournal.org.

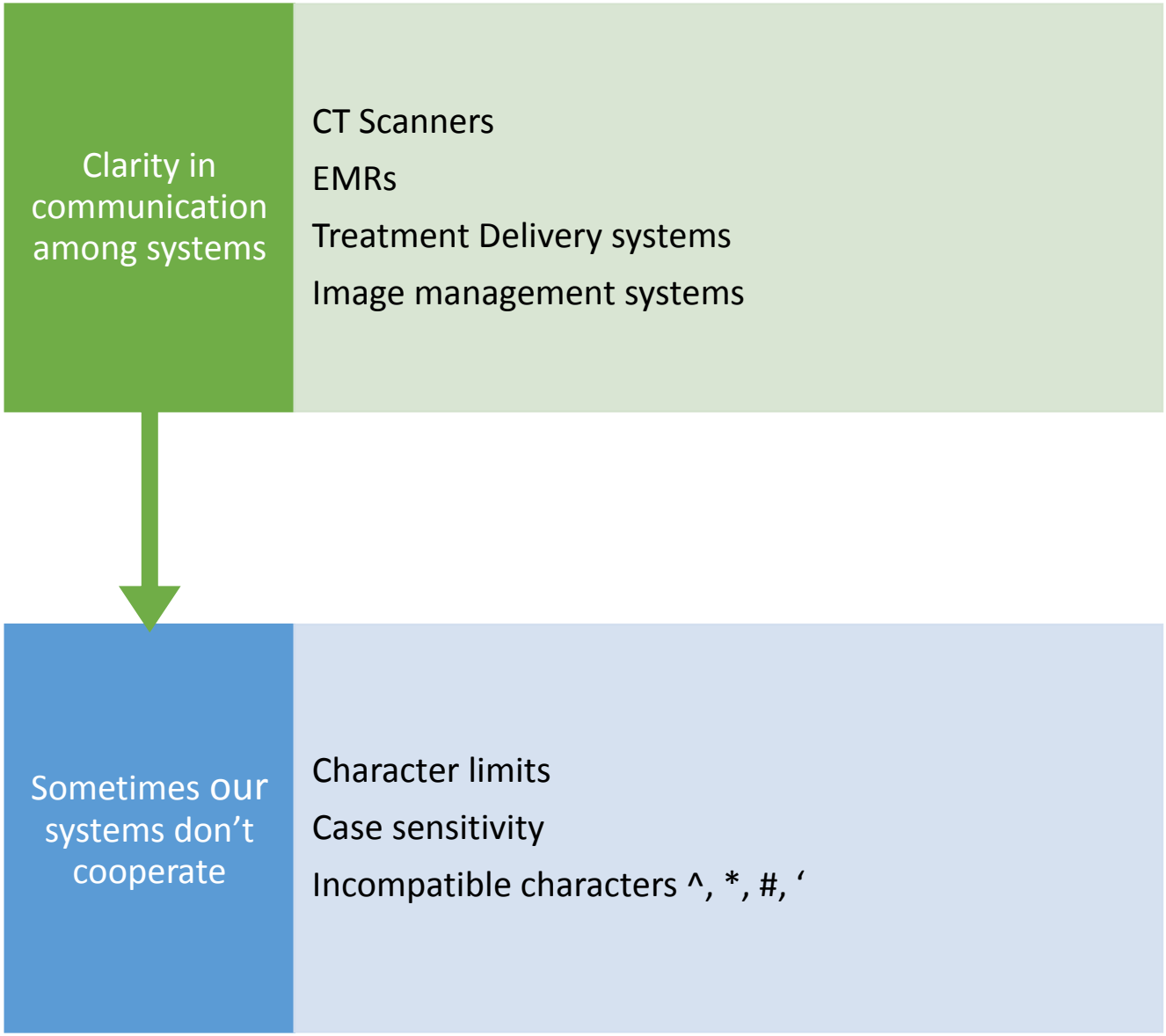
Why Standardize?

- Clarity in communication among team members
  - Are we talking about the same things?
  - Is our INTENT clear?
  - Are we using AMBIGUOUS methods of communicating?

Table 1. Variations in standardized nomenclatures reported for non-target structures by 16 institutions. The number in () indicates the number of respondents using the same value if > 1.

Structure	Number of Institutions	Examples
Left Optic Nerve	12	Lt Optic Nerve, OPTICN_L, OPTNRV_L, optic_nrv_l, L_optic_nerve, OPTIC_NRV_L, OpticNerve_L, LOPTIC, OpticNerve_L (3), Lef Optic Nerve, ON_L
Left Lung	12	Lt Lung, Lung_L(4), LUNG_L(3), lung_l, L_lung, LLUNG, L Lung
Both Lungs	12	Lungs(2), LUNGs, LUNG_TOTAL, lung_total, combined_lung, LUNG, LUNGS(2), Lung,BilatLung, Lung_Both
8th Cranial Nerve	7	CN_VIII(5), cn_viii(2), CN8, CN_8
Right External Iliac Artery	2	A_ILIAC_E_R, a_iliac_e_r

Why Standardize?



A kick in the pants…

Multisite ACR re-accreditation in 2016

ACR-ASTRO Practice Guidelines

- Define the goals and requirements of the treatment plan, including the specific dose constraints for the target(s) and nearby critical structure(s).
- Delineate tumor and specify and approve target volumes, preferably using appropriate methodology of the International Commission on Radiation Units and Measurements (ICRU).
- Review and approve all critical structures contoured. Perform final evaluation and approve the final IMRT plan for implementation
- Additional recommendation to specify goals and “close the loop” by recording results of planning process
- This was an opportunity…

- Automation
- Solution needed to be deployable across multiple sites
- Configuration allowed for standardization to be encouraged/enforced

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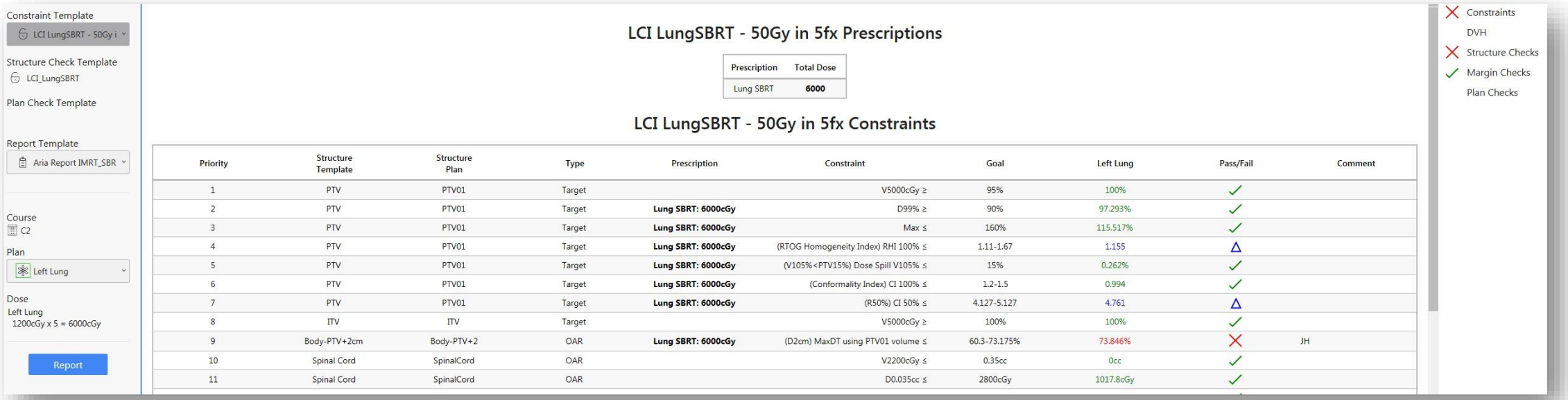
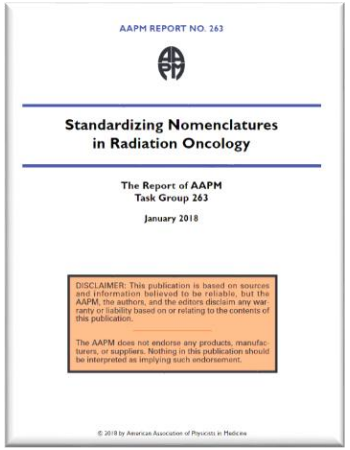
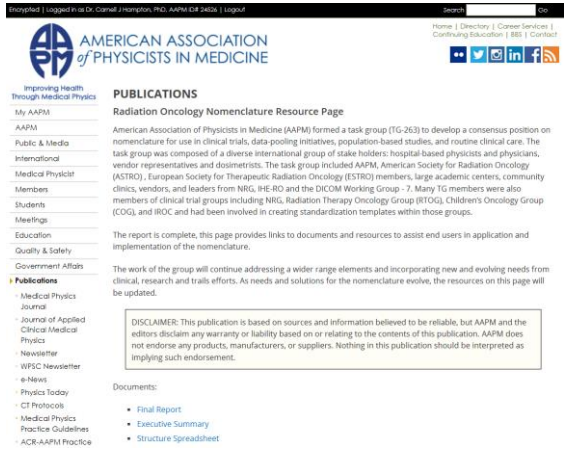
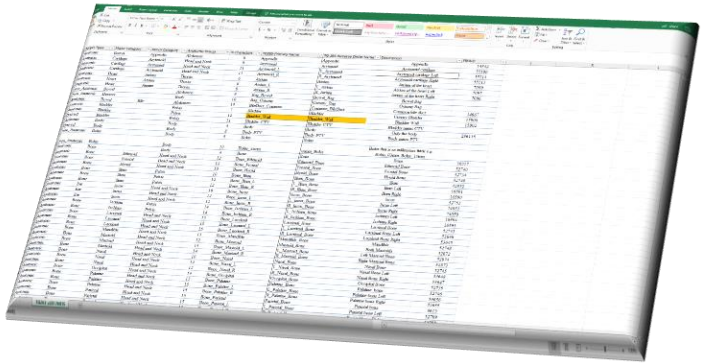


ClearCheck

- ClearCheck is a script that is integrated into the Eclipse treatment planning software that provides plan quality assurance functionality
- Made optimally efficient through the matching of planning structures and a template
- TG-263 Standardized nomenclature can easily be incorporated into templates







- TG Report
  - Principles for non-target, target nomenclature
  - Recommendations for DVH Metrics
  - Implementation
- Nomenclature spreadsheet
  - >700 structure names
- Eclipse structure templates

TG-263 Resources

https://www.aapm.org/pubs/reports/RPT_263_Supplemental/

Will my dosimetrists, physicists and oncologists EMBRACE standardization?

https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwjzrrHO85XhAhWLTd8KHaDLAz0QjB16BAgBEAQ&url=https%3A%2F%2Fwww.winshuttle.com%2Fblog%2Fshared-services-process-standardization%2F&psig=AOvVaw1UI4gjhho9fcTy1-J8vci5&ust=1553345806268298

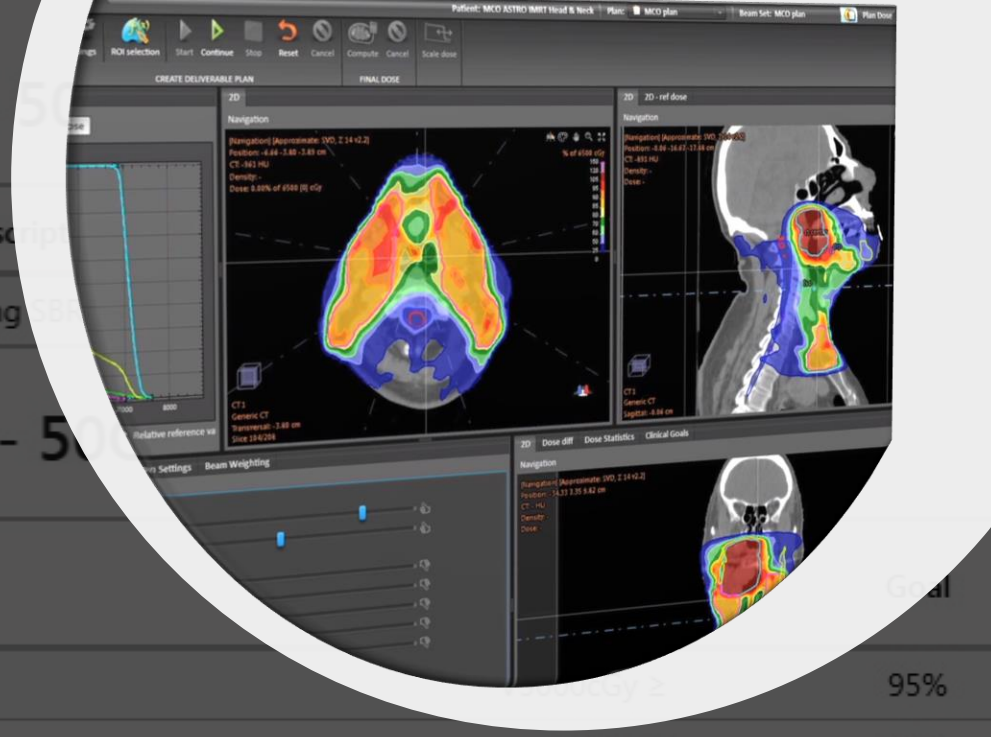
collaboration
worrisome
cookie
streamlined
amazing
joy
necessary
loss
cutter
team
care
trust
annoying
safety
protocol
same
restricted
positivity
fear
personalized
rote
teamwork
painful
systems
joyful
consistency

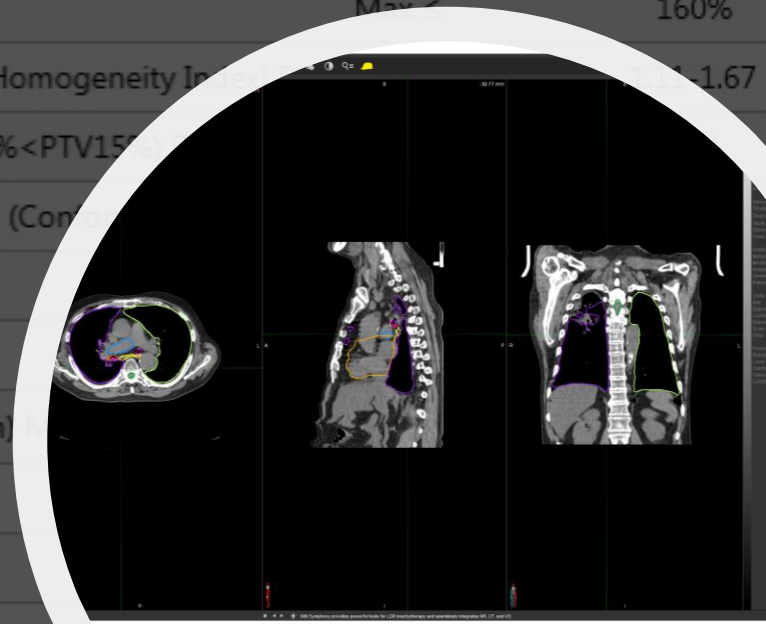
Environmental Challenges

- **Regional practices**
- **Varied environments**
- **Lean staffing Vs Academic practice**
- **Rotating Coverage**

Technology Challenges

- Multiple vendor environment
  - 3 different EMRs – Varian ARIA 15.1, Varian ARIA 13.6, Mosaiq
  - 3 different TPS – Varian Eclipse 15.1, Varian Eclipse 13.6, Raysearch Raystation
  - 2nd Check Software – Radcalc
  - DVH & Objective Analysis Software – ClearCheck
  - Image Management Database – MIM Maestro



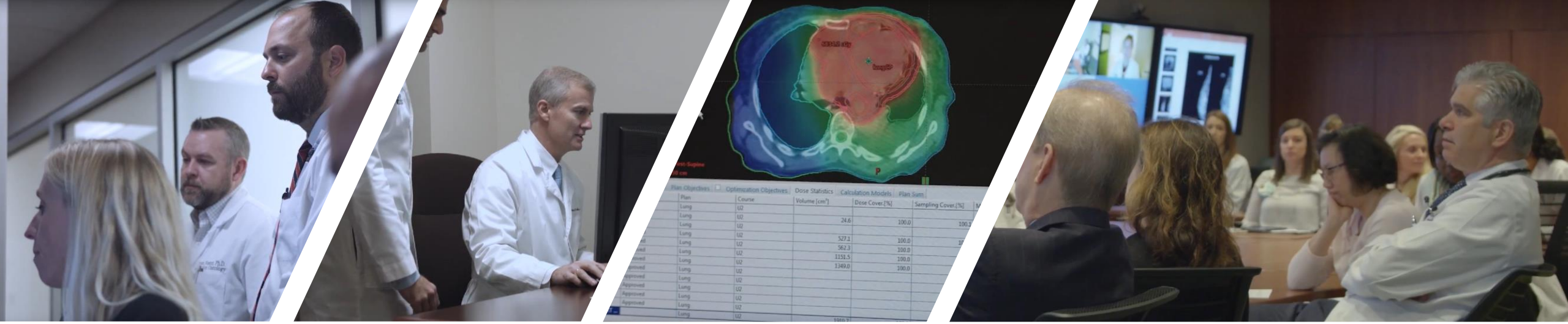


Develop Implementation Plan

- Define goal
  - Realize efficiencies in the planning and plan documentation processes
  - Enhance safety by standardizing nomenclature
  - Demonstrate utilization and compliance with standards in all clinics
- Leading measure
  - Feedback/participation in weekly implementation meetings

Communication

- Communicate with all stakeholders the broad goal of standardization
- Provide documentation

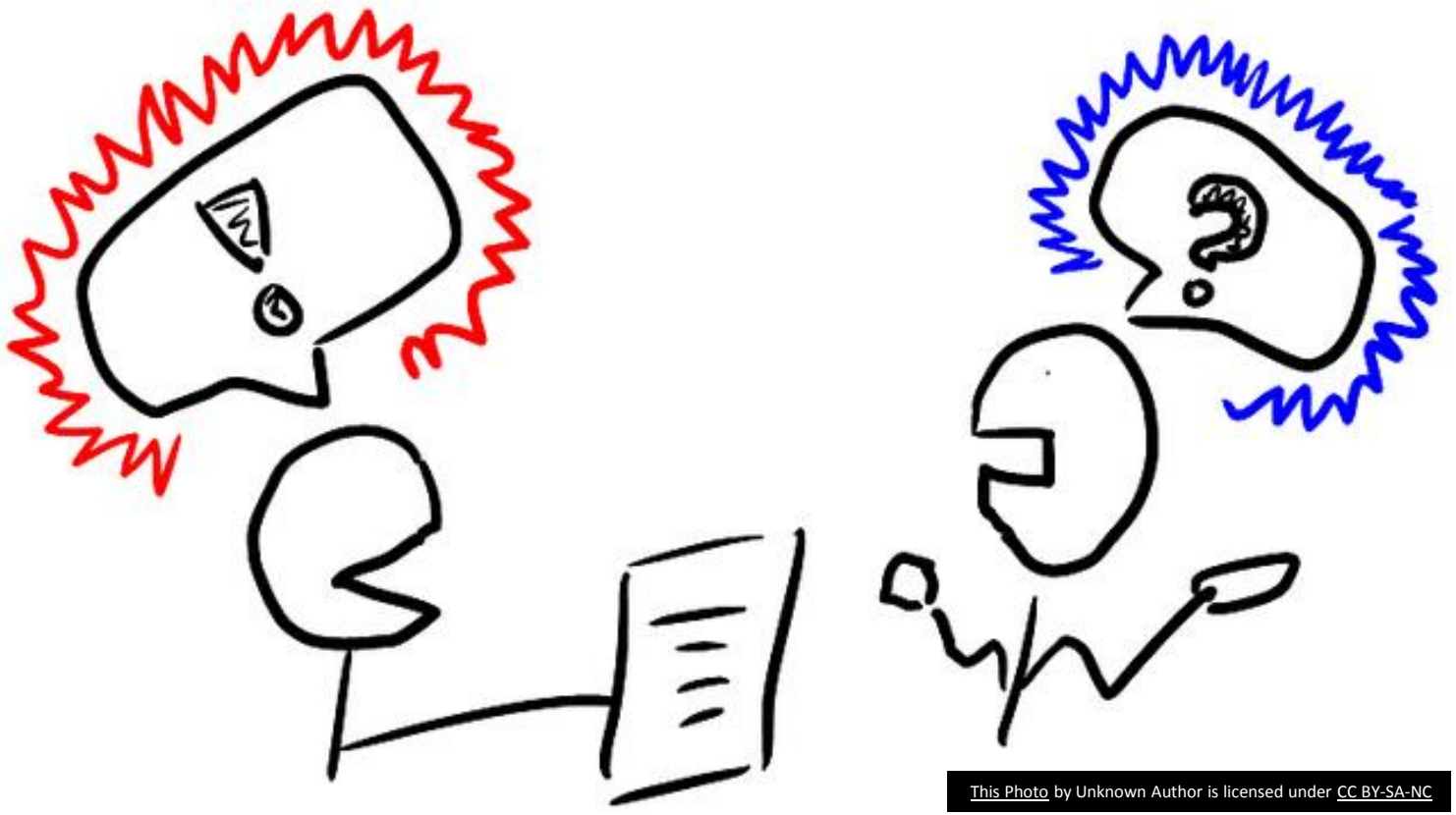


- Provide training
- Selectively introduce at robust clinical site
- Identify champions
- Develop best practices for workflows, protocols
- Gather feedback from smaller groups

Pilot Implementations

Expansion

- Introduce templates, workflows, protocols at a second rad therapy clinic
- Promote champion's experience
- Incorporate key lessons learned



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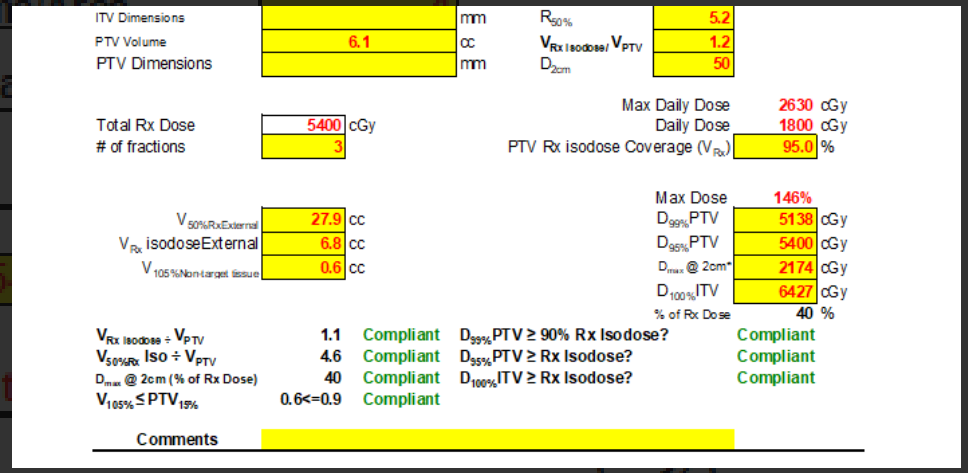
Feedback

- Understand small process differences from clinic to clinic
- Identify roadbacks to implementation
- Perform necessary revisions
- Allow constrained creativity

Implementation of Standardized Tx Planning Standards: Lung SBRT



Goal

- Implement ClearCheck as consistent tool for analyzing OAR and target plan quality goal attainment
- Standardize use of consistent OAR nomenclature for all treatment plans
- Eliminate use of multiple spreadsheets or manual plan scoring sheets

Practical Radiation Oncology (2019) 9, 65-72

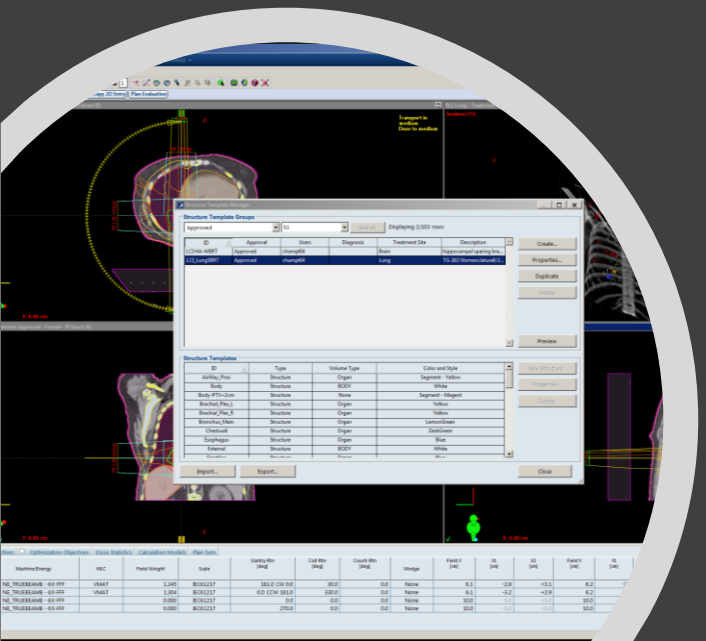
Special Article

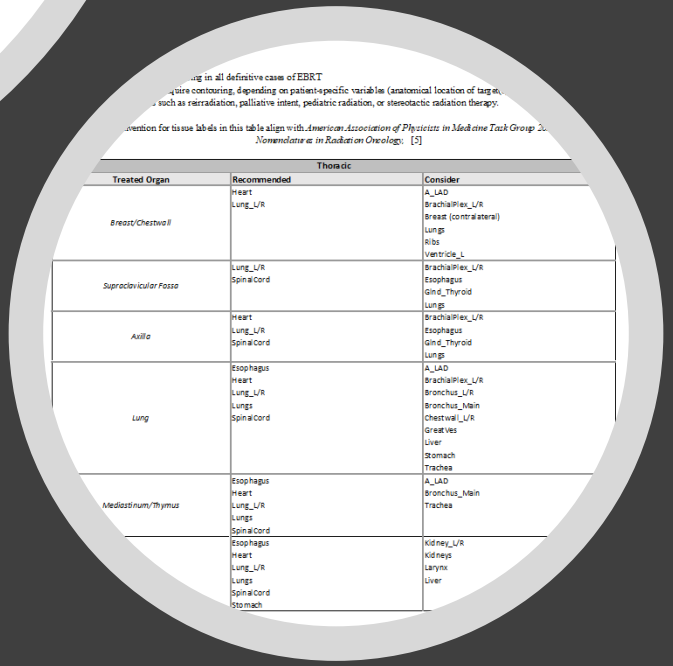
Standardizing Normal Tissue Contouring for Radiation Therapy Treatment Planning: An ASTRO Consensus Paper

Jean L. Wright MD [a], Sue S. Yom MD, PhD, MAS [b], Musaddiq J. Awan MD [c], Samantha Dawes CMD [d,*], Benjamin Fischer-Valuck MD [e], Randi Kudner MA [d], Raymond Mailhot Vega MD, MPH [f], George Rodrigues MD, PhD [g]

Hopkins University, Baltimore, Maryland; [b]University of California, San Francisco, Calif... Milwaukee, Wisconsin; [d]American Society for Radiation Oncology, Arlington, V... [f]University of Florida, Jacksonville, Florida; [g]London Health Science...

...revised 29 November 2018; accepted 8 December 2018





...ing in all definitive cases of EBRT

...quire contouring, depending on patient-specific variables (anatomical location of target... ...such as reirradiation, palliative intent, pediatric radiation, or stereotactic radiation therapy.

...vention for tissue labels in this table align with *American Association of Physicists in Medicine Task Group 2... Nomenclature in Radiation Oncology*: [5]

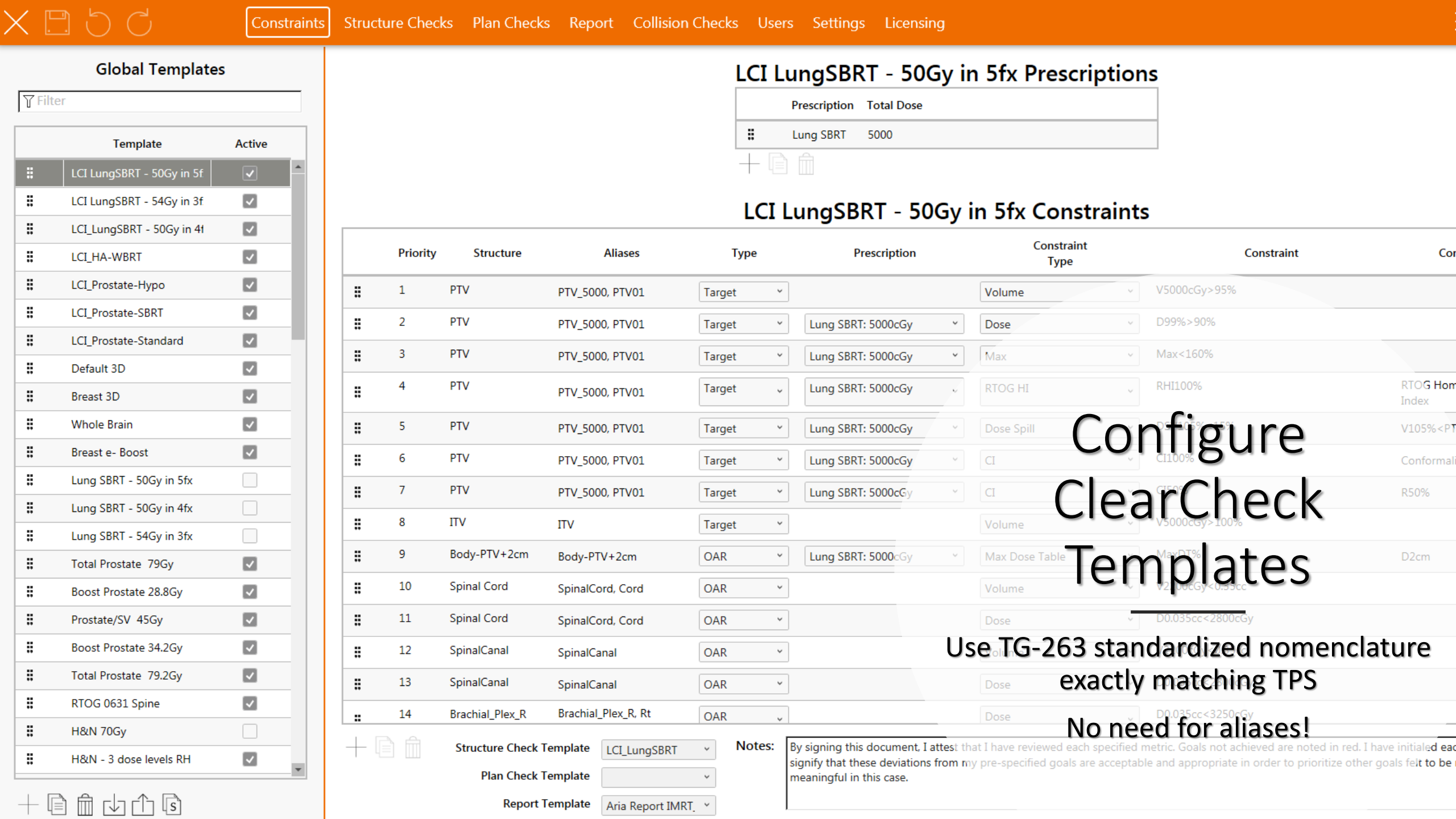
Thoracic		
Treated Organ	**Recommended**	**Consider**
Breast/Chestwall	Heart Lung_L/R	A_LAD BrachialPlex_L/R Breast (contralateral) Lungs Ribs Ventricle_L
Supraclavicular Fossa	Lung_L/R SpinalCord	BrachialPlex_L/R Esophagus Glnd_Thyroid Lungs
Axilla	Heart Lung_L/R SpinalCord	BrachialPlex_L/R Esophagus Glnd_Thyroid Lungs
Lung	Esophagus Heart Lung_L/R Lungs SpinalCord	A_LAD BrachialPlex_L/R Bronchus_L/R Bronchus_Main Chestwall_L/R GreatVes Liver Stomach Trachea
Mediastinum/Thymus	Esophagus Heart Lung_L/R Lungs SpinalCord	A_LAD Bronchus_Main Trachea
	Esophagus Heart Lung_L/R Lungs SpinalCord Stomach	Kidney_L/R Kidneys Larynx Liver

Methods

Create Standard for all LCI Clinics

- Download Eclipse template from TG-263 resource page, Import into Eclipse V15.1 and customize:
  - Inclusive of ASTRO consensus OARs
  - Consensus of names for planning structures
  - TG suggested target nomenclature
- Export configured Eclipse Structure Template and import into Eclipse V13.6

Practical Radiation Oncology 9; 65-72 (2019)


Constraints
Structure Checks
Plan Checks
Report
Collision Checks
Users
Settings
Licensing
Global Templates
Filter
Template
Active
LCI LungSBRT - 50Gy in 5f
LCI LungSBRT - 54Gy in 3f
LCI_LungSBRT - 50Gy in 4f
LCI_HA-WBRT
LCI_Prostate-Hypo
LCI_Prostate-SBRT
LCI_Prostate-Standard
Default 3D
Breast 3D
Whole Brain
Breast e- Boost
Lung SBRT - 50Gy in 5fx
Lung SBRT - 50Gy in 4fx
Lung SBRT - 54Gy in 3fx
Total Prostate 79Gy
Boost Prostate 28.8Gy
Prostate/SV 45Gy
Boost Prostate 34.2Gy
Total Prostate 79.2Gy
RTOG 0631 Spine
H&N 70Gy
H&N - 3 dose levels RH
LCI LungSBRT - 50Gy in 5fx Prescriptions
Prescription
Total Dose
Lung SBRT
5000
LCI LungSBRT - 50Gy in 5fx Constraints
Priority
Structure
Aliases
Type
Prescription
Constraint Type
Constraint
1 PTV PTV_5000, PTV01 Target Volume V5000cGy>95%
2 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy Dose D99%>90%
3 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy Max Max<160%
4 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy RTOG HI RHI100%
5 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy Dose Spill
6 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy CI
7 PTV PTV_5000, PTV01 Target Lung SBRT: 5000cGy CI
8 ITV ITV Target Volume
9 Body-PTV+2cm Body-PTV+2cm OAR Lung SBRT: 5000cGy Max Dose Table
10 Spinal Cord SpinalCord, Cord OAR Volume
11 Spinal Cord SpinalCord, Cord OAR Dose D0.035cc<2800cGy
12 SpinalCanal SpinalCanal OAR
13 SpinalCanal SpinalCanal OAR Dose
14 Brachial_Plex_R Brachial_Plex_R, Rt OAR Dose D0.035cc<3250cGy
Structure Check Template
LCI_LungSBRT
Plan Check Template
Report Template
Aria Report IMRT
Notes:
By signing this document, I attest that I have reviewed each specified metric. Goals not achieved are noted in red. I have initialed eac
signify that these deviations from my pre-specified goals are acceptable and appropriate in order to prioritize other goals felt to be
meaningful in this case.
Configure ClearCheck Templates
Use TG-263 standardized nomenclature exactly matching TPS
No need for aliases!

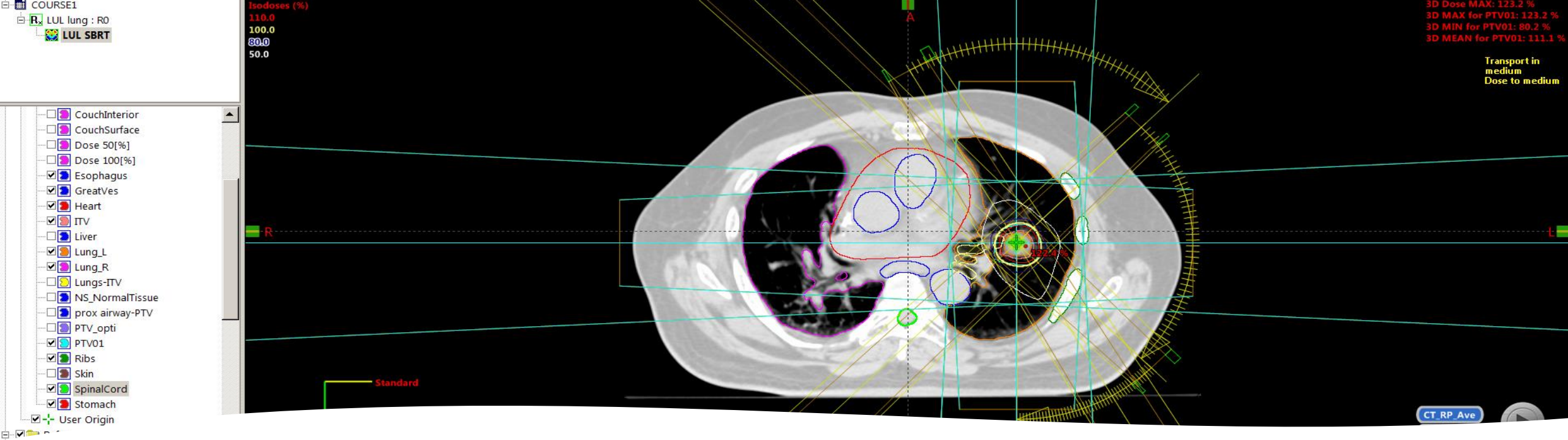
Process Refinement

- 3-week “trial” implementation
- All sites encouraged to use clinically
- Record feedback in worksheet
- Weekly Skype meetings with users to demonstrate functionality, answer questions and review feedback

Standardized Nomenclature Feedback Tool

Please provide feedback about items missing from either the Eclipse Template or ClearCheck

Product	Comment	User - Please Enter Name	Comment
ClearCheck	Please add the Spinal Canal, small airway, Pericardium		Addressed; pericardium has same constraints as heart. Changed cc name from "heart" to "heart/pericard"
Eclipse Template	Can PTVs be changed to translucent or contour? Our physicians do not like segment when looking at targets on CBCT	Romeo Boulet	Addressed; changed targets to translucent
ClearCheck SBRT Lung	The margin check is not in the print report template for SBRT lung. It is also not configured, standard is a 5 mm PTV expansion from the ITV.	Mark DiMascio	Addressed; added margin check for ITV->PTV expansion and added to report template
ClearCheck	What should be done about constraints objectives that are not met		MDs should initial constraints that are unment during plan review. Standard language added to all cc templates.
ClearCheck	Better explaination for plan quality metrics	Ben Moeller/Ryan Foster	familiar nomenclature added as comments in template which print on final pdf
ClearCheck	It may be beneficial to add a rib contour to the template and constraints; we reference RTOG and Timmerman rib guidelines when applicable	Nina Bahar	added Rib V3000cGy<30cc



Results: Efficiency Metric

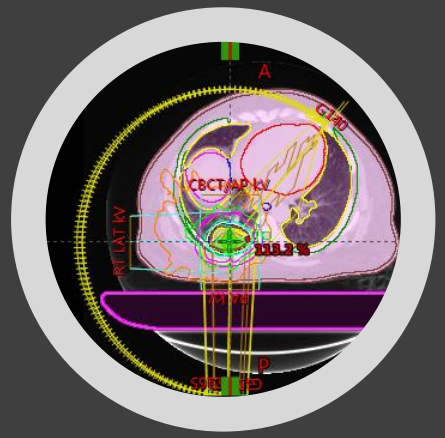
	Description	Standardized Plan/Template	Manually Matched OAR Names	Manually Recorded from Eclipse DVH
Case #1 – SBRT (New User)	23 PTV/OAR	1 min 2 secs	1 min 53 sec	N/A
Case #1 – SBRT (Experienced User)		0.32 secs	0.43 sec	5min 55 sec
Case #2 - IMRT Brain (new user)	11 PTV/OAR	N/A	1 min 3 secs	2min 12 secs
Case #1 – IMRT Brain (exp. user)		N/A	1 min	1min 45 secs

Results: Structure Naming Variation

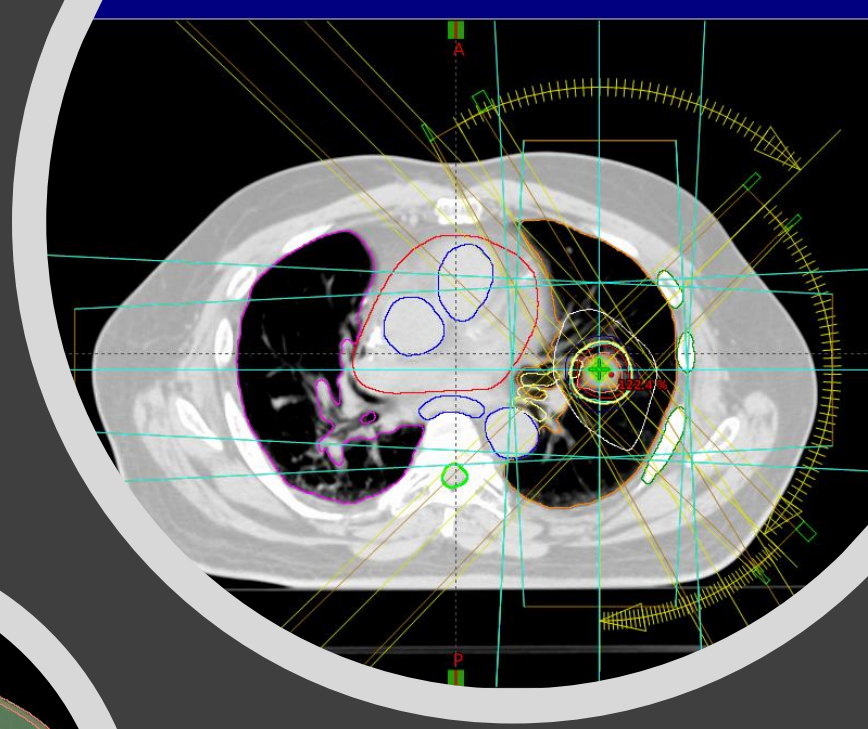
LCI Before Standardization	LCI After TG-263 Standardization
• Lung_Lt, Lung L	• Lung_L
• Aorta, large vessels, Great Vessels	• GreatVes
• Bronchus_LT	• Bronchus_Main
• Small Airway, proximal bronch	• AirWay_Prox
• Spinal Cord, cord	• SpinalCord
• Total Lung	• Lungs, Lungs-ITV
• Skin, Skin_dvh	• Skin
• Brachial plexus	• BrachialPlex
• Chest wall, chestwall	• Chestwall

Results:
Technique Adoption

- 4 of 9 practices deliver SBRT
- 100% utilization rate for ClearCheck matching to templates with standardized OAR nomenclature



Site #1



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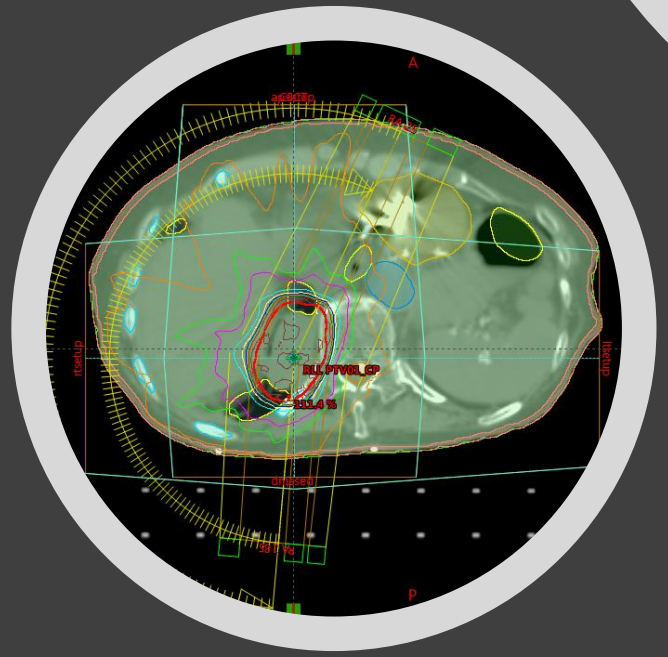
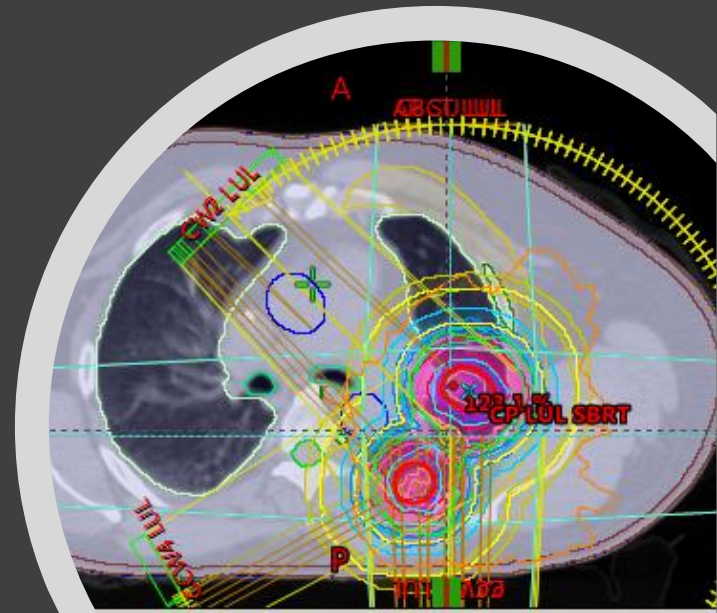


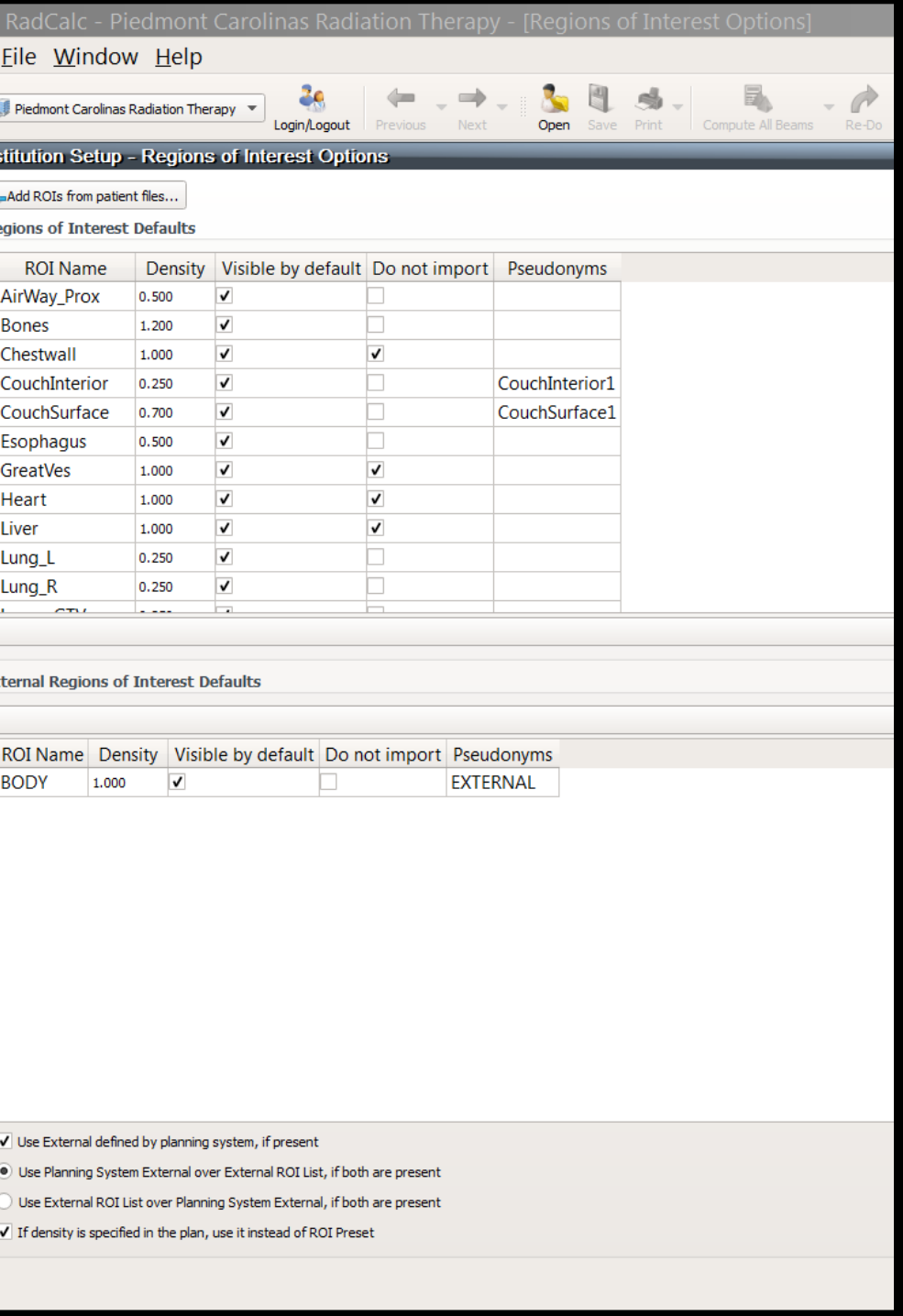
Site #2



Site #3

Extension to Other Software Platforms

TG-263 Standardized Nomenclature



Automatic Density Assignments

- Radcalc ROI module recognizes and matches imported structures names matching the TG-263 standardized OAR names in the configuration utility
- Default densities, visibility for structures can be set
- No need for pseudonyms

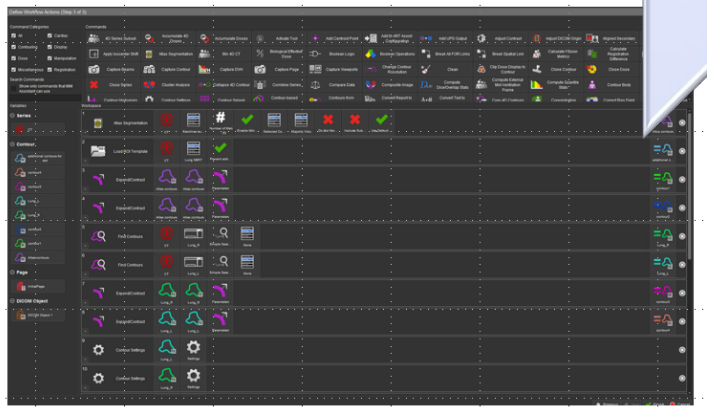
MIM Maestro

- MIM Maestro custom workflows configured to load “SBRT Lung” ROI templates using TG-263 standardized ROI nomenclature
- Deployment of MIM at all Rad. Therapy centers promotes standardization across platforms

Sim CT kicks off autosegmentation of OARs

Targets contoured by physician; expansions autocreated using scripted workflow

CT with contoured targets, target expansions and OARs transferred to TPS for tx planning



Assistant Atlas – Carolinas Lung

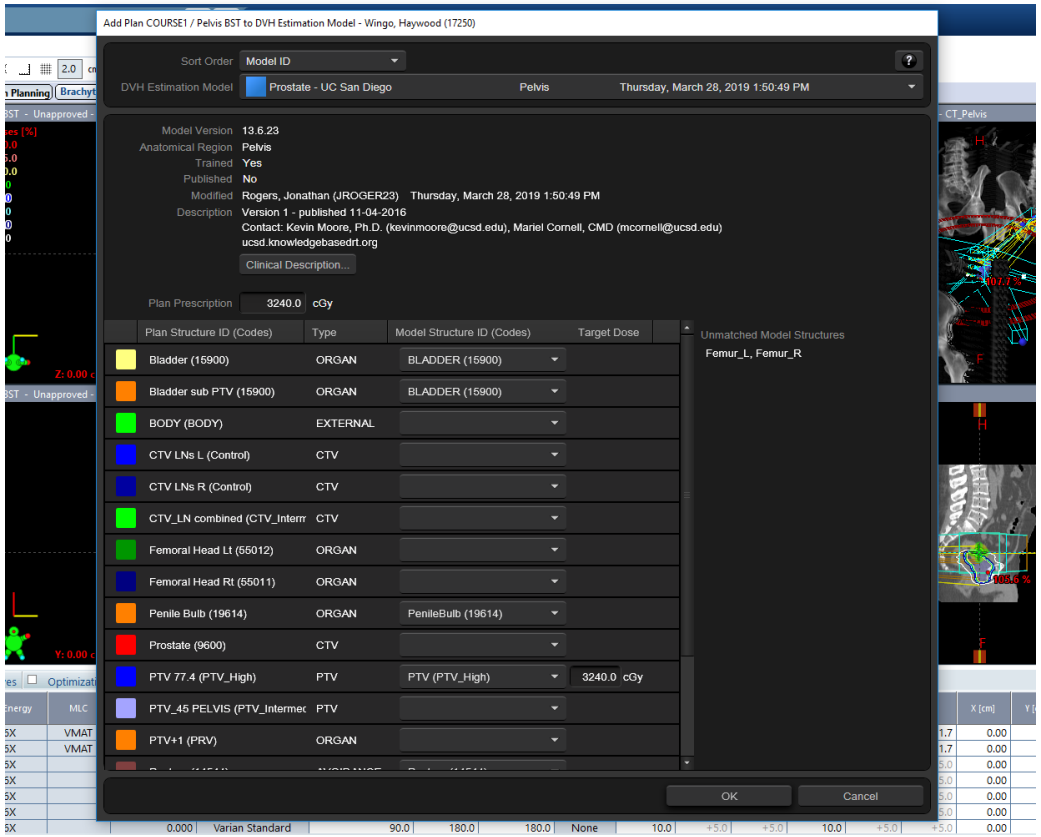
Auto triggered by “CT” with StudyDescription contains “AIP” and “Lung”

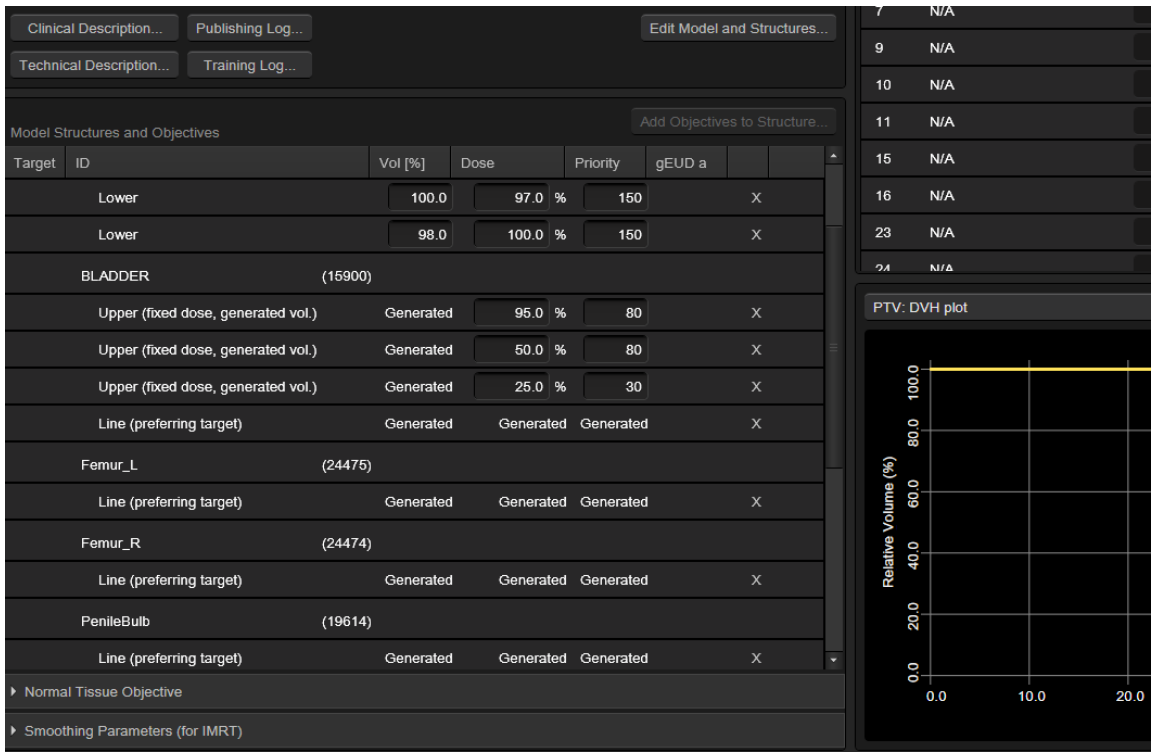
Workflow

- Atlas Segmentation
  - Carina, Esophagus, GreatVes, Heart, Lung_L/R, Spinal Cord
- Add other structures in Lung SBRT template
- Expand/Contract Atlas Segmented structures
- Expand/Contract Lung_L/R, fill holes and smooth
- Save structure set
- Rename Proximal Airway to AirWay_Prox (added 3/12/19)
- Manual run version is called “Atlas – Carolinas Lung” and doesn’t save contours

RapidPlan

Standardized nomenclature simplifies the matching of structures to the RapidPlan template





Conclusions

- Use of TG-263's standardized nomenclature has reduced variation across users at multiple facilities
- Efficiencies in the planning and plan documentation processes were realized when users employed customized templates based on TG-263 standardized nomenclature across multiple software systems
- Utilization and compliance with TG-263 templates using standardized nomenclature has been observed in all LCI clinics

Conclusions

- TG-263's standardized nomenclature recommendations can be incorporated into the tx planning process across a number of software platforms
- The medical physicist can serve as a leader or contributor to an effective implementation strategy incorporating varied practice stakeholders

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