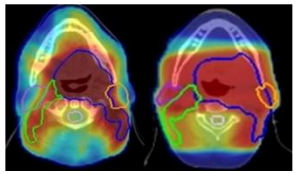
EORTC Radiotherapy Quality Assurance Platform: Establishment of an Integrated Central Review Facility

Damien Charles Weber
RTQA Strategic Committee,
Radiation Oncology Group
EORTC

There are at least six things in this picture that a quality-assurance manager could try to improve. Can you spot them?



QUALITY TIME

IT MAY NOT BE SEXY, BUT QUALITY ASSURANCE IS BECOMING A CRUCIAL PART OF LAB LIFE.

BY MONYA BAKER

456 | NATURE | VOL 529 | 28 JANUARY 2016

There are at least six things in this picture that a quality-assurance manager could try to improve. Can you spot them?

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IT MAY NOT BE SEXY, BUT QUALITY ASSURANCE IS BECOMING A CRUCIAL PART OF LAB LIFE.

BY MONYA BAKER

Started in 2007

University of Minnesota-Veterinary Diagnostic Laboratory in St Paul

DISORGANIZED SAMPLE STORAGE
Clear labelling and proper organization are important for incubators and freezers. Everyone in the lab should be able to identify a sample, where it came from, who did what to it, how old it is and how it should be stored.

INADEQUATE DATA LOGGING
Data should be logged in a lab notebook, not scribbled onto memo paper or other detritus and carelessly transcribed. Notebooks should be bound or digital; loose paper can too easily be lost or removed.

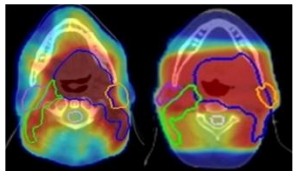
VARIABLE EXPERIMENTS
Protocols should be followed to the letter or deviations documented. If reagents need to be kept on ice while in use, each lab member must comply.

UNSECURED DATA ANALYSIS
Each lab member should have their own password for accessing and working with data, to make it clear who works on what, when. Some popular spreadsheet programs can be locked down so that manipulating data, even accidentally, is difficult.

MISSED MAINTENANCE
Instruments should be calibrated and maintained according to a regular, documented schedule.

OLD AND UNDATED REAGENTS
These can affect experimental results. Scientists should specify criteria for age and storage of all important reagents.

Overall radiotherapy process



Referral

First Dr Visit

Patient positioning and simulation

CT scan for planning

Fusion and contouring (Target and organs at risk)

Planning

Simulation and isocenter verification (using DRR)

Treatment (verification)

Positioning

Immobilisation

Image fusion

Beam arrangement

CT protocol

MLC/ blocks

Volume definition

Treatment machines

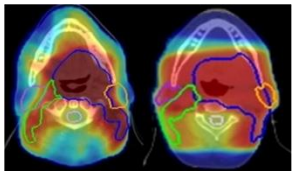
Verification protocol

Positioning

Immobilisation

Delineation process

MD Tumor boards



1977 RTOG initiation of QA program
Retrospective analysis of RTQA showing 19% rate of major deviations (37/198)
Composed of:

1) **On study review (First week of RT)**
2) **Retrospective review**

International Journal of Radiation Oncology*Biology*Physics

Volume 17, Issue 4, October 1989, Pages 883-890

Special feature

Impact of initial quality control review on study outcome in lung and head/neck cancer studies—review of the radiation therapy oncology group experience ☆ ☆☆

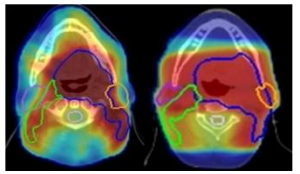
Paul E. Wallner, D.O. [a], Robert A. Lustig, M.D. [b], Thomas F. Pajak, Ph.D. [b], Gregg Robinson, M.S. [b], Lawrence W. Davis, M.D. [c], Carlos A. Perez, M.D. [c], H. Gunther Seydel, M.D. [c], Victor A. M. M.D. [c], Ph.D., M.D. George E. Laramore [c]

Show more

Radiother Oncol. 1996 Aug;6(4):275-84.

Quality assurance control in the EORTC cooperative group of radiotherapy. 1. Assessment of radiotherapy staff and equipment. European Organization for Research and Treatment of Cancer.

Horiot JC, Johansson KA, Gonzalez DG, van der Schueren E, van den Bogaert W, Notter G.



1) a comparison of megavoltage units, technical and staff environment, and data present in clinical and radiotherapy charts for each center
2) radiation physics calibration of photon and electron beams
3) radiation physics measurements on a stimulated clinical case using an Alderson Rando anatomical phantom

Quality Assurance in Cancer Treatment

E. van der Schueren, J. Cl. Horiot, G. Leunens, R. Rubens, W. Steward,
J.A. van Dongen, A.T. van Oosterom and K. Vantongelen
Report of a Working Party from the European School of Oncology

Eur J Cancer 1993;29A(2):181-184

Assess Quality through

- Assessment of structure (Equipment and Work force)
- Measurement of process
- Patients' outcome

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Review

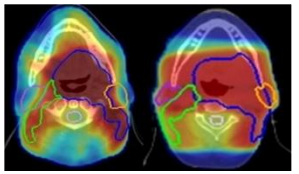
Quality assurance for prospective EORTC radiation oncology trials: The challenges of advanced technology in a multicenter international setting

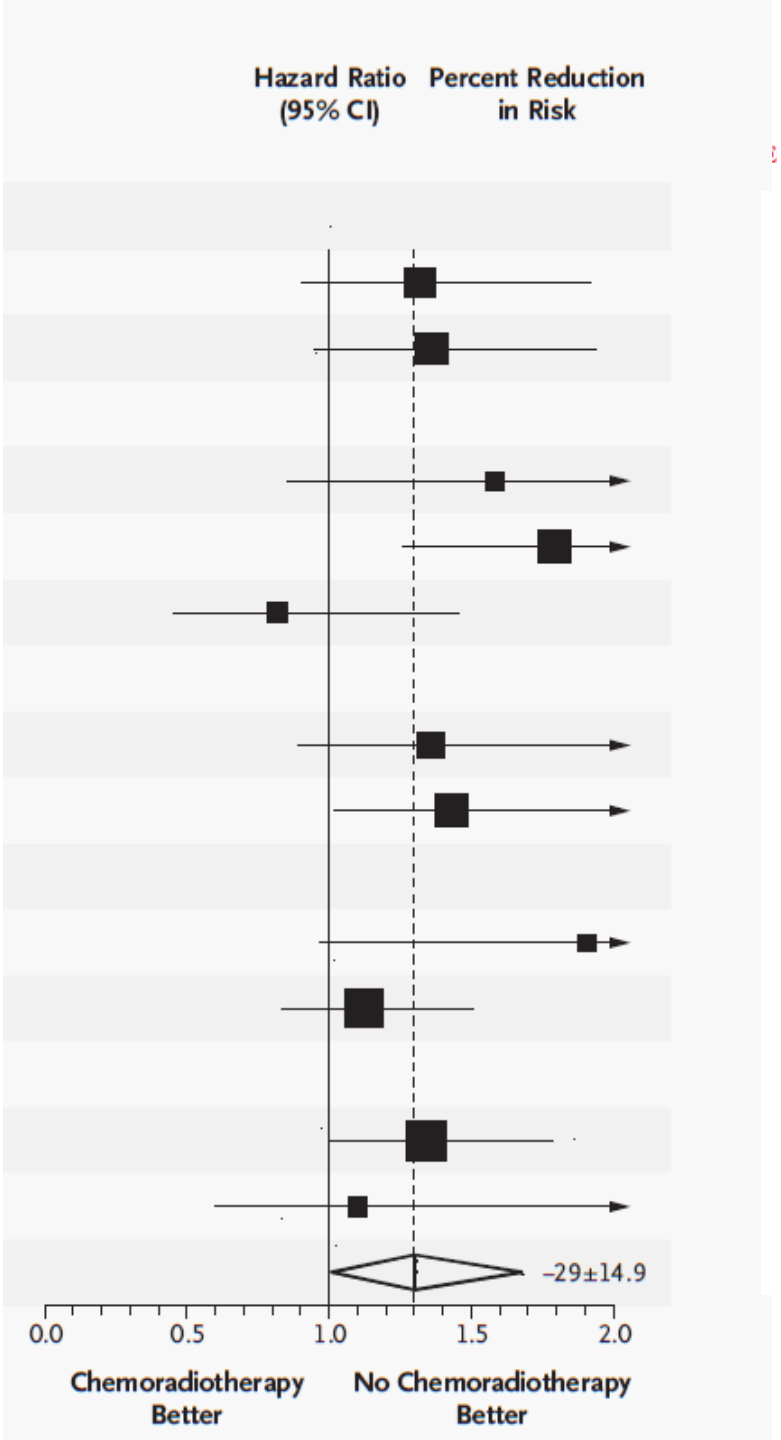
Damien C. Weber [a], Philip M.P. Poortmans [b], Coen W. Hurkmans [c], Edwin Aird [d], Akos Gulyban [e], Alysa Fairchild [e,*]

Specific consideration of RTQA for clinical prospective trials

- determination of protocol ambiguities that may affect treatment delivery;
- education of sites in RT-specific trial guidelines;
- promotion of consistency between centers;

- ensuring sites meet minimum technical and personnel requirements;
- ensuring accuracy and integrity of data;
- estimation of inter-patient and inter-institutional variation; and
- identification and correction of flaws in study design.





EORTC

The future of cancer therapy

ORIGINAL ARTICLE

A Randomized Trial of Chemoradiotherapy and Chemotherapy after Resection of Pancreatic Cancer

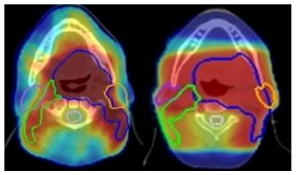
EDITORIAL

A CHALLENGE TO THE THERAPEUTIC NIHILISM OF ESPAC-1

MARY C. KOSHY, M.D.,* JEROME C. LANDRY, M.D.,* SEAN X. CAVANAUGH, M.D., PH.D.-C,†
CLIFTON D. FULLER, B.S.,† CHRISTOPHER G. WILLETT, M.D.,‡ ROSS A. ABRAMS, M.D.,§
JOHN P. HOFFMAN, M.D.,‖ AND CHARLES R. THOMAS, JR., M.D.†

APPA techniques
Worse performance status pts treated with chemoRT (48 days vs. 61 days)
40 Gy split course
Up to 60 Gy
30% did not receive RT/inhomogeneous RT in chemoRT
No RTQA

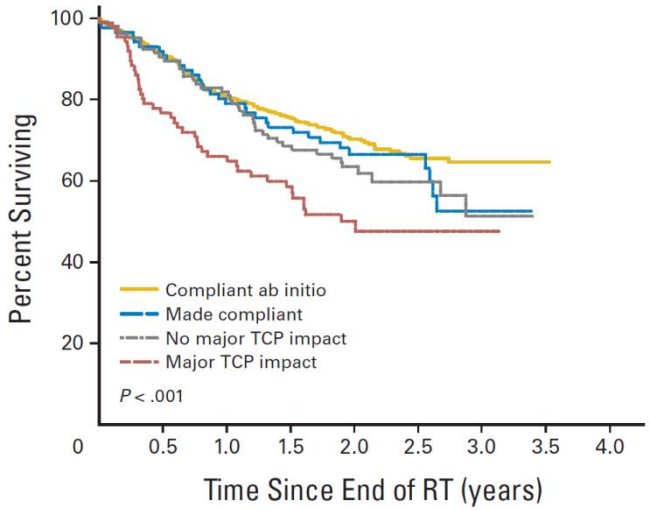
RT Protocol unacceptable variations affect the outcome of trials

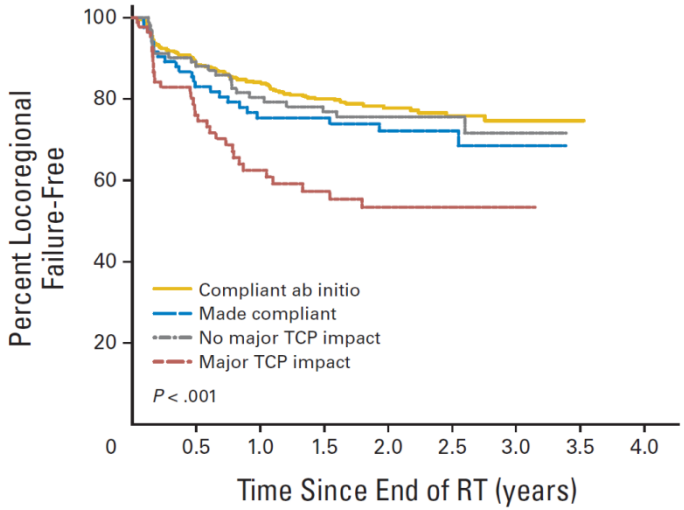


JOURNAL OF CLINICAL ONCOLOGY

Critical Impact of Radiotherapy Protocol Compliance and Quality in the Treatment of Advanced Head and Neck Cancer: Results From TROG 02.02

Lester J. Peters, Brian O'Sullivan, Jordi Giralt, Thomas J. Fitzgerald, Andy Trotti, Jacques Bernier, Jean Bourhis, Kally Yuen, Richard Fisher, and Danny Rischin





JCO 2010;28(18):2996-3001

QA makes a clinical trial stronger: Evidence-based medicine in radiation therapy

Damien C. Weber [a,e,*], Milan Tomsej [b], Christos Melidis [c], Coen W. Hurkmans [d,e]

Study [ref]	Type of QA	Number of cases evaluated *n* (%)	Minor deviations *n* (%)	Major deviations *n* (%)	Technical issues with QA review *n* (%)	Impact on clinical outcome	*p* Value
HD 4 [5]	R	368 (98.0)	–	141 (37.5)*	8 (2.1)	7-year RFS with D: 72% *vs.* 7-year RFS with no D: 84%	0.004
EORTC 20884 [2]	R	135 (88.8)	–	63 (46.7)	46 (30.3)	5-year RFS with D: 90% *vs.* 5-year RFS without D: 84%	0.31
RTOG 0411 [4]	R	NS	–	13 (13.4)	NS	Grade GI ⩾ 3 toxicity with D:45%‡ *vs.* Grade GI ⩾ 3 toxicity without D:18%‡	0.05
RTOG 9704 [1]	R	416 (92.2)	–	200 (48.0)**	14/35 (40.0)†	mOS with D: 1.46 yo *vs.* mOS without D: 1.74 yo	0.008
RTOG 0022 [8]	R	67 (97.0)	47 (89.0)	6(11.0)	14/67 (21.0)	LRF with major D: 50% *vs.* LRF with no major D: 6%	0.04
TROG 0202 [15]	P & R††	687 (80.5)‡‡	–	97 (11.8)	33/820 (4.0)	OS with major D: 70% *vs.* OS without major D: 50%	<0.001

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Retrospective RTQA review

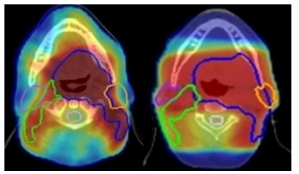
To consult the RTQA team after a study has completed accrual is often merely to ask them to conduct a post mortem examination. They could perhaps say what the study died of (modified from Ronald Fisher)

3 Limited Individual Case Review (L-ICR)

Retrospective or prospective

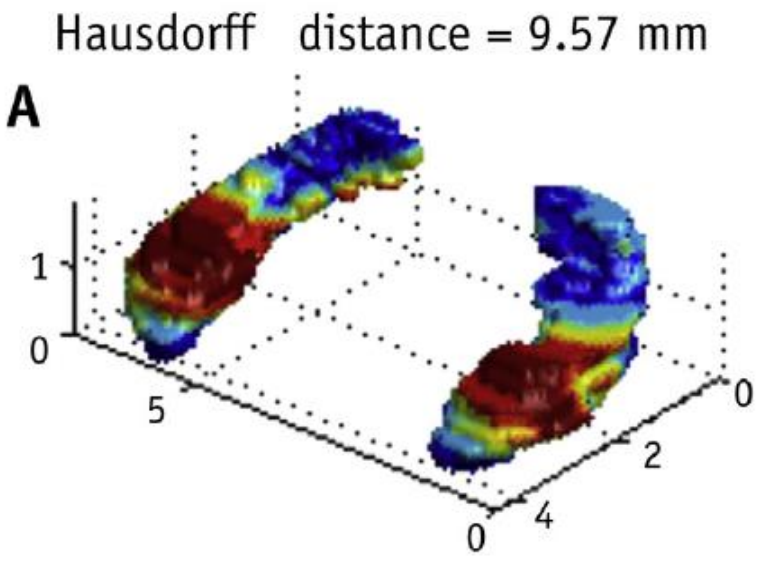
4 Extensive Individual Case Review (E-ICR)

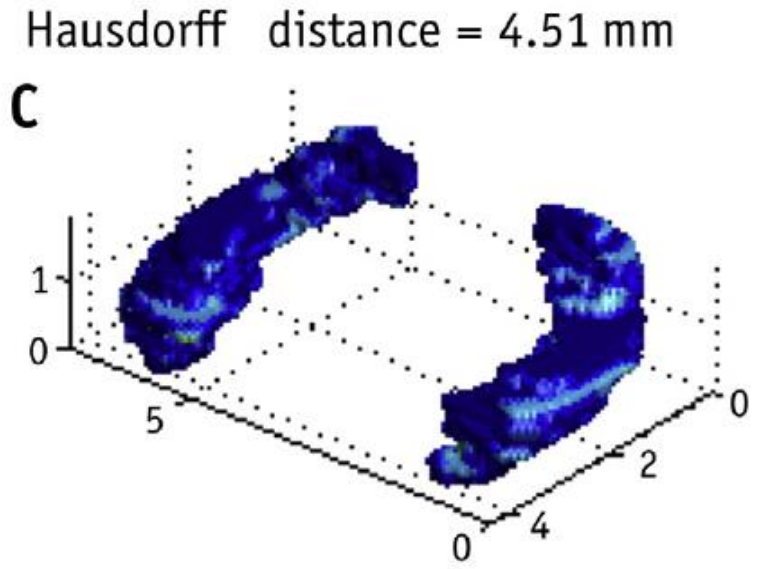
Review for protocol compliance after site activation



Real-Time Pretreatment Review Limits Unacceptable Deviations on a Cooperative Group Radiation Therapy Technique Trial: Quality Assurance Results of RTOG 0933

Dosimetric parameter	Mean value	Range	Per protocol	Variation acceptable	Deviation unacceptable
PTV V95%	96.4%	94.0-99.7%			
PTV D98%	26.3 Gy	18.3-36.1 Gy	≥25 Gy	<25 Gy	
PTV D90%	30.9 Gy	30.0-36.6 Gy			<30.0 Gy
PTV D2%	36.0 Gy	31.7-39.8 Gy	≤37.5 Gy	>37.5 Gy, ≤40 Gy	>40.0 Gy
Hippocampal maximum dose	14.8 Gy	10.6-17.0 Gy	≤16 Gy	≤17 Gy	>17 Gy
Hippocampal D100%	8.6 Gy	6.3-10.0 Gy	≤9 Gy	≤10 Gy	>10 Gy
Optic nerve maximum dose	32.8 Gy	11.4-37.2 Gy	≤37.5 Gy	≤37.5 Gy	>37.5 Gy
Optic chiasm maximum dose	34.4 Gy	31.0-37.4 Gy	≤37.5 Gy	≤37.5 Gy	>37.5 Gy





Mean Hausdorff distance: 5.5 mm (range 3 – 15 mm)

	%
Non-credentialed physician (DR)	**5.6**
Non-credentialed IMRT (plans)	**9.5**
Unaceptable variations (prospective)	**25**
Unaceptable variations (retrospective)	**24**

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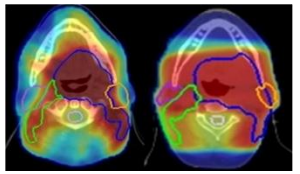
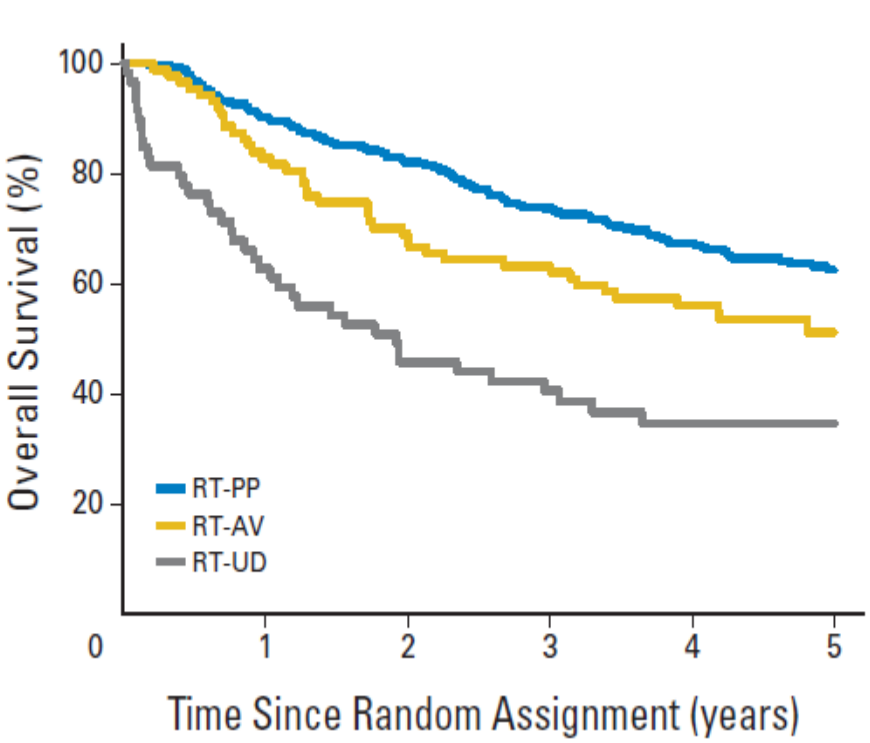
JOURNAL OF CLINICAL ONCOLOGY
ORIGINAL REPORT



RTOG 0129



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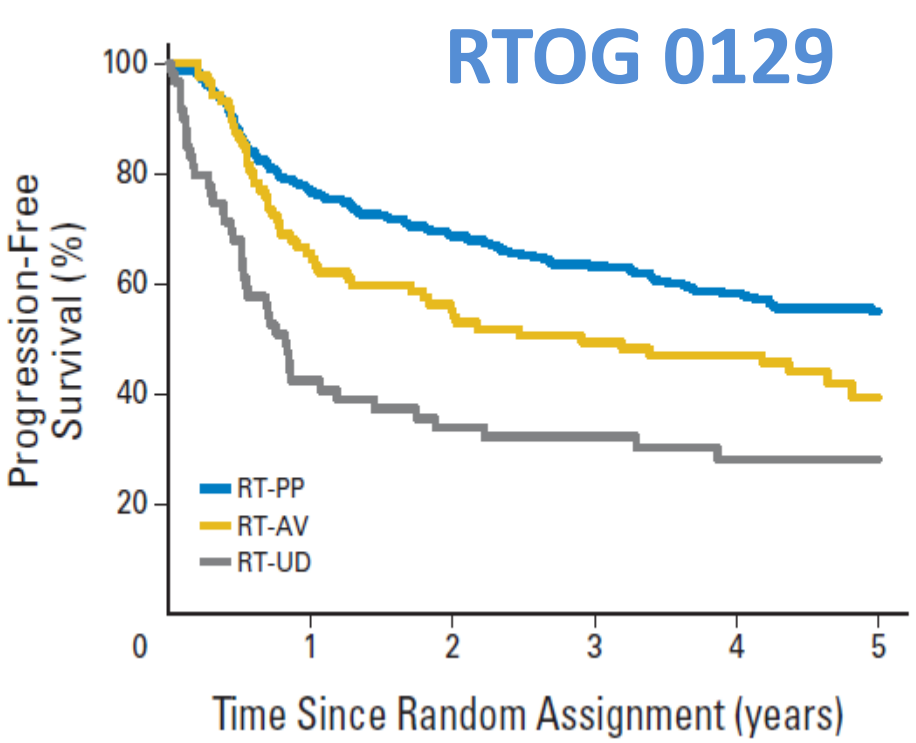
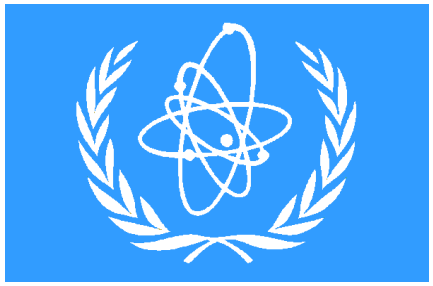


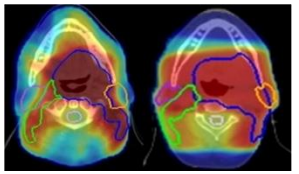
	% (p value)
Protocol deviations (High accruing)	**6.0 (<0.01)**
Protocol deviations (Low accruing)	**18.0**
OS (High accruing)	**69.1 (0.02)**
OS (Low accruing)	**51.0**

clinical trials

Global Harmonisation Group



Global Harmonization of Quality Assurance Naming Conventions in Radiation Therapy Clinical Trials



New name
Facility questionnaire
Beam output audit
Benchmark case
Dummy run (without delineation exercise)
Dummy run (with delineation exercise)
Complex treatment dosimetry check
Virtual phantom
(Prospective or retrospective) individual case review
Review of patients' treatment records
Case report forms
Protocol compliance and dosimetry site visit

Table 3a Standardized organ at risk names

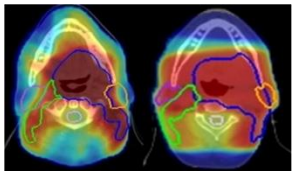
Standard names	Description	Standard names	Description
AnalCanal	Anal Canal	**Esophagus_Middle**	**Middle Esophagus**
A_Pulmonary	**Pulmonary Artery**	External	Skin
A_Carotid	**Carotid Artery**	**Eye**	**Eye**
A_Brachiocephali	**Brachiocephalic Artery**	Femur	Femur
A_Coronary	**Coronary Artery**	**FemoralJoint**	**Femoral Joint**
A_Subclavicular	**Subclavicular Artery**	**FrontalLobe**	**Frontal Lobe**
A_Hypophyseal	**Hypophyseal Artery**	**GHJoint**	**Glenohumeral Joint**
Aorta	**Aorta**	Globe	Eye Globe
AnalSphincter	**Anal Sphincter**	Glottis	Glottis
Atrium	**Atrium**	GreatVessel	Great Vessel
Bladder	Bladder	Heart	Heart
BladderWall	**Bladder Wall**	**Hippocampus**	**Hippocampus**
BrachialPlexus	Brachial Plexus	**Hypothalamus**	**Hypothalamus**
Brain	Brain	Kidney	Kidney
BrainStem	Brain Stem	LargeBowel	Large Bowel
Breast	Breast	Larynx	Larynx
BronchialTree	Bronchial Tree	LacrimalGland	Lacrimal Gland
BaseOfTongue	**Base of Tongue**	Lens	Eye Lens
Carina	Carina	Lips	Lips
CaudaEquina	Cauda Equina	Liver	Liver
Cerebellum	Cerebellum	Lung	Lung
Cerebrum	Cerebrum	Mandible	Mandible
Chiasm	Optic Chiasm	**MassMuscle**	**Masseter Muscle**
CN_VII	Seventh Cranial Nerve	**Mediastinum**	**Mediastinum**
CN_VIII	Eighth Cranial Nerve	MainBronchus	Main Bronchus
Cervix	**Cervix**	**OccipitalLobe**	**Occipital Lobe**
Cochlea	Cochlea	OpticNerve	Optic Nerve
Colon	**Colon**	OralCavity	Oral Cavity
ConstrMuscle	**Constrictor Muscle**	Ovary	Ovary

Physics Contribution

Standardizing Naming Conventions in Radiation Oncology

Lakshmi Santanam, Ph.D.,* Coen Hurkmans, Ph.D.,† Sasa Mutic, Ph.D.,*
Corine van Vliet-Vroegindeweij, Ph.D.,‡ Scott Brame, Ph.D.,* William Straube, M.S.,*
James Galvin, D.Sc.,‡ Prabhakar Tripuraneni, M.D.,§ Jeff Michalski, M.D.,*
and Walter Bosch, D.Sc.*,¶

ROG QART structure



EORTC HQ

EORTC ROG executive

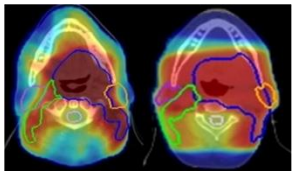
RTQA Strategic Committee

RTQA Office

RTQA Team

RTQA Reviewers

Summary / Conclusions



RT community led the quality assurance paradigm within the scientific world

RTQA will assure non-corruption of the study primary endpoint

Part of the RTQA platform introduced in 2009

Allow digital RTQA for multinational trials with modern RT

Facilitates rapid review (even before RT starts)