

# Integration Issues in Electronic Charting for Radiation Therapy

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During the next few minutes I will discuss integration issues in electronic charting for radiation therapy.

## Disclosures

- The speaker has no conflicts of interest to report.
- Mention of specific commercial products in this presentation is meant for illustrative purposes only and does not constitute any kind of endorsement.

I have nothing to disclose.

## Objectives

- Understand the advantages of going paperless
  - Improved workflow and efficiency
  - Stronger error reduction strategies
- Appreciate the sacrifices of going paperless
  - Loss of a tamper-robust record
  - Less integration of dose record with comments
- Understand access and storage challenges
  - Incompatibility issues and version stability
  - Archival considerations

In this presentation you will learn about the advantages and disadvantages of electronic charting, along with several other issues inherent to the process of going paperless.

## History of R&V Systems

Year	System	Historical Context
1988	Varian RMS	<i>Roseanne &amp; Red Dwarf</i>
1991	IMPAC Multi-ACCESS	<i>Home Improvement &amp; Seinfeld 3<sup>rd</sup> season</i>
1993	Varian VARiS	<i>X-Files &amp; Frasier</i>
2004	IMPAC MOSAIQ	<i>Lost &amp; Desperate Housewives</i>
2005	Varian ARIA Elekta acquires IMPAC	<i>Grey's Anatomy &amp; How I met Your Mother</i>

The first commercial R&V system was the Varian RMS system release in 1988, later followed by RMS-2000. For those whose memories go that far back, this was also the debut year of the American TV show *Roseanne* and the British TV show *Red Dwarf*. These R&V systems have a long history and the continuing evolution of radiation therapy demands could not have been anticipated in the mid-1990s.

From the presentation: "History of Medical Dosimetry" by David Robinson, CMD, MBA, Medical Dosimetry Day 2013.

[http://www.imdb.com/search/title?sort=moviemeter&title\\_type=tv\\_series&year=1991,1991](http://www.imdb.com/search/title?sort=moviemeter&title_type=tv_series&year=1991,1991)

## Guidance Documents

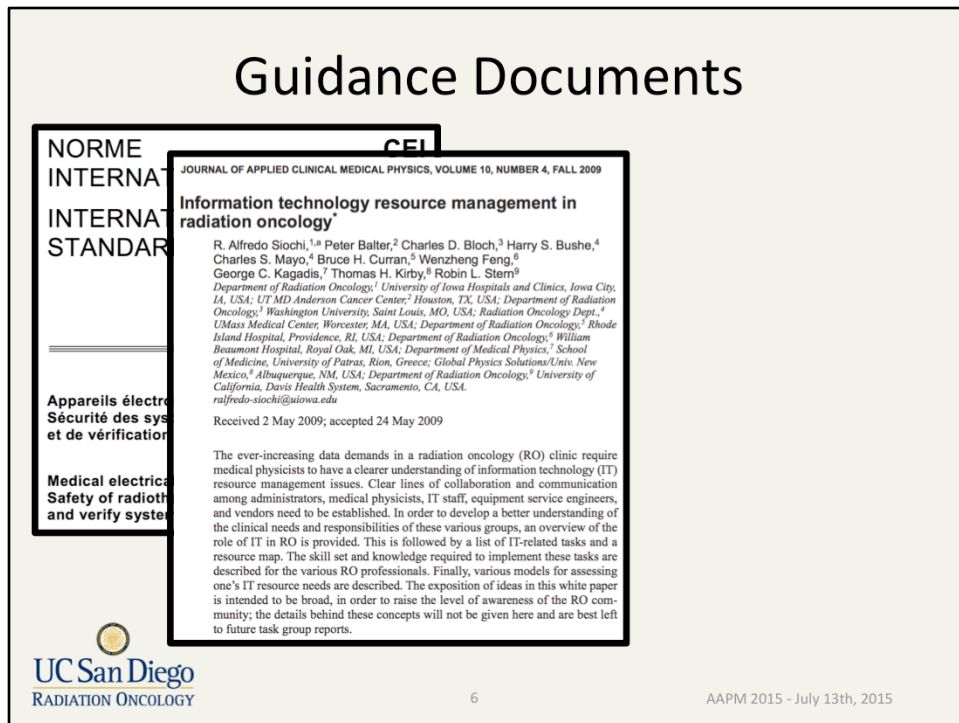


Several resources are useful to review when making the transition to paperless charting.

In 2005 the International Electrotechnical Commission published a standard for record and verify systems which addresses topic such as treatment recording and reporting. This document may be purchased from the IEC.

2005 IEC International standard: Medical electrical equipment – Safety of radiotherapy record and verify systems.

# Guidance Documents

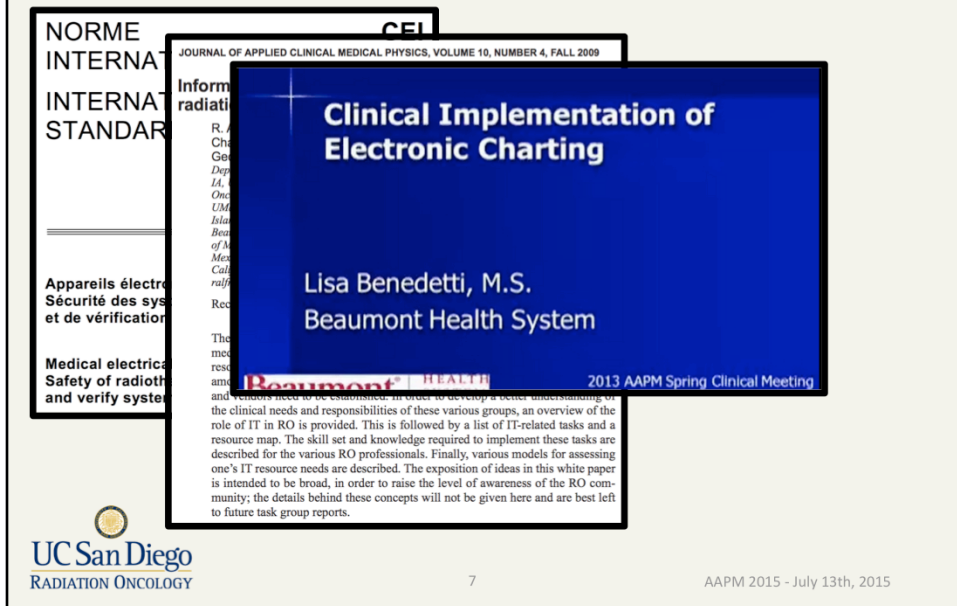


In 2009 the AAPM Working Group on Information Technology published a guide to information technology resource management in radiation oncology. It contains useful information about the breadth of systems and processes that must be integrated with the electronic charting system.

2009 Information technology resource management in radiation oncology  
Siochi et al.

Journal of Applied Clinical Medical Physics, Volume 10, Number 4, Fall 2009

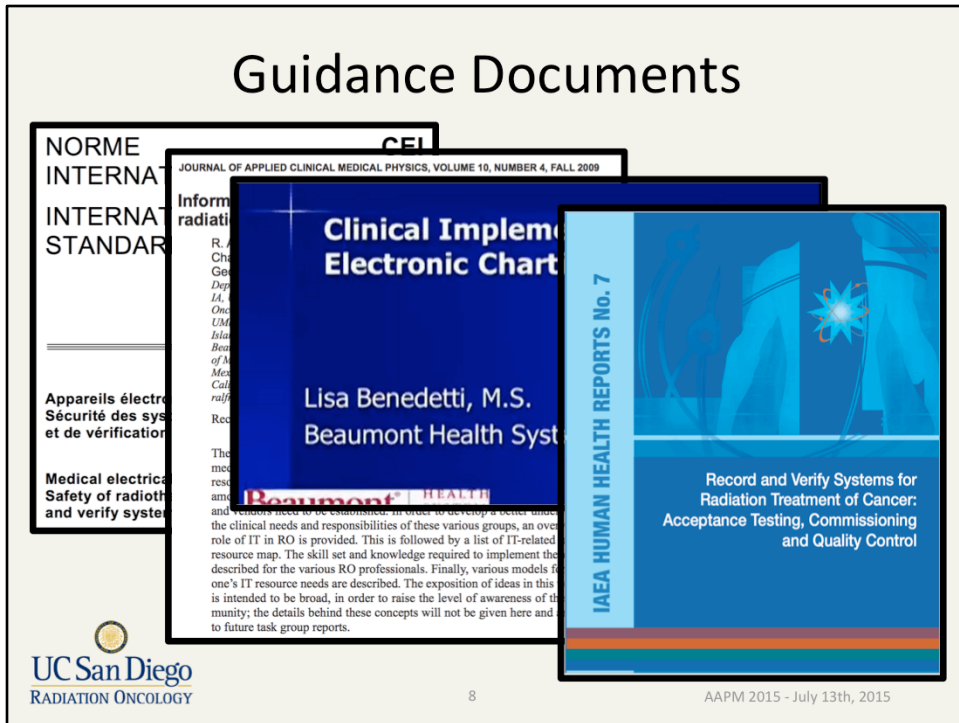
# Guidance Documents



In 2013 Lisa Benedetti presented the William Beaumont Hospital with electronic charting at the AAPM Spring Clinical Meeting. Her hour-long presentation is available on Vimeo.

2013 Data Integrity and Electronic Charting (EBRT and Brachytherapy): Clinical Implementation of Electronic Charting  
Lisa, Benedetti (Burgess), William Beaumont Hospital  
AAPM Spring Clinical Meeting  
<https://vimeo.com/90160027>

# Guidance Documents

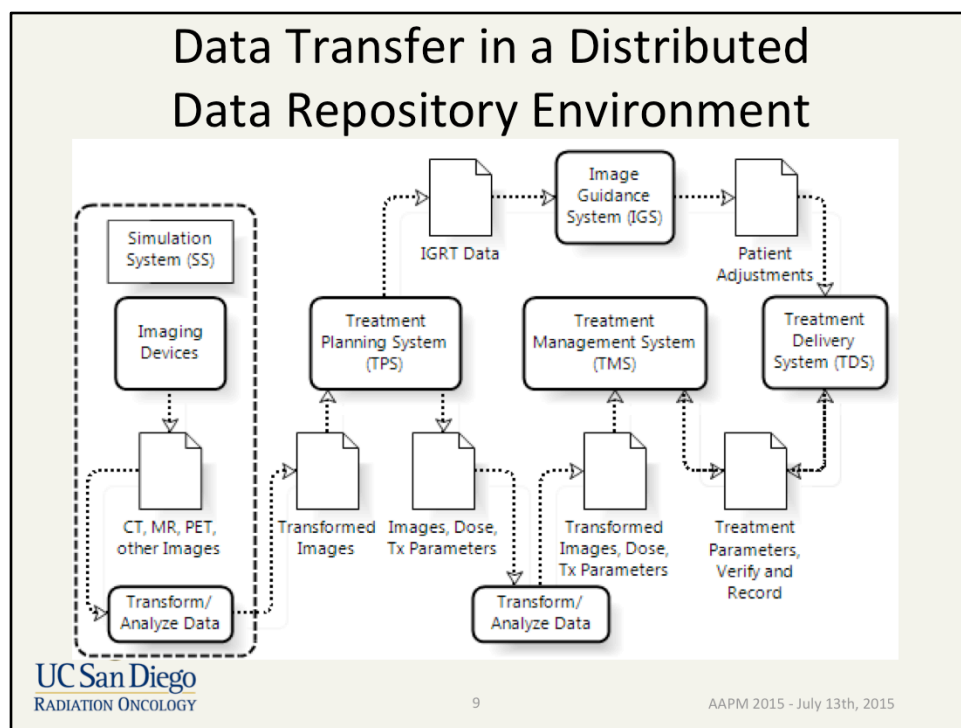


Also in 2013 the IAEA published a useful guide to starting up an R&V system for clinical use.

2013: Record and verify systems for Radiation treatment of cancer: Acceptance testing, commissioning and quality control.

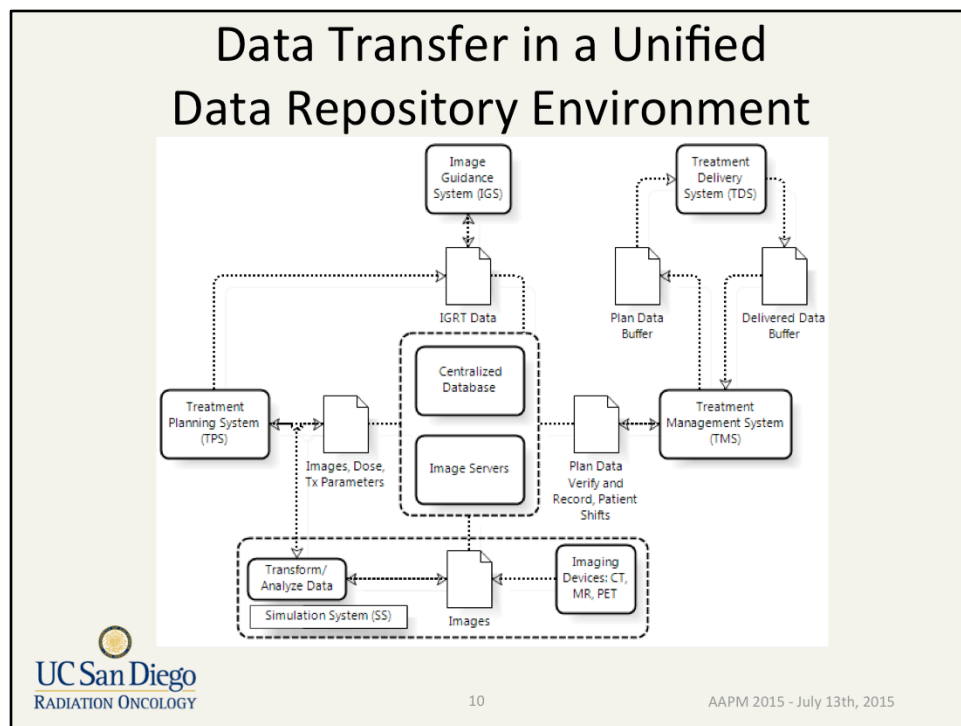
IAEA





**Improved workflow and efficiency:** Jim's presentation distinguished between three parts of an oncology information system: the chart, the workflow management to pass the chart from person to person, and the record and verify system. An advantage of an oncology information system which supports electronic charting is the integration of a patient's radiation oncology medical record into one system. But this is only possible when the connections for electronic data transfer are working. In a Mosaic-Pinnacle-Synergy environment, the different components store data separately. These systems interact with imaging systems, hospital electronic medical records, archival systems, and ancillary systems.

Image: From TG-201 (in draft).



**Improved workflow and efficiency:** In an Aria-Eclipse-Trilogy environment, the different components share data in a single database. These systems still interact with imaging systems, hospital electronic medical records, archival systems, and ancillary systems. Because data can be transferred between systems, there is reduced likelihood of transfer errors and a great improvement in efficiency. This efficiency is a requirement for many facets of modern radiation therapy, such as IMRT/IGRT.

In either of these two configurations, the oncology information system can store the data needed for electronic charting in a meaningful way.

Image: From TG-201 (in draft).

# Hierarchy of Error Reduction Strategies

**Forcing functions/constraints**

**Automation/computerization**

**Standardization/protocols**

**Checklists/double check systems**

**Rules/policies**

**Education /Information**

**Exhortation**



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**Stronger error reduction strategies:** A second advantage of systems for electronic charting is the ability to implement error reduction strategies directly into the oncology information system. The Institute for Safe Medical Practices has popularized a hierarchy of error reduction strategies. Paperless charting strategies take advantage of automation, computerization, forcing functions, and constraints, resulting in safer design. For example, privileges are set the kinds of modifications each staff member may make. Common checklist-based tasks can be embedded in the system, such as via encounters.

"Medication error prevention toolbox," from Acute Care, June 2, 1999. The Institute for Safe Medical Practices.

## “Old School” Paper Charting

### TREATMENT DOSE PRESCRIPTION

Date	Tx Site	Technique	Energy	Dose/Fx	# Fx	Dose	Pattern	MD
11/02	Bladder	IMRT	6 MV	180	25	4500	Daily	JS

### DAILY DOSE RECORD

Date	Fraction Number	Elapsed Days	Fraction Dose	Total Dose	Radiation Therapist	Comments
11/12	10	14	180	1800	PS/AG	Ant SSD = 88 cm.
11/13	11	15	180	1920	PS/AG	Patient missed OTV
11/16	12	18	180	2000	SB/CB	
11/17	13	19	180	2180	SB/CB	Bolus discontinued
11/18	14	20	180	2360	SB/CB	CBCT imaging today



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**Loss of a tamper-robust record:** There are several disadvantages which must be kept in mind when converting to an electronic chart. If data were corrupted in an electronic record, there might be no way to discover it. The old paper-based charting methods were more resistant to data corruption issues. Key items here are the prescription signed by the attending radiation oncologist and the daily record of treatment with running total, SSDs, and comments, including imaging.

The observant audience member may have noticed that in the “paper charting” example, the running dose total has an error. Catching these banal errors was a key component of weekly chart checks.

# Fully Electronic Daily Treatment Record

Date/Time	Field ID	Field Type	Fraction Nu...	MU	Energy	Treatment Ti...	Elapsed Days	Tolerance Table	Dose Rate	Gantry Rtn	Coll Rtn	MLC Plan	Couch Lat	Couch Long	Couch Vert	Couch Rtn
11/20/2014 5:11:...	1 Rt Med Tang	Planned		178	6X	1.04		Breast	600	53	0	4.4	7.2	143.8	20.1	0
12/22/2014 9:23:18...	1 Rt Med Tang	PIMG	1	1	6X	0.02	0	Breast	100	53	0	4.4	7.2	143.9	20.1	0
12/22/2014 9:25:00...	1 Rt Med Tang	PIMG	1	1	6X	0.02	0	Breast	100	53	0	4.4	7.2	143.8	20.1	0
12/22/2014 9:32:14...	1 Rt Med Tang	TRT	1	178	6X	0.28	0	Breast	600	53	0	4.4	7.2	143.9	20.1	0
12/23/2014 9:35:08...	1 Rt Med Tang	TRT	2	178	6X	0.3	1	Breast	600	53	0	4.4	7.4	142.6	20.3	359.9
12/24/2014 9:25:26...	1 Rt Med Tang	TRT	3	178	6X	0.3	2	Breast	600	53	0	4.4	11.3	142.8	20.1	359.9
11/20/2014 5:11:...	2 Rt Lat Tang	Planned		140	6X	0.82		Breast	600	233	4.4	4.4	7.2	143.8	20.1	0
12/22/2014 9:19:42...	2 Rt Lat Tang	PIMG	1	1	6X	0.02	0	Breast	100	233	4.4	4.4	7.2	143.8	20.1	0
12/22/2014 9:20:45...	2 Rt Lat Tang	PIMG	1	1	6X	0.02	0	Breast	100	233	4.4	4.4	7.2	143.8	20.1	0
12/22/2014 9:22:05...	2 Rt Lat Tang	PIMG	1	1	6X	0.02	0	Breast	100	233	4.4	4.4	7.2	143.8	20.1	0
12/22/2014 9:31:10...	2 Rt Lat Tang	TRT	1	140	6X	0.23	0	Breast	600	233	4.4	4.4	7.2	143.8	20.1	0
12/23/2014 9:36:11...	2 Rt Lat Tang	TRT	2	140	6X	0.23	1	Breast	600	233	4.5	4.5	7.4	142.6	20.3	359.9
12/24/2014 9:26:30...	2 Rt Lat Tang	TRT	3	140	6X	0.22	2	Breast	600	233	4.4	4.4	11.3	142.8	20.1	359.9

**Less integration of dose record with comments:** One disadvantage of electronic charting system, as currently offered by vendors, is the inability to see at a glance all the information a therapist would want to. Fully electronic records frequently present the dose record without comments and clinical parameters such as SSDs: Despite the many advantages of an electronic chart, layout limitations may make them unusable by therapists in the intended way.

The top image is a daily treatment record shown in Aria. The lower image shows a view from Aria 11. In both instances, machine overrides are indicated in yellow. A key part of weekly chart checks now is to follow up on each override and ensure that it was warranted.

Image: From the presenter.

## Paper-like form in Electronic Chart

Patient: \_\_\_\_\_ MRN: \_\_\_\_\_ DOB: \_\_\_\_\_  
 Doctor: MD \_\_\_\_\_ Machine: Trilogy \_\_\_\_\_  
 Chart Rounds: 11/19 \_\_\_\_\_ Dx: 185 - Malignant neoplasm of prostate

Pt Name: \_\_\_\_\_ MRN: \_\_\_\_\_ DOB: \_\_\_\_\_

Billing: CBCT/MRT (RA)			Site	Site	Site	Site	MLC Check	EDW Check	ID/Size TO-Check	CV	SSD AP	SSD Rt	SSD Lt	Couch LNO*	* Record Couch LNO daily for Thoracic area Notes
Film Only	Date	Initials	Dose	Dose	Dose	Dose									
			Prostate							11.4	88.9	81.2			No Shifts: Prostate BED
			180 x 39												New Start QA RTT Initials: mib Date: 10/30/11 V-Sim Sent To: ju Imaging Modality Used: CBCT RTT Initials: E Date of V-Sim MD Approval: 11/03/11
1	11/26		180				x	x		10.6	89.2	81			CBCT (pt due to small bladder) approved by ju prior to tx.
2	11/4		360				x	x							CBCT (pt reminded to expel gas)
3	11/5		540				x	x							CBCT
4	11/6		720				x	x							CBCT
5	11/7		900				x	x							CBCT
6	11/10		1080				x	x		11.0	89	81			CBCT
7	11/12		1260				x	x							CBCT pt asked to drink more
8	11/13		1440				x	x							CBCT
9	11/14		1620				x	x							CBCT
10	11/17		1800				x	x							CBCT
11	11/18		1980				x	x		10.7	88.7	81.2			CBCT
12	11/19		2160				x	x							CBCT
13	11/20		2340				x	x							CBCT
14	11/21		2520				x	x							CBCT

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**Less integration of dose record with comments (a crutch):** A frequently used work around is to embed a document within the electron chart, which allows the therapists to see at a glance the current fraction information, imaging schedule, upcoming changes, SSDs, and any comments left by radiation therapists or other staff. The challenge is to find the most effective use of the electronic charting systems so that ad hoc work-arounds don't diminish the efficiencies that are possible.

Image: From the presenter.

# Incompatibility issues and version stability

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 12, NUMBER 1, WINTER 2011

## A rapid communication from the AAPM Task Group 201: Recommendations for the QA of external beam radiotherapy data transfer. AAPM TG 201: Quality assurance of external beam radiotherapy data transfer

R. Alfredo Siochi,<sup>1a</sup> Peter Balter,<sup>2</sup> Charles D. Bloch,<sup>3</sup> Lakshmi Santanam,<sup>3</sup> Kurt Blodgett,<sup>4</sup> Bruce H. Curran,<sup>5</sup> Martijn Engelsman,<sup>6</sup> Wenzheng Feng,<sup>7</sup> Jim Mechalakos,<sup>8</sup> Dan Pavord,<sup>9</sup> Tom Simon,<sup>10</sup> Steven Sutfel,<sup>11</sup> and X. Ronald Zhu,<sup>12</sup>  
*Department of Radiation Oncology,<sup>1</sup> University of Iowa Hospitals and Clinics, Iowa City, IA, USA; UT MD Anderson Cancer Center,<sup>2</sup> Houston, TX, USA; Department of Radiation Oncology,<sup>3</sup> Washington University, Saint Louis, MO, USA; Department of Radiation Oncology,<sup>4</sup> Allegheny General Hospital, Pittsburgh, PA, USA; Department of Radiation Oncology,<sup>5</sup> Rhode Island Hospital, Providence, RI, USA; Center for Proton*

### IHE Radiation Oncology

IHE Radiation Oncology addresses information sharing, workflow, and patient care in radiation oncology. It is sponsored by the American Society for Radiation Oncology (ASTRO).

- [Radiation Oncology Technical Framework](#)

### IHE Radiation Oncology Profiles

- [\[NTPL-S\] Normal Treatment Planning-Simple](#) illustrates flow of treatment planning data from CT to Dose Review for basic treatments
- [\[MMR-RO\] Multimodality Registration for Radiation Oncology](#) integrates PET and MRI data into the contouring and dose review process.
- [\[TRWF\] RT Treatment Workflow](#) integrates daily imaging with radiation therapy treatments using workflow

[IHE Radiation Oncology Wiki](#)

Committee Co-Chairs

Planning Committee: Bridget Koontz, Adam Earwicker, Colin Field

Technical Committee: Scott Hadley, Chris Pauker



**Incompatibility issues and version stability:** Compatibility testing recommendations are given in the AAPM TG-201 rapid communication (2011) and report (forthcoming). Intraoperability issues are tested and addressed by the IHE-RO.

A rapid communication from the AAPM Task Group 201: Recommendations for the QA of external beam radiotherapy data transfer. AAPM TG 201: Quality assurance of external beam radiotherapy data transfer

Siochi et al.

Journal of Applied Clinical Medical Physics, Volume 12, Number 1, Winter 2011.

IHO Radiation Oncology

[http://www.ihe.net/Radiation\\_Oncology/](http://www.ihe.net/Radiation_Oncology/)

## Archival Considerations

- Regulation dictates archival requirements.
  - How long are you required to retain radiation oncology treatment records? E.g., beyond the patient's lifetime for a period of five years.
- Options:
  - Mosaiq Data Director
  - Varian's Long Term Archive Product
  - Third Party Solutions



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**Archival considerations:** While a paper chart can simply be scanned into PDF format for long term storage, an electronic chart requires much greater attention to issues of long term data readability and retention. Appropriate archival methods are often expensive.

Archiving options may include on-line access via rack mounted servers, tape backup, remote access (Citrix), and cloud-based.



Thanks!