During the next few minutes I will discuss integration issues in electronic charting for radiation therapy.
I have nothing to disclose.

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.
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

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

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?
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.
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
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
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**

- 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.

**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.
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 form 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.
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: 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/
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

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!