Going Paperless in Radiation Therapy

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Conflicts of interest

- None
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• Jay Callahan, IT guru
• Kim Gadsden, RN
• Ingrid Marshall, PhD
• Ken Vanek, PhD
Paper charts

We know the future is paperless.

Depiction of the 23rd century’s paperless environment in the 1966 Star Trek TV series.

Changing What’s Possible
Learning objectives

• Be familiar with the common motivations and challenges to implementation of EHR
• View the implementation of EHR through the lens of Robert’s theory on the diffusion of innovation
• Be familiar with the variety of tools and means used to create a paperless environment
Outline

- The motivators behind EMR
- Challenges in adoption of EMR
- Examples of how MUSC went paperless
- Current works in progress in our wired/paperless clinic
Does your clinic currently use electronic treatment charts (not paper charts)?

Audience Response Instructions

Yes

No
Primary Care Doctors’ Use of Electronic Medical Records in Their Practice, 2009 and 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>2009</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETH</td>
<td>99.98</td>
<td>99.98</td>
</tr>
<tr>
<td>NOR</td>
<td>97.98</td>
<td>97.97</td>
</tr>
<tr>
<td>NZ</td>
<td>97.97</td>
<td>97.97</td>
</tr>
<tr>
<td>UK</td>
<td>96.97</td>
<td>95.92</td>
</tr>
<tr>
<td>AUS</td>
<td>82</td>
<td>72</td>
</tr>
<tr>
<td>GER</td>
<td>69</td>
<td>68</td>
</tr>
<tr>
<td>US</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>FR</td>
<td>56</td>
<td>37</td>
</tr>
<tr>
<td>CAN</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>SWIZ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Changing What’s Possible
Incentives for converting to EHR

• Potential for:
  – Improving quality and safety
  – Increased accessibility of information

• HITECH Act of 2009
  – Financial gain
  – Avoiding financial loss
HITECH Act of 2009

• Authorized CMS to offer incentives to providers for adoption of EHR
  – Prove more meaningful use than an electronic version of a paper chart
    • Must satisfy “meaningful use” (MU) criteria
  – Stage 1 of incentive program (years 1 & 2)
    • Demonstrate 18 objectives and 6 clinical quality measures (CQM)
  – Stage 2 (year 3)
    • Demonstrate 20 objectives and 9 CQMs
## Examples of MU criteria

<table>
<thead>
<tr>
<th>Record Smoking Status</th>
<th>Record smoking status for patient 13 years old or older.</th>
<th>Medication Allergy List</th>
<th>Maintain active allergy list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug Interaction Checks</td>
<td>Implement drug-drug and drug-allergy interaction checks.</td>
<td>Electronic Copy of Health Information</td>
<td>Provide patients with an electronic copy of their health information upon request</td>
</tr>
<tr>
<td>e-Prescribing (eRx)</td>
<td>Generate and transmit permissible prescriptions electronically (eRx).</td>
<td>Clinical Summaries</td>
<td>Provide clinical summaries for patients for each office visit.</td>
</tr>
</tbody>
</table>
## The Carrot...

<table>
<thead>
<tr>
<th>Payment by Reporting Period</th>
<th>Year Meaningful Use First Demonstrated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
</tr>
<tr>
<td>2011 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$18,000</td>
</tr>
<tr>
<td>2012 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$12,000</td>
</tr>
<tr>
<td>2013 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$8,000</td>
</tr>
<tr>
<td>2014 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4,000</td>
</tr>
<tr>
<td>2015 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$2,000</td>
</tr>
<tr>
<td>2016 Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Payment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$44,000</td>
</tr>
</tbody>
</table>

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Changing What’s Possible

Adapted from https://www.astro.org/Practice-Management/EHR-Incentive-Program/Index.aspx
HITECH Act of 2009

• Mandatory reductions in Medicare payments starting in 2015 if MU criteria not met
• Payment adjustments are cumulative for every year “meaningful use” is not certified
...and the stick

<table>
<thead>
<tr>
<th>Reporting Year</th>
<th>Adjustment Year</th>
<th>Medicare Reimbursement Adjustment Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013/2014*</td>
<td>2015</td>
<td>-1%</td>
</tr>
<tr>
<td>2014</td>
<td>2016</td>
<td>-2%</td>
</tr>
<tr>
<td>2015</td>
<td>2017</td>
<td>-3%</td>
</tr>
<tr>
<td>2016</td>
<td>2018</td>
<td>-4%</td>
</tr>
<tr>
<td>2017</td>
<td>2019</td>
<td>-5%</td>
</tr>
</tbody>
</table>

*Must attest by Oct. 1 to avoid penalty in 2015, meaning 90-days EMR reporting period must begin no later than July 1, 2014

Photo credit: [http://www.flickr.com/photos/59937401@N07/](http://www.flickr.com/photos/59937401@N07/)

Table adapted from [https://www.astro.org/Practice-Management/EHR-Incentive-Program/Index.aspx](https://www.astro.org/Practice-Management/EHR-Incentive-Program/Index.aspx)
Top reasons to implement EMR

#1 Collect CMS bonuses: 83%
#2 Avoid CMS penalties: 78%
#3 Improve patient care: 50%

Changing What’s Possible
Shen et al. 2012
T/F: My clinic has no plans to go paperless in the future?

Audience Response Instructions

True

False
What’s keeping you from joining the bandwagon

CHALLENGES AND BARRIERS
Changing What’s Possible

## Stages of the adoption process

<table>
<thead>
<tr>
<th>Stage</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong></td>
<td>Exposed to the idea of EMR; lacks needed information; not inspired to seek more information</td>
</tr>
<tr>
<td><strong>Persuasion</strong></td>
<td>Become interested in EMR; seek needed information and resources</td>
</tr>
<tr>
<td><strong>Decision</strong></td>
<td>Decide whether to accept or reject EMR on an individual basis; personal cost/benefit analysis</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td>EMR implemented to varying degrees; usefulness of EMR may be personally evaluated and additional information sought</td>
</tr>
<tr>
<td><strong>Confirmation</strong></td>
<td>Final decision to continue using EMR as the “right” decision; EMR becomes standard practice</td>
</tr>
</tbody>
</table>
Knowledge and resources

• Shen et al. surveyed 21 RadOnc facilities
  – Hypothesis: lack of knowledge and resources are the rate-limiting steps in adopting MU criteria for EMR systems
  – Surveyed about:
    • Quality and safety
    • Factors of importance to implementation
Most important barriers to implementation

![Bar chart showing the most important barriers to implementation. The chart includes categories such as Cost of implementation, Difficult to integrate with hospital system, No national guideline for radiation oncology, No commercial systems, Delays in hospital EHR implementation, Lack of knowledge, Guidelines do not apply, and Workflow concerns. The chart indicates the number of responses and differentiates between very important and moderately important barriers.]

Changing What’s Possible

Figure from Shen et al. 2012
Perception of quality and safety

- 71% - EMR improves safety and quality
  - Remaining 29% “unsure”
- Gains cited in
  - Improved documentation
  - Reduced treatment errors
  - Reduced medication errors
HIGH LEVEL TIPS FOR GOING PAPERLESS
Governance matters: end users must have a choice in designing and implementing processes affecting their work.
Measure twice, cut once: preparation and advanced planning may take years and should not be rushed.
Have in-person support available on “go-live” date or as major transitions occur.

Support at the elbow

Changing What’s Possible
Simon et al. 2013
The paradigm is shifting. Leadership should be aware of concerns and address them promptly.
The paradigm is shifting. Leadership should address concerns promptly to keep stakeholders focused.
Prepare to address the dominos that fall once EHR is implemented. Have a plan to address these consequences.
PRACTICAL TIPS FOR GOING PAPERLESS
Focus your initial effort on early adopters. Avoid spending too much energy persuading laggards.

Focus initial implementation effort on these people.

Innovators 2.5 %
Early Adopters 13.5 %
Early Majority 34 %
Late Majority 34 %
Laggards 16 %

Changing What’s Possible
Quickly get some wins to build momentum.
Make it compatible to make it painless.
What has been your experience?
User-friendly EHR review

- 6 medical residents & 6 nurses with iPADs
  - Limited computers in exam rooms
  - Use of Win8 tablet currently being tested
- Dual monitors at workstations for physicists, physicians, and dosimetrists
PINNACLE

PRODUCING PAPERLESS RT-PLAN DOCUMENTATION
PINNACLE and the PDF

• PDF is a widely used format for document archiving
• PINNACLE lacks a native PDF printer
  — ECLIPSE v11 does as well
• How can one archive treatment plans in PDF format from PINNACLE?
Several solutions for PINNACLE users available online

- No need to reinvent the wheel
- Search “PDF” on www.medphysfiles.com
- MUSC’s PDF printing process was adapted from Nathan Childress’ upload
PINNACLE

File naming script

*.ps files

“Export” script sends *.ps files to “watched” folder

Windows PC
Adobe Distiller & batch file

*.pdf files on MOSAIQ’s ESCAN directory

Changing What’s Possible
File naming script

*.ps files

Export script FTPs to "watched" folder

Windows PC
Adobe Distiller & .bat file

*.pdf files on MOSAIQ’s ESCAN directory

Click on button to run HotScript
- Set 11 isolines
- Set 11 IDL for Electrons
- Create a PS file
- Publish PS files to PDF
- Publish IMRT Summary and Text to PDF

Changing What’s Possible
WarningMessage = "Provide a unique filename, then proceed with printing to file. Do not alter the MRN in the filename."

Store.FreeAt.TempPS = "";
Store.At.TempPS = SimpleString();
Store.At.TempPS.AppendString = "/home/p3rtp/Plans/";
Store.At.TempPS.AppendString = PlanInfo.MedicalRecordNumber;
Store.At.TempPS.AppendString = "-";
Store.At.TempPS.AppendString = PlanInfo.PatientName;
Store.At.TempPS.AppendString = "-ps";

ColorPrinterControl.WindowDumpSelectionMethod.LongName = "Click on window to be printed.";
ColorPrinterControl.PrintToFile = 1;
ColorPrinterControl.PrintToFilePaperSize = "Letter";
ColorPrinterControl.PrintToFileFileList.File = Store.At.TempPS.String;
WindowList.WindowPrint.Create = "Print Window...";
WindowList.ColorPrinterSelection.Create = "Select Printer...";

Example filename:
987654321-Smith-.ps

Make filename unique by adding a descriptor here for each page printed.

Changing What’s Possible
Changing What’s Possible
A unix script moves the * .ps files from the PINNACLE system to the WINDOWS PC via FTP.

```bash
#!/bin/sh
# FTPs all PS files to a server
UserName=p3rtp
Password=p3rtp
echo "open WINDOWS PC IP ADDRESS\n    user $UserName $Password\n    bin\n    prompt off\n    lcd /home/p3rtp/Plans\n    mput * .ps\n    bye\n" | ftp -nv
```
We use WingFTP Server as our FTP Service.

1. Export script FTPs to "watched" folder
2. Setup the user ‘p3rtp’ within WingFTP
3. File naming script
4. Adobe Distiller & batch file
5. * .pdf files on MOSAIQ’s ESCAN directory
6. PINNACLE

Changing What’s Possible
Specify the home directory of the WingFTP user ‘p3rtp’

- PINNACLE
  - File naming script
  - *.ps files
    - Export script FTPs to “watched” folder
    - Windows PC
    - Adobe Distiller & batch file
  - *.pdf files on MOSAIQ’s ESCAN directory

Changing What’s Possible
Setup “C:\PS” as a watched folder in Adobe Distiller

*.ps files in C:\PS\in are converted to *.pdf files located at C:\PS\out

Changing What’s Possible
Create a batch (*.bat) file to move new PDF files to ESCAN directory

- **Pinnacle**
  - File naming script
  - ***.ps files**
    - Export script FTPs to “watched” folder
      - **Windows PC**
        - Adobe Distiller & batch file
          - ***.pdf files on MOSAIQ’s ESCAN directory**

- **Batch file contains 2 lines:**
  - `@ECHO OFF`
  - `Move /Y c:\ps\out\*.pdf \\your path here\escan`

  Distiller creates *.pdf files here
Create a batch (*.bat) file to move *.pdf files to ESCAN directory

Schedule the batch file to run every minute...
What the user sees...

- The PINNACLE user only gives the name to the individual .PS files, presses

Steps 1,...,n

Step n +1
PDF documents are available here to pull into patients’ documents...

...here.
How MUSC setup a form for inking on an iPAD

Create a form in MS-WORD, EXCEL, Adobe, etc.

Export or save blank form as a PDF

Open the PDF in TakeNotes app on iPAD

Type or “ink” on the PDF, e.g. patient signature

Secure email finished form to oneself

Move form to OIS import folder

Changing What’s Possible
Tools for electronic forms on an iPad

- **TakeNotes app on iPad** by Tipirneni Software LLC
  - $3.99 on iTunes
  - Captures signature using PDF as background image
- Currently using the technique for patient consent forms
Tools for electronic forms on an iPad

• FormConnection (formconnections.com, $10 on iTunes)
  – Pro: create forms with drop downs
  – Cons: forms have to be edited in app, then emailed to self for import into OIS import directory (eSCAN)

• Example: Review of Systems (ROS) form

• Also look at FormFast.com

• 3\textsuperscript{rd}-Party systems rely on users to manually export, move, and import the PDF into the OIS.
Review of Systems (ROS) form on iPad

Completed form is emailed to self, then moved to OIS import directory

Changing What’s Possible
Clinic domain

Pathways to paperless

Many paths to produce PDF

Many paths to create templates

OIS template library

Patient chart in OIS

OIS import directory

PDF document

Hospital EMR

Changing What’s Possible
Library of templates

MOSAIQ template window

Changing What’s Possible
Compatibility with hospital system is a potential barrier

- eSCRIBE template automatically populates patient & treatment info
- Need to export to hospital EMR via HL7
- Some fields in MQ 2.3 template are inaccurately rendered after transmission through HL7
- Workaround: manually alter doc to correctly rendered by HL7, e.g. Tx Summary
- MQ 2.5 is promised to have enhanced features to improve interface to hospital EMR systems
WORKS IN PROGRESS
Windows tablets replacing iPAD

- Install MQ directly on Win tablet
- Create VBA forms for tablets running Windows
- Streamline workflow by increasing direct use of templates contained within the OIS
EMR supports research

- The next ROS form will automatically store data in a searchable database.
Summary

- Key to adoption of the electronic paradigm in your clinic is leadership recognizing the inevitability of EHR replacing paper-based records and the cost associated with not converting.

- View the adoption of EHR as an individual decision based on a cost/benefit analysis so that you can help facilitate that decision in others.

- Home-grown solutions will continue to be necessary until tools and capabilities for paperless charting improve among vendors.
References