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Database Design and Automation of Input

Quick introduction

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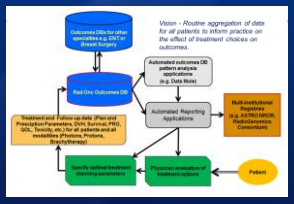
WE-G-9A-1 Radiation Oncology Informatics

How did things turn out for your patients when you made that change to the way you treated?

Need a wide range of data
- Demographics
- Prescription details
- Diagnosis and Staging
- Treatment plan
- DVH data (both curves and metrics)
- Toxicity
- Patient Reported Outcomes (PRO)
- Survival/Recurrence
- Treatment Delivery
- Lab/follow up

A simple question, what does it take to answer it?

Need to gather data for all patients treated to be able to correlate "improvements" in treatment methods with improvements in outcomes for patients



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Manual effort is the enemy
- solutions that depend on "someone" typing data in
- data organized as free text very difficult to automate extraction
- not standardizing nomenclatures requires people to interpret the record

Need to change mindset to think about routine clinical data not just as a care provider but as a scientist needing more accuracy

What about just using your Radiation Oncology Information System (ROIS) for the Outcomes Database ?

Depending on your needs that may work for you, but there are some questions to ask yourself

- Does the ROIS DB have all of the information that our group wants to use in assessing outcomes? (DVH, PRO, Labs, etc)
- The primary function of the ROIS is for treatment, is the DB design well suited for the questions we want to ask for outcomes? How hard is it to figure out the SQL queries that get the information we want?
- What happens to your outcomes DB when the product get an upgrade that changes the design?
- Do you need to interface to other systems to pull in data, trigger reports or send out data?

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Work with your group to think carefully about what information you need to have gathered to be able to answer the question

- **Crucial to think carefully about how the data items are linked.**

  That defines the relations in the relational database.

- **Important to think carefully about what data items you are going to want for all patients and items that you may change your mind about later.**

  That helps define how you approach designing the tables in the database.

  The answer will probably change. Take an approach that is flexible.

- **Then prioritize the information. If you can't get it all what is most important?**

  That helps define in what order you'll create the database tables and start rolling them out for testing and use.

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Technology basis choices-
Key, this is where you can make a serious misstep.

"Any given program, when running, is obsolete." - Unknown

" The cheapskate pays the most"

Car Talk wisdom from Tom and Ray Magliozzi

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Technology basis choices-
Key, this is where you can make a serious misstep.

Take a serious look at technologies that may require you to learn new skills but have a high probability of being routine in the future.

Take a realistic view of the likely hood of the technology becoming standard in the larger community. Institutional IT groups will eventually follow.

Examples:
- Windows vs Unix vs MacOS
- WPF vs Silverlight
- LINQ
- C#.Net vs Java
- MS SQL vs Sybase vs Oracle

Software technologies come and go with proponents arguing passionately that this is the way

In the long run technology choices are like finding a spouse, stability, ability to grow and good communication are better than exciting and super attractive.

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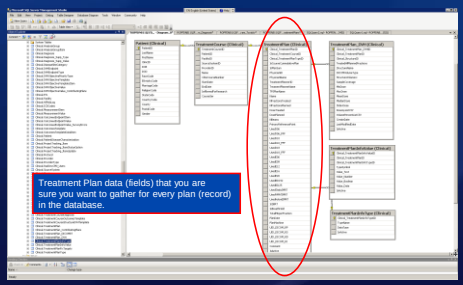
Use flat tables when you are certain it is going to be rare that you need to change what information you are gathering

Use IVV (Item Table –Value Table -View) when the information that you are going the gather is pretty likely to change or is not uniformly collected.



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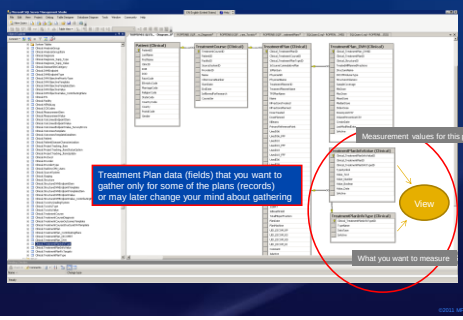

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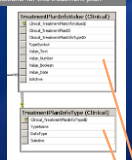
Measurement values for this plan
e.g. specific stats on couch positions for this treatment plan



What you want to measure
e.g. statistics on couch position

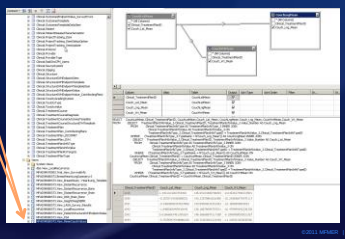
Combine (Join) data from these two tables into a View

You can reference the View in SQL queries

At a later date – if you decide to redesign your database schema to move the data into a flat table it this simplifies the change

The view is an SQL query that produces a table.

- You can change views without change the database table design or having any affect on the data in the tables.
- Views can be indexed to make access fast
- In your program, instead of referencing a view in the database. You can write a query that does the same thing.



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To set up the technology to automate you will need to

- Set up QA on your data inputs

  Garbage in – Despair out

- Standardize your process and nomenclatures

  Writing code to handle arbitrary inputs uses up your limited IT resources. Better to get everyone to use a standard

  Lung_L, Left lung, Llung, Ipsilateral lung, lung_l, ContraLung,LungL, Ltlung, ….

  FYI TG263 – Nomenclatures for Radiation Therapy

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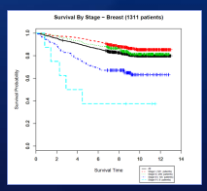
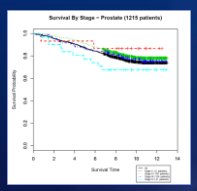
Data Input QA example

Early example, constructing a database to enable examining survival/recurrence for all patients treated. With technology and data (> 9850 patients, 42 disease sites) in place, first look highlighted need to QA diagnosis and staging information and to enter more standardized detail.





Physician group put in a rigorous review process of each diaganosis and Staging to be sure that a consistent approach is being used

Good data in – Data Mining Joy out

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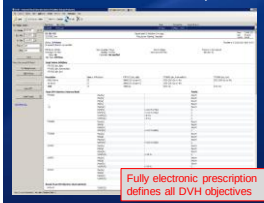
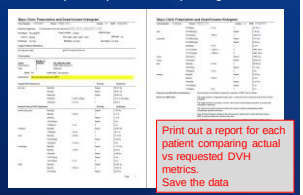
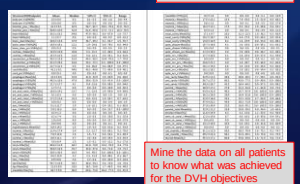
Standardization Benefit Example – Our electronic prescription and reporting tools



Fully electronic prescription defines all DVH objectives



Print out a report for each patient comparing actual vs requested DVH metrics.
Save the data



Mine the data on all patients to know what was achieved for the DVH objectives

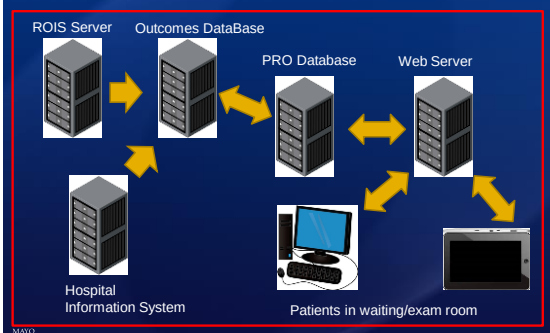
Standardization on structure and DVH nomenclatures, and coordination among physician disease site leaders Have enabled us to create a fully Electronic Prescription and reporting system.

As a result we can mine the data for thousands of patients to develop statistical models of what DVH metrics are achievable … and correlate with other factors.

PRO issues and security

IT happy, same risk level for PHI as all other systems
Least expensive and most flexible if you have a strong IT group

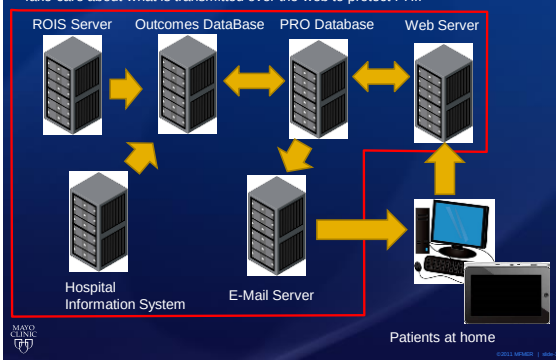
Servers/interactions/PHI under institutional control and behind firewalls



PRO issues and security

IT worried but still in control (able to protect) of data
IT in control of customizing interactions, triggers, etc

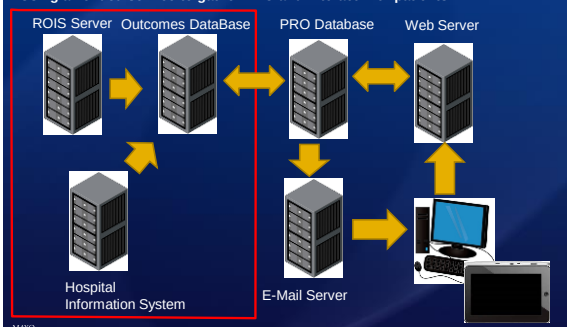
Servers/interactions/PHI under institutional control and behind firewalls.
Take care about what is transmitted over the web to protect PHI.



PRO issues and security

IT very worried. Lot's of questions about DB design, security, backup, etc.
There are systems with good track records in the market.
Can be substantially more expensive, but easy to get up and running quickly

Using a vended service to gather PRO and interact with patients.



Summary

- Work with your group to standardize to so that computers can replace manual data entry.
- The time spent working with your group about what data you need to measure outcomes is well spent.
- Be savvy about your technology choices, for the long term use of the project it might be in your best interest to learn something new.
- Patient reported outcomes are going to be very important. recognize that when your technology reaches outside the institution, there are going to be additional concerns.

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