iTherapy Process [iTP]
Checklist Workflow Manager

M. Coevoet
December 2019, Orthanc Conference
Background

• **2003 - 2017 | Radiotherapy @CUSL**
  • Head engineer in charge of all the IT / machine of RO Dept.

• **2017 – 2018 | IT Dept @CUSL**
  • IT Project Manager

• **2018 – 2020 | Epic implementation project @CUSL**
  • Reporting coordinator
« The DATA »
Context – « Safety of IT Medical Data »

reliability & constancy
Why?

« Member States shall ensure that depending on the medical radiological practice, the medical physics expert takes responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals subject to medical exposure, give advice on medical radiological equipment, and contribute in particular to the following: ... »

Source: Euratom - RADIATION PROTECTION NO 174 EUROPEAN GUIDELINES ON MEDICAL PHYSICS EXPERT (article 83, 2014)
Quality Assurance

« Who runs our tools? »
IT spread in Rad. Onc. Dept.
IT spread in Rad. Onc. Dept.

RESPONSIBILITY
Data: origin?

> 500 softwares

PACS

Patient Agenda

... « EMR »

> 500 softwares
Amount of data per patient inside our RO Dept.:

- +/- ext. RO 1000 patients/year
- ~ 1Gb / 3D patient
- 3 ~ 5 Gb / VMAT patient
- 10Gb / SRS-4D patient

>1 Tb / year excl. Diagnosis data

- Multiple modalities for contouring/planning
- Pre-treatment setup imaging
- VMAT/IMRT
- 4D Treatment
- Adaptive
- ...
IT is everywhere ...

- In the past: **Workstation – Link – Server – Application**


- « Our softwares treat patients ... »

- HIT Dept do not have any responsibility; we do.
Example 1

Screen: 1980 x 1080 px = 2M Pixels

CT: 512 x 512 px = 262k Pixels
Degraded to 256 x 256 ... 65k px ...

Human eyes: « 576M Pixels »

WYSIWYG
« What You See Is What You Get »
« What You See Is MAYBE What You Get »
Example 1.1
Example 2

? 1,000.000 € ≡ 1.000,000 €

cm ... versus mm, quid?
Example 2.1
Example 3

Thanks to M. Van Dycke/S. Vynckier

Impact: 3 fractions of 13Gy vs 2Gy
Example 3

Couch position in Absolute / Relative

... 34 mm difference!

Virtual / Physical GPU card

... Impact on TPS calculation results!
What could we do?
How to secure Clinical workflow & Digital workflow?
Why a CHECKLIST?
8 hospitals around the world

Results:
- 35% complication
- 47% deathrate
Surgical Safety Checklist

Before induction of anaesthesia
(with at least nurse and anaesthetist)

- Has the patient confirmed his/her identity, site, procedure, and consent?
  - Yes
  - Not applicable

- Is the site marked?
  - Yes

- Is the anaesthesia machine and medication check complete?
  - Yes

- Is the pulse oximeter on the patient and functioning?
  - Yes

- Does the patient have a:
  - Known allergy?
    - No
    - Yes
  - Difficult airway or aspiration risk?
    - No
    - Yes, and equipment/assistance available
  - Risk of >500ml blood loss (7ml/kg in children)?
    - No
    - Yes, and two IVs/central access and fluids planned

Before skin incision
(with nurse, anaesthetist and surgeon)

- Confirm all team members have introduced themselves by name and role.

- Confirm the patient’s name, procedure, and where the incision will be made.

- Has antibiotic prophylaxis been given within the last 60 minutes?
  - Yes
  - Not applicable

- Anticipated Critical Events
  - To Surgeon:
    - What are the critical or non-routine steps?
    - How long will the case take?
    - What is the anticipated blood loss?
  - To Anaesthetist:
    - Are there any patient-specific concerns?
  - To Nursing Team:
    - Has sterility (including indicator results) been confirmed?
    - Are there equipment issues or any concerns?

Before patient leaves operating room
(with nurse, anaesthetist and surgeon)

- Nurse Verbally Confirms:
  - The name of the procedure
  - Completion of instrument, sponge and needle counts
  - Specimen labelling (read specimen labels aloud, including patient name)
  - Whether there are any equipment problems to be addressed

- To Surgeon, Anaesthetist and Nurse:
  - What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.
Checklist origin

« Nor the aircraft, nor the pilot experience were the root cause of the crash. »
Same « standard » medical practice
• 1970: 2 clinical FTE
• 2000: > 15 clinical FTE

Healthcare world:
• 4000 medical procedures
• 6000 drugs

Too complex for 1 expert ...
Checklists

« Reminder of key things to not forget ... »

To help making experts better.
To help people to handle complex systems.

Hierarchy of Effectiveness in Preventing Errors

1. Forcing functions & constraints
2. Automation / computerization
3. Simplification / standardization
4. Reminders, checklists, double checks
5. Rules & Policies
6. Education & training

Hazards

Losses

Cheese Model, J. Reason
Herbert William Heinrich
Radiation Oncology Workflow
Issues from a « multi-disciplinary & sequentiel work », impacts...

- Where are the CT images?
- What is the prescription?
- When ...
- What about ...

- Stress
- Operating losses
- Inefficiency
- Risks
- Delays
- Poor organisation
- Treatment quality
- ...

Issues from a « multi-disciplinary & sequentiel work », impacts...
### Solution ?

<table>
<thead>
<tr>
<th>Process</th>
<th>Étape</th>
<th>Nom</th>
<th>Prénom</th>
<th>MedAss/Phys</th>
<th>Req</th>
<th>Site</th>
<th>PTV</th>
<th>Plan</th>
<th>Start PTV1</th>
<th>Start PTV2</th>
<th>Machine</th>
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**Nombre de patients : 28**
How does it work?

= Airplane checklist:
1. Do not forget – incident
2. Reminder rare action
3. Standardisation
4. ...
How does it work?

**iTherapy Process**

**VERSION TEST SUR SERVEUR TEST 10.96.4.229**

**ETAPE 4.20 / APPROBATION DU TP**

**Action:**
- Approbation du TP (Tomo) *
- Taille des métaîtres *
- Direct ou Helical *
- Nom du plan approuvé *
- Vérification des lasers *
- Vérification du fractionnement *
- Final Accept *

**Action à réaliser:**
- Oui  Refus  Rassen
- 2.5 cm
- Helical
- Plan test
- NA

**Réalisée par ... le ...**
- MX - Tuesday 02/10/2012 - 10:35
- MX - Tuesday 02/10/2012 - 10:35
- MX - Tuesday 02/10/2012 - 10:35
- MX - Tuesday 02/10/2012 - 10:35
- MX - Tuesday 02/10/2012 - 10:35

**Commentaires:**

How does it work?
How does it work?
Personalized workflow

IN

Machine?

Linac

Blocks?

Yes

Create blocks

No

Treatment chart

Tomo

Prepare DQA

DQA OK?

No

Treatment chart

Yes
Concept ...

... one team

... one step

... one physician/physicist

... a mix of teams/users/steps
IT world
Solutions

1. Upgrade & update

2. QA ! [specific & process]

- Link R&V 📏 Linac
- Dicom transfers (CT, TPS, CBCT, OIS, ...)
- Dosimetric calculation/parameters (TPS)
- DB consistency (= post-validation stability)
- IT systems consistency (OS, Applications, ...)
- Tomorrow:
  - Data Mining
  - Clinical aid decision (Adaptive TRT)
  - Process intelligence
  - Machine learning, ...
The process [including data transfers] become « the product » throughout which a QC will be applied.

AAPM TG100: Method for Evaluating QA Needs in Radiation Therapy

iTherapy Process [www.itp.wf]

Workflow manager by checklist
Regulatory: huge challenge!

- Standards
- Accreditation
- Grants [€]
- Decision helper
- Decision maker
Licence: AGPL

« Same concept as a recipe »

Direct access to the code:
- safety,
- responsibility,
- efficiency,
- evolution,
...

No company development political constraints
“Future is made by users.”

Concepts, ideas, code, add-ons, ...
Shared online!

User based development:
=> available to all of us!

AGPL
- Open Source

Win / Win

Free

Dedicated
- configuration
- evolution

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to the code:
safety,
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AGPL
Free Software

Free as in Freedom
Conclusions

- Standardization of workflow
- Integration of checklists and forcing functions
- Clear task attribution
- Workflow monitoring
- Increased efficiency
- Decreased risk of error

Challenges

- Automation
- More integration
- Clinical & Digital WORKFLOWS link
Thank you!