

Workflow optimization by checklists

ICCR 2016 - M. Coevoet

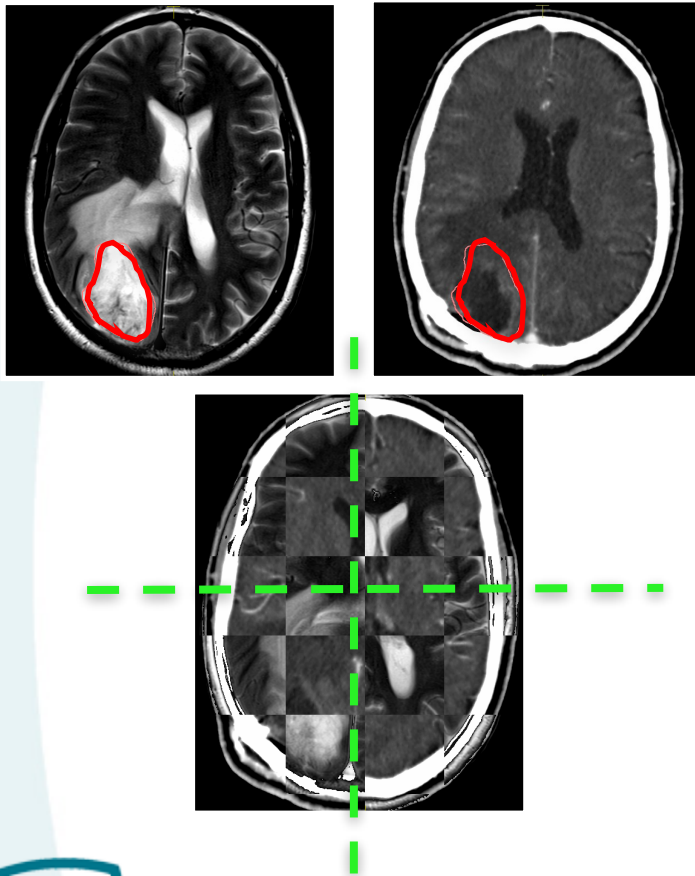


**INSTITUT
ROI ALBERT II**

CANCÉROLOGIE ET HÉMATOLOGIE
Cliniques universitaires **SAINT-LUC** | **UCL** Bruxelles

Radiotherapy workflow ...

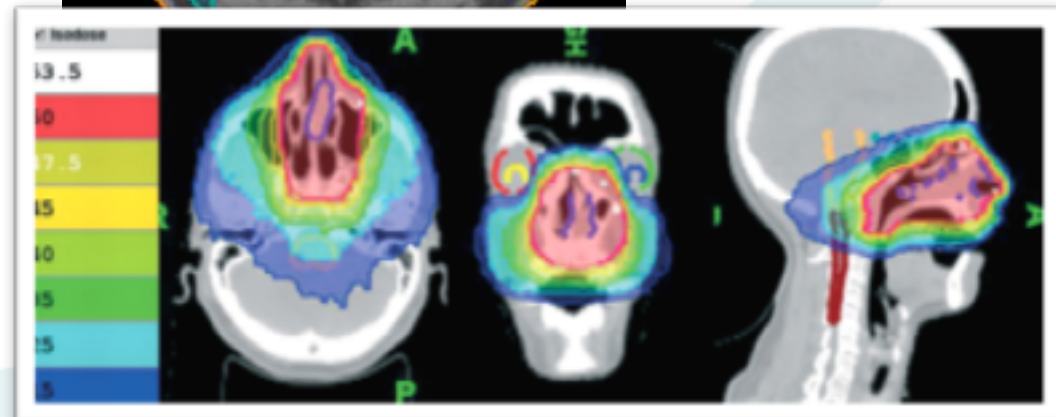
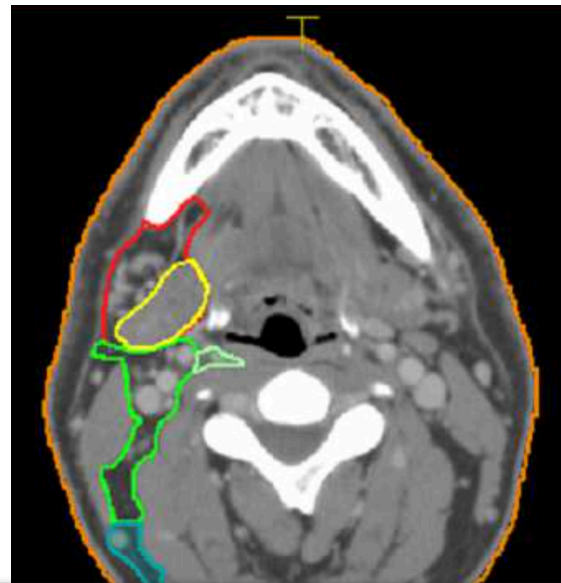
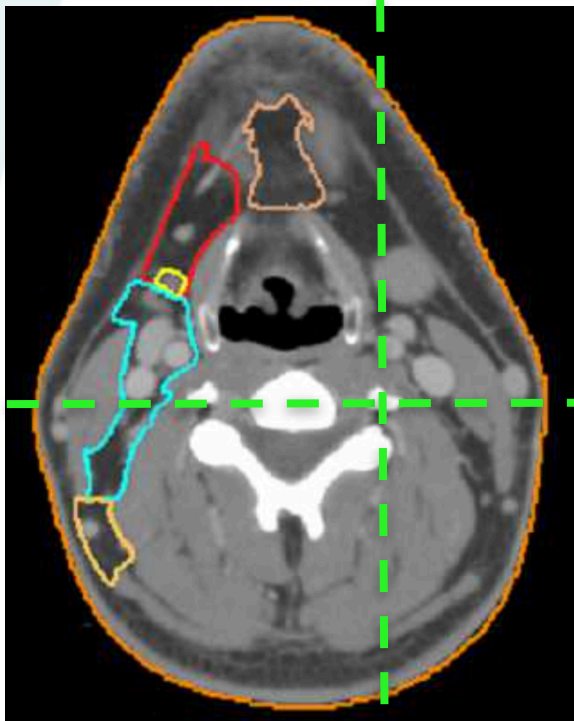
Imaging



Radiotherapy workflow ...

Imaging

Planning (TPS)

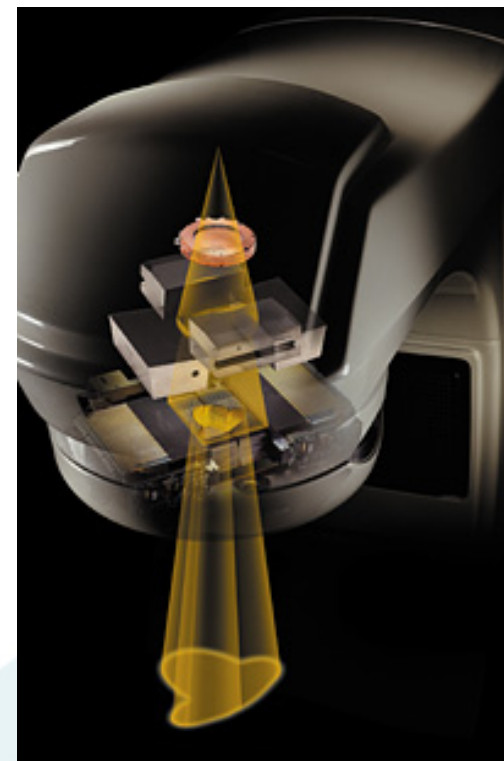
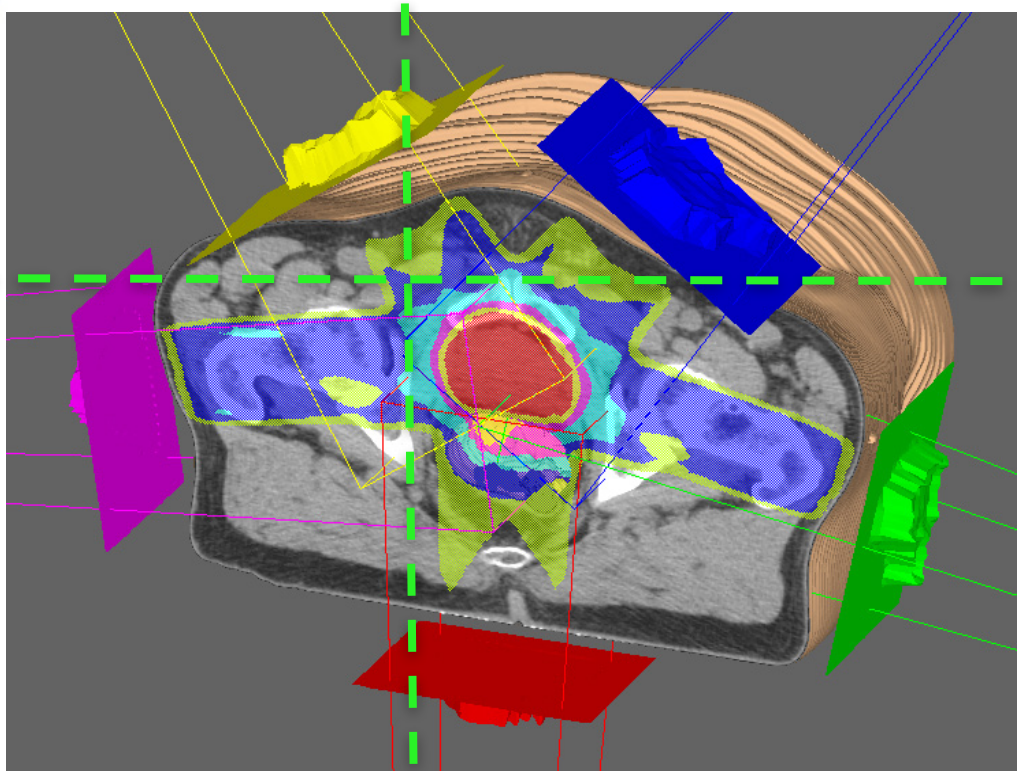


Radiotherapy workflow ...

Imaging

Planning (TPS)

OIS transfer



Radiotherapy workflow ...

Imaging

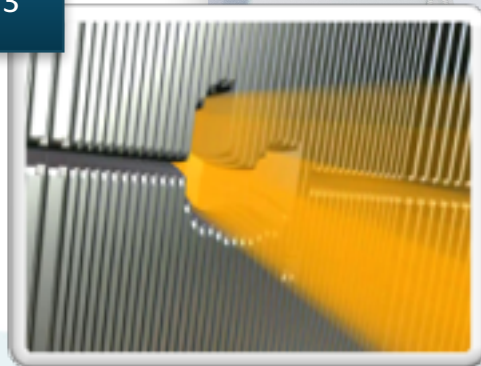
Planning (TPS)

OIS transfer

Treatment



8T, 1mm³



Etape	Légende
0.0	Administratif
0.1	Coord. med.
1	Sim. 1
1.1	Sim. 1 bis
2	Scanner
3	Dose Plan Basis
4	Contour de vol.
5.0	TP
5.1	Approb. du TP
5.2	TP (QC et Doc)
6	Confection
7	Contre sign. TP
8	Sim. 2
9	Faiscx de rep.
10	Carte
11	En traitement

Radiation
oncologists

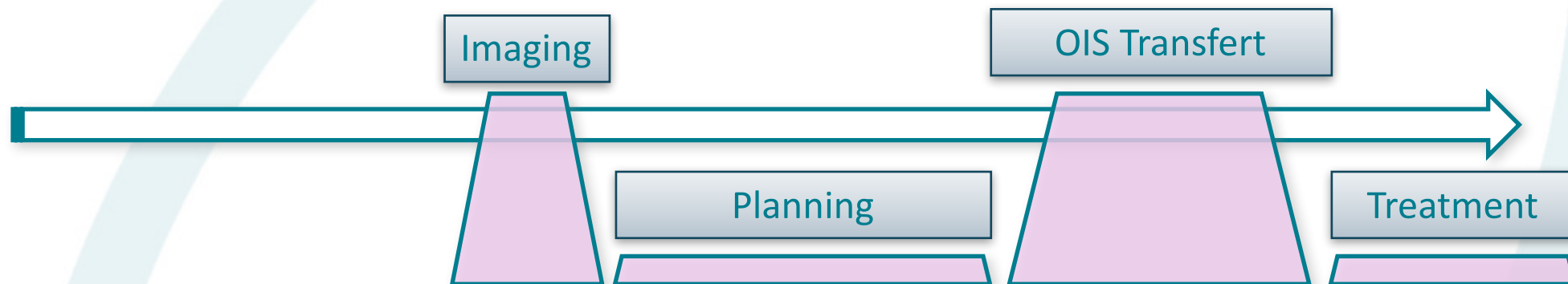
Physicists

Quality
Manager

Secretary/Book
ing

Patient





	0.0 Administrative	0.1 Demographic Demographic	1. Simulation	2. Scanner	3. Dose Plan Basis	4. Contouring	5. Planning	5.1 Plan approval	5.2 TP QC & Docs	6. Blocks	7. RO Approval	8. Simulation 2	9. Imaging	10. Chart	11. Treatment
RO															
Med.Phys.															
RTT															
Tech./IT															



As a « multi-disciplinary & sequential work », it generates ...

- Treatment quality
- Stress
- Operating losses
- Inefficiency
- Risks
- ...



- **Time lost** due to information « not efficiently » exchanged.
- « Last minute task »:
 - **hurry** ... increase of the risk of incident.
 - any forecasting allowed.
 - **delay** => treatment postponement.
- Risks of **errors** (during information transfer).
- Poor personal **organisation**.
- ...



Solution ?

iTherapy Process

the way to go, the way to know

MX - logout
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WorkflowMédicalPhysiqueRTTTechniqueDivers

VERSION TEST SUR SERVEUR TEST 10.96.4.229
URGENCE SOUS 72H

Process	Etape	Nom	Prénom	Med/Ass/Phys	Req	Site	PTV	Plan	Start PTV1	Start PTV2	Machine
Radio.	4.20			LR / SBO / SV	1	1	1	1	-0 j, 8 h	...	Tomo2
Radio.	3.20			PS / CSA /	1	1	1	1	-2 j, 8 h	...	Tomo1
Radio.	3.10			CK / CK /	1	1	1	1	-1 j, 8 h	...	SP18
Radio.	4.20			LR / SBO / SV	1	1	1	1	-1 j, 8 h	-48 j, 8 h	Tomo2
Radio.	3.10			LR / SBO / SV	1	1	2	1	-1 j, 8 h	-48 j, 8 h	Tomo2
Radio.	0.30			PS / /	1	1	1	1	-3 j, 8 h	...	SL25
Radio.	6.00			PS / CSA /	1	1	1	1	-1 j, 8 h	...	Tomo1
Radio.	4.70			PS / CSA /	1	1	2	1	-1 j, 8 h	...	Tomo1
Radio.	3.10			CK / PSM /	1	1	1	1	-2 j, 8 h	...	SP18
Radio.	4.30			XG / / AD	1	1	1	1	-1 j, 8 h	...	SL25
Radio.	4.30			PS / CSA / EB	1	1	1	1	-1 j, 8 h	-24 j, 8 h	SL25
Radio.	4.00			LR / / EB	1	1	1	1	-0 j, 8 h	...	SP18
Radio.	4.30			LR / SBO / SV	1	1	1	1	-0 j, 8 h	...	Tomo2
Radio.	4.30			LR / SBO / SV	1	1	2	1	-0 j, 8 h	...	Tomo2
Radio.	4.01			LR / SBO /	1	1	1	1	-1 j, 8 h	-48 j, 8 h	Tomo2
Radio.	4.00			LR / SBO /	1	1	2	1	-1 j, 8 h	-48 j, 8 h	Tomo2
Radio.	6.00			CK / PSM / EB	1	1	1	1	-3 j, 8 h	-29 j, 8 h	SP18
Radio.	5.20			CK / PSM / EB	1	1	2	1	-3 j, 8 h	-29 j, 8 h	SP18
Radio.	3.00			CK / CK /	1	1	1	1	-3 j, 8 h	-42 j, 8 h	SP18
Radio.	3.00			XG / SBO / AD	1	1	1	1	-3 j, 8 h	...	Tomo1
Radio.	4.00			PS / CSA /	1	1	1	1	-0 j, 8 h	...	SL25
Radio.	0.30			XG / SBO /	1	1	1	1	-2 j, 8 h	...	SP18
Radio.	0.30			LR / SBO /	1	1	1	1	-2 j, 8 h	...	SP18
Radio.	0.30			PS / /	1	1	1	1	-0 j, 8 h	...	Tomo1
Radio.	4.00			LR / SBO /	1	1	1	1	-1 j, 8 h	...	Tomo2
Radio.	4.00			LR / SBO /	1	1	2	1	-1 j, 8 h	...	Tomo2
Radio.	4.00			CK / /	1	1	1	1	-3 j, 8 h	-29 j, 8 h	SP18
Radio.	3.00			CK / PSM /	1	1	1	1	-1 j, 8 h	-28 j, 8 h	SP18

Nombre de patients: 28

PATIENTS EN COURS DE PRÉPARATION DE TRAITEMENT

Process	Etape	Nom	Prénom	Med/Ass/Phys	Req	Site	PTV	Plan	Start PTV1	Start PTV2	Machine
Radio.	12.00			PS / SBO / EB	1	1	1	1	+6 j, 16 h	...	SL25
Radio.	10.00			PS / SBO / EB	1	1	1	1	+4 j, 16 h	...	SL25
Radio.	12.00			LR / CSA /	1	1	1	1	+36 j, 16 h	...	SL25
Radio.	4.20			LR / SBO / SV	1	1	1	1	-0 j, 8 h	...	Tomo2
Radio.	0.40			VG / ELO /	1	1	1	1	-13 j, 8 h	-44 j, 8 h	Tomo1
Radio.	12.00			CK / PSM / JMD	1	1	1	1	+46 j, 16 h	...	SP18

Tri par corps de métier

med
inf phys
secr tech

Tri par utilisateur:

Med Ass Phys

TOUS

Afficher tous les patients ...
=> ... en traitement
... archivés

Etape Légende

Radiothérapie Externe

Avant preparation

0.00 Demande de mise en traitement
0.10 Nouvelles demandes de mises en traitement
0.20 Clôture administrative
0.30 Préparation Simulation par les médecins

Preparation du traitement

0.40 Préparation Simulation par les infirmiers
1.00 Simulation
1.10 Simulation
1.20 Préparation Simulation sur Tomo
1.30 Préparation Simulation sur Tomo
1.40 Simulation MVCT
1.50 Exportation sur Focal (Simul MVCT)
1.90 Treatment Calendar
2.00 Dose Plan Basis



How does it work?

iTherapy Process

the way to go, the way to know

MX - logout
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WorkflowMédicalPhysiqueRTTTechniqueDivers

VERSION TEST SUR SERVEUR TEST 10.96.4.229

ETAPE 4.20 / APPROBATION DU TP

Status: Treatment

Mme ☐, Mlle ☐, Mr ☒ - Nom:

ID St-Luc: H42873E / Course: 1

Superviseur: LR / Assistant: SBO / Physicien: SV

Prénom:

Site d'irradiation: 1 Bassin / PTV: 1 Loge prost / Plan: 1

Hospi: ☐ - Unité: - SPO: ☐

Plus d'infos ...

PROCESS: RADIOTHERAPIE EXTERNE

Retour au suivi des patients

Etape	Légende
0.00	Demande de mise en traitement
0.10	Nouvelles demandes de mises en traitement
0.20	Clôture administrative
0.30	Préparation Simulation par les médecins
0.40	Préparation Simulation par les infirmiers
1.00	Simulation
1.10	Simulation
1.20	Préparation Simulation sur Tomo
1.30	Préparation Simulation sur Tomo
1.40	Simulation MVCT
1.50	Exportation sur Focal (Simul MVCT)
1.90	Treatment Calendar
2.00	Dose Plan Basis
3.00	Contourage de volumes
3.10	Validation des volumes
3.20	Tomostruct
4.00	TP
4.01	Validation physique
4.10	Optimisation (Tomo)
4.20	Approbation du TP
4.30	Documentation dosimétriste
4.40	Plombs, plomb électron clic...
4.50	Importation dans Mosaic
4.60	Préparation DQA
4.70	Mesures DQA
4.80	Analyse DQA
5.00	Fabrication des plombs
5.20	Simulation cicatrice
6.00	Contre-signature
6.10	Mesure du facteur plomb
6.20	Introduction des UM dans Mosaic
7.00	Carte de traitement
10.00	Vérification physique de la carte
11.00	Correction suite à la vérification

Action

Action à réaliser

Réalisée par ... le ...

☐ Oui ☐ Refus ☐ Reset

2.5 cm

Helical

☐

☐

☐

NA

26/09/2012 - 13:48 - SV => PTV60Gy (PTV nodule RMN confirmé?)

Sauver

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= Airplane checklist:

1. Do not forget – incident
2. Reminder rare action
3. Standardisation
4. ...



How does it work?

iTherapy Process

the way to go, the way to know

MX - logout
Service de Radiothérapie des Cliniques universitaires St-Luc
Pas de nouveau message | 02/10/2012 Anniversaire de:

WorkflowMédicalPhysiqueRTTTechniqueDivers

VERSION TEST SUR SERVEUR TEST 10.96.4.229
David Commerce - H42873E

ETAPE 4.20 / APPROBATION DU TP

Status: Treatment

Mme ☐, Mlle ☐, Mr ☒ - Nom: Prénom:

ID St-Luc: H42873E / Course: 1

Superviseur: / Assistant: / Physicien:

Site d'irradiation: 1 / PTV: 1 / Plan: 1

Hospi: ☐ - Unité: - SPO: ☐

Plus d'infos ...

PROCESS: RADIOThERAPIE EXTERNE

Retour au suivi des patients

PROCESS:

Etape	Légende
0.00	Demande de mise en traitement
0.10	Nouvelles demandes de mises en traitement
0.20	Clôture administrative
0.30	Préparation Simulation par les médecins
0.40	Préparation Simulation par les infirmiers
1.00	Simulation
1.10	Simulation
1.20	Préparation Simulation sur Tomo
1.30	Préparation Simulation sur Tomo
1.40	Simulation MVCT
1.50	Exportation sur Focal (Simul MVCT)
1.90	Treatment Calendar
2.00	Dose Plan Basis
3.00	Contourage de volumes
3.10	Validation des volumes
3.20	Tomostruct
4.00	TP
4.01	Validation physique
4.10	Optimisation (Tomo)
4.20	Approbation du TP
4.30	Documentation dosimétrique
4.40	Plombs, plomb électron clic...
4.50	Importation dans Mosaik
4.60	Préparation DQA
4.70	Mesures DQA
4.80	Analyse DQA
5.00	Fabrication des plombs
5.20	Simulation cicatrice
6.00	Contre-signature
6.10	Mesure du facteur plomb
6.20	Introduction des UM dans Mosaik
7.00	Carte de traitement
10.00	Vérification physique de la carte
11.00	Correction suite à la vérification

Action

Approbation du TP (Tomo) *

Taille des mâchoires

Direct ou Helical

Nom du plan approuvé *

Vérification des lasers *

Vérification du fractionnement *

Final Accept *

Il y a une proposition avec un changement d'iso

* : étapes obligatoires

Commentaires:

26/09/2012 - 13:48 - SV => PTV60Gy (PTV nodule RMN confirmé?)

Sauver

Action à réaliser

☒ Oui ☐ Refus ☐ Reset

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

MX - Tuesday 02/10/2012 - 10:35

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How does it work?

iTherapy Process

the way to go, the way to know

MX - logout
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WorkflowMédicalPhysiqueRTTTechniqueDivers

VERSION TEST SUR SERVEUR TEST 10.96.4.229
License: Commercial - 14628735

ETAPE 4.30 / DOCUMENTATION DOSIMÉTRISTE

Status: Treatment

Mme ☐ , Mlle ☐ , Mr ☒ - Nom: Prénom:

ID St-Luc: H42873E / Course: 1

Superviseur: / Assistant: / Physicien:

Site d'irradiation: 1 / PTV: 1 / Plan: 1

Hospi: ☐ - Unité: - SPO: ☐

Plus d'infos ...

PROCESS: RADIOThERAPIE EXTERNE

Action

Impression et docs par dosimétriste *

Y a-t-il un changement d iso? *

Nom du plan approuvé

* : étapes obligatoires

Commentaires:

26/09/2012 - 13:48 - SV => PTV60Cy (PTV nodule RMN confirmé?)

Sauver

Action à réaliser

☐

☐ Oui ☐ Non ☐ Reset

Plan test

Réalisée par ... le ...

Retour au suivi des patients

PROCESS:

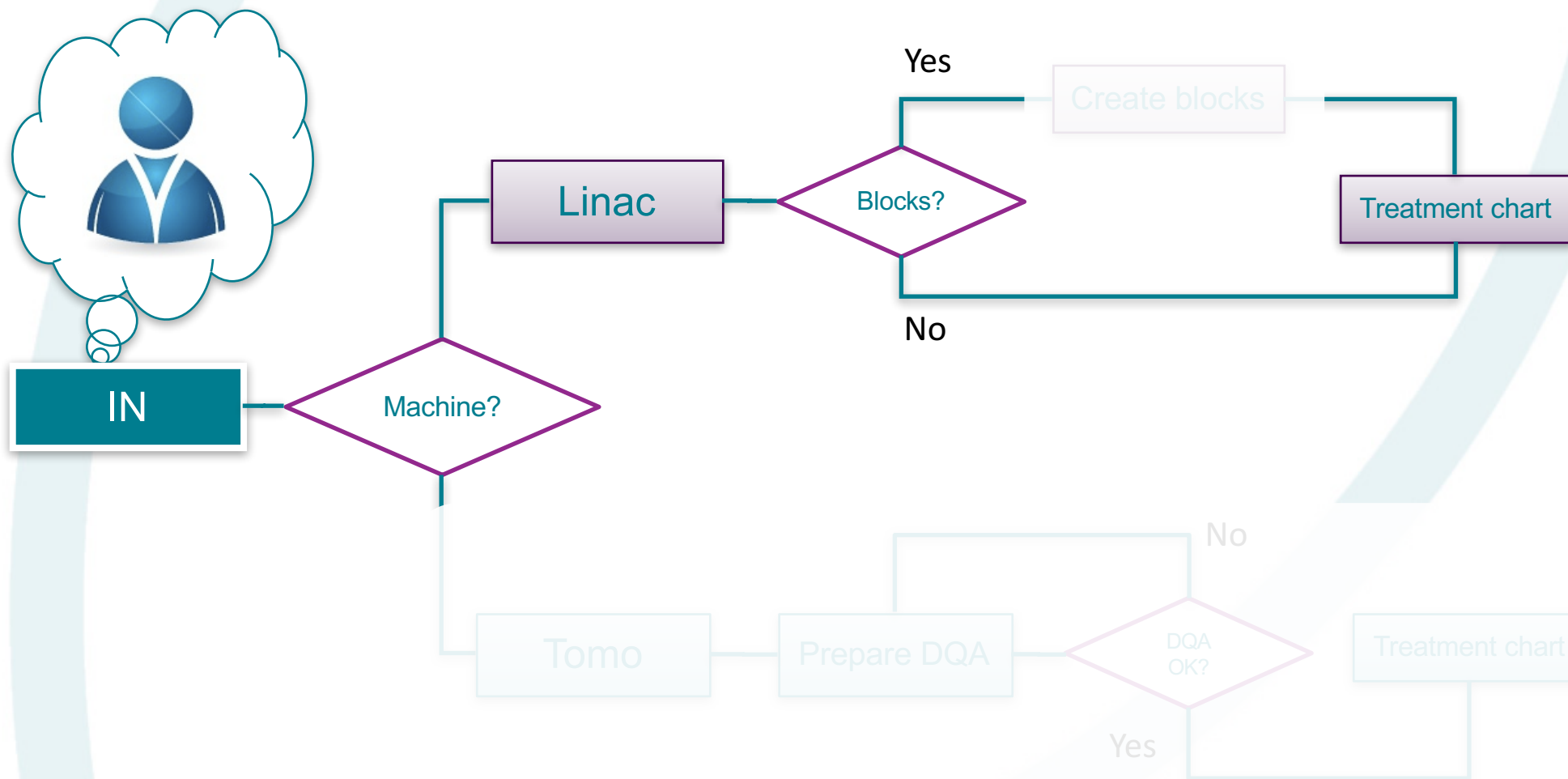
Etape	Légende
0.00	Demande de mise en traitement
0.10	Nouvelles demandes de mises en traitement
0.20	Clôture administrative
0.30	Préparation Simulation par les médecins
0.40	Préparation Simulation par les infirmiers
1.00	Simulation
1.10	Simulation
1.20	Préparation Simulation sur Tomo
1.30	Préparation Simulation sur Tomo
1.40	Simulation MVCT
1.50	Exportation sur Focal (Simul MVCT)
1.90	Treatment Calendar
2.00	Dose Plan Basis
3.00	Contourage de volumes
3.10	Validation des volumes
3.20	Tomostruct
4.00	TP
4.01	Validation physique
4.10	Optimisation (Tomo)
4.20	Approbation du TP
4.30	Documentation dosimétriste
4.40	Plombs, plomb électron clic, ...
4.50	Importation dans Mosaik
4.60	Préparation DQA
4.70	Mesures DQA
4.80	Analyse DQA
5.00	Fabrication des plombs
5.20	Simulation cicatrice
6.00	Contre-signature
6.10	Mesure du facteur plomb
6.20	Introduction des UM dans Mosaik
7.00	Carte de traitement
10.00	Vérification physique de la carte
11.00	Correction suite à la vérification

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13

Personalized workflow



Concept ...

iTherapy Process
the way to go, the way to know

MX - logout
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Pas de nouveau message | 25/01/2013 Anniversaire de:

Workflow Médical Physique RTT Technique Divers

URGENCE SOUS 72H

Process	Etape	Nom	Prénom	Med/Ass/Phys	Req	Site	PTV	Plan	Start PTV1	Start PTV2	Machine
Nombre de patients: 0											

PATIENTS EN COURS DE PRÉPARATION DE TRAITEMENT

Process	Etape	Nom	Prénom	Med/Ass/Phys	Req	Site	PTV	Plan	Start PTV1	Start PTV2	Machine
Radio.	12.00			XG / SBO / ADR	1	1	1	1	+10 j, 18 h	...	SL25
Radio.	12.00			XG / ELO / EB	1	1	1	1	+31 j, 18 h	...	SP18
Radio.	12.00			XG / SBO / EB	1	1	1	1	+23 j, 18 h	...	SL25
Radio.	12.00			XG / SBO / DD	1	1	1	1	+8 j, 18 h	...	SL25
Radio.	12.00			XG / SBO / AD	1	1	1	1	+54 j, 18 h	...	Tomo1
Radio.	12.00			XG / SBO / NDP	1	1	1	1	+58 j, 18 h	...	Tomo1
Radio.	12.00			XG / ELO / VR	2	1	1	1	+16 j, 18 h	...	SP18
Radio.	12.00			XG / ELO /	1	1	1	1	+15 j, 18 h	...	SP18
Radio.	12.00			XG / SBO / AD	1	1	1	1	+11 j, 18 h	...	SL25

Nombre de patients: 9

Tri par corps de métier

med	inf	secr	phys	tech

Tri par utilisateur:

XG Ass Phys

TOUS

Afficher tous les patients ...
=> en traitement
... archivés

Etape Légende

Radiothérapie Externe

Avant préparation

0.00	0.10	0.20	0.30
Demande de mise en traitement	Nouvelles demandes de mises en traitement	Closure administrative	Préparation Simulation par les médecins

Préparation du traitement

0.40	1.00	1.10	1.20	1.30	1.40	1.50	2.00	3.00	3.10
Préparation Simulation par les infirmiers	Simulation	Simulation	Préparation Simulation sur Tomo	Préparation Simulation sur Tomo	Simulation MVCT	Exportation sur Focal (Simul MVCT)	Dose Plan Basis	Contourage de volumes	Validation des volumes

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... one team

... one step

... one physician/physicist

... a mix of teams/users/steps



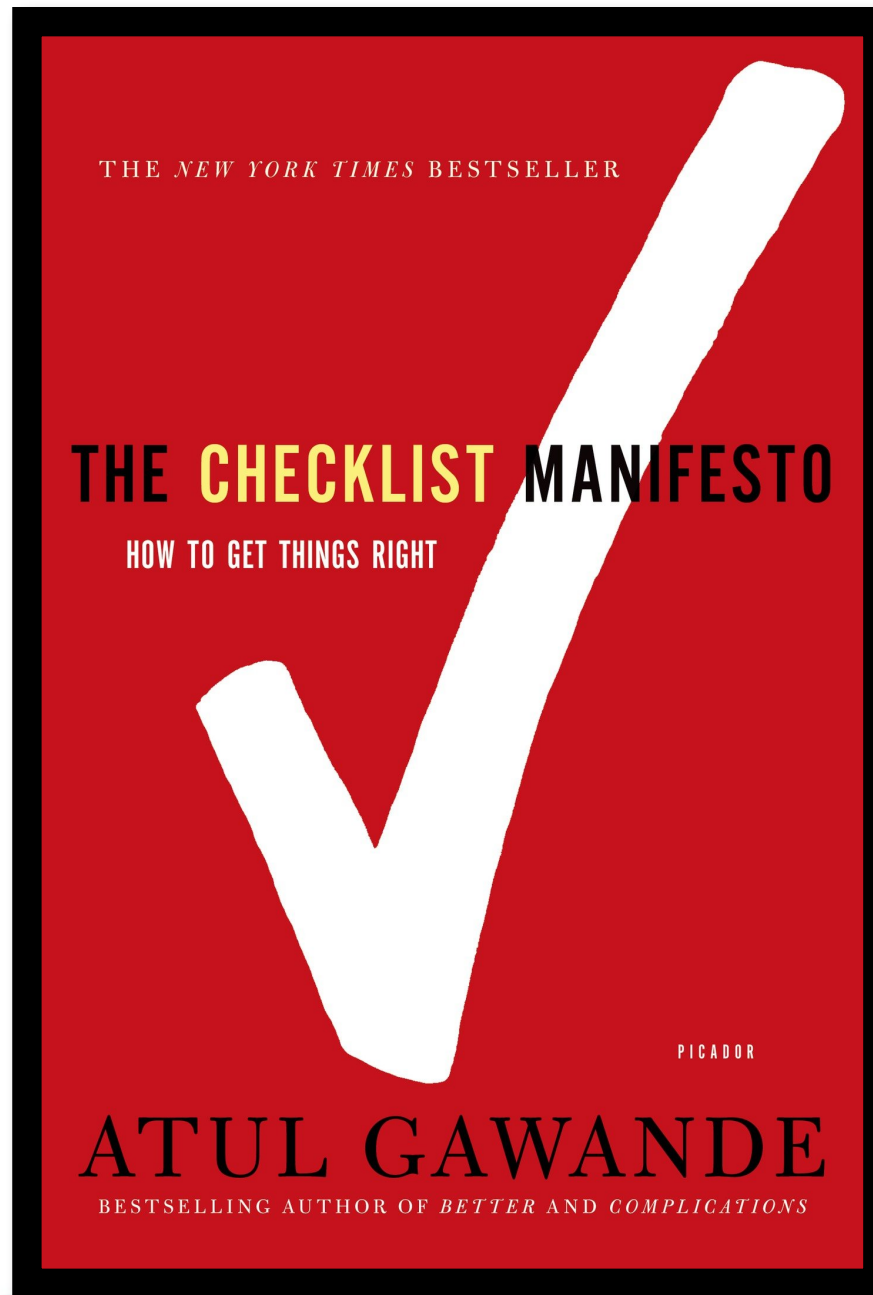
Numbers

iTherapy Process (iTP) has first been developed under the name of « Intranet Radiotherapy »

- 1st version: 2005 (88 « checks » - 16 steps)
- Latest version: 387 « checks » - 35 steps
- Experience of more than 12 000 patients
- DB: 44 requests/sec
- 6500 views per day
- Installed in Alger, Liège, (Bordeaux), ...



Why a CHECKLIST?



Experience



8 hospitals around the world

Results:



35% complication



47% deathrate



Surgical Safety Checklist



World Health
Organization

Patient Safety

A World Alliance for Safer Health Care

Before induction of anaesthesia

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?

☐ Yes

Is the site marked?

☐ Yes

☐ Not applicable

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?

Is essential imaging displayed?

☐ Yes

☐ Not applicable

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.

Revised 1 / 2009

© WHO, 2009



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

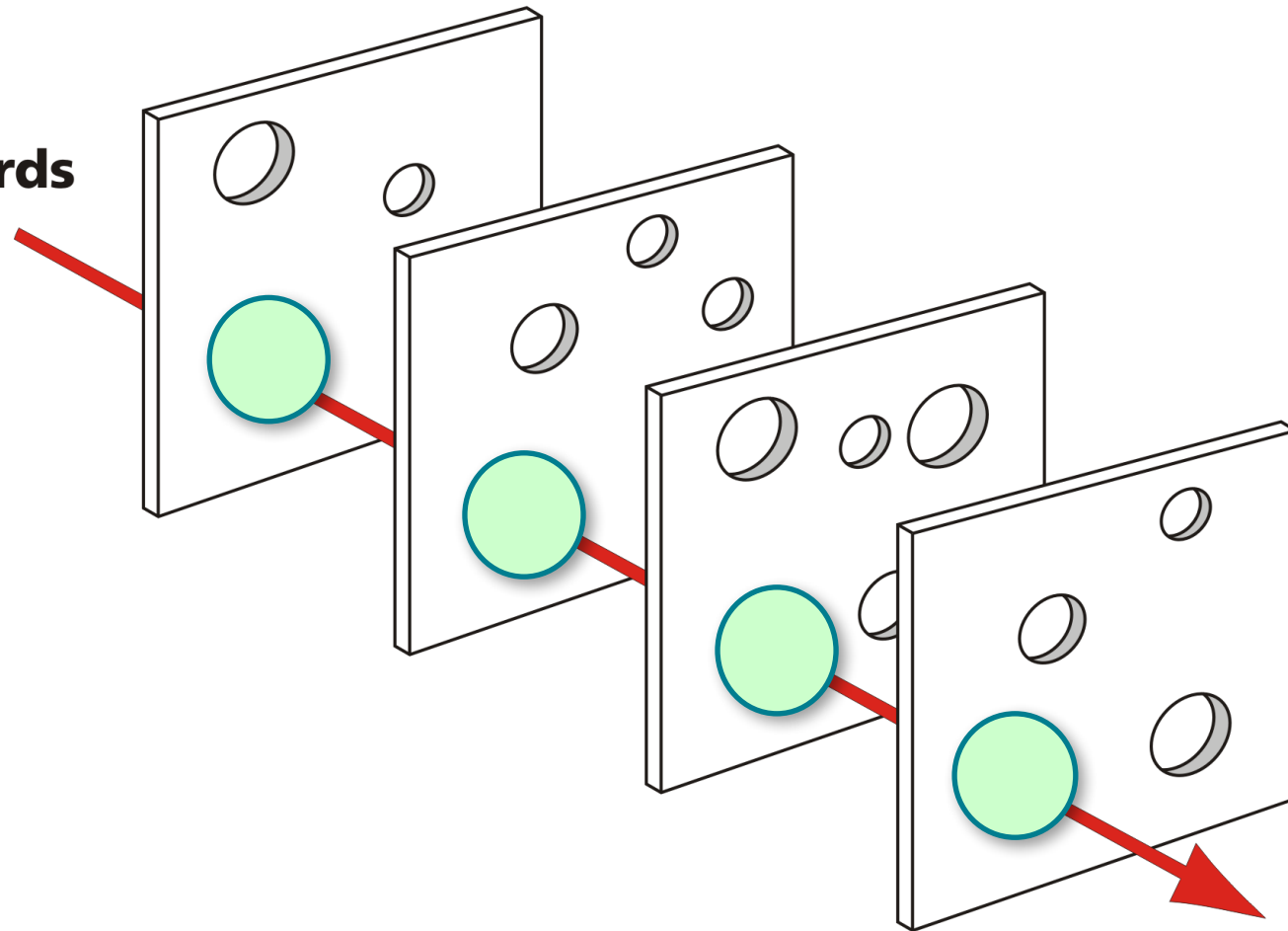
Most
effective



Institute for Safe Medical Medication practices. Medication error prevention “toolbox”. Med Safe Alert 1999;4:1.



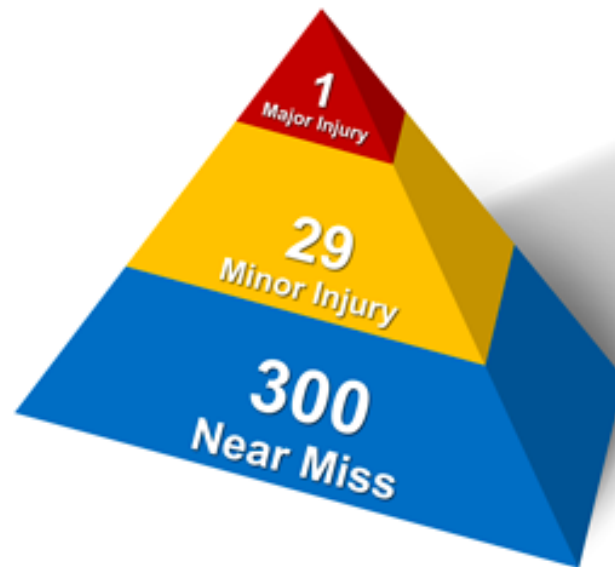
Hazards



Losses

Cheese Model, J. Reason





GoWBW.com

Herbert William Heinrich



IT side ...



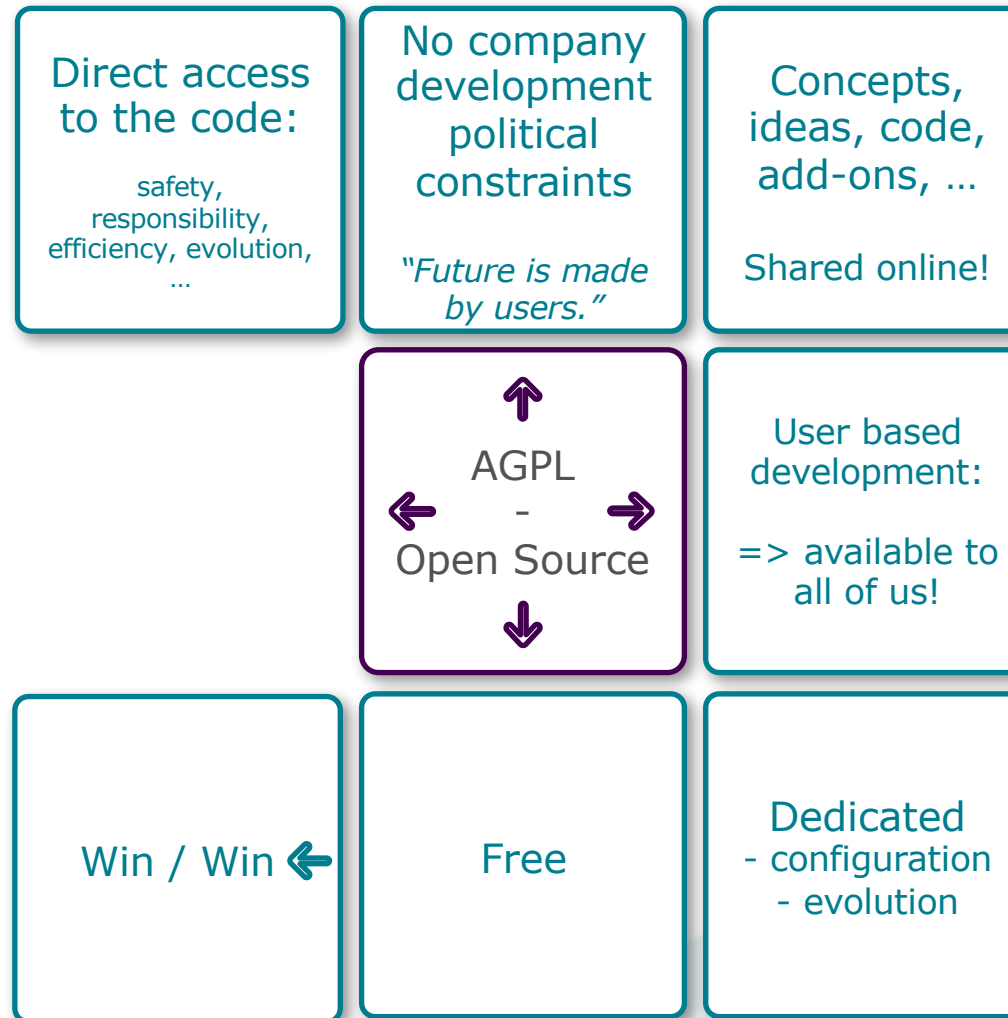
Web based software



Licence: AGPL



« Same concept as a recipe »





Thank you!

www.itp.wf



Integration ...

Hospital

- **Patient demographic data** (name, address, telephone, ID, ...)
- **Medical data (EMR)**
- **PACS imaging**
- **Agenda**
- ...

Workflow manager

iTP_{.wf}

Treatment manager

Mosaiq (*Elekta*)
Aria (*Varian*)

Treatment DATA (from TPS)



Others functionalities

- Users rights



- Internal mailing



- Procedure sharing



- Multiple workflows
Brachytherapy, TBI, ...

- Easy updates

- Incident reporting:
ROSIS/PRISMA form

- Statistics



- Breakdown database



- Downtime



Others functionalities

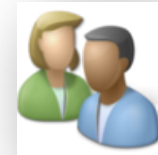
- Team calendar



- URL shortcuts



- Directory



- Isotopes library



- In-Vivo management



- "eNal protocol"



33

Implementation

Resistance ... need global approval of a change ...



Independant, Autonomy,
Self sufficiency, ...

Humility, Discipline,
Team work, ...



No discussion about Healthcare cost (42% inefficiency – OCDE)