Experience with automated planning in busy international clinic setting



Clínica Iram – Santiago - Chile

FM. Alejandro Cuadra.

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Standard Disclaimers

- Speaker Disclousures.
 - Reflects my own opinion and not necessarily represent to IRAM.
- Conflicts of interest.

- None.

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Alejandro Cuadra, MSc.

– Physicist.

- Tarapaca`s University.
 Pre grade
- Pre grade
 University of Chile.
- Post grade in Physics.
- Universitat Valencia, Spain. – Msc.Medical Physics.
- "Clínica IRAM" since 2002.
 - Quality Asurance in Radiotherapy.
 - Clinical Dosimetry Department.



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Clínica IRAM.

- Since 1978.
- > 3000 treatments per years.
- 15 Radiation Oncologists.
- 3 Physicists.
- 17 Dosimetrists.
 - 5 in inverse planning.
 - 12 in Linacs.
- 12 Technicians for supporting in Linacs.
- 1 engineer for service support.

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Clínica IRAM.







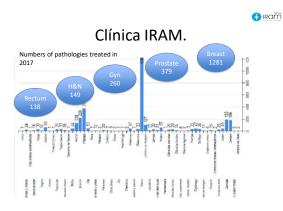
Dr. C.V. Sole, "Evolución Tecnológica Iram, Desarrollo Organizacional y Planificación Basada en Conocimiento", SOCHIRA, 2018.

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Clínica IRAM.

- SRS. (1996 2016 change system).
 - Cone system.
 - GE Saturne 41.Siemens Oncor.
 - Brain metastasis and arteriovenus malformation (AVM).
- SBRT (2016).
 - Liver.
 - Lung.
 - Oligo metastasis.
- RPM (2016 Breath hold modality).

Left breast.



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• Iram's Workflow.

- High workload by dosimetrist.
 - 7 to 10 planning per day.
 - Different level of training and knowledge.
 - Dependence of some professionals to develop more complex treatment plans.

Clínica IRAM.

- Initially.
 - ID's Contour of Structures.
 - Configuration treatment fields and optimizations process.
 Manual
 review
 - DVH evaluation.

Workflow is time consuming

Clínica IRAM. • First stage improvement.

Useful for next stage

Structures templates.

- Color's code.
- Structure's code.
- Optimization goals for different kind of treatments.
- Reduction of planning times.
 - Structures and optimization objectives conecting by code.
 Reduce plannig time compare with manual process.

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Clínica IRAM.

- Second stage improvement.
 - Inclusion of clinical protocol.
 - A series of clinical protocols were created according to the treatment site
 - Define PTV and OAR dose limits parameters .
- Faster plan evaluation.Significant decrease in planning times.
- Clinical protocol OAR evaluation in prostate fossa.

Principal	al . Prescripción .			Fracción Dissis (cGy)	Dosis total (cGy)	Dosis total real [cGy]	
1	PTV-T-7000	Como mucho	0.0	% recibe más de	220.0	7700.0	7596.3
1	PTV-T-7000	Al menos	95.0	% recibe más de	190.0	6650.0	0046.0
E	PTV-T-7000	Al menos	90.0	% recibe más de	180.0	6300.0	6720.1
P	PTV-T-7000	Punto de referenc	ia 🛛	recibe	200.0	7000.0	16/2
101	CTV-T-7000	Al menos	99.0	% recibe más de	200.0	7000.0	6668.3
-	CTV-T-7000	Al menas	99.0	% recibe más de	190.0	6650.0	6668.5
1	PTV-T-7000	Como mucho	1.0	% recibe más de	214.0	7490.0	7363.5

Varian Medical System, Inc., Eclipse v13.6 protocolo clínico

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Clínica IRAM.

• Third stage improvement.

- Workflow implementation.
 - Define responsibilities for each activity.Assigned task execution times.
 - Automation of workflow tasks.



Clínica IRAM.

- Standardized workflows by type of treatments.
 - Different amount of steps according to Treatment.
 - Between 3 and 7 days.

Agregar nuevo	
Elementos Plantillas	۷
Departamento Oncologia	•
Buscar Bus	GW .
Braquiterapia Ginecologica	2
Planificacion 3DCRT	- 7
Planificacion Electrones	6
Planificacion IMRT	10
Planificacion Paliativo	7
Planificacion SRS/SBRT	10
Planificacion URR	7
Recalculo Planes TTO	3

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Clínica IRAM.

- In summary.
 - Decrease in planning times.
 - · Standardization of treatment plans.
 - Increase in the number of schedules.
 - Maintain the quality standard by evaluating clinical protocols.

..... But these improvements do not replace the dependence of the experience of the Dosimetrist or Physicist in charge of the planning.....

• Complex inverse planning in the hands of few physicists or Dosimetrist.

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Knowledge Based planning Implementation.

- Currently there are 2 dosimetrist in training in SW and RapidArc techniques.
- Aim: achieve transversality in the management of highly complex techniques among the dosimetrist staff.
- ¿How to achieve a fast and secure ability to develop high complexity treatment plans?

- Chronology
 - Early January 2016 we had the help to develop and implement rapid plan by creating our own models.
 - Hypofractionated prostate.
 33 patients.
 - In the middle of October 2016 an on-site training was carried out to show us in a practical way.
 Deborn Neton.
 - In March 2017, Kevin Moore help us to valiadate our new models and try
 USCD models with our patients.

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Knowledge Based planning Implementation.

RapidPlan model	Number of re-plan validations	Notes
IRAM prostate	7	Used existing IRAM model, one round of filtering, new optimization objectives
IRAM APBI Left Breast	7	5-field static field sliding window
IRAM Lung (Stage III)	5	
UCSD Prostate Bed	7	
UCSD Head-and-Neck	6	Added POST NECK as avoidance to model, per IRAM institutional practices
UCSD Prostate + Pelvic Nodes	5	Unpublished UCSD model
UCSD Liver SBRT	3	Unpublished UCSD model
UCSD Lung SBRT	3	Both UCSD Right and Left Lung SBRT models loaded onto IRAM database
	Total: 48	

Validation IRAM models and UCSD models with IRAM's patients; Dr. Kevin

Knowledge Based planning Implementation.

Consideration of hypofractionated prostate model:

- Specific model, requires few patients for optimal performance.
- There is little variability between the structures.
- Comparison of commonly made manual plans versus RapidPlan plans.
- Plans calculated with the RapidPlan model were all clinically accepted.
- -

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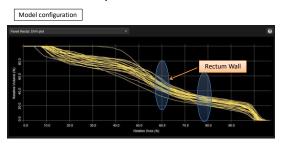
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Model configuration

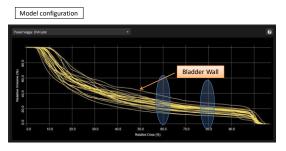


Knowledge Based planning Implementation.



Varian Medical System, Inc., Eclipse v13.6, Model configuration

Knowledge Based planning Implementation.



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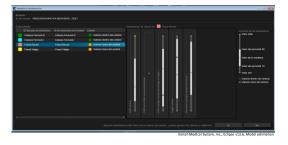
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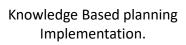


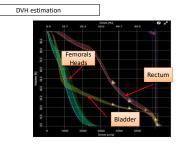
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Knowledge Based planning Implementation.

Estimation statistics







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Varian Medical System, Inc., Eclipse v13.6, Model estimation

- Other models implementation in Clinica IRAM (since January 2017).
 - Prostate model 76Gy.
 - Prostate fossa70Gy.
 - Pelvis + lymph nodes.
 - Acelerated Partial breast irradiation.
 - Head and neck (data base).
 - GBM (data base).
 - Lung (validation process).
 - Rectum.

Knowledge Based planning Implementation.

- UCSD Models used in Clinica IRAM.
 - Prostate and prostate fossa.
 - Pelvis + lymph nodes.
 - Head and neck.
 - Gynecological.
 - SRS.
 - SBRT lung.
 - SBRT Liver.
- Test and compare UCSD models with local data.

Knowledge Based planning

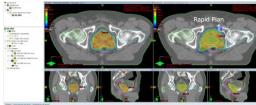
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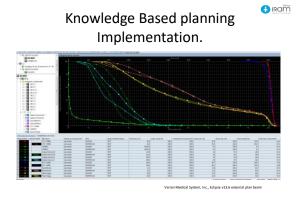
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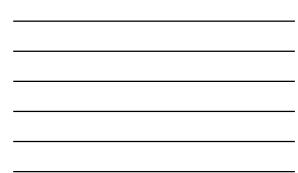
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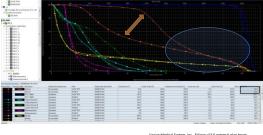
Implementation.

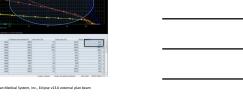
IRAM Prostate model Hypofractionated









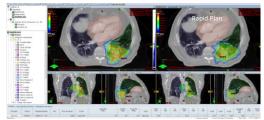


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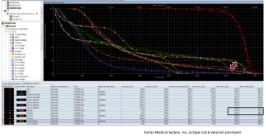
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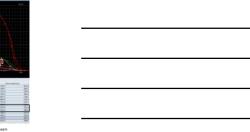
Knowledge Based planning Implementation.

IRAM Lung model Stage III



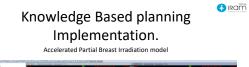
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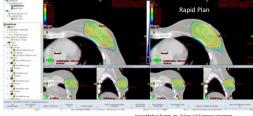


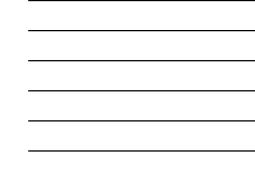


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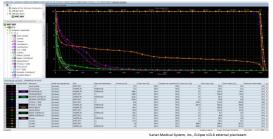
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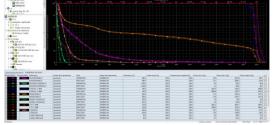
Knowledge Based planning Implementation.





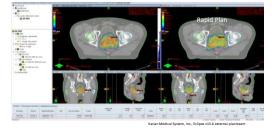
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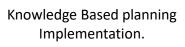
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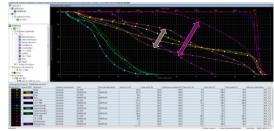


Knowledge Based planning Implementation.

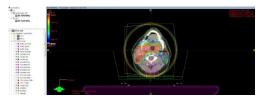
UCSD Prostate model, modified optimization parameters







USSD Head and Neck model.



Varian Medical System, Inc., Eclipse v13.6 external plan beam

Knowledge Based planning Implementation. 🔥 iram

> Knowledge Based planning Implementation. UCSD SBRT Lung model.

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Knowledge Based planning Implementation.

Creating a model.

- At least 20 patients to create a models knowledge-based planning.
 More complex models require more patients.
- Validate the model with plans already calculated.
- Decrease planning time.
- Improve consistency.
- Expand current IMRT and VMAT opportunities with minimal impact on current staffing levels.
- Preliminary results.

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Minimize training time of new staff.

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Preliminary results

Prostate Hypo	Manual plan	Manual plan		RapidPlan ™ .	
Clinical evaluation	Optimal	Optimal		Optimal	
User	Advance		Minimal training		
Time planning	60 min.	60 min.		30 min.	
Key features	Variability in distribution	Variability in dose distribution		Consistency in dose distribution	
2018	Нуро	Prostate and Prostate Foss		rostate + Limph	
№ planning	41	37		119 (15)	
Nº optimization	1	1		1 or (2)	
Time (min)±	30	30		45	

Preliminary results

Head and Neck	Manual plan		RapidPlan ™ .	
Clinical evaluation	acceptable		Optimal	
User	Advance		Minimal training	
Time planning	4 hrs.		30 - 45 min.	
Key features	High heten diferent dose l	ogeneity in evels.	Consistency in dose distribution	
2018		Head and Neck		
Nº planning		55		
Nº optimization	ı	1 (2)		
Time (min)±		45 (70)		

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Preliminary results

АРВІ	Método Manu	al		RapidPlan™.	
Clinical evaluation	Optimal			Optimal	
User	Advance			Minimal training	
Time planning	60 min.			25 min.	
Key features	dependence geometry	on	beam	fewer optimizations	
0010				1001	
2018		АРВІ			
Nº planning		86			
Nº optimization			1		
Time (min)±		25			

Preliminary results

2018	Rectum	Gyn
№ planning	108 (15)	123 (10)
Nº optimization	1 (2)	1 (2)
Time (min)±	35	40

Conclusions.

- General considerations
 - Change in the technological platform at Clínica IRAM allowed the development of high precision radiotherapy.
 - Automated Clinical Protocols -RapidPlan- improve security and decrease planning time.
 - · Accelerate the learning curve of dosimetrist.
 - RapidPlan can allow clinics to reduce variability in treatment planning to achieve greater consistency, efficiency and quality in patient care.



Thanks for your attention

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