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.







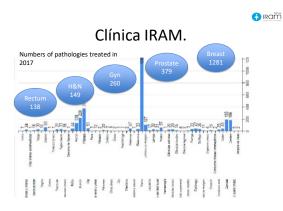
Dr. C.V. Sole, "Evolución Tecnológica Iram, Desarrollo Organizacional y Planificación Basada en Conocimiento", SOCHIRA, 2018.

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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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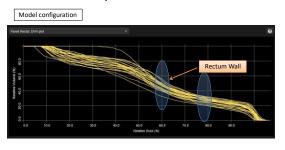
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Model configuration

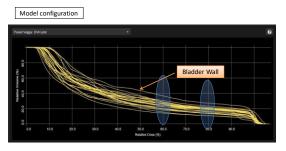


Knowledge Based planning Implementation.



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

Knowledge Based planning Implementation.



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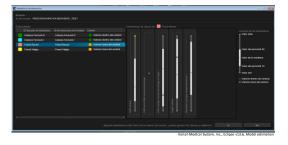
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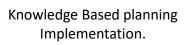


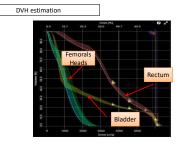
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Knowledge Based planning Implementation.

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

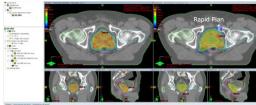
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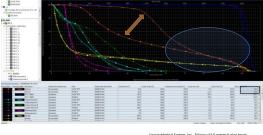
Implementation.

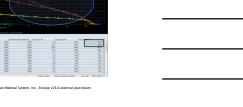
IRAM Prostate model Hypofractionated









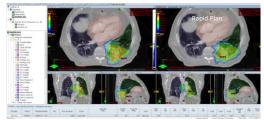


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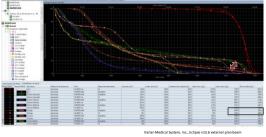
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Knowledge Based planning Implementation.

IRAM Lung model Stage III



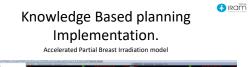
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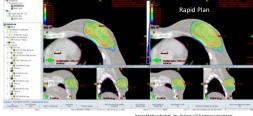


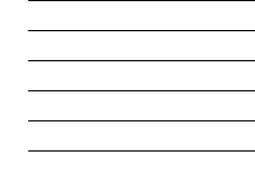


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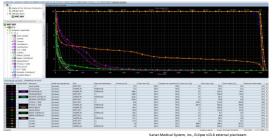
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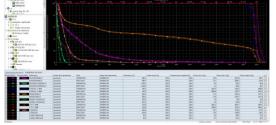
Knowledge Based planning Implementation.





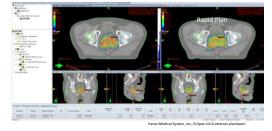
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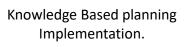
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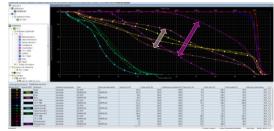


Knowledge Based planning Implementation.

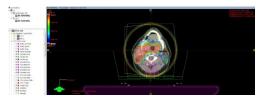
UCSD Prostate model, modified optimization parameters







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.

•

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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