

The Game Changer in Pediatric Care (& in adults?): Proton therapy

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ASOPROCÁNCER
Asociación Pro Congreso de Cancerología

Outline of the presentation

The context:

Proton Therapy. How does it work ?

Proton Therapy. Examples:

Who could benefit from Proton Therapy ?

Proton Therapy in Spain and in Catalonia:

Proton Therapy in Colombia:

Where is Proton Therapy today ?



Cost of cancer treatments per year in USA cancer center

Chemo

\$ 85 B*

Drugs
Kills cancer cells
Long and harsh
Lose hair and weight
Lots of new developments
Immunotherapy

Surgery

\$ 38 B*

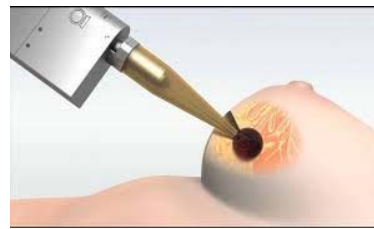
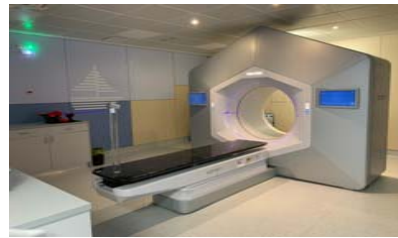
Surgery
Removes the tumor
Short and radical
Invasive and scary
Fear of anesthesia
Robot surgery

**Radio
Therapy**

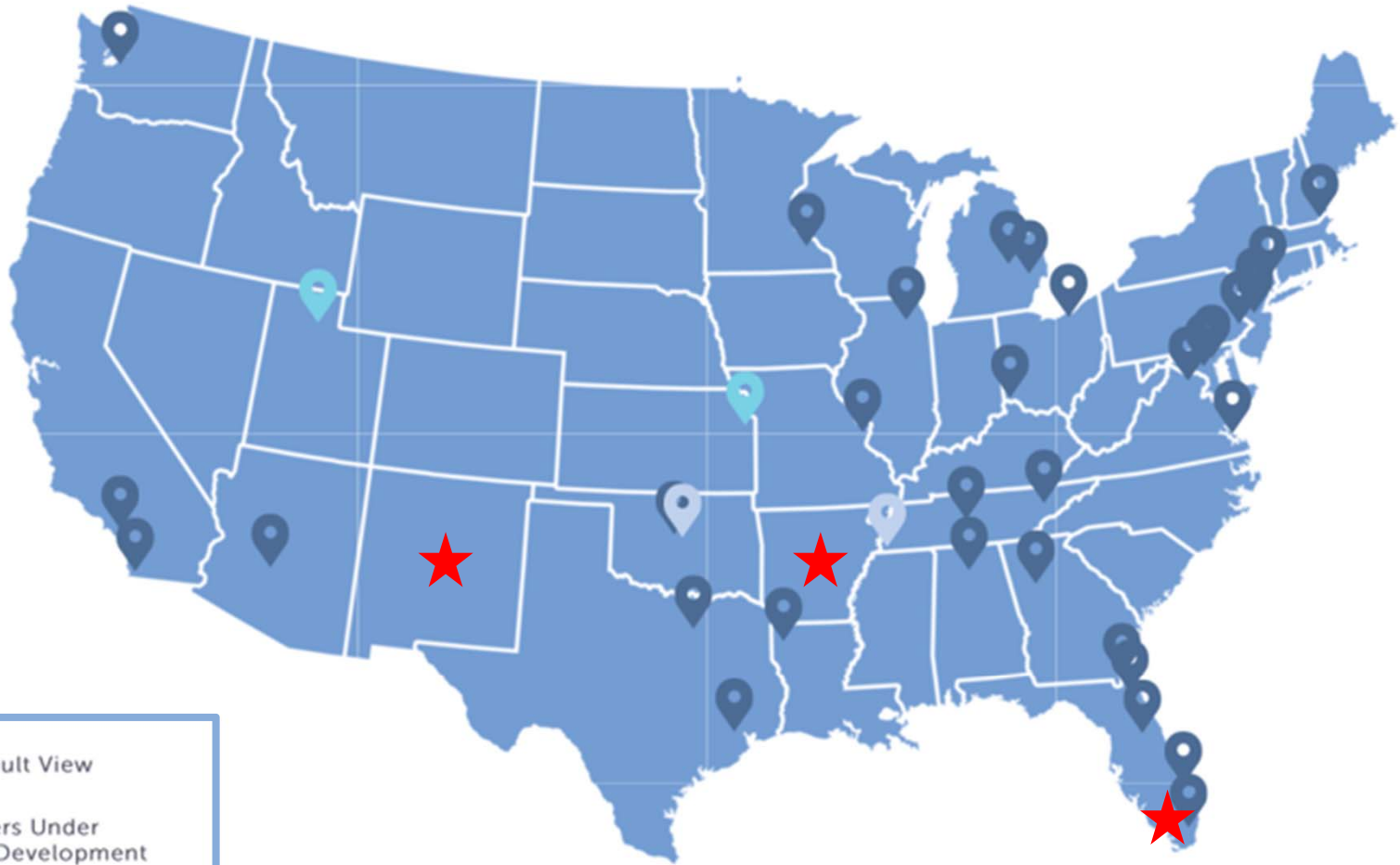
\$ 10 B*

Radiation
Destroys the tumor
Non disruptive
Non-Invasive
Lots of new developments
Proton Therapy

We have now more and more Technology.....



The Growing U.S. Market



Return to Default View

Member Centers Under Construction/Development

Member Operating Centers

Non-Member Operating Centers

★ IBA newcomers

Source: <https://www.proton-therapy.org/map/>

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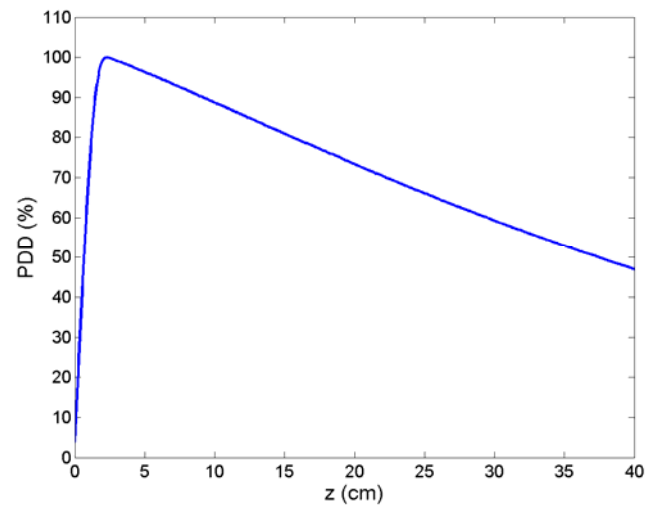
Proton Therapy in Colombia:

Where is Proton Therapy today ?

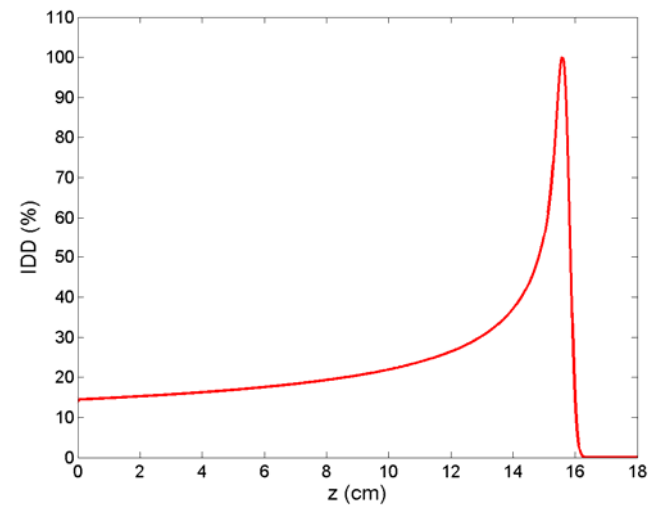


The Bragg Peak

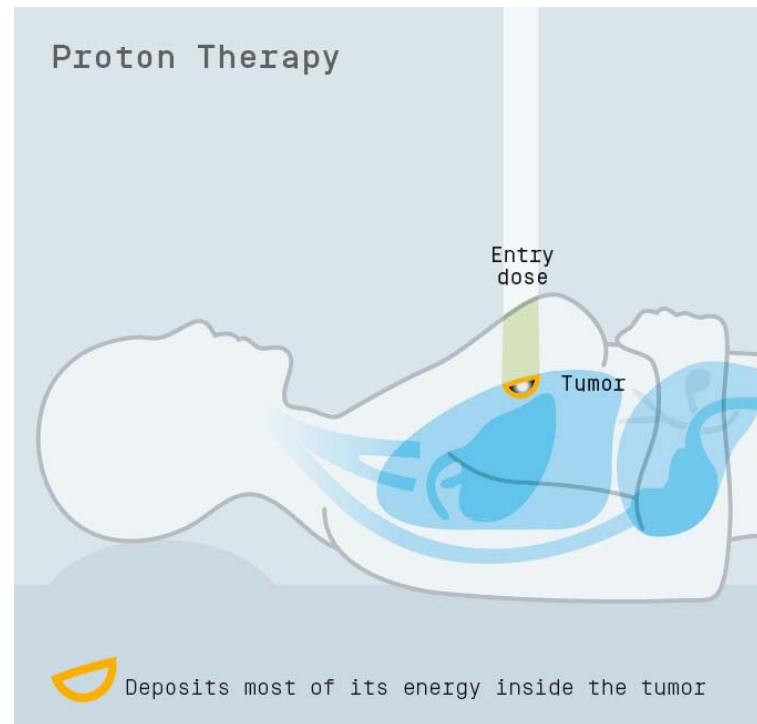
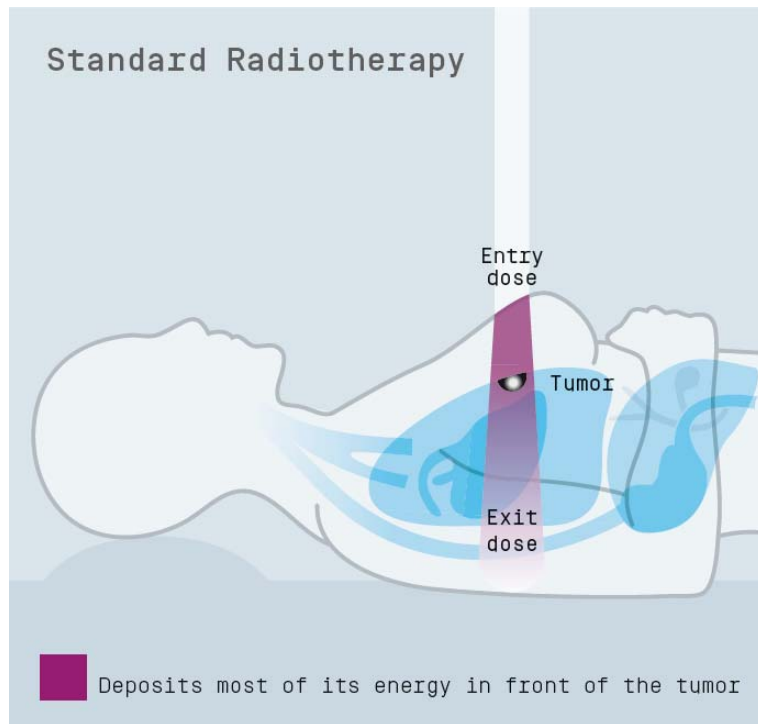
Photons



Protons (Bragg Peak)



Standard RT vs Proton Therapy



Potential benefits of Proton Therapy

- 1. Improvement of local control.**
- 2. Reduce of side effects.**
- 3. Lower risk of secondary cancer.**

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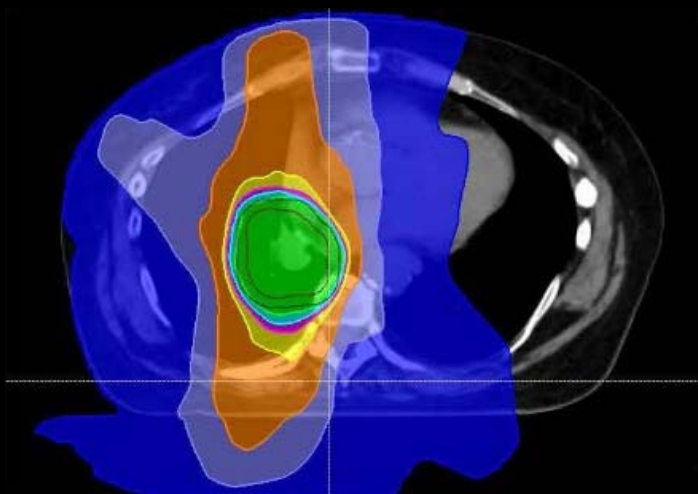
Proton Therapy in Spain and in Catalonia:

Proton Therapy in Colombia:

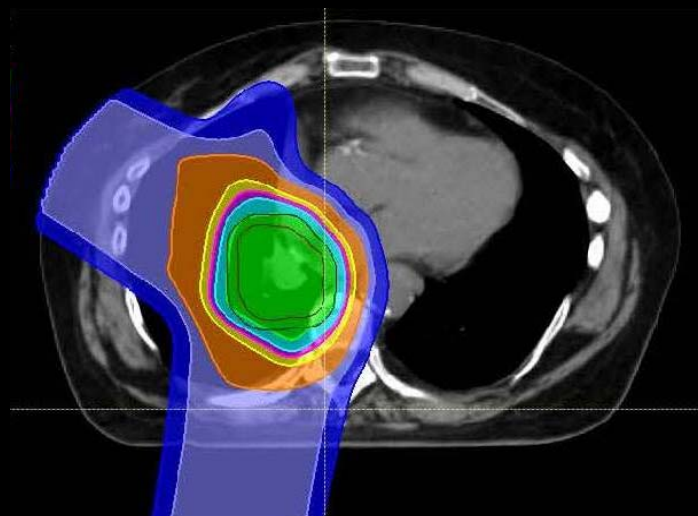
Where is Proton Therapy today ?



Proton Therapy: Lung Cancer



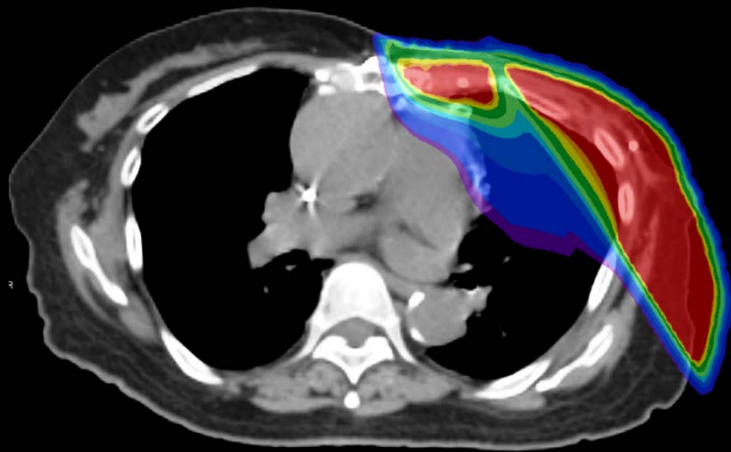
Photons



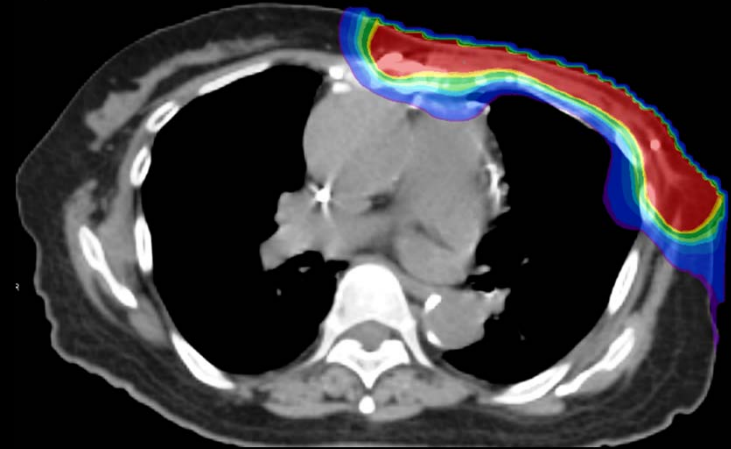
Protons

Courtesy of Seattle Cancer Care Alliance Proton Therapy Center

Proton Therapy: Left Breast Cancer



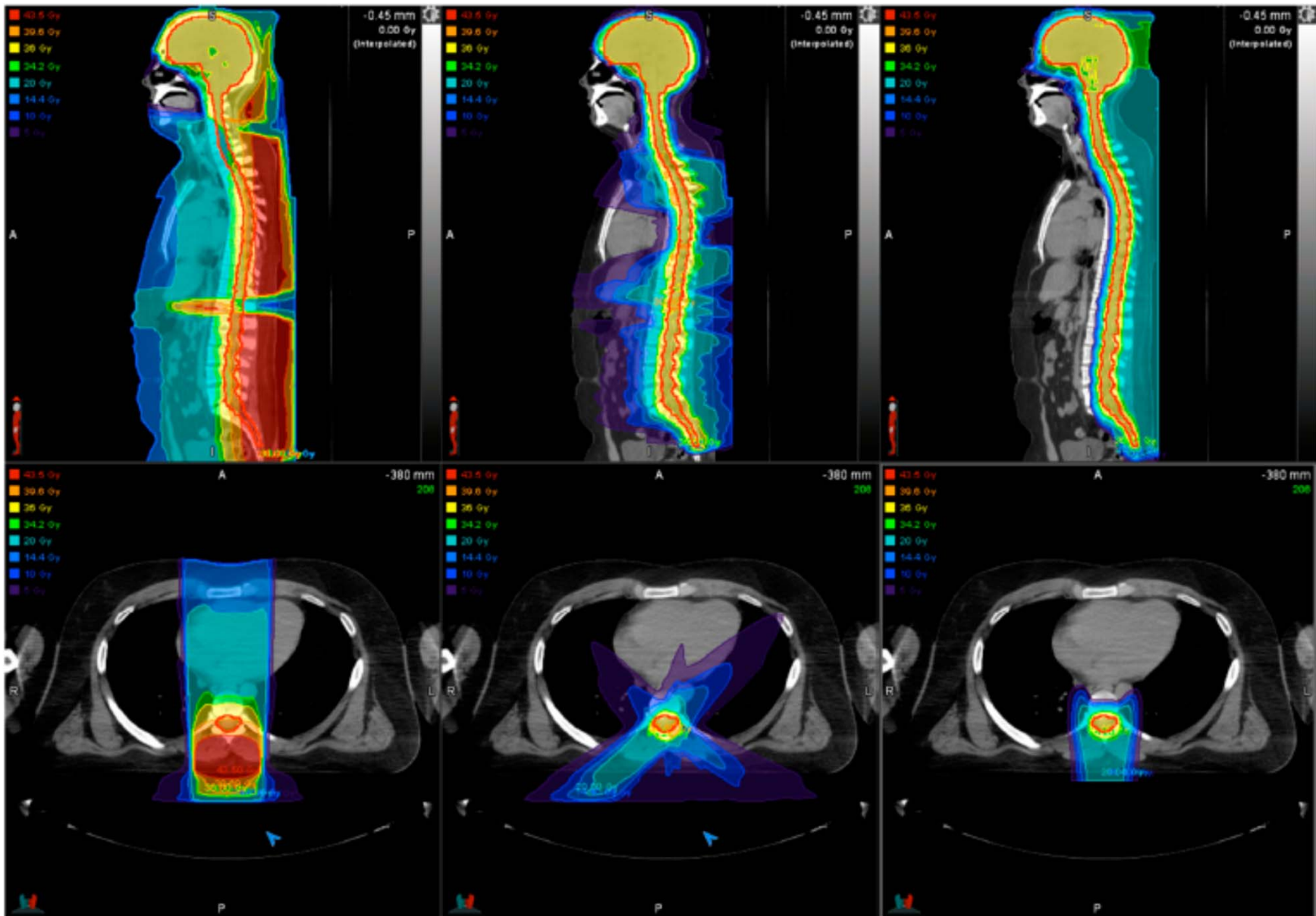
Photons



Protons

Courtesy of Seattle Cancer Care Alliance Proton Therapy Center

Proton Therapy: Meduloblastoma

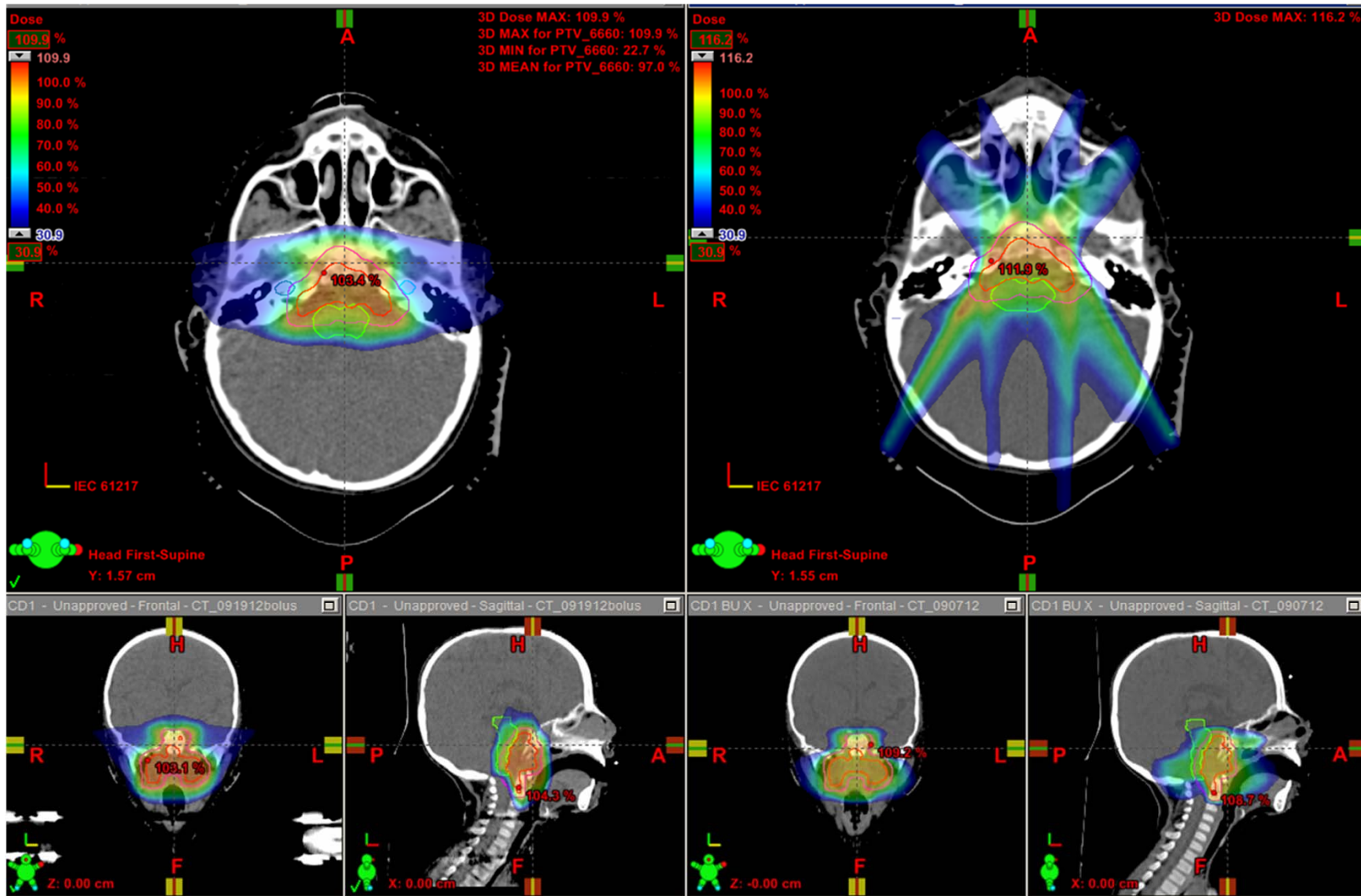


3DCRT

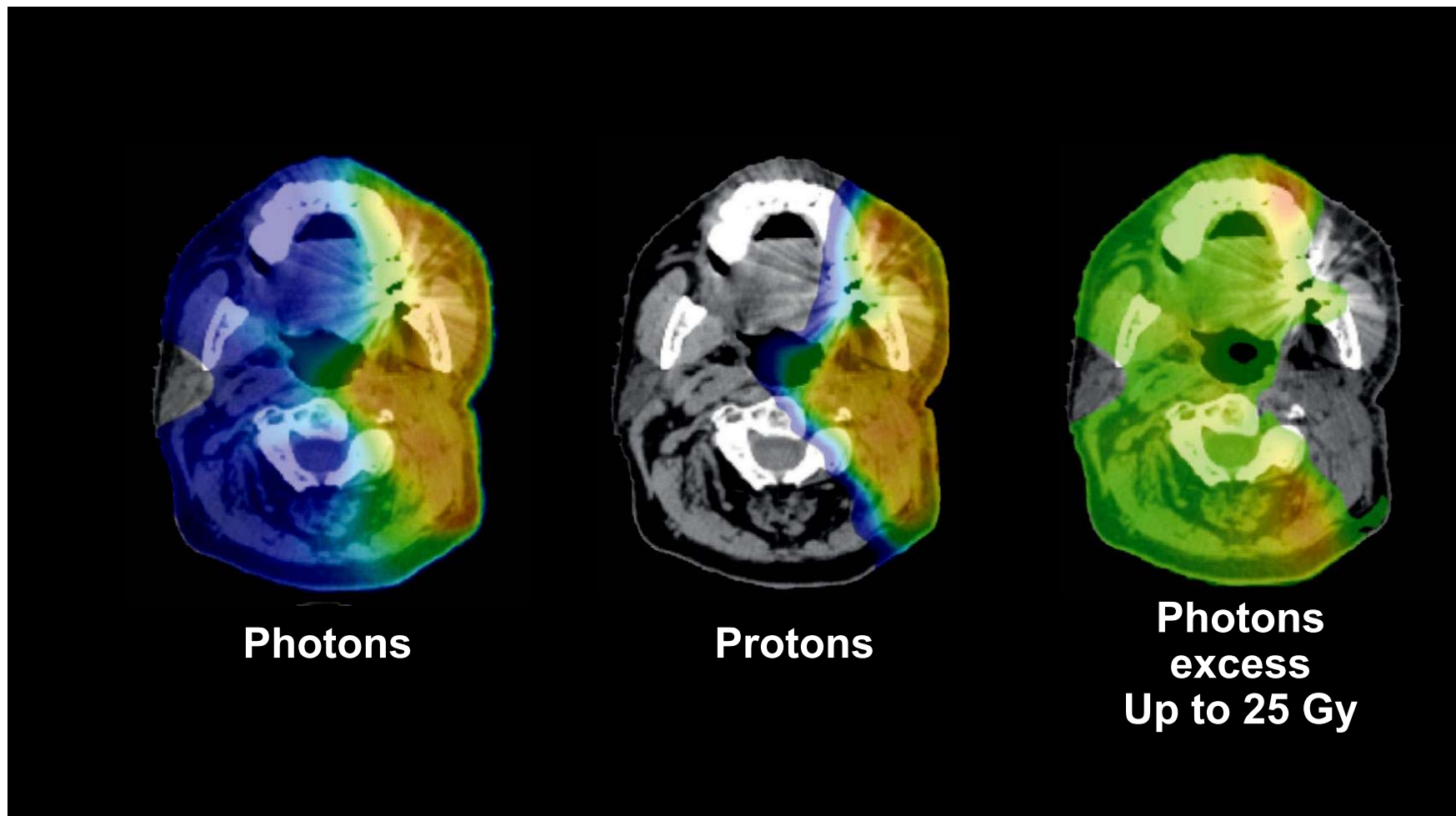
IMRT

PBRT

Proton Therapy: H&N Cancer



How does that reflect to the patient?

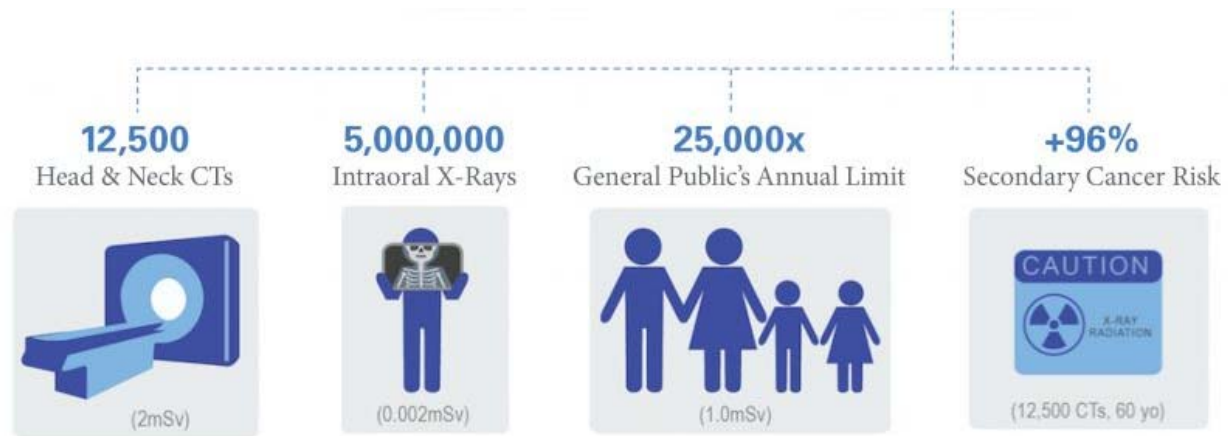


Courtesy of Nancy Lee,
MSKCC

What unnecessary radiation dose of 25 Gy means for the patient?

What is a Gray (Gy)?

It is a measure of absorbed radiation dose.



Courtesy of Steven Frank, MD Anderson Cancer Center

Dosimetric advantage of protons translated into lower rates of acute treatment-related toxicities



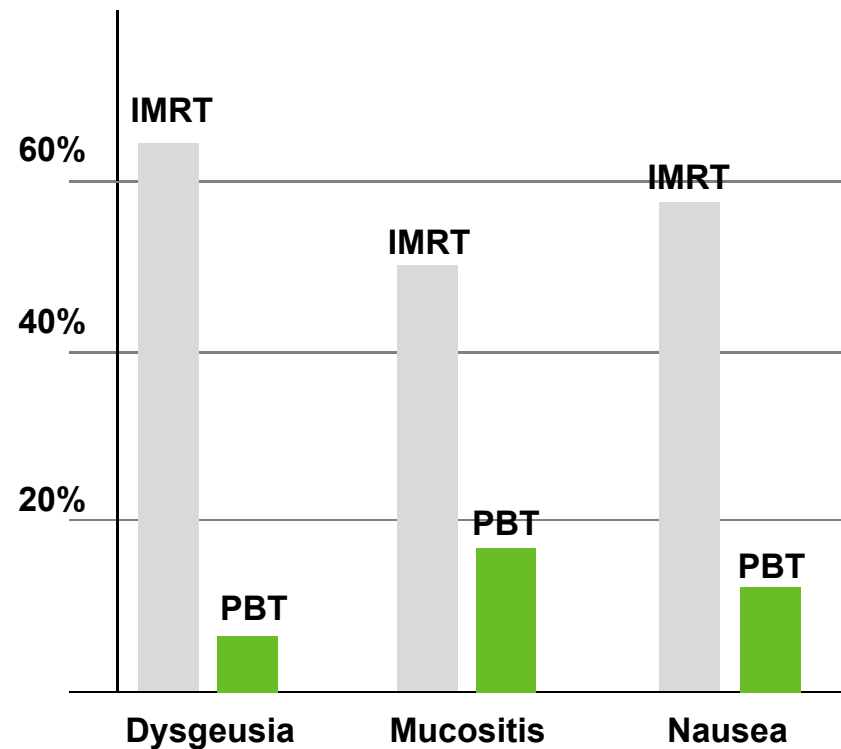
Particle therapy in head and neck cancer

Proton beam radiation therapy results in significantly reduced toxicity compared with intensity-modulated radiation therapy for head and neck tumors that require ipsilateral radiation [☆]



Paul B. Romesser^a, Oren Cahlon^{a,b}, Eli Scher^{a,c}, Ying Zhou^d, Sean L. Berry^a, Alisa Rybkin^a, Kevin M. Sine^b, Shikui Tang^b, Eric J. Sherman^e, Richard Wong^f, Nancy Y. Lee^{a,*}

^aDepartment of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York; ^bProCure Proton Therapy Center, Somerset; ^cRowan University School of Osteopathic Medicine, Stratford; ^dDepartment of Medical Physics, Memorial Sloan Kettering Cancer Center, New York; ^eDepartment of Medicine, Memorial Sloan Kettering Cancer Center, New York; and ^fDepartment of Surgery, Memorial Sloan Kettering Cancer Center, New York, United States



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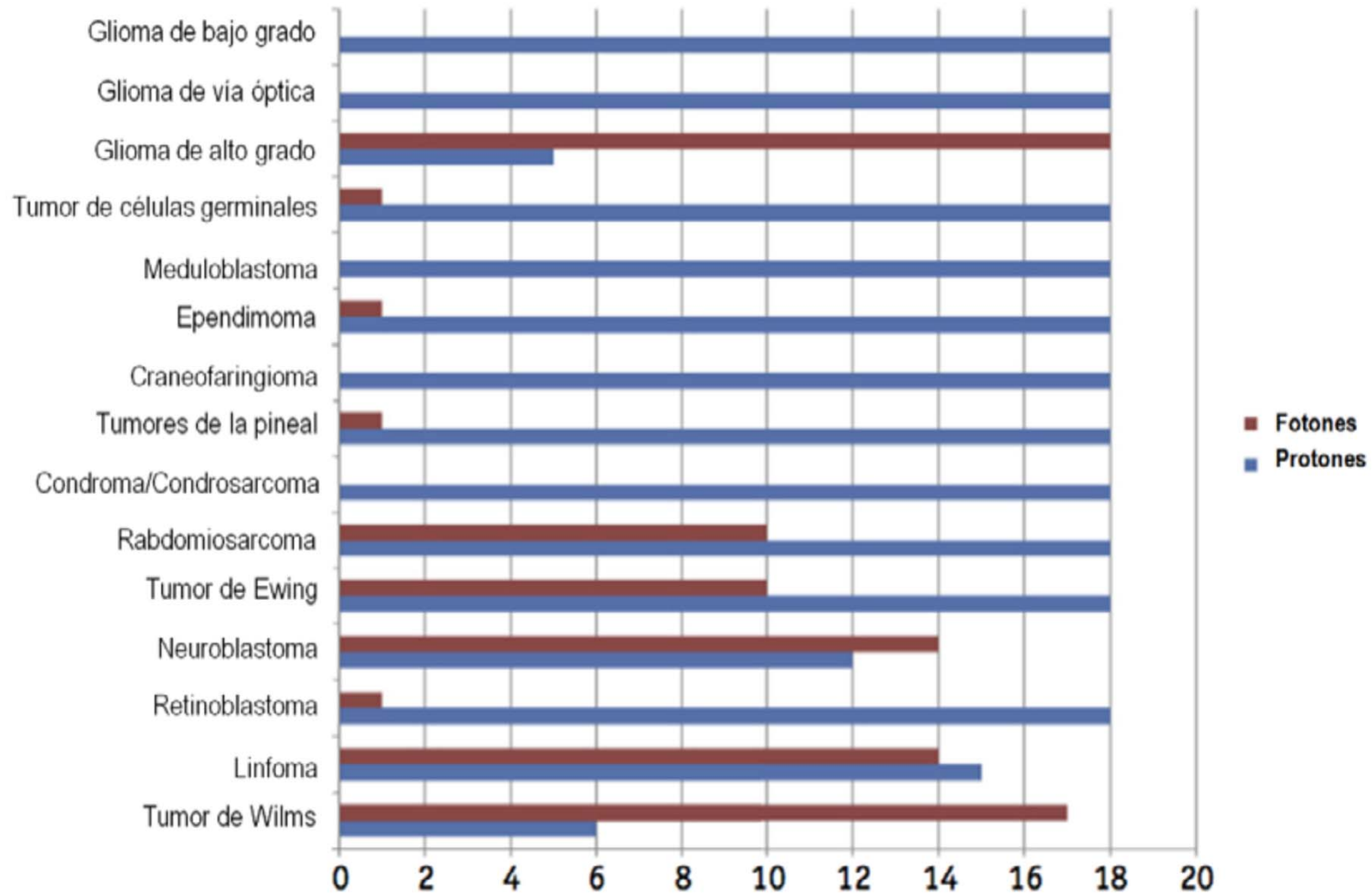
Where is Proton Therapy today ?





Courtesy of Andres Morales, Hospital Sant Joan de Deu. Barcelona

**Pediatrics' Patients: Which patients could benefit from protons?
 Consensus Report from the Stockholm Pediatric Proton Therapy Conference:
 Results of experts opinion for protons indications in pediatric patients.**

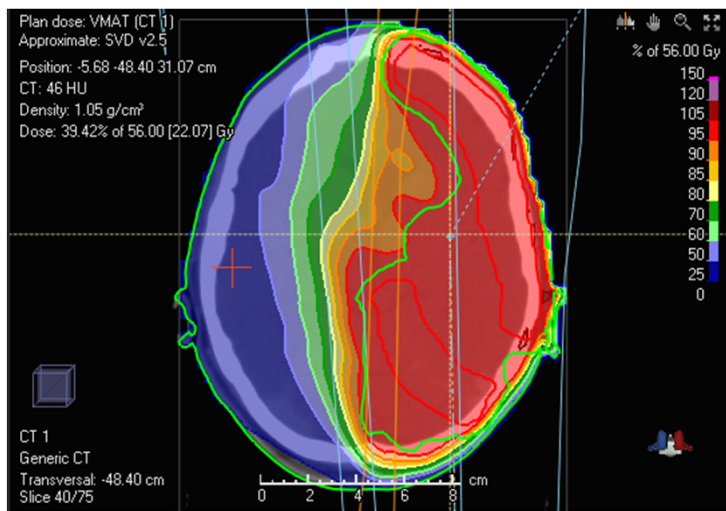


Consensus Report from the Stockholm Pediatric Proton Therapy Conference
 Int J Radiation Oncol Biol Phys, 96, 387-392. 2016.

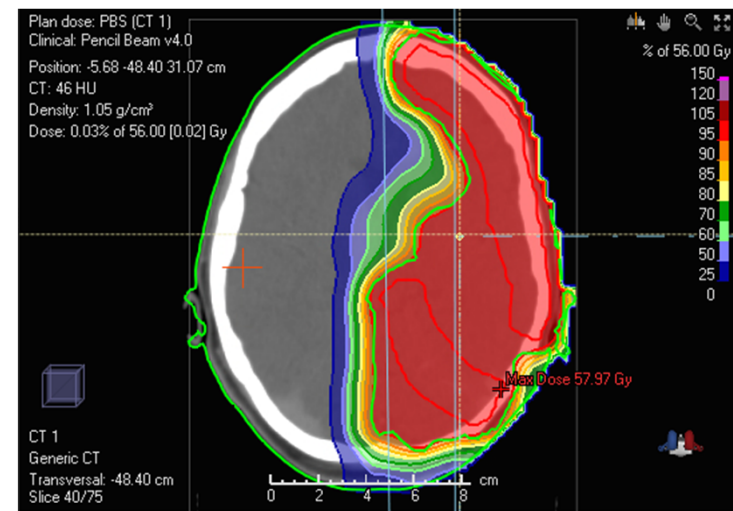
Pediatrics Patients: Which patients could benefit from protons?

Photons vs Protons in Low grade Glioma:

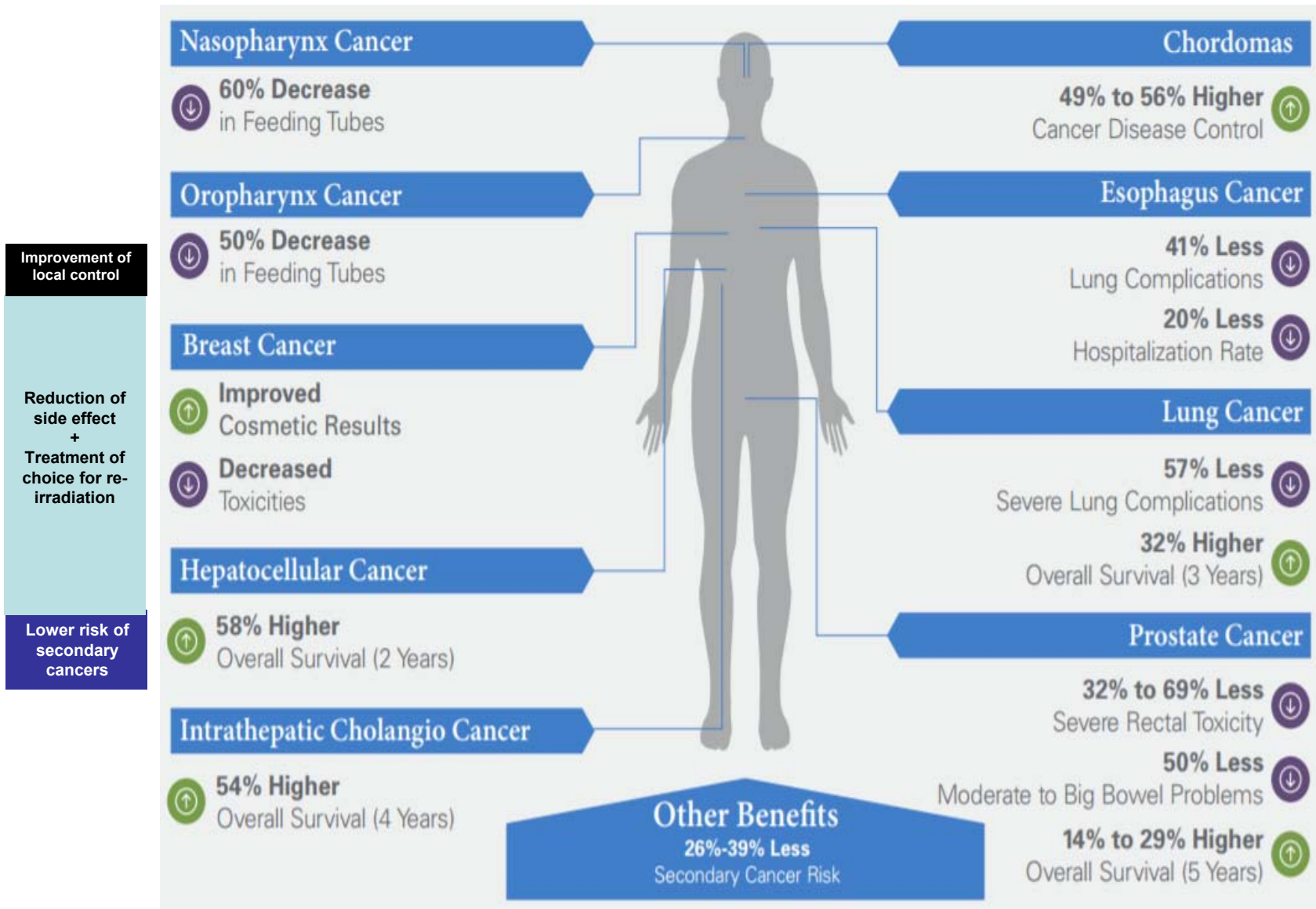
Conventional Radiotherapy



Proton Therapy (PT)



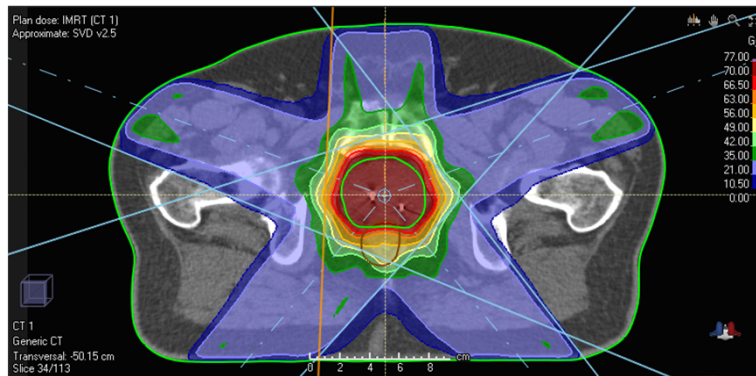
Adult's Patients: Which patients could benefit from protons?



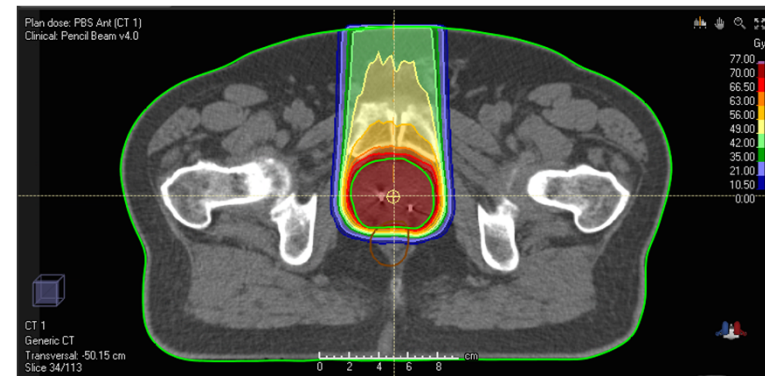
Courtesy of Steven Frank, MD Anderson Cancer Center

Adult's Patients: Which patients could benefit from protons? Photons vs Protons in Prostate cancer:

Conventional Radiotherapy



Proton therapy (PT)



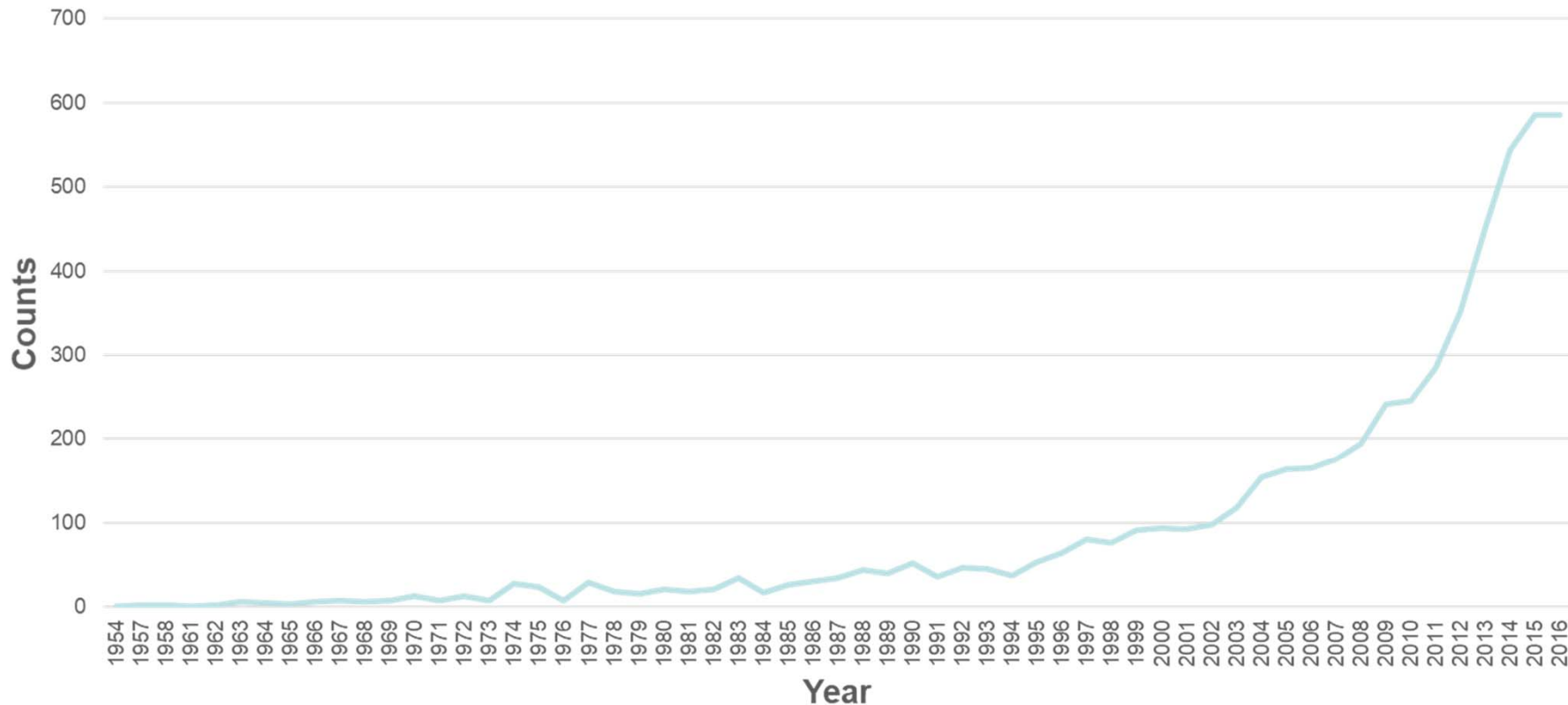
Growing interest in proton therapy: Pubmed Search



Proton Therapy or Proton Radiotherapy or Proton Beam Therapy

From technical and standard indications publications (Ocular, Pediatrics, Base of Skull Chondrosarcoma and Chordoma) to new indications (Lung, Breast, Head and Neck) expanding the use of PT

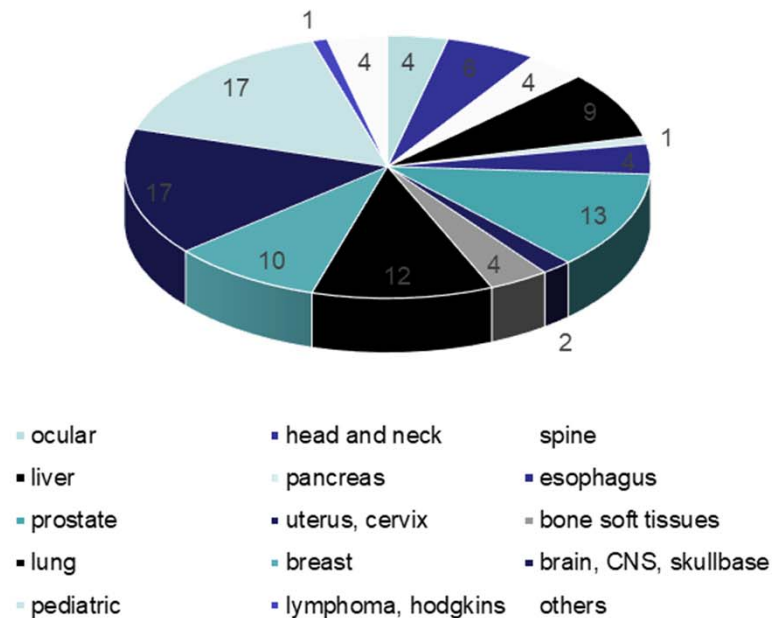
Publication Numbers



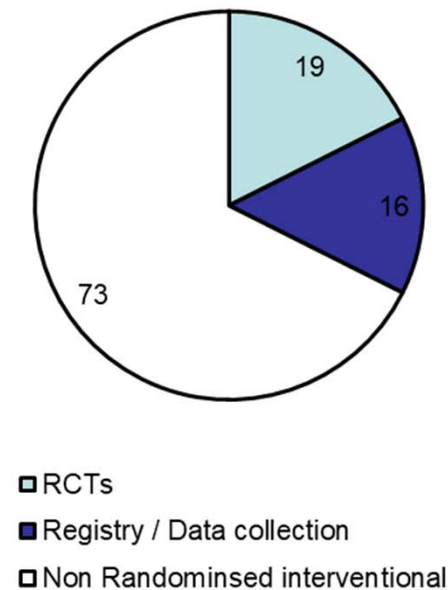
Growing interest in proton therapy: Clinical Trials at 12- 2016

- 108 prospective clinical trials on ClinicalTrials.gov with status of open and recruiting.
- 19 randomized controlled trials: 16 registry and data collection trials.
- 39 active but not recruiting trials

108 Trials Open and Recruiting



Trial by Study Type



QoL



Courtesy of Andres Morales, Hospital Sant Joan de Deu. Barcelona

At the heart of it all



Protect, Enhance and Save Lives

Viggo Mommaerts

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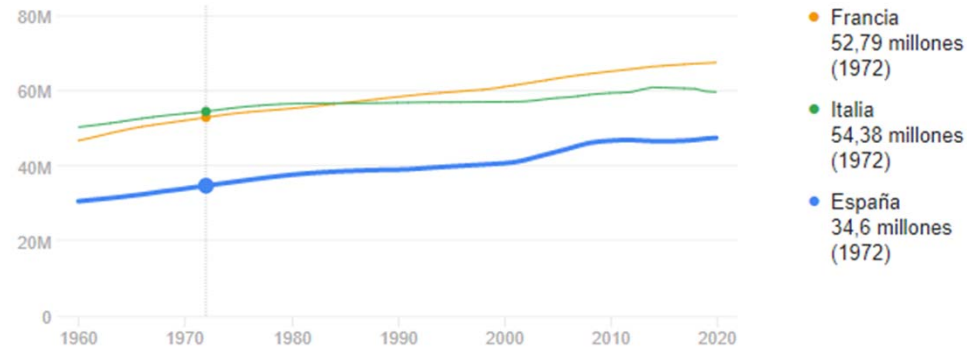
Proton Therapy in Colombia:

Where is Proton Therapy today ?



Current population of Spain

47,35 millones (2020)



List of cities in Spain by population



List	Population	Metropolitan population
Madrid	3,14 million	6,16 million
Barcelona	1,6 million	5,18 million
Valencia	0,79 million	1,65 million
Sevilla	0,66 million	0,68 million

Recomendaciones de la Sociedad Española de Oncología Radioterápica (SEOR) para la protonterapia en España. Indicaciones pediátricas:

Indicación	Observaciones
Tumores cerebrales	<ul style="list-style-type: none"> • Meduloblastoma • Ependimoma • Tumores germinales y pinealomas • Astrocitoma difuso • Gliomas de bajo grado • Oligodendroglioma anaplásico • Tumor Teratoide/Rabdoide Atípico • Craneofaringiomas • Tumores del plexo coroideo <p>No indicado en:</p> <ul style="list-style-type: none"> • Glioma Difuso de Protuberancia (DIPG) • Gliomas de alto grado: <ul style="list-style-type: none"> ○ Glioblastomas ○ Astrocitomas anaplásicos
Tumores oculares	<ul style="list-style-type: none"> • Retinoblastoma • Glioma del nervio óptico
Sarcomas de partes blandas	<ul style="list-style-type: none"> • Parameningeos • Orbitarios • De cabeza y cuello • Torácicos, si próximos a corazón o columna • Abdominales, si próximos a hígado o riñón • Pélvicos
Tumor de Ewing	<ul style="list-style-type: none"> • Si próximo a órganos de riesgo (médula, corazón)
Neuroblastoma	

**Recomendaciones de la SEOR para la protonterapia en España.
Indicaciones para adultos:**

Indicación	Observaciones
Melanoma intraocular/uveal	Cuando no esté indicada la braquiterapia
Cordoma y condrosarcoma	
Sarcomas primarios paraespinales	Cuando la dosis de radioterapia supere la tolerancia medular

Donación de la Fundación Amancio Ortega para la compra de 10 unidades de Protones para España por 240 millones de Euros.



17 comunidades autonomas en España	Numero de unidades de protones
Madrid	2 (ya hay 2 privadas)
Andalucia	2
Cataluña	2
Valencia	1
Galicia	1
Canarias	1
Pais Vasco	1
Cantabria (Santander)	1 (Iniciativa privada para ámbito público)

La protonterapia en Cataluña (8 millones de habitants)
Demanda previsible en Catalunya

Tumores infantiles neuro-oncológicos	75 casos
Tumores neuro-oncológicos del adulto	45 casos
Melanoma ocular no candidato a braquiterapia	5 casos
Ensayos clínicos sobretudo em adultos, Re-irradiaciones, pacientes potencialmente sensibles a la RT (síndromes genéticos)	80 casos
TOTAL	205 Casos

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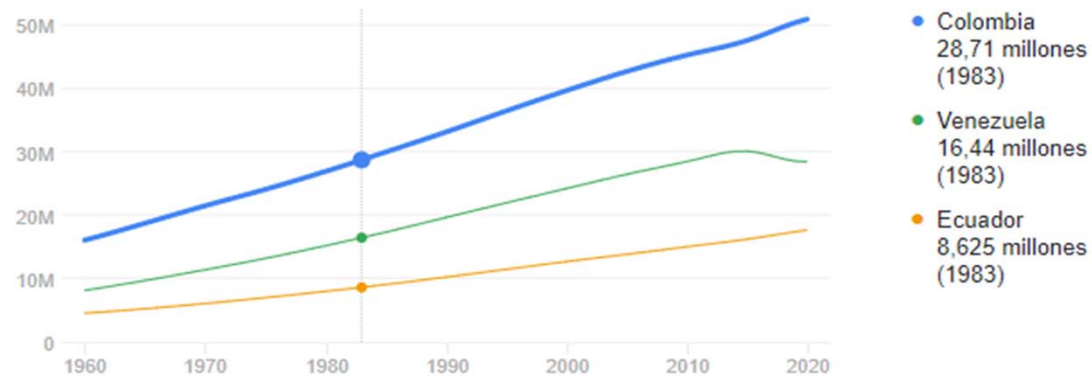
Proton Therapy in Colombia:

Where is Proton Therapy today ?



Current population of Colombia

50,88 millones (2020)



List of cities in Colombia by population



N.º	Municipio	Población Total
1	Bogotá	7 901 653
2	Medellín	2 612 958
3	Cali	2 280 907
4	Barranquilla	1 312 473

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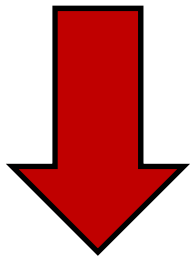
Where is Proton Therapy today ?



Eligible population for proton Therapy

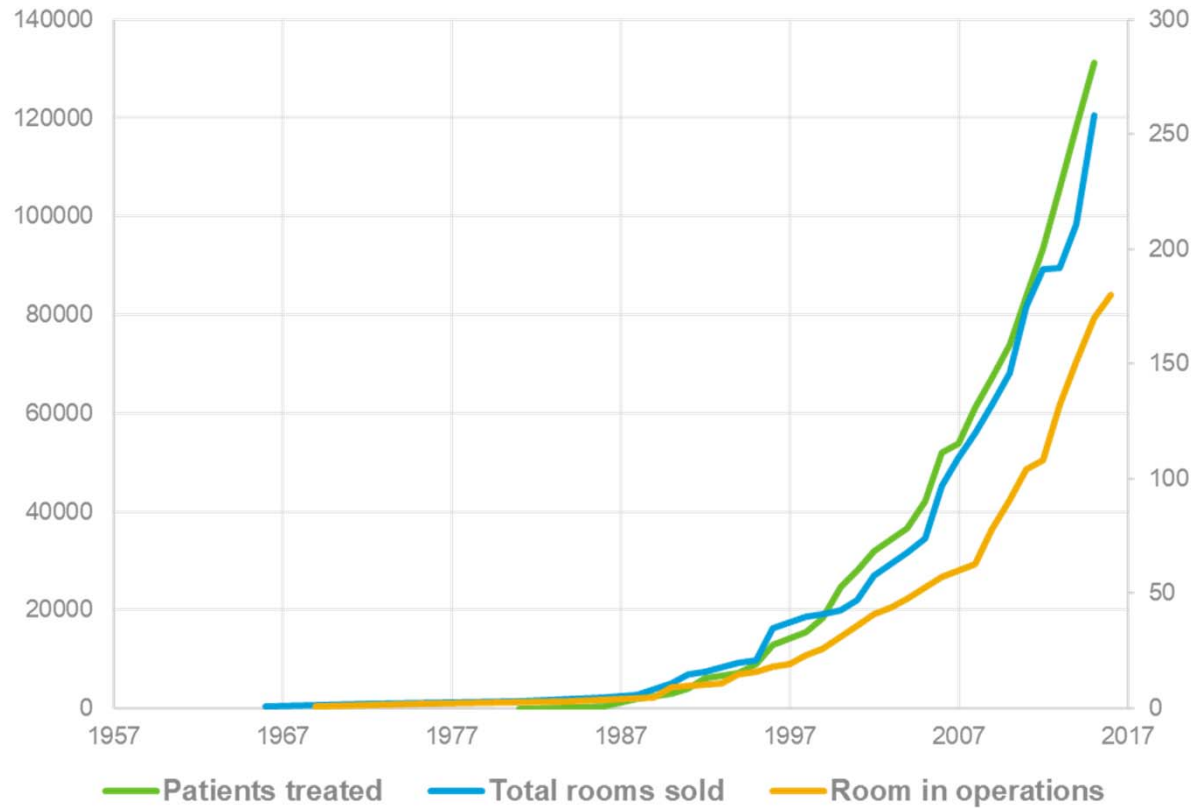
1%

Patients of RT
treated with PT
today



20%

Potential RT patients
treated with PT
tomorrow



Recomendaciones de la SEOR para la protonterapia en España: Conclusiones

El tratamiento con protones presenta ventajas dosimétricas y radiobiológicas en relación al tratamiento estándar con fotones.

Su uso en determinados tumores ha sido consensuado por diferentes sociedades médicas y guías de práctica clínica.

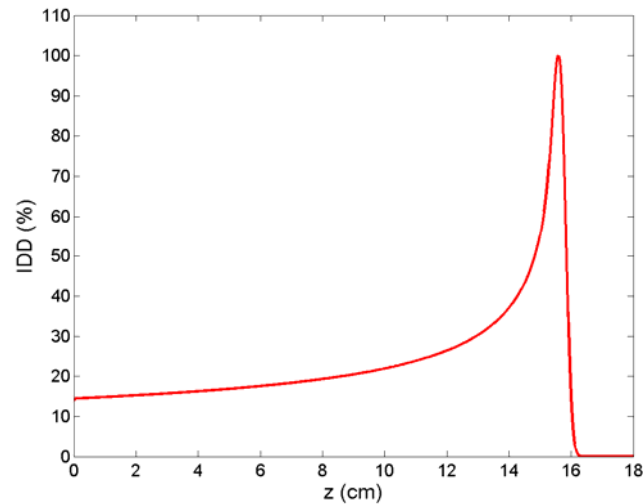
La población pediátrica, los largos supervivientes y los tumores con histologías resistentes al tratamiento con fotones constituyen los principales subgrupos beneficiarios de este tratamiento en el momento actual.

Se espera que el inicio de esta actividad en nuestro país constituya un punto de partida que facilite el tratamiento al menos en las indicaciones consideradas estándar, para ir incrementándose paulatinamente en los años siguientes.

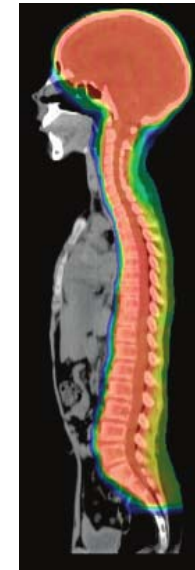
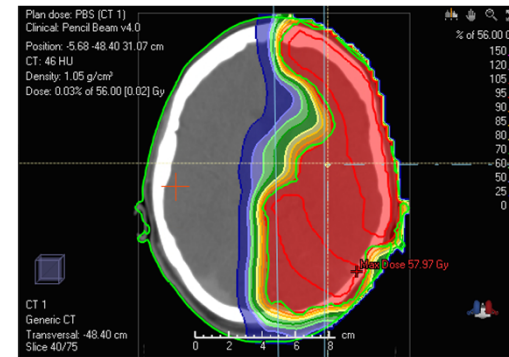
En resumen con los tratamientos ya considerados “Clásicos” en protonterapia (pediatria, Base de cráneo, reirradiaciones), se estima en 2-4 años el tiempo necesario para llegar a una “actividad de crucero” con estimaciones máximas de 250 pacientes por año y por sala.

Proton Therapy: Take home message

Ideal depth-dose profile



Minimal integral dose



Bibliografía:

- **Recomendaciones de la SEOR para la protonteràpia en España. 2019.**
- **Recomendaciones de la Comisión mixta de SEOR y SEFM en relación con las instalaciones de Unidades de Protonterapia en España. 7-2022.**

Thank You



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