

Medical Accelerators

John Allen – Chief Engineer



Medical accelerators

Most of the linear accelerators in the world are used for medical. Approximately 17000

Elekta has around 5000 systems treating patients around the world.

Elekta is a public company (listed in Sweden) with a market cap of around \$2.5B

One of a small number of medical accelerator providers globally



Types of Radiotherapy v types of accelerators

- **Megavoltage X-rays**
 - By far the most common type of radiotherapy delivered
 - Megavoltage spares the skin
 - Can treat deep tumours with high conformality
- **Megavoltage electrons**
 - Typically used for tumours at of close to the skin.
- **Protons and light ions**
 - Using the Bragg peak, protons have advantages for delivery
 - As with megavoltage X-rays, modern techniques allow highly conformal plans. However, the Bragg peak results in a lower background dose, hence it is often for paediatric cases.
 - Considerably more expensive than Megavoltage X-ray systems
- **Brachytherapy**
 - This term covers radiotherapy delivered inside the body.
 - This has advantages where the tumour is accessible through body orifices or simple surgery.

Uses copper linear accelerators. Typically, S-band but some C-band and X band designs

Mostly delivered by the same accelerators used for X-rays

Mostly delivered by cyclotrons of various designs, sometimes combined with linacs.

Typically, machines called after loaders move radioactive sources inside the body, using applicators carefully position by physicians

How Radiotherapy treats cancer

Ionizing radiation penetrates the tumour without trauma.

Radiation is toxic to both cancer cells and healthy tissue, but it is usually more toxic to cancer cells (therapeutic ratio)

Modern radiotherapy localises the radiation to the physical shape of the tumour

The X-rays kill or damage cancer cells by damaging DNA, **stopping them from growing or slowing growth.**



The above work together to provide effective cancer treatment

Radiotherapy

Linear accelerators at scale

- We know laboratories like CERN build big accelerators but treating cancer is also a problem of scale

Building medical accelerators for the world is a job for industry not laboratories



More than half of ALL

cancer patients will receive a type of radiation therapy as part of their treatment.¹



Thompson, M.K., Poortmans, P., Chalmers, A.J. et al. Practice-changing radiation therapy trials for the treatment of cancer: where are we 150 years after the birth of Marie Curie? Br J Cancer 119, 389–407 (2018).

<https://doi.org/10.1038/s41416-018-0201-z>

Although **millions** of courses of radiotherapy are delivered each year,

not everyone has access.

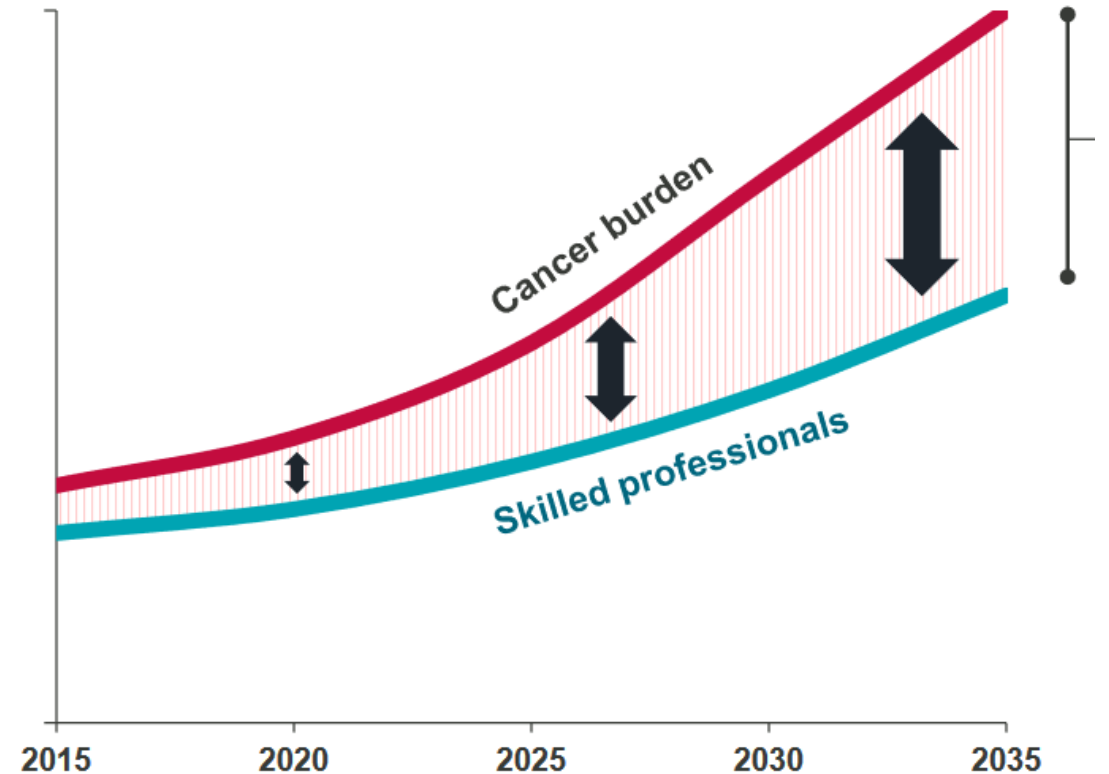


Scaling radiotherapy to the whole world

More than an engineering problem, current need scale the people as well as the equipment



Cancer care professionals supply vs. demand
Indicative



Innovation in radiotherapy

The industry is not new but innovation continues



Early radiotherapy was based on simple rectangular collimators. Only basic X-ray taken in advance of treatment guided the therapy

New technology allows complex 3D treatment guided by MRI images. Images can be taken during radiotherapy



Elekta's site in Crawley

Linear accelerator have been built on the since the 1960



Simplifying radiotherapy

- To meet the growing demand for radiotherapy
- Customer needs
 - Simple easy to use equipment
 - Integrated software
 - Help operators with AI
 - Uses their skilled workforce effectively
 - Safe and reliable equipment
 - Available worldwide
- Remember radiotherapy is personal
 - Every treatment is designed for the patient
 - The “machine” knows your name



Hope for everyone
dealing with cancer.