Lean Innovation Transforming Global Access to Cancer Care


GLOBAL HEALTH
Bringing Global Access to Radiation Therapy: Time for a Change in Approach
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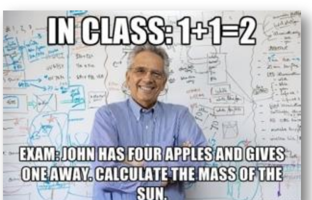


NB: SAM hints may or may not be provided
With pop-up yellow boxes throughout this talk

Conflict of Interest Declaration

Founder of Nano-X Pty Ltd

Low and middle income countries need an additional 10,000 radiotherapy machines just to meet current (2020) demands.

Lean Innovation

Realization of an effective solution with *limited* resources.

Outperforms or at least as good as the best alternatives.

Scalable and sustainable.

Myths of lean innovation


Poor access to radiotherapy is killing rural cancer patients

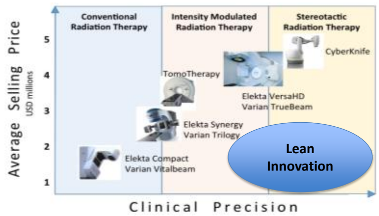
CANCER patients in the bush are up to 30 per cent more likely to die than those living in the city because they can't access radiotherapy treatment.

Myth : Low cost = Obsolete Technology

Myth : Its *only* for LMICs

Lean innovation drives the creation of well-designed and high quality products that are scalable and sustainable with limited resources

Lean Innovation in Radiotherapy?



Lean Innovation in Radiotherapy?

- 100% increase costs in a decade of radiotherapy
  - Van de Werf, Verstraete, Lievens, 2011, Radiotherapy & Oncology
- Higher treatment not necessarily associated with better patient-related outcomes
  - Boero et al 2015, Radiotherapy & Oncology

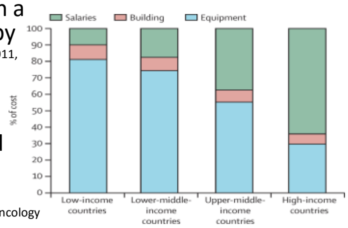


Figure reproduced from Atun et al 2015, The Lancet Oncology 16, 1153

Challenges to implementing high-impact technologies include resources in equipment budgets, personnel availability, infrastructure requirements and expedient decision making

Existing 'Low-Cost' Technologies

-> Cobalt systems with 3D CRT

-> Low-cost offerings of standard linacs

-> Second hand units

***Best in class* systems are what is needed and wanted!**

Devicienti *et al. Journal of Experimental & Clinical Cancer Research* 2010, **29**:47
http://www.jeccr.com/content/29/1/47

Journal of Experimental & Clinical Cancer Research

REVIEW Open Access

Patient positioning in the proton radiotherapy era

Salvatore Devicienti[1], Lidia Strigari[2], Marco D'Andrea[2], Marcello Benassi[2], Vincenzo Dimiccoli[3] and Maurizio Portaluri*[1,4]

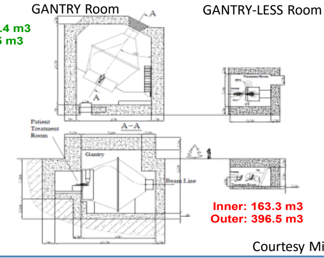
Abstract
The main hindrance to the diffusion of proton therapy facilities is the high cost for gantry installations. An alternative technical option is provided by fixed-beam treatment rooms, where the patient is rotated and translated in space with a robotic arm solution to enable beam incidence from various angles. The technological efforts based on robotic applications made up to now for patient positioning in proton beam facilities are described here, highlighting their limitations and perspectives.

MASSACHUSETTS GENERAL HOSPITAL

Product Genesis fixed proton, stereotactic brain therapy

Photo courtesy: Brendan Whelan

Proton Therapy : gantry vs fixed beam



Courtesy Michael Marash

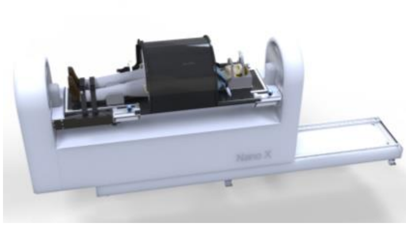
Do we need to rotate gantries if we can handle complexities in software AND if patients tolerate slow rotation?

Nano-X: fixed beam real-time IGRT

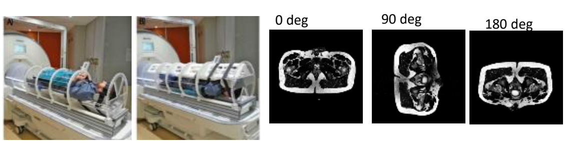
- Fixed, vertical, inline linac
- Onboard kV imaging
- Dynamic MLC tracking
- Compact frame and bunker (about 1/3 size)
- Rotating Couch

Eslick & Keall, 2014, Technol Cancer Res Treat. 2015, (5), 565-72
Feain et al., 2016, under review

Nano-X Rotating Couch Development

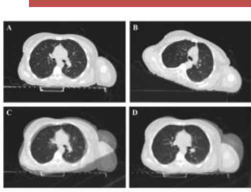


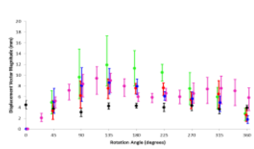
Horizontal Rotation for the Australian MRI-linac



Courtesy Brendan Whelan

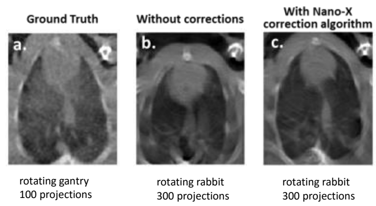
Deformation due to rotation 2-3 times that due to respiration.





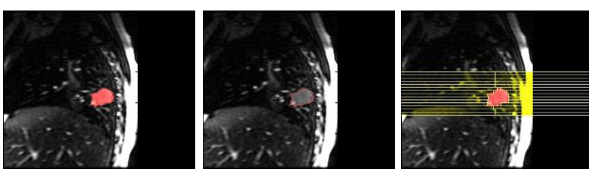
Counter et al. 2016, under review

CBCT Image Reconstruction Development



Courtesy Chun-Chien Shieh

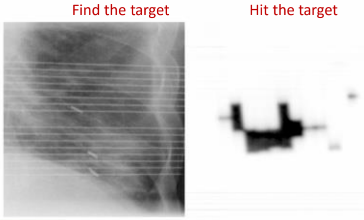
Adapting to the motion
Real time tumour imaging and dynamic MLC tracking



Tumor tracking components

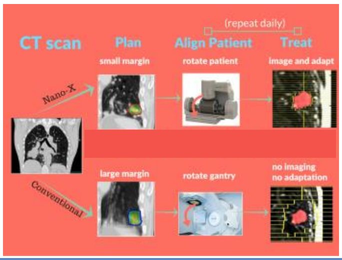
kV imaging during Tx:
Find the target

MLC motion during Tx:
Hit the target



Courtesy Vincent Caillet

Nano-X workflow



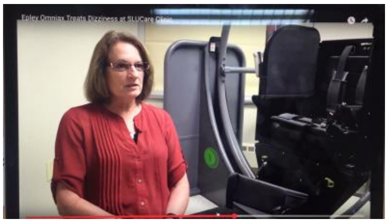
Upright Chair Development

THE UNIVERSITY OF TEXAS
MD Anderson Cancer Center
Making Cancer History®
THE GRADUATE SCHOOL OF BIOMEDICAL SCIENCES
GSBS

Courtesy Rachel McCarroll

Fixed beam linacs utilising patient rotation aim to deliver high-impact radiotherapy with lower overheads, smaller machines and smaller bunker sizes

DO PATIENT'S ACCEPT ROTATION?



Clinical trial:

15/15 cancer patients rotated on Omniax

Found no increase in motion sickness, anxiety or claustrophobia

"There's a way to do it better - find it!"

THOMAS EDISON 1847 - 1941

Needs multi-disciplinary approaches between academia, industry, investors, government, hospitals.

Can fixed beam treatments be delivered safely with automated planning, QA and adaptive tumour tracking techniques?