

SESSION 1: IMPROVING QUALITY of LIFE

PANEL 1.1B: Human health



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Harnessing Advanced New Technologies for Health

Mary Gospodarowicz MD

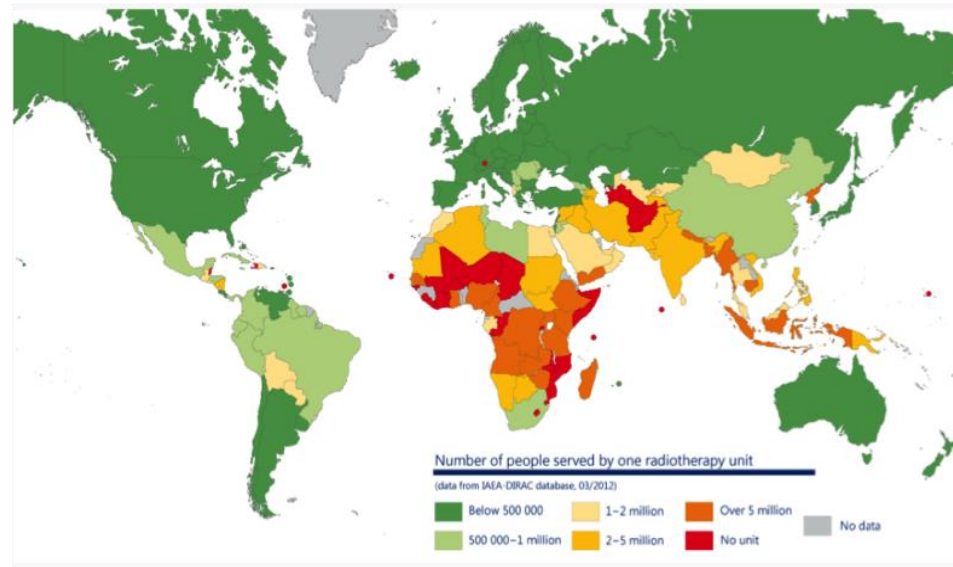
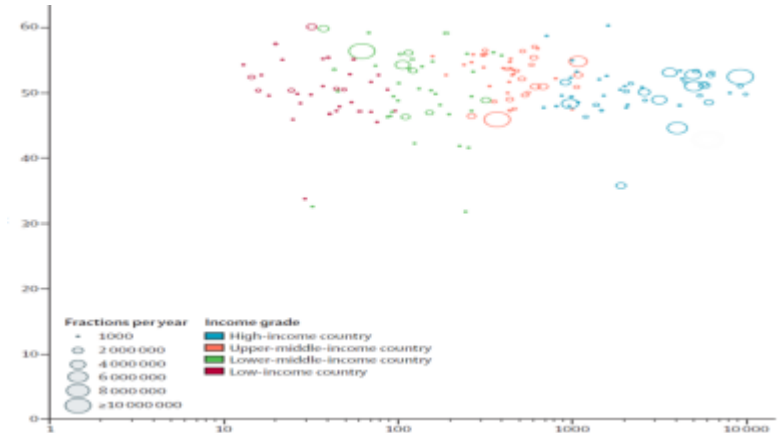
Princess Margaret Cancer Centre, Canada

University of Toronto, Canada

Union for International Cancer Control, Switzerland

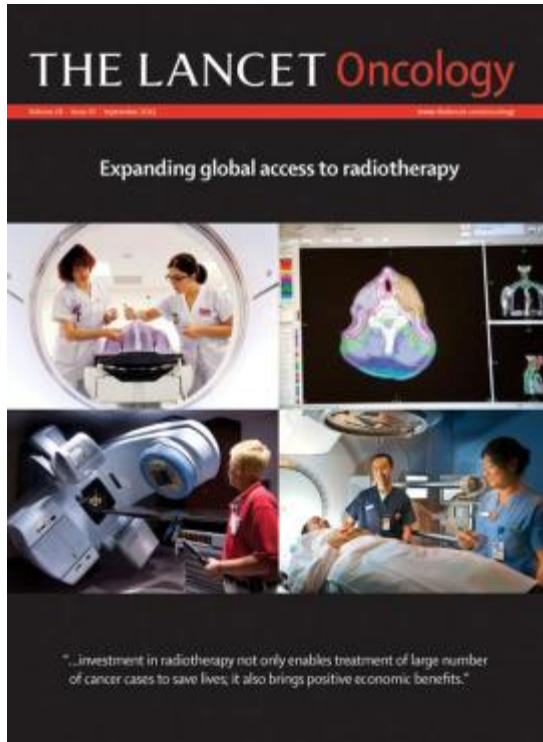
Global access to radiotherapy

- Cancer will grow by 54% by 2030
- >50% of all patients benefit from RT
- Huge gap in the access globally
- RT has huge potential to save lives
- Investment in RT produces economic benefits
- There is an urgent need to invest in cancer and in radiotherapy
- Need >200,000 new health professionals by 2035 to
- Urgent need to deploy new technologies



Population per radiotherapy treatment unit

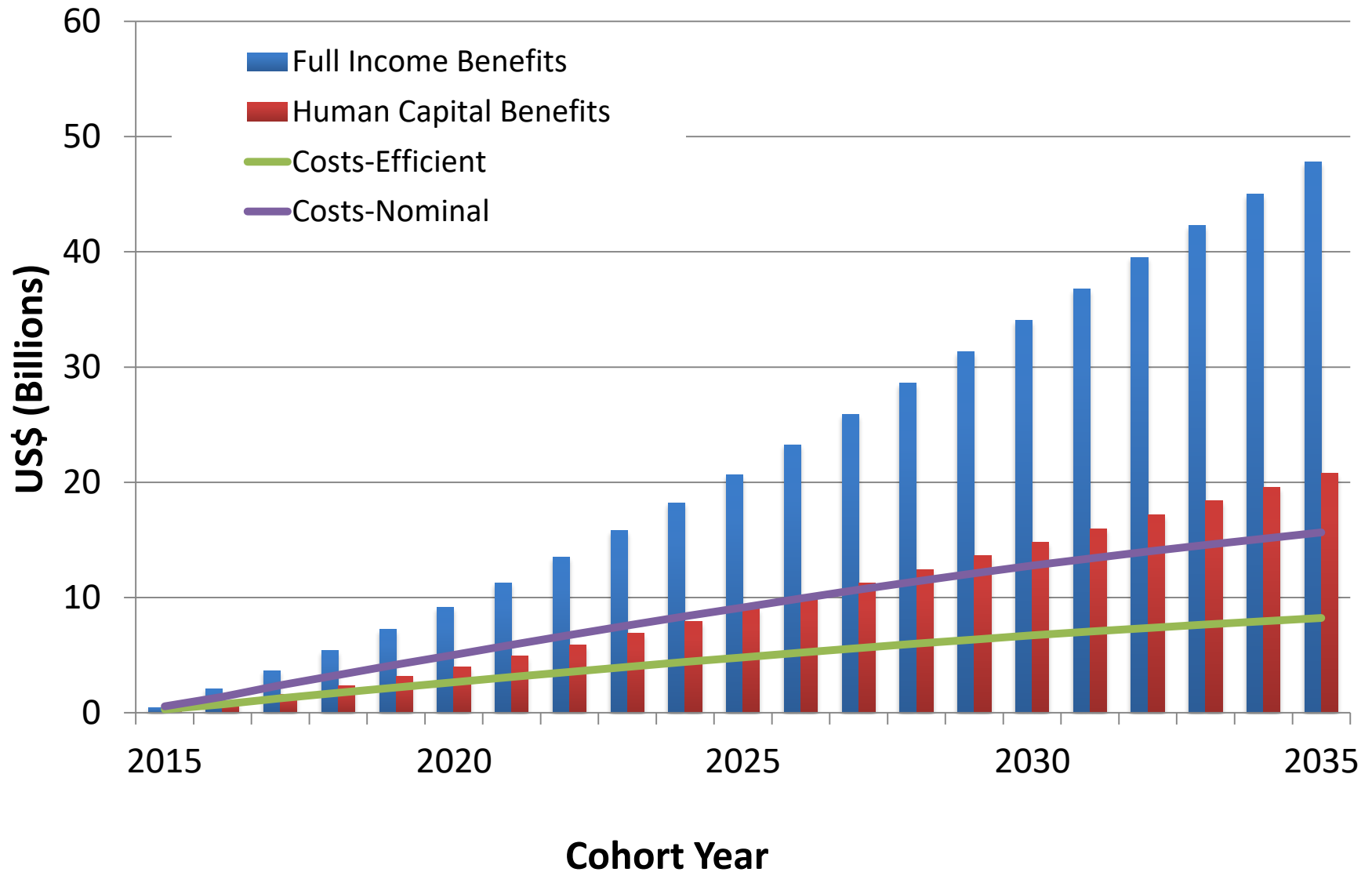
Global Access to Radiotherapy



If, by 2035, every cancer patient who needs radiotherapy has access to it, **almost one million more lives will be saved every year worldwide.**⁴

2035	High-income countries	Upper-middle-income countries	Lower-middle-income countries	Low-income countries
Fractions	76 424 000	77 014 000	40 974 000	13 268 000
Radiotherapy departments	4600	3700	2000	600
Megavoltage machines	9200	7400	3900	1300
CT scanners	4600	3700	2000	600
Radiation oncologists to be trained	15 500	16 800	9900	3300
Medical physicists to be trained	17 200	12 500	7200	2400
Radiation technologists to be trained	51 900	45 300	24 900	8100

Radiotherapy – Return on Investment



Powerful New Tools and Techniques for Precision Radiotherapy



IGRT
CT
guided

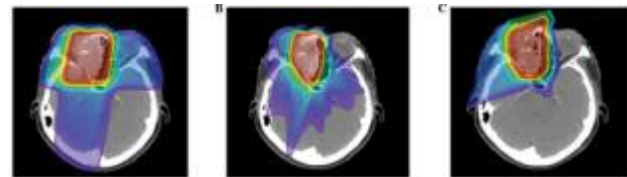
SBRT



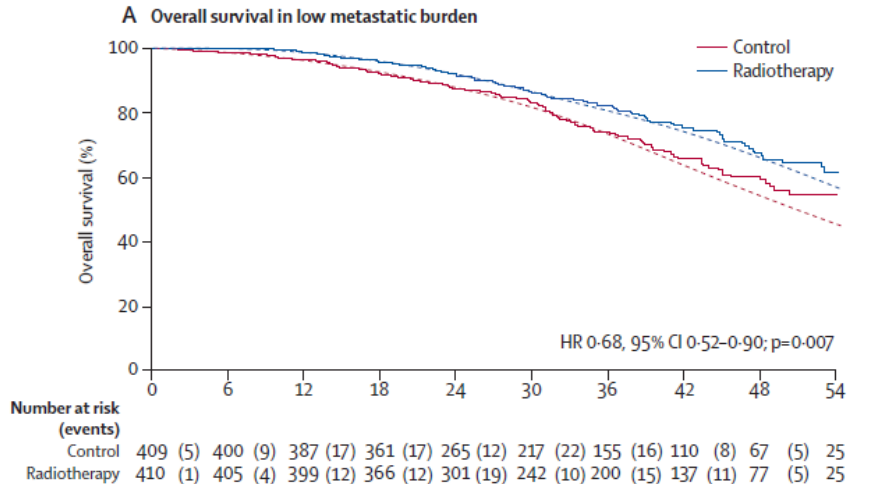
IGRT
MR
guided



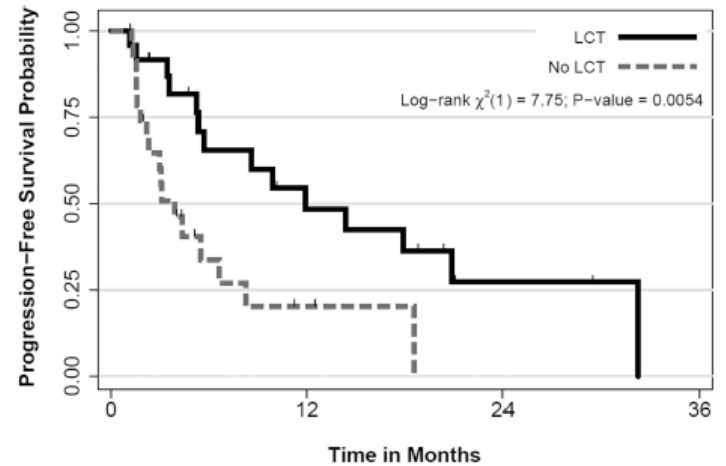
Particle
protons and heavy ions



New Benefits of Modern Radiotherapy

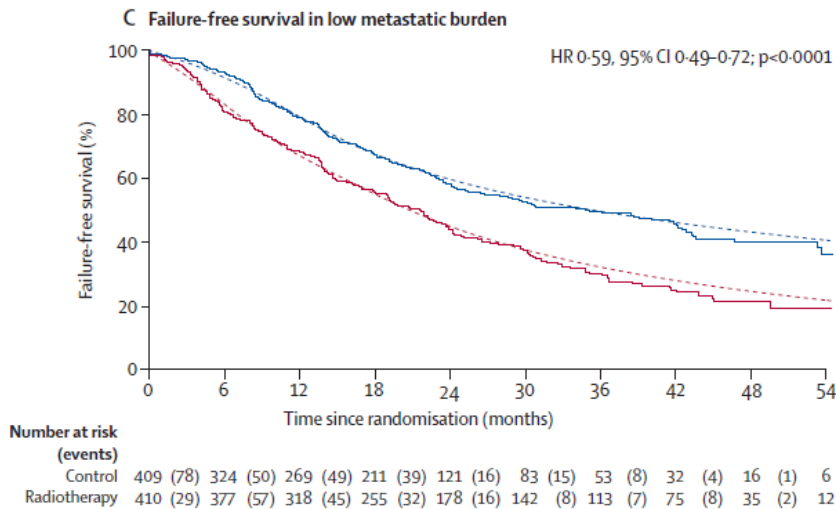


Parker et al. STAMPEDE Trial The Lancet 2018



		Time in Months			
Number at risk (Number Censored)		0	12	24	36
LCT	24 (0)	8 (6)	2 (3)	0 (1)	0 (1)
No LCT	24 (0)	2 (6)	0 (1)	0 (0)	0 (0)

Gomez et al SBRT Lung ca Lancet Oncology 2017

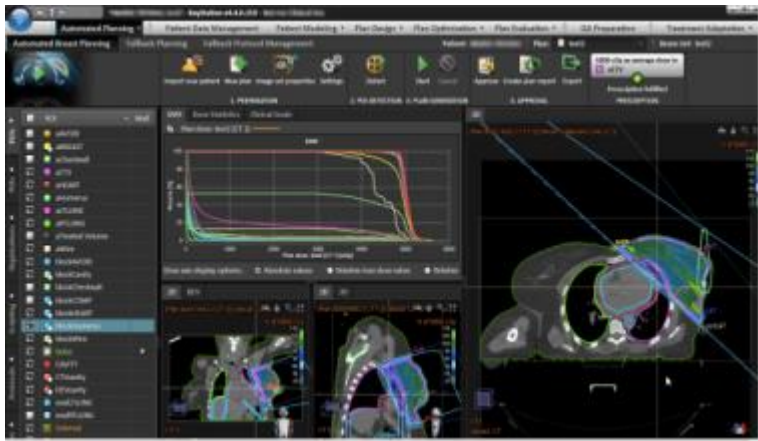


Innovative Technologies

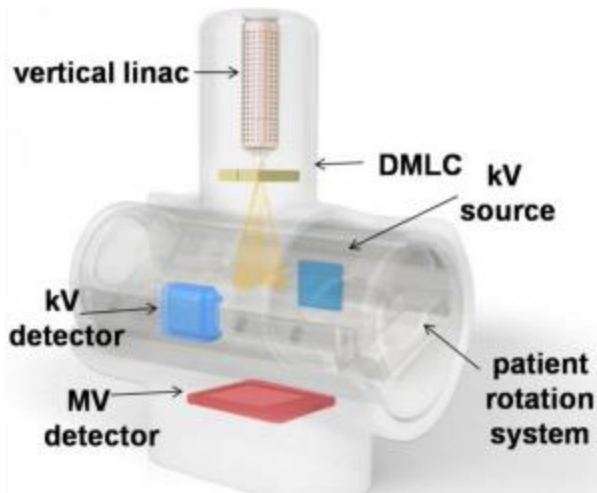
Software systems that automate the treatment planning process and improve plan quality.

>Planning from 4 hours to 4 min.

Purdie et al. - Int J Radiat Oncol Biol Phys. 2011



Migration to the Cloud will enable shared learning and lower infrastructure costs.



NanoX radiotherapy system design including fixed linac and patient rotation system.

>Significant construction cost savings.

Keall et al.

<http://dx.doi.org/10.1594/ranzcr2014/R-0142>

Opportunity to 'bury the complexity' of RT.

Complexity

Radiotherapy

is a rapidly evolving type of treatment

- Technology innovation will continue as will demand for high quality interventions
- New technologies increase complexity and are used to decrease complexity
- New quality monitoring tools
- Tools for managing complexity
 - Data science, machine learning
 - Automation, AI
 - Augmented cognition

AQUA



IQM - Integral Quality Monitor

Advanced uses of data are changing the landscape of radiotherapy. For example, big data analysis using algorithms powered by artificial intelligence can be used to predict overall survival, treatment response and toxicity. This information can help guide clinical decision-making about how to use radiotherapy and further personalise treatment.^{4 29 30}

Grand Chess Master Kasparov loses to IBM Deep Blue in 1997



“Machines won’t make us obsolete, our complacency might...
...and intelligent machines can help us turn our grandest dreams into reality.”

- Garry Kasparov (2017)

2017 CBC Interview with Garry Kasparov

<http://www.cbc.ca/listen/shows/the-current/segment/12642300>

Messages

- New technologies offer unprecedented precision in the use of radiotherapy for cancer
- There is increasing evidence for expanded role of radiotherapy in cancer control
- Technology - increases / helps manage complexity
 - Data science, machine learning, AI, Augmented cognition
- The impact of investment must be measured in terms of radiotherapy utilization by cancer patients and lives saved and not in machines installed
- IAEA – the only UN agency explicitly concerned with technology is a crucial catalyst for the progress