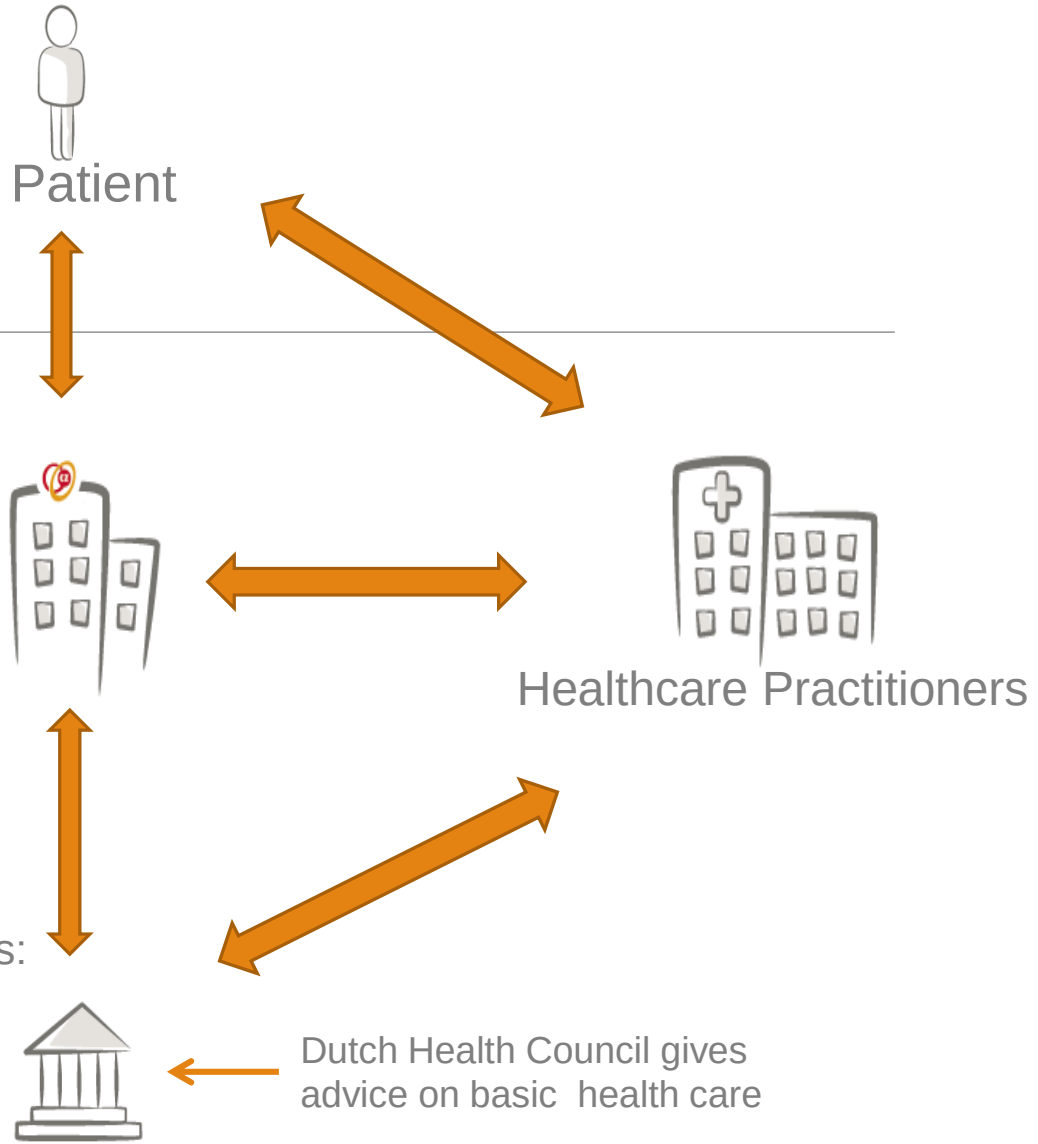
Health Economics of proton therapy from a health insurance perspective

MEDICIS-PROMED Summer School, 7 June 2017

Madelon Johannesma, MSc, PhD _ Health Insurance Company CZ

- Can switch from insurance provider



- Non-Profit
- Determine Policy Premium
- Develop Supplementary policies
- Innovate care to meet goals

Sets the rules (examples):

- Goals for Health insurance providers: Maintain Quality, Accessibility and Affordability of Care
- Determines Covered Care
- Duty of Care
- Open enrolment obligation

There are a lot of providers The Netherlands….

CZ-group is third largest Dutch health insurer

non-profit

Our Customers

Customer satisfaction:	7.9
Policy holders:	3.5 million
Market share:	20%
Premium income:	€ 8.97 billion

Our Operations

Brands:	CZ, OHRA, delta lloyd, CZdirect.nl
Healthcare providers contracted:	45.000
Operating costs as % of premium:	3,8%
Solvency II Solvability:	169%
Employees:	2.600

‘license to operate’: to maintain high-quality, accessibility and affordability within the Dutch healthcare system

What drives	**CZ represents solidarity in health care**
What we do	**CZ wants the best possible care for it’s insured.**
How we do it	**focus of procurement is on best possible care against lowest costs**

CZ defines ‘the best possible care’ as care which creates the most patient value

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Perspective

What Is Value in Health Care?

Michael E. Porter, Ph.D.

N Engl J Med 2010; 363:2477-2481 | December 23, 2010

Article | References | Citing Articles (47) | Letters

Two framework papers that develop the concepts outlined in this article, "Value in Health Care" and "Measuring Health Outcomes," are available as Supplementary Appendixes.

In any field, improving performance and accountability depends on having a shared goal that unites

Founding father of the concept of ‘value’ is Michael E. Porter

Value is defined as

Quality

Cost

Health Care Costs are rising exponentially

…and as a consequence the premium

An important cost driver is Health technology

new medical technology is an important determinant in rising health care expenditures 25-75% (average 50%)

	Di Matteo[15]	Jones[16]	Pricewaterhouse Coopers[7]	Smith et al[19]	Peden and Freeland[17]	Cutler[9]	Newhouse[10]
Life expectancy/aging	~9%	*	15%**	2%	6%–7%	2%	2%
Administrative costs	*	*	15%***	3%–10%	*	13%	*
Changes in financing	*	*	*	10%	4%–5%	10%	10%
Personal income growth	9%–20%	*	*	11%–18%	14%–18%	5%	<23%
Health care prices	*	*	18%	11%–22%	*	19%	*
Technology	~65%	50%–75%	25%	38%–62%	70%–75%	49%	>65%

Trade-off

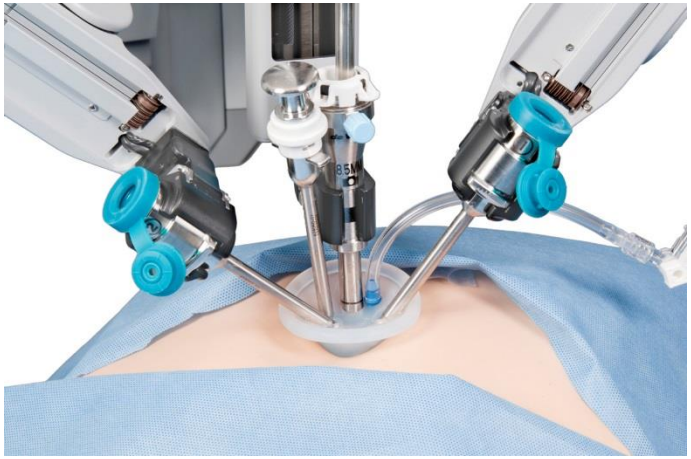
A new treatment/technology is considered to be accepted as compared to standard treatment if:

- Better survival rates
- and/or a better QoL
- Acceptable costs

Determined by the Dutch Health Counsil for basic healt care

Current practice: Quick dissiminiation of new technologies without clear proven effectiveness against high costs

e.g. ROBOTIC SURGERY



e.g. PROTON THERAPY

80+ Treatment Rooms to be Operational in Europe by 2020

Number of Treatment Rooms In Each Country

HOTTEST!		MODERATE		JUST HEATING UP	
18	Germany	7	Italy	4	Czech Republic
14	UK	6	France	4	Denmark
9	Switzerland			3	Austria
9	Netherlands			3	Poland
				3	Sweden
				2	Belgium

Treatment Rooms are Spread Across 35 Proton Therapy Centres* in 12 European Countries: Germany and UK Leading the Pack

*Planned and operational

Number of Treatment Rooms Per City

This infographic was created in collaboration with **MEDraysintell**, in coordination for the forthcoming **Proton Therapy Congress** hosted by **Kisaco Research**, taking place in **London, September 20-21, 2016.**

In general……there are some difficulties in evidence generation of technologies:

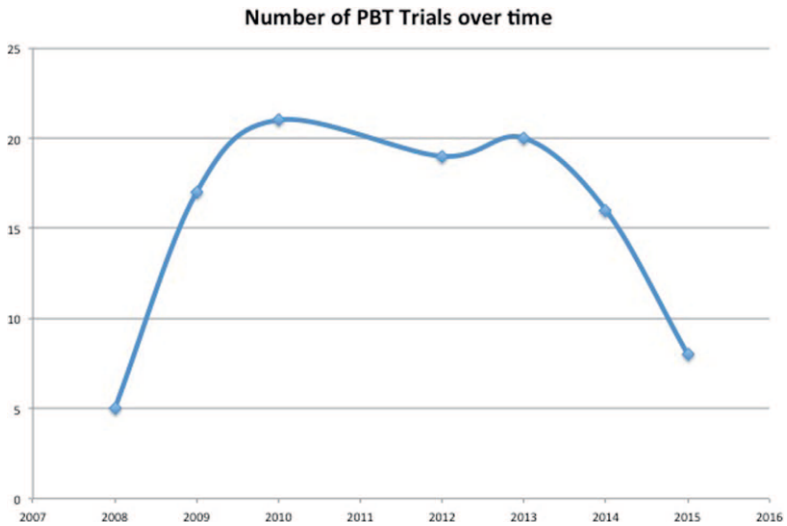
As compared to drugs:

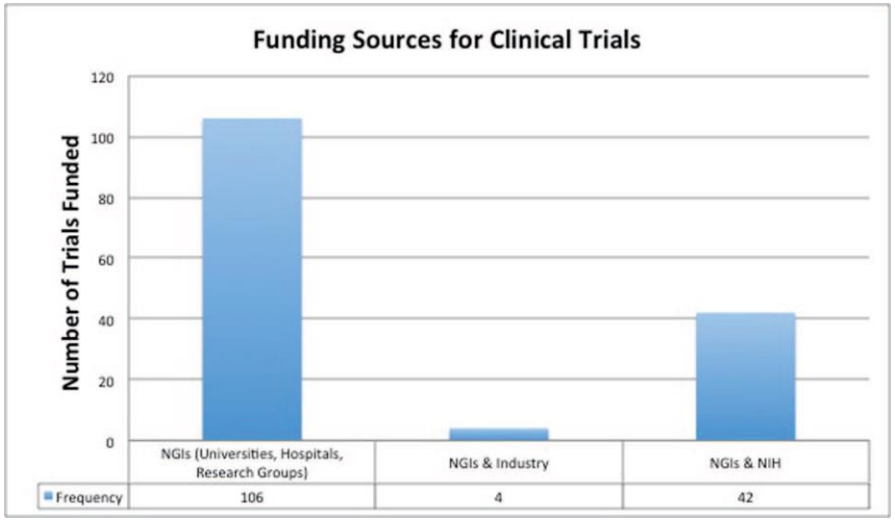
1. economic evaluation guidelines are written primarily for pharmaceutics
2. unlike drugs, medical devices are indivisible, often multiple applications.
3. in contrast with drugs, the technical performance of a technology involve interaction with the clinician, while drugs are a classic case of embodied practice
4. blinded studies are more difficult to undertake for technologies
5. on whom's responsibility? no proof of effectiveness is required for technologies before entry on the market as is with drugs.

focus is on safety and utility, not on effectiveness and costs

Lievens, et al.(2015) Cost calculation :a necessary step towards widespread adoption of advanced radiotherapy technology, Acta Oncologica, 54:9, 1275-1281

Besides, funding of clinical trials on technologies hampers evidence generation





- Only 3% of trials funded by industry (in contrast to 42% in drugs trials)
- Major funding by universities, hospitals, and research groups (70%)

Evidence gap of technologies can interfere with reimbursement

Whether a particular technology increases or decreases costs depends on whether a given technology:

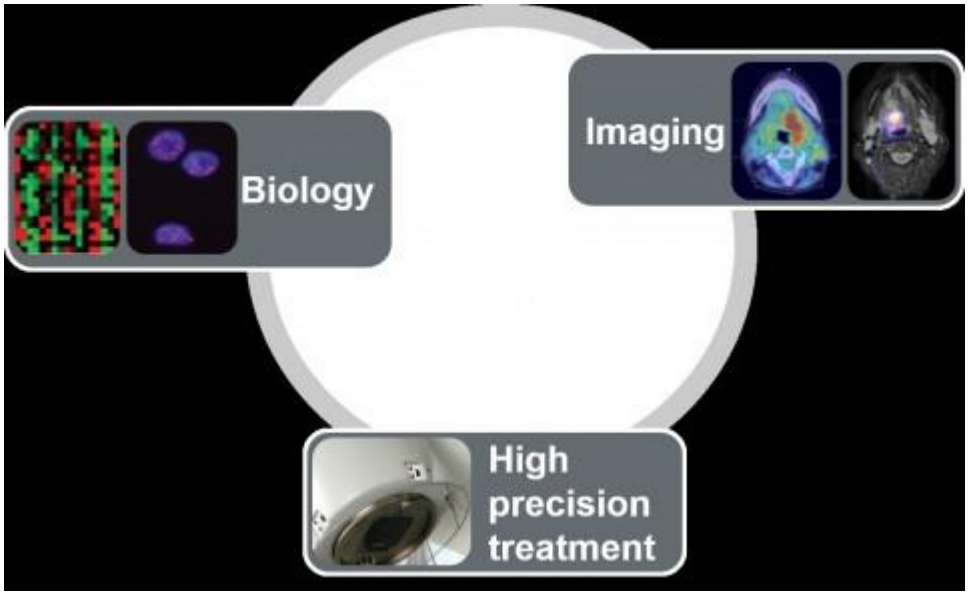
intensifies level of use of the technology for the same condition

liquid biopsy

impacts the delivery of care

robotic surgery

broadens the definition of diseases



substitutes for an existing service

radiomics

expands the number of treatable conditions

IMRT
SBRT

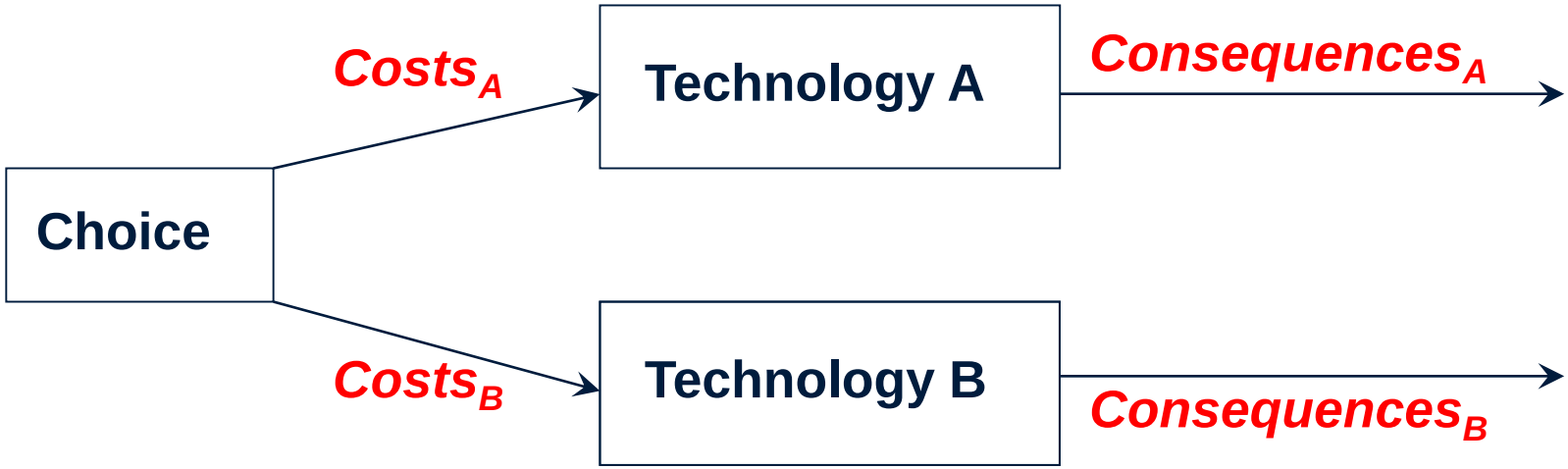
AI

protons

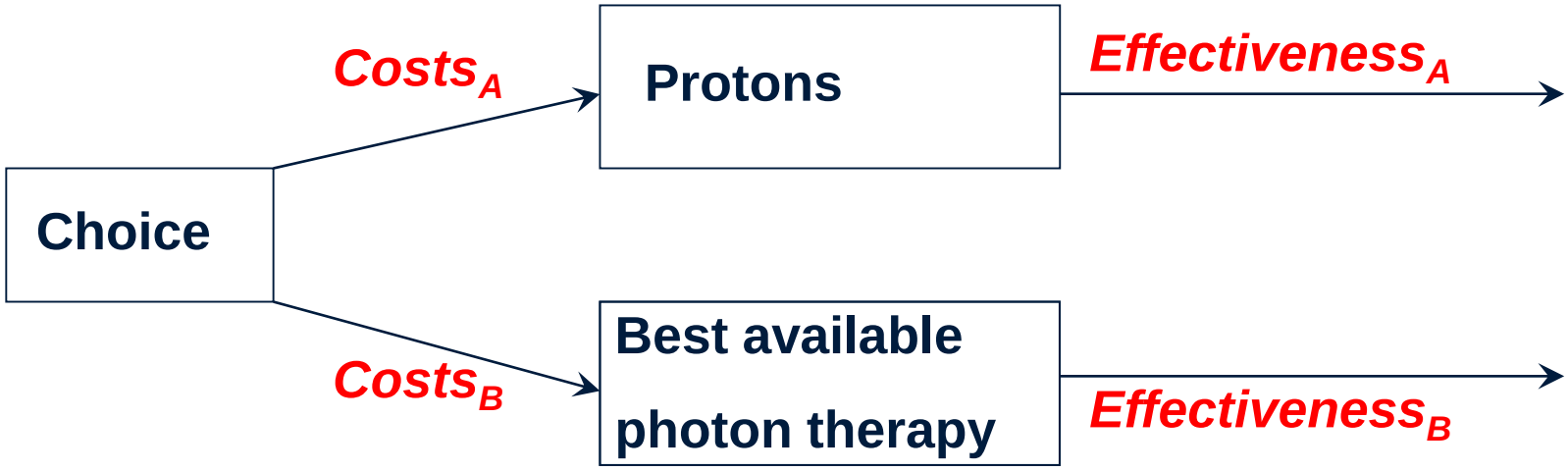
Decicison Support Systems

To determine the value for money of new technologies cost-effectiveness analyses are performed

= The comparative analysis of alternative courses of action in both their costs and consequences



In case of proton therapy……



Let's go 10 years back in time…. 2007: no firm conclusion on (cost)effectiveness proton therapy

Conclusion: Existing data do not suggest that the rapid expansion of HT as a major treatment modality would be appropriate. Further research into the clinical and cost-effectiveness of HT is needed. The formation of a European Hadron Therapy Register would offer a straightforward way of accelerating the rate at which we obtain high-quality evidence that could be used in assessing the role of HT in the management of cancer.

Reference:

Lodge M, Pijls-Johannesma M, Stirk L, Munro AJ, De Ruysscher D, Jefferson T. A systematic literature review of the clinical and cost-effectiveness of hadron therapy in cancer. Radiother Oncol. 2007 May;83(2):110-22.

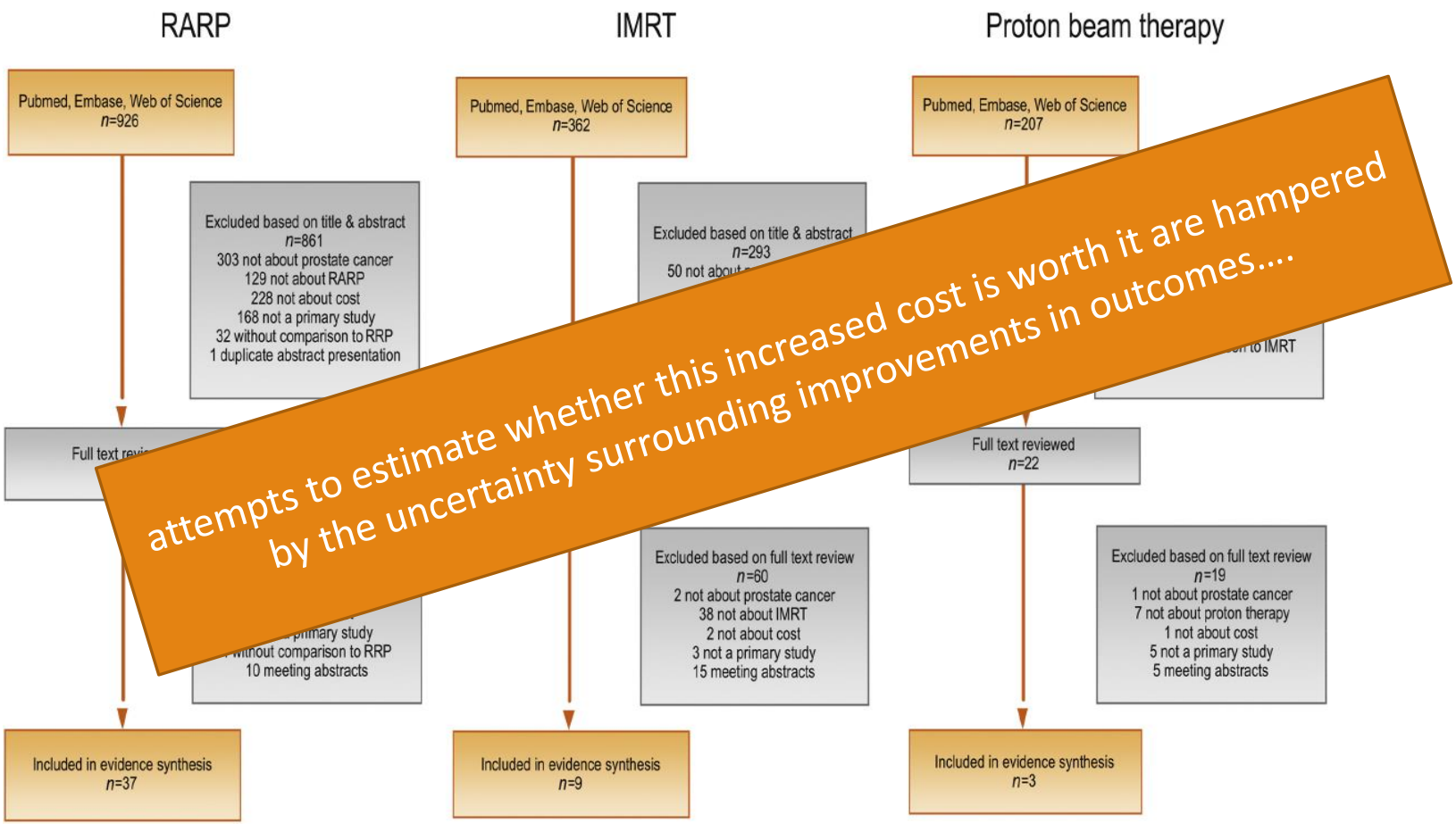
2013: Limited CEAs for protons for different indications

	Tumor site	Design	Outcome	Result	Report uncertainty
Lundkvist, 2005	Breast	Markov	QALY	€10.130	no
Lundkvist, 2005	Medulloblastoma H&N	Markov	QALY	€10.130	no
Lundkvist, 2005	Prostate	Markov	QALY		no
Jakel, 2007	chord			7.692	no
Konski, 2007		Markov	QALY	$63,578	no
Grutters, 2010	NSCL	Markov	QALY	€67,257	yes
Maboraki, 2010	Rectum	Retrospective analysis	LYG	-	no

high level of uncertainty: many assumptions, suboptimal methodology

Lievens & Pijls-Johannesma, Seminars in Oncology, 2013

2017: Robotic surgery and proton therapy seems more costly than IMRT on prostate cancer treatment.



Schroeck FR, et al. Cost of New Technologies in Prostate Cancer Treatment: Systematic Review of Costs and Cost Effectiveness of Robotic-assisted Laparoscopic Prostatectomy, Intensity-modulated Radiotherapy, and Proton Beam Therapy. Eur Urol (2017)

So current status (2017): Highly unlikely that protons will be the most cost-effective option for all cancers or even for all patients with a given type of cancer

- Lack of evidence (mainly due to lack of comparable data)
- sub-optimal methodology CEA
- Patient selection needed

Mishra, Mark V. et al. Establishing Evidence-Based Indications for Proton Therapy: An Overview of Current Clinical Trials. Feb 2017;97 (2): 228 – 235

Verma V, Mishra MV, Mehta MP. A systematic review of the cost and cost-effectiveness studies of proton radiotherapy. Cancer. 2016 May 15;122(10):1483-501.

Verma V, Shah C, Rwigema JC, Solberg T, Zhu X, Simone CB 2nd. Cost-comparativeness of proton versus photon therapy. Chin Clin Oncol. 2016 Aug;5(4):56.

Patient selection can be done by modeling, using NTCP & insilico trials

Results of some studies using model-based approaches showed that PBT was not cost-effective for breast-[1,2] and head-neck cancer[3] patients, as it was for a selected group of patients

1. *Tommasino F, et al. Model-based approach for quantitative estimates of skin, heart, and lung toxicity risk for left-side photon and proton irradiation after breast-conserving surgery. Acta Oncol. 2017 May;56(5):730-736.*
2. *GY Vega et all. Int J Radiation Oncol Biol Phys, Vol. 95, No. 1, pp. 11-18, 2016*
3. *Ramaekers et al. Protons in head-and-neck cancer: bridging the gap of evidence. Int J Radiat Oncol Biol Phys. 2013 Apr 1;85(5):1282-8.*

Example 1

Patient selection by combining in silico data with NTCP

International Journal of Radiation Oncology biology • physics
www.redjournal.org
Volume 85 Number 5 2013

Clinical Investigation

Protons in Head-and-Neck Cancer: Bridging the Gap of Evidence

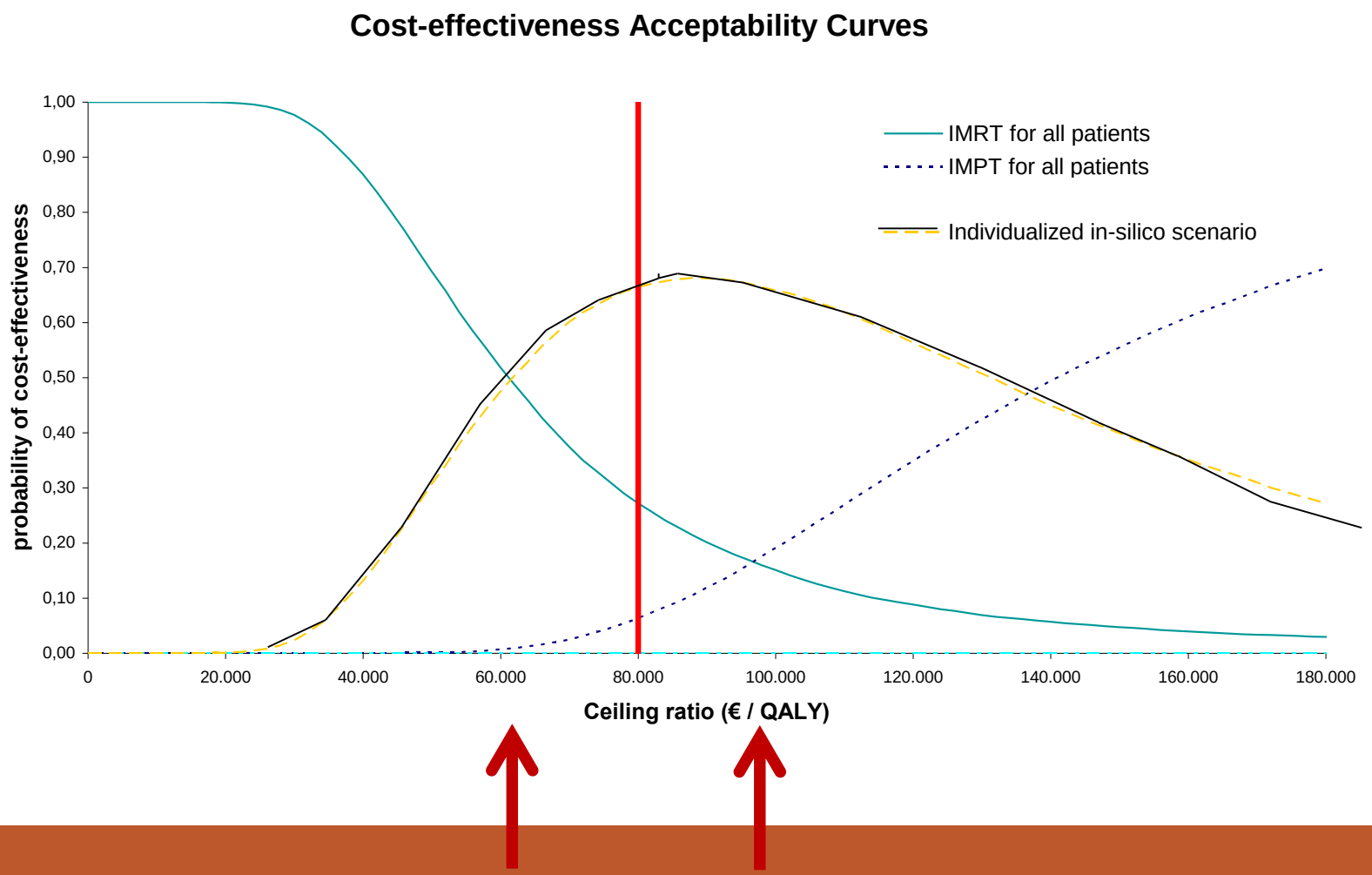
Bram L.T. Ramaekers, MSc,*,† Janneke P.C. Grutters, PhD,* Madelon Pijls-Johannesma, PhD,† Philippe Lambin, PhD,† Manuela A. Joore, PhD,*,‡ and Johannes A. Langendijk, PhD§

Aim: Given the lack of data, estimate the cost-effectiveness of protons in H&N cancer (IMRT vs IMPT)

Main endpoint: xerostomia and/or dysphagia
- according to available NTCP models*
- dose parameters were derived from in silico trials

* Beetz et al. Radioth Oncol 2010;96:S84-S85.
Christianen et al. Radiother Oncol 2012;105:107-114.

IMPT in H&N cancer cost-effective for subgroup of patients

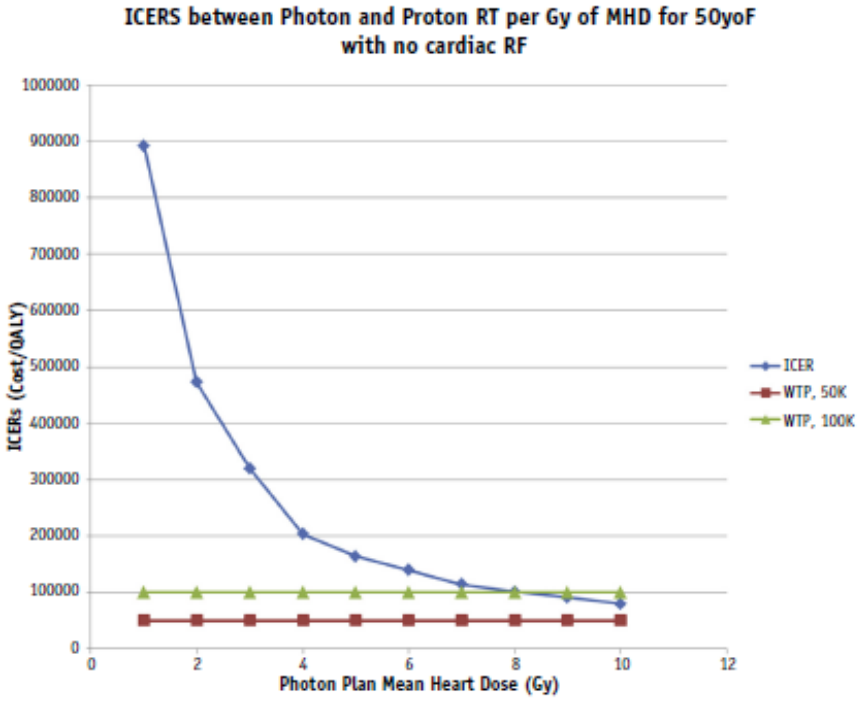


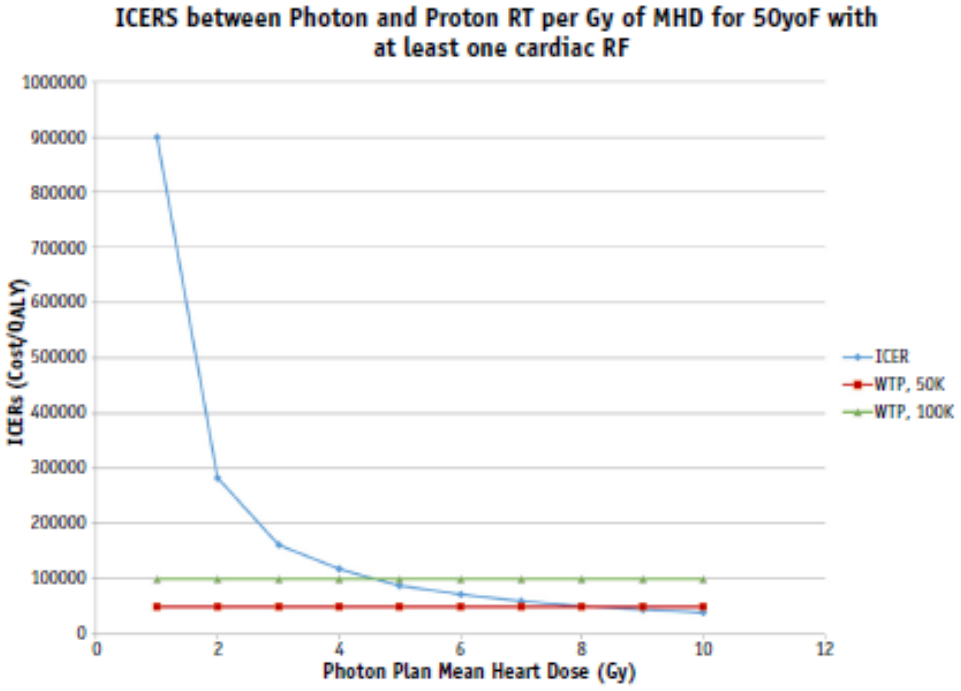
Example 2

Will patient selection contribute to cost-effectiveness of protons in breast cancer treatment?

- CEA, Markov model
- photon versus protons
- different strata based on age (40y,50y,60y) and presence/lack of cardiac risk factors (CRF)

Protons for breast-cancer only cost-effective if ≥ 1 CRF and MHD ≥ 5 GY





Model-based approach is adopted by the Dutch Health Council

NTCP models will be used to select patients who are likely to benefit from proton therapy (prevention of side effects)

Radiotherapy and Oncology 107 (2013) 267–273

Contents lists available at SciVerse ScienceDirect

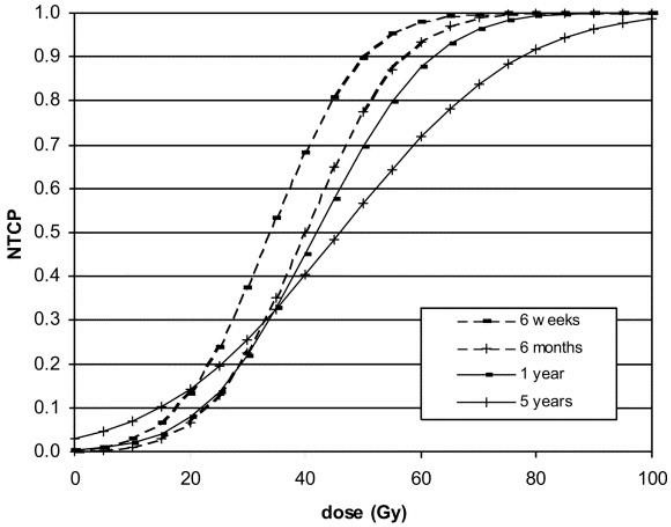
Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Proton radiotherapy

Selection of patients for radiotherapy with protons aiming at reduction of side effects: The model-based approach

Johannes A. Langendijk[a,*], Philippe Lambin[b], Dirk De Ruysscher[c], Joachim Widder[a], Mike Bos, Marcel Verheij[e]

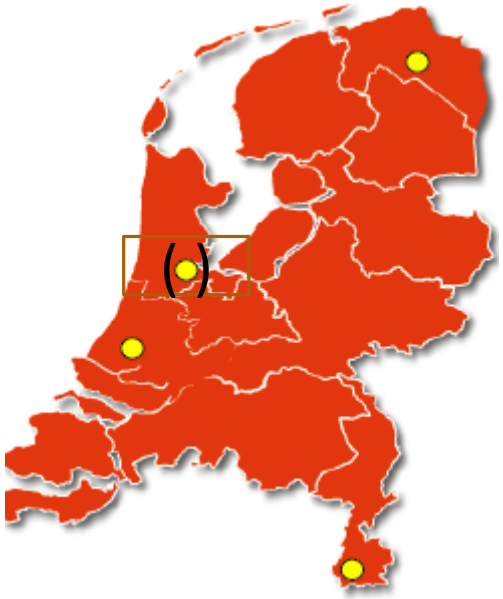


Proton therapy in The Netherlands

Maximum of 4 permits: all granted

Treatment capacity of 2200 patients/year

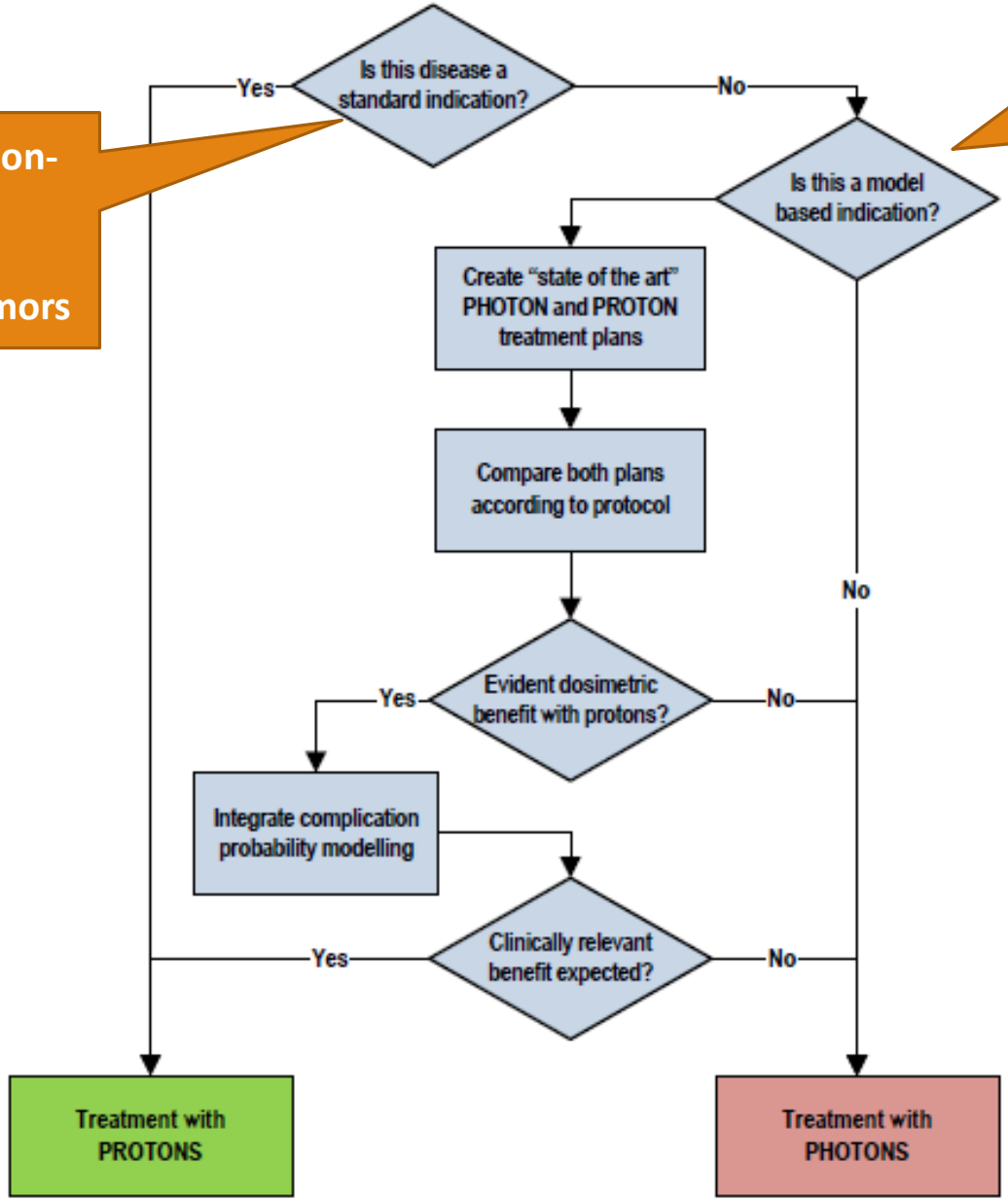
- (Amsterdam: 600 pat/yr)
- Groningen: 600 pat/yr
- R'dam/Delft/Leiden: 600 pat/yr
- Maastricht: 400 pat/yr



Price agreements made for first 3 years

- Different prices per proton center
- price based on expected number of patients/year
- if less patients will be referred, price per patient will increase
- also start-up costs can be integrated in the price

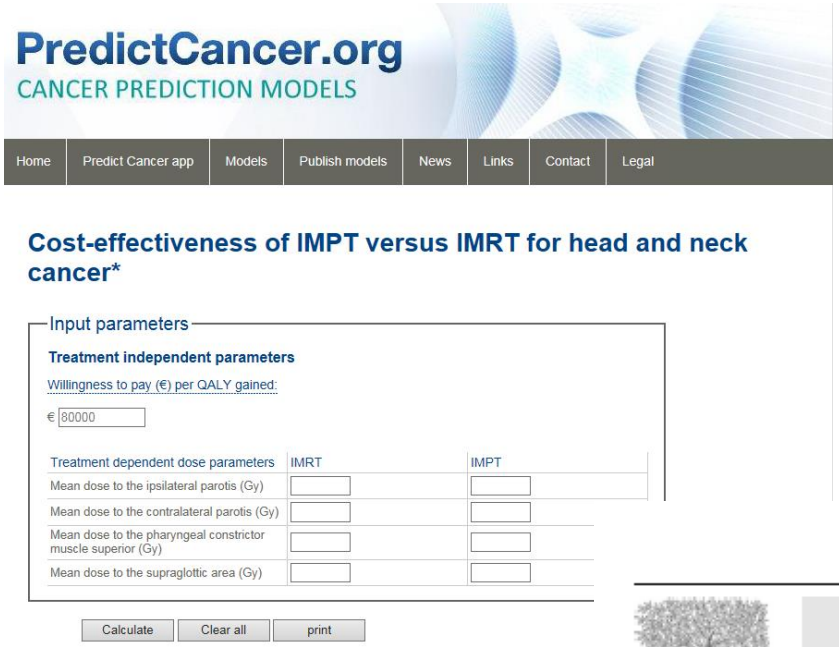
Proton therapy reimbursement decision tree for the Netherlands



- Chordomas/chon-drosarcomas
- Pediatrics
- Intraocular tumors

- Breast
- Lung
- Head&Neck
- Prostate

Decision support systems will play an important role in quickly select the right patient for a certain treatment



Radiotherapy and Oncology 118 (2016) 281–285

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Particle therapy in head and neck cancer

Development and evaluation of an online three-level proton vs photon decision support prototype for head and neck cancer – Comparison of dose, toxicity and cost-effectiveness

Qing Cheng [a,1], Erik Roelofs [a,1], Bram L.T. Ramaekers [b], Daniëlle Eekers [a], Johan van Soest [a], Tim Lustberg [a], Tim Hendriks [a], Frank Hoebers [a], Hans Paul van der Laan [c], Erik W. Korevaar [c], Andre Dekker [a], Johannes A. Langendijk [c], Philippe Lambin [a,*]

Summary (1)

It seems hard, if not impossible, to estimate the cost-effectiveness of proton therapy according to basic economic evaluations

- costs are highly variable between countries
- focus is on safety and utility, not on effectiveness and costs
- funding of clinical trials is a problem
- RCT's seams often not possible

Summary (2)

- A model-based approach could be the solution based on subgroup or individual patients.
- Modeling should complement clinical trials, not replace (RCTs remain the ideal tool for research in proton radiotherapy)
- Next, it is possible to assess the effectiveness of proton therapy for individual patients, comparing photon and proton treatments on dose metric, toxicity and cost-effectiveness levels, retrieved from a decision support system.
- Individualized patient selection will enhance the cost-effectiveness of proton therapy (www.predictcancer.org)
- Patient values should be taken into account

Discussion

For a sustainable health care system it is important to control for referring the right patient to the right treatment

- How to standardize and control patient selection?
- Will 2200 patients be referred in The Netherlands, since at current (2016) < 50 patients/year are referred to proton centers abroad?
- So, are we creating overcapacity in The Netherlands?
- What financial consequences will 4 PT centers have for the RT departments /hospitals with only photon therapy?
- Will we succeed to increase value in health care by the introduction of protons in The Netherlands? How can this be measured?

Thanks for your attention!

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