Radiotherapy equipment, departments and staffing in the European countries

Final results from the ESTRO-HERO survey

Cai Grau, Yolande Lievens
N Defourney, J Malicki, P Dunscombe, J Borras,
M Coffey, B Slotman, M Bogusz, C Gasparotto

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Health Economics in Radiation Oncology (HERO)

The ESTRO initiative was launched as a task force by the clinical committee in 2009 – building on QUARTS

The overall aim of HERO is to

- build a knowledge base concerning the 'infrastructure' and staffing of radiation oncology in the European countries, and
- develop a model for health economic evaluation of radiation oncology on the European level

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Tasks

Four scientific tasks are addressed:

1. Provision and accessibility of radiotherapy
2. The need for radiotherapy

3. Cost-accounting program
4. Economic evaluation models

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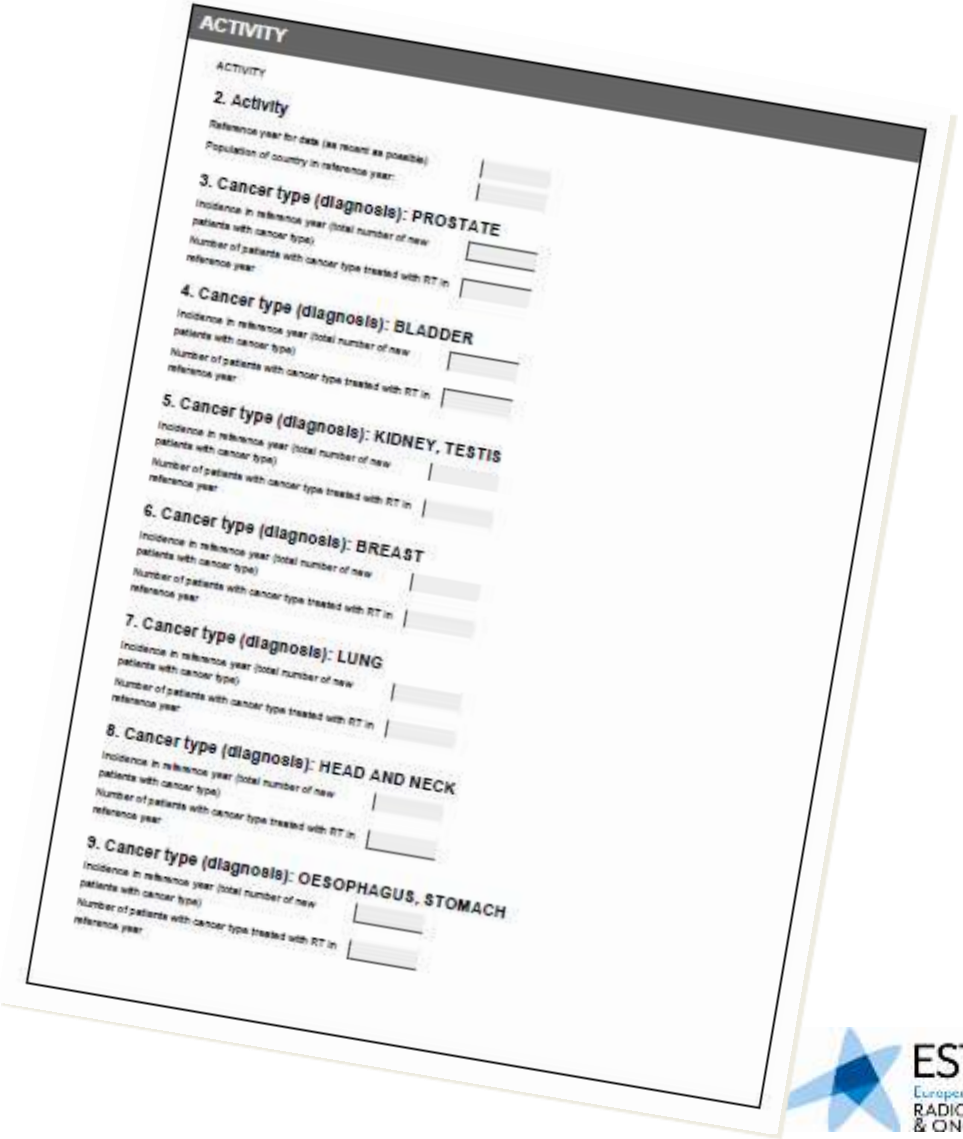
Web-based Questionnaire

- Contact person from NS
- 84 items
  - Activity, cases
  - Departments
  - Technology
  - Staffing
  - Reimbursement
  - Guidelines



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Equipment data (n=26)

Demographics			Treatment units						Other machines			Simulators				Departments		
GNI/n 2011 (USD)	RT Courses	Ref. year equipment	Total MV unit	Linear acceler ators	Linacs with IMRT	Linacs with IGRT	Dedica-ted SRS-	Cobalt units	Ortho-voltage machine	Proton facilitie s	Carbon ion facilities	Total simu-lators	2D sim	2D sim with CT option	CT simu-lators	Total facilities	Depart-ments	Satel-lites
4,050	2,195	2010	4	2	0	0	0	2	1	0	0	2	0	0	2	2	2	0
48,170	21,481	2010	43	42	35	26	1	0	7	0	0	21	8	1	12	14	14	0
6,270		2009	30	8	5	4	0	22	18	0	0	20	9	7	4	23	20	3
45,840	34,672	2013	91	87	71	57	3	1	8	0	0	29	8	7	14	36	25	11
6,640	13,794	2012	13	5	2	1	0	8	10	0	0	6	1	1	4	14	14	0
18,720	32,630	2009	57	43	29	17	4	10	39	1	0	28	18	0	10	48	36	12
60,160	17,680	2010	53	53	50	47	0	0	6	0	0	14	0	0	14	9	7	2
15,260	2,122	2012	4	4	4	4	0	0	0	0	0	3	1	0	2	2	2	0
47,740	13,994	2010	43	41	41	41	2	0	0	0	0	17	2	2	13	13	12	1
42,690	187,172	2012	449	421	412	238	28	0	11	2	0	165	26		139	176	172	4
44,230		2010	450	434				16	103							388	388	0
12,840	19,951	2011	36	26	6	2	1	9	4	0	0	19	12	0	7	12	12	0
35,260	595	2010	2	2	2	1	0		1	0	0	1	0	1	0	1	1	0
38,960	8,373	2009	32	31	10	10	0	1	2	0	0	12	3	0	9	12	12	0
13,000	6,268	2011	10	10	3	2	0	0	5	0	0	5	4	0	1	5	4	1
77,380	1,180	2010	2	2	2	1	0	0	0	0	0	2	1	0	1	1	1	0
6,810	1,500	2011	2	2	0	0	0	0	0	0	0	3	1	1	1	1	1	0
49,660	55,683	2012	132	132	125	125		0	8	0	0	38	8	0	30	29	21	8
88,500	13,483	2011	41	40	40	40	1	0	6	0	0	22	11	0	11	10	5	5
12,340	73,500	2010	120	115	109	77	4	1	5	1	0	76	24	16	36	35	35	0
21,420	17,957	2010, 2012	44	41	30	18	3	0	0	0	0	20	3	5	12	17	17	0
23,940	6,023	2012	8	8	5	3	0	0	1	0	0	3	1	0	2	1	1	0
30,930	98,525	2011	261	220	56	50	36	5	18	0	0	167	35		132	112	112	0
53,530	22,678	2012	63	62	51	44	1	0	4	0	0	21	6	0	15	16	15	1
76,350	19,000	2013	59	52	52	12	6	1	11	2		39	13		26	41	37	4
37,840		2010, 2011	314	307	186	109	6	1	50	1	0	140	25	21	94	77	73	4

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Indicators

Indicators									
Depart-ments / mil inh	MV units / mil inh	MV units / dep	MV units with IMRT	MV units with IGRT	Sim / dep	Sim / MV unit	Sim with 3D	Courses / dep	Courses / MV
0.6	1.3	2.0	0%	0%	1.0	0.5	0%	1,098	549
1.7	5.2	3.1	81%	60%	1.5	0.5	62%	1,534	500
2.1	3.1	1.5	17%	13%	1.0	0.7	55%		
2.3	8.4	3.6	78%	63%	1.2	0.3	72%	1,387	381
1.9	1.8	0.9	15%	8%	0.4	0.5	83%	985	1,061
3.4	5.4	1.6	51%	30%	0.8	0.5	36%	906	572
1.3	9.6	7.6	94%	89%	2.0	0.3	100%	2,526	334
1.5	3.0	2.0	100%	100%	1.5	0.8	67%	1,061	531
2.2	8.0	3.6	95%	95%	1.4	0.4	88%	1,166	325
2.6	6.9	2.6	92%	53%	1.0	0.4	84%	1,088	417
4.8	5.6	1.2							
1.2	3.6	3.0	17%	6%	1.6	0.5	37%	1,663	554
3.1	6.3	2.0	100%	50%	1.0	0.5	100%	595	298
2.7	7.2	2.7	31%	31%	1.0	0.4	75%	698	262
1.3	3.3	2.5	30%	20%	1.3	0.5	20%	1,567	627
2.0	4.0	2.0	100%	50%	2.0	1.0	50%	1,180	590
1.5	3.1	2.0	0%	0%	3.0	1.5	67%	1,500	750
1.2	7.8	6.3	95%	95%	1.8	0.3	79%	2,652	422
1.0	8.3	8.2	98%	98%	4.4	0.5	50%	2,697	329
0.9	3.1	3.4	91%	64%	2.2	0.6	68%	2,100	613
1.6	4.2	2.6	68%	41%	1.2	0.5	85%	1,056	408
0.5	3.9	8.0	63%	38%	3.0	0.4	67%	6,023	753
2.4	5.6	2.3	21%	19%	1.5	0.6	79%	880	377
1.6	6.6	4.2	81%	70%	1.4	0.3	71%	1,512	360
4.8	7.7	1.6	88%	20%	1.1	0.7	67%	514	322
1.2	5.0	4.3	59%	35%	1.9	0.4	82%		

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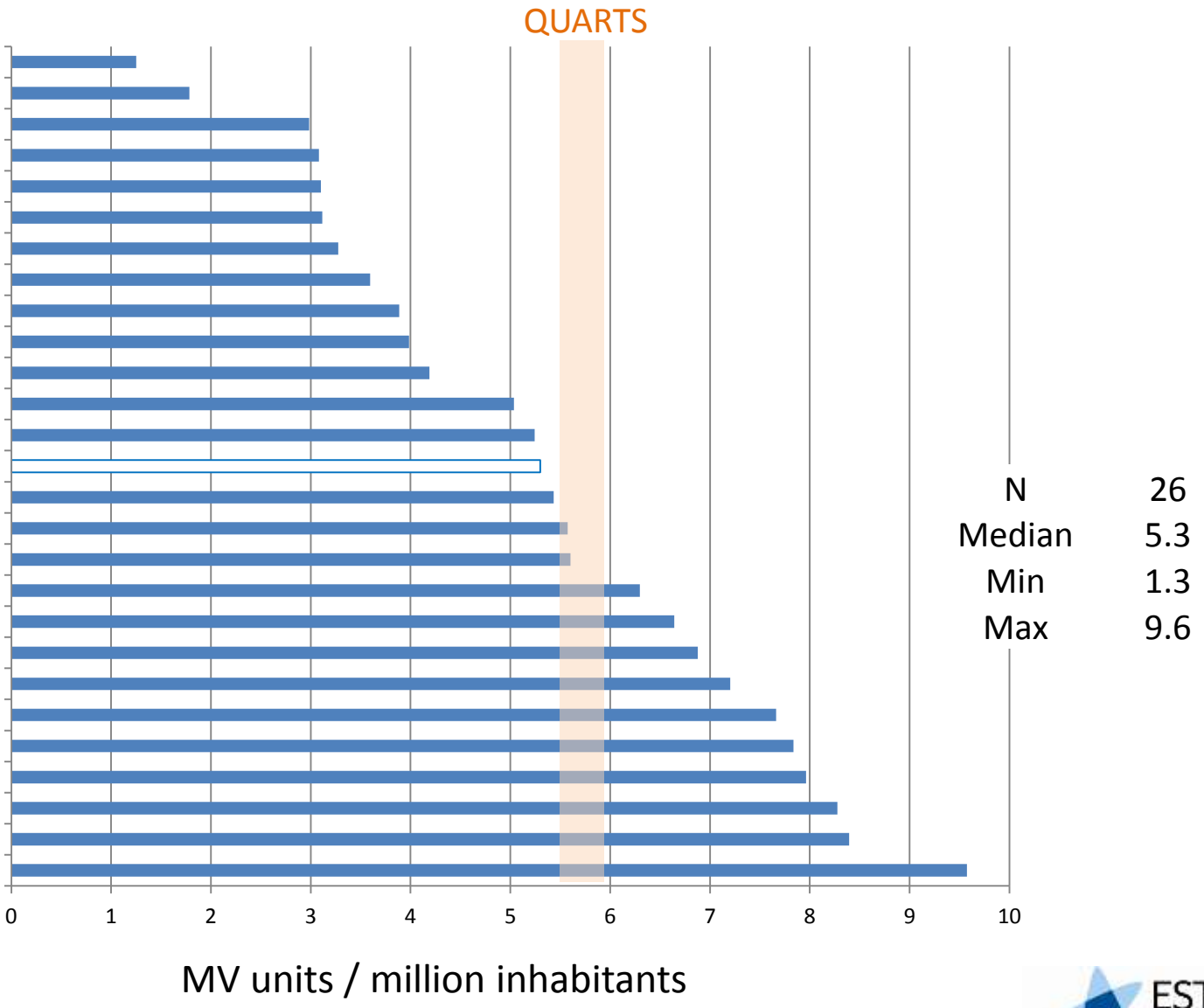
MV machines / million inhabitants



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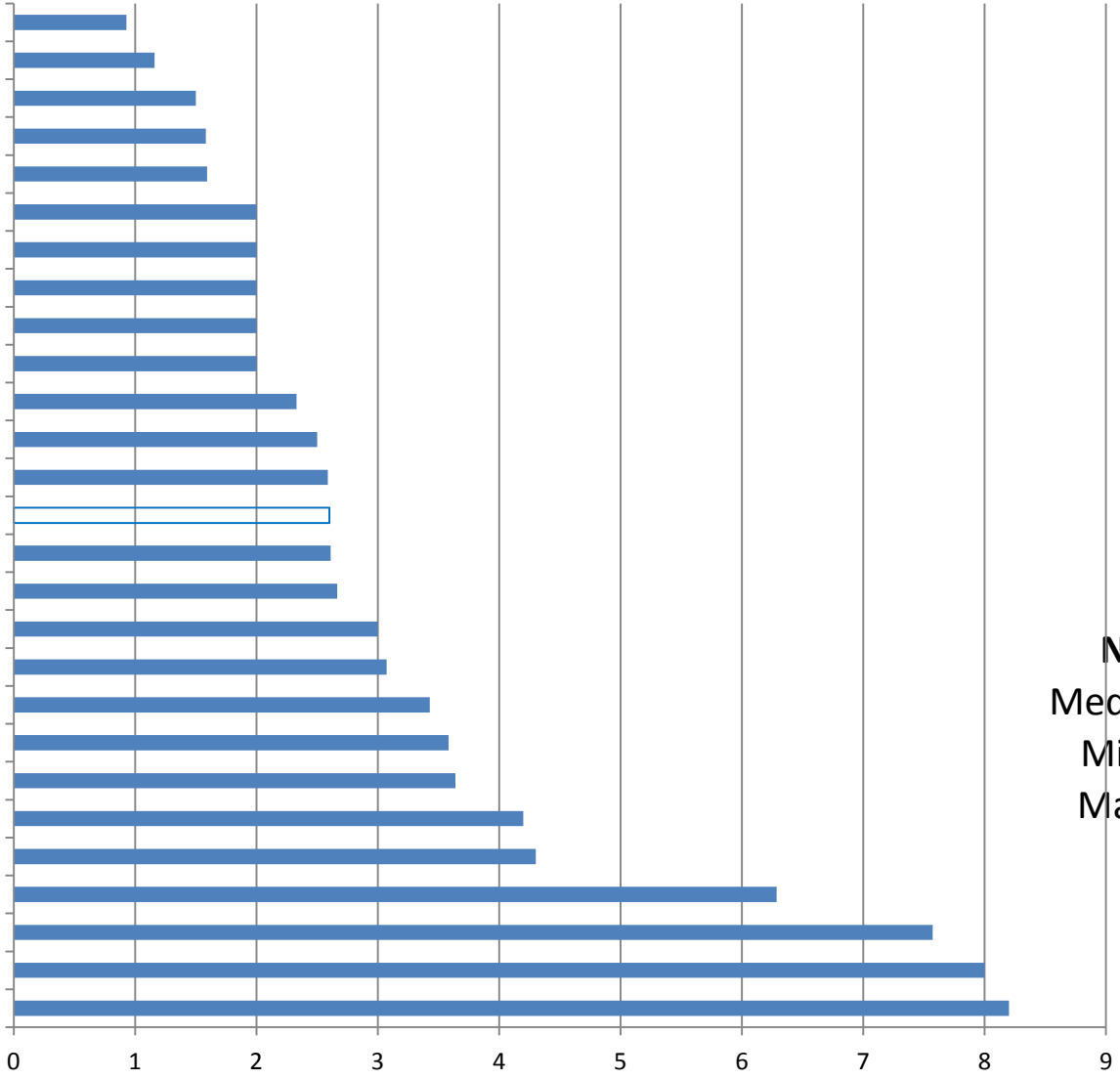
MV machines / department



N	26
Median	2.6
Min	0.9
Max	8.2

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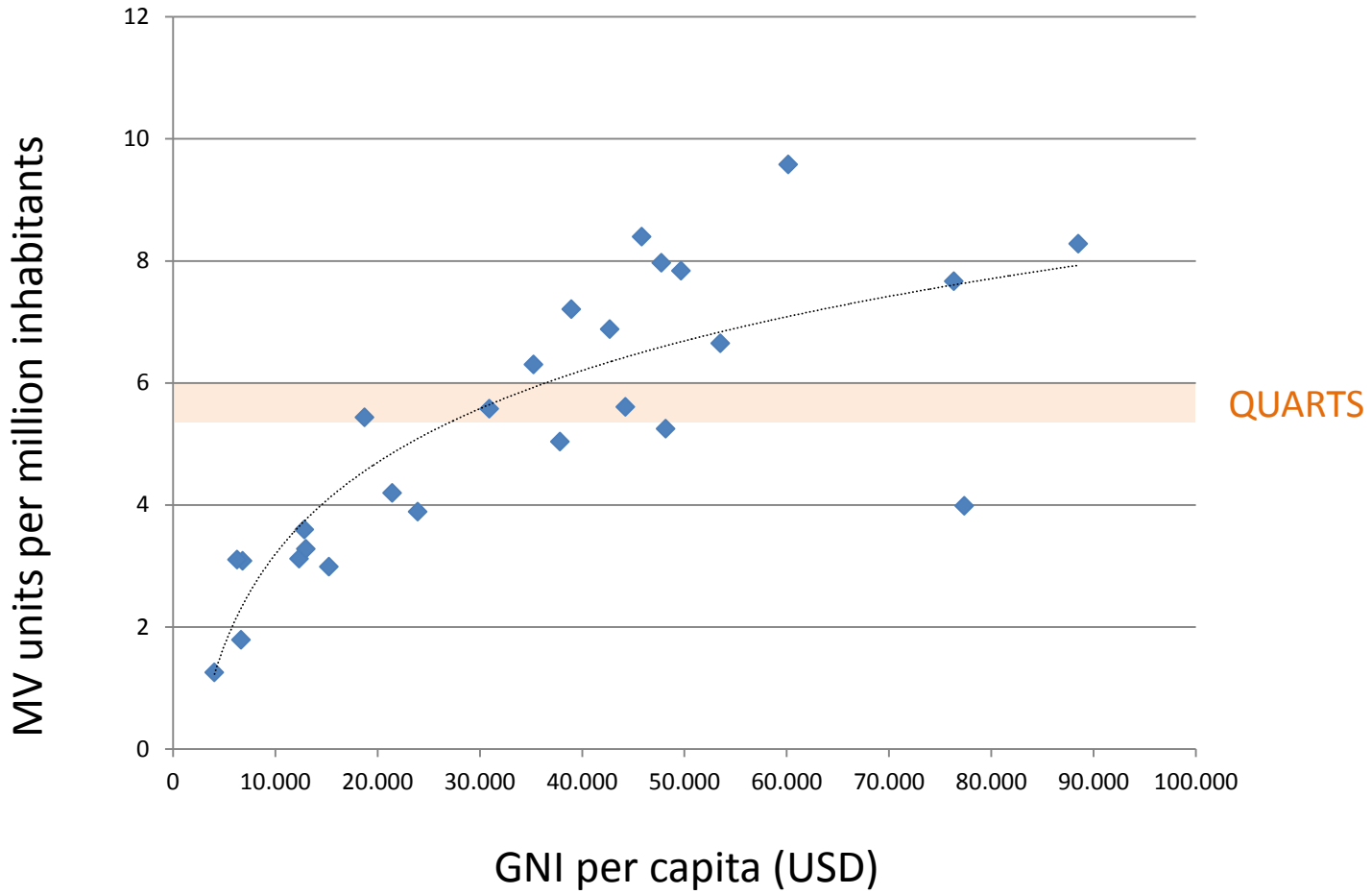
GNI/n and MV units per million



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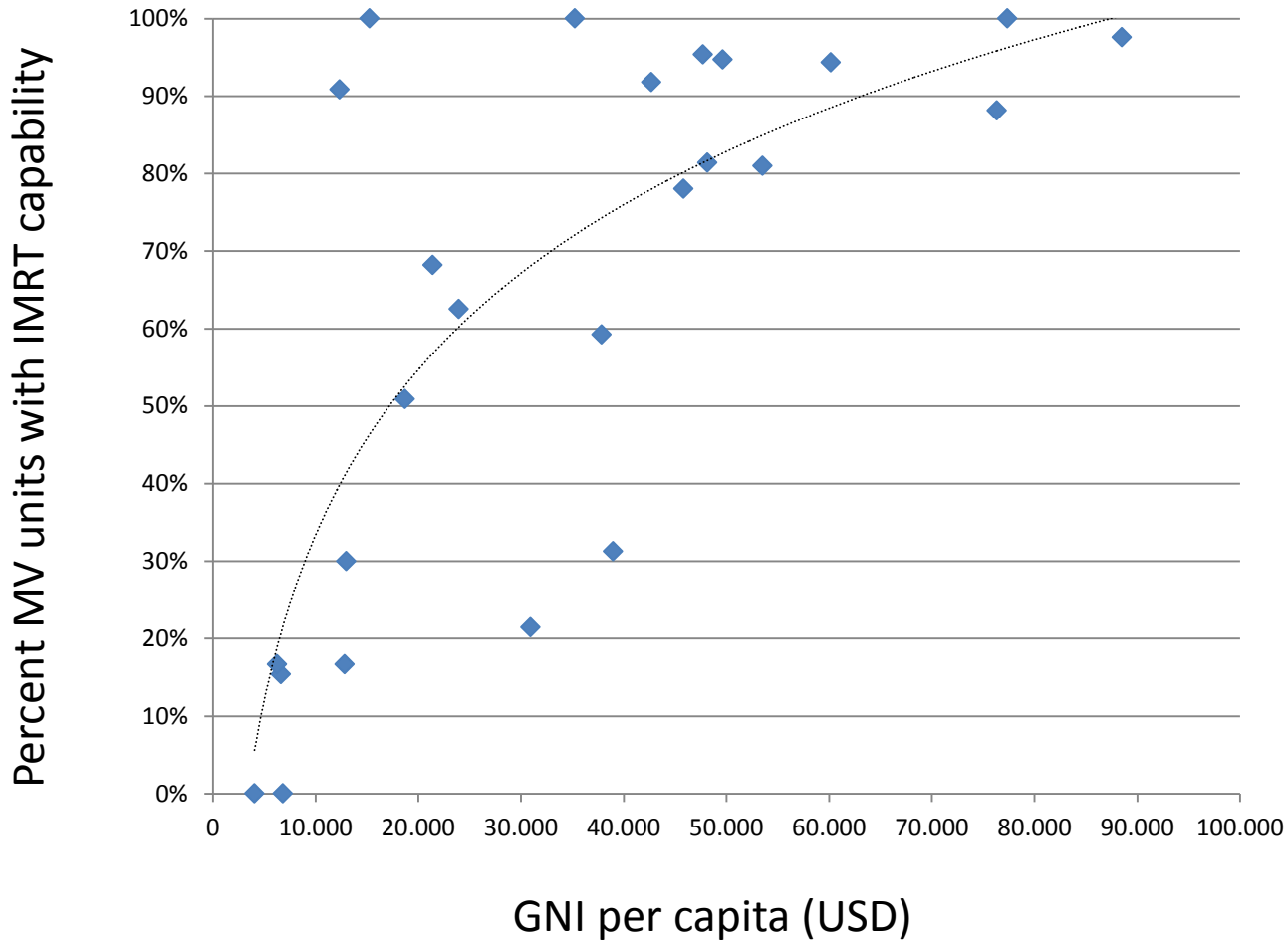
GNI/n and IMRT



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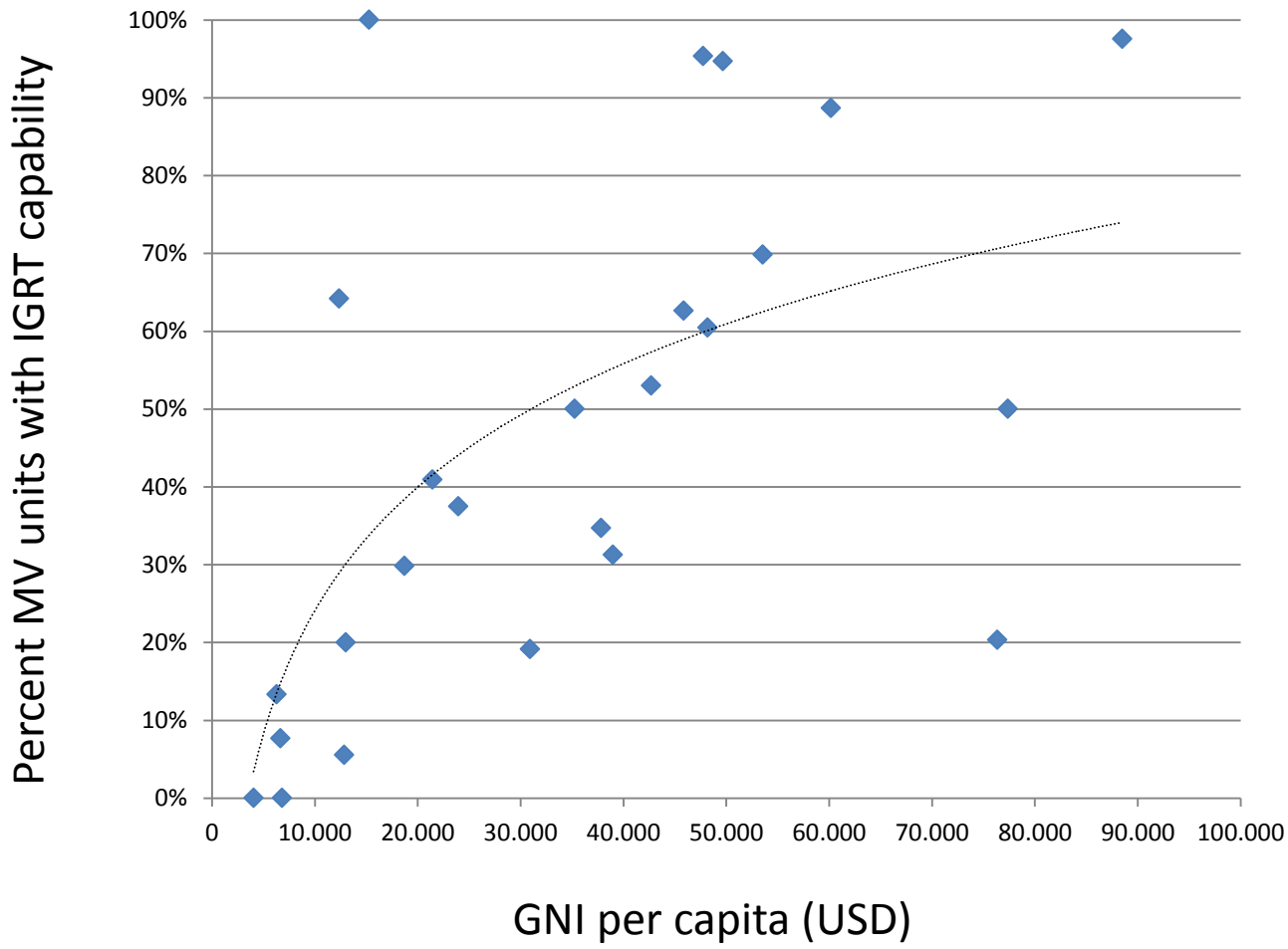
GNI/n and image guidance (IGRT)



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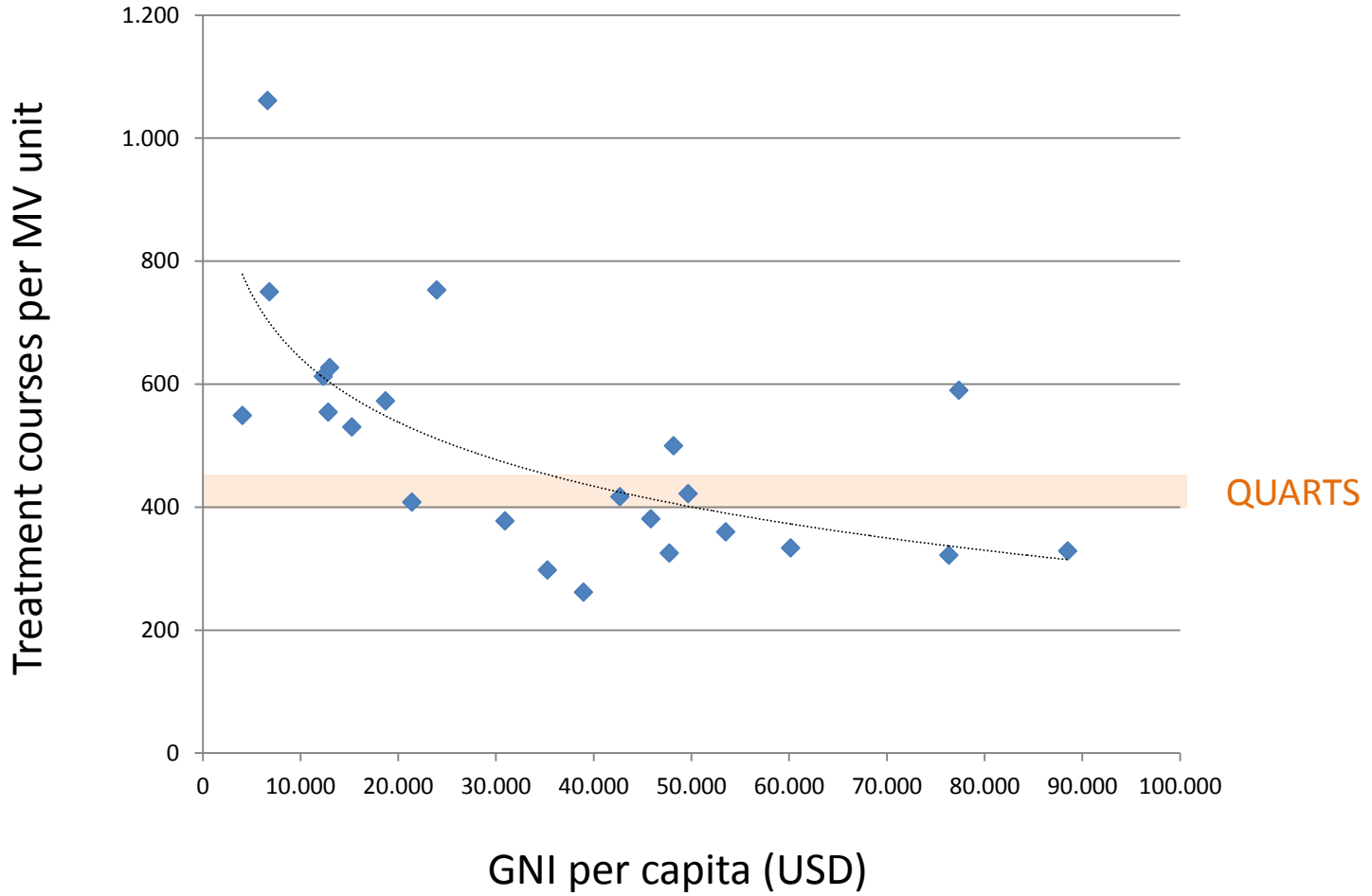
GNI/n and patients per machine

Patients = treatment courses (primary and re-treatments)



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Personnel data (n=24)

Population	GNI per capita 2011	Ref. year incidence	RT Courses	Ref. year staffing	Radiation Oncologists		Medical Physicists		Dosimetrists		Radiation Technologists		Radiotherapy Nurses		Radio-biologists	
					N	*FTE*	N	*FTE*	N	*FTE*	N	*FTE*	N	*FTE*	N	*FTE*
3,195,000	4,050	2010	2,195	2010	7	*7*	6	*6*	n.a.	*n.a.*	13	*13*	1	*1*	n.a.	*n.a.*
8,200,000	48,170	2010	21,481	2010 2013	n.r.	*95*	n.r.	*40*	n.a.	*n.a.*	301	*280*	n.a.	*n.a.*	n.r.	*8*
9,671,912	6,270	2009	n.r.	2009	117	*n.r.*	60	*n.r.*	20	*n.r.*	140	*n.r.*	150	*n.r.*	n.a.	*n.a.*
10,839,905	45,840	2012	34,672	2013	154	*138.5*	113	*107.9*	52	*45.3*	21	*20.6*	471	*403.1*	4	*4*
7,282,041	6,640	2012	13,794	2012	n.r.	*49*	n.r.	*23*	n.a.	*n.a.*	n.r.	*113*	n.r.	*98*	n.a.	*n.a.*
10,491,492	18,720	2009	32,630	2009	254	*n.r.*	56	*n.r.*	n.a.	*n.a.*	251	*n.r.*	n.r.	*n.r.*	20	*n.r.*
5,535,000	60,160	2010	17,680	2010	n.r.	*172*	n.r.	*89*	n.r.	*15*	n.r.	*55*	n.r.	*340*	n.r.	*1*
1,340,675	15,260	2008	2,122	2012	14	*14*	10	*10*	1	*1*	16	*16*	6	*6*	n.r.	*n.r.*
5,400,000	47,740	2010	13,994	2011	n.r.	*33*	n.r.	*45*	n.a.	*n.a.*	n.r.	*229*	n.r.	*n.r.*	n.r.	*n.r.*
65,281,000	42,690	2012	187,172	2012	670	*510*	n.r.	*528*	n.r.	*342*	n.r.	*1,950*	n.r.	*n.r.*	25	*n.r.*
10,014,324	12,840	2011	19,951	2011	90	*n.r.*	60	*n.r.*	8	*n.r.*	207	*n.r.*	n.r.	*n.r.*	3	*n.r.*
317,630	35,260	2010	595	2010	3	*2.6*	3	*2.2*	4	*3*	1	*0.8*	10	*7*	n.r.	*n.r.*
4,442,100	38,960	2009	8,373	2009	30	*30*	54	*54*	12	*12*	291	*249*	35	*35*	n.a.	*n.a.*
3,052,588	13,000	2011	6,268	2011	37	*35.5*	31	*27*	5	*5*	70	*67*	10	*10*	1	*0.5*
502,100	77,380	2010	1,180	2011	5	*4.9*	4	*4*	3	*2.5*	14	*13.5*	2	*2*	n.a.	*n.a.*
649,000	6,810	2011	1,500	2011	6	*5*	0*	*0**	n.a.	*n.a.*	4	*4*	11	*11*	n.a.	*n.a.*
16,847,007	49,660	2011	55,683	2011	256	*231*	119	*115*	n.a.	*n.a.*	1,302	*1,079*	n.a	*n.a*	n.r.	*n.r.*
4,953,000	88,500	2010	13,483	2011	n.r.	*135*	n.r.	*46*	n.a.	*n.a.*	n.r.	*267*	n.a	*n.a*	n.r.	*n.r.*
38,529,866	12,340	2010	73,500	2012	471	*471*	97	*97*	n.a.	*n.a.*	900	*900*	19	*19*	n.r.	*n.r.*
10,500,000	21,420	2010	17,957	2012	113	*107*	94	*94*	73	*73*	317	*317*	130	*130*	2	*2*
2,058,000	23,940	2012	6,023	2013	31	*27*	11	*11*	10	*10*	81	*78.5*	n.a.	*n.a.*	n.a.	*n.a.*
46,815,916	30,930	2011	98,525	2013	702	*579*	n.r.	*n.r.*	n.r.	*n.r.*	n.r.	*n.r.*	n.r.	*n.r.*	n.r.	*n.r.*
7,700,000	76,350	2009	19,000	2009	110	*98.3*	83	*75.3*	7	*6*	312	*274*	110	*72.3*	3	*3*
62.348.845	37.840	2010 2011	n.r.	2010 2011	683	*580.3*	1.246	*1.264.6*	43	*41.7*	2.763	*2.957.2*	403	*440*	n.r.	*n.r.*

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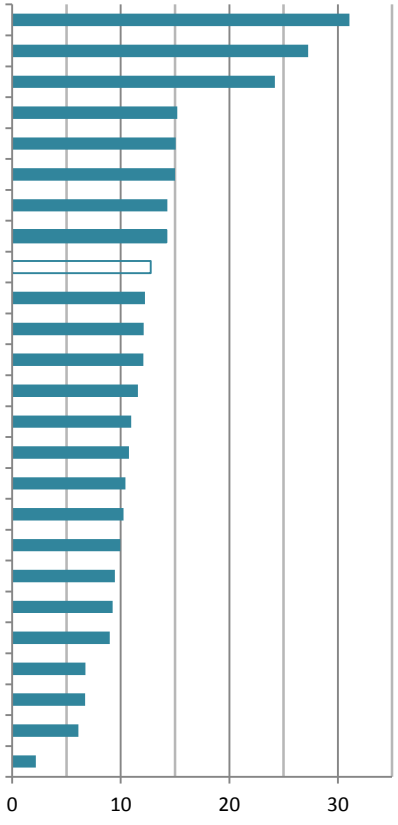
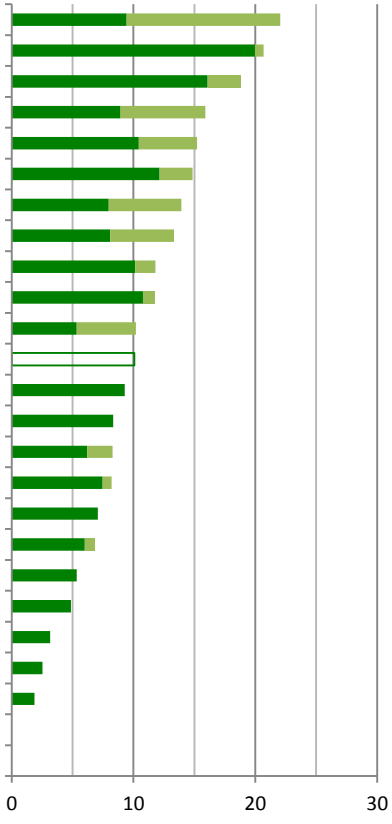
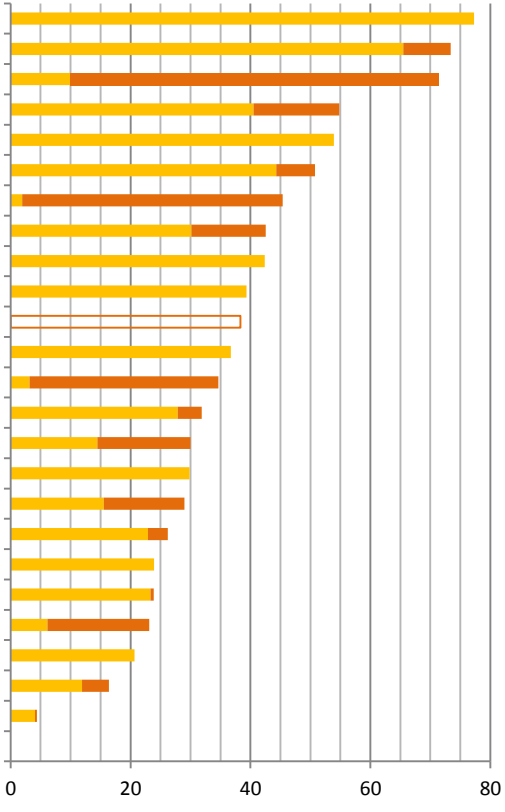
Personnel per million inhabitants



Radiation Oncologists
12,8/MI *(2,2 – 31,1)*



MP & Dosimetrists
10,1/MI *(1,9 – 22)*



RTT & RT nurses
38,3/MI *(4,4 – 77,3)*

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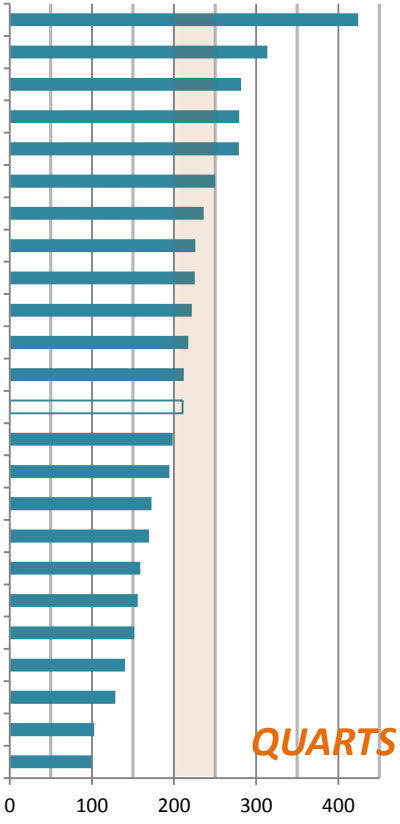
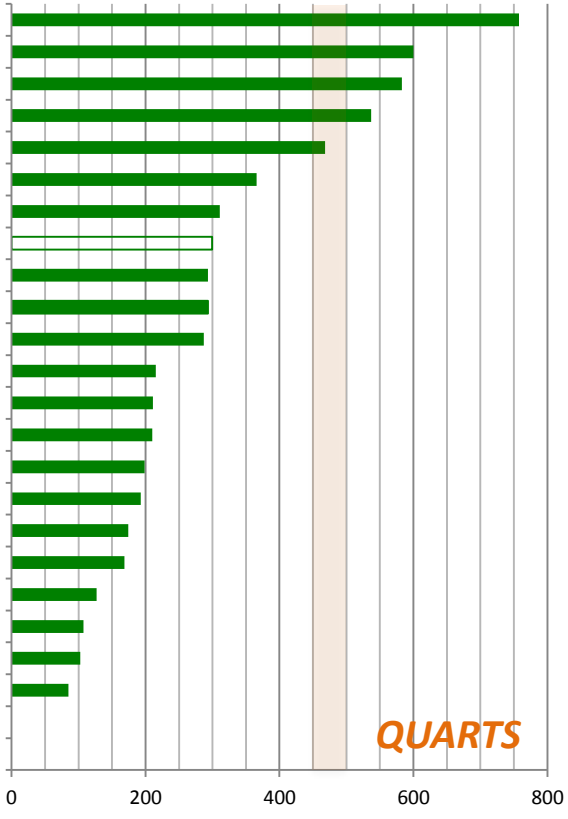
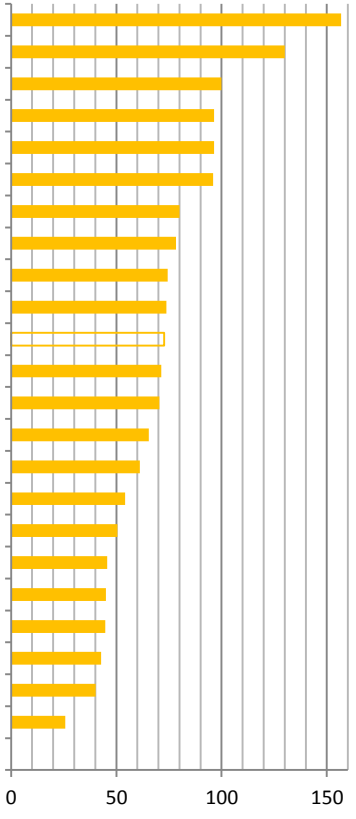
Radiotherapy courses per personnel



Radiation Oncologists
210,4 *(99,9 – 424,1)*



MP + Dosimetrists
299,4 *(85 – 757,7)*



RTT + RT nurses
72,7 *(25,7 – 77,3)*

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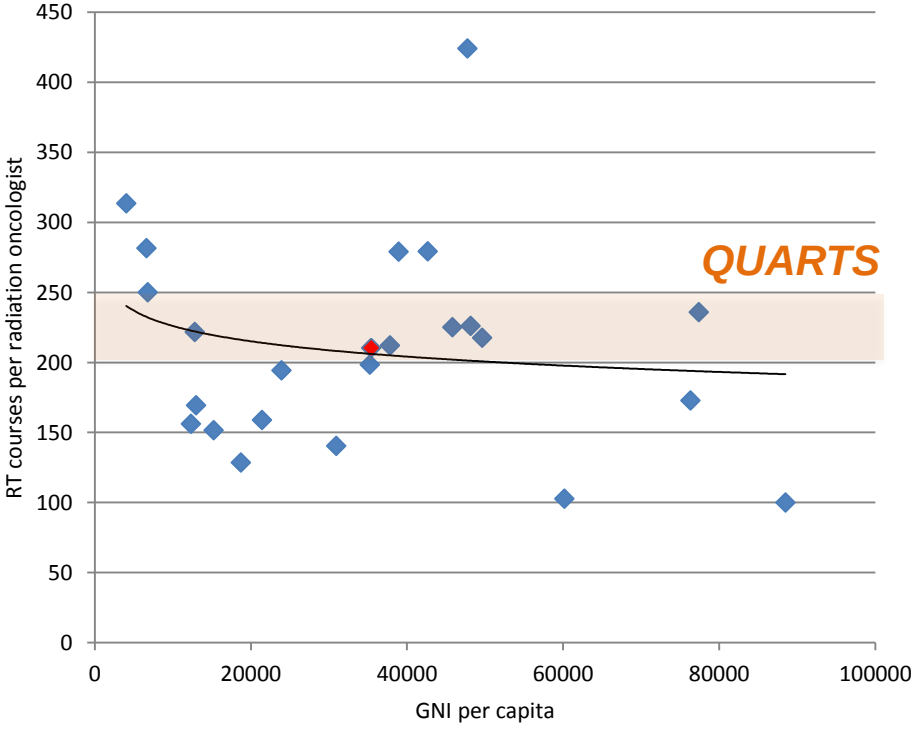
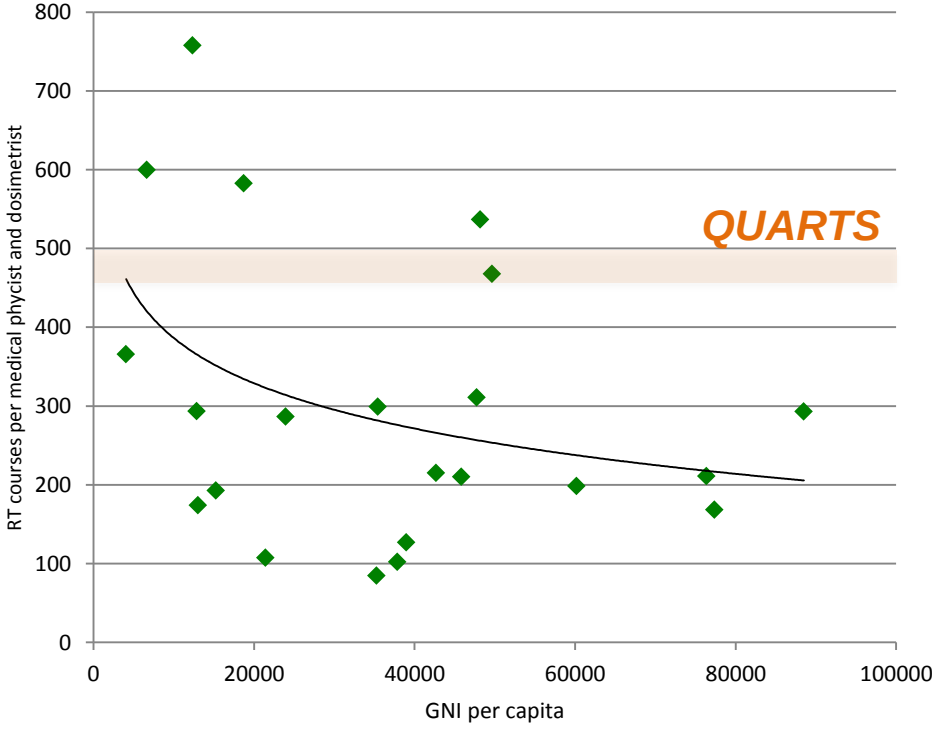
GNI/n vs. RT courses per personnel



Radiation Oncologists



MP & Dosimetrists

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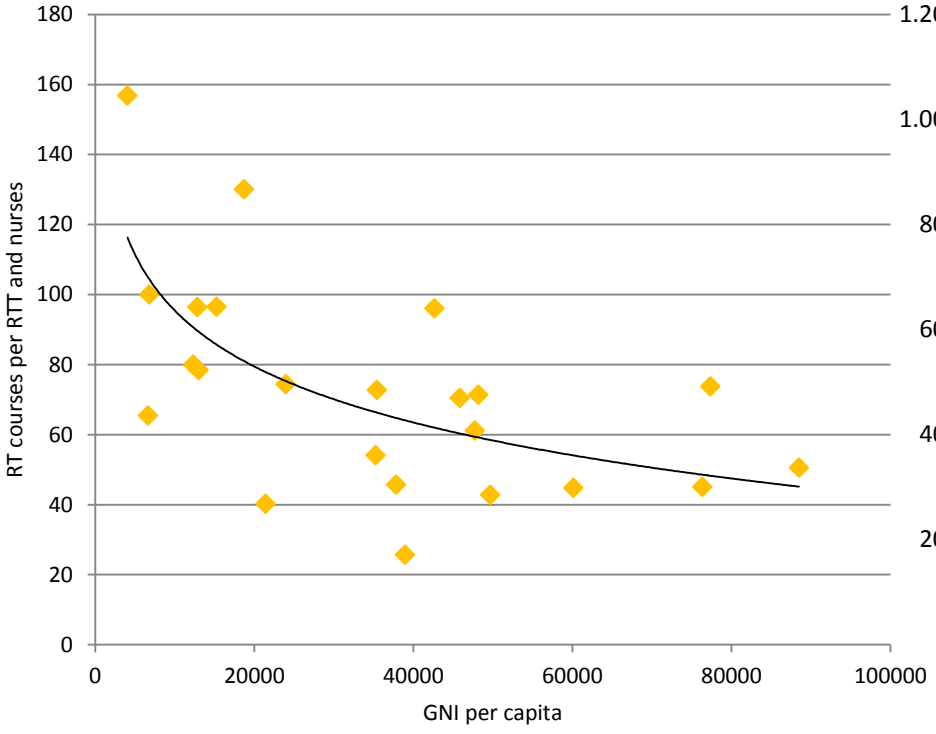
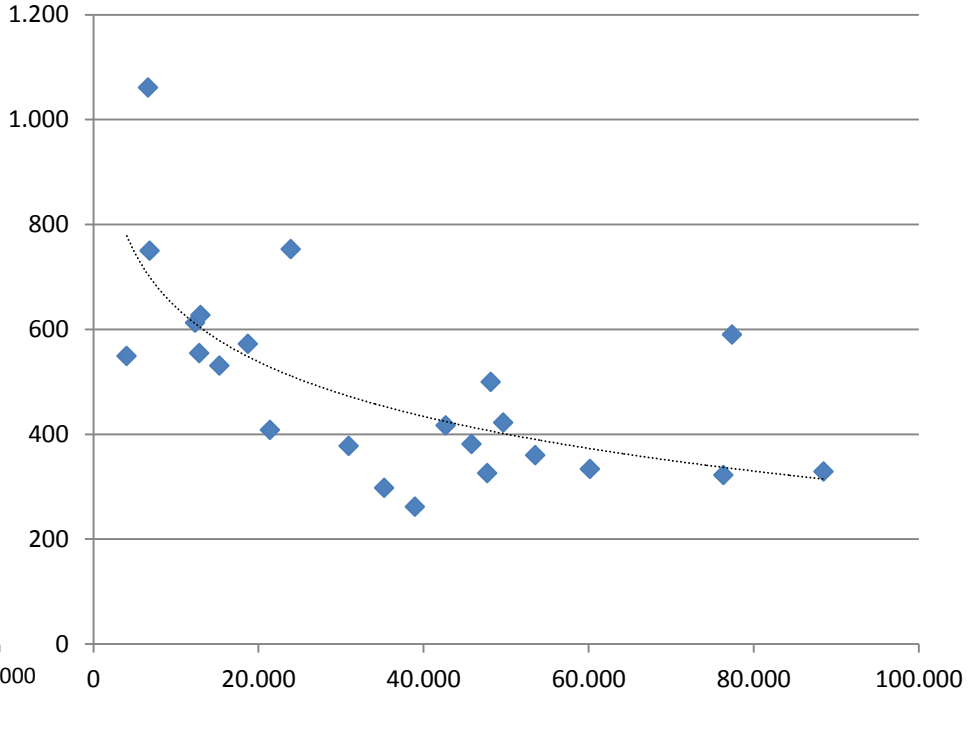
GNI/n vs. RT courses per personnel



RTTs and radiotherapy nurses



GNI/n vs courses per machine

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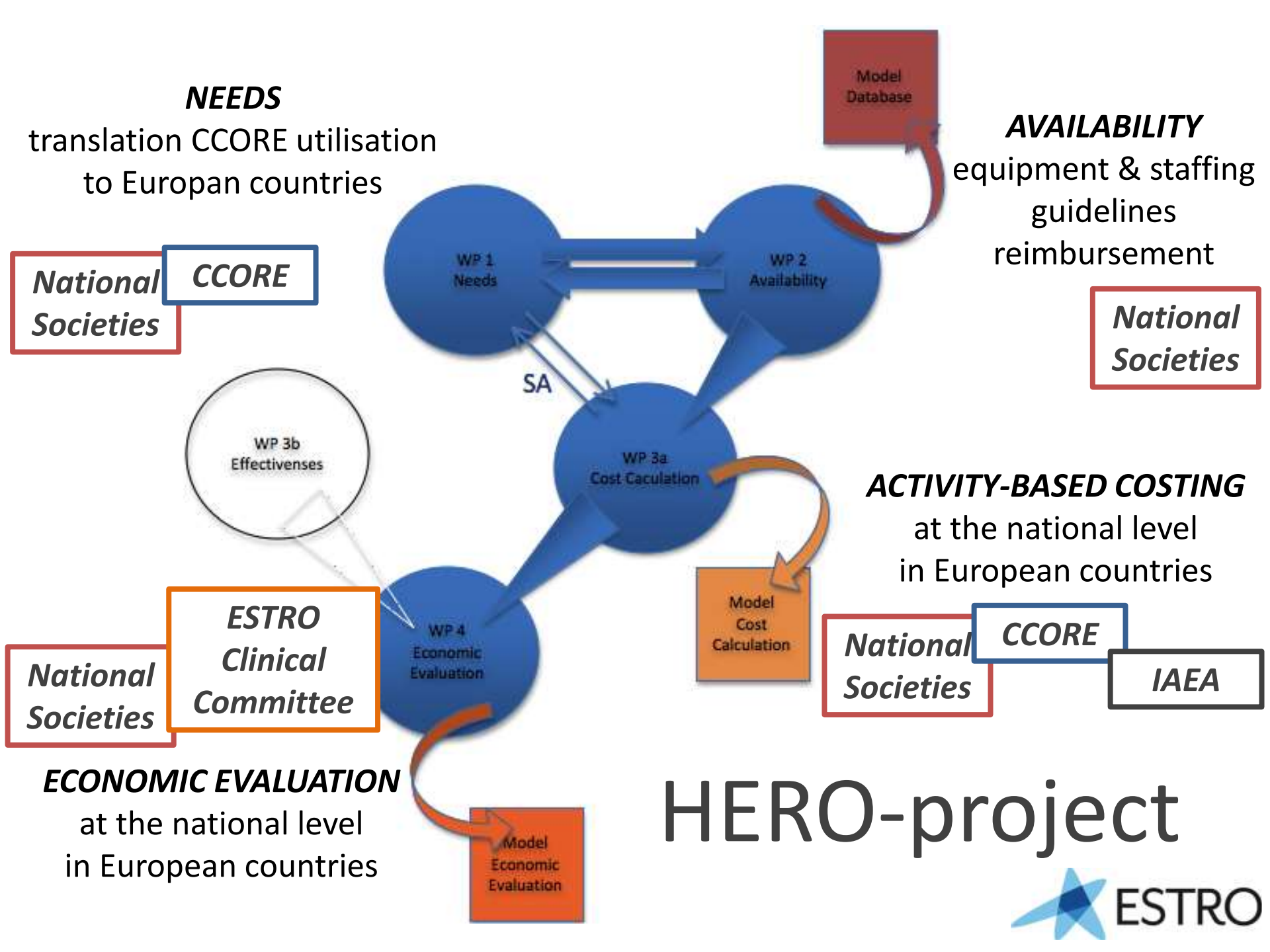

NEEDS
translation CCORE utilisation
to Europan countries
National Societies
CCORE
Model Database
AVAILABILITY
equipment & staffing
guidelines
reimbursement
National Societies
WP 1 Needs
WP 2 Availability
SA
WP 3b Effectivenses
WP 3a Cost Caculation
ACTIVITY-BASED COSTING
at the national level
in European countries
Model Cost Calculation
National Societies
CCORE
IAEA
ESTRO Clinical Committee
National Societies
WP 4 Economic Evaluation
ECONOMIC EVALUATION
at the national level
in European countries
Model Economic Evaluation
HERO-project
ESTRO

European RT Guidelines

Guidelines for Radiotherapy Resources in Europe: A HERO Project

P Dunscombe[1], C Grau[2], N Defourny[3], B Slotman[4], J Malicki[5], JM Borras[6], M Coffey[7], M Bogusz[8], C Gasparotto[9], Y Lievens[10]

Aim: ESTRO's Health Economics in Radiation Oncology (HERO) project has as its overarching aim the development of a knowledge base and model for the health economic evaluation of radiation treatment in Europe which can then be used in the design and justification of appropriate services for the populations of European countries.

Introduction:

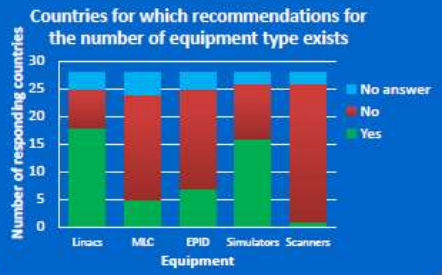
- In this component of the HERO project, the availability of guidelines for radiotherapy equipment infrastructure and staffing is examined.
- Under the QUARTS umbrella, a similar survey of European nations was undertaken ten years ago (Radiother Oncol 2005;75:349-54) thus affording the opportunity to identify any significant changes in guideline development over time.

Materials and Methods:

- In 2011 an 84 part questionnaire was sent out to all 43 nations of greater Europe, as defined by the European Cancer Observatory , principally through their national societies.
- A request to update responses was made in early 2013 with direct contact made where no response was received.
- This analysis of the 27 questions related to guidelines on radiotherapy capital and human resources was conducted in early 2014, and is based on partial or complete responses from 28 countries.

Future Plans: The HERO project is currently addressing the needs for and availability of radiotherapy services in Europe and will shortly progress to an examination of costs followed by evaluations of cost effectiveness.

Results: The figure shows a small sample of the results of the survey.



Other observations from the data:

- 64% of the responding countries do have plans to meet future radiotherapy needs.
- Guidelines for the lifetimes of treatment machines and simulators appear not to have changed over ten years.
- Current staffing guidelines show some evidence of a reduction in workload compared with the QUARTS survey.
- In 68% of countries treatment planning is carried out by Medical Physicists with or without others. In the remaining 32% of countries Medical Physicists appear not to be involved in this activity.
- Metrics used vary considerably. For example, in determining the number of linacs required some countries use the number of inhabitants [36%] while others use patient numbers [36%] .

Lead: P. Dunscombe and B. Slotman

3 publications

Equipment
Staffing
Guidelines

May 2014

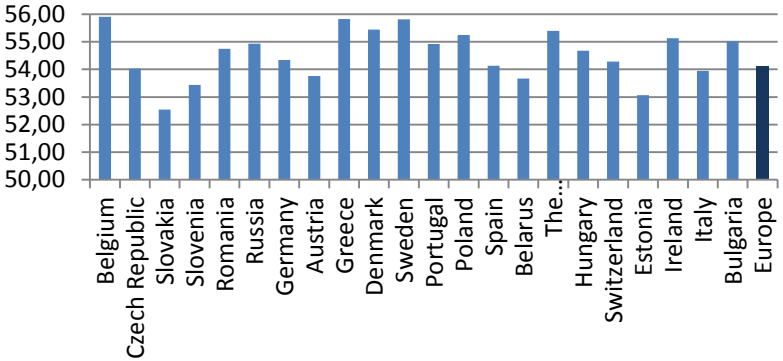
European RT Needs Estimation

Lead: JM Borras

Updated 2013 CCORE analysis

Radiotherapy Utilisation Rate: 48,3%

Radiotherapy Utilisation Rate
2012 – cancer types



Radiotherapy Utilisation Rate
2012 – tumor stages

Rectal cancer CCORE: 61%	←→ 52% to 67%
Prostate cancer CCORE: 60%	←→ 56% to 64%
Head and Neck CCORE: 78%	←→ 72% to 88%
Lung Cancer CCORE: 76%	←→ 73% to 80%
Breast cancer CCORE: 83%	←→ 81% to 83%

Translation to selected European countries

Integrate country-specific variations in **cancer types** and **stages**

Belgium, Slovenia, Poland, The Netherlands

Estimate the European need for radiotherapy

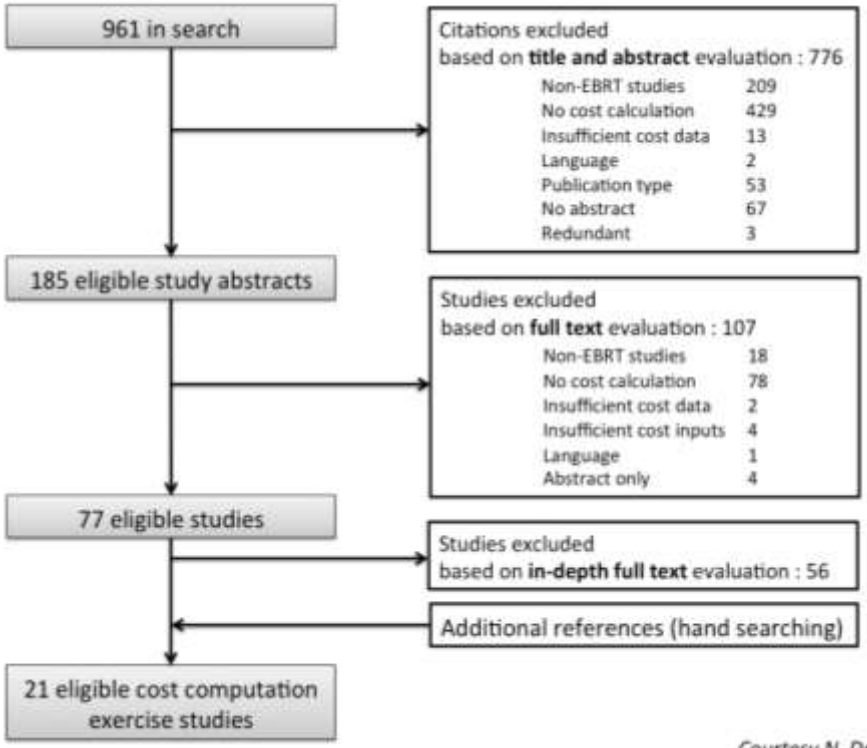
Compare with the actual use of RT

Summer 2014

European RT Cost Calculation Model

Lead: Y Lievens, N Defourny

activities consume resources
to produce products



Courtesy N. Defourny

Definition model input variables (resources, activities, treatments)
Development of the model
Test-phase in selected countries
Computation of RT cost in European countries

Q2 2015

Conclusions

- Although the European average number of MV machines per million inhabitants and per department is now better in line with QUARTS recommendations from 2005, there is still a **significant heterogeneity** in the access to radiotherapy equipment in Europe
- While **high income countries** especially in Northern-Western Europe are **well-served** with radiotherapy resources, other countries are facing important **shortages** of both equipment in general and machines capable of delivering high precision conformal treatments (IMRT, IGRT)

Conclusions

- The average personnel figures in Europe are **consistent** with the **QUARTS** recommendations.
- A **3 to 5-fold variation** in available personnel and workload is observed among the highest and lowest staffing levels.
- This reflects different cancer **incidence** and **socio-economic** determinants, but also the variation in **technology adoption** and in **professional roles and responsibilities** within each country.
- Our data underpin the need for accurate **prediction models** and long-term **training programs**.

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