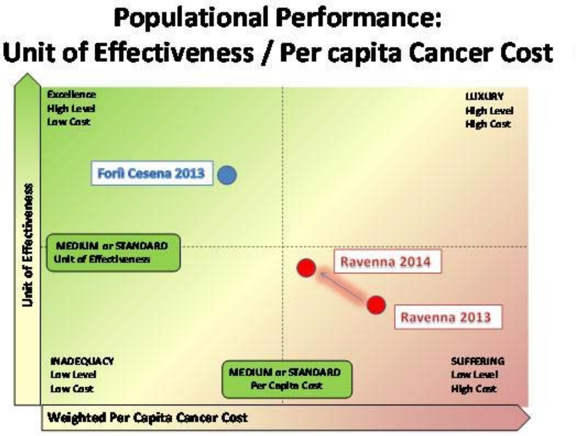

Fig.2 Indicator results

Indicators	2013 Ravenna	2014 Ravenna	2013 Forlì Cesena
Waiting times for treatments (Performance Index to 30 days)	35%	76,9%	31%
% Advanced treatment (V-MAT - IMRT)	23%	48%	53%
Passive migration to other areas	55%	41%	14%
Average access to treatment	19	15	14

Conclusion: Investments in technological upgrades in public services can result in increased efficiency and productivity levels, while improving service quality, decreasing costs and reducing service duplication and overlapping. Our preliminary findings suggest the applicability of our model to the full cancer care pathway

PO-0786

Could a 3-tier teleradiotherapy network provide a cost-effective radiotherapy care in LMICs?

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Purpose or Objective: Information and communication technologies (ICTs) have enabled cost-effective eHealth programmes gain wider acceptance in a range of health disciplines. However, this is yet to be evaluated in radiotherapy (RT), especially in low- and middle income countries (LMICs). We explored the use of ICTs to create a 3-tier network of teleradiotherapy centres (RTC), namely - primary (PRTC) with 1 teletherapy (TRT) unit; secondary (SRTC) with 2 TRT units and brachytherapy (BRT); and tertiary RT centre (TRTC) with state-of-the-art RT facilities. The cost-effectiveness of this network was evaluated for 10 adjoining countries in middle and east Africa.

Material and Methods: Seven of the 10 countries (Gabon, Congo Republic, Congo DR, Central African Republic, South Sudan, Rwanda and Burundi) have no RT facilities for their 123.6 million inhabitants. Remaining 3 countries (Uganda, Kenya and Tanzania) have in total 11 TRT and 6 BRT units. Thus, presently, only 2.3% of 262.2 million people have RT access in these 10 countries. Based on the regional population density and location of current centres, 6 PRTCs, 2 upgraded PRTCs (with BRT), 6 SRTCs and upgradation of an existing centre to SRTC are proposed. These could be networked to share the available resources. With DICOM RT compatible data sets, ICTs could facilitate an easy exchange of patient information between centres. Consequently, patients at PRTC with a standalone TRT unit could deliver RT based on treatment plans derived at SRTC. Similarly patients treated at PRTC could receive brachytherapy at SRTC. TRTC could cater to specialized RT techniques not feasible either at PRTC or SRTC. Thus, patients within the 3-tier network would have access to state-of-the-art technology in a shared step-wise manner.

Results: The total cost of the infrastructure, networking, maintenance and incidentals is estimated around US$ 66.25 million. With a total of 32 TRT and 15 BRT units provided in this network, the RT accessibility would enhance from 2.3% to 30.7% (9.2%-76.9%). The mean cost of this investment for the 262.2 million inhabitants would be around US$ 0.69 per inhabitant (US$ 0.12-2.22) while the average cost in terms of individual patients receiving RT is estimated to be US$ 374 (US$ 71.67-508.33). Capacity building could be undertaken through telementoring by linking to regional or international centres of excellence and professional societies through multisectoral collaborative efforts.

Conclusion: The 3 tier-teletherapy network with ICTs could provide cost-effective comprehensive RT care by overcoming the geographical barriers by optimizing resource sharing, pedagogical telementoring and capacity building. This could lead to scalable, equitable, affordable and improved RT access to patients of the region. The approach could be explored for other underserved LMICs and executed with the help of respective national and international stakeholders.

PO-0787

Abstract withdrawn

PO-0788

Predicted patient demand for MRI Linac

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Purpose or Objective: MRI offers superior soft tissue delineation compared to CT. When incorporated in to a linear accelerator (MRI Linac), it could improve temporal resolution and dynamic visualisation of the target during treatment allowing for motion compensation and real-time adaptive planning. This study investigated the predicted patient demand for radiotherapy delivered via a MRI Linac for prostate and lung cancer at a large comprehensive cancer centre to ensure that any clinical research will be achievable.

Material and Methods: Local stage data was sourced from hospital databases and the UK NHS CASCADE system. Indications for MRI Linac were obtained by consulting with the specialist clinical leads for prostate and lung cancers. Locally advanced patients where soft tissue definition would be clinically advantageous were identified (T3/4 prostate, stage 2/3 non-small cell lung cancer [NSCLC] including superior sulcus tumours and limited stage small cell lung cancer [SCLC] with good performance status). The Malthus programme was used to estimate the demand for MRI Linac. The Malthus programme is an evidence based, predictive mathematical model, based on regional population and incidence data, mapping around 2,000 clinical decisions relating to radiotherapy for 23 different cancer sites.

Results: The catchment area of the comprehensive cancer centre in the study is approximately 3.2 million people. For prostate, the total projected incidence for 2015 was 1,983 cases, of which 436 high risk patients were predicted to be eligible for MRI Linac. For lung, the total projected incidence for 2015 is 2,634 cases. Of these, a total of 360 patients were identified as suitable for MRI Linac (table 1). Approximately 92 of the NSCLC's were considered superior sulcus tumours.

Table 1. Estimated number of patients eligible for MRI Linac according to stage and type of lung cancer.

Disease & Stage	Estimated number for MRI Linac
NSCLC	
Stage 2	94
Stage 3a	169
Stage 3b	45
SCLC	
Limited	52
Total	360

Conclusion: The potential cohort is estimated at 796 eligible patients for MRI Linac in lung and prostate cancer. In the context of lung and prostate cancer, we estimate during the initial research phase that we will treat around 180 patients per year on one machine. Therefore, the estimated number of eligible patients far exceeds the estimated throughput for a single MRI Linac machine. This has positive implications for its use as a research tool. Even after accounting for patients who will inevitably decline entry to clinical trials, the estimated eligible patient population is such that trials should still have sufficient recruitment; this is especially important for rare indications such as superior sulcus tumours.

PO-0789

Treatment time in breast irradiation: a trade-off between positioning and complexity.

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Purpose or Objective: In whole breast irradiation (WBI), different approaches are used to spare the organs at risk, including intensity modulation and altered positioning. These may however come at the cost of longer treatment times, which in turn may slow down adoption in daily clinical practice. To document the impact of different approaches, time measurements were performed, following a strict protocol.

Material and Methods: A time-and-motion study was carried out using a 'continuous timing' method (running chronometer with defined intervals), according to the following protocol:
- Positioning time: Patient in bunker - Start Cone Beam CT (CBCT)
- CBCT recording time: Start CBCT - Stop CBCT
- Adaptations: Stop CBCT - Beam on
- Irradiation time: Beam on - Beam off
- Patient recovery time: Beam off - Patient exits bunker

Time measurements were categorized per position, technique and target. Positioning time is reported over all patients, irradiation time per category, in absolute time and, to correct for dose and volume differences, in Irradiation Time per 100MU's (ITcMU). Statistical analysis was performed using parametric testing, i.e. the One Way Anova.

Results: Registration was performed in 86 patients, of which 47 in prone and 39 in supine position. Positioning time was measured in 74 patients, and irradiation time in 86. Results are listed in table 1.

Treatment characteristics (n=86)								
Supine				Prone				
39				47				
Without lymph node irradiation				With Lymph nodes				
65				21				
WBI		SIB		Thoracic Wall		Tumorbed		
36		28		12		10		
IMRT without table rotation		IMRT with table rotation		VMAT		Single-arc VMAT		
52		21		6		7		
Positioning time (per fraction) (n=74)								
Supine (n=28)				Prone (n=42)				Significance (One way Anova)
00:03:52				00:05:03				p=0,01
WBI (n=32)		SIB (n=19)		Thoracic wall (n=9)		Tumorbed (n=10)		
00:04:45		00:04:49		00:03:44		00:04:18		p=0,5
Without Lymph nodes (n=56)				With Lymph nodes (n=14)				
00:04:46				00:03:49				p=0,1
Irradiation time (ITcMU) (n=86)								
Supine (n=37)				Prone (n=45)				
00:00:53				00:01:10				p=0,002
WBI (n=34)		SIB (n=27)		Thoracic wall (n=11)		Tumorbed (n=10)		
00:01:06		00:00:54		00:01:02		00:01:11		p=0,1
IMRT without table rotation (n=48)		IMRT with table rotation (n=21)		VMAT (n=6)		Single-arc VMAT (n=7)		
00:01:02		00:01:11		00:01:18		00:00:29		p<0,001
No LNI (n=37)	LNI (n=11)	No LNI (n=17)	LNI (n=4)	No LNI (n=5)	LNI (n=1)	No LNI (n=3)	LNI (n=4)	
00:00:59	00:01:10	00:01:14	00:00:57	00:01:20	00:01:07	00:00:22	00:00:34	
"WBI only" irradiation time (ITcMU) (n=32)								
Supine (n=5)				Prone (n=27)				
00:01:03				00:01:05				p=0,8
IMRT without table rotation (n=28)			IMRT with table rotation (n=4)			VMAT (n=1)		
00:01:04			00:01:21			00:00:40		p=0,08
"WBI only" irradiation time (per fraction dose 2,67Gy) (n=32)								
Supine (n=5)				Prone (n=27)				
00:04:38				00:02:59				p=0,02
IMRT without table rotation (n=27)			IMRT with table rotation (n=4)			VMAT (n=1)		
00:03:07			00:04:34			00:01:30		p=0,08
"Overall" irradiation time (per treatment) (n=55)								
No LNI						LNI		
Hypofractionation WBI		Hypo-fractionation SIB	Acceleration SIB			Hypofractionation TxW	Acceleration TxW	
Supine (n=5)	Prone (n=19)	Prone (n=4)	Supine (n=11)	Prone (n=4)		Supine (n=9)	Supine (n=3)	
01:09:39	00:43:35	01:16:56	00:35:37	00:35:46		01:35:16	00:41:55	
Acceleration (5 fractions)				Hypofractionation (15 fractions)				
IMRT (n=9)	IMRT with table rotations (n=3)	VMAT (n=1)	Single-arc VMAT (n=3)		IMRT (n=28)	IMRT with table rotations (n=8)	VMAT (n=3)	
00:36:50	00:43:20	00:40:40	00:17:10		00:46:46	01:12:45	01:09:45	

Abbreviations: WBI = Whole breast irradiation; SIB = Simulatineously integrated boost; IMRT = Intensity modulated radiotherapy; VMAT = Volumetric modulated arc therapy; ITcMU = irradiation time per 100 monitor units.

Positioning time per session was on average 1'11" longer for prone than for supine. This difference is confirmed in "WBI only", simultaneous integrated boost (SIB) and tumor bed irradiation, all three predominantly performed in prone, in contrast to two purely supine positions: thoracic wall and "lymph node included" irradiation.
ITcMU was 17" faster for supine versus prone positioning. Looking into hypofractionated WBI only, no difference was observed in ITcMU, but irradiation time per fraction was 1'40" longer for supine versus prone position. The mean number of gantry positions for prone and supine position was respectively 2 and 5, signifying less complex planning in prone to obtain equivalent dosimetric results.
Single-arc Volumetric Modulated Arc Therapy (VMAT) resulted in less than half of the irradiation time needed compared to IMRT or normal VMAT used for similar target or position.

Conclusion: Prone position comes at the cost of longer positioning time, but reduces irradiation time as a result of less need for complex planning, especially for WBI and sequential boosting. Although fraction time increases when using acceleration, overall irradiation time decreases, which compensates for potentially higher time demands of more complex treatment techniques. Single-arc VMAT reduces longer fraction times. These data will be used for balancing the costs and effects of the different approaches.