

IntelliMax

Case Study no 2019/09/16

Utilization of Hospital Equipment and IntelliMax Analytics

Background

Sophisticated and expensive equipment is now the order of the day in most modern hospitals. The cost, effectiveness and utilization of equipment is often unclear and information about this is hidden in a myriad of systems.

IntelliMax pulls data together from Fixed Asset registers, Financial systems, Patient management systems and other operational systems to provide a comprehensive picture about the cost and utilization of all major equipment items in a hospital and then relate this to how patient consume the equipment and effect that this has on the cost-to-serve the patient.

Equipment Analysis

1. Introduction:

For many years, x-ray imaging, computed tomography (CT), and ultrasound (US) have been the preferred imaging modalities for cervix and prostate brachytherapy treatment planning. However, in recent years, MRI equipment has been increasingly used in treatment planning for brachytherapy - with its excellent soft-tissue contrast, MRI is well suited for staging, treatment planning, monitoring of treatment response and surveillance after treatment in many cancer sites. Unfortunately, MRI equipment comes at a high cost - in the following case study, equipment costs are investigated with a view to improving the hospital's overall financial performance.

Equally so, there are numerous other highly advanced and expensive equipment items that can be analysed in the same way.

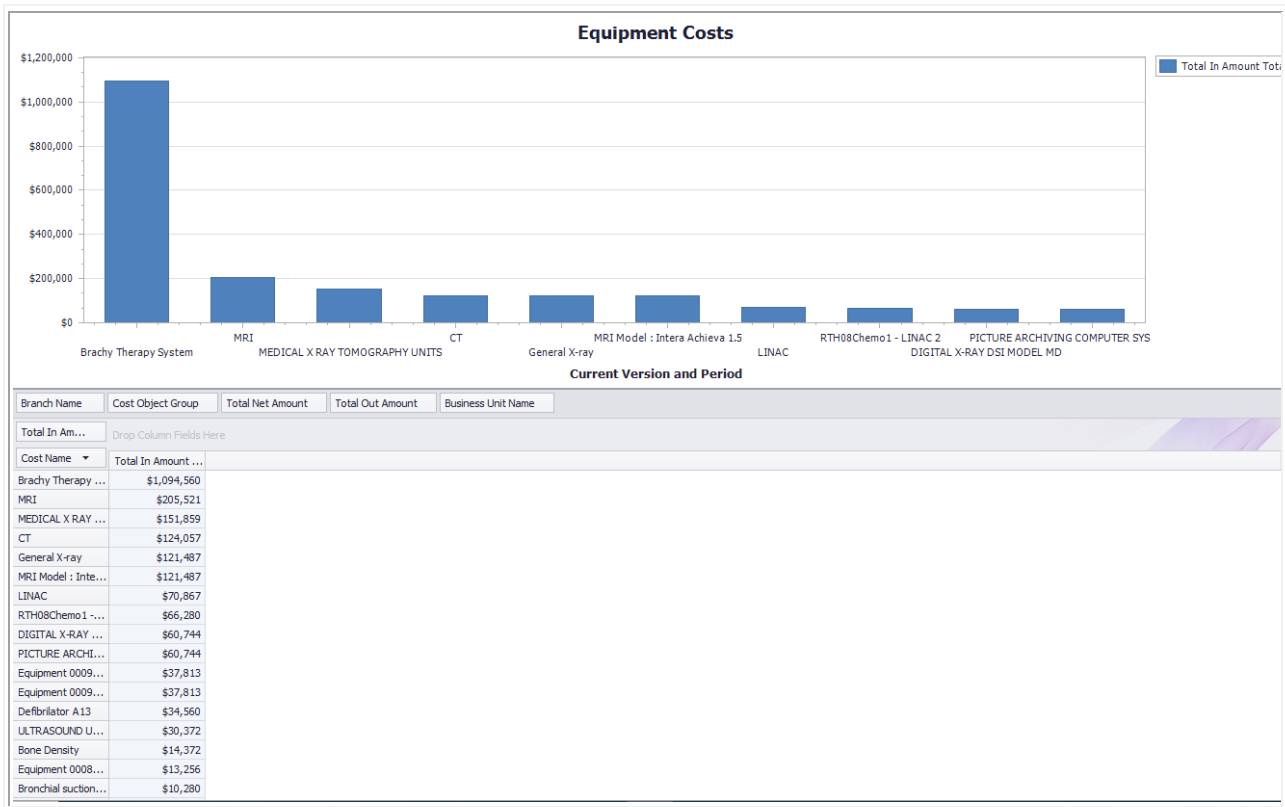
2. Background

A Case manager was investigating the high costs for a specific patient and came across the costs of the Brachy Therapy usage. Consider the following breakdown of costs for a case where Brachy Therapy was applied - the below is for patient "FQS8063":

Single Patient - DEMO - (Ac 2016/11) - 4.0.4.22471 - admin				
Patient: FQS8063 - Patient 60632				
Visits Episode of Care Patient Demographic Visit Details Measures OR Details Professionals ICD Procedure Contracts Day Of Sta				
Visit Code ▲ Product Group ▲				
Product Group	Cost Rate	Total Cost	Product	Service Cost Centre
☐ Visit Code : 193927 (11 items)	\$192,010.04	\$92,838.35		
☐ Product Group : 3rd Party (9 items)	\$100,818.95	\$33,606.32		
☐ Product Group : Accommodation (56 items)	\$5,696.11	\$12,649.43		
☐ Product Group : Doctor Fee (2 items)	\$109.55	\$109.55		
☐ Product Group : Drugs (3 items)	\$19,575.33	\$6,525.11		
☐ Product Group : EQUIP (3 items)	\$2,391.90	\$2,391.90		
☐ Product Group : Lab (4 items)	\$134.98	\$134.98		
☐ Product Group : Operating Room (16 items)	\$127.06	\$3,219.85		
☐ Product Group : Patient services (3 items)	\$57.11	\$57.11		
☐ Product Group : Radiology (2 items)	\$2,310.00	\$13,860.00		
Radiology	\$655.00	\$3,930.00	Brachytherapy session	Ward B-Gen
Radiology	\$1,655.00	\$9,930.00	MRI session	Ward B-Gen
☐ Product Group : Recharge (3 items)	\$0.00	\$0.00		
☐ Product Group : Supplies (24 items)	\$60,789.06	\$20,284.10		

- Note the high costs for MRI and Brachytherapy sessions.
- Note that, in the example visit, the patient received both MRI and Brachytherapy sessions.

See also the following report, which shows that the costs for the MRI and Brachy machines are among the highest of any medical equipment in the hospital group:

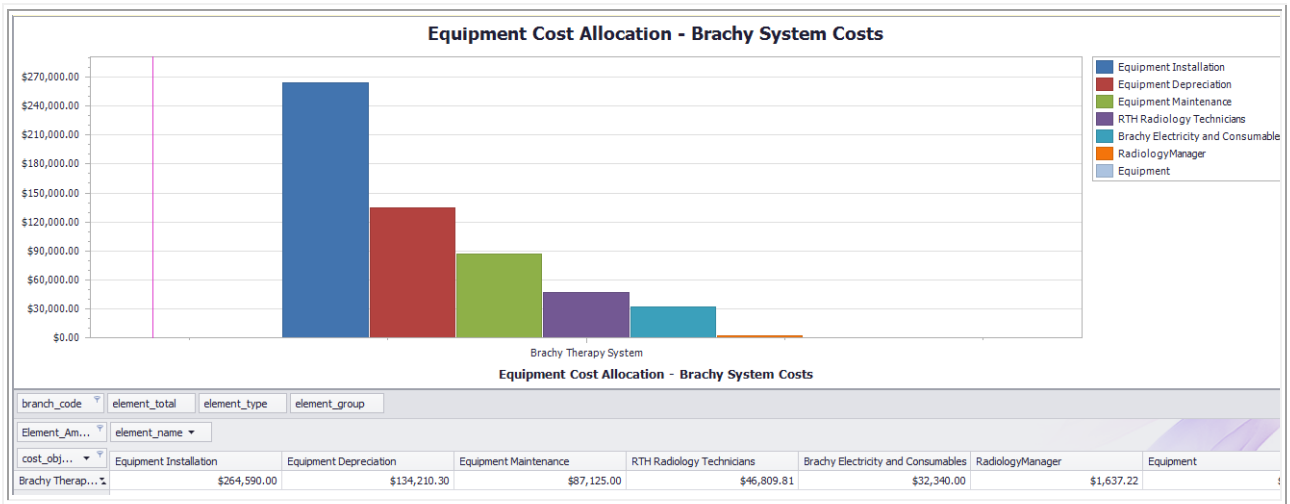


3. Cost Breakdown:

IntelliMax is a sophisticated business intelligence system built for hospitals - and one of its major strengths is the fact that it has a fully integrated activity-based costing system that calculates the cost of any hospital object or process and allows this to be related to other performance parameters. The MRI and Brachy Therapy equipment have been configured in the IntelliMax costing system, which allows us to see which costs each of these items attracts -

The following shows the main cost drivers for the MRI and Brachy Therapy equipment, for the current month:

Brachy Therapy System:



DEMO Equipment Cost Detail

Version: Ac - Actual
Period: 2016/11 - 2008 Nov

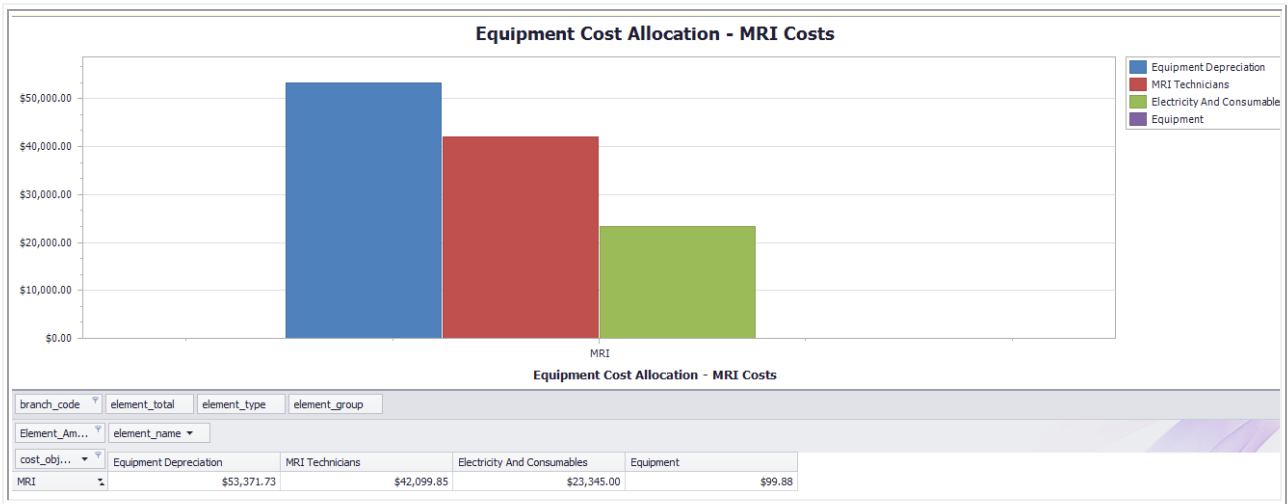
BU	CC/Branch	Code	Name	UOM	Quantity	WF	WQ	Rate	Amount	
Hospital 5	RTH02		Brachy Therapy Sy							
			Brachy Therapy System							
COC:GL Accounts					0.00	0.00	0.00	\$95.82	\$95.82	
Hospital 5	RTH03	Equipment	Equipment						95.82	
GL Accounts					0.00	0.00	0.00	\$518,265.30	\$518,265.30	
Hospital 5	RTH02	BrachyElec	Brachy Electricity and Consumables						32,340.00	
Hospital 5	RTH02	EquipmentDepreciatio	Equipment Depreciation						134,210.30	
Hospital 5	RTH02	EquipmentInstallatio	Equipment Installation						264,590.00	
Hospital 5	RTH02	EquipmentMaintenance	Equipment Maintenance						87,125.00	
Transfer In					2.00	1.00	2.00	\$24,223.51	\$48,447.03	
Hospital 5	RTH04	RadiologyManager	RadiologyManager	SVal	1.00	1.00	1.00	1,637.22	1,637.22	
Hospital 5	RTH04	RTHRadiTechnicians	RTH Radiology Technicians	SVal	1.00	1.00	1.00	46,809.81	46,809.81	
Total Input									\$566,808.15	
Transfer Out					SVal	6.00	1.00	6.00	-\$94,468.02	-\$566,808.15
Hospital 5	RTH08	FastNeutrTherapySess	FastNeutronTherapySession	SVal	1.00	1.00	1.00	94,468.02	-94,468.02	
Hospital 5	RTH04	RTHRadiology	Radiology Services	SVal	5.00	1.00	5.00	94,468.02	-472,340.12	
Total Output									-\$566,808.15	
Net Amount / Cost Per Unit					SVal	6.00	1.00	6.00	\$94,468.02	\$0.00

- From the above analysis it is clear that installation costs were significant to introduce the equipment and a further drill-thru on this may shed some light if this has been treated correctly. Below are the once-off equipment installation costs for the Brachy Therapy System.

Object Code	Element Code	Element Group	Element BU Code	Element WF	Element WQ	Element Branch Code	Element Total	Element Name	Element Rate	Element Amount	Fixed Rate	Fixed Amount	Variable Rate	Variable Amount
Object Code : Brachy Therapy Syste (10 items)														
1	RTHRadTechnicians	Transfer In	Hospital 5	5.0000	14.0000	RTH04	Total Input	RTH Radiology Technicians	\$331,851.10	\$46,809.81	\$0.00	\$331,851.10	\$0.00	\$46,809.81
2	RTHRadiology	Transfer Out	Hospital 5	1.0000	5.0000	RTH04	Total Output	Radiology Services	\$94,468.02	-\$472,340.12	\$94,468.02	-\$472,340.12		
1	EquipmentDepreciatio	GL Accounts	Hospital 5			RTH02	Total Input	Equipment Depreciation	\$134,210.30	\$134,210.30				\$134,210.30
1	Equipment	COC:GL Accounts	Hospital 5			RTH03	Total Input	Equipment	\$95.82	\$95.82				\$95.82
2	FastNeutrTherapySess	Transfer Out	Hospital 5	1.0000	1.0000	RTH08	Total Output	FastNeutronTherapySession	\$94,468.02	-\$94,468.02	\$94,468.02	-\$94,468.02		
1	RadiologyManager	Transfer In	Hospital 5	1.0000	1.0000	RTH04	Total Input	RadiologyManager	\$1,637.22	\$1,637.22	\$1,637.22	\$1,637.22		
1	EquipmentMaintenance	GL Accounts	Hospital 5			RTH02	Total Input	Equipment Maintenance	\$87,125.00	\$87,125.00				\$87,125.00
1	EquipmentInstallatio	GL Accounts	Hospital 5			RTH02	Total Input	Equipment Installation	\$264,590.00	\$264,590.00				\$264,590.00
1	BrachyElec	GL Accounts	Hospital 5			RTH02	Total Input	Brachy Electricity and Consumables	\$32,340.00	\$32,340.00				\$32,340.00
3	Net Amount / Cost Per	Net Amount / Cost		1.0000	6.0000		Net Amount / Cost	Net Amount / Cost Per Unit	\$94,468.02	\$0.00	\$94,468.02	\$0.00		

These costs would probably be amortized if significant and has a significant effect on the equipment costs and costs charged through to the patient.

MRI

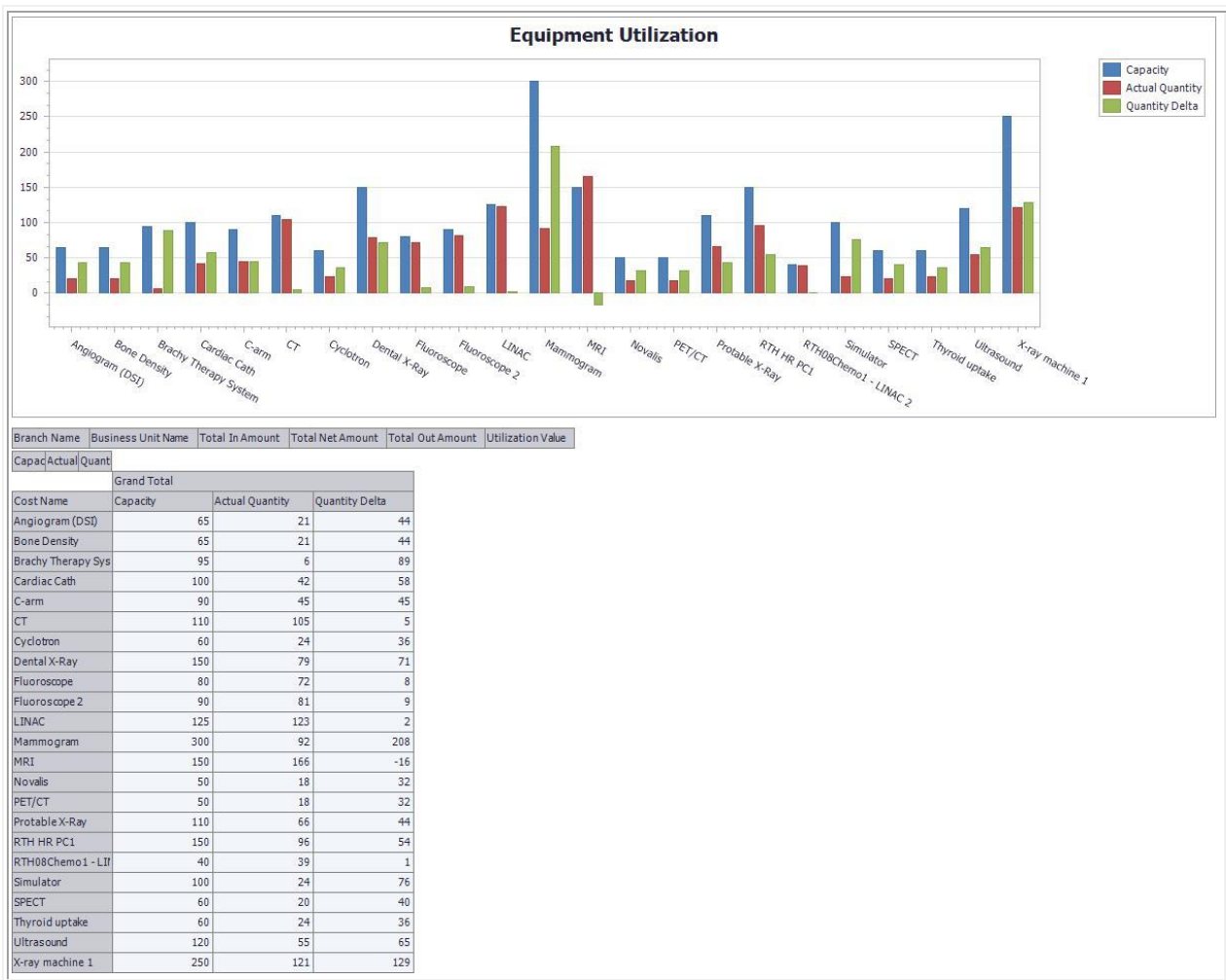


DEMO		Equipment Cost Detail						Version: Ac - Actual Period: 2016/11 - 2008 Nov		
BU	CC/Branch	Code	Name	UOM	Quantity	WF	WQ	Rate	Amount	
Hospital 5	RTH02	MRI	MRI							
COC:GL Accounts					0.00	0.00	0.00	\$99.88	\$99.88	
Hospital 5	RTH03	Equipment	Equipment						99.88	
GL Accounts					0.00	0.00	0.00	\$76,716.73	\$76,716.73	
Hospital 5	RTH02	ElectricityConsumabl	Electricity And Consumables						23,345.00	
Hospital 5	RTH02	EquipmentDepreciatio	Equipment Depreciation						53,371.73	
Transfer In					156.00	1.00	156.00	\$269.87	\$42,099.85	
Hospital 5	RTH04	MRI Technicians	MRI Technicians	SVal	156.00	1.00	156.00	269.87	42,099.85	
Total Input									\$118,916.46	
Transfer Out					SVal	186.00	1.24	230.17	-\$516.64	-\$118,916.46
Hospital 5	RTH04	EncathelitisCheck	Encathelitis Check	SVal	1.00	1.10	1.10	516.64	-568.31	
Hospital 5	RTH04	Fmri brain by phys	Fmri brain by phys	SVal	1.00	1.22	1.22	516.64	-630.31	
Hospital 5	RTH04	Fmri brain by tech	Fmri brain by tech	SVal	1.00	1.12	1.12	516.64	-578.64	
Hospital 5	RTH04	Mri abdomen w/dye	Mri abdomen w/dye	SVal	1.00	1.33	1.33	516.64	-687.14	
Hospital 5	RTH04	Mri abdomen w/o dye	Mri abdomen w/o dye	SVal	1.00	1.30	1.30	516.64	-671.64	
Hospital 5	RTH04	Mri abdomen w/ow/dye	Mri abdomen w/o & w/dye	SVal	1.00	1.22	1.22	516.64	-630.31	
Hospital 5	RTH04	Mri brain w/dye	Mri brain w/dye	SVal	1.00	1.50	1.50	516.64	-774.97	
Hospital 5	RTH04	Mri brain w/o dye	Mri brain w/o dye	SVal	1.00	1.10	1.10	516.64	-568.31	
Hospital 5	RTH04	Mri chest w/dye	Mri chest w/dye	SVal	1.00	1.20	1.20	516.64	-619.97	
Hospital 5	RTH04	Mri chest w/o dye	Mri chest w/o dye	SVal	1.00	1.30	1.30	516.64	-671.64	
Hospital 5	RTH04	Mri jnt of lwr extre	Mri jnt of lwr extre	SVal	1.00	1.10	1.10	516.64	-568.31	

- Note that the MRI and Brachy Therapy System have cost entries for the cost of capital (see the report above) - this reflects the opportunity cost of the capital required to purchase these expensive pieces of equipment.

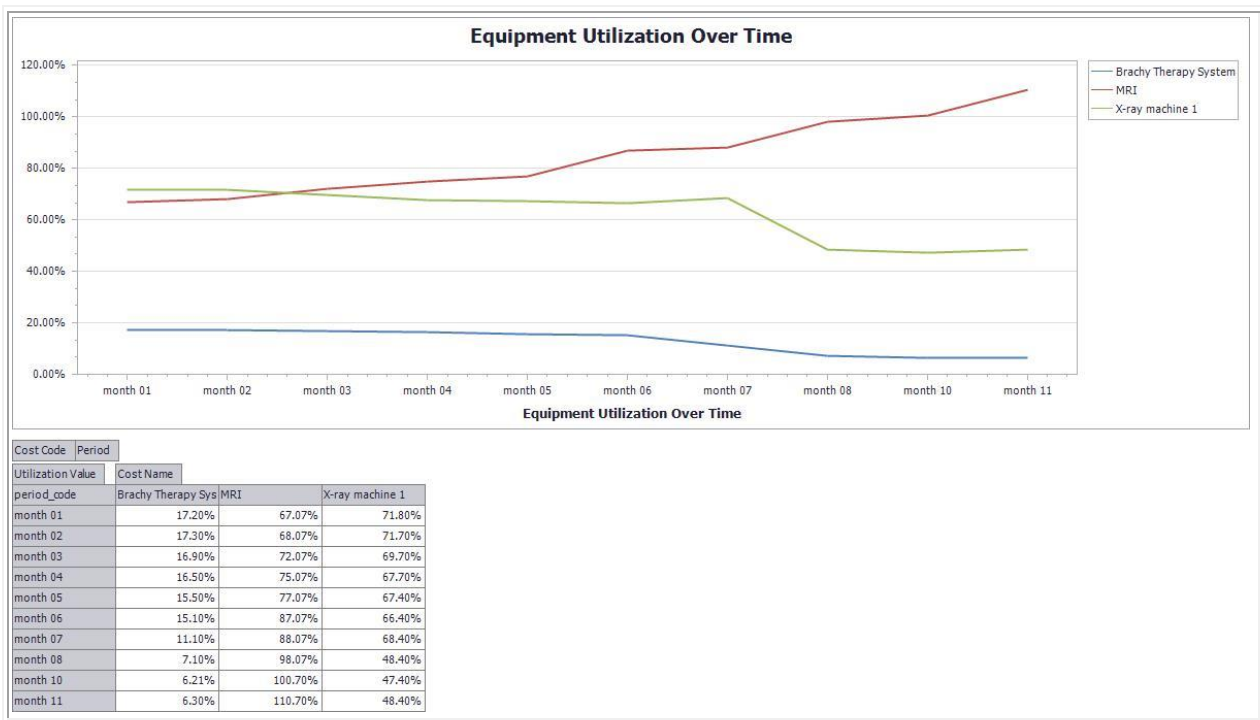
4. Equipment utilization and capacity

Given the high costs for the Brachy Therapy System and MRI equipment, it's important to consider the utilization for these equipment pieces. See the report below, which shows the capacity utilization of some of the most expensive equipment pieces in use



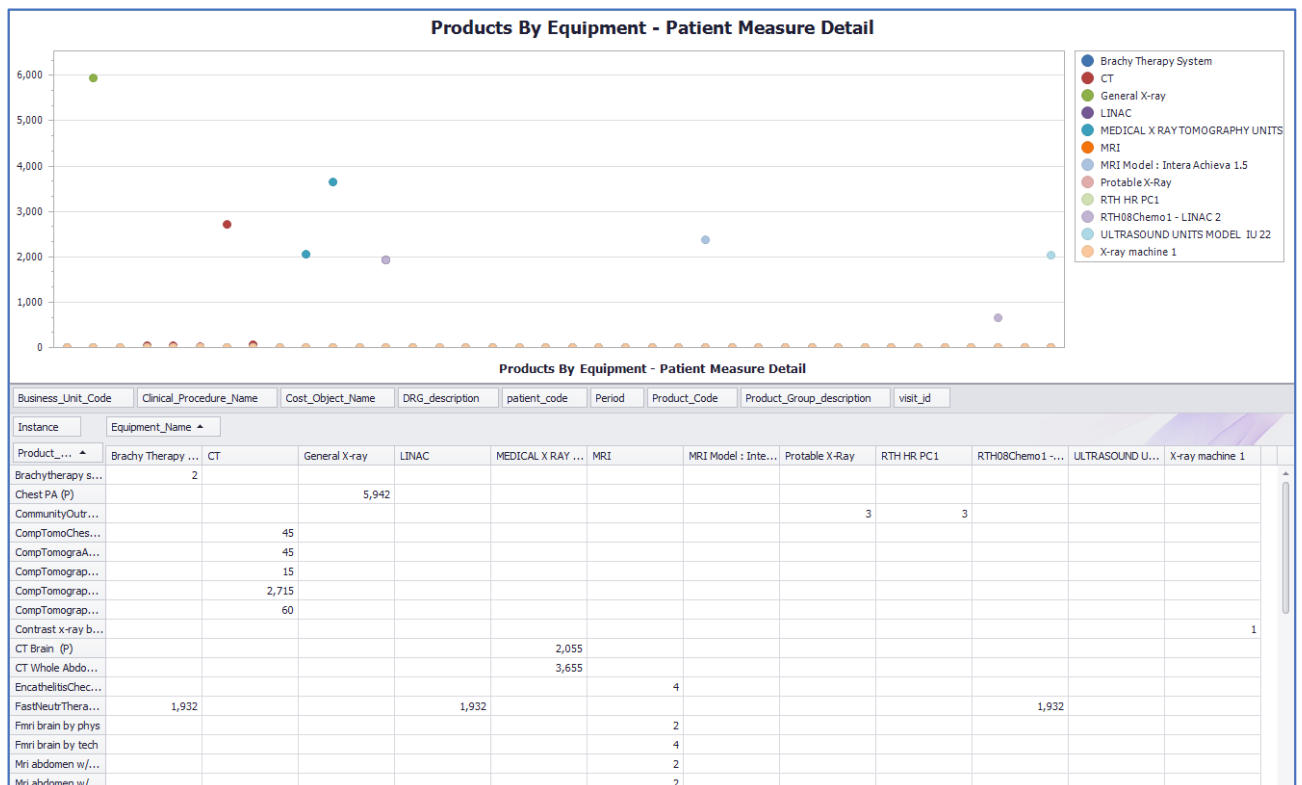
- Note that, for the Brachy Therapy System, there is a big shortfall in utilization; of a capacity of 95 units, only 6 units were used during the period under review.
- Also note that the MRI is being used at a rate that is actually slightly higher than its capacity - 166 units were used, while its capacity is set at 150 units.

A further analysis indicates that the utilization of the MRI equipment had been rising, while that of the Brachy Therapy equipment, as well as the X-Ray equipment, had been declining:



- Note that the MRI utilization appears to be increasing where the X-Ray equipment utilization appears to be declining. Questions should be asked for the reasons for this, maybe preferences of clinicians or mix of patients affecting this?

In the initial Patient view, an example of the use of these pieces of equipment was shown. More generally, IntelliMax allows a user to view the number of Visits where a piece of equipment was used for specific procedures – see, for example, the “Products By Equipment - Patient Measure Detail” report:



- Note that this report allows a user to filter by DRG, Business Unit, Procedure, and other attributes
- Double-clicking on a cell in the report will show the detail records where the procedure and equipment piece intersect – for example, this is for the equipment “RTH08Chemo1 - LINAC 2” and the procedure “IMRT treatment delivery”:

Please select the column to zoom in on

Instance	Version_ID	Period	visit_id	patient_code	Business_Unit_Cod	Clinical_Procedure	DRG_description	Product_Group_dei	Product_Code	Product_Description	Equipment_Name	Co
1	1	Period 11	53902	090710503321	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53911	090710503430	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53936	090710503555	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53945	090710503564	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53970	090710503789	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53979	090710503798	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53905	090710503324	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53912	090710503431	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53919	090710503438	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53955	090710503674	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53962	090710503681	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53969	090710503788	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	54005	0907105039124	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	54012	0907105039131	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53982	090710503311	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53925	090710503444	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53939	090710503558	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53942	090710503561	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53956	090710503675	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	53989	0907105038108	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	54006	0907105039125	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak
1	1	Period 11	54007	0907105039126	Hospital 5	IMRT treatment d...	Lymphoma and N...	Radiology	RadiologyTmtDe...	RadiologyTmtDe...	RTH08Chemo1 - ...	Rak

From here, double-clicking on the “patient code” cell will take the user to the Visit Details screen:

Single Patient - DEMO - (Ac 2016/11) - 4.0.4.18220 - admin

Patient: FOS8063 - Patient 60632

Visits Episode of Care Patient Demographic Visit Details Measures OR Details Professionals ICD Procedure Contracts Day Of Stay

Visit Code Product Group Service Cost Centre

Flows: 123

Product Group	Product	Service Date	Line #	Quantity	Cost Rate	Total Cost	Revenue	Discount	Profit
Visit Code : 193927 (11 items)				687.1667	\$189,700.04	\$78,978.35	\$98,477.00	\$33,606.32	-\$14,107.67
Product Group : 3rd Party (1 item)				2.0000	\$95,044.64	\$27,832.00	\$42,218.86	\$0.00	\$14,386.85
Product Group : Accommodation (3 items)				141.6667	\$5,696.11	\$12,649.43	\$7,029.49	\$0.00	\$-5,619.94
Product Group : Doctor Fee (1 item)				2.0000	\$109.55	\$109.55	\$170.00	\$0.00	\$60.45
Product Group : Drugs (1 item)				1.0000	\$19,575.33	\$6,525.11	\$6,768.47	\$0.00	\$243.36
Product Group : EQUIP (2 items)				1.0000	\$2,391.90	\$2,391.90	\$13,179.38	\$0.00	\$10,787.48
Product Group : Lab (1 item)				4.0000	\$134.98	\$134.98	\$634.23	\$0.00	\$499.25
Product Group : Operating Room (2 items)				514.5000	\$127.06	\$32,198.85	\$2,848.11	\$0.00	\$-371.74
Product Group : Patient services (3 items)				3.0000	\$57.11	\$57.11	\$0.00	\$0.00	\$-57.11
Product Group : Radiology (1 item)				2.0000	\$5,774.31	\$5,774.31	\$8,759.15	\$33,606.32	\$-30,621.47
Service Cost Centre : Ward B-Gen (2 items)				2.0000	\$5,774.31	\$5,774.31	\$8,759.15	\$33,606.32	\$-30,621.47
Radiology	MRI session	2016-10-13 00:00:00	BNI...	1.0000	\$5,774.31	\$5,774.31	\$8,759.15	\$0.00	\$2,984.84
Radiology	Brachytherapy session	2016-10-13 00:00:00	BNI...	1.0000	\$0.00	\$0.00	\$0.00	\$33,606.32	-\$33,606.32
Product Group : Recharge (1 item)				0.0000	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Product Group : Supplies (3 items)				16.0000	\$60,789.06	\$20,284.10	\$16,869.30	\$0.00	\$-3,414.80

5. Discussion

From the points raised in the introduction section, it looked as if MRI and the Brachy Therapy systems are increasingly being used together - or should be used together, if possible. From the utilization report, however, we can see that the MRI is currently being over-utilized - while the Brachy Therapy System is not running at capacity. These two problems may be related: for example, it's possible that the MRI equipment's over-utilization has become a bottleneck in the use of the Brachy Therapy System; so doctors may be reluctant to perform Brachy Therapy without first using the MRI machine to plan the Brachy Therapy session - but as the MRI machine is constantly in use, there may be delays in getting access to the MRI machine, which causes the Brachy Therapy machine to stand idle some of the time.

Also note that some of the cost drivers for the MRI machine - the cost of floor space and

technical staff, for example - may not increase significantly if the number of MRI machines increased: the MRI technicians should be able to service additional MRI machines without increasing staff headcount, and some of the floor space may be shareable between multiple MRI machines.

5. Conclusion

It looks as if the MRI equipment has become a bottleneck in the processing of cancer patients - it looks as if this is impacting the utilization of the Brachy Therapy system, which is a serious problem, as the Brachy Therapy system is an expensive system too. It may make business sense to increase the investment in the MRI equipment to remove the current bottleneck.