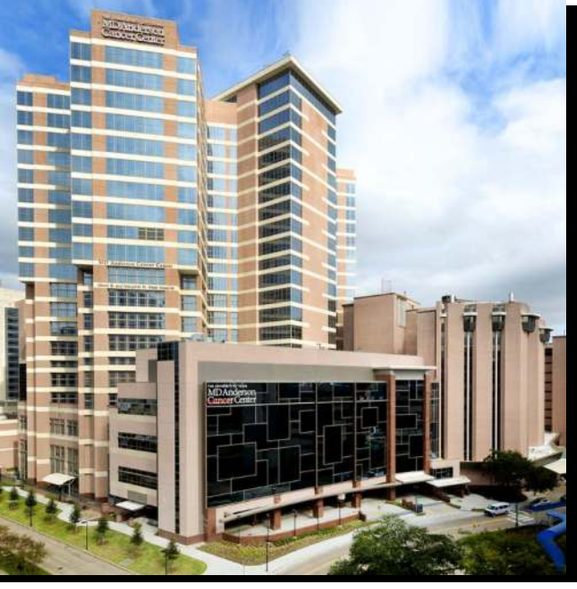

Comparison of Qualified Medical Physics (QMP) staffing and activities in a large US Academic radiation practice with photons and protons

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THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

Making Cancer History®

UT MDACC Medical Devices

Main Campus Units
18 electron linacs
1 MR linac
2 Gamma knifes
7 CT's
2 HDR's
4 PDR's
Device experts: 3 QMP's, 4 service techs, vendors

Proton Therapy Center
3 proton treatment rooms with scattered beam
1 proton treatment room with scanned beam
1 electron linac
2 CT's
1 MR
Device experts: 2 QMP's, 8 service techs, vendors

Conclusions:
There are only a limited number of QMP's who possess high level knowledge of the photon or proton treatment systems
The proton system receives attention 24 hours/day, 7 days/week
The photon systems generally receive attention 14 hours/day, 5 days/week
Unique equipment requires more resources than standard equipment.

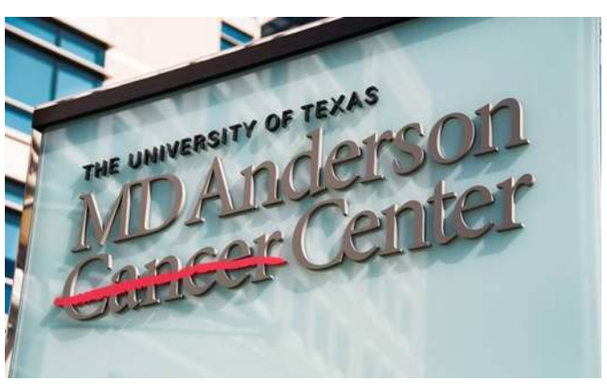
Medical Device Updates and Maintenance

Photon Accelerators
7 new TrueBeams (TB) in last 4 years
TB system upgrades from V. 1.6 to V. 2.7
Total Annual Maintenance Costs:
Approximately $3M

Proton Device
Zero new devices
Limited SW upgrades (old OS Issue)
Total Annual Maintenance Costs:
Approximately $5M

Serious Patient Events FY 18

Level	Photons	Protons
1- State Reportable	1	1
2- Reached Patient	4	2



Staffing

UT MDACC Main Campus (Photons)
Monday through Friday: 7 am to 7 pm
Weekends – Not routinely
Qualified Medical Physicists (QMP's) – 41
Physics Assistants (PA's) – 3

UT MDACC Proton Therapy Center
Qualified Medical Physicists – 8
Physics Assistants – 5
Monday through Friday: 7 am to mid-night
Saturday: 8 am to 9 pm
Sunday: Periodically 4 to 8 hours

Conclusions:
Proton QMP's spend more time monitoring patient treatments than photon QMP's
Proton PA's perform both patient specific QA and morning warm-ups, while photon QA's only perform patient specific QA.

New Patients Starts (NPS) FY18

Photons

2D	1,025
3D	3,250
IMRT	621
VMAT	2,412
GK	550
TBI	115

175 Photon NPS/QMP
137 GK NPS/QMP

Protons

All	815

102 Proton NPS/QMP

TPS Protons
1 TPS – new version every 12 months
2 QMPs

Conclusions:
There are almost twice the number of new patient starts per QMP for photon patients than for proton patients. Possible explanations include larger amount of time is spent on patient specific QA for protons, the proton delivery system is more complex with 24 beams per scattered beam nozzle, and 92 beams for the scanned beam nozzle, and more time is spent on machine QA.
There are more treatment delivery issues with protons (aborts and pauses) than with photons.
While not explicitly noted, the MRL requires the highest number of QMP's per NPS than any other device.

FY 19 Major Disease Sites Treated by Radiation Oncology

	Photons	Protons
CNS/Pedi	20%	26%
GI	10%	4%
GU	10%	28%
H&N	9%	26%
Thor	15%	12%

Conclusions
> 50% of proton patients are either H&N or CNS/Pedi

UT MDACC Information Systems

Shared Photon and Proton Systems
Rad Onc Information System – New version every 18 months
PAC's System
Hospital Electronic Medical Record
2 QMP's

TPS Photons
2 major TPS – new version every 12 months
4 specialized systems
4 QMPs

TPS Protons
1 TPS – new version every 12 months
2 QMPs

Conclusions:
1.Limited number of share systems.
2.New versions of SW require substantial validation time
3.Each system requires QMP experts

Final Statements

The accuracy and safety of radiation oncology treatments are independent of the photon or proton modality.
The goal for both photons and protons is to have ZERO technical events. There will be clinical events.
Considerable QMP time is spent on routine chart reviews and routine machine and patient QA.
Better systems are needed to identify non-routine issues, which should be evaluated.
The UT MDACC system is designed to meet the demands for safe and accurate treatments. All upgrades to HW and SW, all repairs, every introduction of new technology represent a risk for a technology event.
Training and review of systems (end-to-end testing from the hospital EMR to the treatment delivery device) should receive greater emphasis.