Staffing models for Multi-site Institutions

2018 AAPM Spring Clinical Meeting

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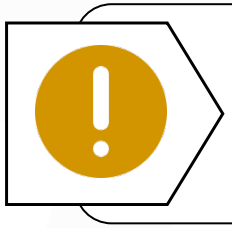
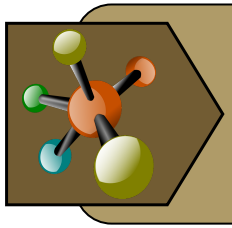
Department of Radiation Oncology
Vanderbilt University Medical Center

VANDERBILT UNIVERSITY
MEDICAL CENTER



Why appropriate staffing is essential to the radiation oncology practice?

Present and discuss the advantages and disadvantages of several Physics & Dosimetry Staffing models



Approaches to scheduling and staffing Physics & Dosimetry for radiation oncology practices spanning across several sites

- Best possible treatment to the individual patient.
- Timely and appropriate commissioning of new technology & techniques

- Ensure technical aspects of facility operate as efficiently as possible.
- Ensure errors are minimal in number and magnitude.

- Appropriate bandwidth for administrative roles.
- Accreditation efforts.

Who, what, when, where & how?

Who, what, when, where & how?

Medical Physicists,
Clinical & Faculty

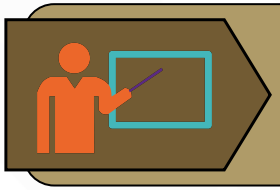
Medical Dosimetrists

Medical Physics
Assistants & Residents

Who, what, when, where & how?

Clinical Support

Clinical Development



Classroom & Clinical Teaching

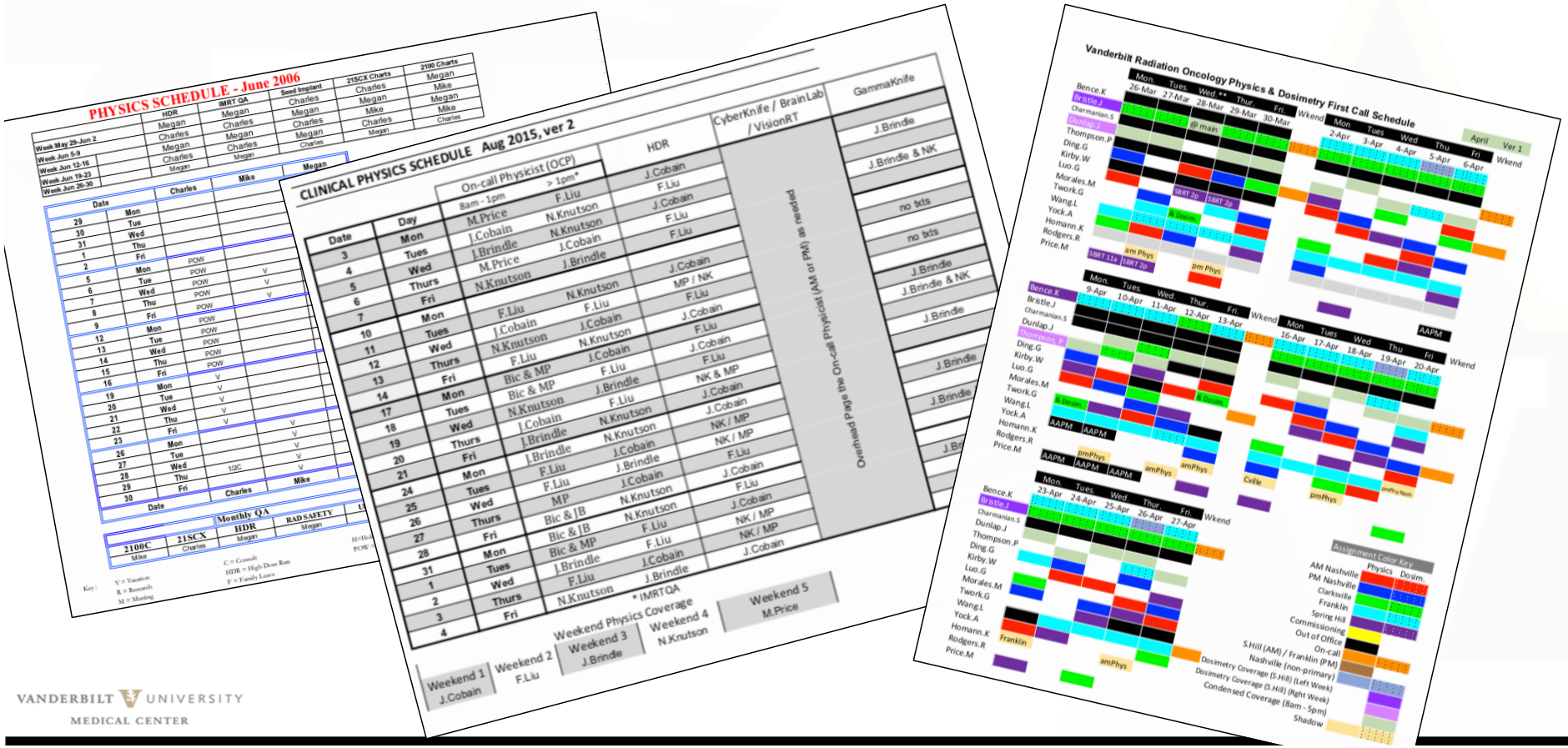
Quality Improvement Initiatives

Radiation Safety

Administration

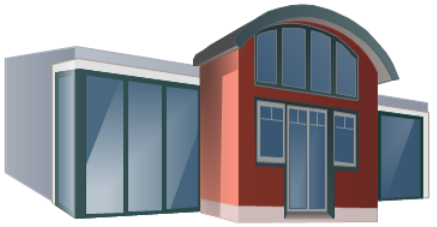
Research

Who, what, when, where & how?

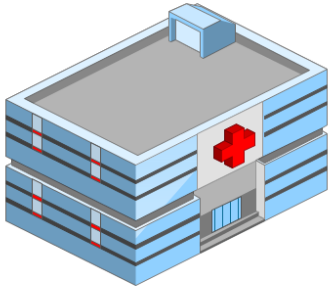


Who, what, when, where & how?

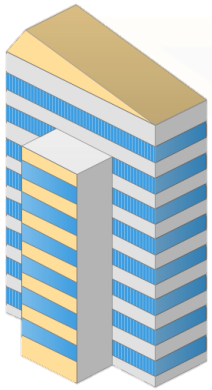
Academic center



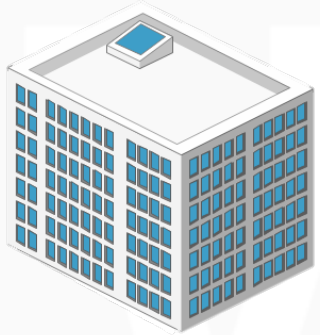
Community practice



Hospital-based



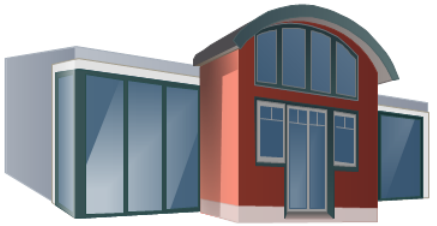
Diverse, large practice



Private practice

Who, what, when, where & how?

Academic center



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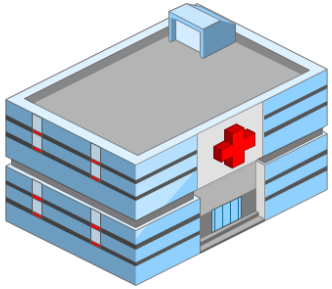

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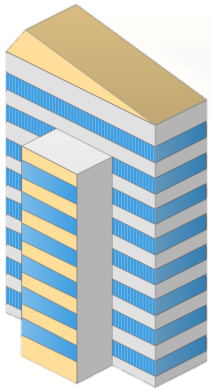

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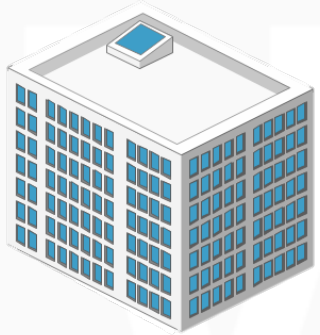

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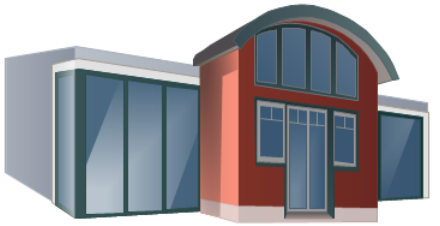

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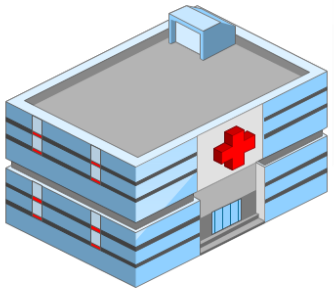

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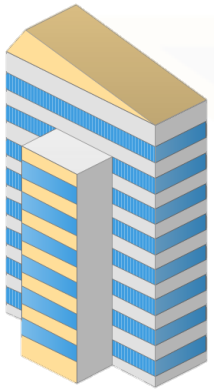

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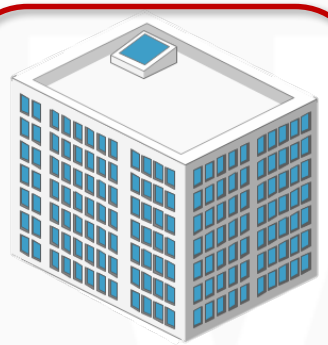
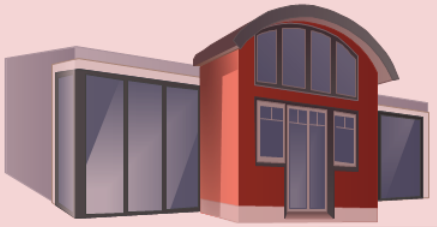


Private practice

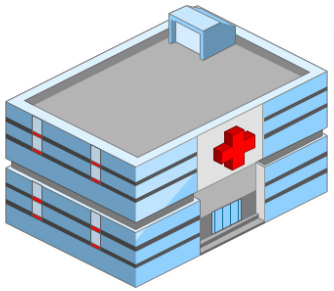
Who, what, when, where & how?

Academic center

"Siloed"



Community practice



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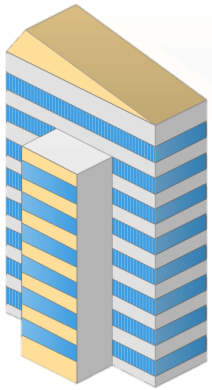

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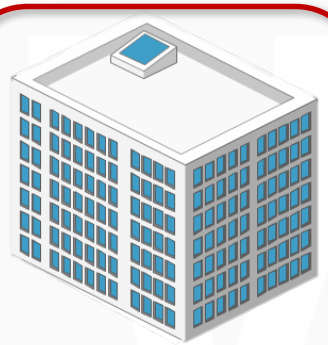


Private practice

Who, what, when, where & how?

Familiarity of staff with culture, idiosyncrasies of specific practices

Comfort with equipment, techniques and physicians

"Micro" operational budgeting

Amenable to practice building

Coverage model will lack robustness

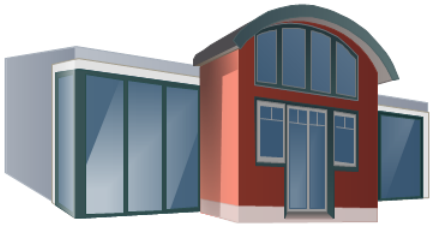
Difficult to adopt change

Difficult to support clinical development & new modalities

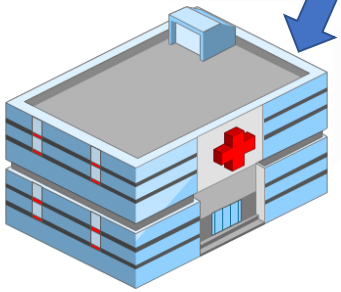
Challenge to standardize procedures & equipment

Who, what, when, where & how?

Academic center



Community practice



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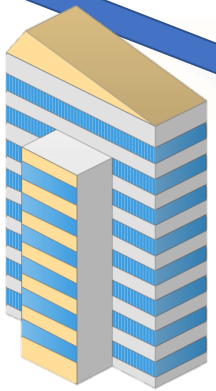

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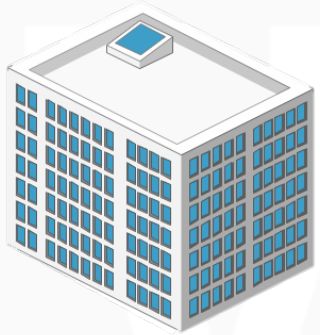
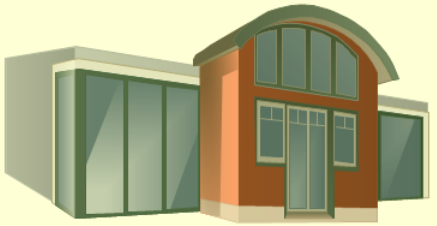


Private practice

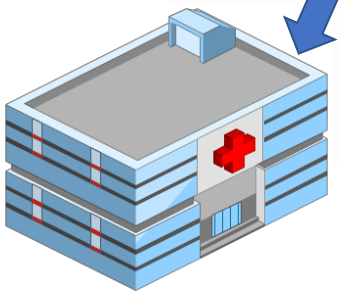
Who, what, when, where & how?

Academic center

"Satellite Staff"



Community practice



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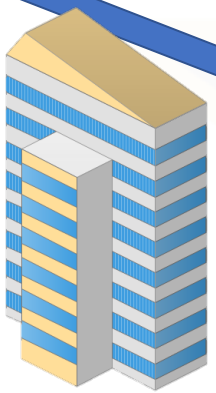

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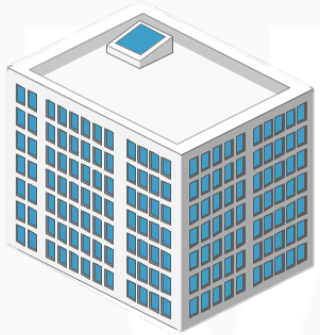


Private practice

Who, what, when, where & how?

Familiarity & comfort of "siloed" model

Benefit from experience & resources of "mothership"

Can be easier to backfill coverage

Centralized management and/or leadership structure

Depending on site's business "designation," operational budgeting can be challenging

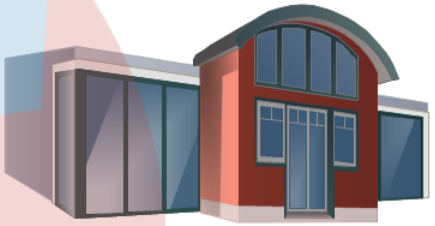
May be an obstacle for recruitment

Difficult to support clinical development & new modalities

May be challenge to standardize procedures & equipment

Who, what, when, where & how?

Academic center



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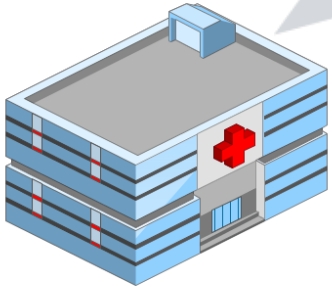

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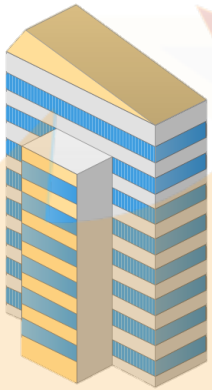

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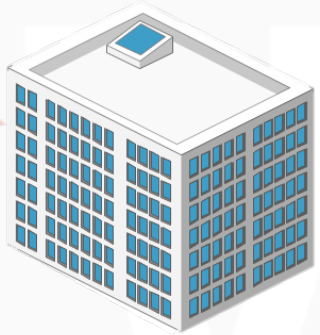
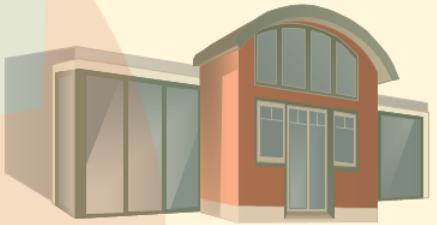


Private practice

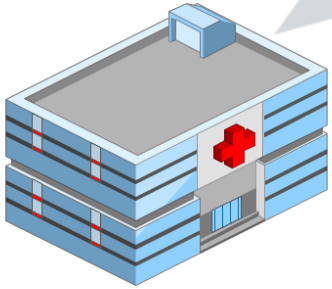
Who, what, when, where & how?

"Distributed Effort"

Academic center



Community practice



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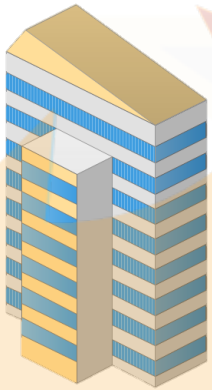

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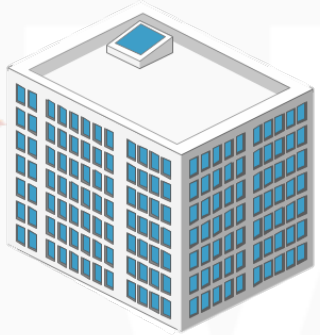
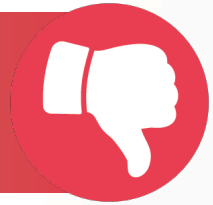


Private practice

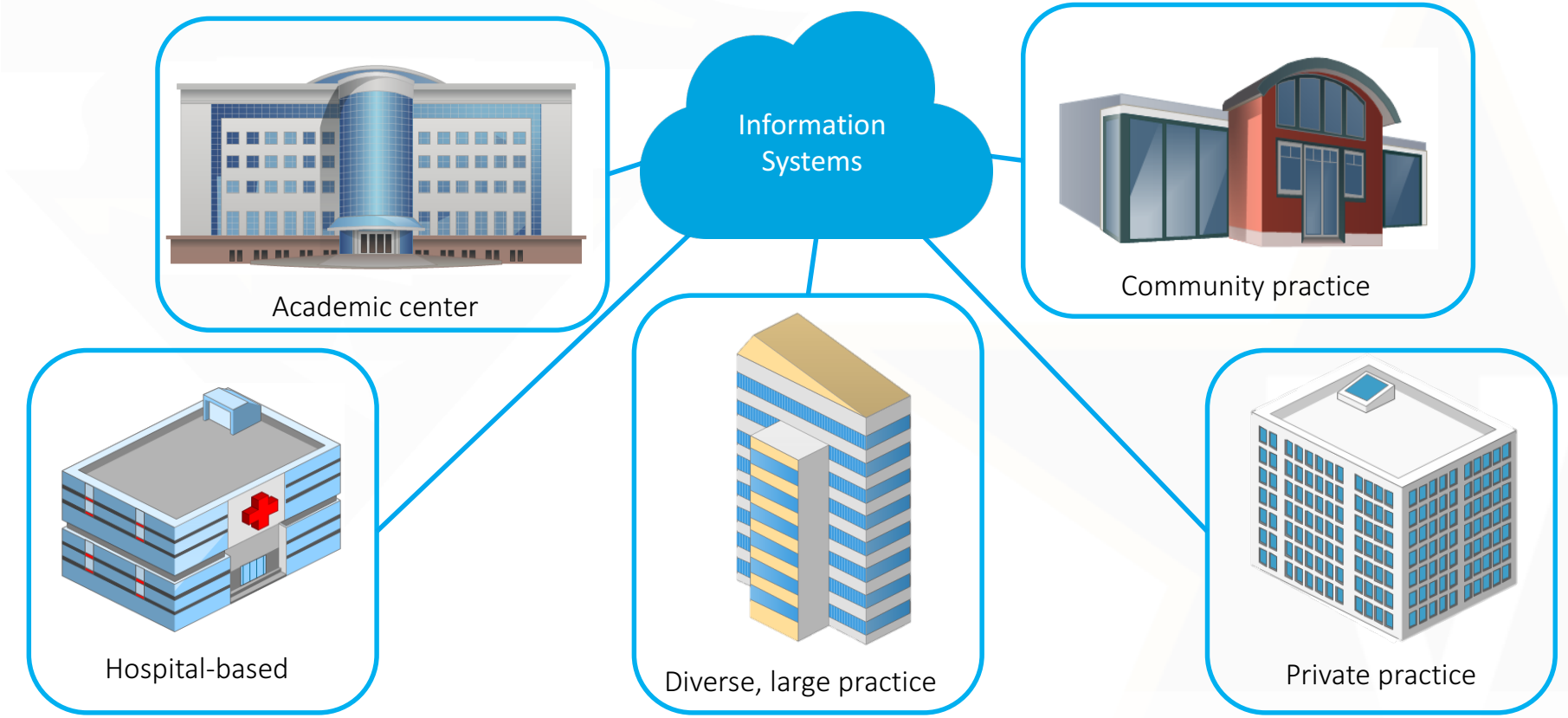
Who, what, when, where & how?

"Distributed Effort"



Flexible coverage that may be scaled based on procedural & non-procedural needs	Transitioning to "Effort" based model from "FTE" approach can be challenging
Academic perspective shared with community & private practices	Coverage scheduling can be complicated
Facilitates standardization	Some loss of familiarity & comfort with on-site clinical staff
Strengthened position in capital budgeting	Coordination & communication with "local" administration can be difficult

Who, what, when, where & how?



Notwithstanding the setting, how do you get the resources you need?

Staffing recommendations from professional & technical societies

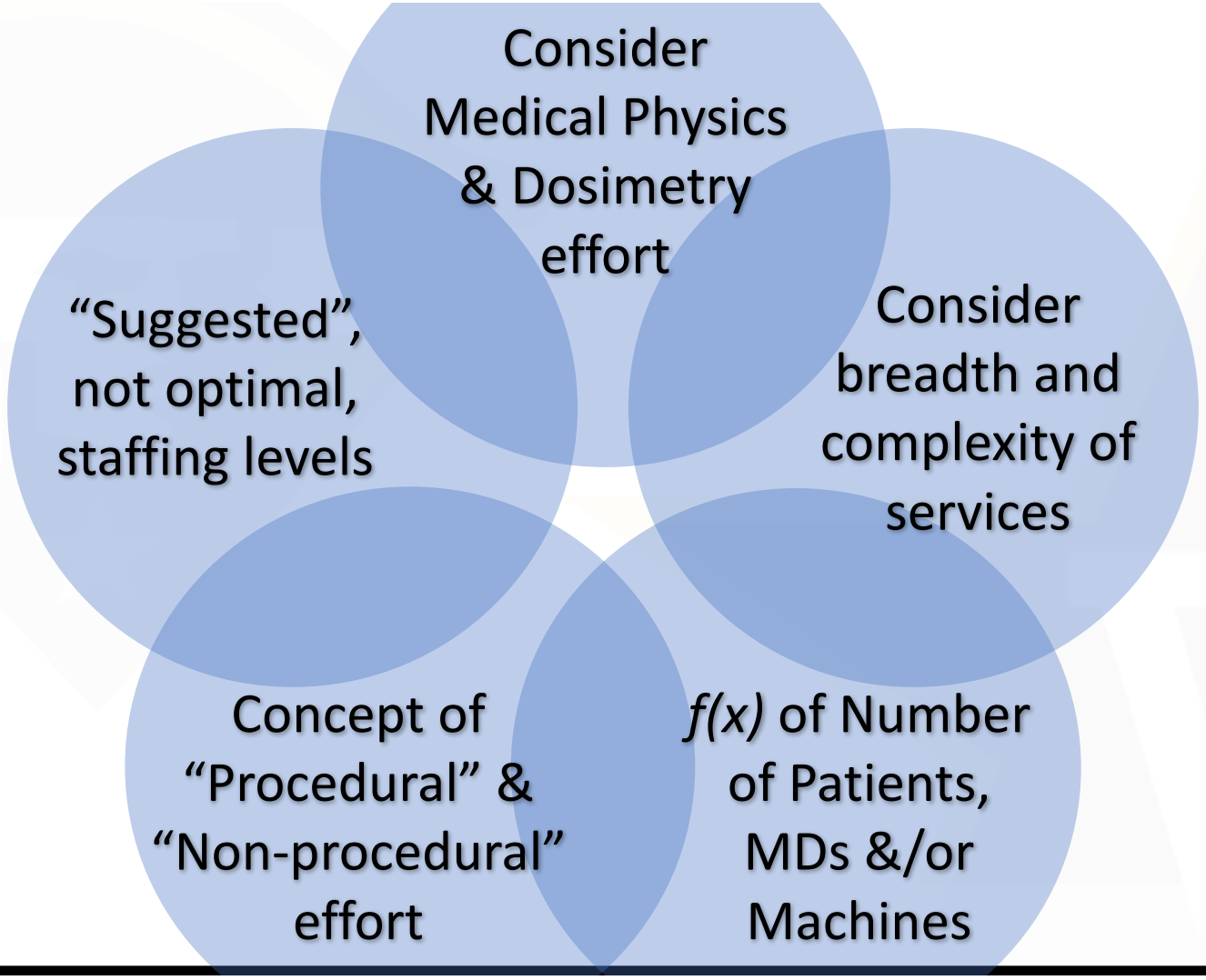
Medical Physics Staffing Needs in Diagnostic Imaging and Radionuclide Therapy: An Activity Based Approach (IAEA, 2018)
The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round IV (AAPM, 2015)
Medical Physics Expert Staffing Levels in Europe, Annex 2, European Federation of Organizations for Medical Physics (EFOMP, 2015)
Financial Survey, The Society Of Chairs Of Academic Radiation Oncology Programs (SCAROP) And The American Society For Radiation Oncology (ASTRO), (2014)
Medical Physics Personnel for Medical Imaging - Requirements, Conditions of Involvement and Staffing Levels (ASN / SFPM Recommendations, 2013)
AFOMP POLICY STATEMENT No. 2: recommended clinical radiation oncology medical physicist staffing levels in AFOMP countries, Round *et. al*, Australas Phys Eng Sci Med (2010)
Setting Up A Radiotherapy Programme: Clinical, Medical Physics, Radiation Protection And Safety Aspects (IAEA), (2008)
Guidelines for the Provision of a Physics Service to Radiotherapy, UK Institute of Physics & Engineering in Medicine (2002)
Survey of Special Procedures (ACMP, 1998)

Published staffing approaches

“Medical physics in Europe following recommendations of the International Atomic Energy Agency,” - Casar et. al, Radiol Oncol (2016)
"Medical physics staffing for radiation oncology: a decade of experience in Ontario, Canada,” - Battista et. al, Oncology Publications. (2012)
Staffing for Quality Physics, Mills in “Quality and Safety in Radiotherapy,” Pawlicki (2010)
“Reimbursement versus effort in medical physics practice in radiation oncology,” Herman *et. al*, J Appl Clin Med Phys (2003)
“Estimating medical physicist FTE using the 2003 Abt Survey and procedure volumes in radiation therapy,” Herman *et al.*, Med Phys (2005)
“Staffing Requirements in Radiation Medicine,” Merwe *et al.*, M. Long (Ed.): World Congress on Medical Physics and Biomedical Engineering, IFMBE Proceedings (2013)

Accreditation guidelines

ACR Radiation Oncology Practice Accreditation Program
ASTRO Accreditation Program for Excellence (APEx) Radiation Oncology Practice Accreditation Program


Consider Medical Physics & Dosimetry effort
"Suggested", not optimal, staffing levels
Consider breadth and complexity of services
Concept of "Procedural" & "Non-procedural" effort
f(x) of Number of Patients, MDs &/or Machines

The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round IV

Final Report

Radiation Oncology Practice Accreditation Program Requirements

ACR American College of Radiology

PEx

ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round IV

Final Report

Radiation Oncology Practi
Program Require

ACR American College of Radiology

ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

VANDERBILT UNIVERSITY MEDICAL CENTER

In 1995, The American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM) engaged Abt Associates Inc. (Abt) to conduct a survey-based study to quantify Qualified Medical Physicist work for medical physics services (repeated in 2003, 2007 & 2014).

Reimbursement of Medical Physicists efforts are based on Current Procedure Terminology (CPT®) codes, which uniquely designate each service or procedure.

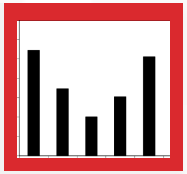
Payments for these services are divided into a technical component received by the employer of the QMP and a professional component paid to the physician or the physician's employer.

Amount of monies for each code based on associated (1) Practice expense, (2) Malpractice costs & (3) Work. Work is product of **professional time** needed to complete task and complexity (intensity) of said task.

$W=TxI$

Professional time was addressed in the study into two parts: non- procedural and procedural time. This represented a departure from common practice (*pre-, intra- and post-service*) → "Work = *f*(CTP)"

Report also presents median QMP as a function of case loads derived from respondent data



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Procedural time:

(analogous to intra-service) is the time a QMP spends in support of patients during treatment.

Non-procedural time:

(analogous to pre-service) is devoted to the general maintenance of radiation therapy equipment and treatment units, and is shared across medical physics services with the exception of consultation-only services (77336 and 77370).

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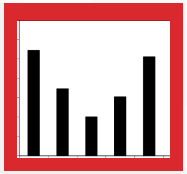

Staffing Example using Abt Median QMP data

Clement Burton Foles Regional Cancer Center	
Patients Treated (yr^{-1})	1,750
Radiation Oncologists	6
Main facility	5 Linacs (IGRT & IMRT)
1st Satellite facility	1 Linac
2nd Satellite facility	1 Linac
Contracted Satellite facility	1 Linac
Special Procedures	HDR & LDR Brachytherapy, TSE

Staffing Example using Abt Median QMP data

Procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.50	8,018	4009
77334	Complex Txt. Device	0.78	9,264	7226
77336	Cont. MP Consultation	0.75	7,486	5615
77315	Complex Isodose Plan	1.00	436	436
	….. *etc.* …			

Staffing Example using Abt Median QMP data

Procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.50	8,018	4009
77334	Complex Txt. Device	0.78	9,264	7226
77336	Cont. MP Consultation	0.75	7,486	5615
77315	Complex Isodose Plan	1.00	436	436
	….. *etc.* …			

Non-procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.19	8,018	1523
77334	Complex Txt. Device	0.01	9,264	93
77336	Cont. MP Consultation	*n/a*	*n/a*	*n/a*
77315	Complex Isodose Plan	0.19	436	83
	….. *etc.* …			

Staffing Example using Abt Median QMP data

Procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.50	8,018	4009
77334	Complex Txt. Device	0.78	9,264	7226
77336	Cont. MP Consultation	0.75	7,486	5615
77315	Complex Isodose Plan	1.00	436	436
	….. *etc.* …			

Non-procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.19	8,018	1523
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77336	Cont. MP Consultation	*n/a*	*n/a*	*n/a*
77315	Complex Isodose Plan	0.19	436	83
	….. *etc.* …			

$$\frac{\sum}{2080 \text{ hrs yr}^{-1}} = \text{\# QMP FTE}$$

≅ 11 QMP FTE

Staffing Example using Abt Median QMP data

Procedural Effort

CPT code	Procedure Description	Median QMP hrs. procedure^{-1}	Procedures yr^{-1}	QMP Hours yr^{-1}
77300	Basic Dosimetry Calc.	0.50	8,018	4009
77334	Complex Txt. Device	0.78	9,264	7226
77336	Cont. MP Consultation	0.75	7,486	5615
77315	Complex Isodose Plan	1.00	436	436
	….. *etc.* …			

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77336	Cont. MP Consultation	*n/a*	*n/a*	*n/a*
77315	Complex Isodose Plan	0.19	436	83
	….. *etc.* …			

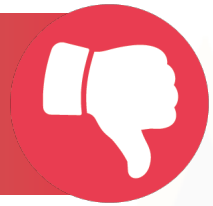
$$\frac{\sum}{2080 \text{ hrs yr}^{-1}} = \text{\# QMP FTE}$$

≅ 11 QMP FTE

≅ 7 dosimetrist FTE*

** 0.67 Ratio of Certified Medical Dosimetrist to QMP, averaged over all practice types (Table 9, Abt IV)*

"Abt Report model"



Vetted data, "standard," & easier to swallow by administration

Model has been re-addressed periodically to account for increased proficiencies. Past versions produced unrealistically large # QMPs:

- 18.6 hrs "work" / IMRT planning (Abt I)
- 7.5 hrs. "work" / IMRT planning (Abt IV)

Calculations based on "bottom-line" finances

Proportional to "true" clinic volume

Can be difficult to get clear picture via CPT codes

- Under-billing due to lack of staffing
- Mix of QMP & dosimetrists effort

Fails to implicitly account for non-clinical responsibilities

-Teaching, Quality, IT, Research & Administration

- *The 2080 hrs. yr^{-1} "fudge factor"*

For multi-site practice, no accounting for travel, management nor clinical coordination overhead

- Create discrete model for each site?
- Add "off-site" coefficient to "intensity"

Question 1

1. The work of a qualified medical physicist may be qualified as *non-procedural* and *procedural time*. Using these definitions, *non-procedural time* is:

a. the time a QMP spends in support of patients during treatment

b. time spent with the patient before the service

c. time spent performing research and teaching duties

d. time is devoted to the general maintenance of radiation therapy equipment and treatment units

Question 1

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Reference: The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round III, *Prepared by* Abt Associates Inc. *for the* American College of Medical Physics *and the* American Association of Physicists in Medicine (March 2008).

The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round IV

Final Report

Radiation Oncology Practice Accreditation Program Requirements

ACR American College of Radiology

PEx

ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

A facility's staffing levels for radiation oncologists, physicists, radiation therapists, and dosimetrists are compared to the accredited facility averages and averages for the clinic's "designation" (Academic or Comprehensive Cancer center, Hospital-based & Freestanding) and number of patients (July 2017).

Serve as guidelines, **variations from these levels generally do not result in the withholding of accreditation** unless inadequate staffing levels result in non-compliance with ACR standards

ACR staffing model does not account for the staff's other duties (*e.g.* simulation for therapists) nor is the data scaled for complexity or the breadth of clinical services provided by any one clinic.

Staffing guidelines are derived from ASTRO's "*Safety is No Accident"* publication (2012) and reflect the "combined input from the surveys performed by several professional organizations (ACR, ASTRO, AAMD, AAPM and the ABR studies) during the last decade." Physics & Dosimetry.

Provide a "relative FTE factor" as a function of (1) # of patient procedures, (2) # of treatment machines & (3) **does include** time spent in non-clinical roles (*i.e.* education, training, committees, administration)

Plan is to update relative FTE factors in subsequent editions of "*Safety is No Accident"* per data collected from facilities undergoing APEx accreditation (*finalizing currently*)

Question 2

The American College of Radiology accreditation program for Radiation Oncology practices staffing recommendations are derived from accredited facility averages and:

a. variations from these levels generally **result in the withholding of accreditation**

b. variations from these levels generally **do not result in the withholding of accreditation** unless inadequate staffing levels result in non-compliance with ACR Practice Parameters and Technical Standards

c. are required by state regulatory commissions.

Question 2

The American College of Radiology accreditation program for Radiation Oncology practices staffing recommendations are derived from accredited facility averages and:

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b. variations from these levels generally **do not result in the withholding of accreditation** unless inadequate staffing levels result in non-compliance with ACR Practice Parameters and Technical Standards

c. are required by state regulatory commissions.

Reference: Radiation Oncology Practice Accreditation Program Requirements, American College of Radiology, (2017).

Radiation Oncology Practice Accreditation Program Requirements

ACR AMERICAN COLLEGE OF RADIOLOGY

Staffing Example, ACR

New patients per:	All Accredited Facilities	Academic or Comprehensive Cancer Center	Hospital - based			Freestanding		
			< 200 patients	201-599 patients	> 600 patients	< 200 patients	201-599 patients	> 600 patients
Radiation Oncologist	202	182	138	221	251	148	230	234
Physicist	252	190	213	254	274	222	309	271
Dosimetrist	257	261	196	256	310	191	305	290

Clement Burton Foles Regional Cancer Center	
Patients Treated (yr^{-1})	1,750
Radiation Oncologists	6
Main facility	5 Linacs (IGRT & IMRT)
1st Satellite facility	1 Linac
2nd Satellite facility	1 Linac
Contracted Satellite facility	1 Linac
Special Procedures	HDR & LDR Brachytherapy, TSE

Radiation Oncology Practice Accreditation Program Requirements

ACR American College of Radiology

Staffing Example, ACR

New patients per:	All Accredited Facilities	Academic or Comprehensive Cancer Center	Hospital - based			Freestanding		
			< 200 patients	201-599 patients	> 600 patients	< 200 patients	201-599 patients	> 600 patients
Radiation Oncologist	202	182	138	221	251	148	230	234
Physicist	252	190	213	254	274	222	309	271
Dosimetrist	257	261	196	256	310	191	305	290

Physicist	7	9	6.4	6.5
Dosimetrist	7	7	5.6	6

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Radiation Oncology Practice Accreditation Program Requirements

ACR American College of Radiology

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ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

Staffing Example, APEx (*Safety is no Accident)*

			Relative FTE Factor	
Equipment, Sources and Systems	**Services -- # of Units or Licenses***	**No. of systems***	**Physicist**	**Dosimetrist**
	Multi energy accelerators		0.25	0.05
	Single energy accelerators		0.08	0.01
	Tomotherapy, CyberKnife, GammaKnife		0.3	0.03
	Cobalt Units, IMRT, PACS, EMR & Contouring		0.08	0.03
	Orthovoltage and superficial units		0.02	0.01
	Manual brachytherapy; LDR Seed Implants		0.2	0.03
	HDR brachytherapy		0.2	0.02
	Simulator, CT-Simulator, PET, MRI Fusion		0.05	0.02
	Computer planning system (per 10 workstations)		0.05	0.02
	HDR planning system		0.2	0.01
No. Patient Procedures	**Annual # of Patients undergoing Procedures****	**No. of patients****		
	External Beam RT with 3D planning		0.0003	0.003
	External Beam RT with conventional planning		0.0002	0.002
	Sealed source Brachytherapy (LDR & HDR)		0.008	0.003
	Unsealed source therapy		0.008	0.005
	IMRT, IGRT, SRS, TBI, SBRT		0.008	0.005
Nonclinical - Estimated Total FTE Effort	**Estimated Total (Phys & Dosim) FTE Effort*****	**FTE Effort*****		
	Education & Training (FTE)		0.667	0.333
	Generation of Internal Reports (FTE)		0.667	0.333
	Committees & Meetings; Inc. Rad. Safety (FTE)		0.667	0.333
	Administration and Management (FTE)		0.667	0.333

"Safety is no Accident" also provides minimum personnel requirements for Clinical Radiation Therapy. Of interest:

Category	Staffing
Chief Medical Physicist	One per facility
Medical Dosimetrist	As needed, approximately **one per 250** patients treated annually

ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

Staffing Example, APEx (*Safety is no Accident)*

			Relative FTE Factor	
Equipment, Sources and Systems	**Services -- # of Units or Licenses***	**No. of systems***	**Physicist**	**Dosimetrist**
	Multi energy accelerators	**7**	0.25	0.05
	Single energy accelerators	**0**	0.08	0.01
	Tomotherapy, CyberKnife, GammaKnife	**1**	0.3	0.03
	Cobalt Units, IMRT, PACS, EMR & Contouring	**12**	0.08	0.03
	Orthovoltage and superficial units	**0**	0.02	0.01
	Manual brachytherapy; LDR Seed Implants	**1**	0.2	0.03
	HDR brachytherapy	**2**	0.2	0.02
	Simulator, CT-Simulator, PET, MRI Fusion	**6**	0.05	0.02
	Computer planning system (per 10 workstations)	**2**	0.05	0.02
	HDR planning system	**2**	0.2	0.01
No. Patient Procedures	**Annual # of Patients undergoing Procedures****	**No. of patients****		
	External Beam RT with 3D planning	**25**	0.0003	0.003
	External Beam RT with conventional planning	**854**	0.0002	0.002
	Sealed source Brachytherapy (LDR & HDR)	**86**	0.008	0.003
	Unsealed source therapy	**0**	0.008	0.005
	IMRT, IGRT, SRS, TBI, SBRT	**785**	0.008	0.005
Nonclinical - Estimated Total FTE Effort	**Estimated Total (Phys & Dosim) FTE Effort*****	**FTE Effort*****		
	Education & Training (FTE)	**1**	0.667	0.333
	Generation of Internal Reports (FTE)	**0.15**	0.667	0.333
	Committees & Meetings; Inc. Rad. Safety (FTE)	**0.10**	0.667	0.333
	Administration and Management (FTE)	**0.80**	0.667	0.333

Clement Burton Foles Regional Cancer Center	
Patients Treated (yr^{-1})	1,750
Radiation Oncologists	6
Main facility	5 Linacs (IGRT & IMRT)
1st Satellite facility	1 Linac
2nd Satellite facility	1 Linac
Contracted Satellite facility	1 Linac
Special Procedures	HDR & LDR Brachytherapy, TSE

ASTRO Accreditation Program for Excellence

Safety and quality for radiation oncology practice

Staffing Example, APEx (*Safety is no Accident)*

			Relative FTE Factor	
Equipment, Sources and Systems	Services -- # of Units or Licenses*	No. of systems*	Physicist	Dosimetrist
	Multi energy accelerators	7	0.25	0.05
	Single energy accelerators	0	0.08	0.01
	Tomotherapy, CyberKnife, GammaKnife	1	0.3	0.03
	Cobalt Units, IMRT, PACS, EMR & Contouring	12	0.08	0.03
	Orthovoltage and superficial units	0	0.02	0.01
	Manual brachytherapy; LDR Seed Implants	1	0.2	0.03
	HDR brachytherapy	2	0.2	0.02
	Simulator, CT-Simulator, PET, MRI Fusion	6	0.05	0.02
	Computer planning system (per 10 workstations)	2	0.05	0.02
	HDR planning system	2	0.2	0.01
No. Patient Procedures	Annual # of Patients undergoing Procedures**	No. of patients**		
	External Beam RT with 3D planning	25	0.0003	0.003
	External Beam RT with conventional planning	854	0.0002	0.002
	Sealed source Brachytherapy (LDR & HDR)	86	0.008	0.003
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	IMRT, IGRT, SRS, TBI, SBRT	785	0.008	0.005
Nonclinical - Estimated Total FTE Effort	Estimated Total (Phys & Dosim) FTE Effort***	FTE Effort***		
	Education & Training (FTE)	1	0.667	0.333
	Generation of Internal Reports (FTE)	0.15	0.667	0.333
	Committees & Meetings; Inc. Rad. Safety (FTE)	0.10	0.667	0.333
	Administration and Management (FTE)	0.80	0.667	0.333

Clement Burton Foles Regional Cancer Center	
Patients Treated (yr^{-1})	1,750
Radiation Oncologists	6
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1st Satellite facility	1 Linac
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Contracted Satellite facility	1 Linac
Special Procedures	HDR & LDR Brachytherapy, TSE

≅ 13 QMP FTE

≅ 9 dosimetrists FTE

Question 3

According to ASTRO's 2012 publication, "Safety is No Accident," the minimum personnel requirement for medical dosimetry is:

a. As needed, approximately one per 100 patients treated annually
b. As needed, approximately one per 250 patients treated annually
c. As needed, approximately one per 350 patients treated annually
d. No guideline given, just as needed

Question 3

According to ASTRO's 2012 publication, "Safety is No Accident," the minimum personnel requirement for medical dosimetry is:

a. As needed, approximately one per 100 patients treated annually

b. As needed, approximately one per 250 patients treated annually

c. As needed, approximately one per 350 patients treated annually

d. No guideline given, just as needed

Reference: "SAFETY IS NO ACCIDENT: A Framework for Quality Radiation Oncology and Care," American Society for Radiation Oncology. (2012).

Accrediting body models

Different roads, similar-*ish* results …

Living models, updated semi-regularly with participant data (ACR) or committee oversight / participant feedback (APEx).

Institutional desire for accreditation can serve as support for your operating budget requests

ACR & APEx accreditation emphasize quality and safety, great words to use with administrators

ACR recommendations are probably closer to how things are rather than where we would like them to be

APEx (& SINO) is *relatively* new and modelling sampling data reflects number and type of early program participants

Again, for multi-site practices, no accounting for travel, management nor clinical coordination overhead

Accrediting body models

	Abt Associates	ACR American College of Radiology	APEx
Medical Physicists	11	9	13
Dosimetrists	7	7	9

Accrediting body models

Different roads, similar results …

Living models, updated semi-regularly with participant data (ACR) or committee oversight / participant feedback (APEx).

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Again, for multi-site practices, no accounting for travel, management nor clinical coordination overhead

Effort Approach

- Move away from FTEs and towards budgeted effort
  - Convert work estimates to $$$ not FTEs
- Provides flexibility & robustness while still maintaining degree of specialization
- Works well for a multi-site practice
  - Geographic limitations (< 50min commute)
- Centralized management, budgeting revolves around periodically negotiated Physics Service Agreements

	Treatment Designation	Number of Treatment Units Annually '08	'09	'10	'11	'12	'13 *projected*	CAGR ('08-'13)	Average Effort / Treatment [hr]	Physics Procedural Hours (2013)
A.	Conventional External Beam RT									
	A.1 Routine Activities	856	1065	1078	1109	984	1020	9%	0.5	2,540
	A.2 Unscheduled Consultations								4.3	300
	A.3 Construction / verification of special bolus, immobilization devices or collimation								0.7	95
B.	Brachytherapy									
	B.1 Gynecological BT	18	108	70	78	90	93	50%	12.0	1,116
	B.2 Eye Plaque Brachytherapy		-	-	13	11	7	3%	5.0	35
	B.3 Prostate Brachytherapy	0	0	8	10	9	9	3%	7.0	63
C.	Robotic Radiotherapy									
	C.1 Stereotactic Radiotherapy	74	93	124	89	80	114	20%	10.0	1,140
	C.2 Stereotactic Radiosurgery	45	70	51	52	58	69	24%	7.0	483

Treatment Designation	Number of Treatment Units Annually '08	'09	'10	'11	'12	'13 *projected*	CAGR ('08-'13)	Average Effort / Treatment [hr]	Physics Procedural Hours (2013)
A. Conventional External Beam RT									
A.1 Routine Activities									
A.2 Unscheduled Consultations									
A.3 Construction / verification of collimation									
B. Brachytherapy									
B.1 Gynecological BT									
B.2 Eye Plaque Brachytherapy									
B.3 Prostate Brachytherapy									
C. Robotic Radiotherapy									
C.1 Stereotactic Radiotherapy									
C.2 Stereotactic Radiosurgery									

Task Commissioning, Development & Ongoing Quality Assurance	Number of Systems 2013	2014 *projected*	Median QMP[1] [hr / yr / system]	Physics Non-procedural Hours (2014)
Linac Quality Assurance & Commissioning [2]	6	6	493.0	2958.0
Linac Quality Assurance & Commissioning (next generation) [4]	0	1	565.0	565.0
TLD / Diode QA & Total Commissioning time [4]	1	1	52.2	52.2
Total Body Irradiation [3]	2	2	35.1	70.2
Afterloaded HDR Brachytherapy [3]	1	1	80.4	80.4
LDR Brachytherapy [3]	1	1	20.1	20.1
Prostate seed implantation [3]	1	1	56.0	56.0
Intra-operative radiotherapy [3]	1	1	62.3	62.3
Radiosurgery (Robotic)	1	1	180.0	180.0

Treatment Designation	Number of Treatment Units Annually '08	'09	'10	'11	'12	'13 *projected*	CAGR ('08-'13)	Average Effort / Treatment [hr]	Physics Procedural Hours (2013)
A. Conventional External Beam RT									
A.1 Routine Activities	856	1065	1078	1109	984	1020	9%	0.5	2,540
A.2 Unscheduled Consultations									
A.3 Construction / verification of special bolus, immobilization devices or collimation								0.7	95
B. Brachytherapy									
B.1 Gynecological BT	18	108	70	78	90	93	50%	12.0	1,116
B.2 Eye Plaque Brachytherapy									
B.3 Prostate Brachytherapy									
C. Robotic Radiotherapy									
C.1 Stereotactic Radiotherapy	74	93	124	89					
C.2 Stereotactic Radiosurgery	45	70	51	52					

Task	Number of Systems 2013	2014 *projected*	Median QMP[1] [hr / yr / system]	Physics Non-procedural Hours (2014)
Commissioning, Development & Ongoing Quality Assurance				
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TLD / Diode QA & Total Co				
Total Body Irradiation [3]				
Afterloaded HDR Brachyth				
LDR Brachytherapy				
Prostate seed implantation				
Intra-operative radiotherapy				
Radiosurgery (Robotic)				

Table III. Required Physics Expenditure, 2014

Physics Support Type	Total Annual Physics Effort Expenditure [hr]
I. Procedural	9,615
II. Non-procedural *(2014 projected)*	5,462
III. Medical Physics Training Program	1,418
IV. Administrative	1,226
V. Computing	4,960
Total hours expended:	22,681

	Level	Assigned Daily Clinical Responsibilities	Qualified Medical Physicist	Category of Physics Support					Total *
				Proced.	Non-proced.	Train.	Admin.	Comp.	
A	Associate	no	yes	5%	3%	8%	15%	5%	36%
B	Assistant	yes	yes	60%	10%	5%	0%	3%	78%
C	Assistant	yes	yes	60%	3%	5%	0%	0%	68%
D	Assistant	yes	yes	65%	5%	20%	0%	0%	90%
E	Assistant	no	no	0%	7%	0%	0%	85%	92%
F	Assistant	yes	yes	30%	30%	10%	30%	0%	100%
G	Staff	yes	yes	70%	3%	10%	10%	5%	98%
H	Staff	yes	yes	80%	15%	5%	0%	0%	100%
I	Staff	yes	yes	80%	15%	5%	0%	0%	100%
J[2]	Staff	no	no	0%	0%	0%	0%	90%	90%
K[2]	Staff	no	no	0%	0%	0%	0%	80%	80%
Total Physics Effort Expended [1] (2013) [hr]:				7,956	1,609	1,202	972	5,269	

	Procedural	Non-procedural	Training	Admin.	Computing	Total
Total QMP effort expended (2013) [hrs]	7,956	1,609	1,202	972	5,269	16,478
Total QMP hours per service required (2014) [hours]	9,615	5,462	1,418	1,226	4,960	22,634
Deficit of Physics Support [hours]:	1,659	3,853	216	254	-309	6,156
Additional annual Physics effort required to fulfill 2014 requirements:	**94%**	**218%**	**12%**	**14%**	**-17%**	
					Total required additional annual Physics effort (2014):	**321%**

Physics Support	Total Annual Physics Expenditure (hours)	Cost per Hour		Total Cost		
		low	*high*	low	average	high
I. Procedural	9510	($75	- $125)	$713,250	$951,000	$1,188,750
II. Non-procedural *(2014 projected)*	5462	($70	- $120)	$382,340	$518,890	$655,440
III. Training	1418	($80	- $130)	$113,440	$148,890	$184,340
IV. Administrative	1226	($90	- $140)	$110,340	$140,990	$171,640
V. Computing	4960	($40	- $55)	$198,400	$235,600	$272,800
Total hrs. expended:	22,576			$1,517,770	$1,995,370	$2,472,970

Additional considerations for multi-site practices

Expertise

- ABR certification & required licensing
- General experience in the field
- Special procedure support

Resources

- Adequate equipment
  - shared vs. local
- TPS deployment
  - centralized vs. local, # of licenses)
- IT and Service support
  - IT centralized? Separate service groups

Strategic planning

- Clear vision
- Administrative buy-in (quality, accreditation)
- Lead time for recruitment & equipment acquisition

Morale

- # per site
- Commute
- Backfill
- Prevent isolation

Staffing models for Multi-site Institutions

2018 AAPM Spring Clinical Meeting

M.Price, Ph.D.
Associate Professor, Vice Chair & Director of Physics
Vanderbilt University Medical Center

VANDERBILT UNIVERSITY
MEDICAL CENTER