Diagnostic Workforce and Manpower Survey – Part 2 Analysis and Results

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Outline

- Demographics of responders
- FTE assumptions and analysis
- Procedure based cost analysis
- Sample profile of a large academic facility
- Conclusions

Demographic analysis

Section 1

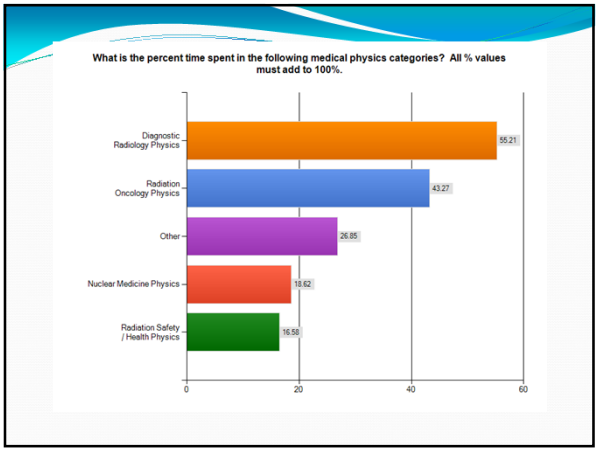
Why do the totals on these slides not add up to 100% ?

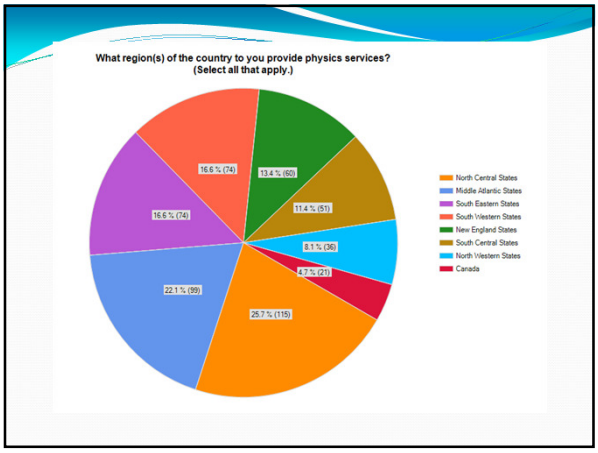
Respondents were asked to provide percentages of their activities in the categories that apply

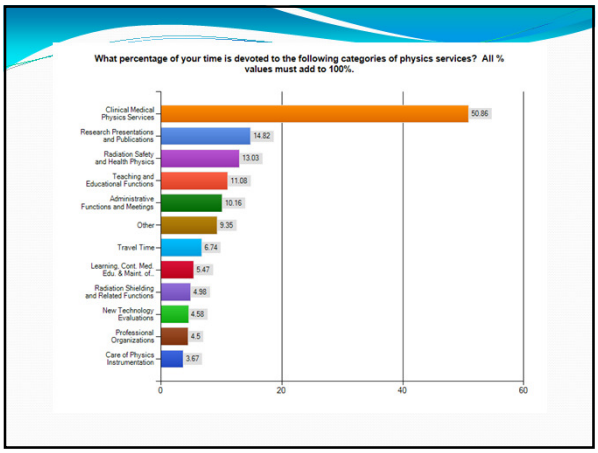
If the categories did not apply, no entry was made; no 0% was recorded

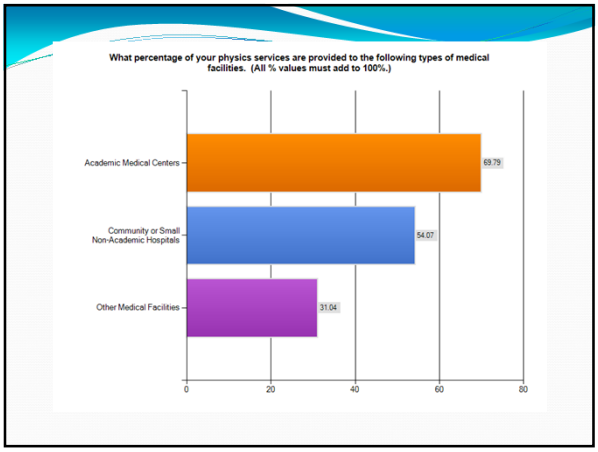
Each category had varying numbers of responses

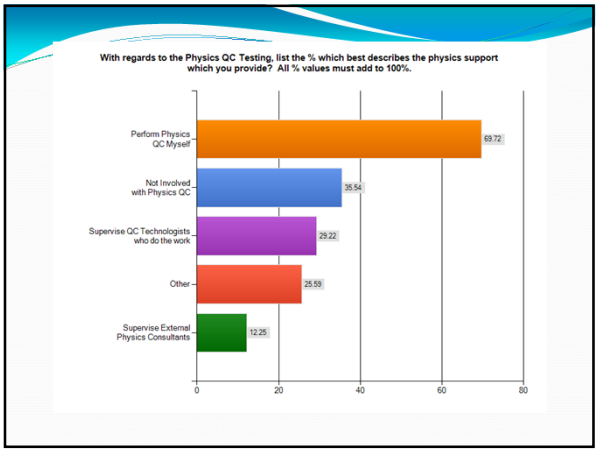
The total of the averages therefore exceed 100%

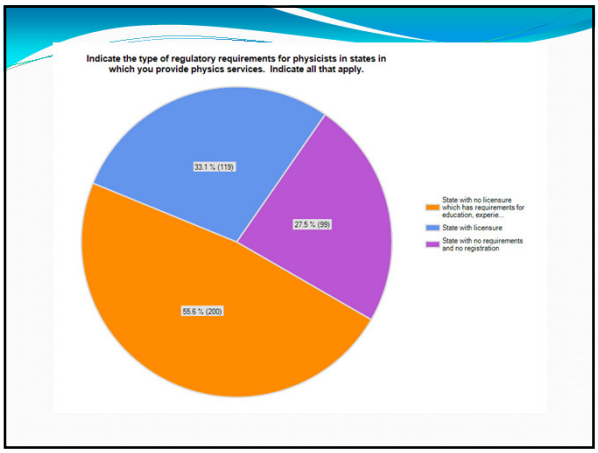


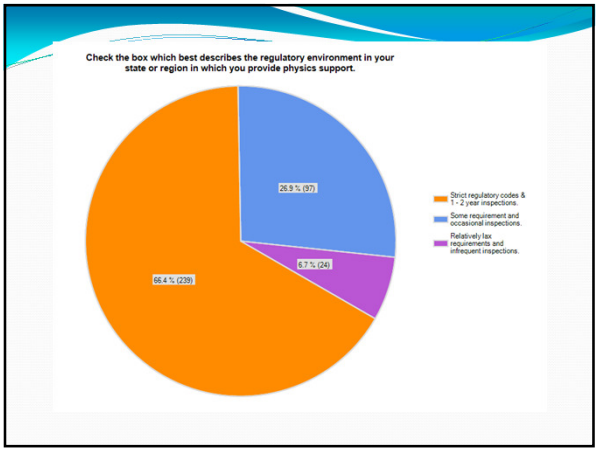


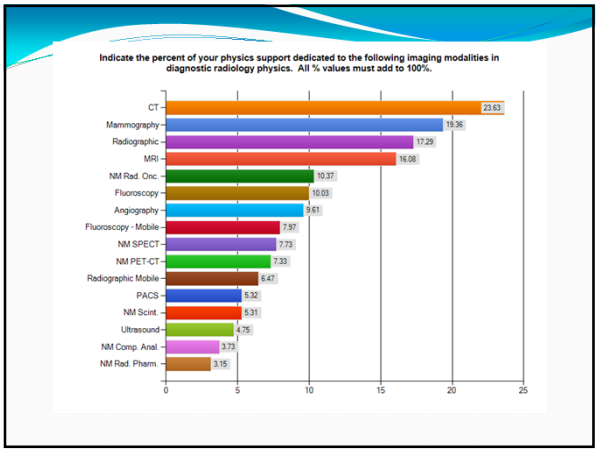

What percentage of your time is devoted to the following categories of physics services? All % values must add to 100%.
Clinical Medical Physics Services
50.86
Research Presentations and Publications
14.82
Radiation Safety and Health Physics
13.03
Teaching and Educational Functions
11.08
Administrative Functions and Meetings
10.16
Other
9.35
Travel Time
6.74
Learning, Cont. Med. Edu. & Maint. of.
5.47
Radiation Shielding and Related Functions
4.98
New Technology Evaluations
4.58
Professional Organizations
4.5
Care of Physics Instrumentation
3.67
0
20
40
60


What percentage of your physics services are provided to the following types of medical facilities. (All % values must add to 100%.)
Academic Medical Centers
69.79
Community or Small Non-Academic Hospitals
54.07
Other Medical Facilities
31.04
0
20
40
60
80


With regards to the Physics QC Testing, list the % which best describes the physics support which you provide? All % values must add to 100%.
Perform Physics QC Myself
69.72
Not Involved with Physics QC
35.54
Supervise QC Technologists who do the work
29.22
Other
25.59
Supervise External Physics Consultants
12.25
0
20
40
60
80


Indicate the type of regulatory requirements for physicists in states in which you provide physics services. Indicate all that apply.
33.1 % (119)
27.5 % (99)
55.6 % (200)
State with no licensure which has requirements for education, experie...
State with licensure
State with no requirements and no registration


Check the box which best describes the regulatory environment in your state or region in which you provide physics support.
26.9 % (97)
6.7 % (24)
66.4 % (239)
Strict regulatory codes & 1 - 2 year inspections.
Some requirement and occasional inspections.
Relatively lax requirements and infrequent inspections.

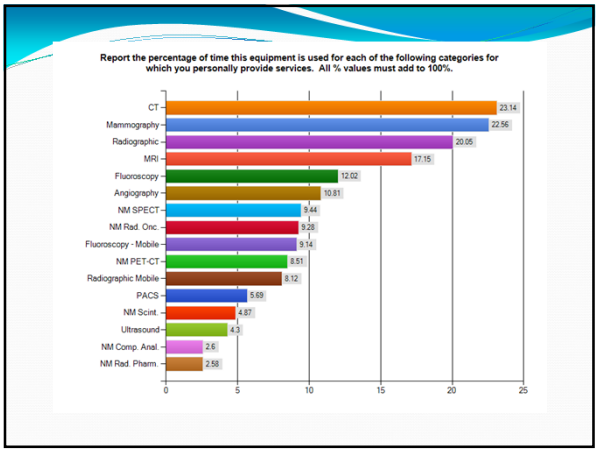

Indicate the percent of your physics support dedicated to the following imaging modalities in diagnostic radiology physics. All % values must add to 100%.
CT 23.63
Mammography 19.36
Radiographic 17.29
MRI 16.08
NM Rad. Onc. 10.37
Fluoroscopy 10.03
Angiography 9.61
Fluoroscopy - Mobile 7.97
NM SPECT 7.73
NM PET-CT 7.33
Radiographic Mobile 6.47
PACS 5.32
NM Scint. 5.31
Ultrasound 4.75
NM Comp. Anal. 3.73
NM Rad. Pharm. 3.15
0
5
10
15
20
25

FTE assumptions and analysis

Section 2

Cost of physics equipment personally used to provide services

Median cost of diagnostic imaging performance measurement equipment	
Costs	Median
Radiation detectors – initial cost	$15,000
Other equipment and phantoms – initial costs	$10,000
Total repairs and calibration – annual costs	$2,000
Total cost of ownership – annual costs	$7,600



Allocation of equipment cost

- Every respondent to the survey reported a unique set of equipment costs and equipment service mix
- The cost of performance equipment was allocated for each individual respondent
- The cost was allocated across the equipment service mix for each individual respondent
- If the respondent did no performance evaluations for a certain equipment type, no information was reported or evaluated

Reported number of units/systems/programs the respondent supports	
Type of unit/system/program	Median
Radiographic	20
Mobile Radiographic	12
Fluoroscopy	10
Mobile Fluoroscopy	12
Angiography	6
Mammography	10
CT	9.5
MRI	5.5
Ultrasound	4.5
PACS	1
Nuclear Medicine Scintigraphy	2
Nuclear Medicine SPECT	5
Nuclear Medicine PET-CT	2
Nuclear Medicine Computer Analysis	1
Nuclear Medicine Radiopharmacy	1
Nuclear Medicine Radiation Oncology	1

Do these numbers seem small?

- Remember:
  - The median respondent practices about 50% diagnostic and about 20 % nuclear medicine
  - The median respondent work allocation is about 50% clinical and about 15% research with the rest devoted to other duties
  - The median respondent reports about 70% of their clinical work is performed in an academic center
  - Only a small percentage of respondents are full-time imaging physics consultants

Estimate the average number of procedures performed per week per unit	
Type of unit/system/program	Median
Radiographic	150
Mobile Radiographic	80
Fluoroscopy	25
Mobile Fluoroscopy	25
Angiography	30
Mammography	70
CT	150
MRI	100
Ultrasound	50
PACS	3000
Nuclear Medicine Scintigraphy	40
Nuclear Medicine SPECT	25
Nuclear Medicine PET-CT	25
Nuclear Medicine Computer Analysis	30
Nuclear Medicine Radiopharmacy	100
Nuclear Medicine Radiation Oncology	4

During the initial planning, estimate the number of hours/single unit	
Type of unit/system/program	Median
Radiographic	5
Mobile Radiographic	2
Fluoroscopy	5.5
Mobile Fluoroscopy	3
Angiography	6
Mammography	8
CT	10
MRI	10
Ultrasound	2
PACS	5
Nuclear Medicine Scintigraphy	5
Nuclear Medicine SPECT	8
Nuclear Medicine PET-CT	12
Nuclear Medicine Computer Analysis	5
Nuclear Medicine Radiopharmacy	5.5
Nuclear Medicine Radiation Oncology	6

During a year, report # hours providing services including initial planning	
Type of unit/system/program	Median
Radiographic	5
Mobile Radiographic	2.4
Fluoroscopy	5.1
Mobile Fluoroscopy	4.6
Angiography	6.2
Mammography	11.6
CT	12.0
MRI	10.0
Ultrasound	2.4
PACS	7.0
Nuclear Medicine Scintigraphy	9.0
Nuclear Medicine SPECT	11.6
Nuclear Medicine PET-CT	12.4
Nuclear Medicine Computer Analysis	11.0
Nuclear Medicine Radiopharmacy	5.1
Nuclear Medicine Radiation Oncology	11.2

Procedure based cost analysis

Section 3

Some cost assumptions:

- Median equipment cost is $38,000 over 5 years, or $7,600 per year
- The median cost per hour of an imaging physicist is $150,000.
- The median imaging physicist works 1800 hours per year, but approximately half of this time is devoted to clinical support
- Performance equipment and clinical equipment is assumed to have a five-year amortization and useful life

Reported number of units/systems/programs the respondent supports	
Type of unit/system/program	Median
Radiographic	20
Mobile Radiographic	12
Fluoroscopy	10
Mobile Fluoroscopy	12
Angiography	6
Mammography	10
CT	9.5
MRI	5.5
Ultrasound	4.5
PACS	1
Nuclear Medicine Scintigraphy	2
Nuclear Medicine SPECT	5
Nuclear Medicine PET-CT	2
Nuclear Medicine Computer Analysis	1
Nuclear Medicine Radiopharmacy	1
Nuclear Medicine Radiation Oncology	1

Physics service costs for the median respondent workload			
Type of unit/system/program	Labor cost	Equip. cost	Total cost
Radiographic	$15,000	$1,140	$16,140
Mobile Radiographic	$4,320	$684	$5,004
Fluoroscopy	$7,650	$760	$8,410
Mobile Fluoroscopy	$8,280	$760	$9,040
Angiography	$5,580	$760	$6,340
Mammography	$17,400	$1,292	$18,692
CT	$17,100	$1,140	$18,240
MRI	$8,250	$380	$8,630
Ultrasound	$1,620	$380	$2,000
PACS	$1,050	$38	$1,088
Nuclear Medicine Scintigraphy	$2,700	$266	$2,966
Nuclear Medicine SPECT	$8,700	$380	$9,080
Nuclear Medicine PET-CT	$3,720	$380	$4,100
Nuclear Medicine Computer Analysis	$1,650	$76	$1,726
Nuclear Medicine Radiopharmacy	$765	$76	$841
Nuclear Medicine Radiation Oncology	$1,680	$228	$1,908

Median workload summary

- Labor Cost $105,465
- Equipment Cost 8,740
- Total Cost $114,205
- Number of units/systems/programs - 103
- Median workload hours – 703
- Ratio between median workload hours and total program support hours for this equipment is:
- 1800/703 = 2.56

Median labor/equipment cost/procedure & total program cost/procedure		
Type of unit/system/program	Labor/equip. cost	Program cost
Radiographic	$0.11	$0.28
Mobile Radiographic	$0.10	$0.27
Fluoroscopy	$0.67	$1.72
Mobile Fluoroscopy	$0.60	$1.54
Angiography	$0.70	$1.80
Mammography	$0.53	$1.37
CT	$0.26	$0.66
MRI	$0.31	$0.80
Ultrasound	$0.18	$0.46
PACS	$0.01	$0.02
Nuclear Medicine Scintigraphy	$0.74	$1.90
Nuclear Medicine SPECT	$1.45	$3.72
Nuclear Medicine PET-CT	$1.64	$4.20
Nuclear Medicine Computer Analysis	$1.15	$2.95
Nuclear Medicine Radiopharmacy	$0.17	$0.43
Nuclear Medicine Radiation Oncology	$9.54	$24.42

Median # units supported, annual equipment hours, annual program hours

Type of unit/system/program	Units	Hours Equip.	Hours Pgm.
Radiographic	20	100	256.0
Mobile Radiographic	12	28.8	73.7
Fluoroscopy	10	51	130.6
Mobile Fluoroscopy	12	55.2	141.3
Angiography	6	37.2	95.2
Mammography	10	116	297.0
CT	9.5	114	291.9
MRI	5.5	55	140.8
Ultrasound	4.5	10.8	27.6
PACS	1	7	17.9
Nuclear Medicine Scintigraphy	2	18	46.1
Nuclear Medicine SPECT	5	58	148.5
Nuclear Medicine PET-CT	2	24.8	63.5
Nuclear Medicine Computer Analysis	1	11	28.2
Nuclear Medicine Radiopharmacy	1	5.1	13.1
Nuclear Medicine Radiation Oncology	1	11.2	28.7

A single unit/system/program is what fraction of an FTE? (Pgm. Hours)

Type of unit/system/program	FTE fraction	FTE Recommended
Radiographic	0.007	0.010
Mobile Radiographic	0.003	0.005
Fluoroscopy	0.007	0.010
Mobile Fluoroscopy	0.007	0.010
Angiography	0.009	0.010
Mammography	0.016	0.020
CT	0.017	0.020
MRI	0.014	0.020
Ultrasound	0.003	0.005
PACS	0.010	0.010
Nuclear Medicine Scintigraphy	0.013	0.015
Nuclear Medicine SPECT	0.016	0.020
Nuclear Medicine PET-CT	0.018	0.020
Nuclear Medicine Computer Analysis	0.016	0.020
Nuclear Medicine Radiopharmacy	0.007	0.010
Nuclear Medicine Radiation Oncology	0.016	0.020

Sample profile of a large academic facility

Section 4

Staffing estimates from AAPM Report 33 and this study			
Type of unit/system/program	# Units	FTE	FTE
Radiographic (R only plus R/F)	10 + 20 = 30	0.45	0.3
Mobile Radiographic	20	0.3	0.1
Fluoroscopy (Fluoroscopy only for R/F)	20	0.7	0.2
Mobile Fluoroscopy	15	0.45	0.15
Angiography	10	0.8	0.1
Mammography	15	0.225	0.3
CT	20	1.6	0.4
MRI	15	1.5	0.3
Ultrasound	15	0.225	0.075
PACS	2	0.5	0.02
Nuclear Medicine Scintigraphy	3	0.3	0.045
Nuclear Medicine SPECT	5	1.25	0.1
Nuclear Medicine PET-CT	3	0.3	0.06
Nuclear Medicine Computer Analysis	3	0.75	0.06
Nuclear Medicine Radiopharmacy	2	0.1	0.02
Nuclear Medicine Radiation Oncology	1	0.1	0.02

Type of unit/system/program	Pgm $/Proc.	# Proc.	Cost allocated
Radiographic	$0.28	225000	$61,979.80
Mobile Radiographic	$0.27	80000	$21,351.16
Fluoroscopy	$1.72	25000	$43,060.73
Mobile Fluoroscopy	$1.54	18750	$28,929.03
Angiography	$1.80	15000	$27,051.63
Mammography	$1.37	52500	$71,779.83
CT	$0.66	150000	$98,307.50
MRI	$0.80	75000	$60,255.23
Ultrasound	$0.46	37500	$17,067.27
PACS	$0.02	300000	$5,570.76
Nuclear Medicine Scintigraphy	$1.90	6000	$11,389.84
Nuclear Medicine SPECT	$3.72	6250	$23,245.63
Nuclear Medicine PET-CT	$4.20	3750	$15,744.56
Nuclear Medicine Computer Analysis	$2.95	4500	$13,256.15
Nuclear Medicine Radiopharmacy	$0.43	10000	$4,306.07
Nuclear Medicine Radiation Oncology	$24.42	200	$4,884.65

Results of cost allocation

- A number of units and procedures was used to postulate a typical large academic center equipment and procedure mix
- The total cost allocated to support the medical physics imaging program was $508,180 per year
- These funds should be allocated to support equipment needs, salary and benefits of 2.25 FTE medical physicists as predicted by this matrix
- The older Report 33 and the AAPM/ACMP reports predict 9.6 and 7.9 FTE, respectively

Conclusions

Section 5

Conclusions:

- There is a very large chasm between the FTE effort to support imaging equipment as estimated in the early 1990's versus what is reported today by respondents in the community
- This chasm is almost completely independent of:
  - Primary specialty – diagnostic imaging, nuclear medicine, radiation oncology, health physics
  - Primary practice location – academic, community, other
  - Percentage of time devoted to clinical practice
  - Whether the respondent personally performed the services
  - Geographic location

Conclusions

- There is a very large chasm between the FTE effort to support imaging equipment as estimated in the early 1990's versus what is reported today by respondents in the community
- Possible factors to explain this chasm:
  - The 1990's reports overestimated physicist FTE values
  - The respondents are underestimating their work effort
  - The performance measurement equipment is much more efficient greatly improving physicist efficiency
  - Physicists use more support staff today versus 1990
  - Shortage of imaging physicists – the work does not get done

Conclusions

- Why does the Abt Associates methodology work in the radiation oncology physics community and seem to fail in the imaging physics community?
  - The Abt measured data closely aligns with panel data as published in the ASTRO "Blue Book"
  - Physicist demand and support in radiation oncology is driven by patient safety and identified CPT codes
  - Physicist demand and support in imaging physics is driven by regulatory requirements; there is no identified revenue stream for imaging physics support and patient safety provides only occasional visible support
- Is there too little imaging physics practiced in the US?

Conclusions

- Future Research
  - The Abt methodology fails to fully illuminate the wide range of acceptable types of imaging physics practice in the United States
  - A second survey of targeted practices will be designed
    - Twenty large imaging consulting practices will be targeted
    - Twenty large academic centers with large numbers of employed imaging physicists will be targeted
    - The work performed by employed imaging physicists but not provided by consulting imaging physicists will be ascertained
  - The results of the future survey should provide better understanding of imaging physics practice in the US

Thank you!!