Dx Workforce Subcommittee Update

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2015 AAPM Annual Meeting

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

AMERICAN ASSOCIATION of PHYSICISTS IN MEDICINE

DWWSS

Diagnostic Work and Workforce Study Subcommittee

Start date: 25 Feb 2008

Charge

To measure the work associated with Diagnostic Medical Physics Procedures and estimate the workforce required to provide diagnostic physics services in the United States.

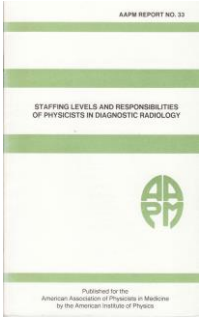
http://www.aapm.org/org/structure/default.asp?committee_code=DWWSS

Previous AAPM Reports

- 1991 AAPM Report No. 33 of TG 5
- 1993 AAPM-ACMP Bilateral Recommendations on Physics Staffing for Diagnostic Radiology

1995, 2003, & 2008 Abt reports for radiation oncology physics services

AAPM Report 33 – 1991



- Task Group 5 – Members:
  - Edward L Nickoloff (Chair)
  - James Atherton
  - Priscilla Butler
  - Robert Chu
  - Lance Hefner
  - Mitchell Randall
  - Louis Wagner
- Consultant Reviewers
  - Stephen Balter
  - Joseph Blinick
  - Donald Frey
  - Joel Gray
  - Mary Moore
  - Robert Waggener

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AAPM Report No. 33

- Dx MPs provide professional services for selecting, evaluating, monitoring and optimizing imaging devices
- Staff size recommendations are based on equipment inventory
  - Emphasis placed on the needs generated by each piece of equipment
- **Variations in needs between types of institutions have not been addressed**
- Physics staffing must also address educational services, administrative, regulatory and accreditation work

Slide courtesy of Michael Mills, PhD

Excerpt

"The AAPM recommendations for physics staffing are based on the type and amount of equipment in the radiology facility. However, the physics services extend far beyond the support of the listed equipment. The equipment merely serves as an index value for assessment of the needed physics staff."

Table 1

AAPM Physics Staffing Recommendations

Amount of Equipment	Staff Recommendations* For Physicists
I. Diagnostic X-ray	
For each mobile radiography unit	0.015 FTE
For each general x-ray room	0.015 FTE
For each mobile fluoroscope	0.03 FTE
For each R/F room	0.05 FTE
For each Special Procedures Room	0.08 FTE
For each digital system**	0.04 FTE
For each CT scanner	0.08 FTE
II. In Nuclear Medicine	
For each scintillation camera	0.10 FTE
For each image processing computer	0.25 FTE
For each SPECT	0.25 FTE
For each PET	TBD***
III. Ultrasound	
For each ultrasound scanner	0.015 FTE
IV. MRI	
For each MRI	0.1 - 0.25 FTE

Recommended ratio of DxMPs : Support Staff

1 : 1.5

Table 2, example

400-600 bed hospital

Equipment	FTE's per Equipment	Recommended FTE Physicists
15 general x-ray rooms	0.015/room	0.225
4 RF rooms	0.05/room	0.20
3 special procedures rooms	0.08/room	0.24
2 digital systems	0.04/system	0.08
1 CT scanner	0.08/room	0.08
5 radiographic portable units	0.015/unit	0.075
2 portable fluoroscopic units	0.03/unit	0.06
2 nuclear medicine imagers	0.10/unit	0.20
1 image processing computer	0.25/unit	0.25
1 SPECT unit	0.25/unit	0.25
4 ultrasound units	0.015/unit	0.06
Total		1.72

Table 2, example

400-600 bed hospital

Practical Staffing: 2.0 FTE Physicists and 2.6 (1.5 x 1.75) FTE Support Staff The facility could hire 1 full-time physicist in x-ray with an additional 72% part-time physicist in Nuclear Medicine, Ultrasound and Radiation Safety operations. In practical terms, 2 physicists are appropriate. The appropriate physics support staff is 2.6 FTE's.

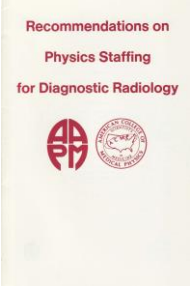
Total scope of example:
22 x-ray rooms
1 CT
7 mobile x-ray
2 gamma cameras
1 SPECT
4 US
1 image processing computer

Final thoughts on Report 33

- Equipment is vastly different now
  - More complex, probably w/o exception
- Increased complexity means different level of DxMP support required
- Practice of DxMP has gained some efficiencies since 1991
- AAPM Report No. 33 has never been superseded

Slide courtesy of Michael Mills, PhD

AAPM ACMP – Physics Staffing for Diagnostic Radiology – 1993



- Members of the Trilateral Task Force: AAPM, ACMP and ACR Commission on Physics
  - » Edward Nickoloff (Chair)
  - » Stewart Bushong (AAPM)
  - » Charles Kelsey (AAPM)
  - » James Kereiakes (ACR)
  - » Mark Mishkin, MD (ACR)
  - » Lawrence Rothenberg (ACMP)
  - » Louis Wagner (AAPM)
- Contributing Consultants
  - » James Deye
  - » Thomas Payne
  - » Ray Tanner

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Survey + consensus

- Survey distributed, responses from 52 institutions of mixed size
- Analysis studied by group of senior DxMPs and a physician
- Group consensus reached and recommendations published

TABLE 1. Simplified staff recommendations for diagnostic radiology[a]

Type of Diagnostic Equipment	Recommended Physicist Staff[b]
x-ray[c]	1 FTE/40 x-ray tubes[d]
ultrasound	1 FTE/50 units
nuclear Medicine	1 FTE/8 imagers

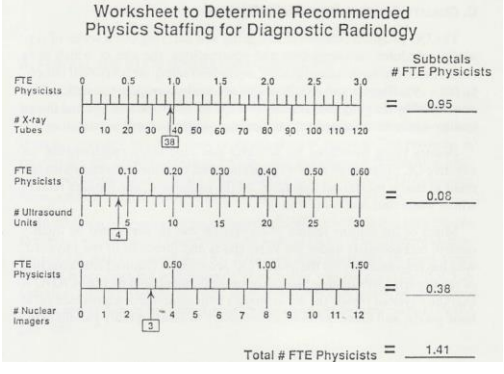
[a] *The physics support staff is 1.5 FTE per physicist and includes QC technologists and radiation safety personnel, but it does not include x-ray servicemen.*

[b] *This value is based upon routine clinical duties performed in diagnostic radiology facilities. It does not include staff for magnetic resonance, teaching, or research.*

[c] *Includes radiographic, fluoroscopic, tomographic, mammographic, portables, and CT units.*

[d] *One FTE is equivalent to one person working 230 8-hour days per year.*

Note: No MR & no PET



Final thoughts on AAPM-ACMP

- Considerably simplified compared to Report 33
- Heroic effort to get agreement with all societies then representing the professional concerns DxMPs
- Ultimately endorsed by AAPM and ACMP but not ACR
- Remains most recent DxMP staffing document endorsed by AAPM

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Keep in mind

"...largest financial investment in high technology equipment in the medical facility... experts who can ensure that the investment is fully realized in daily performance." -*AAPM Report No. 33*

"The financial investment in equipment is enormous." - *Trilateral task force*

"Sunshine report"

Diagnostic Medical Physicists and Their Clinical Activities

Yasmin S. Cypel, PhD[a], Jonathan H. Sunshine, PhD[a,b]

Purpose: The primary objective of this study was to obtain basic, descriptive information about medical physicists involved in diagnostic radiology-related activities, the diagnostic-related activities that they performed, and the time spent on these activities.

Methods: A survey was sent to a randomly selected sample of 1511 medical physicists from July through October 2001 using primarily e-mail methods; a total of 851 surveys was received, for a response rate of 56%. Of these, 427 were responses from physicists who do partly or only clinical diagnostic medical physics; it is this group for which results are presented.

Results: Fifty-four percent of the physicists who reported doing any clinical diagnostic medical physics performed clinical activities only in diagnostic medical physics. Fourteen percent of all those doing clinical diagnostic medical physics were women. Over 97% of the physicists doing clinical diagnostic medical physics reported having graduate degrees in physics; 53% had PhDs. The mean total weekly hours worked by physicists doing clinical diagnostic medical physics was 42. Medical physicists doing only clinical diagnostic activities reported working approximately 40 hours weekly, whereas those doing partly clinical diagnostic medical physics reported working 14 hours weekly in the field (approximately one-third of their work time). Radiography and fluoroscopy, computed tomography, nuclear medicine, and mammography are all fields in which the majority of those doing any clinical diagnostic medical physics are active. Full-time physicists

J Am Coll Radiol 2004;1:120-126.

Sunshine survey (2001)

- Random selection of AAPM membership
- 1511 initially
- 56% response
- 50% of those "do partly or only diagnostic medical physics"
- … N = 427
- ~40 question multiple choice
- 12 month lookback

Partly vs. only

46% only

54% partly

Who is speaking for us?

Only Dx

13% reported being in private practice

Respondent profile

- 40-50 hours per week
- All modalities
- Lower % for US & MR
- Holds for partly and only Dx

Stats

Median # units "responsible for"
- Only = 25 (mean = 85, 25th-75th = 2-100)
- Partly = 10 (mean = 41, 25th-75th = 3-50)

Work at two facilities

Overall median # units "evaluated"
- 57 (mean = 113, 25th-7th = 9-148)

Definition lacking

Responsible for

vs.

Evaluated or consulted on

Hours per survey

Table 3. Computed tomography (CT) and other x-ray clinical activities performed in past 12 months, by level of involvement in clinical diagnostic medical physics (DMP)

Type of Unit and Physicist Work Pattern	Number of Units Evaluated/Image Consultation					Frequency of Evaluation (%)							Hours/Evaluation				
			Percentile												Percentile		
				50th												50th	
	n	Mean (SE)	25th	(Median)	75th	n	M	Q	S	A	B	Acc	n	Mean (SE)	25th	(Median)	75th
Breast imaging: mammography tubes																	
Part DMP	118	12 (1.3)	1	6	16	90	0	3	98	7	0	1	89	7 (0.7)	5	6	8
DMP only	145	16 (2.1)	3	7	15	113	1	3	108	7	0	0	113	8 (0.5)	5	7	10
Breast imaging: stereotactic breast biopsy tubes																	
Part DMP	93	2 (0.3)	0	1	2	67	0	0	79	0	0	3	64	7 (0.6)	4	5	8
DMP only	128	2 (0.2)	0	1	2	95	0	1	49	4	1	0	93	6 (0.3)	4	6	7
CT																	
Part DMP	124	5 (0.5)	1	3	6	97	4	5	87	6	2	4	93	6 (0.7)	2	4	6
DMP only	150	7 (1.0)	1	4	7	115	6	3	157	2	1	3	108	6 (0.5)	3	4	6
Radiographic tubes (excluding portables)																	
Part DMP	119	42 (5.5)	5	25	51	105	1	4	108	4	1	1	102	3 (0.2)	2	2	3
DMP only	144	70 (7.7)	5	42	89	113	0	9	117	7	1	3	108	3 (0.4)	1	2	4
Radiographic tubes (portables only)																	
Part DMP	116	13 (1.6)	1	8	15	90	0	6	49	0	0	0	89	2 (0.1)	1	2	2
DMP only	137	19 (2.4)	2	10	20	105	0	6	118	3	0	0	104	2 (0.2)	1	2	2
CR-DR systems																	
Part DMP	89	2 (0.5)	0	0	2	40	3	5	88	0	0	5	40	6 (1.0)	2	4	6
DMP only	113	3 (0.7)	0	1	5	63	6	11	106	3	0	10	61	7 (1.5)	2	3	7
Fluoroscopic tubes (excluding portable C-arms)																	
Part DMP	120	18 (2.9)	2	9	20	106	1	4	88	6	0	1	104	3 (0.2)	2	2	3
DMP only	137	25 (3.1)	4	15	30	112	1	12	147	1	1	1	109	3 (0.3)	2	2	4

Interesting question(s)

Do the large number and, more particularly, broad range of equipment units for which the typical diagnostic medical physicist is responsible create strains, and do physicists feel that the quality of their work is unduly challenged thereby?

Cypel & Sunshine, JACR 2004

2012 Dx manpower survey

- Time per unit
- Their time separate from support staff time
- Their percentage effort by sub-specialty
- Their location by region of the country
- Their percentage of time by physics category of service or work
- Percentage of physics services to type of medical facilities
- Percentage effort by type of physics support (e.g., do all CQ work, supervise support staff, supervise consultants, etc.)
- Regulatory environment in states where services are provided
- Percentage of support time to various imaging units
- Performance equipment cost and use by equipment category
- Number of units for which you personally provide services
- Number of patient procedures per week on each type of unit
- Hours of support for initial planning and installation
- Annual hours of support for each type of unit

Slide courtesy of Michael Mills, PhD

Ideal report

- Both the number of hours/year and the % FTE of effort for the imaging QMP to support a unit of equipment
- The cost in equipment, salary and benefits to provide imaging QMP support for each unit of equipment
- The cost of imaging QMP support per patient procedure by category of procedure
- A business model for the imaging physicist to use to support an imaging section based on:
- Income from a structured revenue stream based on the cost of providing imaging physics support for patient procedures
- Needed support for equipment, salaries, benefits and space

Slide courtesy of Michael Mills, PhD

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

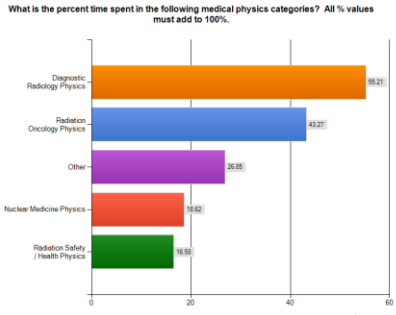
If the categories did not apply, no entry was made; no 0% was recorded

Each category had varying numbers of responses

The total of the averages therefore exceed 100%

Slide courtesy of Michael Mills, PhD

2012 respondent demo



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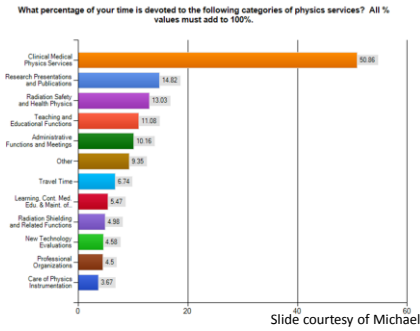
2012 time categorization



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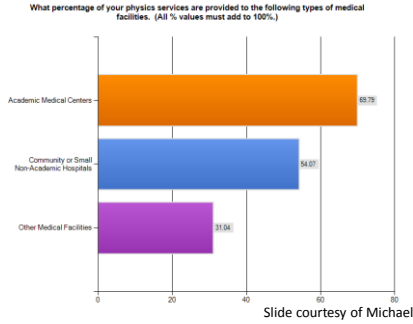
2012 facility breakdown



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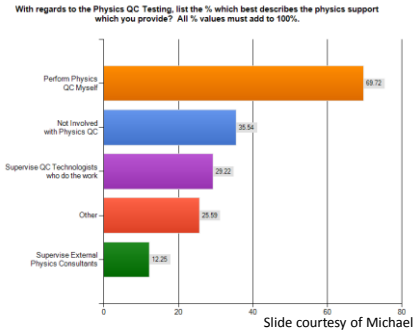
Hands on the equipment



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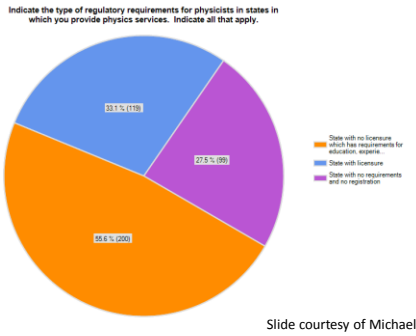
Licensure & registration



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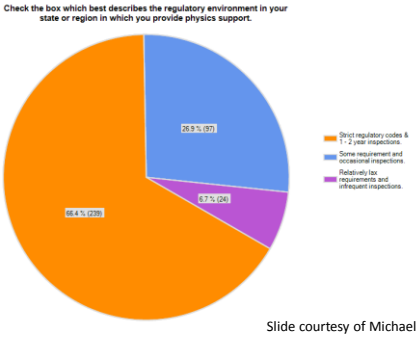
Regulatory environment



Slide courtesy of Michael Mills, PhD

We don't fit neatly into boxes

- % of time devoted to clinical service
- Practice subspecialty (x-ray, MR, NM, HP, therapy, etc.)
- % of time devoted to non-clinical activities (education, administration, AAPM, etc.)
- Nature of the clinical support provided (perform QC, supervise technologists, P&P, etc.)
- Regulatory environment & impact on time spent per unit

Slide courtesy of Michael Mills, PhD

Consultant vs. in-house DxMP

No distinction in data collected

One respondent per group

Only requested responses from practice group leaders

My opinion

As a community, we DxMPs do a poor job communicating our value, and it is incredibly difficult to capture and quantify the value of many of the things we do via survey.

Our value goes beyond testing equipment.

Important to note

Michael Mills and Ed Nickoloff have spent hundreds and hundreds of hours on this work, in addition to the other volunteers on the subcommittee.

This is a massive challenge. If you have an easy solution, I'm all ears.

2014 change

Current DWWSS

Penny Butler
Jessica Clements
Ken Coleman
Davy Goff
Dustin Gress (C)
David Jordan (VC)
Melissa Martin
Michael Mills
Thomas Nishino
Bob Pizzutiello
Lou Wagner

AAPM staff: Lynne Fairobent

2014

Met @ SCM in Denver (March)

Met @ AAPM in Austin (July)

1.5 day retreat in Dallas (October)

Reconsidering our approach

- We need progress, and quickly
- Einstein's definition of insanity
- Comprehensive survey is not attractive
  …rabbit hole after rabbit hole…

New approach

1. Build consensus (à la AAPM-ACMP 1993)
2. Publish white paper
3. Survey to fill gaps, ~in parallel with WP
4. Follow-up report

Meaningful taxonomy

- Recall: No distinction in previous data between in-house and consultant DxQMPs
- Define Levels of Service:

1. Required
2. Following cookbook
3. Writing the cookbook

Level 1

Medical physics services mandated by national accreditation bodies or regulatory agencies. Cost to stay in business for imaging facility. Direct value added to end user.*

*Working definition(s); subject to change

Level 1 examples

- Equipment performance surveys
- Survey report preparation
- QC program review
- Most things required by your regs or accreditation program(s)

Level 2

Medical physics best practices that are not mandated, but necessary to enhance safety and patient care. Guidance available via regulatory guide(s), publication, Task Group reports, Practice Guidelines, etc. May include regulatory tasks that are not be required to be done by a QMP, but a QMP brings relevant expertise to executing the tasks well.*

*Working definition(s); subject to change

Level 2 examples

- Institutional committee service
- Personnel dosimetry record review
- Sealed source inventory and leak tests
- RSC meetings
- Shielding design and evaluation
- Unsealed radiopharmaceutical support
- PPE QC
- Fetal/patient dose assessment
- P&P development and review

Level 3

Medical physics services that are not mandated, and are still in developmental stages. Medical physics expertise provides enhanced safety and patient care. Guidance not available via publication, Task Group reports, Practice Guidelines, etc.*

*Working definition(s); subject to change

Level 3 examples

- Ad hoc patient counseling
- QMP peer review
- Radiation Dose Index Monitoring (RDIM)
- Clinical image quality issues
- Hanging protocols

Consensus building

Strategy

Taxonomy

Consensus on Level 1

For example

Mammo			
	CR	DR	DBT
hrs hands on survey time:	6	5	5
qc program review:	incl	incl	incl
report preparation:	incl	incl	incl
Modifier 1.3x:	8	6.5	6.5

...for each of the modalities

Consensus was not as difficult to reach as you may imagine.

Our times were not dissimilar from those reported by Cypel & Sunshine.

...It does not appear that we are crazy.

"Job book"

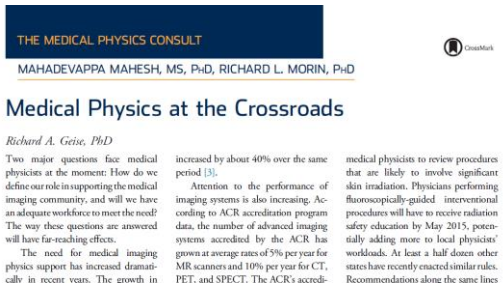
Long discussion of the various things we do, mostly giving substance to Levels 2 and 3.

Current status

Member volunteers have led drafting teams in writing sections of white paper.

Aiming to submit white paper to JACMP prior to RSNA. Limited survey to follow shortly thereafter.

Problem statement



THE MEDICAL PHYSICS CONSULT

MAHADEVAPPA MAHESH, MS, PhD, RICHARD L. MORIN, PhD

Medical Physics at the Crossroads

Richard A. Geise, PhD

Two major questions face medical physicists at the moment: How do we define our role in supporting the medical imaging community, and will we have an adequate workforce to meet the need? The way these questions are answered will have far-reaching effects.

The need for medical imaging physics support has increased dramatically in recent years. The growth in increased by about 40% over the same period [3].

Attention to the performance of imaging systems is also increasing. According to ACR accreditation program data, the number of advanced imaging systems accredited by the ACR has grown at average rates of 5% per year for MR scanners and 10% per year for CT, PET, and SPECT. The ACR's accredi-

medical physicists to review procedures that are likely to involve significant skin irradiation. Physicians performing fluoroscopically-guided interventional procedures will have to receive radiation safety education by May 2015, potentially adding more to local physicists' workloads. At least a half dozen other states have recently enacted similar rules. Recommendations alone the same lines

JACR, online Dec. 2014: http://dx.doi.org/10.1016/j.jacr.2014.10.022

Two major questions

"How do we define our role in supporting the medical imaging community, and will we have an adequate workforce to meet the need?"

Geise, JACR, online Dec. 2014

Interesting question(s)

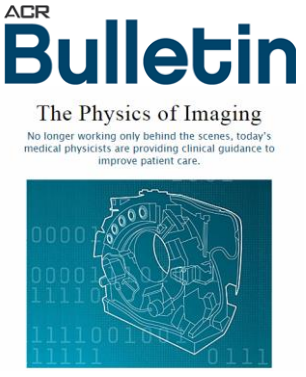
Do the large number and, more particularly, broad range of equipment units for which the typical diagnostic medical physicist is responsible create strains, and do physicists feel that the quality of their work is unduly challenged thereby?

Cypel & Sunshine, JACR 2004

Challenge

"Like radiologists, medical physicists need to decide if it is time to switch to a role that is based on value or stay with one in which their worth is based on volume."

Geise, JACR, online Dec. 2014

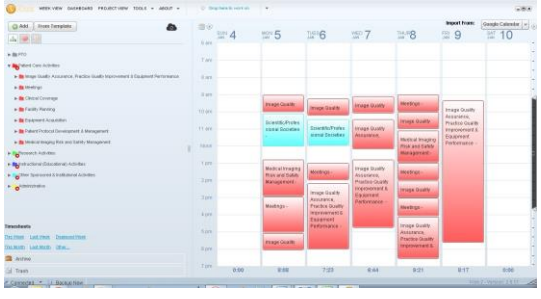


https://acrbulletin.org/54-quality-and-safety/225-the-physics-of-imaging June 2015

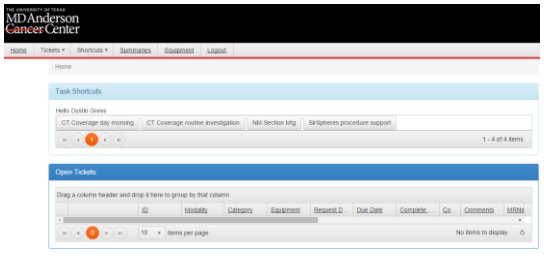
Conclusions

1. This is a very challenging project.
2. People have worked very hard on it.
3. Volunteers continue to work very hard.
4. Our professional livelihood and viability may hang in the balance.
5. Answer the call!

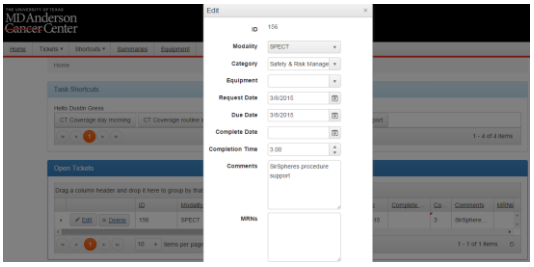
Categorizing time



Ticketing system



Ticketing system cont'd



Answer the call!