The path to assessing diagnostic physics* workforce

*including nuclear medicine

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Objectives

1. Understand challenges of collecting data on diagnostic medical physics practice

2. Understand AAPM’s future approach to characterizing diagnostic medical physics

3. Become familiar with AAPM Report 301’s updated description of diagnostic workforce

DWWSS, est. 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/organ/structure/default.asp?committee_code=DWWSS
“Diagnostic Workforce Study”

What is the right question to ask?

• “How many diagnostic medical physicists does the U.S. need?”
• “How many diagnostic medical physicists (or how much physics support) does a given facility need?”
• “How much physics support does a given machine, facility, or operation require?”

Overview of prior work to date

Several efforts have quantified diagnostic workforce needs over time

Another update due, and field has changed

These inform our approach and provide reference data

Past assessments

• AAPM Report No. 33 (1991)
• AAPM-ACMP Recommendations on Physics Staffing for Diagnostic Radiology (1993)
• Sunshine Report, JACR (2004)
• AAPM Dx Workforce and Manpower Survey (2012)

AAPM Report 33

Recommended ratio of DxMPs : Support Staff
1 : 1.5

AAPM-ACMP Recommendations

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
- Remained most recent (1993) DxMP staffing document endorsed by AAPM until May 2017
"Sunshine report" (2004)

**Diagnostic Medical Physicists and Their Clinical Activities**

Yasuo O. Cypen, PhD, Joseph A. Sutter, PhD

**Purpose:** The primary objective of this study was to obtain descriptive, self-reporting, data from medical physicists regarding diagnostic radiology-related activities. This diagnostic radiology-related activity data was used in the development and validation of the Diagnostic Radiology Radiation Safety (DRRS) database.

**Methods:** A self-administered, paper-and-pencil questionnaire was developed and distributed via electronic mail to all AAPM members in 2004. The questionnaire included questions regarding the type and amount of work performed by diagnostic medical physicists in the past year.

**Results:** A total of 120 surveys were completed, representing a 53% response rate. Of the respondents, 60% worked in academic institutions, 30% worked in private practice, and 10% worked in government agencies. The majority of respondents reported performing diagnostic radiology-related activities, with 75% of respondents reporting performing diagnostic radiology-related activities for at least 50% of their total work.

**Discussion:** The results of this study indicate that diagnostic medical physicists are involved in a wide range of activities related to diagnostic radiology. These activities include the development and implementation of radiation safety programs, the delivery of radiation therapy, and the interpretation of diagnostic imaging studies.

Sunshine survey (2001)

• Random selection of AAPM membership surveyed ca. 2001 regarding past 12 months’ work
• 56% response
• 50% of those “do partly or only diagnostic medical physics”
  • 46% of these “only”
  • 54% of these “partly”
• 13% of “only diagnostic” respondents in private practice

Hours per survey
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 AAPM Dx manpower survey

Analysis of collected data suggested conclusions markedly inconsistent with known realities of practice.

Results could not be summarized in a useful form and published.

(Aside: Therapy Physics Workforce)


AAPM developed staffing models from data

Other models (ACR, ASTRO) use different inputs (patients vs. procedures vs. machines, etc.)
Lessons Learned I: What to Do

AAPM Report 33: cautioned there’s more to Dx physics work than equipment inventory

AAPM-ACMP blended survey response data with consensus of committee – cross-section of veteran Dx medical physicists

Lessons Learned I: What to Do

All of these* collected data from actual medical physicists doing Dx work

AAPM 2012 survey group assembled a dedicated, hard-working, passionate team of volunteers (we assume the others did too)
DWWSS members’ perspectives

• Veteran Dx MP who do mostly or all clinical work
• In-house academic, in-house community, and consulting members
• Some members have significant experience in two or more settings
• In-house members from both individual hospitals and health system networks
• Consulting members have special projects and consulting services in addition to routine equipment evaluation and accreditation work for clients of all sizes

Lessons Learned II: What to Change

Categorizing the respondent by practice setting (consultant, in-house, academic, community, etc.):
• useful for demographics to validate respondent population
• appears to confound the data

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
Terminology

What does it mean to “support” a machine (CT scanner, MRI scanner, mammography unit, etc.)?

...or to “cover” one?
...or to “be responsible for”?
...or to “consult on”?

Terminology

• What are “basic” diagnostic medical physics services?

• What are “comprehensive” diagnostic medical physics services?

Practice environments

• What are the real natures of consulting and in-house physics support?

• What are the differences / similarities?

• Are all facilities strictly “academic” or “not”?
Practice environments

• What do we do about “blended” models vs. pure consulting and pure in-house?

• Can we account for differences using a model that does not force a facility (or a physicist) to be treated strictly as one or the other?


Need to let go of trying to get single authoritative answer from the equipment inventory ...

“... 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.” (AAPM Report 33)

New Framework: Levels of Service

• DWWSS developed the Levels of Service (LoS) model

• Attempts to describe and classify DxMP work without relying on traditional practice model or environment categories

• Published in AAPM Report 301 (May 2017)
Level 1

• Required services, or de facto requirements
• Well-defined
• Relatively high degree of agreement on procedures, time, effort

... EPEs

Level 2

• Well-described
• Frequently the responsibility of a medical physicist*
• Carried out according to published methods, procedures, standards
• Includes mandatory and non-mandatory services

... FGI safety program à la NCRP 168 ... RSO

*Not exclusively carried out by medical physicists

Level 3

• Not well-defined
• Not mandatory outside institution
• Broadly: research or developmental activities

... testing new tools & techniques, basic science, clinical research
Level 0

- Essential activities
- Cost of making medical physics services available
- Perhaps negotiable, perhaps necessary

... getting CE, calibrating instruments, maintaining certifications & licenses, operations & personnel mgmt

Neat.

- How does this help?

- Consensus+ on Level 1 times for each modality
  - Deliverable for AAPM membership
  - Transparency with membership

- Allows us to ask more granular, specific questions

Appendix 1, Table 1

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Hours per EPE</th>
<th>Modifier</th>
<th>Total hours per year for Level 1 services only</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQSA physics survey, S/F</td>
<td>Annual MQSA physics services for analog (screen-film) mammography systems. Includes hands-on survey time, QC program review, and report preparation**</td>
<td>6.0</td>
<td>1.3</td>
<td>7.8</td>
</tr>
<tr>
<td>MQSA physics survey, DR only, no DBT*</td>
<td>Annual MQSA physics services for DR systems. Includes hands-on survey time, QC program review, printer and one primary EWS (review workstation) evaluation, and report preparation**</td>
<td>5.0</td>
<td>1.3</td>
<td>6.5</td>
</tr>
<tr>
<td>MQSA physics survey, DBT**</td>
<td>Annual MQSA physics services for digital breast tomosynthesis (DBT) systems. Includes hands-on survey time, QC program review, notation and data</td>
<td>8.0</td>
<td>1.6</td>
<td>14.8</td>
</tr>
</tbody>
</table>
Appendix 1, cont’d

<table>
<thead>
<tr>
<th>Equipment</th>
<th>#</th>
<th>Level 1 Low eSIC per sub</th>
<th>Total Levy for Level 1 EPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>15</td>
<td>2.2</td>
<td>33</td>
</tr>
<tr>
<td>Radiographic</td>
<td>15</td>
<td>2.2</td>
<td>33</td>
</tr>
<tr>
<td>Table type and Mobile Fluoroscopy</td>
<td>3</td>
<td>1.8</td>
<td>9</td>
</tr>
<tr>
<td>Angiography: PCD</td>
<td>3</td>
<td>1.8</td>
<td>9</td>
</tr>
<tr>
<td>Ultrasonography (transducer per sub)</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Transducers</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammography</td>
<td>4</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td>PET</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>SPECT</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>MRI</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Radiology Workstations</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Ordered dose devices (e.g., DEXA or DEXA)</td>
<td>9</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38</td>
<td></td>
<td>59.3</td>
</tr>
</tbody>
</table>

DxMP could cover ~6-7 of these facilities

LEVEL 1 ONLY

Validation Needed

• Report 301, Table 1 is an anecdotal consensus
• Agrees well with Cypel & Sunshine (2004)
• Cypel & Sunshine collected real data from large # of working physicists—respondent caveats apply
• Mills, Nickoloff, et al. in 2012 collected real data from large # of working physicists

Validation Example & LoS:

• 1 Large Hospital:
  • 6 MRI
  • 3 PET-CT
  • 6 CT
  • 5 NM cameras
  • 7 X-ray rooms
  • 4 R&F rooms
  • 23 C-arms
  • 2 special procedures fluoro
  • 8 single-plane angio/cath
• 3 biplane angio/cath
• 16 portable X-ray
• 3 digital mammography
• 1 stereo biopsy
• 1 bone density
• 6 dental
• 4 mammography workstations
• 35 diagnostic workstations
How many physicists?

• Add up testing hours:
  • Approx. 260 hours for annual testing
  • 35 person-days per year
  • (Round up to 8 weeks)

• Implies:
  • 1 person for ~2 months
  • 1 FTE could serve 4-5 similar facilities

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Actual staffing?

1 Senior Diagnostic MP, 2 Junior Diagnostic MP
(also 1 full-time RSO and a ARSO)
Current status

• AAPM Report 301 published in May 2017
• “An Updated Description of the Professional Practice of Diagnostic and Imaging Medical Physics”
• Formalizes the LoS model / definitions
• Describes common duties of DxMP’s
• Tabulates consensus values for time required for Level 1 EPE’s

Next steps for DWWSS

• Considering data sources and collection approaches
• Requested budget to hire experts to design and conduct one (or more) surveys for AAPM
• Validate Level 1 EPE times from Report 301
• Quantify Level 2 work actually being done
• Assess time being spent on Level 3 work
• Estimate demand/market size via state X-ray lists, ACR totals, etc.

Challenges Ahead

Photo: Andreas Weith, CC BY-SA 4.0
Pathway into the workforce

• ABR certification via CAMPEP residency
• Shortage of diagnostic residency programs and slots
• What role can/will DMP programs play?

• A robust workforce needs assessment should help motivate and justify solutions at national level
  • E.g. AAPM-RSNA-SNMMI program startup grants

Medical Physics Assistants

• MPA role in Dx MP is emerging and evolving

• What will be their impact on supply and demand?

• Answer likely to evolve over shorter vs. longer term

Rapid changes in field

• Coming changes in healthcare economics
• Medical Physics 3.0 driving expansion in ways difficult to foretell in detail
• New & expanding Joint Commission, regulatory requirements
• Want model for extrapolation, not "snapshot"

• Theme/trend: \( \frac{d^2 C}{dt^2} > 0 \)
Value amidst healthcare chaos

Medical Physics at the Crossroads

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?”

Medical Physics Value Proposition

• DxMP community often does not communicate its value well

• Difficult to capture, quantify value of much of what we do via questionnaires.

Our value reaches far beyond testing equipment.
**Challenge**

“Like radiologists, [Dx] 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

**Objectives Summary**

1. Understand Learned challenges of collecting data on diagnostic medical physics practice

2. Understand Learned AAPM’s future approach to characterizing diagnostic medical physics

3. Become Became familiar with AAPM Report 301’s updated description of diagnostic workforce

**Answer the call**