SDAMPP Annual Meeting

Financial Models for Medical Physics Training Programs

Room 211-212, Charlotte Convention Center
8:00 - 11:00AM, Saturday, July 28, 2012

Program Director: J. Daniel Bourland, SDAMPP President-Elect

Start Time	*End Time*	*Title*	*Speaker*
7:55 AM	8:00 AM	**Welcome**	Dan Bourland
I. Financial Models: Overview and Residency Programs			
8:00 AM	8:20 AM	**Overview: Training Program Financial Models**	Mike Mills
8:20 AM	8:45 AM	**Diagnostic Physics Residency, Upstate Medical Physics**	Bob Pizzutiello
8:45 AM	9:10 AM	**Radiation Oncology Residency, Mary Bird Perkins Cancer Center**	John Gibbons
9:10 AM	9:25 AM	**Radiation Oncology Residency, Research Year, University of Iowa**	John Bayouth
9:25 AM	9:40 AM	**Break**	
II. Financial Models: Graduate Programs			
9:40 AM	10:00 AM	**Certificate Program, University of Calgary**	Peter Dunscombe
10:00 AM	10:20 AM	**Doctorate of Medical Physics, Vanderbilt University**	Charlie Coffey
III. Residency Application Process and Workforce Assessment			
10:20 AM	10:40 AM	**AAPM Common Application and Match Program**	John Antolak
10:40 AM	11:00 AM	**Workforce Assessment**	Mike Mills
Adjourn to SDAMPP Business Meeting			

1. Financial Models: Overview and Residency Programs

Overview: Training Programs and Financial Models

Michael D. Mills, PhD

SDAMPP annual Meeting
Charlotte, NC

Outline

- Mission Statement
- Financial Plan – Executive Summary
- Important Assumptions
- Break-Even Analysis
- Projected Profit and Loss
- Projected Cash Flows
- Projected Balance Sheet
- Types of Models
- Supply and Demand of Therapy Physics Services
- Conclusion

Mission Statement

- A mission statement specifies why the program should exist at your institution.
- It may address such things as the unique role of the institution in the community, the local, regional and national need for qualified medical physicists, and the resources available at the institution.
- The University of Louisville provides a residency program in radiation oncology physics to utilize the unique resources and faculty of the Brown Cancer Center to train therapy medical physicists for clinical service to patients regionally and nationally.

Financial Plan – Executive Summary

- This section should summarize your financial projections and defend why a Residency Program makes financial sense for your institution
  - Answer why and how a Residency Program could save money
  - Answer how a Residency Program could improve quality of care
  - Answer how a residency program could help the institution grow its business
- Will you institution need more medical physicists in the future?
- What is the probability that you will spend your time and resources training physicists for your competition?

Important Assumptions

- Are your current faculty/staff physicists eager to assume mentoring in a residency program?
- Do they understand their responsibilities for directing residents, evaluating their performance, grading their competencies?
- Do they understand the benefit of mentoring and reviewing rather than performing a portion of the clinical work?
- What is the competitive condition of your clinic – growing or falling patient load?
- What are the general economic conditions in your community – are their fewer insured patients over time?

Break-Even Analysis

- The cost and benefit of supporting a residency program may be reduced to dollars and cash flow.
- At first, the program may be a drain on resources as there will be allocations for space, computers, classrooms, administrative support and etc.
- Additionally, cost in the time faculty/staff spend mentoring will outweigh the benefit of labor from the residents.
- At some point their will be a break-even point in the analysis where the cost is equal to the benefit.
- Beyond that point, the residents will provide a net benefit for the institution.

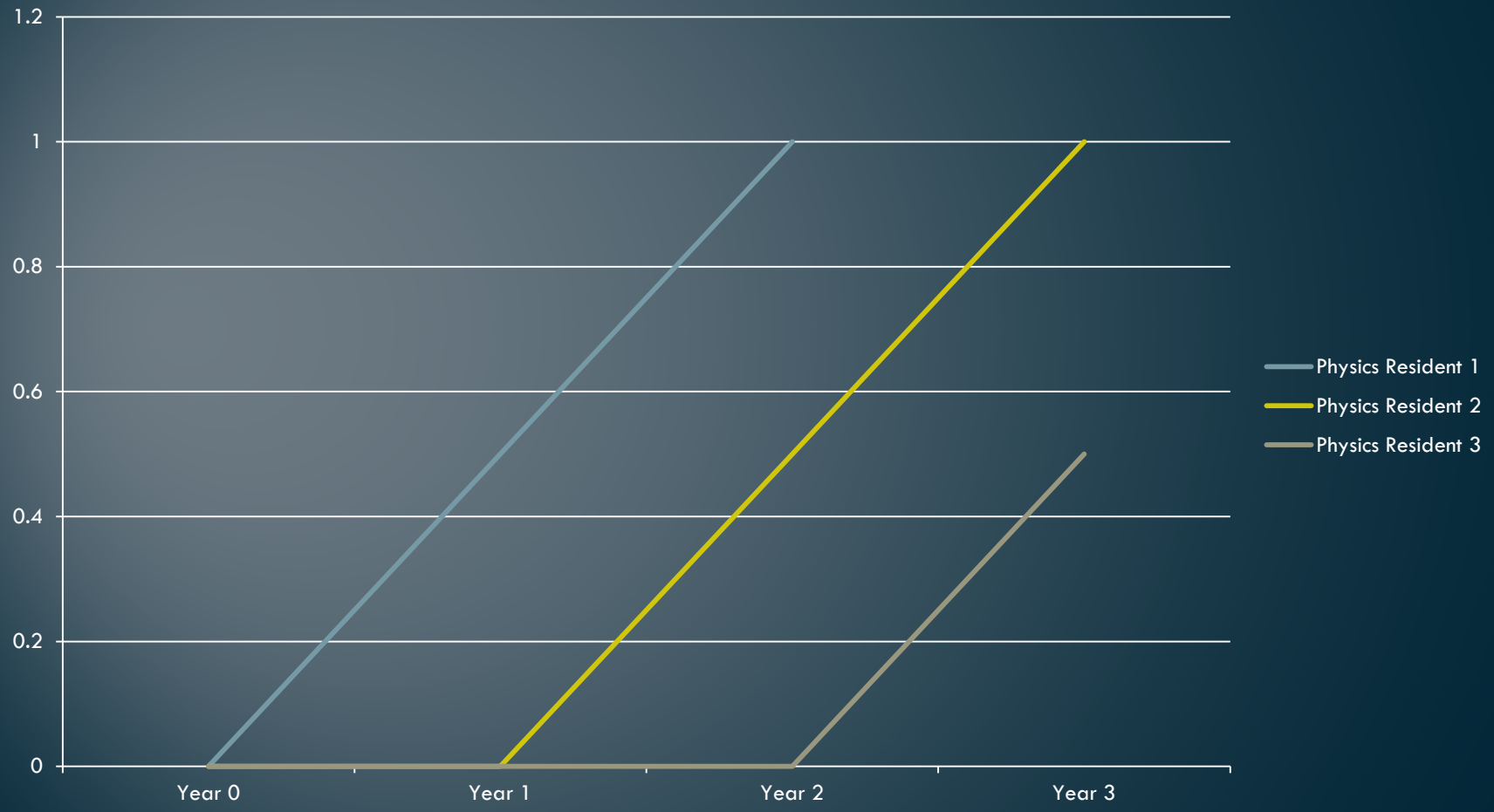
You are the administrator of a clinic treating 1,000 patients annually

# Personnel	No residency program	With residency program
Physicists	6	6
Dosimetrists	6	5
Physics Assistants	1	1
Physics Residents	0	2
Total	13	14

Rationale for this change

- With more hypofractionated treatments, physicists are performing more of the treatment planning and verification
- There is correspondingly a lower workload for conventional planning and conventional IMRT
- Residents over time will provide physics labor for the department
- The cost to support two residents is approximately equivalent to supporting one CMD

Productivity is cyclical



Projected Profit and Loss

- A residency program may be evaluated as a business and planned like any other business.
- One aspect of business planning is a statement of profit and loss.
- The profitability of the business may be defended by comparing how labor loss, recruitment, and retention costs of the institution may be reduced by supporting a residency program.
- Be careful to be realistic in your numbers here as some the costs and benefits are subjective and difficult to quantify.
- Profit and loss statements may be calculated during the mid-point or at the end of a term.

Personnel costs of a residency program

- Assume the program director spends 4 hours per week administrating the program (10% FTE, 5% per resident)
- Assume other faculty physicists spend 2 hours mentoring residents per week (5% FTE, 2.5% per resident)
- Assume dosimetrists spend 3% of time per week mentoring the physics residents.
- Median productivity of your residency program is exemplified at the midpoint of the residency year (0.25 FTE Resident 1 and 0.75 FTE Resident 2) or 1 FTE.
- To "purchase" this FTE, the cost is (5 x 5%) + (1 x 10%) or 35% physicist FTE and 3% X 5 or 15% dosimetrist FTE.
- The 1 FTE of Resident labor "costs" 0.5 FTE from faculty

Projected Cash Flows

- "Cash flow" as a summary of the residency program business model may be tabulated monthly or quarterly.
- It may be used as a model to project future cash flow.
- The cash flow may be negative at the beginning of a term when the new resident(s) needs additional mentoring and administrative effort. As the resident gains skills, efficiency and productivity, the cash flow should turn positive.
- New residents with demonstrated clinical experience and special expertise may substantially benefit the cash flow projections.
- FTE may be used as a surrogate for cash.

Cyclical “cash” flow in FTE

	Resident FTE	Faculty FTE "cost"	Net "benefit"
Quarter 1	0.75	0.5	0.25
Quarter 2	1	0.5	0.5
Quarter 3	1.25	0.5	0.75
Quarter 4	1.5	0.5	1

Projected Balance Sheet

- The most important item on the balance sheet is “cash”.
- The full balance sheet includes all assets, liabilities, and capital.
- The numbers may and likely will improve over time as the program becomes more efficient training residents and the residents become productive earlier in the program.
- The “new worth” is the bottom line of the balance sheet: assets minus liabilities.
- A balance sheet may reveal a weakness in the program; perhaps more resources are needed.

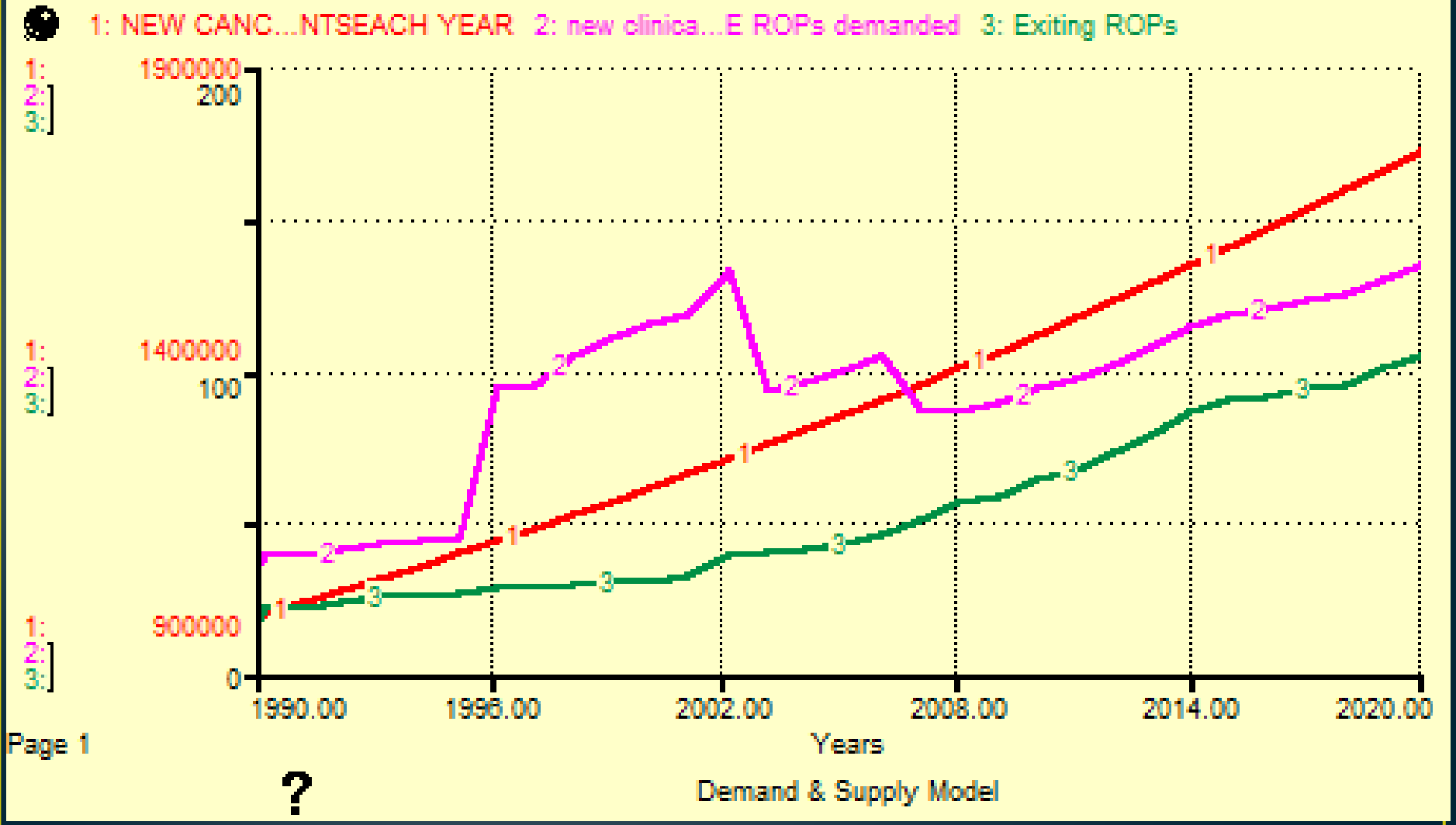
Residency Program Balance Sheet

Current Assets		Current Liabilities	
Program Assets:		Salary and Benefits	
Start-Up Grant	$10,000	Resident 1	$60,000
Resident Equipment	$10,000	Resident 2	$65,000
Salary Line:		Office Space/Utilities	
From Hospital	$65,000	Resident 1	$1,000
From Other Source	$60,000	Resident 2	$1,000
Tuition:		Malpractice Insurance	
From Student	?	Resident 1	$1,000
From Other Source	?	Resident 2	$1,000
Other Donations		Faculty S&B (0.5 FTE)	$75,000
Time Donation	$75,000	Meeting Allowance	$5,000
Source 2		Book Allowance	$1,000
Total Assets	$220,000	Total Liability	$210,000

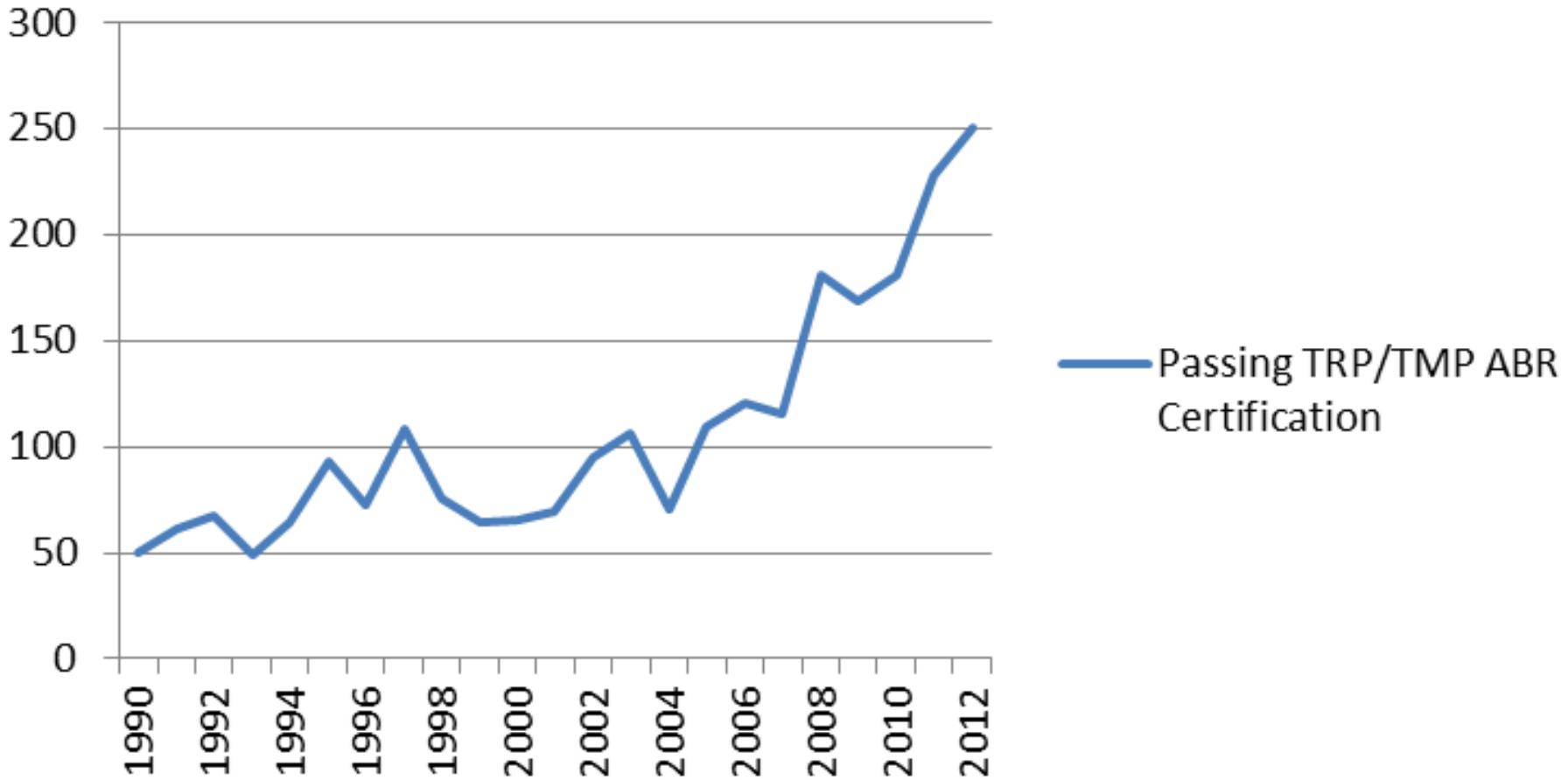
Types of Models

- Classic Academic Center
- Academic Center with Medicare (CMS) support
- Private Provider Organization
- Private Physics Group
- DMP Program

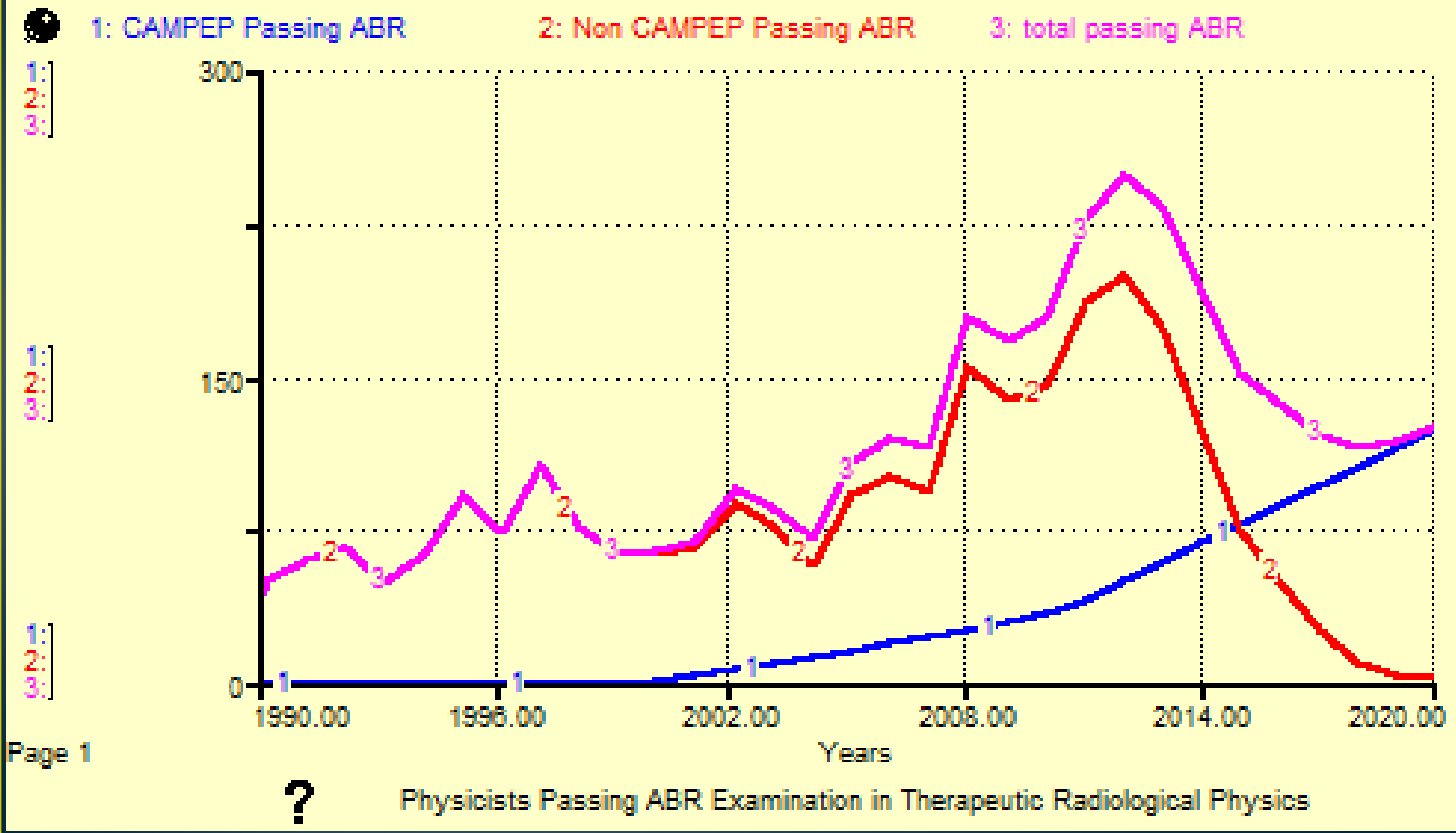
When was the big demand?



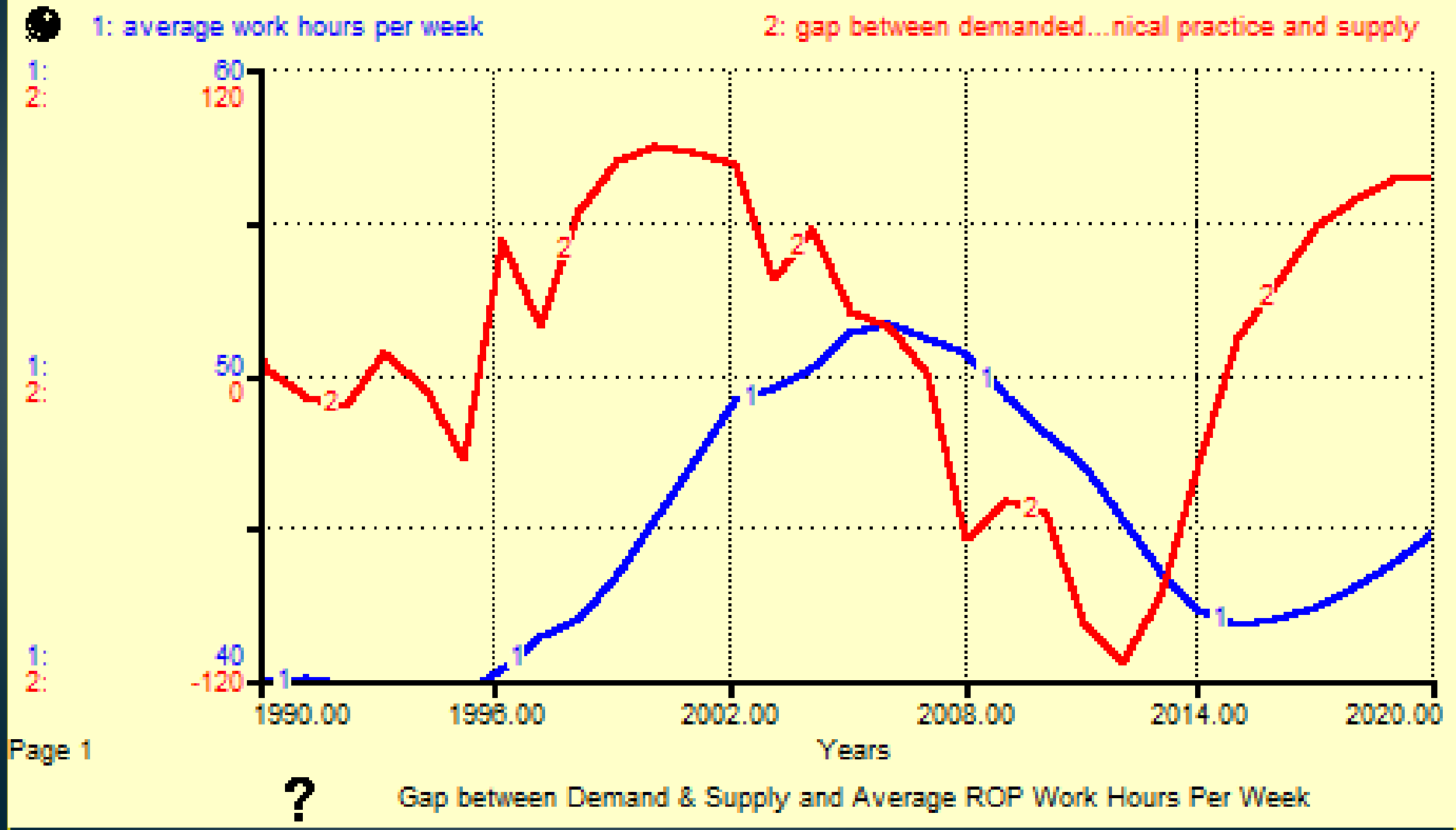
Passing TRP/TMP ABR Certification



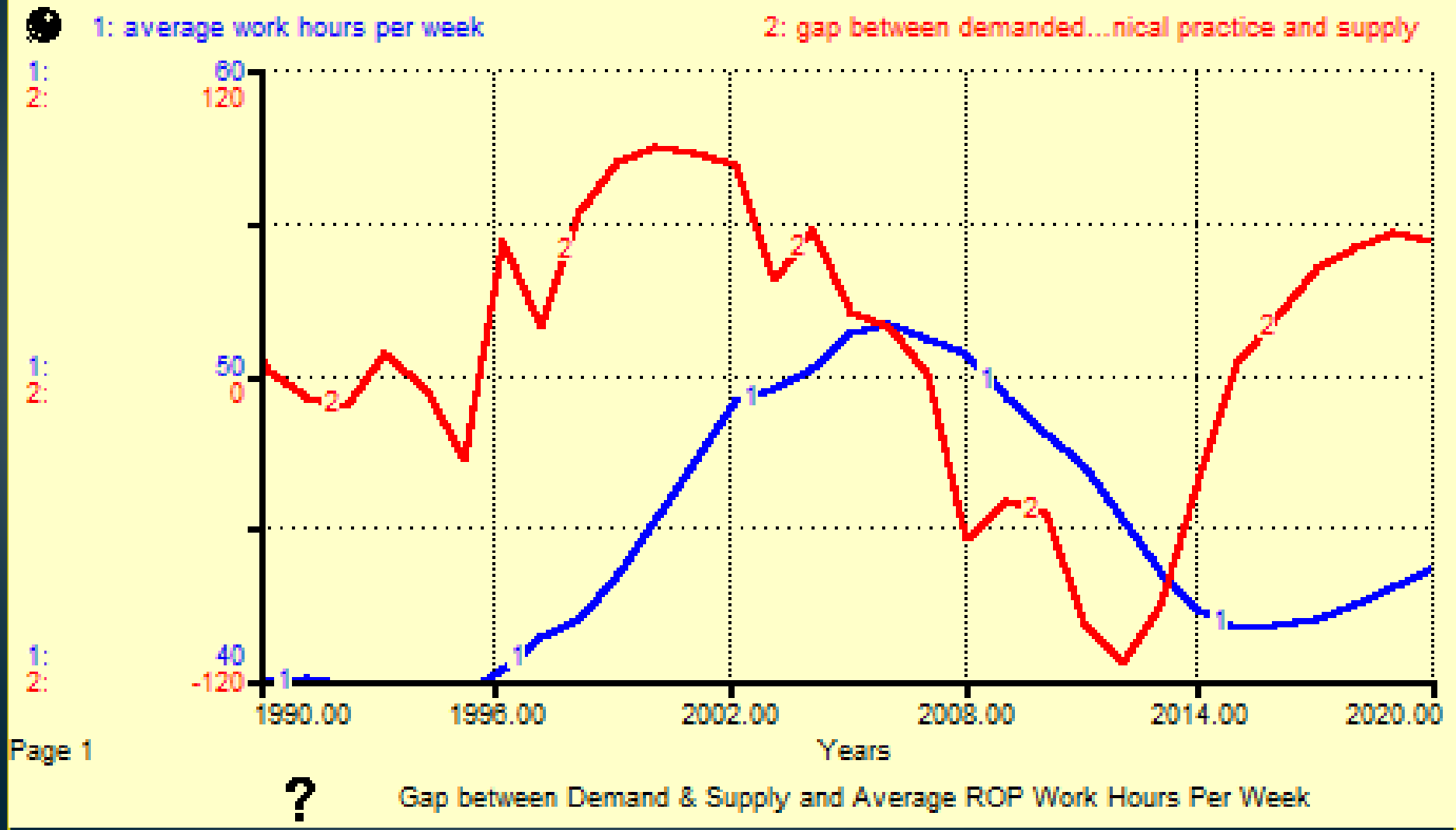
Projected ABR TMPs through 2020



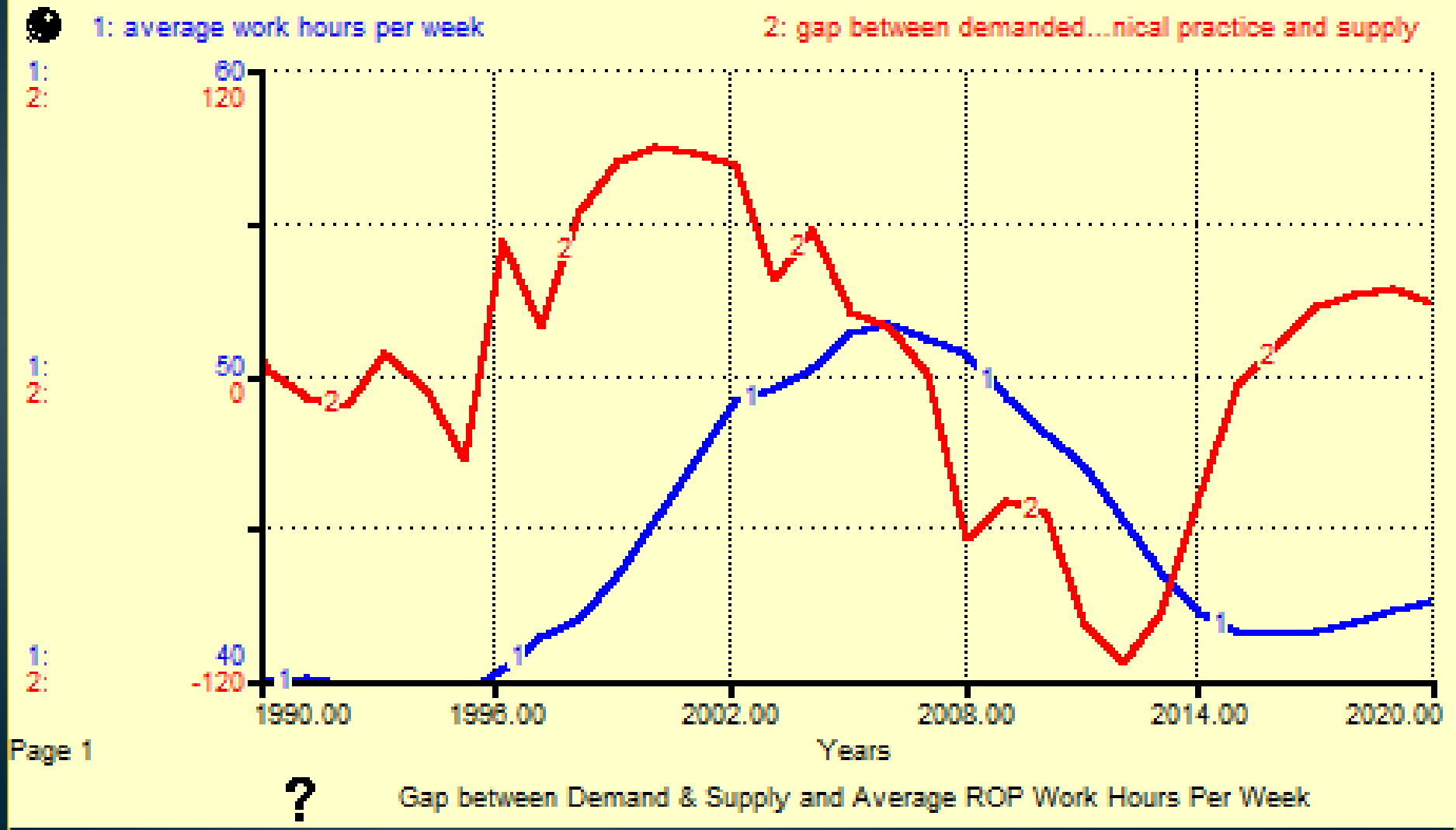
2020–If we graduate 100 TMPs



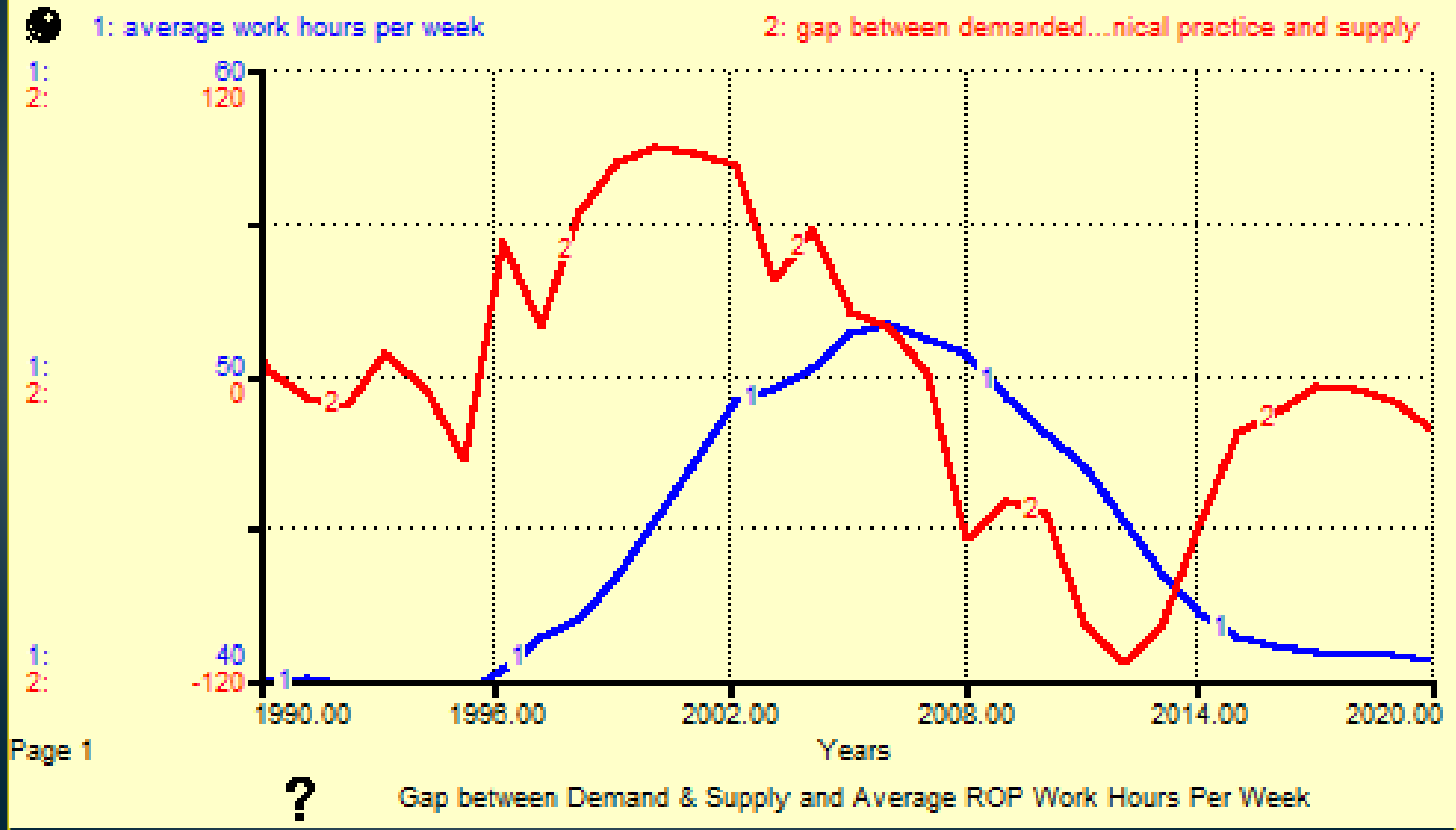
2020–If we graduate 125 TMPs



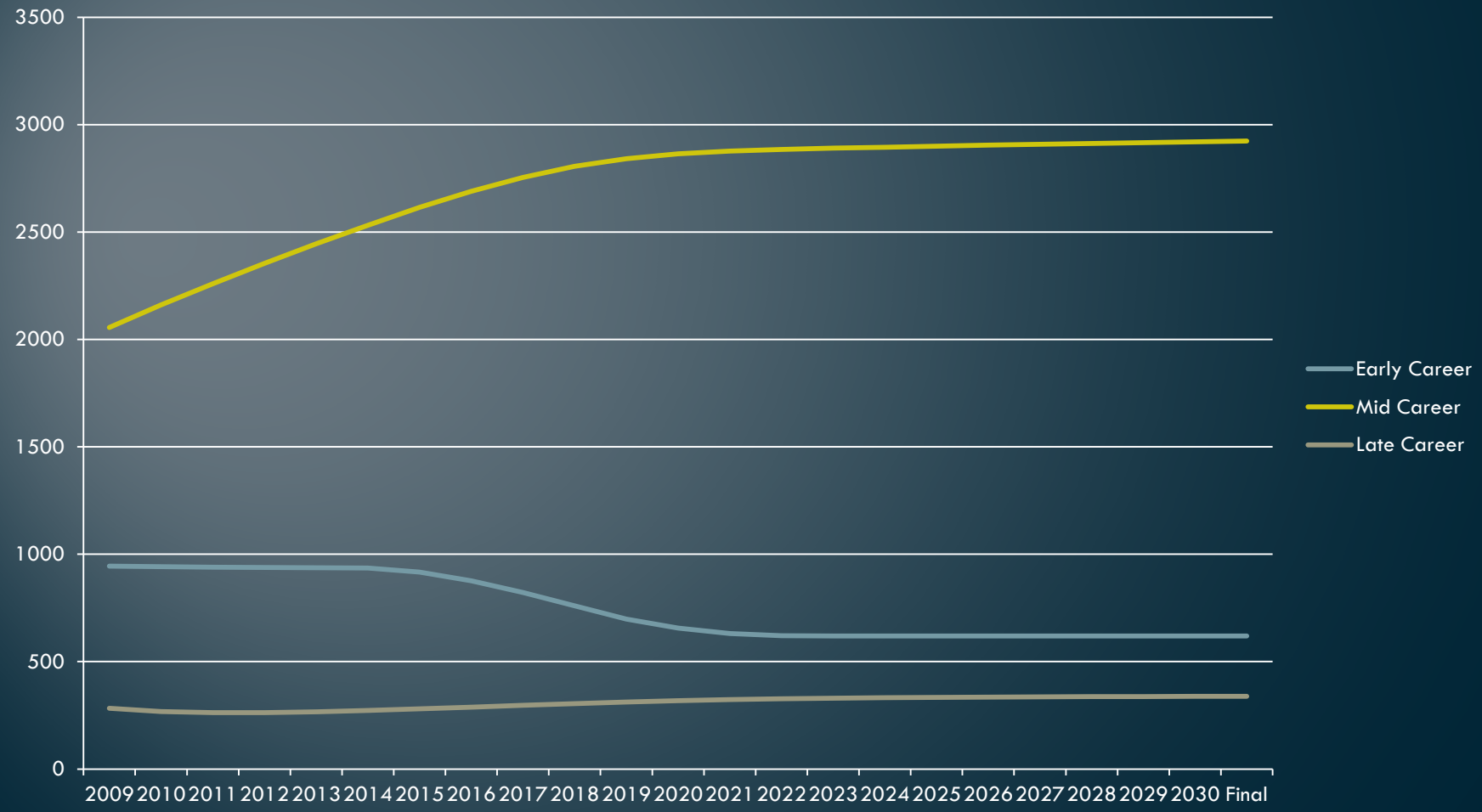
2020–If we graduate 150 TMPs



2020–If we graduate 200 TMPs

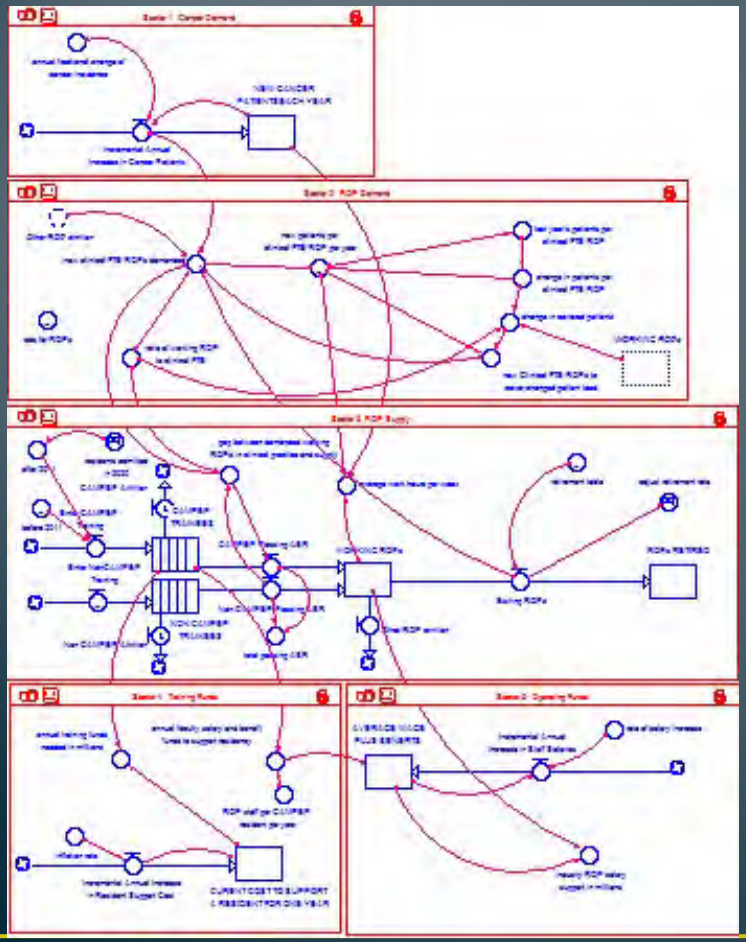


SUNY Albany Workforce Study
Therapy Physicists

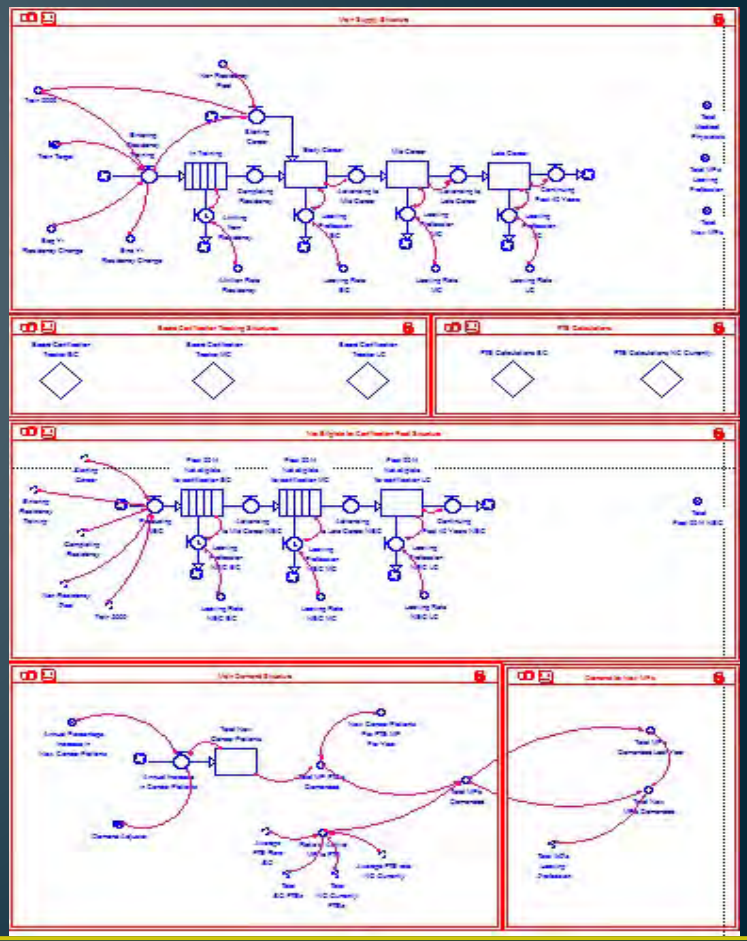


Stella Models

Mills Model



Albany Model



How many physicists must we train?

- Current number of CAMPEP Residents must increase from 40 to a minimum of 125 per year by 2020; 100 will not work!
- A more comfortable number would be 150; 200 would balance supply and demand
- If we are unable to make enough TMPs:
  - Will more medical physicists retire or leave the profession?
  - Will this impact safety and quality assurance?
  - Will this impact patient care negatively?

Conclusions

- All residency programs have a business plan, written or otherwise
- Department managers understand there are intangible benefits that go beyond the balance sheet
  - First choice at the best residents
  - Increase the local supply of physicists
  - Reduce recruiting costs
  - Reduce the salaries by having a steady stream of new physicists
- There is some flexibility in the business model so if the center undergoes significant changes the residency program may be able to adapt and survive
- Despite the current oversupply, current capacity in CAMPEP therapy physics residency programs must double by 2020

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POWERFUL PARTNERSHIPS ADVANCING IMAGING AND THERAPY

Financial Model
Diagnostic Physics Residency
Upstate Medical Physics

Robert J. Pizzutiello, MS, FAAPM, FACMP
Senior Vice President, Imaging Physics
Upstate Medical Physics –
A LANDAUER Medical Physics Partner

Outline

- Brief History of UMP residency
- Residency in a Private Practice Group
  - How it works
- Financial Model, with assumptions
- What the financial model does not show
- Conclusion

History

- 1989 RJP solo FTE
- 1990 2.5 FTE
- 2000 6 FTE
- Growth creates need for more MP's
  - recruitment is tough and costly (time and $)
- New paradigm emerges in 2005-06
  - Joel Gray suggested Dustin Gress, MS student
  - Steve Rudin suggested Mark Wu, Ph.D student
- Convert OJT to Residency Program (more structure)
- UMP residency accredited 2010

Residency in Private Practice Group

- Staff
  - Office based ~ 2 days/week
    - Meetings, Journal Clubs, prep and review reports
  - Field work ~ 3 days per week
    - Drive time plus work at client sites
- Residents apprentice with senior MP's
  - Preparation
  - Field work
  - Reports
  - Review

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Residency in Private Practice Group

- UMP offers no courses
- Residents work under NY License
  - Limited permit
  - Direct supervision for scope of practice work
  - General supervision for data collection, after demonstrating competency and faculty signoff
  - All reports signed by licensed MP
- MQSA
  - 20 surveys under supervision, Pennsylvania approval and FDA letter until completion of ABR Part III.

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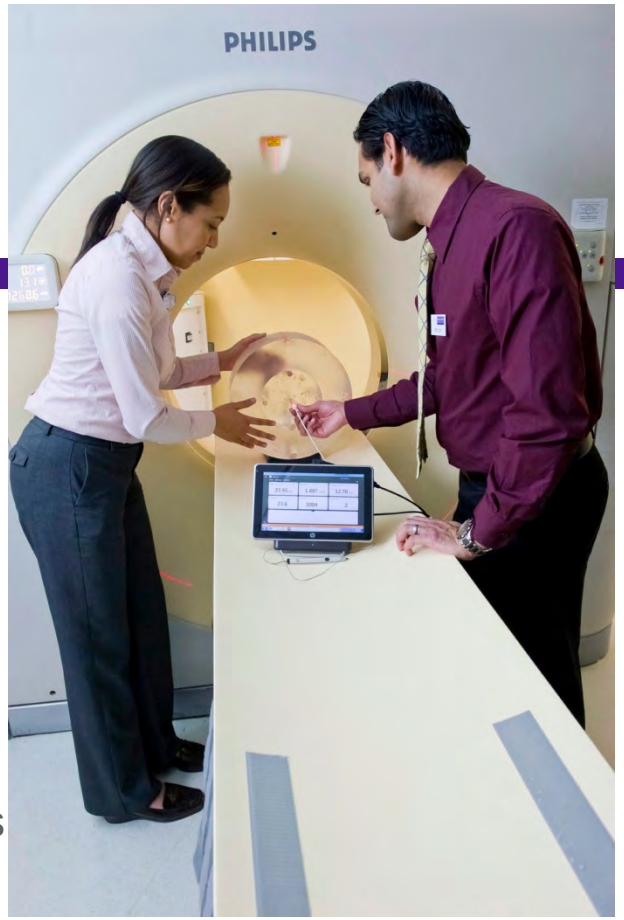
Residency in Private Practice Group

- After demonstrating competency in modality, resident begins to perform independent field work
  - Maintain skills
  - Stay sharp for ABR
  - Contribute to the practice
- When resident leaves, they should be competent, with recent experience in all modalities
  - Prep for real world jobs

Why a three year program?

- AAPM hallway chat with Mike Herman
- “I am having trouble fitting everything in..”
- Hypothesis (view from 10,000 feet)
  - R1 – Expenses exceed revenue
  - R2 – Expenses equal revenue
  - R3 – Revenue exceeds expenses
  - Overall – modestly profitable, fractional FTE

Assumptions



- Initial field work
  - Observe
  - Assist senior MP
  - Primary, with senior MP assist
  - Solo
  - Demonstrated competency, different models, sites
- Independent Field Work
  - After competency signoff
  - Reports reviewed by licensed MP (scope of practice)

Financial Overview

- Fixed Program Costs, shared: $150k/year
  - Includes clinical teaching (MD, RN)
- Equipment Costs, per resident: $20k/year
  - R1 shares with senior MP's
  - R2 and R3 have their own
- Travel costs
  - R1 rides with senior MP
  - R2 and R3 have their own cars and costs

Shared Program Costs, Annual

Program Director and Assoc Dir	$ 50,000
Ed Coordinator	$ 45,000
Clinical Lectures	$ 40,000
Online journals, etc.	$ 2,500
Miscellaneous	$ 12,500
Total	$ 150,000

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Cost Summary

	Salary	Benefits	Business travel	Phone	Prof Travel	Memberships, Licenses, etc	Shared Costs	Total
R1	$ 50,000	$ 9,500	$ -	$ 600	$ 2,500	$ 1,000	$ 50,000	$ 113,600
R2	$ 55,000	$ 9,500	$ 4,800	$ 600	$ 2,500	$ 1,000	$ 50,000	$ 123,400
R3	$ 60,000	$ 9,500	$ 4,800	$ 600	$ 4,000	$ 1,000	$ 50,000	$ 129,900
								$ 366,900

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Revenue and Cost – R1

Qty	Type	Unit Fee [1]	Net[2]
100	RF	$ 400	$ 36,000
20	CR/PDM	$ 400	$ 7,200
5	Mammo	$ 1500	$ 6,750
			$ 49,950

1. Approximate minimum unit fee to make program profitable
2. Assumes 10% of revenue for supervision

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Revenue and Cost – R2

	Type	Unit Fee [1]	Net[2]
250	RF	$ 400	$ 90,000
50	CR/PDM	$ 400	$ 18,000
40	Mammo	$ 1500	$ 54,000
5	Shielding	$ 600	$ 2,700
10	CT	$ 1,800	$ 16,200
			$ 180,900

1. Approximate minimum unit fee to make program profitable
2. Assumes 10% of revenue for supervision

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Revenue and Cost – R3

	Type	Unit Fee [1]	Net[2]
150	RF	$ 400	$ 54,000
50	CR/PDM	$ 400	$ 18,000
40	Mammo	$ 1500	$ 54,000
5	Shielding	$ 600	$ 2,700
30	CT	$ 1,800	$ 48,600
25	MR	$ 1,800	$ 40,500
			$ 217,800

1. Approximate minimum unit fee to make program profitable
2. Assumes 10% of revenue for supervision

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Revenue and Cost – All

	Cost	Revenue	Net
R1	$ 113,600	$ 49,950	$ (63,650)
R2	$ 123,400	$ 180,900	$ 57,500
R3	$ 129,900	$ 217,800	$ 87,900
	$ 366,900	$ 448,650	$ 81,750

1. Addresses labor, travel and other costs
2. Excludes equipment expenses

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What the model does not show

- Teaching does take time and patience
  - Typically add 25% to time for initial field work
  - Saves some time writing reports
- Influx of new blood, new training, new skill set, new ideas
- Promotes a thinking, questioning, teaching environment
- Journal clubs and CAMPEP credits benefit the entire group
- Forces seniors to re-think or recall “Why?”
- Allows practice to train MP’s in real world environment

Summary

- Brief History of UMP residency
- Residency in a Private Practice Group
  - How it works
- Financial Model, with assumptions
- What the financial model does not show

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Conclusion

- A private practice residency program can be financially sustainable, subject to sufficient
  - additional work (fractional FTE)
  - fee structure
  - supervisory staff (teaching interest, skills)
  - Systems (Continuous Quality Improvement)
- Benefits to a private practice are more than just financial
- UMP is currently exploring adding additional groups to create hub and spoke model

Financial Model for the Mary Bird Perkins Medical Physicist Residency Training Program

John P. Gibbons, Jr., Ph.D.

Mary Bird Perkins Cancer Center, Baton Rouge, LA

MARY BIRD PERKINS
CANCER CENTER

Acknowledgements

B. Parker[1,2], K. Hogstrom[1,2], K. Ferachi[1],
J. Duhon[3], C. Yang[4], H. Wu[5]

[1]Mary Bird Perkins Cancer Center, Baton Rouge, LA
[2]Louisiana State University, Baton Rouge, LA
[3]OncoLogics, Inc., Lafayette, LA
[4]University of Mississippi Medical Center, Jackson, MS
[5]Willis-Knighton Cancer Center, Shreveport, LA

MARY BIRD PERKINS
CANCER CENTER

Residency Program Description
Motivation

- Joint Louisiana State University (LSU) and Mary Bird Perkins Cancer Center (MBPCC) M.S. and Ph.D. in Medical Physics program (CAMPEP accredited)
  - Graduates ~6 students per year

- MBPCC goal to accommodate 6 new residents per year in time for the 2014 requirement

- AAPM Report 90 recommended physicist-to-resident ratio of 2:1
  - 12 MBPCC physicists ➔ 6 total residents maximum
  - 3 new residents per year (2-year program)

Residency Program Description
Introduction

- *How do we accommodate the other 3 needed positions per year?*

- Solution was to develop partnerships with regional medical physics groups to provide clinical residency training

- Hub-and-spoke model (TG-133)
  - MBPCC responsible for initial accreditation, curriculum development, resident performance tracking, scheduling exams, clinical training, etc.
  - Partner sites responsible for clinical training

Residency Program Description
Residency Consortium

- Takes advantage of facilities with good clinical physics but inadequate administrative resources to start and maintain program

- Began approaching potential partners in early 2010
  - Good support from physicists to “train our own”
  - Currently 3 partner sites in Consortium with MBPCC

MARY BIRD PERKINS CANCER CENTER

OncoLogics, Inc.
Treating Cancer Personally

WILLIS-KNIGHTON HEALTH SYSTEM

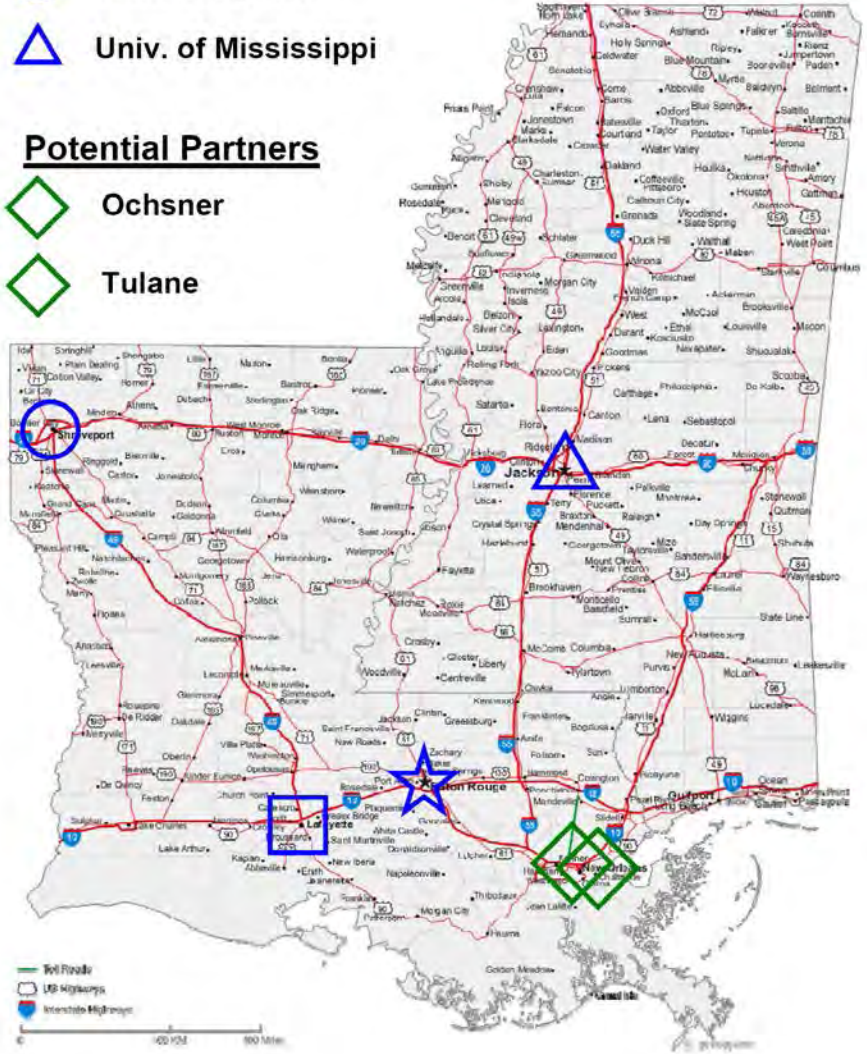
THE UNIVERSITY OF MISSISSIPPI MEDICAL CENTER

Current Partners

- Mary Bird Perkins
- OncoLogics
- Willis-Knighton
- Univ. of Mississippi

Potential Partners

- Ochsner
- Tulane

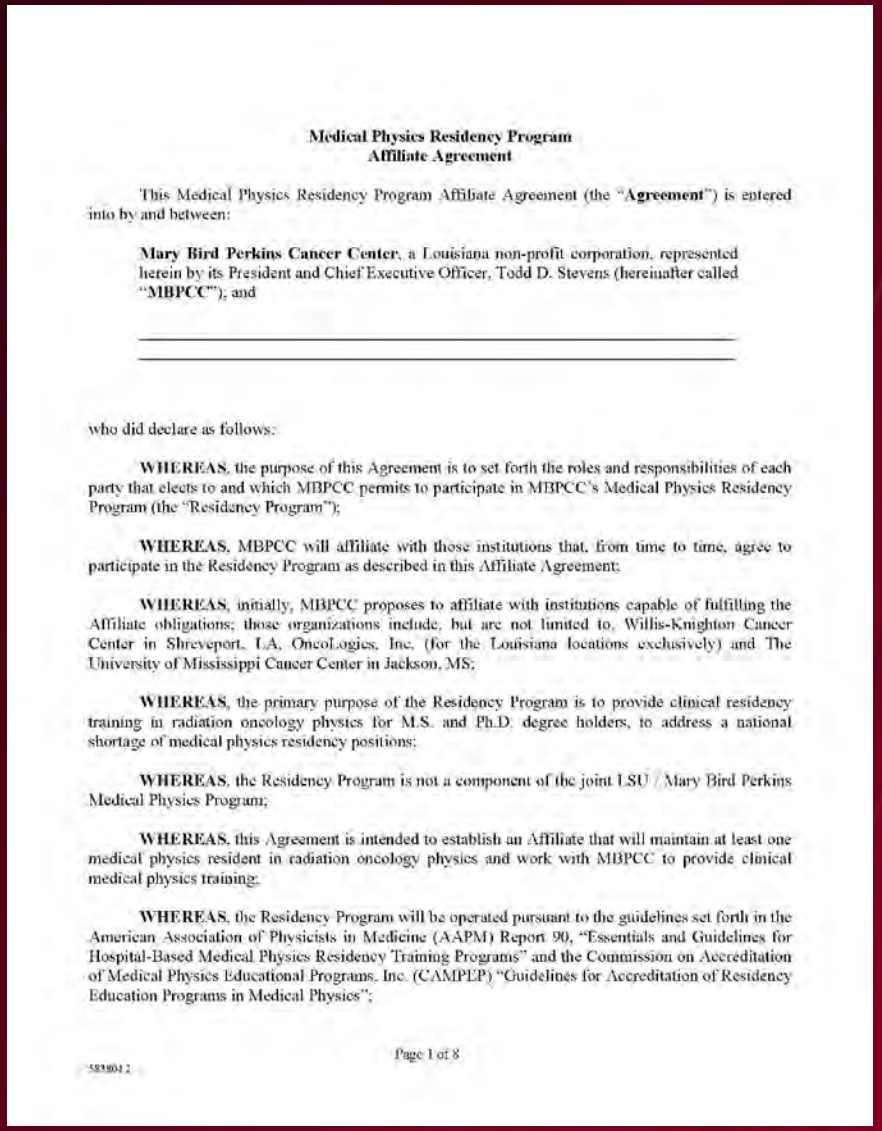


Residency Program Description
Residency Consortium

- Mix of private, community, for profit, nonprofit, and academic institutions
- Offers broader range of clinical procedures, technology, equipment, etc. than typically available at single institution
- Written agreements exist between MBPCC and partner sites

Residency Program Description
Affiliate Agreements

- Generic agreement developed outlining roles & responsibilities of MBPCC and affiliate sites
- Minor changes (i.e., unrelated to residency training) made in each agreement specific to the affiliate's program
- Completion of final agreements took ~1 year



Medical Physics Residency Program
Affiliate Agreement

This Medical Physics Residency Program Affiliate Agreement (the "**Agreement**") is entered into by and between:

Mary Bird Perkins Cancer Center, a Louisiana non-profit corporation, represented herein by its President and Chief Executive Officer, Todd D. Stevens (hereinafter called "**MBPCC**"); and

_____

_____

who did declare as follows:

WHEREAS, the purpose of this Agreement is to set forth the roles and responsibilities of each party that elects to and which MBPCC permits to participate in MBPCC's Medical Physics Residency Program (the "Residency Program");

WHEREAS, MBPCC will affiliate with those institutions that, from time to time, agree to participate in the Residency Program as described in this Affiliate Agreement;

WHEREAS, initially, MBPCC proposes to affiliate with institutions capable of fulfilling the Affiliate obligations; those organizations include, but are not limited to, Willis-Knighton Cancer Center in Shreveport, LA, OncoLogics, Inc. (for the Louisiana locations exclusively) and The University of Mississippi Cancer Center in Jackson, MS;

WHEREAS, the primary purpose of the Residency Program is to provide clinical residency training in radiation oncology physics for M.S. and Ph.D. degree holders, to address a national shortage of medical physics residency positions;

WHEREAS, the Residency Program is not a component of the joint LSU / Mary Bird Perkins Medical Physics Program;

WHEREAS, this Agreement is intended to establish an Affiliate that will maintain at least one medical physics resident in radiation oncology physics and work with MBPCC to provide clinical medical physics training;

WHEREAS, the Residency Program will be operated pursuant to the guidelines set forth in the American Association of Physicists in Medicine (AAPM) Report 90, "Essentials and Guidelines for Hospital-Based Medical Physics Residency Training Programs" and the Commission on Accreditation of Medical Physics Educational Programs, Inc. (CAMPEP) "Guidelines for Accreditation of Residency Education Programs in Medical Physics";

Residency Program Description
Affiliate Agreements

- MBPCC Commitments:
  - Develop the program curriculum
  - Administration of program (Coordinating advisory committee, Resident evaluations, Oversee compliance with training requirements)
  - Work with affiliates to obtain CAMPEP accreditation

Residency Program Description
Affiliate Agreements

- Affiliate Commitments:
  - Accept one new resident per year. Affiliate sites are responsible for residents' salary (at appropriate PGY levels), benefits, and professional development funds.
  - Appoint affiliate program director responsible for implementation of program
  - Provide appropriate resources to support the residency program (e.g., space, administrative, equipment)

Residency Program Description
Residency Placement

- LSU students receive first priority
  - Unfilled positions opened to outside applicants
- Student assigned to training site based on *internal* match system using National Resident Matching Program (NRMP) algorithm
  - Fair to all sites ➔ no biased selections
- Residency position not guaranteed, only the opportunity
  - Must be ranked as “acceptable” by Consortium

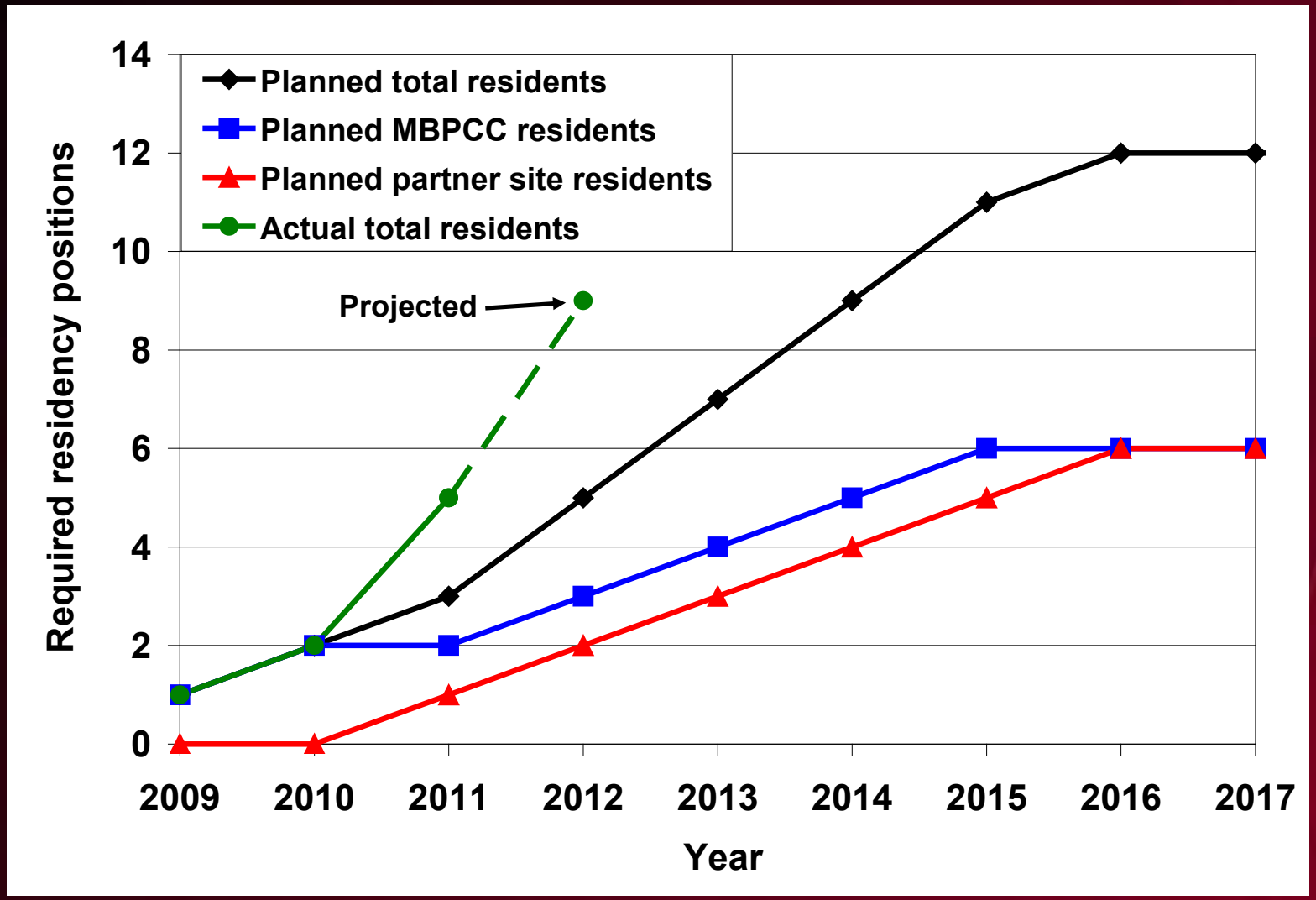
Residency Program Description
Resident Training & Responsibilities

- At MBPCC, residents credentialed after 1st year
  - Must demonstrate competency in areas of credentialing
  - Credentialed for duties of non-ABR physicist

- Two purposes:
  - More cost effective as resident is assigned ½ clinical rotation FTE
  - Resident becomes comfortable with independent work

Residency Program Description

Strategic Plan for Resident Enrollment



Residency Program Description
Program Status

- Two MBPCC residents completed program. Nine residents currently in program (3 at MBPCC, 6 at affiliate sites)

- CAMPEP-accreditation in progress.
  - Self-study submitted Fall 2011
  - Site visit completed in June 2012.

Financial Model
Inclusion of Residents in Staffing Model

- Medical Physics residents perform clinical service – they should be included in model
- Justifies resident positions on the basis of clinical demand.
- Ideal for smaller sites: i.e., if there is a need for <1 FTE, this can be fulfilled with the addition of MP resident(s).

Financial Model
MBPCC Staffing Levels

Pre-2009:
MP = # Patients/275 + 0.5 (Administration)
+ 3.2 (Academics, IOS)

2009-2011:
MP = # Patients/275 + 0.5 (Administration) – 0.25 * # Res
+ 2.6 (Academics, IOS)

2011-Present:
MP = # Patients/290 + 0.5 (Administration) – 0.25* # Res
+ 2.4 (Academics)

Financial Model
Institutional Cost/Resident

Simple Model

Avg MP FTE Return per Resident	**0.375**	(0.25 FTE for first-year resident; 0.50 for second-year resident)
MP Staff Salary	**$160,000**	
Resident Salary	**$44,168**	

Financial Model
Institutional Cost/Resident

Program Costs

Number Residents	Resident Salary	Total
1	$44,168	**$44,168**
12	$530,016	**$530,016**

Program Revenues

Number Residents	Staff Salary	Total	Net Cost		Net Cost/ Resident
1	$60,000	$60,000	($15,832)		($15,832)
12	$720,000	$720,000	($189,984)		($15,832)

Financial Model
Institutional Cost/Resident

Conservative Model

Clinical FTEs per Resident	**0.15**	(0.2 FTE for first-year resident; 0.1 FTE for second-year resident)
Admin Overhead FTEs	**0.25**	
Avg MP FTE Return per Resident	**0.375**	(0.25 FTE for first-year resident; 0.50 for second-year resident)
MP Staff Salary	**$160,000**	
Resident Salary	**$44,168**	
Benefit Rate	**25.00%**	
Overhead Rate	**25.00%**	

Financial Model
Institutional Cost/Resident

Program Costs

Number Residents	Staff Salary	Staff Benefits	Staff Overhead	Staff Subtotal	Resident Salary	Resident Benefits	Resident Overhead	Resident Subtotal	Total
2	$88,000	$22,000	$27,500	$137,500	$88,336	$22,084	$27,605	$138,025	**$275,525**
4	$136,000	$34,000	$42,500	$212,500	$176,672	$44,168	$55,210	$276,050	**$488,550**
6	$184,000	$46,000	$57,500	$287,500	$265,008	$66,252	$82,815	$414,075	**$701,575**
8	$232,000	$58,000	$72,500	$362,500	$353,344	$88,336	$110,420	$552,100	**$914,600**
10	$280,000	$70,000	$87,500	$437,500	$441,680	$110,420	$138,025	$690,125	**$1,127,625**
12	$328,000	$82,000	$102,500	$512,500	$530,016	$132,504	$165,630	$828,150	**$1,340,650**

Financial Model
Institutional Cost/Resident

Program Revenues

Number Residents	Staff Salary	Staff Benefits	Staff Overhead	Total	Net Cost		Net Cost/ Resident
2	$120,000	$30,000	$37,500	**$187,500**	**$88,025**		**$44,013**
4	$240,000	$60,000	$75,000	**$375,000**	**$113,550**		**$28,388**
6	$360,000	$90,000	$112,500	**$562,500**	**$139,075**		**$23,179**
8	$480,000	$120,000	$150,000	**$750,000**	**$164,600**		**$20,575**
10	$600,000	$150,000	$187,500	**$937,500**	**$190,125**		**$19,013**
12	$720,000	$180,000	$225,000	**$1,125,000**	**$215,650**		**$17,971**

Conclusions

- A hub-and-spoke model residency program has been successfully established with MBPCC and three affiliate sites in Louisiana and Mississippi.
- The distributed model is a practical way to meet ABR mandate in a reasonable time frame.
- Incorporation of physics residents into a medical physics staffing model can help justify the cost of the program to administration.

Radiation Oncology Residency, Research Year, University of Iowa

John E. Bayouth

Problem to Solve

- Developing research opportunity for Medical Physics Residents
- Having clinical knowledgeable hands available to support research projects

Approach

- Convert 12 months of funding for research into 4 months x 3 years to extend residency by 1 year
- Have faculty apply for supporting “research track” applicants
- Make candidates aware of opportunity during recruitment.

Benefit

- Post-doc level research with solid clinical context
- Resident remains additional year, when they are most clinically productive
- They tend to continue research during “off months”

Post-Doctoral Certificate in Radiation Oncology Physics: University of Calgary Experience

WENDY SMITH, Ph.D.
DEREK BROWN, Ph.D.
PETER DUNSCOMBE, Ph.D.

wendy.smith@albertahealthservices.ca

TBCC Clinical Physics Program

The Tom Baker Cancer Centre is a fully equipped, tertiary cancer treatment facility, delivering ~3000 RT courses/yr

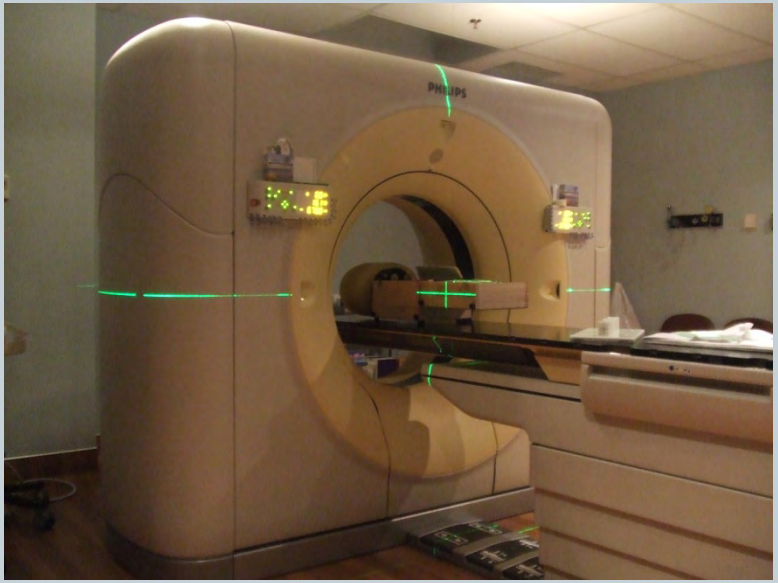
Clinical Staff

- 11 Qualified Medical Physicists
- 18 Radiation Oncologists
- 4 Radiation Therapy Equipment Service Specialists.
- 2 Instrument makers
- 20 FTE Radiation Therapists in immobilization, treatment planning and simulation
- 45 FTE Radiation Therapists in treatment delivery

TBCC Physics Clinical Program

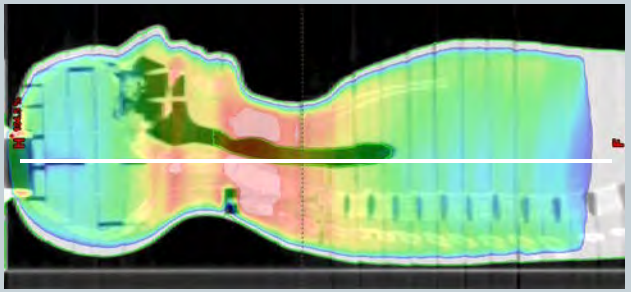
Clinical Equipment:

- 9 Varian linear accelerators
- 1 cobalt treatment unit
- 1 conventional and 2 CT simulators
- Eclipse treatment planning system (20 workstations)
- Prostate brachytherapy using the Nucletron seedSelectron
- HDR brachytherapy
- Stereotactic program with Novalis
- IMRT, IGRT, SBRT and
- participation in RTOG trials
- Total Body Irradiation
- Pediatric radiation therapy



U of Calgary: Radiation Oncology Physics

- CAMPEP Graduate Program
  - Radiation Oncology Physics, a specialization within Physics and Astronomy
  - Average enrollment 8-10 total (half Ph.D.)
- CAMPEP Residency Program
  - Incorporates the University of Calgary Post-Doctoral Diploma in Radiation Oncology Physics
  - 3 current residents in a two-year program
- CAMPEP Certificate Program
- http://www.ucalgary.ca/rop/



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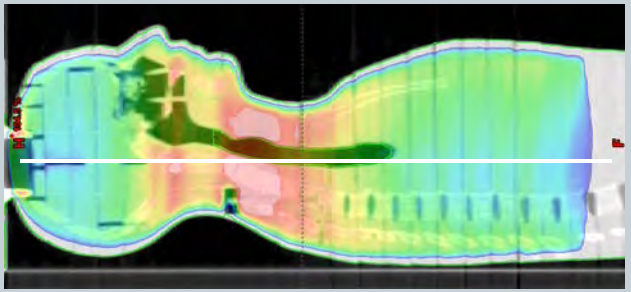
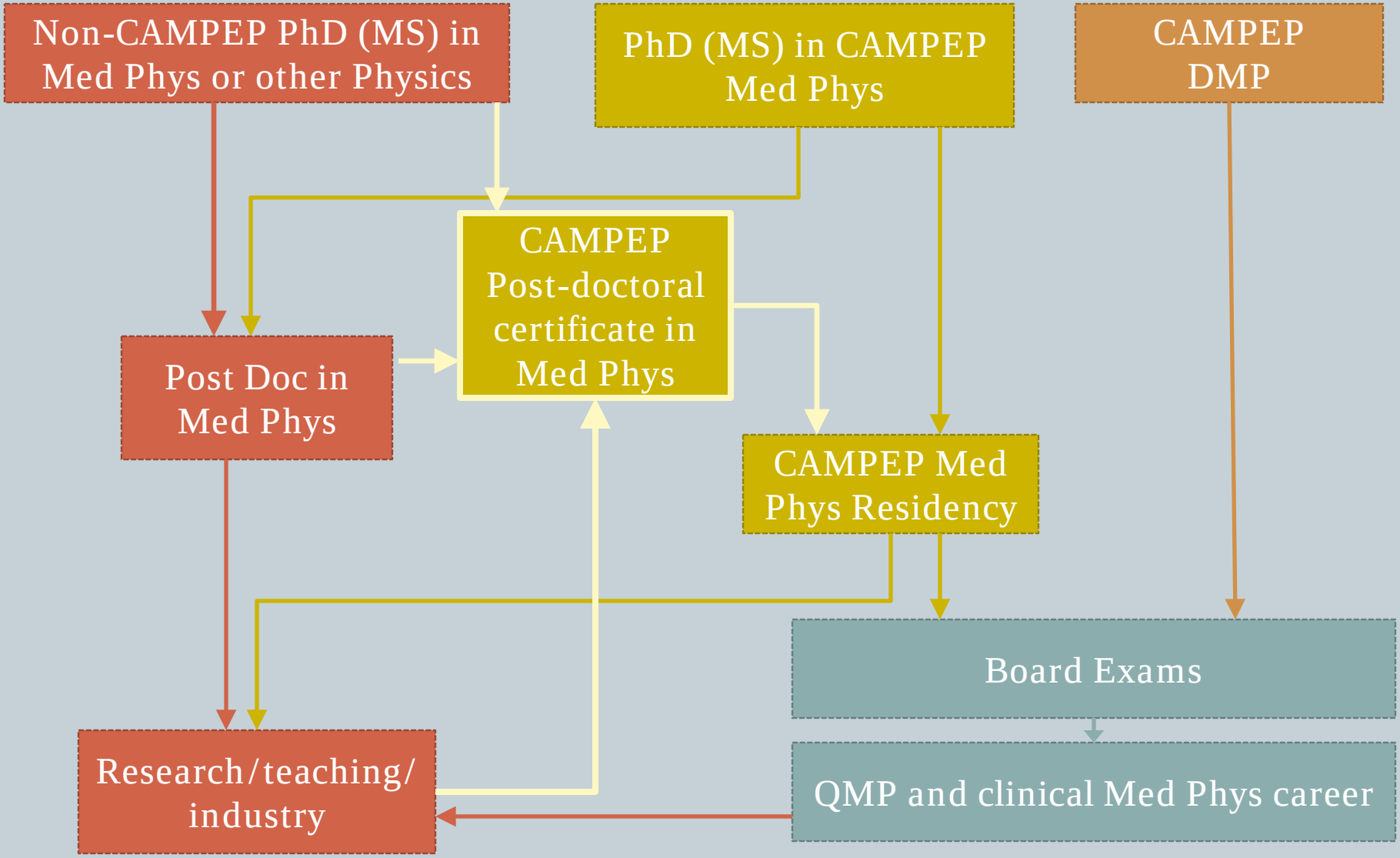


Certificate Program Motivation

- Many applicants to our residency programs.
- Few have the background preparation and soft skills needed to be exceptional medical physicists.
- Several applicants each year to our M.Sc. Program from people who already hold a Ph.D. in physics.

Graduate Training and Career Pathways in Medical Physics



Certificate Program Goals

- To prepare Ph.D. level physicists for entry into a radiation oncology physics residency program
  - **Complying with AAPM Report 197s**

Certificate Program Goals

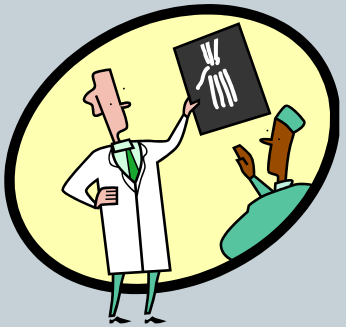
- To prepare Ph.D. level physicists for entry into a radiation oncology physics residency program
  - **Complying with AAPM Report 197s**
  - **Exposure to clinical realities**
  - **Hands-on, practical skill development**

Certificate Program Design Considerations

- Minimize cost to students
  - 8 month program
- Minimize resource implications

Credit Courses

Non-Credit Learning



Clinical Experience

Credit Courses

Fall Semester

- MDPH 623 Radiological Physics and Radiation Dosimetry
  - Photon and electron interactions, charged particle and radiation equilibrium, cavity theory, absolute and relative dosimetry, calibration protocols.
- MDPH 639 Radiobiology and Radiation Safety for Medical Physicists
  - Cell kinetics, cell survival curves, radiation pathology, fractionation, radiation safety and shielding.
- MDSC 689.01 Medical Imaging Techniques
  - Introduction to the theory and practical applications of medical imaging

Winter Semester

- MDPH 625 Radiation Oncology Physics
  - Clinical photon and electron beams, brachytherapy, treatment planning, radiation therapy devices, special techniques.
- MDPH 637 Anatomy and Statistics for Medical Physicists
  - Anatomy, physiology, probability, statistical inference, hypothesis testing, regression models, clinical trials, survival analysis.
- MDPH 633 Radiation Oncology Physics Laboratory
  - Absorption dose determination, dose descriptors, photon beam modelling, quality control.

Students are eligible to receive credit for up to 1 course already completed at a graduate level.

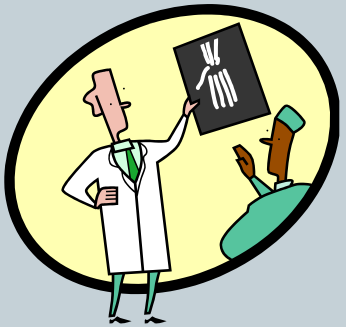
Encompasses all didactic components identified by the American Association of Physicists in Medicine, Report No. 197S

Certificate Program Design Considerations

- Minimize cost to students
  - 8 month program
- Minimize resource implications

Credit Courses

Non-Credit Learning



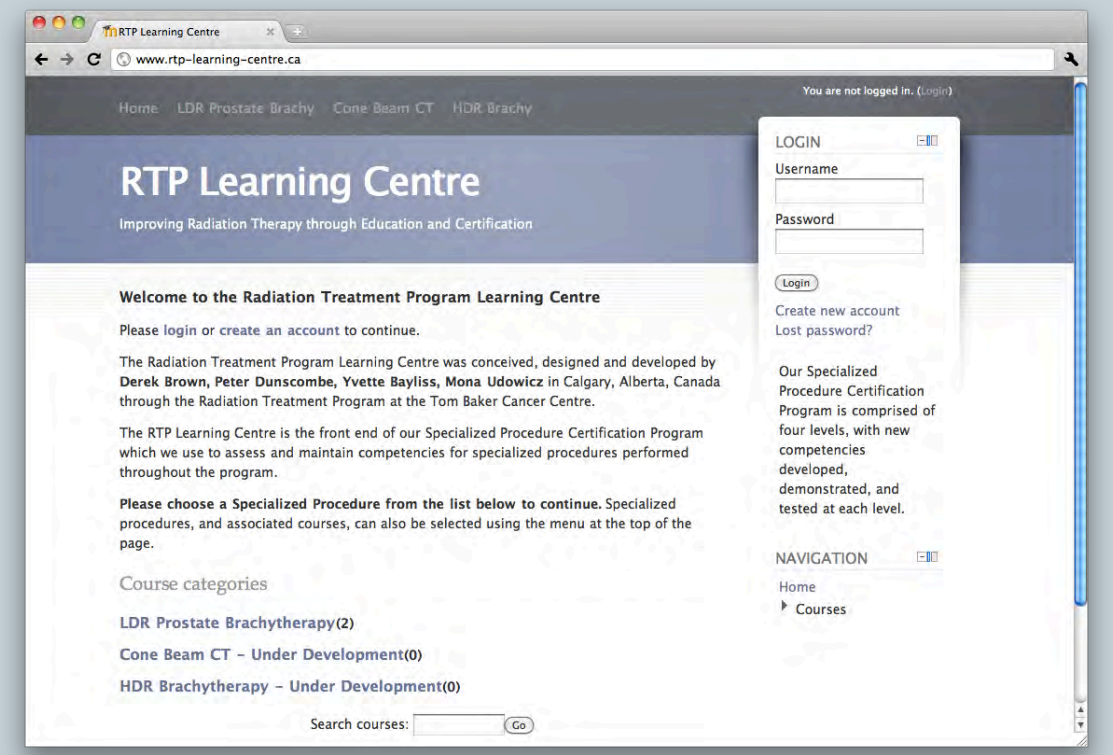
Clinical Experience

Non-credit learning

- Ethics and Errors (36 contact hours)
  - Discussion-based introduction to
    - ethical analyses in clinical, professional, academic and research activities
    - analysis and management of errors in clinical radiation therapy
- Journal Club (weekly)
  - Weekly, student-run workshops and debates
  - Mentored by staff
- Radiation Oncology Rounds (weekly)
- Cancer Centre Grand Rounds (weekly)

Non-credit learning

- On-line competency based learning



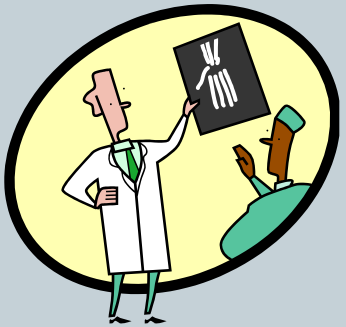
www.rtp-learning-centre.ca

Certificate Program Design Considerations

- Minimize cost to students
  - 8 month program
- Minimize resource implications

Credit Courses

Non-Credit Learning



Clinical Experience

Clinical experience

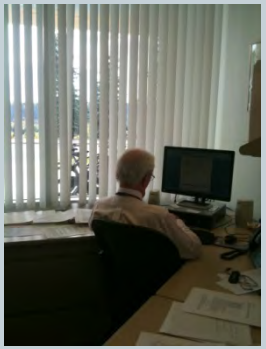
- Clinical Rotations (Minimum of 6 half-days)
  - Hands-on in cast and mould,
  - Simulator
  - 3DCRT
  - IMRT
  - SBRT
  - SRS
  - TBI
  - Brachytherapy

Clinical experience

- Basic Linac Operations and Quality Assurance
  - Weekly lecture/laboratory sessions aimed at competency in performing monthly QA on linear accelerators, Cobalt-60, CT simulator, etc.
  - Shadowing of Physics Assistants to gain exposure to other techniques, including
    - HDR/LDR source calibration and QA
    - TBI measurements and calibration
    - Patient specific IMRT QA

Is it worth it? Costs

- Increase teaching load of 1 course per year
- Increased number of learners per course
  - Up from 2 per course
  - May require TA for marking
  - Laboratory course workload is significantly increased
- Competition for our graduate students



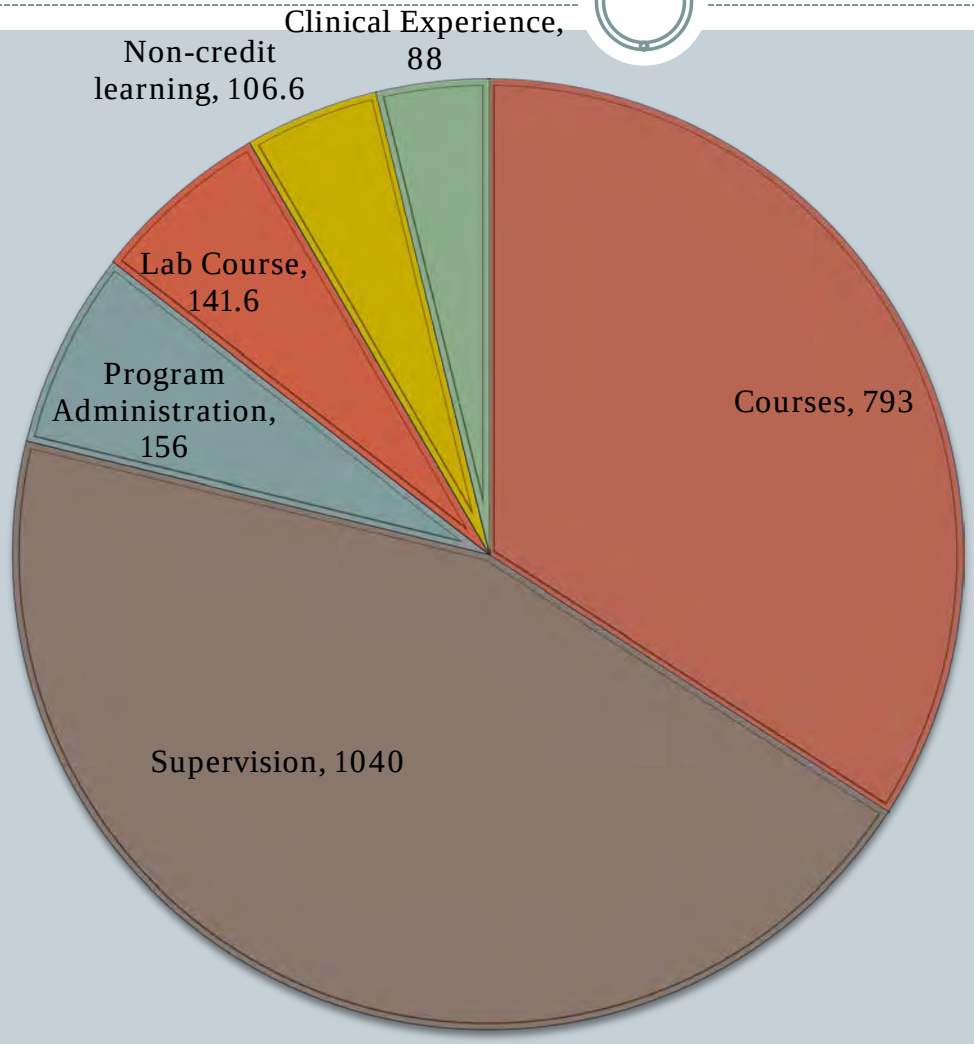
Is it worth it? Benefits

- Enthusiasm, maturity, experience help elevate courses
- Expanded pool of residency applicants
- Provides opportunity for career changes
- Competition for our graduate students

Cost Analysis

- Primary cost of running this program is time.
- We run a 10-student graduate program.
- Certificate program incurs incremental costs on a per-student basis.

Time to run a 10-student graduate program

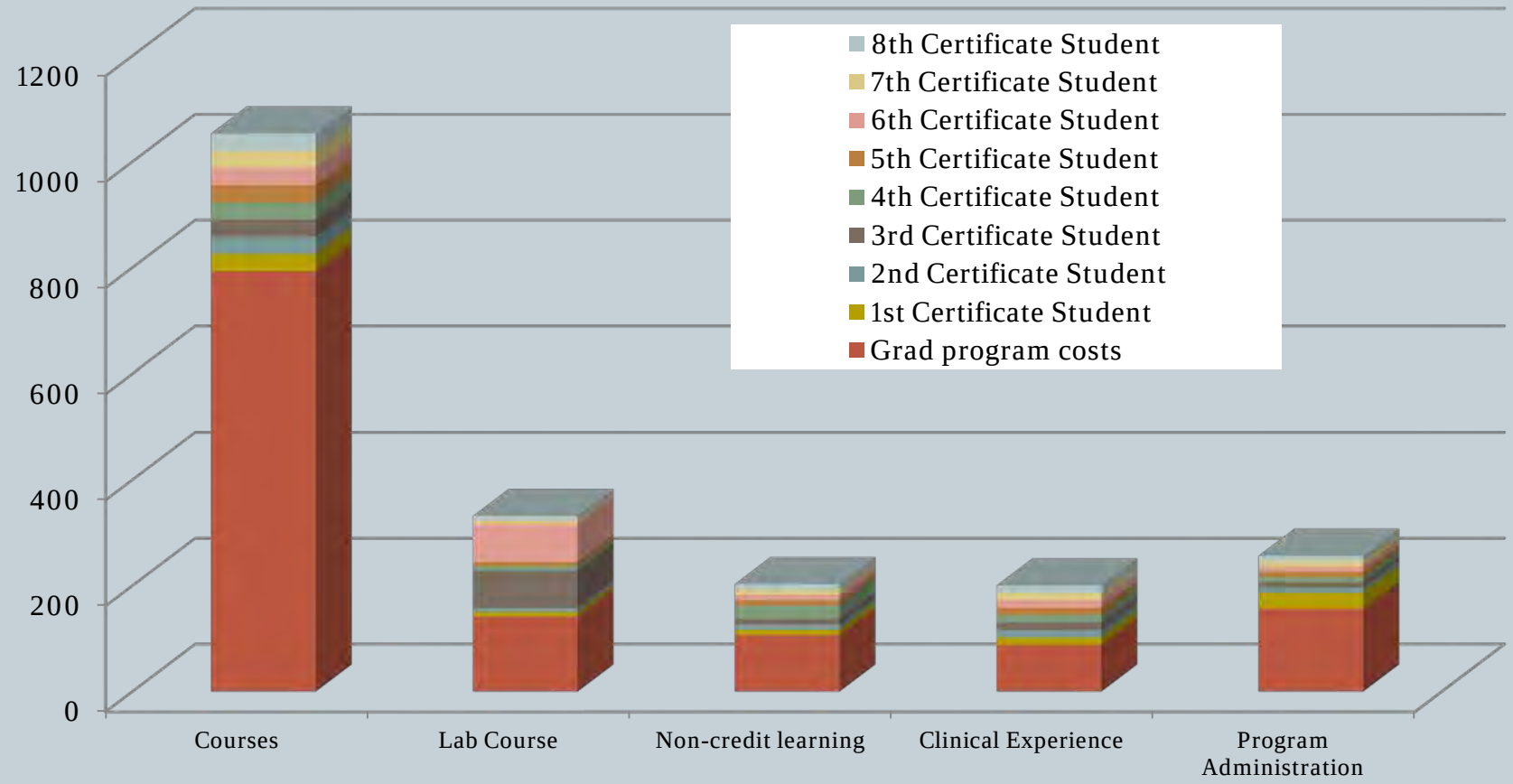


Hours per year

Non-credit learning includes:
- Ethics and Errors,
- Journal Club,

Clinical Experience includes
- Clinical Rotations
- QA training

Incremental cost of certificate program



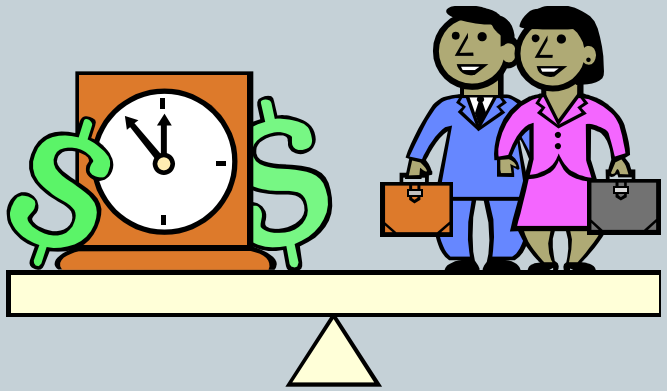
Certificate Program Budget				
Enrollment	**1**	**2**	**4**	**8**
Revenue				
Program Fees	$2,000	$4,000	$8,000	$16,000
Course Fees	$4,171	$8342	$16,684	$33,368
Subtotal	$6,171	$12,342	$24,684	$49,368
Expenditures				
Salaries	$0	$7,957 (1 TA)	$ 11,936 (1.5 TA)	$15,915 (2 TAs)
Scholarships	$0	$0	$1500	$8,000
Travel	$0	$0	$1000	$4,000
Administration Expense (27%)	$1,666	$3,332	$6,665	$13,329
Subtotal	$1,666	$12,290	$21,101	$41,244
Excess of Revenue over Expenses	$4,505	$1,052	$3,583	$8,124

Course fees are set by FGS at $695.16 per course for 2010-2011; we suggested a program fee of $2000 per student. We chose to run a surplus to ease University approval of the program.

All international students get a grant in the amount of the differential between Canadian and International fees, by departmental policy.

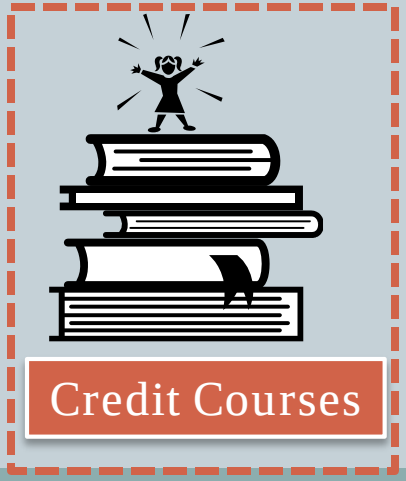
Risk/benefits from the student perspective

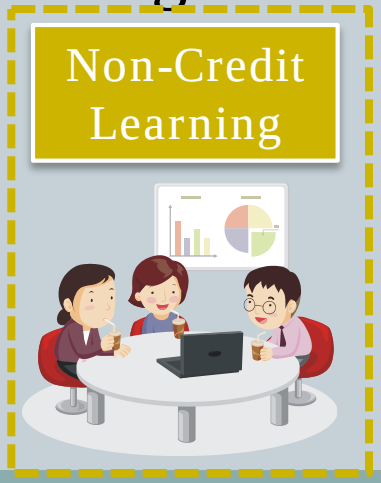
- No guarantee of a residency position
- Risk investing 8 months and more than $6,000
- Opportunity to pursue a career in Medical Physics



Conclusions

- University of Calgary has successfully established a Certificate Program in Radiation Oncology Physics
- Costs for this program were absorbed into the general structure of the graduate program
- We believe a quality certificate program involves much more than just taking courses.





Supplementary Information

Stop talking now, Peter.

U of Calgary: Radiation Oncology Physics

- Summer student research experience
  - Average 4-5 per summer
  - 3 Canadian, medical physics / physics undergraduates
  - 1 French summer internship in Biomedical Engineering
  - 1 machinist
- Undergraduate research project supervision
  - 1-3 per year
- Provide RO residency physics education
  - Average 7 total residents in 5 year program.

Time required to run a graduate program

- Courses are 13 weeks long, 3 h per week
  - 1st time teaching prep = 5 x lecture
  - 2nd time teaching = 1.5 x lecture time
- Laboratory
  - Primary instructor = 5 hr contact, 5 h prep x 8 labs
  - Secondary instructor = 5 hr contact, 2.5 hr prep x 8 labs
- Clinical rotation 6 hours
- Journal Club
  - 2 hr/wk * 26 weeks = 52 hours

Time required to run a graduate program

Supervision hours

- Summer Students = 2 hr per week * 13 wks = 26 hr
- 599 Students = 2 hr per week * 13 wks = 26 hr
- 598 Students = 2 hr per week * 26 weeks = 52 hr
- MSc Students = 2 hrs per week * 52 weeks per year = 104 hr per year
- PhD Students = 2 hrs per week * 52 weeks per year = 104 hr per year
- Graduate committee members 5 hrs/ year
- Resident project supervision = 26 hr

Distance learning

- Loss of clinical opportunities
- Increased convenience for students
- Little direct benefit to our centre with our budget model

DMP Program Suggested Financial Models

CHARLES W. COFFEY, II, PHD
DMP PROGRAM DIRECTOR
VANDERBILT UNIVERSITY
NASHVILLE, TN

DMP Program Suggested Financial Models Outline

- Professional Doctorate (DMP) White Paper
- Evolution of DMP Program at Vanderbilt
- DMP Program Current Status
- Financial Models for Graduate Education
- DMP HUB and SPOKE Model
- Conclusions

DMP Rationale: 2014 Residency Requirements

- Newly Entering Medical Physics Graduate Students for Fall, 2013
- Required to complete a CAMPEP-accredited (24 Month) Medical Physics Residency prior to sitting for Part II of the ABR Exam

- Estimated 175-225 medical physics graduates per year
- Guesstimation: 80% desire to enter clinical work force
- 140-180 medical physics graduates desire to enter clinical work force per year
- Estimated 85 medical physics residency slots per year

- Math Doesn't Work...

- DMP offers a potential, yet partial solution to the Above Math Problem

DMP White Paper

- Prepared by AAPM Working Group on DMP
- Ralph Christensen, Terrance Harms, John Hazle, Bill Hendee, Ken Hogstrom, Melissa Martin, Bruce Thomadsen, and Charles Coffey, Chair

- Report included Positive and Negative Implications/Impact on students, education programs and the profession of medical physics.
- Report Presented and Received by AAPM BoD on July 31, 2008

- Much discussion has taken place among AAPM Members, Educators, and Students with regards to the +/- need/implementation of the DMP Concept

- Vanderbilt has the only DMP Program to date
- Several other programs are considering the concept at their institutions

Evolution of DMP Program at Vanderbilt

- Faculty Approval: Depts of Radiation Oncology and Diagnostic Radiology
- SOM Dean and Chairman's Committee Approval
- Vanderbilt Board of Trust Approval – 2009
- CAMPEP-accreditation – Fall, 2009
- Student Interest – Fall, 2007 (3 students express willingness to be Pioneers)
- Getting "Ducks in a Row"
  a. Credit hours & Tuition rates
  b. Medical Physics courses added & Electives sought
  c. Alternate Pathway
- Three students enter 3rd Year of DMP Program in Fall, 2009
- Nine students have completed graduation requirements as of June, 2012
- Present Student Numbers:

  Four – 4th Year DMPs Four – 3rd Year DMPs

  Five – 2nd Year DMPs Five – 1st Year DMPs

DMP Program Pillars

- Quality
- More than MS Degree + 2-Yr Residency
- Alternate Pathway for Vanderbilt MS Medical Physics Graduates
  a. ABR Board Certified
  b. Return to Campus and Take the Extra Didactic Class Hours (12 – 15)
  c. Complete the Required Research Project (could be off-site)
- Professional Degree
  a. May Allow Graduates to Pursue an Academic Clinical Appointment
  b. May Allow Employer More Leverage for Salary Negotiations within HR
  c. May Result in Additional Employee Perks (ie, travel, dues, etc)
  d. CAVEAT: Will Not Allow Graduates to Pursue a Primary Research PhD Academic Appointment

Current Status of Vanderbilt DMP Program

- Continuous Program
- Start August, 2008.....Completion June, 2012
  July 1, 2010 to June 30, 2012 (Twenty four months of clinical training)

- Three Terms per Year: Fall, Spring, & Summer

- DMP: Professional Degree
  50 Didactic credit hrs + 6 Practicum credit hrs
  + 6 Research Project credit hrs + 30 Clinical Rotation credit hrs
- MS: Basic Science Degree
  32 Didactic credit hrs + 6 Practicum credit hrs

Financial Models

- Current Financial Models
  - I Basic Sciences: Graduate students receive tuition & stipend
  - S Professional: Graduate students do not receive tuition & stipend
  - I PhD Medical Physics: Graduate students receive tuition & stipend
  - S MS Medical Physics: Graduate students do not receive tuition & stipend

- This financial matter of bearing one's own educational costs for a professional degree becomes more of an issue when considering/comparing the new 4-yr DMP Degree versus the 2-yr MS Degree. This dollar issue is a hard sell for both students and those institutions considering implementation of DMP graduate programs.

DMP HUB and SPOKE Model

Assumptions:

- 4 Yr-DMP Programs Will Rise (or Fall) with respect to an Appropriate Model
- Finances Have to Work for Both Institution and the Student
- Clinics are limited as to the maximum of Students in Years 3 & 4 (Funnel^{-1} theory)

- Shared Financial Model Concept (DMP HUB and SPOKE Model)
  - S Tuition/living expenses Years 1 & 2 (student)
  - I Potential teaching, lab assistants opportunities (through the institution)
  - S Tuition/living expenses Year 3 (student)
  - I Reduced tuition Year 4 (similar to research hours during dissertation years)
  - S Student serves in community physics practice Year 4
  - C Community/Teaching Institution enters financial agreement for DMP 4 with part of Finances returned to DMP 4 as a salary
  - I With fewer DMP 4 students on site, the teaching institution has less overhead costs and could perhaps further reduce cost of degree

DMP HUB and SPOKE Model (cont)

- Years 1 & 2: at HUB Institution
  completes didactic classroom and laboratory requirements
  completes an equivalent 300-hr Practicum experience

- Year 3: at HUB Institution
  completes 1-yr of Clinical Rotation Training including observation, participation, and competency tasks

- Year 4: at SPOKE Institution (lower tuition costs & include student salary)
  completes 1-yr of Clinical Rotation Experience (same rotations as Year 3) including participation and competency

Benefits of the DMP HUB and SPOKE Model

- Education Institution may be able to reduce tuition costs during Year 4
- Education Institution may be able to admit more professional students in Years 1, 2, & 3 in that institutional resources are not required in Year 4
- Student gets the opportunity to participate in a SPOKE non-academic physics practice, acquire skills, and share in assignments and problem solving perhaps not as readily available at the HUB.
- Financial and Relational Contracts between the HUB and SPOKE may allow dollars for student salary
- SPOKE physics practice gains a 1-yr trained student resident without the organizational difficulty of administering a residency program and the 2-yr commitment of significant financial resources
- A shared financial model resulting in a net reduction of out-of-pocket student expenses may assist in allowing sufficient numbers of students to choose non-PhD clinical careers in medical physics.

Negotiations Issues HUB and SPOKE

- Quality
  - Faculty/Staff
  - Equipment and Technology
  - Methodology/Procedures/Patient #'s

- Legal/Administrative/Financial Issues
  - Responsibility: Indemnification/Malpractice/Student Conduct/HIPPA
  - "Whereas" and "Therefore"
  - Payment & Where are dollars going?
  - Yearly contract

- HUB is the CAMPEP-accredited Entity
  - SPOKE(S) reported to CAMPEP; possible SPOKE(s) site visits
  - Ultimate responsibility resides with Program Director
  - Day to Day assignments/duties resides with Community Physicist

- DMP Student Remains Vanderbilt Student
  - Clinical Evaluation resides with Community Physicist
  - Ultimate responsibility resides with Program Director
  - CAMPEP will hold HUB accountable for DMP Training

Advantages to STUDENT

- Reduced Tuition
- Salary in Year 4 of DMP
- Opportunity to Participate in Community Physics Practice at SPOKE
- Potential Opportunity to be More “Hands On” at SPOKE
- Show Work Quality, Dependability and Character to Potential Employer(s)
- Permits Easier Transition to that 1st Job

Advantages to SPOKE

- Residency Positions Requirements
  - No CAMPEP application to complete
  - Minimum paperwork and administrative overhead
  - A one-year commitment, NOT a two-year commitment
  - CAMPEP would prefer two residents in alternate years
- Quality, Trained Worker for Fewer Salary Dollars
  - DMP 4 student will have one-full year of clinical training
- Recognition as Partner in Education with HUB
- Potential Opportunity to Assist with CME/MOC Requirements
- Use DMP Position as “Trial” Employment for Future Hires

Advantages to HUB

- There is a Maximum # of DMP Students that a Single Clinic Can Support
- Maintain a Viable Program with Sufficient Student Numbers
- Reduce Education/Training Overhead (Year 4)
- Establish and Cultivate Education Partners within the Community
- Maintain Recruiting Edge for Students
  - Offer Students Opportunity for Salary (Year 4)
  - Offer Students Opportunity for Experience in Community Practice
- Graduate Students with Enhanced Training & Experience Who
  - Rank & Compete Well in the Job Market

Conclusions

- Worthy Goals of the DMP Clinical Medical Physics Education Process

- Graduate Quality, Trained and Experienced Student Residents
- Meet the Man Power Needs
- Keep the Program/Organization Flexible to Meet New Challenges
- Contain Costs within Attainable ALARA Limits

MAYO CLINIC

AAPM Common Application and Match Program

John A. Antolak, Ph.D.

Chair, WGCMPR

MAYO CLINIC

Outline

- Common Application Program (CAP)
  - What is it and how does it work?
  - How did it go last year?
- Future Directions
  - Can we do a match?

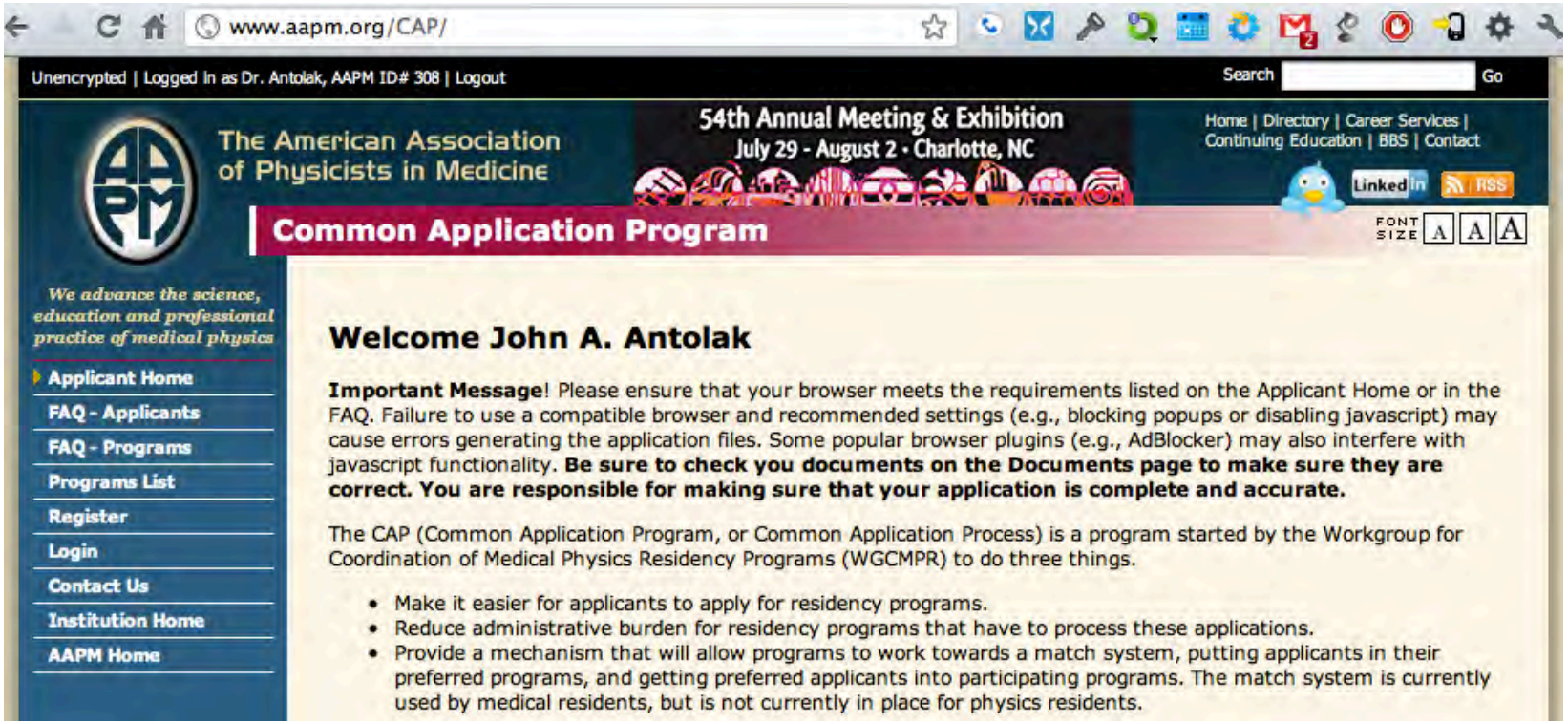
MAYO CLINIC

What is CAP?

- Common Application Program
  - Initiative of AAPM WGCMPR
- Web-based residency application
- Open to any program, and any applicant

MAYO CLINIC

CAP Applicant Home Page



MAYO CLINIC

CAP Applicant Information

- Name, address, contact information
- ABR certification status
- Disclosure of criminal behavior, academic violations, and/or licensure actions
- Employment history
- Military service history (if applicable)
- Education (undergraduate and graduate)
  - CAMPEP prerequisites

MAYO CLINIC

CAP Applicant Information

- Names of 3 references
  - Including one from current advisor or department head
- Personal statement
  - Instead of a cover letter
- Uploaded CV
- Official Transcripts and a copy of TOEFL results (if applicable)
  - Mailed to AAPM Headquarters

MAYO CLINIC

CAP–Applicant Cover Page

Applicant: John Applet Antolak-Test

Submitted: 12/10/2011 12:00 AM EST

Application file includes the following attachments:

Personal Statement: yes

CV: no

Transcripts: no

TOEFL: no

Reference letters: 3

MAYO CLINIC

CAP–Application pdf

Clinical Medical Physics Residency Program Common Application

Start Date Desired: 7/1/2012 Earliest Date Available: 2/1/2012

Personal Information

Name Antolak-Test, John "Applet" Maiden

Last/Family/Surname First/Given Middle Maiden

US Social Security Number (optional) 628-32-6489

Present Mailing Address	4112 Manorwoods Ct NW Rochester, Minnesota 55901 United States
Permanent Address (if different)	Radiation Oncology, Desk R 200 First St SW Rochester, MN 55905 USA

Preferred Phone: 507-255-3553
Cell Phone: 507-722-1524
Work Phone:
E-mail (primary): jaa-cap@antolakhome.net
E-mail (alternate): jaa-captest@antolakhome.net

Gender (optional) Male

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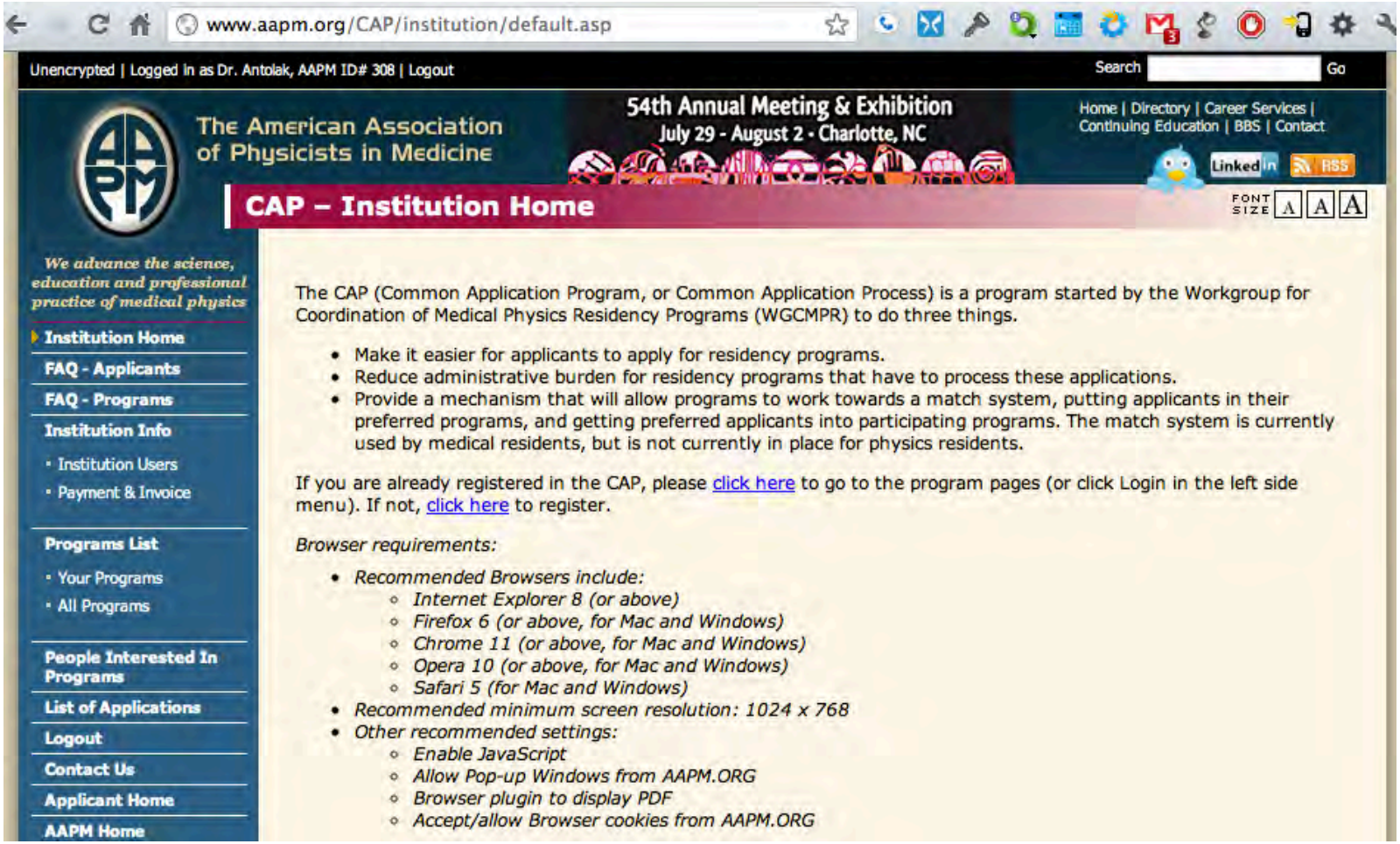
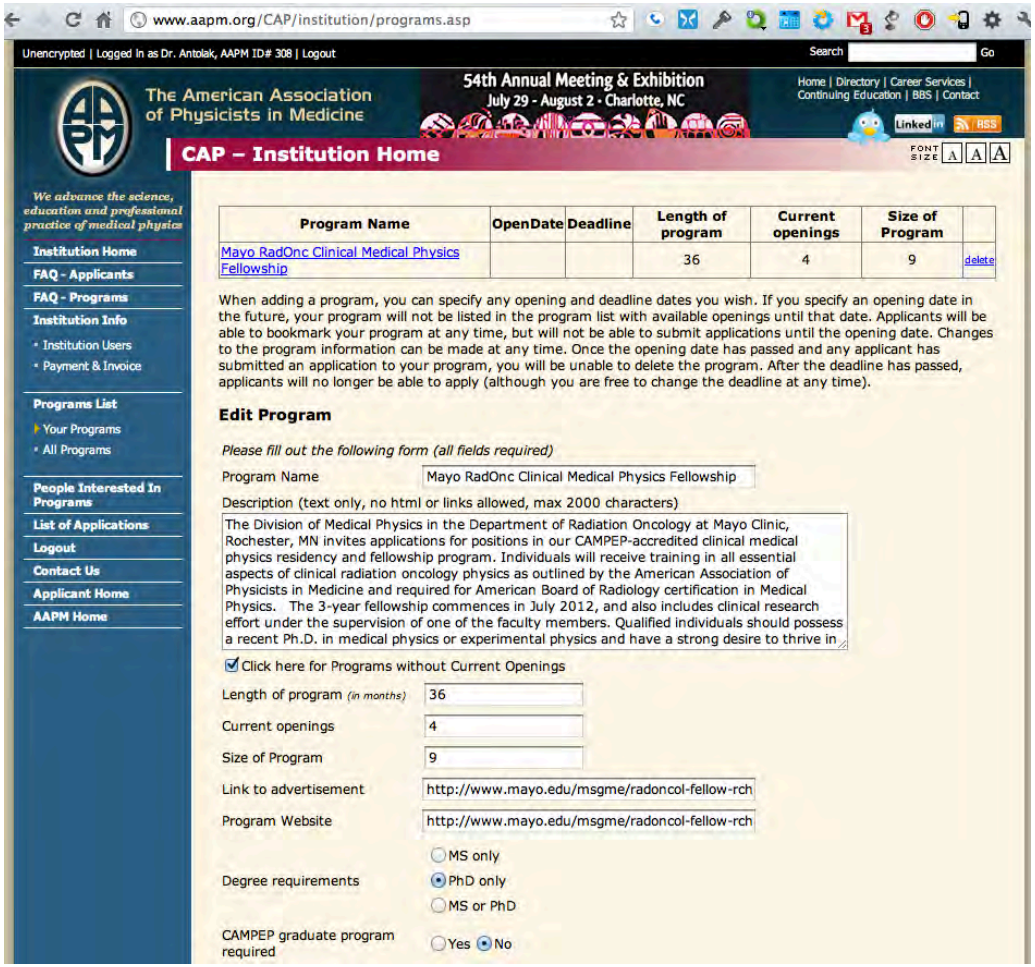
CAP Institution Home Page



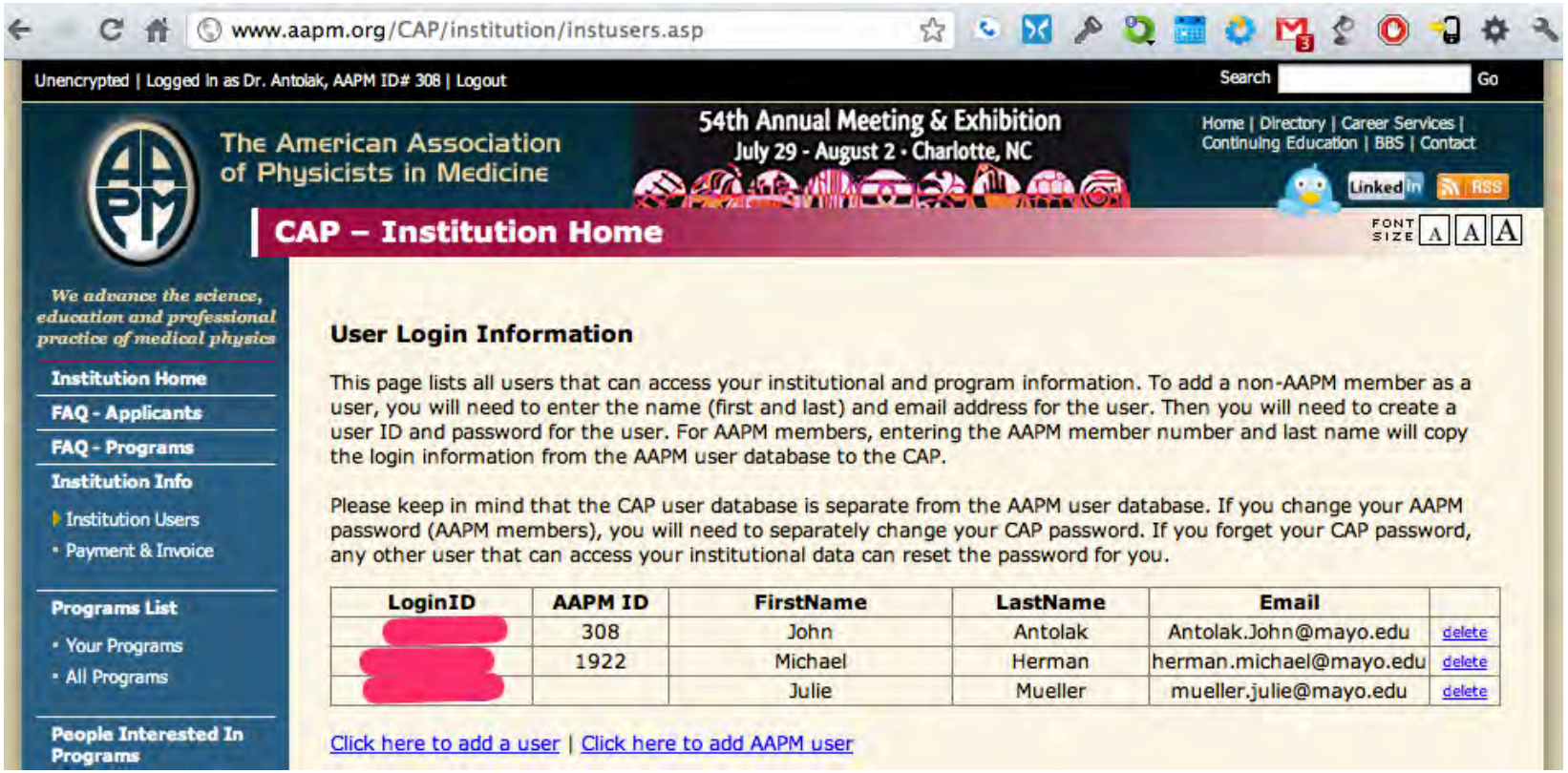
MAYO CLINIC

CAP–Adding a Program



MAYO CLINIC

CAP–Insitutional Users



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CAP History

- Application information gathered by WGCMPR starting in 2009
  - Several iterations
- Web application developed by AAPM HQ staff, starting Aug 2011
- Started taking applicant registrations in Sep 2011
  - Applicants started entering data shortly afterwards
- Opened to institutions early Dec 2011
  - Original plan was Nov 2012

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CAP Statistics (as of Mar 16, 2012)

- 150 unique applicants
  - 79 were AAPM members
- 97% had 2−3 references
  - 89% had 3 references
- 861 applications purchased
  - 121 not used

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CAP Statistics (as of Mar 16, 2012)

- 14 programs
  - 1 received 0 applications due to an error setting program start date
- Average # of applications: 66
  - Range 28–97

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CAP Fee Structure

- Programs paid $200
  - Nominally 1 year
- Applicants paid
  - $20 for one application credit
  - $50 for 5 credits
    - 30% submitted 5 applications
    - 16% submitted 10 applications

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Upcoming Changes

- Uploaded transcripts
  - Scanning transcripts was a burden on AAPM HQ staff
  - Applications (except for reference letters) available immediately upon submission
- Improved reference security
  - AAPM members will be logged as such
  - Other references will be logged by IP address

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Gentleman's Agreement

- For July recruitments to therapy residency programs
- Application deadline not earlier than Dec 15
- Offers no earlier than first Monday in March (new for 2013)
- Applicants have maximum of 24 hours to accept an offer (new for 2013)
- Relies on program and applicant cooperation

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How does a match work?

- Programs can only offer within the match system
- Applicants can only accept within the match system
- Programs and applicants that violate the rules are subject to sanction
- Works well if almost all programs and applicants use the same system, same deadlines, common application
  - NRMP match requires 75% program participation, 75% available positions

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Medical Physics Residency Match?

- Probably not at this time
  - Graduate degrees can be awarded at any time during the calendar year
  - Some residency programs like to start everyone at the same time
  - Some programs juggle start dates to accommodate graduate students
  - Many residency programs are unable to use the CAP at this time
    - A common application in some form is necessary for a match system

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Under discussion for the CAP

- Constrained application deadlines
  - 2–3 recruitment cycles per year
- Automated offer system
  - Programs would rank applicants
  - CAP would send out and accept offers
  - Offer acceptance would remove applicant from other rank lists
  - Recruitment completed very quickly

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Thank You

- **WGCMPR meeting today**
  - **12–2 pm**
  - **Tryon South - 2nd Floor**

2. Workforce Assessment

Residency Application Process and Workforce Assessment

Michael D. Mills, PhD

SDAMPP annual Meeting
Charlotte, NC

Presentation Outline

- Current Manpower Resources and Models
  - Safety is no accident – ASTRO model
  - ASTRO – ACR database
  - Abt Model
  - Battista Model
  - Dosimetry Workforce Study
- Current Manpower Initiatives
  - IAEA
  - AAPM Diagnostic Workforce Study
- Implications of workforce assessment for residency programs
- Conclusions

Objectives

1. Understand the need to establish recommended staffing levels in therapy physics and imaging physics.
2. Understand the information documented in the manpower and staffing resources
3. Understand a current model that predicts the supply and demand for therapy physicists through 2020.
4. Apply the information contained in these studies to the management of CAMPEP – accredited academic and residency programs.

Current Manpower Resources and Models

Sources and Initiatives for US Staffing Recommendations in Radiation Oncology

- ASTRO – safety is no accident
- ASTRO – ACR database
- ABT III report
- Battista model - Canadian workforce study
- AAMD workforce study

Where is the Staffing Data?

ACR™
AMERICAN COLLEGE OF
RADIOLOGY

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

Final Report

March 2008

Prepared for
American College of Medical Physics
1891 Preston White Drive
Reston VA 22091

American Association of Physicists in Medicine
Number One Physics-Ellipse
College Park MD 20740

Prepared by
Abt Associates Inc.
4550 Montgomery Avenue
Suite 800
Bethesda, MD 20814

ASTRO – Safety is no accident

- AAPM approved a version that contained a recommendation of one physicist per 250 patients treated annually
- The ASTRO board removed this line from the printed version of the document
- A physics staffing matrix was included

ASTRO – safety is no accident

- Culture of ASTRO
- Highest leadership and Staff make policy
- The process is less inclusive than you find in the AAPM
- Decisions take a long time
- Projects take a long time (especially collaborative projects)
- It is sometimes difficult to get information
- Information is often released slowly and deliberately

- There was some mild interest in the ASTRO matrix, but some resistance as well.
- The objections were:
  - The model is too complex, even if a filled out example is offered
  - The model is insufficiently validated – is should be published before referenced
  - The model may not be appropriate for certain institutions

ASTRO Model

- Validated for Abt III Matrix Results
- Validated for the AAMD Workforce Survey Matrix Results
- Not validated for the ACR/ASTRO Accredited Program Database
- Future Abt studies may be designed to refine and validate this methodology

Staffing Requirements in a Radiotherapy Department

			Relative FTE Factor		Required FTE		Required Total FTE	
	Services - Number of Units or Licenses*	# of systems*	Physicist	Dosimetrist	Physicist	Dosimetrist	Physicist	Dosimetrist
Equipment, Sources and Systems	Multi energy Accelerators	4	0.25	0.05	1	0.2		
	Single energy accelerators	0	0.08	0.01	0	0		
	Tomotherapy, CyberKnife, GammaKnife	1	0.3	0.03	0.3	0.03		
	Cobalt Units, IMRT, PACS, EMR & Contouring	0	0.08	0.03	0	0		
	Orthovoltage and Superficial units	0	0.02	0.01	0	0		
	Manual brachytherapy; LDR Seed Implants	1	0.2	0.03	0.2	0.03		
	HDR brachytherapy	1	0.2	0.02	0.2	0.02		
	Simulator, CT-Simulator, PET, MRI Fusion	1	0.05	0.02	0.05	0.02		
	Computer planning system (per 10 workstations)	1	0.05	0.02	0.05	0.02		
	HDR planning system	1	0.2	0.01	0.2	0.01		
	Subtotal						2.00	0.33
	Annual # of Patients undergoing Procedures**	# of patients**						
# Patient Procedures	External Beam RT with 3D planning	500	0.0003	0.003	0.15	1.5		
	External Beam RT with conventional planning	200	0.0002	0.002	0.04	0.4		
	Sealed source Brachytherapy (LDR & HDR)	100	0.008	0.003	0.8	0.3		
	Unsealed source therapy	25	0.008	0.005	0.2	0.125		
	IMRT IGRT, SRS, TBI, SBRT	400	0.008	0.005	3.2	2		
	Subtotal						4.39	4.33
	Estimated Total (Phys & Dosim) FTE Effort***	FTE Effort***						
Non Clinical - Estimated Total FTE Effort	Education & Training (FTE)	0.1	0.667	0.333	0.0667	0.0333		
	Generation of Internal Reports (FTE)	0.1	0.667	0.333	0.0667	0.0333		
	Committees & Meetings; Inc. Rad. Safety (FTE)	0.1	0.667	0.333	0.0667	0.0333		
	Administration and Management (FTE)	0.5	0.667	0.333	0.3335	0.1665		
	Subtotal						0.53	0.27
	Total						6.92	4.92

* Enter the sum of the number of therapy units, imaging systems, workstations, support systems and technologies in each category.

** Enter the annual number of new patients that undergo each of the following planning and treatment deliver procedures; count each new patient one time.

***Enter the summed total medical physicist and

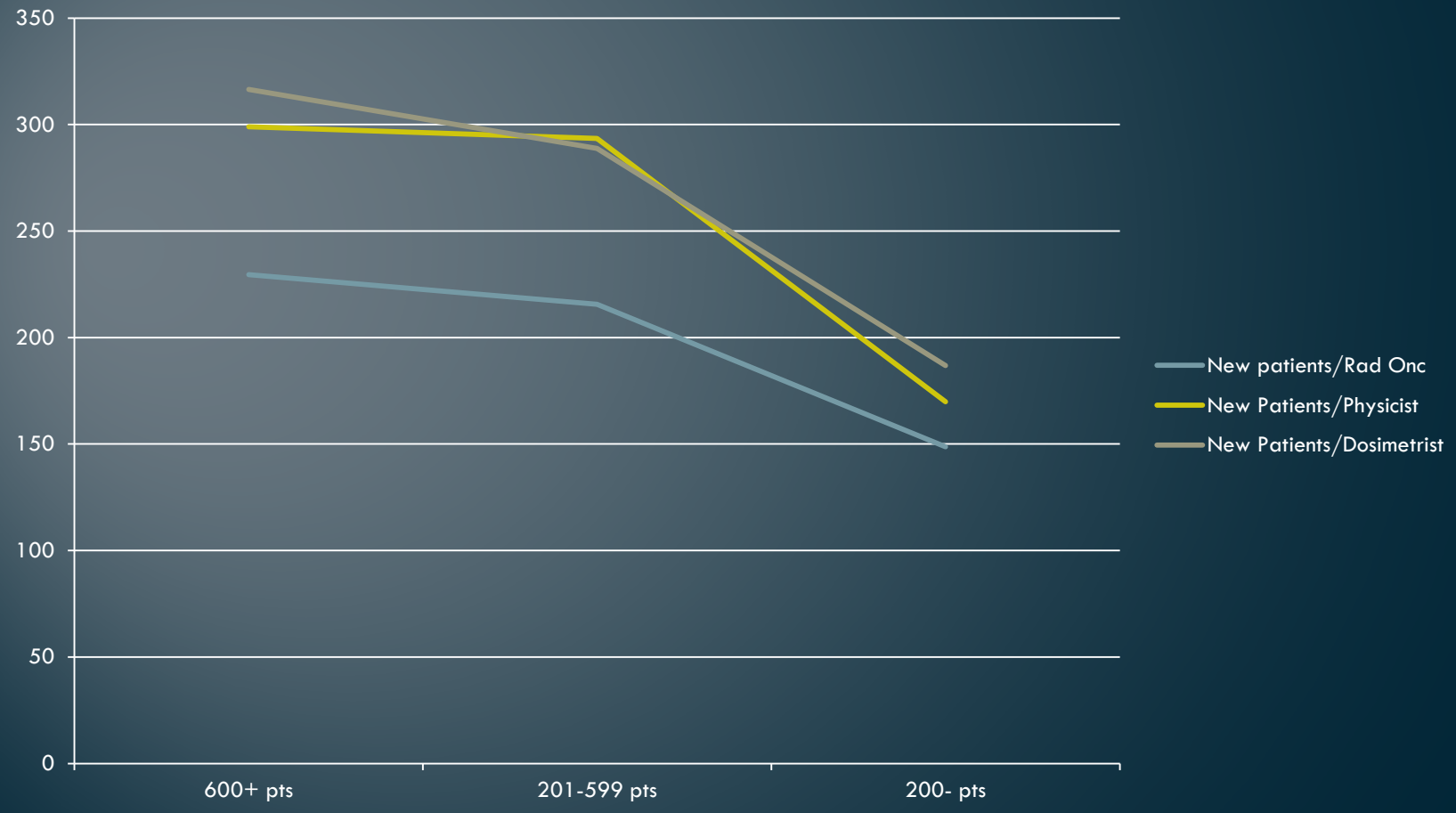
Using the ASTRO sample worksheet

- The model was validated using the Abt II data (2007)
- At that time, SBRT, SRS, SRT and other time intensive special procedures were mostly practiced in large centers
- IMRT market penetration was less than today
- The worksheet works reasonable well for those centers with 40% or less specials and IMRT procedures
- However, it tends to overestimate physics staffing if IMRT and other special procedures make up 50% or more of the total patient service mix

What does the ASTRO – ACR Database and Abt Report Reveal?

- Practice venue largely does not matter
- Community based centers, Freestanding centers and University centers require similar staffing
- The only variable that affects staffing is the number of patients treated in the facility on an annual basis
- Statistically, the fewer the number of patients treated annually in a center, the more generous is the staffing
- In the ASTRO-ACR database, staffing numbers are reported for facilities treating > 600, 200-600 and < 200 patients annually

What does the ASTRO – ACR Database and Abt Report Reveal?



How can we use the Abt III Report?

"I hear you worked so many hours you passed out for 20 minutes. I just thought I'd make it clear that I'm not paying you for those 20 minutes."

How many patients annually per Qualified Medical Physicist

- Abt I 1995 421
- Abt II 2003 325
- Abt III 2008 304

Median overall staffing information in 2007

# Patients treated per year	**595**
# Qualified Medical Physicists	2.0
# Radiation Oncologists	3.0
# Dosimetrists or Junior Medical Physicists	3.0
# Maintenance Engineers	0.0
# Radiation Therapists	8.0
# Radiation Oncology Nurses	3.0

What is the difference between defending staffing and work?

- Staffing applies to the entire medical physics program, work applies only to the QMP
- Staffing may include non-professional effort, QMP work is professional in nature
- For professionals, work is directly related to compensation with respect to services provided, staffing is not

How can we use the Abt III Report?

- The Abt Associates report empowers the medical physicist to negotiate from a middle ground for compensation - between direct billing and a non-professional salary
- We can use the data in Abt III to negotiate with employers in the same manner that Physicians negotiate with CMS – by using the time and work required to deliver patient procedures

Battista Model

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 13, NUMBER 1, 2012

Medical physics staffing for radiation oncology: a decade of experience in Ontario, Canada

Jerry J. Battista,[1] Brenda G. Clark,[2a] Michael S. Patterson,[3] Luc Beaulieu,[4] Michael B. Sharpe,[5] L. John Schreiner,[6] Miller S. MacPherson,[5] Jacob Van Dyk[1]

Medical Physics,[1] London Regional Cancer Program, London, ON; Radiation Medicine Program,[2] The Ottawa Hospital Cancer Centre, Ottawa, ON; Juravinski Cancer Centre and McMaster University,[3] Hamilton, ON; Université Laval,[4] Québec, QC; Radiation Medicine Program,[5] Princess Margaret Hospital and University of Toronto, Toronto, ON; Cancer Centre of South Eastern Ontario,[6] Kingston, ON, Canada

brclark@toh.on.ca

Brown Cancer Center, Louisville KY USA

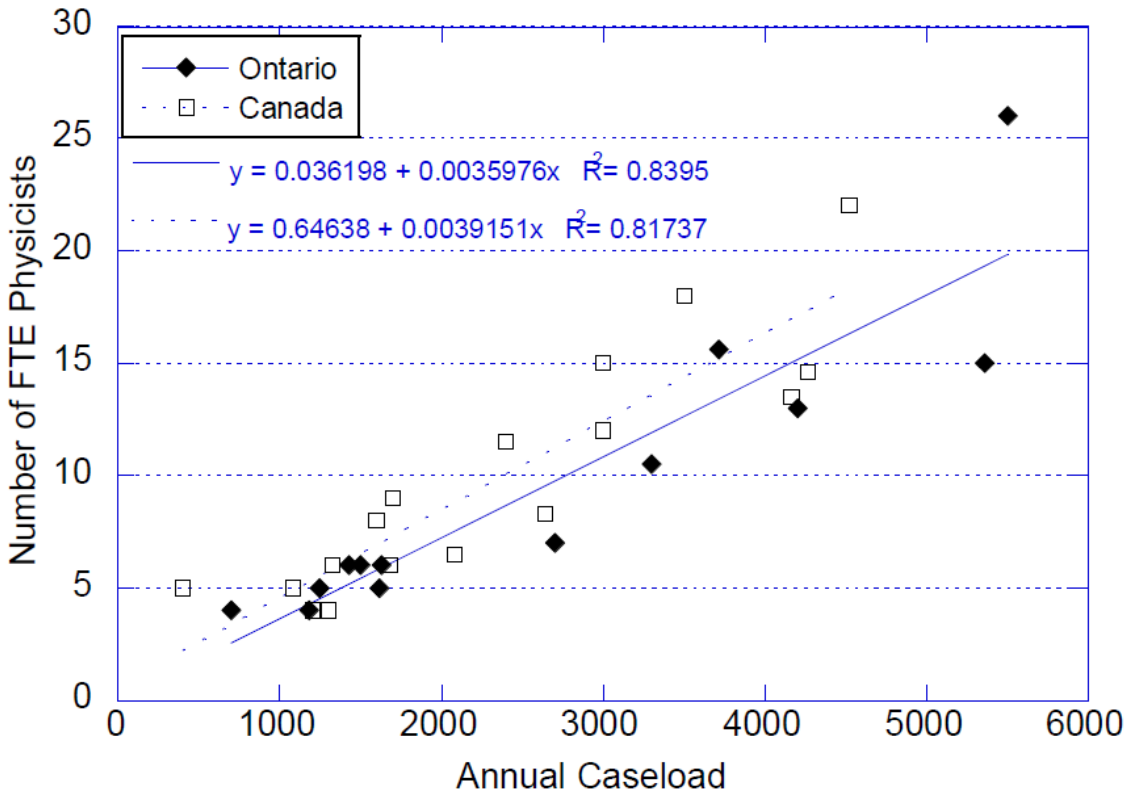
Michael D. Mills, PhD
mdmill03@louisville.edu

Please Select > **Ontario FTE_Weights**

ITEM	WORKLOAD	FTE's					
		Physicist	Physics Assistant	Dosimetrist / Treatment Planner	Engineering Electronics	Engineering Mechanical	Computer Support
CLINICAL PROCEDURES and SERVICES							
All radiation beam/source therapy - includes external beam therapy and brachytherapy (cases/yr)	1080	0.54	0.22	2.16	0.00	0.22	0.11
Complexity bonus increment for inverse IMRT including tomotherapy, clinical trial protocols, gated beams, 4D plans, multi-modality image fusion (cases/yr) .	300	0.45	0.00	0.90	0.00	0.00	0.09
External beam - special procedure bonus increment (total body photon or electron, radiosurgery) (cases/yr)	100	0.50	0.25	0.10	0.00	0.10	0.00
Brachytherapy - LDR or HDR (fractions/yr)	100	0.20	0.05	0.04	0.00	0.00	0.00
Brachytherapy - interstitial seed implants (cases/yr)	40	0.20	0.08	0.08	0.00	0.00	0.00
RADIOTHERAPY EQUIPMENT SUPPORT							
Number of accelerators (all linacs, including tomotherapy and robotic linacs)	5	1.00	1.50	0.00	1.50	0.50	0.00
Major ancillary RT equipment: TPS (1 per vendor per 10 workstations), PET-CT, MR-Sim, 4D CTsim, HDR	6	0.60	0.30	0.00	1.20	0.30	0.60
Minor ancillary RT equipment: X-ray Sim, CT-Sim, LDR unit, Cobalt unit, Gamma Knife, orthovoltage unit, ultrasound unit, gating/motion monitoring device	4	0.20	0.10	0.00	0.40	0.20	0.00
TRAINING and EDUCATION of specialists							
Radiation Oncology Residents*	6	0.16	0.00	0.30	0.00	0.00	0.00
Radiation Therapy Students*	6	0.12	0.00	0.30	0.00	0.00	0.00
Clinical Physics Residents*	2	0.30	0.00	0.10	0.00	0.00	0.00
Medical Physics Graduate Students*		0.00	0.00	0.00	0.00	0.00	0.00
* Baseline + weight per trainee for Physicists							
SubTotals		4.27	2.50	3.98	3.10	1.32	0.80
Administration & Other Duties							
Administrative workload per staff category (Human Resources)		0.43	0.05	0.08	0.06	0.03	0.02
Administration (by Chief, Radiation Safety Officer)		0.66	0.00	0.00	0.00	0.00	0.00
Clinical development, conference attendance, courses, site visits		1.23	0.03	0.04	0.03	0.01	0.01
Time away for paid holidays and vacation (FTE per employee)		0.62	0.25	0.40	0.31	0.13	0.08
Total required staff of each type		**6.78**	**2.77**	**4.42**	**3.44**	**1.46**	**0.89**
Total Physics Staff (including dosimetrists/Tx Planner)	**19.77**						
Current Staffing (with approved budget)		6.00	3.00	6.00	2.00	1.00	1.00
Your desired staffing (best estimate)		6.00	3.00	6.00	2.00	1.00	1.00
Number of clinical hours of operation/day		10.00					
Predicted staff per Linac		1.36	0.55	0.88	0.69	0.29	0.18
Cases per predicted staff		159.30	389.42	244.22	313.55	738.60	1218.05

Population
34 Million

Physicists versus Annual Caseload

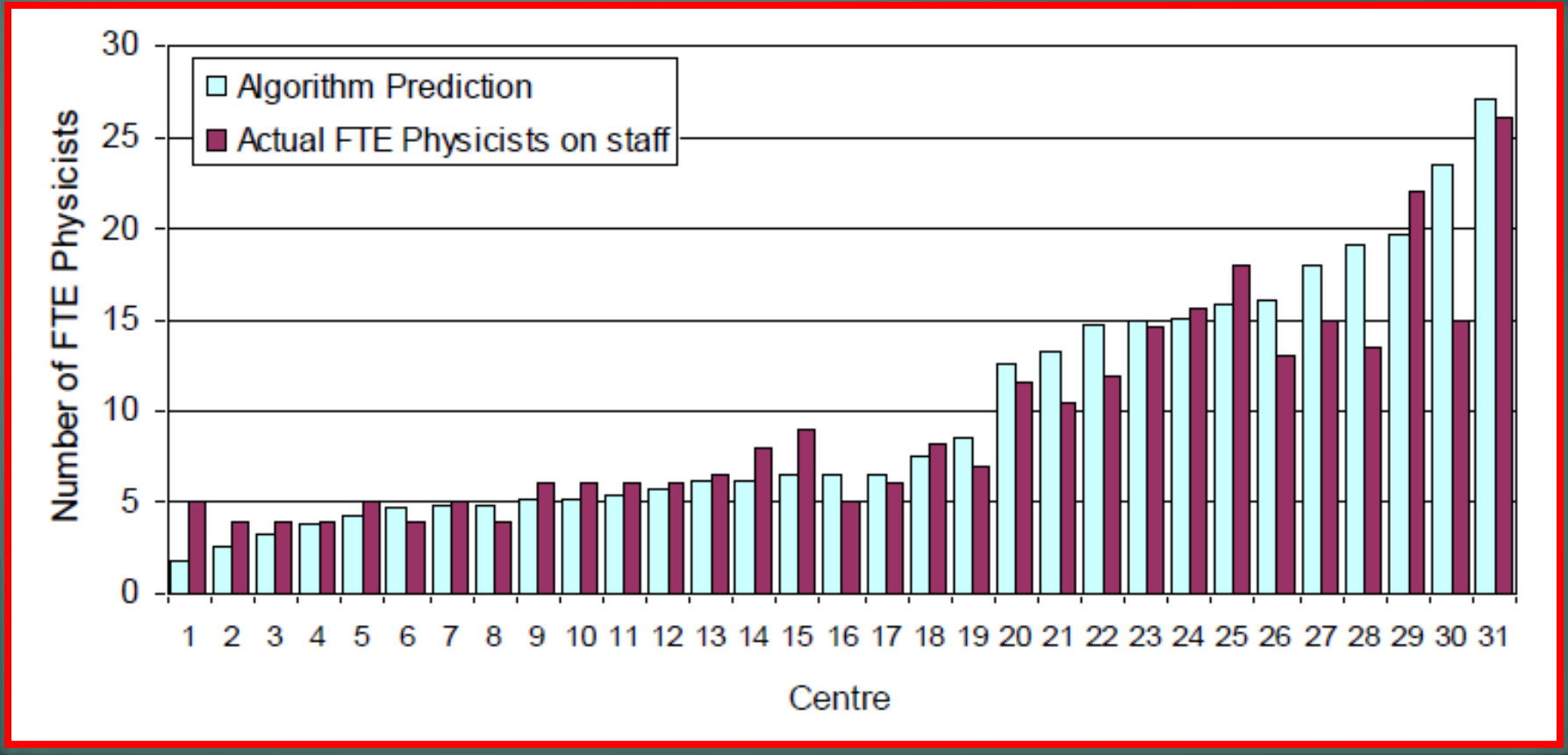


Inverse slope:
Ontario: 278 treated cases/physicist
Canada: 255 treated cases/physicist

Algorithm Predictive Power

Canadian Survey

- Detailed algorithm prediction



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Summary

- Ontario study provides a methodology for determining staffing requirements
  - Validated by trans-Canada survey
  - Works in the Canadian context
- Includes considerations for various support staff
- The simple formula could be adapted by deriving new ratios for various special procedures

Current Manpower Initiatives

IAEA – Vienna, Austria

- Meeting dates:
- January 31 – February 2, 2011
- October 31 – November 4, 2011
- 18 International Representatives
- Embraces all staff in radiation medicine
- Staffing categories in radiation oncology are based on work categories, not profession categories as different professions may perform the same work:
  - Radiation oncology
  - Medical physics
  - Radiation therapy
  - Treatment planning
  - Radiation oncology nursing
  - Information technology
  - Engineering mechanical
  - Engineering electronics

IAEA – Vienna, Austria

- The philosophy of the IAEA group was to divide the staffing by type of work and to determine all of the components of that type of work
- The Abt and Battista staffing numbers were roughly equivalent, but the Canadian institutions tend to staff somewhat more generously than their US counterparts.
- As a first approximation, it was felt that the Abt data provided the best patient procedure manpower estimates and the Battista - Canadian data provided the best equipment-based manpower estimates.

IAEA – Abt, ASTRO and Battista Data

- Merging the Abt and Battista data proved problematic
  - The Abt data was stripped of non-procedural (equipment) time and work
  - The Battista data was stripped of patient time and work
  - The result of adding these two is that staffing for medical physics work was overestimated
  - The conclusion is that either the Battista model overestimates machine activities at the expense of patient procedure time and work, or the Abt model overestimates patient procedure time and work at the expense of machine services, or both
  - The ASTRO model seemed to provide better results, but was considered to simplistic a model to be of use.

STAFFING MODEL FOR RADIATION ONCOLOGY

CATEGORY			Radiation Oncology (Radiation)				Medical Physics				Radiation Therapy				Treatment Planning (Treatment)				Rad Onc Nursing (Rad Onc)				Information Technology				Engineering Mechanical (Hospital engineer)				Engineering Electronics (Hospital engineer)					
Working hours per day			10				10				7.5				7.5				8				6				8				8					
Working days per week			5				5				5				5				5				5				5				5					
Annual leave (working days) + holidays			40				40				40				40				40				40				40				40					
Total worked days per year			220				220				220				220				220				220				220				220					
Total hours worked per year			2200				2200				1650				1650				1760				1320				1760				1760					
		total h/task	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	h	F	#staff	ref	**total person hours**	
Tasks related directly to patient number	***Number of Procedures***	**h/task**																																		
Therapeutic decision	1080	**0.2**	0.2	1	0.0982	c	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0.20	
First consultation	1080	**0.85**	0.85	1	0.4173	3	0	0	0		0	0	0		0	0	0		0	0	0	c	0	0	0		0	0	0		0	0	0		0.85	
EBRT	***Number of Procedures***	**h/task**																																	0.00	
Patient positioning/immobilisation EBRT					0				0				0				0				0				0				0				0			
simple	300	**0.25**	0	0	0		0	0	0		0.5	2	0.0909	c	0	0	0		0		0		0	0	0		0	0	0		0	0	0		0.50	
customised	300	**0.5**	0	0	0		0	0	0		1	2	0.1818	c	0	0	0		0		0		0	0	0		0	0	0		0	0	0		1.00	
complex	480	**1**	0.5	0.5	0.1091		0	0	0		2	2	0.5818	c	0.5	0.5	0.1455		0		0		0	0	0		0	0	0		0	0	0		3.00	
Image acquisition EBRT					0				0				0				0				0				0				0				0			
2D fluoroscopic simulation	180	**0.5**	0	0	0	3	0	0	0		1	2	0.1091	c	0	0	0		0		0		0	0	0		0	0	0		0	0	0		1.00	
CT single slice for 2D/contour	0	**0.5**	0	0	0		0	0	0		0.5	1	0	c	0	0	0		0		0		0	0	0		0	0	0		0	0	0		0.50	
CT simulation for 3D	900	**0.5**	0	0	0	c	0.25	0.5	0.1023		1	2	0.5455	c	0.05	0.1	0.0273		0		0		0	0	0		0	0	0		0	0	0		1.30	
CT simulation for 4D	0	**1**	0.5	0.5	0	c	0.75	0.75	0	c	2	2	0	c	0.1	0.1	0		0		0		0	0	0		0	0	0		0	0	0		3.35	
MRI/PET CT	50	**0.75**	0	0	0		0	0	0		0.75	1	0.0227	c	0	0	0		0		0		0	0	0		0	0	0		0	0	0		0.75	
Target volume definition																																				
2D field delineation/clinical markup	180	**0.5**	0.5	1	0.0409	3	0	0	0		0		0		0		0		0		0		0	0	0		0	0	0		0	0	0		0.50	
2D contour on single CT slice	0	**0.2**	0.2	1	0	c	0		0		0		0		0		0		0		0		0	0	0		0	0	0		0	0	0		0.20	
3D CRT GTV-CTV	900	**1**	1	1	0.4091	3	0		0		0		0		0		0		0		0		0	0	0		0	0	0		0	0	0		1.00	SBRT in the report
PTV	900	**0.5**	0	0	0	3	0		0		0		0		0.5	1	0.2727	c	0		0		0	0	0		0	0	0		0	0	0		0.50	
OAR	900	**1**	0		0		0		0		0		0		1	1	0.5455	c	0		0		0	0	0		0	0	0		0	0	0		1.00	
Image fusion (PET/CT, MRS, etc)	50	**0.5**	0		0		0		0		0		0		0.5	1	0.0152	c	0		0		0	0	0		0	0	0		0	0	0		0.50	
4D CT ITV image generation	0	**0.4**	0	0	0	c	0.4	1	0	c	0		0		0	0	0	c	0		0		0	0	0		0	0	0		0	0	0		0.40	
ITV delineation	0	**0.3**	0.3	1	0	c	0	0	0	c	0		0		0		0		0		0		0	0	0		0	0	0		0	0	0		0.30	
Treatment planning EBRT					0				0				0				0				0				0				0				0			
manual calculation	300	**0.3**	0		0		0.15	0.5	0.0205	c	0		0		0.15	0.5	0.0273	c	0		0		0	0	0		0	0	0		0	0	0		0.30	
2D	0	**0.5**	0		0		0		0		0		0		0.5	1	0	c	0		0		0	0	0		0	0	0		0	0	0		0.50	
3D	380	**2.5**	0		0		0.625	0.25	0.108	yl	0		0		1.88	0.75	0.4318	yl	0		0		0	0	0		0	0	0		0	0	0		2.50	
IMRT (inverse TP)	400	**5.5**	0		0		1.375	0.25	0.25		0		0		4.13	0.75	1		0		0		0	0	0		0	0	0		0	0	0		5.50	
4D	0	**8**	0		0		2	0.25	0		0		0		6	0.75	0		0		0		0	0	0		0	0	0		0	0	0		8.00	
block cutting/accessories	100	**1.25**	0		0		0.25	0.2	0.0114		1	0.8	0.0606	c	0		0		0		0		0	0	0		0	0	0		0	0	0		1.25	
plan approval	780	**0.25**	0.25	1	0.0886	c	0	0	0		0	0	0	c	0		0		0		0		0	0	0		0	0	0		0	0	0		0.25	
Plan data transfer	150		0		0		0		0		0		0	c	0		0		0		0		0	0	0		0	0	0		0	0	0		0.00	
Simulation/verification of treatment plan					0				0				0				0				0				0				0				0			
2D	0	**0.5**	0.1	0.2	0	c	0		0		1	2	0		0		0		0		0		0	0	0		0	0	0		0	0	0		1.10	
3D	380	**0.5**	0.1	0.2	0.0173	c	0		0		1	2	0.2303		0		0		0		0		0	0	0		0	0	0		0	0	0		1.10	
IMRT	400	**1**	0		0		1	1	0.1818	mm	0		0		0		0		0		0		0	0	0		0	0	0		0	0	0		1.00	
Treatment delivery					0				0				0				0				0				0				0				0			
First set-up	1080	**0.3**	0		0	4	0		0	1	0.6	2	0.3927		0.06	0.2	0.0393		0		0		0	0	0		0	0	0		0	0	0		0.66	
Portal imaging	4320	**0.1**	0.1	1	0.1964	3	0		0	1	0.2	2	0.5236		0		0		0		0		0	0	0		0	0	0		0	0	0		0.30	
Daily image guidance	1600	**0.1**	0		0		0		0		0.2	2	0.1939		0		0		0		0		0	0	0		0	0	0		0	0	0		0.20	
In vivo dosimetry	200	**0.1**	0		0		0		0		0.2	2	0.0242		0.1	1	0.0121		0		0		0	0	0		0	0	0		0	0	0		0.30	
Total # fractions 1 slot	10800	**0.2**	0		0		0		0		0.4	2	2.6182		0		0		0		0		0	0	0		0	0	0		0	0	0		0.40	
2 slots	10800	**0.4**	0		0		0		0		0.8	2	5.2364		0		0		0		0		0	0	0		0	0	0		0	0	0		0.80	
3 slots	0	**0.6**	0		0		0		0		1.2	2	0		0		0		0		0		0	0	0		0	0	0		0	0	0		1.20	
4D	0	**0.5**	0		0		0.5	1	0		1	2	0		0		0		0		0		0	0	0		0	0	0		0	0	0		1.50	
SBRT	0	**0.75**	0.75	1	0		0.75	1	0		1.5	2	0		0		0		0		0		0	0	0		0	0	0		0	0	0		3.00	
Chart check	4320	**0.75**	0.3	0.4	0.5891		0.75	1	1.4727		0.3	0.4	0.7855		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		1.35	
Evaluation during treatment					0				0				0				0				0				0				0				0			
In-patient	320	**0.25**	0.25	1	0.0364	3	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0.25	
Out-patient	4000	**0.2**	0.2	1	0.3636	3	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0.20	
BRACHY	***Number of Procedures***	**h/task**																																		
brachytherapy insertion					0				0				0				0				0				0				0				0			
simple	220	**1**	1	1	0.1	3	0	0	0		1	1	0.1333		0	0	0		1	1	0.125		0	0	0		0	0	0		0	0	0		3.00	
complex	220	**2**	2	1	0.2	c	1	0.5	0.1		2	1	0.2667		0	0	0		2	1	0.25		0	0	0		0	0	0		0	0	0		7.00	

permanent prostate	80	**2**	2	1	0.0727 c	2	1	0.0727	2	1	0.097	0	0	0	2	1	0.0909	0	0	0	0	0	0	0	0	0	8.00	
Image acquisition brachy					0			0			0			0			0			0			0			0		
2D simulation	100	**0.5**	0.25	0.5	0.0114	0	0	0	1	2	0.0606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.25	
CT simulation for 3D	120	**0.5**	0.25	0.5	0.0136	0	0	0	1	2	0.0727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.25	
MRI/PET CT	0	**1**	0	0	0	0	0	0	1	1	0	0		0	0		0	0	0	0	0	0	0	0	0	0	1.00	
pre insertion ultrasound	80	**0.5**	0.25	0,5	0.0091	0	0	0	0		0	0		0	0.25	0.5	0.0114	0	0	0	0	0	0	0	0	0	0.50	
treatment planning brachy					0			0			0			0			0			0			0			0		
manual calculation	0	**0.75**	0		0	0.188	0.25	0	0		0	0.56	0.75	0 mm	0		0	0	0	0	0	0	0	0	0	0	0.75	
2D+ (films)	20	**2**	0		0	0.5	0.25	0.0045 mm	0		0	1.5	0.75	0.0182	0		0	0	0	0	0	0	0	0	0	0	2.00	
3D	120	**3**	0		0	0.75	0.25	0.0409	0		0	2.25	0.75	0.1636	0		0	0	0	0	0	0	0	0	0	0	3.00	
prostate pre+post plan	160	**4**	0		0	4	1	0.2909 mm	0		0	0		0	0		0	0	0	0	0	0	0	0	0	0	4.00	
Brachytherapy delivery HDR	400	**0.5**	0.5	1	0.0909 3	0.5	1	0.0909 mm	0.5	1	0.1212	0		0	0		0	0	0	0	0	0	0	0	0	0	1.50	LDR?
Applicators removal/pt. recovery	440	**1**	0.5	0.5	0.1 3	0	0	0 mm	0	0	0	0		0	1	1	0.25	0	0	0	0	0	0	0	0	0	1.50	
List of equipment (technology or areas)	***# of units, systems or complements***	**h/eq/y**																										
kV therapy	0	**400**			0	160	0.4	0 2			0			0			0	0		0	60	0.15	0	180	0.45	0	400.00	
Co-60 teletherapy	0	**400**			0	160	0.4	0 2			0			0			0	0		0	60	0.15	0	180	0.45	0	400.00	
MV single energy	0	**400**			0	160	0.4	0 2			0			0			0	0		0	60	0.15	0	180	0.45	0	400.00	
MV multiple energies/modalities	4	**1050**			0	420	0.4	0.7636 2			0			0			0	0		0	158	0.15	0.358	473	0.45	1.0739	1050.00	
Complements (MLC, EPID)	8	**250**			0	100	0.4	0.3636 2			0			0			0	0		0	37.5	0.15	0.1705	113	0.45	0.5114	250.00	
Brachytherapy HDR	1	**500**			0	200	0.4	0.0909 2			0			0			0	0		0	75	0.15	0.0426	225	0.45	0.1278	500.00	
Brachytherapy LDR	1	**500**			0	200	0.4	0.0909 2			0			0			0	0		0	75	0.15	0.0426	225	0.45	0.1278	500.00	
Fluoroscopic radiotherapy simulator	1	**300**			0	120	0.4	0.0545 2			0			0			0	0		0	45	0.15	0.0256	135	0.45	0.0767	300.00	
CT option on simulator	0	**300**			0	120	0.4	0			0			0			0	0		0	45	0.15	0	135	0.45	0	300.00	
CT-simulator	1	**300**			0	120	0.4	0.0545 2			0			0			0	0		0	45	0.15	0.0256	135	0.45	0.0767	300.00	
CT option on linear accelerator	2	**300**			0	120	0.4	0.1091			0			0			0	0		0	45	0.15	0.0511	135	0.45	0.1534	300.00	
2D TPS up to 10 workstations	0	**300**			0	210	0.7	0			0			0			0	60	0.2	0	0	0	0	30	0.1	0	300.00	
3D TPS up to 10 workstations	3	**600**			0	420	0.7	0.5727			0			0			0	120	0.2	0.2727	0	0	0	60	0.1	0.1023	600.00	
4D TPS up to 10 workstations	1	**750**			0	525	0.7	0.2386			0			0			0	150	0.2	0.1136	0	0	0	75	0.1	0.0426	750.00	
MRI, PET-CT, 4D CT Sim, SPECT-CT	1	**500**			0	200	0.4	0.0909			0			0			0	100	0.2	0.0758	50	0.1	0.0284	150	0.3	0.0852	500.00	
R&V network/Intranet	1	**750**			0	225	0.3	0.1023 2			0			0			0	450	0.6	0.3409	0		0	75	0.1	0.0426	750.00	
Absolute dosimetry equipment	5	**125**			0	106.3	0.85	0.2415 2			0			0			0	0		0	6.25	0.05	0.0178	12.5	0.1	0.0355	125.00	
Relative dosimetry equipment	1	**250**			0	212.5	0.85	0.0966 2			0			0			0	0		0	12.5	0.05	0.0071	25	0.1	0.0142	250.00	
Survey and monitoring equipment	2	**65**			0	55.25	0.85	0.0502 2			0			0			0	0		0	3.25	0.05	0.0037	6.5	0.1	0.0074	65.00	
In-vivo dosimetry	1	**250**			0	212.5	0.85	0.0966 2			0			0			0	0		0	12.5	0.05	0.0071	25	0.1	0.0142	250.00	
Automatic/manual block/comp cutter	1	**200**			0	170	0.85	0.0273 2			0			0			0	0		0	10	0.05	0.0057	20	0.1	0.0114	200.00	
Workshop (patient accessories, devices, etc)	1	**125**			0	50	0.4	0.0227			0			0			0	0		0	56.3	0.45	0.032	18.8	0.15	0.0107	125.00	
SRT/SRS systems	1	**500**			0	350	0.7	0.1591 2			0			0			0	100	0.2	0.0758	50	0.1	0.0284	0	0	0	500.00	
IORT equipment (appl., cones)	0	**500**			0	350	0.7	0 2			0			0			0	100	0.2	0	50	0.1	0	0	0	0	500.00	
List of specific complex techniques	***Number of procedures***	**h/task**																										
SRS	30	**7**	0		0	5.95	0.85	0.0811 mm	0		0	0		0	0		0			0			0			0	5.95	
TBI	25	**3**	3	1	0.0341	9	1	0.1023	6	2	0.0909	0		0	0		0			0			0			0	18.00	
TSET	10	**30**	3	0.1	0.0136	9	0.3	0.0409 mm	60	2	0.3636	0		0	0		0			0			0			0	72.00	
IORT	0	**6**	3	0,5	0	4.2	0.7	0	1.2	0.2	0	0		0	0		0			0			0			0	8.40	
FTE					3.0			6.2			12.8			2.7			0.7			0.9			0.8			2.5	9804.1	
Total time/staff type			6625			13743			21126			4452			1280			1160			1489			4424				
Non-clinical factors (other)	***Percentage of time dedicated***																											
			h/1 FTE			h/1 FTE			h/1 FTE			h/1 FTE			h/1 FTE			h/1 FTE			h/1 FTE			h/1 FTE			total hs/1 FTE	
Research and development work	7%		154	1	0.07 3	154	1	0.07	23	0.2	0.014	116	1	0.07	0		0	0		0	0		0	0		0	446.60	
Follow-up evaluations	30%		660	1	0.3 yl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	528	0	0	1188.00	
Peer review meetings	15%		330	1	0.15 3	165	0.5	0.075	0	0	0	124	0.5	0.075	0		0	0		0	0		0	264		0	882.75	
Administration-management (incl. internal audit	10%		220	1	0.1 3	594	2.7	0.27 IVD	165	1	0.1 IVD	165	1	0.1	88	0.5	0.05	0		0	0		0	176		0	1408.00	
Continuing education	4%		88	1	0.04 ?	88	1	0.04	66	1	0.04 0	66	1	0.04	35	0.5	0.02	0		0	0		0	70		0	413.60	
Radiation Safety and QA Committee meetings	3%		66	1	0.03	66	1	0.03	50	1	0.03	50	1	0.03	53	1	0.03	0		0	0		0	53		0	336.60	
Radiation Safety Training	3%		66	1	0.03	66	1	0.03	50	1	0.03	50	1	0.03	53	1	0.03	0		0	0		0	53		0	336.60	
Other	0%		0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0.00	
%/ 1 FTE					0.72			0.515			0.214			0.345			0.13			0			0			0		
					RO			***MP***			***RT***			***TP***			***RON***			***IT***			***EM***			***EE***		
Total FTE					***5.2***			***9.5***			***15.5***			***3.6***			***0.8***			***0.9***			***0.8***			***2.5***		

~~Factor to change time over/under 40 hours per v INPUT BY USER~~

Other notes arising from the session in 1/4/2011 DMRP/ARBR:

IAEA – Vienna, Austria

- Summary
- The models and data sets are currently undergoing revision and final review
- The IAEA spreadsheet model is highly complex and comprehensive, but difficult to implement
- There is some concern the final model will be dominated by staffing levels in developed countries and not reflect the dominate worldwide reality of practices
- Publication date is anticipated later this year (2012)

AAMD Workforce Study

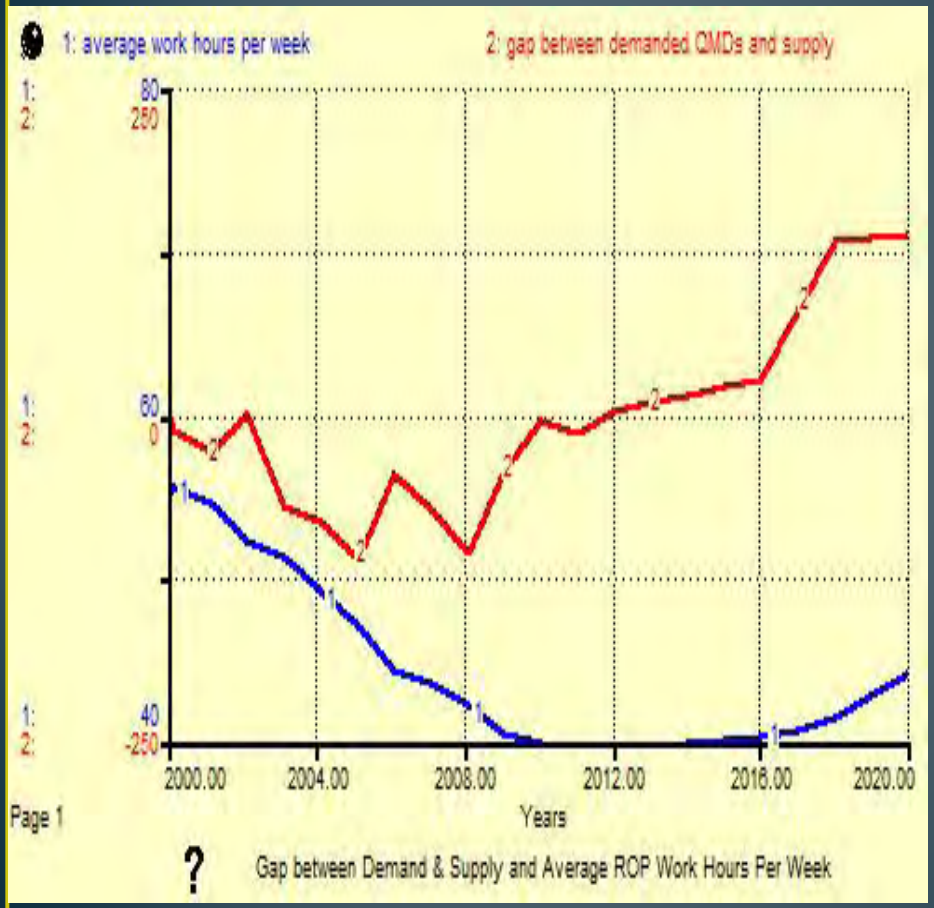
- The AAMD Workforce Study Consists of Five Components:
  - Membership Survey (Similar to that conducted by The Center for Health Workforce Studies, School of Public Health, University at Albany
  - Workforce Survey (Similar to the Abt III 2008 Report)
  - Supply and Demand Study (Similar to Future trends in the supply and demand for radiation oncology physicists, Michael D. Mills, Judah Thornewill, and Robert Esterhay, JACMP (11) 2, 2010.)
  - Complexity Survey (conducted of professional colleagues of medical dosimetrists)
  - Interviews (conducted with selected representatives of the medical dosimetry community)

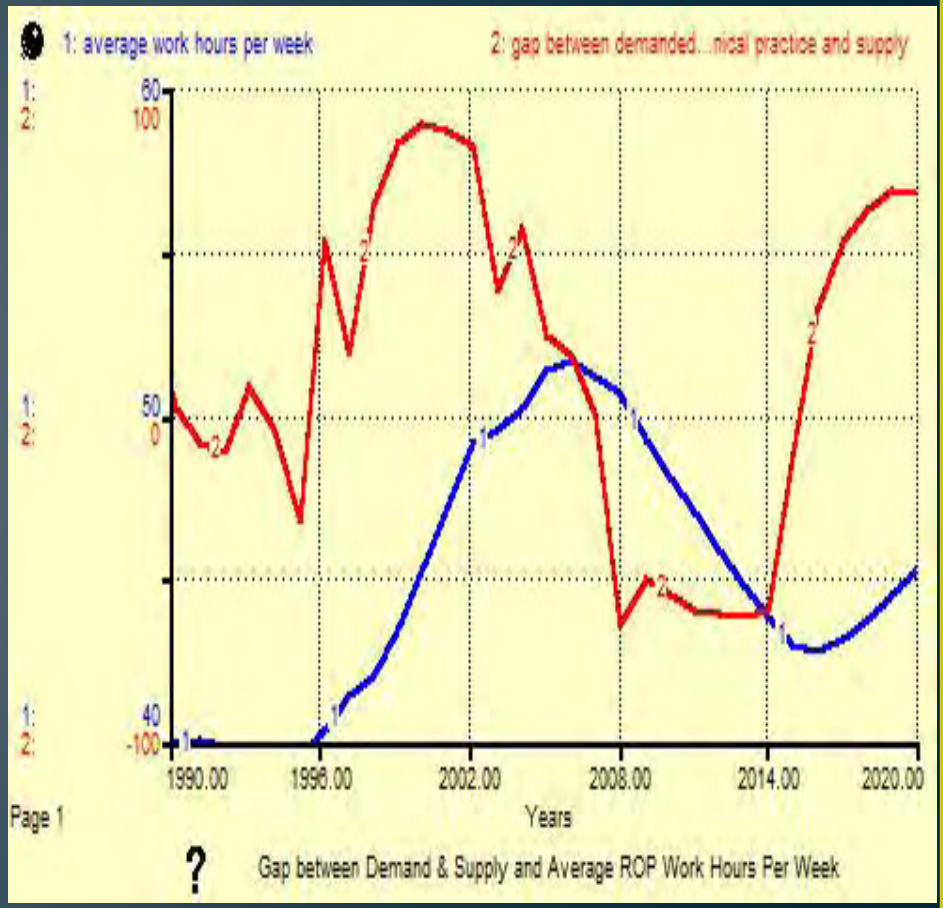
Patient Caseload Description / FTE Staff Employed	Minimum	Q1	Median	Q3	Maximum	Mean	N
Patient caseload of institution for the most recent year for which data were available							
Number of new patients (teletherapy and brachytherapy) treated	112	298	452	720	6648	744	21
Number of total patients (teletherapy and brachytherapy) treated at institution	182	337	563	899	7165	1063	21
Percentage of total patients treated on most heavily utilized teletherapy unit	33%	55%	82%	98%	100%	75%	22
Number of total patients (teletherapy and brachytherapy) per QMD	91	198	245	326	563	261.8	19
Patient treatment fractions							
Number of patient treatments done on most heavily utilized teletherapy unit	250	1,061	5,678	6,862	93,995	8,662	21
Number of teletherapy patient treatments at institution	345	2,427	10,157	15,034	143,615	16,140	21

Number of FTE staff employed by institution:	Minimum	Q1	Median	Q3	Maximum	Mean	N
Medical dosimetrists	1.00	1.00	2.00	3.00	50.00	4.28	23
Medical physicists	0.00	1.00	1.40	2.00	70.00	4.78	23
Physics assistants	0.00	0.00	0.00	1.00	11.00	0.88	23
Radiation oncologists	1.00	1.00	2.00	3.00	60.00	4.62	23
Brachytherapy technologists	0.00	0.00	0.00	0.00	4.00	0.18	23
Mechanical engineers	0.00	0.00	0.00	1.00	6.00	0.72	23
Radiation therapists	3.00	5.00	6.00	9.00	99.00	10.64	23
Radiation oncology nurses	0.00	1.50	2.00	3.00	30.00	3.43	23

CPT Code	Procedure Description	2007 Abt Survey Median QMP Total	2011 Dosimetry Survey Median QMD
77295	Therapeutic radiology simulation – (3 – D)	135.7	305.0
77300	Basic dosimetry calculation	563.2	1092.0
77301	IMRT treatment planning	276.3	312.0
77305	Simple isodose plan	6.2	2.0
77310	Intermediate isodose plan	2.3	1.3
77315	Complex isodose plan	100.9	111.0
77321	Special teletherapy port plan	24.6	19.8
77326	Simple brachytherapy isodose plan	2.5	0.0
77327	Intermediate brachytherapy isodose plan	2.7	0.0
77328	Complex brachytherapy isodose plan	66.9	7.0
77331	Special dosimetry	37.1	3.8
77332	Simple treatment device	3.1	9.0
77333	Intermediate treatment device	1.4	1.5
77334	Complex treatment device	194.4	612.8
77336	Continuing medical physics consultation	1024.0	365.0

Supply and Demand, QMD versus QMP





QMDs and QMPs – some thoughts

- Comparing the service mix and the work hours of the median QMD and QMP, there is almost an exact overlap of both services and work hours by code
- Staffing of the QMD and QMP also match closely in the Abt study, the Battista study, the IAEA study and the ACR/ASTRO Radiation Oncology Accreditation Program Requirements Guide.
- Supply and demand curves are different for QMDs and QMPs. However, both show that as additional qualifications to take the professional boards are emerging and as the baby boom generation retires, there are anticipated shortages in the supply of both professions toward the end of the decade.

Diagnostic Workforce Study

- Designed by Michael Mills and Ed Nickoloff
- Created October 12, 2011
- Survey opened on November 8 2012
- Closed survey on February 27, 2012 with 460 responses
- Purpose was to measure medical physicist staffing and workload by type of equipment
- Purpose was also to assign a medical physicist cost per patient procedure for each type of equipment

Diagnostic Workforce - Analysis

- All calculations are performed for each individual medical physicist
  - Identify the medical physicist by specialty (% diagnostic, nuclear medicine, radiation oncology, and health physics)
  - Identify the medical physicist by vocation (% clinical, research, administration, teaching, other responsibilities)
  - Survey and report median equipment costs: detectors, phantoms, calibrations
  - Determine a median annual equipment cost
  - Determine an equipment mix annual equipment cost for each medical physicist
  - Survey and report the equipment mix profile – types and numbers for each medical physicist
  - Survey and report the average number of procedures for the equipment serviced

Diagnostic Workforce – Analysis (cont.)

- Report the initial commissioning hours by equipment type
- Report the annual support hours by equipment type
- Calculate annual equipment and labor costs to service each equipment type
- Calculate the median medical physicist equipment and labor costs by equipment type
- Calculate the median service profile for a medical physicist supporting imaging equipment
- Calculate the median cost per patient procedure by equipment type consequent to medical physicist services
- Calculate a staffing model by equipment profile based on the equipment mix and productivity of the median medical physicist

A single unit/system/program is what fraction of an FTE?		
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

What is the cost of providing physics services for patient imaging procedures?			
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

Diagnostic Workforce Summary

- We expected to see larger differences between physicists working in academic centers and those serving community hospitals
- Most medical physicists providing imaging and nuclear medicine services are about 50% clinical
- Other duties are administration, teaching and research
- There are a few (about 10% of the total reporting) highly productive full time consulting medical physicists who are 100 percent clinical and demonstrate about twice the median productivity
- These individuals do not impact the median numbers reported

Other Proposed Workforce Studies

- Academic Workforce Study
  - While much effort has been devoted to examining how clinical medical physicists spend their time and to supply and demand issues, the academic community has not been studied
  - The research community is dependent on the availability of funding from both the government and commercial sources
  - Little information exists respecting the historic available of funding nor of the numbers of full-time research positions
- Proton Facility Workforce Study

Implications of workforce assessment for residency programs

- **Why is radiation oncology profitable?**
  - The profitability of radiation oncology is largely based off of one, single procedure – the Medicare IMRT code 77418
  - In 2003, one fraction of IMRT was judged to equal 1/7th the reimbursement of a liver transplant and 1/3rd of that of an aortic valve replacement
  - One IMRT fraction was placed on par with a rib removal or bunion surgery
  - The beauty of IMRT is that while most people have only a finite number of livers, aortic valves, ribs, and bunions, each cancer patient treated with IMRT typically gets 30-40 treatments
  - So a course of IMRT cancer therapy costs the system as much as transplanting 5 livers, and removing 30 bunions
  - CMS made an attempt to cut IMRT by ~ 38% in 2009 as a result of a review of broader imaging codes – ASTRO and other groups stopped the cuts
  - This year, 2012, CMS is proposing to cut IMRT reimbursement to physician owned freestanding centers by ~ 40%

MS Medical Physicists accepted to CAMPEP Residency Programs

- Accepted:
  - **********
- Not Accepted
  - **********
    ****
    ****
    ****
    ****
    ****
    ****

PhD Medical Physicists accepted to CAMPEP Residency Programs

- Accepted
- **********
  ****
  ****
- Not Accepted
- **********
  ****

Summary and Conclusions

- Multiple therapy physics workforce studies exist from US, Canadian and International sources.
- There is general agreement that one medical should be responsible for about 250 patients annually for a typical treatment facility.
- The ASTRO and Canadian models give accurate and consistent measures of staffing for those centers that provide large numbers of special procedures.
- Large numbers of medical physicists have been entering the certification process in advance of the 2014 CAMPEP residency completion requirement deadline.

Summary and Conclusions

- Radiation oncology is not profitable because of physics procedures – these do well to break even
- Radiation oncology profits depend almost entirely on 77418 – IMRT treatment delivery; this code is under attack
- If radiation oncology fails to remain profitable, all the supply and demand models and all the workforce assessments may be meaningless because no one will want to provide the services
- It is not ethical for highly successful MS students to be denied the opportunity to take the ABR Certification examinations because we mismanaged the educational process
- We must make residency opportunities available for our MS students now

Thank You!