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

Final Report

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1. Introduction

Medical physics is the branch of physics associated with the practice of medicine, and includes radiological physics, therapeutic radiological physics, diagnostic imaging physics, nuclear medicine physics, and medical health physics. Qualified medical physicists (QMPs) are the professionals responsible for maintaining the equipment used to provide medical physics services and work closely with the treating physician to plan each patient's course of treatment. QMPs are responsible for assuring patients receive the prescribed quantity, quality, and placement of radiation based on the physician's clinical evaluation.[1]

The American Medical Association's *Current Procedure Terminology: CPT 2003* includes a radiation oncology section. Within radiation oncology is a set of codes entitled "Medical Radiation Physics, Treatment Devices, and Special Services" (the 77300 series) constituting the services normally provided by QMPs. It is these 77300 series codes, along with one other code, 77295 ("Therapeutic Radiology Simulation-Aided Field Setting, Three-Dimensional") that were considered by this study. Currently, the Centers for Medicare and Medicaid Services (CMS) splits payments for these services into a technical component (TC) received by the employer of the QMP and a professional component (PC) that is paid to the physician or the physician's employer.

In 1995, the American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM) engaged Abt Associates Inc. to conduct a study that measured QMP work for medical physics services and to develop a relative work value scale depicting the relative amount of QMP work required for each medical physics service.[2] Recognizing that the many changes in medical physics practice and technology during the last six years may have affected QMP work relative values, the ACMP and AAPM have engaged Abt Associates Inc. once more to update the earlier study (Abt Associates Inc., 1995).

To maintain consistency, the current study adopted exactly the same methodology and techniques used before. Abt's approach included the following:

- Measuring the work *actually* performed by QMPs – QMP functions include, but are not limited to the following: (1) designing treatment plans conforming to physician specifications identified during patients' clinical evaluations; (2) calculating the amount of radiation being released by a treatment unit; (3) verifying treatment units' proper and safe functioning; and (4) installing and managing the treatment planning computer programs used in formulating the treatment approach. The ACMPs QMP definition was also used and is presented in **Appendix I**;
- Accounting for support staff work – certain institutions provide support staff (e.g., medical dosimetrists, physics assistants, medical physics residents, physics technologists, etc.) that assist QMPs. CMS considers support staff work to be a practice expense that

[1] *American College of Medical Physics: Scope of Practice of Medical Physics*, February, 2002.

[2] Abt Associates Inc., *The Abt Study for Medical Physicist Work Values for Radiation Oncology Physics Services*, prepared for the American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM), October 3, 1995 (referred to in this report as Abt Associates Inc., 1995). This study did not include CPT code 77295.

should be excluded when measuring QMP work. In this study, support staff work was carefully measured and then excluded before QMP relative work values were determined; and

- Applying the standard model of work – CMS defines a service's work to be a combination of the professional's time used to provide the service and the intensity of the service (intensity combines mental effort and judgment, technical skill and physical effort, and any psychological stress associated with providing the service). This study measured both a service's time and intensity through a three-phase methodology. In Phase One, a Technical Consulting Panel (TCP) of four QMPs assisted in developing a survey instrument that captures all the data required to calculate QMP work relative values. In Phase Two, this survey was mailed to 100 QMPs. The results of the survey were then analyzed to produce preliminary work estimates for each medical physics service. Finally, in Phase Three, a panel of eight QMPs reviewed and validated the preliminary work estimates.

This report describes the Abt study's (2003) methodology and results. **Section Two** provides a step-by-step explanation of the approach used to calculate medical physics services' QMP relative work values**. Section Three** presents Abt's findings, while **Section Four** concludes this report with an overview of the study's design and results. Additional information and detailed findings are presented in the bibliography and appendices to the report.

2. Methodology

This section discusses Abt's methodology for measuring QMP relative work values for radiation oncology physics services. **Table 1** provides a project overview and lists the specific tasks conducted during each of the project's three phases:

- Consulting with a four member Technical Consulting Panel (TCP) of QMPs to refine the survey design;[3]
- Surveying 100 QMPs and using the survey results to develop a preliminary set of QMP relative work values for medical physics services; and
- Convening a second eight member QMP TCP to assess the survey data's reasonableness and to validate the preliminary QMP relative work value estimates.

Previous research that estimated professional work values determined that interacting with a TCP and validating survey results provided superior results to studies that only collected and analyzed survey data.[4]

Table 1
Abt Methodology for Evaluating Radiation Oncology Physics Services' QMP Work

Phase	Specific Tasks Involved in Phase
I. Preliminary Panel	• Established time periods defining medical physicist work • Selected appropriate benchmark procedure • Developed survey codes' vignettes • Refined survey instrument

II. Survey of Qualified Medical Physicists	• Collected relevant data necessary to produce QMP work estimates including:
	  • Time estimates (non-procedural and procedural) associated with providing medical physics services
	  • Intensity estimates for each service relative to the baseline service
	  • Service-mix data (annual number of services provided by service) and staffing pattern data for institution where QMP provides most of his/her services
	• Analyzed survey data to develop preliminary QMP work estimates for each medical physics service

III. Second Panel	• Performed rigorous review of preliminary QMP work estimates • Examined the intensity, non-procedural, and procedural survey time data

[3] The survey's design used the previous study's (Abt Associates Inc., 1995) survey as a model, refining it where needed (e.g., including code 77295, updating its treatment of new technologies, etc.).

[4] James Kahan, Sally Morton, Gerald Kominski et al., *Issues in Developing a Resource-Based Relative Value Scale for Physician Work,* Report R-4130-HCFA, 1992.

The Professional Work Model and its Application to QMP Work

For the Medicare program, CMS currently reimburses medical providers using a resource-based, relative value scale (RBRVS) fee schedule that consists of three components – work, practice expense, and malpractice. The work component accounts for a provider's time and professional skills, practice expense for the costs incurred in maintaining a medical practice (e.g., administrative and clinical support staff, office rent, equipment, ancillaries, etc.), and malpractice for the costs of maintaining professional malpractice insurance coverage.

In turn, the component of interest to this study, professional work, is defined as encompassing the following four dimensions: (1) the professional time needed to perform a service; (2) mental effort and judgment; (3) technical skill and physical effort; and (4) psychological stress associated with the risks of complications and iatrogenic harm. The latter three components are commonly referred to as a service's "complexity," or more commonly, its' "intensity." Therefore, work consists of professional time and intensity. The American Medical Association Relative Value Update Committee (AMA/RUC) continues to define professional work as the product of a professional's time and intensity. These same concepts were applied to the 17 medical physics services analyzed in this study (see **Table 2**).

This study divided QMP work into two parts – *non-procedural* and *procedural time periods*. This represented a departure from common practice, where professional time is divided into three phases: (1) pre-service – time spent with the patient before the service; (2) intra-service – time spent with the patient during the service; and (3) post-service – time spent with the patient after the service. For medical physics services, non-procedural time is devoted to the general maintenance of radiation therapy equipment and treatment units, and is shared across medical physics services with the exception of consultation-only services (77336, 77370, and 773xx). Procedural time is the time a QMP spends with a patient during treatment; there is not post-service time because work is completed once the medical physics service's dose or treatment plan has been confirmed. The division of QMP time into non-procedural and procedural time periods was used in the previous study (Abt Associates Inc., 1995), and this project's initial TCP confirmed this decision.

As noted above, professional work combines both professional time and intensity for each service. Intensity is the physical and emotional pressure borne by the professional rendering a service. In turn, intensity comprises the mental effort, technical skill, and psychological stress associated with a given service. When surveying professionals to update work values, the AMA/RUC asks respondents to rate each intensity component separately. In practice, mental effort, technical skill, and psychological stress are so interwoven that asking a professional to supply separate estimates for each is often confusing and results in a false sense of precision. In the previous study (Abt Associates Inc., 1995), QMP survey respondents were asked to provide a single, comprehensive intensity estimate for each medical physics service.

The QMP survey respondents were then directed to use "magnitude estimation" to develop their medical physics service's intensity estimates. Magnitude estimation starts by designating a service that is commonly provided, performed in a consistent manner, and has a mid-range level of service as a "benchmark service." In the previous study, CPT Code 77336 (Continuing Medical Physics Consultation) was selected by the first TCP as the benchmark service, and for consistency, the current survey also used 77336 as the benchmark service. The benchmark service was then assigned an

intensity level of 1.00. Respondents were asked to compare the intensity of all other medical physics services relative to the benchmark service. For example, if a respondent believed service X has twice the intensity of 77336, that respondent was asked to record "2.00" as his or her measure of code X's intensity.

Table 2: Radiation Oncology Physics Codes Studied in the Abt Survey

CPT Code	Description
* **77295 (new)**	Three-dimensional therapeutic simulation-aided field testing
77300	Basic radiation dosimetry calculation, central axis depth dose calculation, TDF, NSD, gap calculation, off axis factor, tissue inhomogeneity factors, calculation of non-ionizing radiation surface and depth dose, as required during course of treatment, only when prescribed by the treating physician
* **77301 (new)**	Intensity modulated radiotherapy plan, include dose volume histograms for target and critical structure partial tolerance specifications
77305	Teletherapy, isodose plan (whether hand or computer calculated); simple (one or two parallel opposed unmodified ports directed to a single area of interest)
77310	Teletherapy, isodose plan (whether hand or computer calculated); intermediate (three or more treatment ports directed to a single area of interest)
77315	Teletherapy, isodose plan (whether hand or computer calculated); complex (mantle or inverted Y, tangential ports, the use of wedges, compensators, complex blocking, rotational beam, or special beam consideration)
77321	Special teletherapy port plan, particles, hemibody, total body
77326	Brachytherapy isodose calculation; simple (calculation made from a single plane, one to four sources/ribbon application, remote afterloading brachytherapy, 1 to 8 sources)
77327	Brachytherapy isodose calculation; intermediate (multiplane dosage calculations, application involving 5 to 10 sources/ribbons, remote afterloading brachytherapy, 9 to 12 sources)
77328	Brachytherapy isodose calculation; complex (multiplane isodose plan, volume implant calculations, over 10 sources/ribbons, remote afterloading brachytherapy, over 12 sources)
77331	Special dosimetry (e.g., TLD, microdosimetry) (specify), only when prescribed by the treating physician
77332	Treatment devices, design and construction; simple (simple block, simple bolus)
77333	Treatment devices, design and construction; intermediate (multiple blocks, stents, bite blocks, special bolus)
77334	Treatment devices, design and construction; complex (irregular blocks, special shields, compensators, wedges, molds, or casts)
77336	Continuing medical physics consultation, including assessment of treatment parameters, quality assurance of dose delivery, and review of patient treatment documentation in support of the radiation oncologist, reported per week of therapy
77370	Special medical radiation physics consultation
* **773xx (new)**	Intensity modulated radiotherapy plan special physics consultation (under consideration)

With the QMP time and relative intensity estimates in hand, the following equation was used to calculate work for each medical physics service:

QMP Work (W) = Time (T) * Intensity (I)

Where:

- Time was equal to the sum of QMP non-procedural and procedural time for the service; and
- Intensity was the single magnitude estimate for the service encompassing mental effort and judgment, technical skill and physical effort, and the psychological stress associated with the service.

Preliminary Panel

In the previous study (Abt Associates Inc., 1995), a four member QMP Technical Consulting Panel (TCP) was convened at the start of the project to conduct the following tasks:

- Provide input into the survey design – the TCP determined that QMP time consisted of non-procedural and procedural time, as opposed to the pre-, intra-, and post- service periods typically used to define professional time. The TCP also enumerated all activities typically performed by QMPs providing medical physics services. The survey instrument was then modified to incorporate the non-procedural/procedural time division and to include the list of QMP activities provided during medical physics services;
- Selecting a benchmark service – the TCP designated CPT Code 77336 (Continuing Medical Physics Consultation) as the benchmark service for measuring each medical physics services' relative intensity; and
- Defining service vignettes – for each medical physics service included in the survey, the TCP was asked to develop a vignette that reflects the "typical" patient receiving that service. When conducting its RUC survey, the AMA Relative Value Update Committee asked participating medical societies to write vignettes for each code under review within their specialty so that intensity could be measured for a "typical" occurrence of each service. The first project's TCP created vignettes for each medical physics service using a uniform format – the patient's age, gender, diagnosis (i.e., site and extent of the disease), existing comorbidities or previous therapy, specific treatment details (i.e., radiation dose and treatment modality), and particular responsibilities for the QMP.

For the current study, a similar four member QMP TCP was again convened. This time, however, the TCP was asked to review and comment on the existing survey instrument, choice of the benchmark service, and vignettes for each medical physics service. The survey instrument and vignettes were then updated to reflect the TCP's comments and suggestions. In addition, vignettes were developed for three new codes – 77295, 77301, and the code under consideration, 773xx. The revised medical physics service vignettes used during the current study are presented in **Appendix IV**.

Survey of Radiation Oncology Physics Codes

Two competing goals needed to be balanced in the current survey. On the one hand, it was important to maintain a survey design consistent with the earlier study (Abt Associates Inc., 1995) to allow results from each survey to be compared and contrasted. On the other hand, the practice of medical physics continues to evolve, and the current survey needed to be updated to reflect recent changes in technology and practice. Below, the survey sample is first described, followed by a description of the survey instrument with special attention being paid to any changes from the earlier survey, and then the surveying process itself is described.

Survey Sample

As in the previous survey, a sample of 100 QMPs was selected from among ACMP and AAPM members. The sample was carefully chosen to reflect the full range of where medical physicists practice (geographic regions) and how their practices are organized (practice settings). Data from the 2000 AAPM Professional Information Survey were used to determine the percentage of QMPs with the following characteristics:

- Geographic regions – the distribution of practicing QMPs by the nine Census Division Regions (New England, Mid Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain, and Pacific); and
- Practice settings – medical school/university hospital, medical physics consulting groups, private/community hospitals, and medical (physician) groups.[5]

Two important caveats are worthy of mention. First, several practice settings – government (non-hospital), college or university, and industrial/commercial firm were not included in the survey sample because it was thought QMPs working in these environments were not involved in the day-to-day practice of providing radiation oncology physics services to typical patients. Second, the survey sample is a purposive, not a random, sample. QMPs included in the survey sample were carefully chosen after screening to determine whether they would agree to participate in the survey. While a purposive, non-random sample may be criticized for being unrepresentative, there were greater concerns that a random sample would result in a low response rate and suffer from non-response bias. In addition, by choosing the sample to reflect variations in geographic region and practice settings, weaknesses due to a non-random design were mitigated.

The Survey Instrument

As mentioned above, the survey instrument for the current study replicated the structure and content of the previous (Abt Associates Inc., 1995) survey as much as possible. A copy of the current survey instrument is presented in **Appendix V**. The current survey is composed of the same six sections as the previous survey:

1. General instructions – general instructions for completing the survey and descriptions of key terms (e.g., work, time, intensity, non-procedural and procedural time, magnitude estimation, service vignettes, etc.) are presented;
2. Non-procedural time questions – medical physics services included in the survey were grouped into categories, and non-procedural activities for each category were then described, followed by questions asking respondents to record the amount of non-procedural time spent on various maintenance activities for each group of medical physics services;
3. Procedural time questions – responding QMPs were asked to record their own and their support staff's time spent on procedural activities. Support staff time data were collected to assure that only QMP non-procedural time was included in QMP time estimates;

[5] The 2000 AAPM Professional Information Survey also includes practices based at government hospitals. Given the low number of government hospital-based QMP practices, no such practices were included in the sample of 100 QMP practices selected for this survey.

4. Relative Intensity Estimates – magnitude estimation and the benchmark service (77336) were explained once more before responding QMPs were asked to provide intensity estimates for each service relative to the benchmark service;
5. Utilization data – questions included the annual number of services provided by type of medical physics service at the institution where the responding QMP provided most of his or her services, the total number of patients and services, and practice staffing patterns; and
6. Technology – the last section included questions regarding whether the responding QMPs' institutions offered particular new services or operated new equipment.

Further details on each of the survey instruments' six sections are provided below.

Section One is the General Instructions Section and presents the study's purpose and methodology. When discussing the survey's methodology, key terms, including work, time, intensity, non-procedural and procedural time, and magnitude estimation were defined. In addition, the five remaining section's structures were detailed, and contact information was provided for respondents with questions regarding the survey and study.

Section Two collected non-procedural time data. The 17 medical physics services included in the study and survey were grouped into the following categories:

- Radiation field testing, dosimetry, and isodose plans (CPT codes 77295, 77300, 77301, 77305, 77310, 77315, and 77321);
- Brachytherapy (77326, 77327, and 77328);
- Special dosimetry (77331);
- Simple treatment devices (77332);
- Intermediate treatment devices (77333); and
- Complex treatment devices (77334).

These groupings were selected because each group shares the same equipment. Three services – 77336, 77370 and 773xx -- were not included in the non-procedural time section of the survey instrument, because these three services reflect consultation effort only, and thus non-procedural time is not required. Depending on the group of services, respondents were asked to provide non-procedural time spent on initial commissioning, recalibration due to catastrophic events, annual recalibration, and daily, weekly, and monthly checks.

Section Three included procedural time questions. QMPs were asked to provide the procedural time spent on the single occurrence of each medical physics service for both themselves and their staffs. QMPs were asked to record staff time to make sure staff time was not included in QMP procedural and total time estimates for each medical physics service. In addition, QMPs were asked to report procedural time based on each medical physics services' vignette.

Section Four comprised magnitude estimation of relative intensity for each medical physics service. Respondents were prompted to provide intensity estimates relative to the benchmark 77336 service and to base these estimates on the service vignettes. In addition, respondents were asked to provide estimates of the intensity per unit of time, rather than the total intensity, of each medical physics service.

Section Five included questions on each responding QMP's practice. QMPs practicing at multiple facilities provided institutional data for the one facility where they performed the highest number of their procedures. Respondents were asked to report the number of procedures by type of medical physics service, the total number of procedures and patients served, and staffing data (i.e., the number of full time equivalent (FTE) staff).

Section Six concluded the survey by asking respondents about the new technologies and services provided by their institutions.

Surveying Process

Signed letters from the chairman of the ACMP and the president of AAPM announcing the survey were mailed two weeks before the survey instrument was sent to the 100 QMPs in the survey's sample. This was followed two weeks later by a survey packet that included a cover letter (also signed by the leaders of both organizations), the survey instrument and survey instructions. Three weeks later, a reminder post card was mailed to QMPs that had not yet responded to the survey. Abt staff were available by phone for responding QMPs to ask questions about the survey materials or for clarification of specific survey questions.

Follow-up calls to QMPs that still did not respond after receiving a reminder post-card were also conducted. After the survey had been in the field for four months, QMPs that had not responded to the survey were contacted several times by either telephone and/or email by ACMP and AAPM representatives and were asked to complete the survey. Electronic versions of the survey instrument were provided as requested to allow QMP practices to respond to the survey either by mail or electronically.

Abt staff then reviewed the returned surveys for completeness and reasonableness. Responding QMPs were contacted when necessary to review responses that were unclear or unusual to confirm and correct potential errors. Abt staff then entered the resulting survey data into a survey database for the subsequent analysis.

Using Survey Data to Calculate QMP Work Values

The survey database that compiled survey responses was then analyzed. Summary statistics for all relevant data elements (e.g., non-procedural and procedural time, QMP and staff time, intensity, total work values, service mix, number of patients and patient treatment, staffing, and technologies) were then calculated. Summary statistics included minimum, maximum, mean, standard deviation, median, and inter-quartiles (25^{th} and 75^{th} percentile values).

Several relevant data elements, most notably QMP work, needed to be constructed using other survey data. As mentioned previously, QMP work equals the product of QMP time and QMP intensity. In turn, QMP time is the sum of QMP non-procedural and procedural time. QMP procedural time was reported directly for each medical physics service, but QMP non-procedural time is reported only for those services with non-procedural time (i.e., the three consultation codes 77336, 77370,and 77xxx do not have non-procedural time estimates).

In addition, non-procedural time is also reported for groups of codes – e.g., one such group includes codes 77295, 77300, 77301, 77305, 77310, 77315, and 77321. The survey also collected information on the number of services provided annually by each practice. These service volume data were used to allocate non-procedural time to each code proportionately. For example, suppose a practice reported a total of 3,000 units of service for codes 77295-77321 and that there were 1,000 hours of non-procedural time associated with this group of services. Then, each service would be allocated 1,000 hours/3,000 units = 1/3 hour per unit per service of non-procedural time. The non-procedural time estimates were then added to the service-specific procedural time estimates to yield total times for each service.[6]

The intensity estimates (relative to the benchmark) were applied to each service's total time to determine work values. Work values were first calculated at the individual practice level before summary statistics (e.g., minimum, 1st quartile, median, 3rd quartile, maximum, mean, and standard deviation) were determined. The resulting work estimates were then extensively reviewed at the second panel meeting by the TCP.

Second Panel

The second Technical Consulting Panel (TCP) convened to review the survey data and validate the physicist work estimates for the 17 radiation oncology services included in this study. After the physicist work estimates were presented, the panel then discussed the estimates and reached a general consensus on their validity and reasonableness. **Appendix VI** includes a list of the eight TCP panelists, who represented all four geographic census regions and both the ACMP and AAPM.

Panelists received summary tables that included procedural and non-procedural time and relative intensity estimates for all 17 radiation oncology services. The summary tables included minimum, 1st quartile, median, 3rd quartile, maximum and mean values for procedural and non-procedural time, intensity, and work (time*intensity). **Appendices VII, VIII, IX, and X** include the summary data the panelists received. The intention was to provide panelists with knowledge of the range of survey responses without providing any practice specific data to preserve the privacy and confidentiality of these data.

Overall, the second TCP considered that the estimates of non-procedural, QMP procedural, and staff procedural time, relative intensity, work, service volume and staffing to be quite reasonable. Panel members requested that standard deviations be calculated and displayed in the detailed tables. In addition, the second TCP also asked that one additional table providing procedural volume estimates per QMP also be prepared; this table is now included in **Appendix XI**. The panel did not request that any time, intensity, or work values be changed or modified.

[6] Some components of non-procedural time were not reported on a yearly basis – i.e., commissioning time was reported over a five year period, and daily, weekly, and monthly checks were reported per month. These values were then annualized before non-procedural time estimates were computed.

3. Results of the Abt Study

This section presents the study's survey results. Information reported here includes service-specific time, intensity, and work values, as well as survey respondent practice characteristics, staffing patterns, service mix and volume, and equipment and services offered.

Survey Response

Fifty-three (53) of the 100 QMP practices provided a survey response, yielding a response rate of 53 percent. This compares to a 70 percent response rate from the previous 1995 Abt Survey. There were no significant differences in the practice type distribution between those responding to the survey and the results from the 2000 AAPM Professional Information Survey (see **Table 3**). **Table 4A** provides the number and percentage of survey respondents by state and census division region, while **Table 4B** presents a comparison of the distribution by census division region of survey respondents and respondents to the 2000 AAPM Professional Information Survey[7]. The one significant difference was that the percentage of survey respondents from the Mid Atlantic region (7.5 percent) was lower than that determined by the 2000 AAPM Professional Information Survey (16.7 percent).

Table 3:
Responding Medical Physicist Practice Type Distribution

Practice Type	Number of Respondents	% of Total Abt Survey Sample	% of 2000 AAPM Professional Information Survey	Significant Difference (5% Level, 2-Tailed Test)
Private/Community Hospital	20	37.7%	46.0%	No
Medical School/University Hospital	24	45.3	36.1	No
Medical Physics Consulting Group	4	7.5	9.5	No
Medical (Physician) Group	4	7.5	8.4	No
Unknown	1	1.9	0.0	No

[7] The 2000 AAPM Professional Information Survey is a document published by the AAPM for the private use of its members and reflects national professional medical physics information.

Table 4A:
Survey Respondent Distribution by Census Region/Division Region and State

State	Number of Respondents	% of Respondents
Northeast	**8**	**15.1%**
New England	**4**	**7.5**
Maine	0	0.0
New Hampshire	0	0.0
Vermont	0	0.0
Massachusetts	3	5.7
Connecticut	1	1.9
Rhode Island	0	0.0
Mid Atlantic	**4**	**7.5**
New York	1	1.9
Pennsylvania	0	0
New Jersey	3	5.7
Midwest	**16**	**30.2**
East North Central	**10**	**18.9**
Ohio	3	5.7
Indiana	1	1.9
Michigan	1	1.9
Illinois	1	1.9
Wisconsin	4	7.5
West North Central	**6**	**11.3**
Minnesota	3	5.7
Iowa	0	0.0
Missouri	3	5.7
North Dakota	0	0.0
South Dakota	0	0.0
Nebraska	0	0.0
Kansas	0	0.0
Unknown	**1**	**1.9**

27 of 51 states and District of Columbia represented.
Note: Forty-four (44) of 51 states and the District of Columbia were represented in the 2000 AAPM Professional Information Survey.

State	Number of Respondents	% of Respondents
South	**20**	**37.7%**
South Atlantic	**9**	**17.0**
Delaware	0	0.0
District of Columbia	1	1.9
Maryland	1	1.9
Virginia	2	3.8
West Virginia	0	0.0
North Carolina	1	1.9
South Carolina	2	3.8
Georgia	0	0.0
Florida	2	3.8
East South Central	**4**	**7.5**
Kentucky	1	1.9
Tennessee	1	1.9
Alabama	2	3.8
Mississippi	0	0.0
West South Central	**7**	**13.2**
Arkansas	1	1.9
Louisiana	0	0.0
Oklahoma	0	0.0
Texas	6	11.3
West	**8**	**15.1**
Mountain	**3**	**5.7**
Montana	1	1.9
Wyoming	0	0.0
Colorado	0	0.0
New Mexico	0	0.0
Idaho	0	0.0
Utah	0	0.0
Arizona	2	3.8
Nevada	0	0.0
Pacific	**5**	**9.4**
Alaska	0	0.0
Washington	1	1.9
Oregon	1	1.9
California	3	5.7
Hawaii	0	0.0

Table 4B:
Comparison: Percentages of Respondents to Abt and 2000 AAPM Professional Information Survey: Region and Census Division Region

Region or Census Division Region	Abt Survey %	2000 AAPM Survey %	Significant Difference (5% Level, 2-Tailed Test)
Northeast	**15.1%**	**24.1%**	**No**
New England	7.5	7.4	No
Mid Atlantic	7.5	16.7	Yes
Midwest	**30.2**	**26.2**	**No**
East North Central	18.9	19.2	No
West North Central	11.3	7.1	No
South	**37.7**	**33.6**	**No**
South Atlantic	17.0	18.4	No
East South Central	7.5	5.2	No
West South Central	13.2	9.9	No
West	**15.1**	**16.2**	**No**
Mountain	5.7	3.5	No
Pacific	9.4	12.7	No
Unknown	**1.9**	**0.0**	**No**

Time, Intensity, and QMP Work Estimates

QMP non-procedural and procedural time estimates are provided in **Table 5 for comparison**. Median values are reported in the text because these values are not as sensitive to extreme values; additional statistics (minimum, 1st and 3rd quartiles, maximum values, means, and standard deviations) are reported in **Appendix X.** For comparison, time estimates from previous (1995) and current (2003) surveys are provided. Please note that the non-procedural QMP time estimates are identical for 77295-77321 and for 77326-77328, because these non-procedural time estimates were calculated for each of the two groups of codes.

Six of the 14 codes have differences of less than 20 percent and one had a difference of less than 10 percent.

Table 5:
Median QMP Non-Procedural, Procedural and Total Time for Surveyed Radiation Oncology Physics Services

CPT Code	Procedure Description	1995 Abt Survey			2003 Abt Survey		
		Median QMP Non-Procedural Time	Median QMP Procedural Time	Median QMP Total Time	Median QMP Non-Procedural Time	Median QMP Procedural Time	Median QMP Total Time
77295	Therapeutic radiology simulation-aided field testing	NA	NA	NA	0.15	1.00	1.16
77300	Basic dosimetry calculation	0.38	0.17	0.63	0.15	0.25	0.56
77301	IMRT treatment planning	NA	NA	NA	0.15	5.25	5.53
77305	Simple isodose plan	0.38	0.25	0.82	0.15	0.30	0.54
77310	Intermediate isodose plan	0.38	0.40	0.93	0.15	0.50	0.63
77315	Complex isodose plan	0.38	0.50	1.15	0.15	0.50	0.83
77321	Simple teletherapy port plan	0.38	0.70	1.21	0.15	0.75	1.06
77326	Simple brachytherapy isodose plan	0.83	1.00	2.13	0.38	0.75	1.20
77327	Intermediate brachytherapy isodose plan	0.83	1.00	2.45	0.38	1.00	1.90
77328	Complex brachytherapy isodose plan	0.83	3.00	3.87	0.38	2.50	3.18
77331	Special dosimetry	1.15	1.50	2.76	0.57	1.00	1.61
77332	Simple treatment device	0.01	0.10	0.11	0.02	0.10	0.17
77333	Intermediate treatment device	0.01	0.25	0.30	0.06	0.25	0.36
77334	Complex treatment device	0.04	0.25	0.34	0.02	0.25	0.30
77336	Continuing medical physics consultation	NA	1.50	1.50	NA*	1.50	1.50
77370	Special medical physics consultation	NA	4.0	4.00	NA*	5.60	5.60
773xx	IMRT special physics consultation (under consideration)	NA	NA	NA	NA*	6.00	6.00

** Non-procedural tasks associated with equipment maintenance are not applicable (NA) for consultation CPT codes (77336, 77370, and 77xxx).*

Median relative intensity estimates ranked in increasing (2003) order of intensity for both 1995 and 2003 are presented in **Table 6**. Overall, the intensity estimates from the two surveys agree quite closely – seven of the 14 codes that can be compared had identical intensity estimates, and differences of 10 percent or less occurred for 11 of the 14 codes. In 2003, intensity (relative to 77336 = 1.00) ranged from 0.70 for 77332 (simple treatment device) to 5.00 for 773xx (IMRT special physics consultation.

Table 6:
Median Relative Intensity Estimates for Surveyed Radiation Oncology Physics Services
(Ranked in Increasing Order of Intensity (2003))

CPT Code	Procedure Description	Median QMP Relative Intensity: 1995	Median QMP Relative Intensity: 2003
77332	**Simple treatment device**	0.50	0.70
77336*	**Continuing medical physics consultation**	1.00	1.00
77300	**Basic dosimetry calculation**	0.50	1.00
77305	**Simple isodose plan**	1.00	1.00
77333	**Intermediate treatment device**	1.00	1.00
77310	**Intermediate isodose plan**	1.30	1.20
77334	**Complex treatment device**	1.23	1.20
77315	**Complex isodose plan**	1.55	1.50
77321	**Simple teletherapy port plan**	1.50	1.50
77326	**Simple brachytherapy isodose plan**	1.50	1.50
77327	**Intermediate brachytherapy isodose plan**	1.95	2.00
77331	**Special dosimetry**	2.00	2.00
77295	**Therapeutic radiology simulation-aided field testing**	NA	2.50
77328	**Complex brachytherapy isodose plan**	3.00	3.00
77370	**Special medical physics consultation**	3.10	3.87
77301	**IMRT treatment planning**	NA	4.50
773xx	**IMRT special physics consultation (under consideration)**	NA	5.00

**** CPT code 77336 was selected as the benchmark service for the survey; therefore it was assigned an intensity of 1.00. The intensities of all other services were rated relative to it.***

Table 7 displays median work estimates by code for 1995 and 2003, including estimates where median work for the reference code (77336) has been normalized to 1.00. Because the median work estimate before normalization for 77336 is the same (1.50) in both 1995 and 2003, any resulting relative comparisons between the two years are unaffected. There were some differences -- for example, the normalized relative work estimate for 77310 declined from 0.82 to 0.48 (41 percent) and increased from 0.04 to 0.07 (75 percent) for 77332. Five of the 14 codes had differences of 20 percent or less.

Table 7:
QMP Work Estimates for Surveyed Radiation Oncology Services

CPT Code	Procedure Description	1995		2003	
		Median Survey Work Estimate	Work Estimate Rescaled to Benchmark	Median Survey Work Estimate	Work Estimate Rescaled to Benchmark
77295	Therapeutic radiology simulation-aided field testing	NA	NA	3.21	2.14
77300	Basic dosimetry calculation	0.33	0.22	0.29	0.19
77301	IMRT treatment planning	NA	NA	18.64	12.43
77305	Simple isodose plan	0.75	0.50	0.54	0.36
77310	Intermediate isodose plan	1.24	0.82	0.72	0.48
77315	Complex isodose plan	1.69	1.13	1.30	0.87
77321	Simple teletherapy port plan	1.81	1.21	1.52	1.02
77326	Simple brachytherapy isodose plan	3.18	2.12	1.87	1.25
77327	Intermediate brachytherapy isodose plan	4.73	3.16	3.53	2.35
77328	Complex brachytherapy isodose plan	11.67	7.78	8.67	5.78
77331	Special dosimetry	4.35	2.90	3.60	2.40
77332	Simple treatment device	0.06	0.04	0.11	0.07
77333	Intermediate treatment device	0.31	0.21	0.42	0.28
77334	Complex treatment device	0.39	0.26	0.40	0.27
77336	Continuing medical physics consultation	1.50	1.00	1.50	1.00
77370	Special medical physics consultation	15.00	10.00	20.92	13.95
773xx	IMRT special physics consultation (under consideration)	NA	NA	24.50	16.33

One potential concern is the possibility of biasing the results due to the under or over-representation of practices in the sample from individual census division regions (for example, the under-representation of the Mid Atlantic region -- see **Table 4B** above). To test for the impact of this under-representation on this study's results, the median work value calculations were re-estimated to incorporate weights based on the distribution of practices by Census Division Region from the 2000 AAPM Professional Information Survey. Normalized median unweighted and weighted work values are presented below in **Table 8**; please note that the median work value for reference code (77336) before normalization had the same value (1.50) for both the weighted and unweighted estimates.

Sixteen (16) of the 17 codes had differences of less than 20 percent and 12 had differences of less than 10 percent between the unweighted and weighted median work values. The only difference greater than 20 percent was for 77301 (32 percent). In light of the small differences between unweighted and weighted values and to allow comparisons with earlier (1995) results that were unweighted, it was decided to concentrate on unweighted results for this (2003) study.

Table 8:
Normalized Median Unweighted and Weighted Work Values (77336 Normalized to 1.00): 2003

CPT	Description	Unweighted	Weighted	(Weighted – Unweighted)/Unweighted %
77295	**Therapeutic radiology simulation-aided field testing**	2.14	2.18	2.0%
77300	**Basic dosimetry calculation**	0.19	0.20	3.2
77301	**IMRT treatment planning**	12.43	16.38	31.8
77305	**Simple isodose plan**	0.36	0.35	-0.5
77310	**Intermediate isodose plan**	0.48	0.50	4.6
77315	**Complex isodose plan**	0.87	1.01	16.2
77321	**Simulation teletherapy port plan**	1.02	1.02	0.0
77326	**Simple brachytherapy isodose plan**	1.25	1.25	0.4
77327	**Intermediate brachytherapy isodose plan**	2.35	2.47	4.9
77328	**Complex brachytherapy isodose plan**	5.78	6.21	7.5
77331	**Special dosimetry**	2.40	2.68	11.6
77332	**Simple treatment device**	0.07	0.07	2.1
77333	**Intermediate treatment device**	0.28	0.33	19.3
77334	**Complex treatment device**	0.27	0.27	1.9
77336	**Continuing medical physics consultation**	1.00	1.00	0.0
77370	**Special medical physics consultation**	13.95	13.89	-0.4
773xx	**IMRT special physics consultation (under consideration**	16.33	18.67	14.3

Caseload, Staffing, and Technology

Information on patient caseloads, number of patient treatments, and staffing by practice type are provided in **Table 9**. Overall, QMP practices that are associated with medical schools and universities tend to serve more patients, provide more patient treatments, and have more staff than other QMP practices, but also have fewer patients per QMP.

Finally, information on the percentage of practices offering special procedures and advanced technologies in 1995 and 2003 are presented in **Table 10**. In general, the percentage of practices offering these special procedures and advanced technologies increased from 1995 to 2003, sometimes markedly so. For example, practices offering Remote (HDR or LDR) afterloading brachytherapy increased from 46 to 66 percent, multileaf collimator increased from 19 to 79 percent, and electronic portal imaging rose from 20 to 53 percent. Some procedures and technologies whose use was so limited in 1995 that questions about their use were not included in their survey by 2003 were used by large percentages of responding practices, including prostate seed brachytherapy (89 percent), 3-D conformal radiation therapy (non-IMRT) (92 percent), endovascular brachytherapy (74 percent) and record and verify systems (87 percent).

Table 9:
Median Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice (by Practice Type)

Patient Caseload and FTE Staff	Overall	Private/Community Hospital	Medical School/University Hospital	Medical Physics Consulting Group	Physician Group
Patient caseload of institution where QMP practices:					
Number of New Patients Treated*	923	639	1,325	425	833
Total Number of Patients Treated	1,080	816	1,500	465	1,019
Percentage of Total Patients treated on most heavily utilized teletherapy unit	48%	58%	30%	78%	44%
Number of Patients per QMP	325.3	366.7	257.5	396.0	194.2
Patient treatments:					
Number of patient treatments done on most heavily utilized teletherapy unit	7,400	6,921	7,500	6,812	7,975
Number of teletherapy patient treatments at institution	17,005	10,502	28,000	8,443	17,275
Number of FTE Staff					
Medical physicists	3.5	2.0	5.4	1.3	2.9
Radiation oncologists	4.0	2.8	7.5	1.5	4.0
Dosimetrists and/or junior physicists	2.5	1.9	4.0	1.3	2.0
Physics assistants	0.0	0.0	1.0	0.0	0.0
Brachytherapy technologists	0.0	0.0	0.0	0.0	0.0
Maintenance engineers	1.0	0.0	1.0	0.0	0.0
Radiation therapists	7.0	6.0	10.5	3.8	7.5
Radiation oncology nurses	2.8	1.6	4.5	1.3	3.0

**** Patients include teletherapy and brachytherapy patients.***

Table 10:
Special Procedures and Advanced Technologies Offered
By Institutions Where Responding QMPs Practice

Special Procedure or Advanced Technology	1995	2003
Special Procedures		
Total skin electron irradiation	31%	38%
Total body irradiation	46	57
Electron arc irradiation	11	15
Remote (HDR or LDR) afterloading brachytherapy	46	66
Stereotactic brachytherapy	21	17
Stereotactic external beam irradiation (including radiosurgery)	43	NA
Stereotactic external beam irradiation – radiosurgery (single fraction)	NA	51
Stereotactic external beam irradiation – radiotherapy (multiple fraction)	NA	43
Intraoperative radiotherapy	13	25
Prostate seed brachytherapy	NA	89
Intensity modulated radiation therapy (IMRT)	NA	57
3-D conformal radiation therapy (non-IMRT)	NA	92
3-D treatment planning	47	NA
Endovascular brachytherapy	NA	74
Independent jaw treatments	79	NA
Advanced Technologies		
Record and verify system	NA	87
Dynamic wedge	16	40
Multileaf collimator	19	79
Electronic portal imaging	20	53
Dynamic multileaf collimator (for intensity modulated radiotherapy)	NA	58

4. Conclusions

Using a methodology and survey approach similar to that employed in the earlier (1995) survey, Abt has completed a new (2003) survey of QMP time, intensity, work (time * intensity), caseload, staffing and technology for the ACMP and AAPM. The resulting survey included a purposive sample of 100 QMPs selected according to the distribution of QMP practices by Census Division Region and practice type from the 2000 AAPM Professional Information Survey.

The resulting study concluded the following:

- Response rate of 53 percent (53 of 100 surveys returned) – this was somewhat lower than the earlier (1995) survey that attained a 70 percent response rate;
- The distributions of (2003) respondents by Census Division Region and practice type was quite similar to those observed for the 2000 AAPM Professional Information Survey;
- The resulting estimates for time, intensity, and work for the 2003 Survey were similar to those determined by the earlier 1995 Survey. The new 2003 results were carefully inspected by a Technical Consulting Panel (TCP) consisting of eight QMPs, who considered these results to be highly reasonable;
- As expected, academic practices (those associated with medical schools and university hospitals) tended to treat more patients, provide more treatments, employ larger staffs, and treated fewer patients per QMP; and
- The percentage of practices using special procedures and technologies increased between 1995 and 2003, and these increases were often quite substantial. In addition, several new special procedures and technologies that either were in limited use or did not exist in 1995 were used by large majorities of responding practices by 2003.

Bibliography

Readers of this report may find that following references provide additional valuable information.

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Kahan J, Morton S, Kominski G et al., *Issues in Developing a Resource-Based Relative Value Scale for Physician Work,* Report R-4130-HCFA, 1992.

Please note that the *2000 AAPM Professional Information Survey* is not available for public distribution; thus, no reference for this document is included here.

APPENDIX I: Definition of the Qualified Medical Physicist

A Qualified Medical Physicist is an individual who is competent to practice independently one or more of the subfields of medical physics.

I. Therapeutic Radiological Physics

This particular field pertains to:

1. the therapeutic applications of x-rays, gamma rays, electron and charged particle beams, neutrons and radiations from sealed radionuclide sources
2. the equipment associated with their production, use, measurement and evaluation
3. the quality of images resulting from their production and use
4. medical health physics associated with this subfield

II. Diagnostic Radiological Physics

This particular field pertains to:

1. the diagnostic applications of x rays, gamma rays from sealed sources, ultrasonic radiation, radio frequency radiation and magnetic fields
2. the equipment associated with their production, use, measurement and evaluation
3. the quality of images resulting from their production and use
4. medical health physics associated with this subfield

III. Medical Nuclear Physics

This particular field pertains to:

1. the therapeutic and diagnostic applications of radionuclides (except those used in sealed sources for therapeutic purposes)
2. the equipment associated with their production, use, measurement and evaluation
3. the quality of images resulting form their production and use
4. medical health physics associated with this subfield

IV. Medical Health Physics

This particular field pertains to:

1. (1) the safe use of x rays, gamma rays, electron and other charged particle beams of neutrons or radionuclides and of radiation from sealed radionuclide sources for both diagnostic and therapeutic purposes, except with regard to the application of radiation to patients for diagnostic or therapeutic purposes
2. (2) the instrumentation required to perform appropriate radiation surveys

THE QUALIFIED MEDICAL PHYSICIST (Continued)

It is expected that an individual will not hold himself/herself out to be qualified in a subfield for which he/she has not established competency. An individual will be considered competent to practice one or more of the subfields of Medical Physics if that individual is certified in that subfield by any one of the following:

1. The American Board of Radiology
2. The American Board of Medical Physics
3. The American Board of Health Physics
4. The American Board of Science in Nuclear Medicine
5. The Canadian College of Physics in Medicine

The American Association of Physicists in Medicine regards board certification in the appropriate medical subfield and continuing education as the appropriate qualification for the designation of Qualified Medical Physicist.

In addition to the above qualifications, a Qualified Medical Physicist shall meet and uphold the "Guidelines for Ethical Practice for Medical Physicists" as published by the American Association of Physicists in Medicine, and satisfy state licensure where applicable.

APPENDIX II: CPT Descriptors of Medical Physics Codes

77295	Three-dimensional therapeutic simulation-aided field testing
77300	Basic radiation dosimetry calculation, central axis depth dose calculation, TDF, NSD, gap calculation, off axis factor, tissue inhomogeneity factors, calculation of non-ionizing radiation surface and depth dose, as required during course of treatment, only when prescribed by the treating physician
77301	Intensity modulated radiotherapy plan, include dose volume histograms for target and critical structure partial tolerance specifications
77305	Teletherapy, isodose plan (whether hand or computer calculated); simple (one or two parallel opposed unmodified ports directed to a single area of interest)
77310	Teletherapy, isodose plan (whether hand or computer calculated); intermediate (three or more treatment ports directed to a single area of interest)
77315	Teletherapy, isodose plan (whether hand or computer calculated); complex (mantle or inverted Y, tangential ports, the use of wedges, compensators, complex blocking, rotational beam, or special beam consideration)
77321	Special teletherapy port plan, particles, hemibody, total body
77326	Brachytherapy isodose calculation; simple (calculation made from a single plane, one to four sources/ribbon application, remote afterloading brachytherapy, 1 to 8 sources)
77327	Brachytherapy isodose calculation; intermediate (multiplane dosage calculations, application involving 5 to 10 sources/ribbons, remote afterloading brachytherapy, 9 to 12 sources)
77328	Brachytherapy isodose calculation; complex (multiplane isodose plan, volume implant calculations, over 10 sources/ribbons, remote afterloading brachytherapy, over 12 sources)
77331	Special dosimetry (e.g., TLD, microdosimetry) (specify), only when prescribed by the treating physician
77332	Treatment devices, design and construction; simple (simple block, simple bolus)
77333	Treatment devices, design and construction; intermediate (multiple blocks, stents, bite blocks, special bolus)
77334	Treatment devices, design and construction; complex (irregular blocks, special shields, compensators, wedges, molds, or casts)
77336	Continuing medical physics consultation, including assessment of treatment parameters, quality assurance of dose delivery, and review of patient treatment documentation in support of the radiation oncologist, reported per week of therapy
77370	Special medical radiation physics consultation
773xx	Intensity modulated radiotherapy plan special physics consultation (under consideration)

American Medical Association. *Current Procedure Terminology CPT 2002: Professional Edition*. AMA Press, 2001.

APPENDIX III: Members of First Technical Consulting Panel

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APPENDIX IV: Vignettes of Surveyed Medical Physics Services

CPT Code	Procedure Vignette
77295	**Therapeutic radiology simulation-aided field testing:** 63-year-old male with prostate cancer presents for 3-dimensional conformal radiation therapy involving 6 irregular and opposing fields with high energy photons. CT scans are performed throughout the pelvis, and CT planning is performed, including generation of dose volume histograms for the target and normal structures.
77300	**Basic dosimetry calculation:** 72-year-old female with metastatic disease involving T12 and L1. A single port is prescribed with intent to deliver 3000 cGy in 10 fractions at a depth of 6 cm. A central axis does calculation is performed.
77301 (not to be used until 2002)	**IMRT Treatment Planning:** A 58 year old male with adenocarcinoma of the prostate is planned with an IMRT treatment approach. Inverse planning techniques are used to deliver a minimum of 7800 cGy to the Planning Target Volume, which is the prostate plus specific margins for each interface. The oncologist contours the prostate. The critical target structures include the rectum, the bladder and the right and left femoral heads. The QMP contours the critical structures. The oncologist's prescription includes the goal dose, the percentage of the volume allowed to receive less than the goal dose, the minimum dose, and the maximum dose. Three different iterations of the plan are developed. The oncologist and the QMP review each iteration. The review includes both the dose distribution in multiple planes and the dose volume histogram. The physicist also reviews the plan for safety and feasibility considerations. After the oncologist approves the final plan, the QMP transfers the planning data from the treatment planning system to the Record and Verify System.
77305	**Simple isodose plan:** 61-year-old male with soft tissue sarcoma involving the right arm. An irregular field was designed to treat postoperative residual disease. Central axis and off-axis points were specified, with the dose of 6000 cGy in 6 weeks to be delivered from parallel opposed, equally loaded ports. Doses to 3 off-axis irregular field points are determined and reported.
77310	**Intermediate isodose plan:** 68-year-old male with squamous carcinoma in the middle third of the esophagus. Post-operative irradiation is to be delivered after a partial resection. Tumor is treated using 1 anterior port with 2 posterior obliques with no blocking required. The single plane isodose distribution must demonstrate coverage of the prescribed target volume.
77315	**Complex isodose plan:** 56-year-old female with 2 cm tumor and simple excision proving infiltrating ductal carcinoma of the right breast. Breast tangents are designed with the dose to be given from equally loaded parallel opposed ports. Isodose curves are generated using 0, 30, & 45 degree wedges.
77321	**Special teletherapy port plan:** 55-year-old female with acinic cell carcinoma of the parotid gland. Post-op radiation is designed to deliver unilateral mixed beam irradiation with 6 MV photons and electrons. 3 energies of electrons are considered: 9 MeV, 12 MeV, and 16 MeV.
77326	**Simple brachytherapy isodose plan:** 65-year-old female with carcinoma of the vagina. Since a hysterectomy has been performed, the radiation oncologist elects to do the treatment with dome cylinder colpostats. 6000 cGy surface dose is delivered in 72 hours, using 3 Cesium-137 sources.
77327	**Intermediate brachytherapy isodose plan:** 58-year-old female with carcinoma located in the vaginal fornices with an intact cervix. Irradiation is given with an intrauterine tandem and ovoid colpostats. Dose of 6600 cGy is given to involved vaginal site using 6 Cesium-137 sources for 72 hours.
77328	**Complex brachytherapy isodose plan:** 55-year-old male with squamous cell carcinoma involving the base of the tongue. Irradiation is planned using Ir-192 sources in a multiplanar or volume implant. A total of 80 sources are used in 11 ribbons. A dose of 5500 cGy is given to the volume in 72 hours.

Vignettes of Surveyed Medical Physics Services (continued)

CPT Code	Procedure Vignette
77331	**Special dosimetry:** 49-year-old male with squamous carcinoma involving the nasopharynx. External beam irradiation is planned using 6 MV photons, parallel opposed, equal weighting, at 180 cGy/fraction, total dose 6300 cGy. TLD dosimetry is requested with the dosimeters to be placed using a nasogastric (Levin) tube. The results of right and left lateral port measurements must be checked by the QMP.
77332	**Simple treatment device:** 63-year-old male with metastatic brain disease is treated with 6 MV photons with lateral fields, 200 cGy/fraction to a total dose of 3000 cGy. A tray with a single standard block is prepared.
77333	**Intermediate treatment device:** 65-year-old female with squamous cell caracinoma of the posterior pharyngeal wall. 7000 cGy is prescribed to be delivered in 7 weeks at 200 cGy/fraction using 6 MV photons, parallel opposed, equal weighting. A custom bite block is fabricated to reproduce the position of the patient for treatment each day. The bite block is approved by the QMP.
77334	**Complex treatment device:** 47-year-old male with squamous cell carcinoma of the right lung. External beam irradiation is planned using 6 MV photons, parallel opposed, equal weighting. Custom lung blocks are designed using a hot wire cutter to produce a Styrofoam mold into which Lipowitz metal (Cerrobend) is poured. The lung blocks are then bolted to a Lucite plate which slides into the tray holder attached to the rotating secondary collimator of the radiation unit.
77336	**Continuing medical physics consultation:** 65-year-old male with adenocarcinoma of the prostate. External beam irradiation is planned using 18 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered using 4 ports, equal weighting at isocenter. Two conedowns are scheduled during the course of treatment. QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations
77370	**Special medical physics consultation:** 56-year-old male presents with an arterio-venous malformation (AVM) and is referred for stereotactic radiosurgery. The AVM is treated to a dose of 2500 cGy in a single fraction. The QMP supervises the CT imaging of the patient with the stereotactic frame rigidly attached to the patient's skull. A two-isocenter plan is generated using 11 non-coplanar arcs. The QMP performs QA procedures to verify the patient position before treatment begins. The QMP assures all patient positions and arcs are delivered according to plan. The QMP generates and signs a report detailing the effort associated with the stereotactic radiosurgery procedure.
773xx (under consid-eration)	**IMRT Special Physics Consultation:** A 55-year-old male with an unknown head and neck primary has been planned to receive a course of treatments using a step and shoot IMRT treatment technique. The QMP confirms that the treatment can be delivered in a safe and accurate manner. Specific elements confirmed include the accurate transfer of the treatment parameters from the planning system to the treatment delivery computer, the ability to deliver the treatment in a safe manner, the estimation of the maximum dose to the spinal cord and the dose to the contralateral parotid, and the consistency between the dose prescription and the treatment parameters. Specific measurements are made to confirm the dose to a volume within the high dose region and to confirm the general characteristics of the dose distribution. In addition, the QMP is present for the first treatment and insures that the correct shift of the patient from the plane of reference is made. The QMP, together with the oncologist, reviews the orthogonal portal films, which are taken to confirm the patient treatment location. A written report is generated which describes the physics consultation provided to this patient.

APPENDIX V: Survey of Practice Parameters Associated with Radiation Oncology Physics Services

Survey of Practice Parameters Associated with Radiation Oncology Physics Services

Section 1: General Survey Instructions

1. Purpose of Survey

The survey's purpose is to measure "Qualified Medical Physicist (QMP)" work rendered during medical physics services. The American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM) jointly authorized this investigation. To assist your completion of the questionnaire, the AAPM's definition of a "Qualified Medical Physicist" is provided on the enclosed sheet. The survey's results will be made available to the medical physics community and will provide medical physicists with comprehensive medical physics services' work and cost data. Medical physicists may use these data to defend the resources they require to provide their services. The current survey updates a similar survey[8] conducted by Abt Associates Inc. for the ACMP and AAPM, and Abt has been selected again to conduct the new survey.

2. Methodology

This questionnaire asks you to provide information that will help to develop medical physics services' work estimates. As the following formula indicates, work is the product of time and intensity:

$$\text{Work} = \text{Time} * \text{Intensity}$$

where time is the time spent preparing for and conducting each medical physics service, and intensity combines the mental effort and judgment, technical skill and physical effort, and psychological stress associated with each service.

You will be asked to provide time and intensity data for 17 medical physics services (Current Procedure Terminology (CPT) codes) – the 14 77300 series ("physics series") codes, one additional code (77295), one intensity modulated radiation therapy (IMRT) treatment planning code (77301) and one code for physics IMRT special consultation (773XX, not yet approved).[9] The enclosed sheet

[8] Abt Associates Inc., *The Abt Study of Physicist Work Values for Radiation Oncology Physics Services*, prepared for the American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM), October 3, 1995.

[9] Further information on each of the 16 codes is contained in American Medical Association (AMA), *Current Procedure Terminology CPT 2002 Professional Edition,* AMA Press, 2001, pp. 276-277.

presents complete definitions along with vignettes describing the "typical" patient for each service. We ask that you base the time and intensity data you record for each service on each service's vignette.

Sections 2 and **3** ask for medical physics services' time data – ***non-procedural time*** in **Section 2** and ***procedural time*** in **Section 3**. Non-procedural time is the time spent on regular equipment maintenance that is not conducted before each specific procedure. Procedural time includes time spent on tasks directly associated with each service. Together, non-procedural time plus procedural time equal total time for medical physics services.

Section 4 of the survey asks for service-specific intensity data. You will be asked to employ a technique referred to as ***magnitude estimation*** to rate each service's intensity. Magnitude estimation begins by selecting a commonly provided service; the intensity for this "benchmark service" is then set equal to 1.0. You will then be asked to rate the intensity of each of the other 13 medical services relative to the benchmark service. For example, if you believe service X's intensity is twice as great as that of the benchmark, you would assign service X an intensity of 2.0.

The survey includes two additional sections. In **Section 5**, we ask you to provide the number of procedures by service for the institution where you perform the greatest number of services and for which complete data are available. In addition, we also ask for data on the number of patient treatments performed at your institution and your staffing patterns. Finally, **Section 6** asks for information on new technologies.

The Medicare hospital outpatient prospective payment system (HOPPS) created an ambulatory patient classification (APC) system that took effect in 2000. APCs apply to hospital, outpatient technical charges for Medicare patients. The net effect of the APCs is to group the CPT services into a limited number of categories, where, in theory, services within each category (APC) require using similar resources. This survey provides a means to define the resources used to provide radiation oncology physics services and to provide evidence that the services are associated with an appropriate APC.

All data collected in this survey will be treated as strictly confidential. Individual respondents will not be identified as your answers will be combined with others and reported only in statistical form.

If you have any questions about the survey, please contact Kevin Coleman at (202) 263 – 1750 or email him at kevin_coleman@abtassoc.com.

Section 2: Medical Physics Services Non-Procedural Time Estimates

DIRECTIONS: In this section you will be asked to estimate the time required to perform tasks that are not specific to a procedure (non-procedural time) including:

- Initial commissioning;
- Complete recalibrations due to catastrophic events;
- Annual calibrations; and
- Daily, weekly, and monthly checks.

This section is organized into sets of questions that apply to groups of procedures. For example, the questions in Set I refer to CPT codes 77295, 77300, 77305, 77310, 77315, and 77321. Some tasks listed above are not applicable to certain procedures; questions that do not apply to a set of services are not listed below. In addition, two services (77336 and 77370) are medical physics consultations that do not involve equipment use; there is no non-procedural time for these two consultation services.

When responding to time questions, please express time in hours and use decimals to indicate fractions of an hour. For example, use "0.25 hours" to record 15 minutes of time. We ask you to base your estimates on your own clinical experience.

I. CPT Codes 77295, 77300, 77305, 77310, 77315, and 77321: Three-dimensional therapeutic radiology simulation-aided field setting, basic dosimetry calculations and simple, intermediate, complex, and special isodose plans.

a. Initial Commissioning Time

Estimate the number of hours required to commission fully radiation oncology equipment for patient treatments. Assume the equipment consists of a dual photon energy unit with six (6) electron energies, with an associated simulator and treatment planning computer. Please refer to the table below for specific directions regarding what to include for the initial commissioning time estimate ……_____ hours

In making your estimates, **INCLUDE:**	**ALSO INCLUDE:**
Time to: • Design radiation shielding • Perform radiation surveys • Commission local standard chambers, electrometers, field instruments, beam scanning and film dosimetry • Adjust and verify accuracy of all position, angle and distance indicators • Accept linear accelerator • Accept and commission simulator • Measure CAX profile for each beam • Measure off-axis profiles for each beam • Measure wedge and tray factors • Measure output factors • Reduce data to usable SSD and TMR charts • Determine and verify output calibrations • Determine and verify output and energy checks • Check leakage radiation • Accept treatment planning computer • Enter and verify data in computer • Prepare reports on calibration, acceptance tests, commissioning and radiation survey • Complete additional commissioning tasks	**Time to Commission** • Tissue compensating filters • Microdosimetry (TLD) • Block cutting • Independent jaw treatment • Multileaf collimator • Dynamic wedge • Electronic portal imaging • Total body photons • Total skin electrons • Stereotactic radiosurgery • Stereotactic radiotherapy • Three-dimensional treatment planning • Intraoperative radiotherapy • Intensity modulated radiotherapy • Other specialized treatments

b. Recalibration Time Due to Catastrophic Events

Estimate the number of hours required to perform recalibration procedures due to catastrophic or non-routine events over a five (5) year period of a *linear accelerator* ……..……..……._____ hrs/5 years

Estimate the number of hours required to perform recalibrations due to catastrophic events over a five (5) year period of a *simulator, treatment planning computer, beam scanning and film dosimetry system*……..……..……._____ hrs/5 years

c. Annual Calibration Time

Estimate the number of hours required to perform an annual calibration of a dual photon energy unit with five (5) or six (6) electron energies and an associated simulator. Please refer to the table below for specific instructions on what to include in the annual calibration time estimate ……..……..……._____ hrs/ year

In making your estimates **INCLUDE** time for verification of:	
• X-ray output for all energies • Electron output for all energies and applicators • CAX dosimetry (PDD/TMR) • Transmission factors for all accessories • Wedge factors • Monitor chamber linearity • X-ray constancy and beam uniformity versus gantry angle • Multileaf collimator verification • Electronic portal imaging verification • Total body photon irradiation verification	• Electron output and beam uniformity versus gantry angle • Collimator rotation isocenter • Gantry and couch rotation isocenter • Coincidence of radiation and mechanical isocenter • Coincidence of collimator, gantry and couch axis with isocenter • Table top sag • Vertical travel of table • Light field intensity • Validation of all daily and monthly checks • Total skin electron verification • Intensity modulated radiotherapy verification • Stereotactic radiotherapy and radiosurgery verification
Also include in your estimate time spent each year performing quality assurance of ion chamber and film dosimetry equipment (including the processor), beam scanner, diodes and other measurement and support equipment.	

d. Time for Daily, Weekly and Monthly Checks

Estimate the number of hours required for the QMP to perform one month's work of daily, weekly and monthly machine checks for a dual photon energy unit with six (6) electron energies, simulator, treatment planning computer, CT unit and beam scanner. Please refer to the table below in making your estimates……..……._____ hrs/ month

Daily Checks include:	**Monthly Checks** include:	
• X-ray output constancy • Audiovisual monitors • Electron output constancy • Door interlock • Optical distance indicator (ODI) • Field size indicators • Other daily checks	• X-ray output constancy • Electron output constancy • X-ray central axis dosimetry (PDD/TMR) • Electron central axis dosimetry (PDD) • X-ray and electron beam uniformity • Emergency off switches • Dosimetry, symmetry, wedge, and electron cone interlocks • Collision avoidance interlocks • Light/radiation field coincidence • Electron portal imaging device verification • Total body photon irradiation verification	• Gantry/collimator angle indicators • Wedge position • Tray position • Field size indicators • Cross-hair centering • Treatment couch position indicators • Latching of wedges and blocking trays • Jaw symmetry and field light intensity • Total skin electron verification • Intensity modulated radiotherapy verifications • Stereotactic radiosurgery and radiotherapy verification
Also include time spent performing checks on the simulator and CT scanner, such as lasers, positional accuracy, image quality, CT number calibration, etc., as well as the treatment planning computer and beam scanner.		

II. CPT Codes 77326, 77327, and 77328: Simple, intermediate and complex brachytherapy plan

a. Initial Commissioning Time

Estimate the number of hours required to commission your brachytherapy system. Please refer to the table below for specific instructions on what to include in the initial commissioning time estimate ……..……_____ hours

In making your estimates **INCLUDE** time to:
• Commission the treatment planning system for all sources in the brachytherapy inventory • Commission the well ionization chamber or other source activity verification device • Perform initial tests for precision, linearity, collection efficiency, geometrical length dependence, energy dependence, source wall dependence venting and leakage • Commission intracavitary (Fletcher type) and interstitial applicators • Check and verify brachytherapy algorithm in treatment planning computer • Check and verify remote (HDR or LDR) afterloading • Check and verify prostate seed brachytherapy procedures • Check and verify stereotactic brachytherapy procedures

b. Time for Annual Checks

Estimate the number of hours for an annual check for the brachytherapy system. Please refer to the table below for specific instructions on what to include in the annual check time estimate ……..……_____ hours/year

In making your estimates **INCLUDE**:
• Performance of spot checks and wiping of test sources for your brachytherapy system • Source guide inspection • Ribbon preparations accuracy • Applicators' source positioning accuracy • Source calibration • Applicators' mechanical integrity • Brachytherapy system calibration • Prostate seed brachytherapy system evaluation • Remote (LDR or HDR) afterloading system evaluation *Also include time to simulate emergency conditions and verify source inventory*

III. CPT Code 77331: Thermoluminescent Dosimetry (TLD) in vivo dosimetry (includes TLD and/or diodes; the CPT term for this service is Microdosimetry)

a. Initial Commissioning Time

Estimate the number of hours required to commission completely a TLD system for dose measurements for two photon (2) and six (6) electron energies ……_____ hours

b. Time for Monthly Checks

Estimate the number of hours required per month to perform quality assurance checks on the TLD system ……_____ hours/month

c. Initial Commissioning Time

Estimate the number of hours required to commission completely a diode system for dose measurements for two photon (2) and six (6) electron energies ……_____ hours

d. Time for Monthly Checks

Estimate the number of hours required per month to perform quality assurance checks on the diode system ……_____ hours/month

IV. CPT Code 77332: Simple treatment device system (e.g., non-custom block, blocking tray or simple bolus)

Estimate the number of hours required to commission completely a simple treatment device system for clinical use……..._____ hours

V. CPT Code 77333: Intermediate treatment devices (e.g., shaped bolus, stent, or bite block)

Estimate the number of hours required to commission completely an intermediate treatment device system for clinical use……..._____ hours

VI. CPT Code 77334: Complex treatment device systems (e.g., custom low temperature alloy blocking system, custom face mask system and tissue compensation system)

a. Initial Commissioning Time

Estimate the number of hours required to commission completely a complex treatment device system for clinical use……..……_____ hours

b. Time for Monthly Checks

Estimate the number of hours required per month to perform quality assurance checks on a complex treatment delivery system; include time to verify the multileaf collimator system…….._____ hours/month

Section 3: Medical Physics Services Procedural Time Estimates

DIRECTIONS: In the following worksheet we ask you to estimate the number of hours required to complete each of the 17 medical physics services (procedural time). When reporting procedural time, please:

- Base your estimates on your recent clinical experience; and
- Base your estimates on the vignette assigned to each medical physics service.

It is important that your time estimates are based on time needed to serve a "typical" patient; the vignettes were carefully chosen to represent typical patients receiving each medical physics service. Procedural time estimates should include time for activities *directly* related to the performance of a *specific procedure*; they should not include time for non-procedural activities that are performed periodically to maintain equipment (see **Section 2** above for non-procedural maintenance activities).

To assist your thinking regarding your procedural time estimates, examples of common tasks performed when providing medical physics services are listed in the table below.

In making your time estimates **INCLUDE** time to:	**DO NOT INCLUDE** time for:

• Obtain patient measurements and treatment parameters
• Accompany patient to imaging procedure
• Retrieve, load, and digitize patient data
• Perform dosimetry calculations
• Perform brachytherapy plans
• Perform isodose curve plans
• Custom make or fit a treatment device
• Check and issue verifications for:
  • Dosimetry calculations
  • Isodose treatment plans
  • Brachytherapy plans (including time that the qualified medical physicist is physically present during loading and unloading of the sources)
  • Treatment devices
	• Initial commissioning
	• Recalibrations
	• Annual calibrations
	• Daily, weekly and monthly checks
	• Other non-procedural activities

For a continuing medical physics consultation (CPT Code 77336), include time for the following procedural activities:

- Reviewing the patient case in initial presentation, simulation, planning and treatment
- Performing weekly chart check of all charting, diagnostic studies, port films, and patient calculations
- Reviewing charts with other members of patient management team in chart rounds
- Viewing patient positioning and machine set-up
- Researching treatment scheme (assuming a special medical radiation physics consultation (CPT Code 77370) is not billed)
- Performing final chart check and validation.

For each service, we ask you to provide separate estimates of both support staff and Qualified Medical Physicist (QMP) time as explained below:

Support Staff Time: Includes time expended by any support staff member (dosimetrists, physics assistants, brachytherapy technologists, and junior medical physicists) who assist in providing medical physics services. You are asked to report in the space provided below the number of hours spent by these staff in providing each service. Do not record any support staff time for medical physics consultation services (CPT Codes 77336 and 77370), because the QMP is the only staff member qualified to provide consultation services. The "Support Staff Time" boxes for CPT Codes 77336 and 77370 have been already marked N/A.

QMP Time: Include only Qualified Medical Physicist (QMP) time. Please provide the estimated number of QMP hours typically spent in rendering a single occurrence of each service.

For 77370, special medical physics consultation, please complete Appendix 1 to estimate a median procedure time over a number of typical special procedures. A sample completed time estimation is provided in Appendix 1.

Procedural Time Estimates for Medical Physics Services

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
77336	**Continuing medical physics consultation:** 65-year-old male with adenocarcinoma of the prostate. External beam irradiation is planned using 18 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered using 4 ports, equal weighting at isocenter. Two conedowns are scheduled during the course of treatment. QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations	N/A	
77300	**Basic dosimetry calculation:** 72-year-old female with metastatic disease involving T12 and L1. A single port is prescribed with intent to deliver 3000 cGy in 10 fractions at a depth of 6 cm. A central axis does calculation is performed.		
77305	**Simple isodose plan:** 61-yar-old male with soft tissue sarcoma involving the right arm. An irregular field was designed to treat postoperative residual disease. Central axis and off-axis points were specified, with the dose of 6000 cGy in 6 weeks to be delivered from parallel opposed, equally loaded ports. Doses to 3 off-axis irregular field points are determined and reported.		
77310	**Intermediate isodose plan:** 68-year-old man with squamous carcinoma in the middle third of the esophagus. Post-operative irradiation is to be delivered after a partial resection. Tumor is treated using 1 anterior port with 2 posterior obliques with no blocking required. The single plane isodose distribution must demonstrate coverage of the prescribed target volume.		
77315	**Complex isodose plan:** 56-year-old female with 2 cm tumor in simple excision proving infiltrating ductal carcinoma of the right breast. Breast tangents are designed with the dose to be given from equally loaded parallel opposed ports. Isodose concentrations are generated using 0, 30, & 45 degree wedges.		
77321	**Special teletherapy port plan:** 55-year-old female with acinic cell carcinoma of the parotid gland. Post-op radiation is designed to deliver unilateral mixed beam irradiation with 6 MV photons and electrons. 3 energies of electrons are considered: 9 MeV, 12 MeV, and 16 MeV.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
77326	**Simple brachytherapy isodose plan:** 65-year-old female with carcinoma of the vagina. Since a hysterectomy has been performed, the radiation oncologist elects to do the treatment with dome cylinder colpostats. 6000 cGy surface dose is to be delivered in 72 hours, using 3 Cesium-137 sources.		
77327	**Intermediate brachytherapy isodose plan:** 58-year-old female with carcinoma located in the vaginal fornices with an intact cervix. Irradiation is given with an intrauterine tandem and ovoid colpostats. Dose of 6600 cGy is given to involved vaginal service using 6 Cesium-137 sources for 72 hours.		
77328	**Complex brachytherapy isodose plan:** 55-year-old male with squamous cell carcinoma involving the base of the tongue. Irradiation is planned using IR-192 sources in a multiplanar or volume implant. A total of 80 sources are used in 11 ribbons. A dose of 5500 cGy is given to the volume in 72 hours.		
77331	**Special dosimetry:** 49-year-old male with squamous carcinoma involving the nasopharynx. External beam irradiation is planned using 6 MV photons, parallel opposed, equal weighting, at 180 cGy/fraction, total dose 6300 cGy. TLD dosimetry is requested with the dosimeters to be placed using a nasogastric (Levin) tube. The results of right and left lateral port measurements must be checked by the QMP.		
77332	**Simple treatment device:** 63-year-old male with metastatic brain disease is treated with 6 MV photons with lateral fields, 200 cGy/fraction to a total dose of 3000 cGy. A tray with a single standard block is prepared.		
77333	**Intermediate treatment device:** 65-year-old female with squamous cell caracinoma of the posterior pharyngeal wall. 7000 cGy is prescribed to be delivered in 7 weeks at 200 cGy/fraction using 6 MV photons, parallel opposed, equal weighting. A custom bite block is fabricated to reproduce the position of the patient for treatment each day. The bite block is approved by the QMP.		
77334	**Complex treatment device:** 47-year-old male with squamous cell carcinoma of the right lung. External beam irradiation is planned using 6 MV photons, parallel opposed, and equal weighting. Custom lung blocks are designed using a hot wire cutter to produce a Styrofoam mold into which Lipowitz metal (Cerrobend) is poured. The lung blocks are then bolted to a Lucite plate which slides into the tray holder attached to the rotating secondary collimator of the radiation unit.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
77370	**Special medical physics consultation:** 56-year-old male presents with an arterio-venous malformation (AVM) and is referred for stereotactic radiosurgery. The AVM is treated to a dose of 2500 cGy in a single fraction. The QMP supervises the CT imaging of the patient with the stereotactic frame rigidly attached to the patient's skull. A two-isocenter plan is generated using 11 non-coplanar arcs. The QMP performs QA procedures to verify the patient position before treatment begins. The QMP assures all patient positions and arcs are delivered according to plan. The QMP generates and signs a report detailing the effort associated with the stereotactic radiosurgery procedure.	N/A	See Appendix 1
77295	**Therapeutic radiology simulation-aided field testing:** 63-year-old male with prostate cancer presents for 3-dimensional conformal radiation therapy involving 6 irregular and opposing fields with high energy photons. CT scans are performed throughout the pelvis, and CT planning is performed, including generation of dose volume histograms for the target and normal structures.		
77301 (Not to be used until 2002)	**IMRT Treatment Planning:** A 58 year old male with adenocarcinoma of the prostate is planned with an IMRT treatment approach. Inverse planning techniques are used to deliver a minimum of 7800 cGy to the Planning Target Volume, which is the prostate plus specific margins for each interface. The oncologist contours the prostate. The critical target structures include the rectum, the bladder and the right and left femoral heads. The QMP contours the critical structures. The oncologist's prescription includes the goal dose, the percentage of the volume allowed to receive less than the goal dose, the minimum dose, and the maximum dose. Three different iterations of the plan are developed. The oncologist and the QMP review each iteration. The review includes both the dose distribution in multiple planes and the dose volume histogram. The physicist also reviews the plan for safety and feasibility considerations. After the oncologist approves the final plan, the QMP transfers the planning data from the treatment planning system to the Record and Verify System.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
773XX (under consid-eration)	**IMRT Special Physics Consultation:** A 55 year old male with an unknown head and neck primary has been planned to receive a course of treatments using a step and shoot IMRT treatment technique. The QMP confirms that the treatment can be delivered in a safe and accurate manner. Specific elements confirmed include the accurate transfer of the treatment parameters from the planning system to the treatment delivery computer, the ability to deliver the treatment in a safe manner, the estimation of the maximum dose to the spinal cord and the dose to the contralateral parotid, and the consistency between the dose prescription and the treatment parameters. Specific measurements are made to confirm the dose to a volume within the high dose region and to confirm the general characteristics of the dose distribution. In addition, the QMP is present for the first treatment and insures that the correct shift of the patient from the plane of reference is made. The QMP, together with the oncologist, reviews the orthogonal portal films, which are taken to confirm the patient treatment location. A written report is generated which describes the physics consultation provided to this patient.	N/A	

Section 4: Relative Intensity Estimates for Medical Physics Services

DIRECTIONS: In the worksheet below, we ask you to rate the intensity of each medical physics service ***relative*** to a benchmark procedure CPT 77336 (continuing medical physics consultation). When assessing the intensity of each service relative to the benchmark (i.e., **magnitude estimation**) please keep in mind that intensity combines the following elements:

- Mental effort and judgment;
- Technical skill and physical effort; and
- Psychological stress due to concerns regarding risks of complications and iatrogenic harm.

Recall that Work = Time * Intensity. This relationship in turn implies that Intensity = Work/Time, or work per unit of time (e.g., work per minute). Intensity measures the QMP's physical and emotional stress caused by delivering a medical physics service.

Relative Intensity Estimates: You are asked to score each procedure using ***magnitude estimation***. Magnitude estimation is a technique that compares the intensity of each medical physics service relative to the benchmark service (CPT Code 77336 – continuing medical physics consultation). The benchmark procedure CPT Code 77336 is assigned an intensity value equal to 1.00. If you believe

that the intensity of another medical physics service X is two and one half times as great as CPT Code 77336, please assign that medical physics service an intensity equal to 2.50.

When developing your relative intensity estimates, please consider the *average* intensity during the entire medical physics service, because intensity is likely to vary from minute to minute. Please also remember that intensity is defined on a *per minute* basis, and longer services do not necessarily have higher intensities. Your intensity estimates for each medical physics service should be based on each services' same vignette presented above in **Section 3**. The vignettes are meant to represent typical patients, and are presented again in the following table for your convenience.

For 77370, special medical physics consultation, please complete Appendix 2 to estimate median procedure intensity over a number of typical special procedures. A sample of a completed intensity estimation is provided in Appendix 2.

Relative Intensity Estimates for Medical Physics Services

CPT Code	Procedure Vignette	Relative Intensity Estimate
77336	**Continuing medical physics consultation:** 65-year-old male with adenocarcinoma of the prostate. External beam irradiation is planned using 18 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered using 4 ports, equal weighting at isocenter. Two conedowns are scheduled during the course of treatment. QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations	1.00
77300	**Basic dosimetry calculation:** 72-year-old female with metastatic disease involving T12 and L1. A single port is prescribed with intent to deliver 3000 cGy in 10 fractions at a depth of 6 cm. A central axis does calculation is performed.	
77305	**Simple isodose plan:** 61-yar-old male with soft tissue sarcoma involving the right arm. An irregular field was designed to treat postoperative residual disease. Central axis and off-axis points were specified, with the dose of 6000 cGy in 6 weeks to be delivered from parallel opposed, equally loaded ports. Doses to 3 off-axis irregular field points are determined and reported.	
77310	**Intermediate isodose plan:** 68-year-old man with squamous carcinoma in the middle third of the esophagus. Post-operative irradiation is to be delivered after a partial resection. Tumor is treated using 1 anterior port with 2 posterior obliques with no blocking required. The single plane isodose distribution must demonstrate coverage of the prescribed target volume.	
77315	**Complex isodose plan:** 56-year-old female with 2 cm tumor in simple excision proving infiltrating ductal carcinoma of the right breast. Breast tangents are designed with the dose to be given from equally loaded parallel opposed ports. Isodose concentrations are generated using 0, 30, & 45 degree wedges.	

Relative Intensity Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Relative Intensity Estimate
77321	**Special teletherapy port plan:** 55-year-old female with acinic cell carcinoma of the parotid gland. Post-op radiation is designed to deliver unilateral mixed beam irradiation with 6 MV photons and electrons. 3 energies of electrons are considered: 9 MeV, 12 MeV, and 16 MeV.	
77326	**Simple brachytherapy isodose plan:** 65-year-old female with carcinoma of the vagina. Since a hysterectomy has been performed, the radiation oncologist elects to do the treatment with dome cylinder colpostats. 6000 cGy surface dose is delivered in 72 hours, using 3 Cesium-137 sources.	
77327	**Intermediate brachytherapy isodose plan:** 58-year-old female with carcinoma located in the vaginal fornices with an intact cervix. Irradiation is given with an intrauterine tandem and ovoid colpostats. Dose of 6600 cGy is given to involved vaginal service using 6 Cesium-137 sources for 72 hours.	
77328	**Complex brachytherapy isodose plan:** 55-year-old male with squamous cell carcinoma involving the base of the tongue. Irradiation is planned using IR-192 sources in a multiplanar or volume implant. A total of 80 sources are used in 11 ribbons. A dose of 5500 cGy is given to the volume in 72 hours.	
77336	**Continuing medical physics consultation:** 65-year-old male with adenocarcinoma of the prostate. External beam irradiation is planned using 18 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered using 4 ports, equal weighting at isocenter. Two conedowns are scheduled during the course of treatment. QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations	1.00
77331	**Special dosimetry:** 49-year-old male with squamous carcinoma involving the nasopharynx. External beam irradiation is planned using 6 MV photons, parallel opposed, equal weighting, at 180 cGy/fraction, total dose – 6300 cGy. TLD dosimetry is requested with the dosimeters to be placed using a nasogastric (Levin) tube. The results of right and left lateral port measurements must be checked by the QMP.	
77332	**Simple treatment device:** 63-year-old male with metastatic brain disease is treated with 6 MV photons with lateral fields, 200 cGy/fraction to a total dose of 3000 cGy. A tray with a single standard block is prepared.	
77333	**Intermediate treatment device:** 65-year-old female with squamous cell caracinoma of the posterior pharyngeal wall. 7000 cGy is prescribed to be delivered in 7 weeks at 200 cGy/fraction using 6 MV photons, parallel opposed, equal weighting. A custom bite block is fabricated to reproduce the position of the patient for treatment each day. The bite block is approved by the QMP.	

Relative Intensity Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Relative Intensity Estimate
77334	**Complex treatment device:** 47-year-old male with squamous cell carcinoma of the right lung. External beam irradiation is planned using 6 MV photons, parallel opposed, and equal weighting. Custom lung blocks are designed using a hot wire cutter to produce a Styrofoam mold into which Lipowitz metal (Cerrobend) is poured. The lung blocks are then bolted to a Lucite plate which slides into the tray holder attached to the rotating secondary collimator of the radiation unit.	
77370	**Special medical physics consultation:** 56-year-old male presents with an arterio-venous malformation (AVM) and is referred for stereotactic radiosurgery. The AVM is treated to a dose of 2500 cGy in a single fraction. The QMP supervises the CT imaging of the patient with the stereotactic frame rigidly attached to the patient's skull. A two-isocenter plan is generated using 11 non-coplanar arcs. The QMP performs QA procedures to verify the patient position before treatment begins. The QMP assures all patient positions and arcs are delivered according to plan. The QMP generates and signs a report detailing the effort associated with the stereotactic radiosurgery procedure.	See Appendix 2
77295	**Therapeutic radiology simulation-aided field testing:** 63-year-old male with prostate cancer presents for 3-dimensional conformal radiation therapy involving 6 irregular and opposing fields with high energy photons. CT scans are performed throughout the pelvis, and CT planning is performed, including generation of dose volume histograms for the target and normal structures.	
77336	**Continuing medical physics consultation:** 65-year-old male with adenocarcinoma of the prostate. External beam irradiation is planned using 18 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered using 4 ports, equal weighting at isocenter. Two conedowns are scheduled during the course of treatment. QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations	1.00
77301 (Not to be used until 2002)	**IMRT Treatment Planning:** A 58-year-old male with adenocarcinoma of the prostate is planned with an IMRT treatment approach. Inverse planning techniques are used to deliver a minimum of 7800 cGy to the Planning Target Volume, which is the prostate plus specific margins for each interface. The oncologist contours the prostate. The critical target structures include the rectum, the bladder and the right and left femoral heads. The QMP contours the critical structures. The oncologist's prescription includes the goal dose, the percentage of the volume allowed to receive less than the goal dose, the minimum dose, and the maximum dose. Three different iterations of the plan are developed. The oncologist and the QMP review each iteration. The review includes both the dose distribution in multiple planes and the dose volume histogram. The physicist also reviews the plan for safety and feasibility considerations. After the oncologist approves the final plan, the QMP transfers the planning data from the treatment planning system to the Record and Verify System.	

Relative Intensity Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Relative Intensity Estimate
773XX (under consid-eration)	**IMRT Special Physics Consultation:** A 55-year-old male with an unknown head and neck primary has been planned to receive a course of treatments using a step and shoot IMRT treatment technique. The QMP confirms that the treatment can be delivered in a safe and accurate manner. Specific elements confirmed include the accurate transfer of the treatment parameters from the planning system to the treatment delivery computer, the ability to deliver the treatment in a safe manner, the estimation of the maximum dose to the spinal cord and the dose to the contralateral parotid, and the consistency between the dose prescription and the treatment parameters. Specific measurements are made to confirm the dose to a volume within the high dose region and to confirm the general characteristics of the dose distribution. In addition, the QMP is present for the first treatment and insures that the correct shift of the patient from the plane of reference is made. The QMP, together with the oncologist, reviews the orthogonal portal films, which are taken to confirm the patient treatment location. A written report is generated which describes the physics consultation provided to this patient.	

Section 5: Institutional Medical Physics Service Volumes and Staffing Patterns

DIRECTIONS: For each of the medical physics services listed below, please estimate the total number of times that service was performed in your institution during the most recent year for which you have complete data. If your practice provides services in more than one institution, please provide service volume for that institution where:

- You have a complete year of data; and
- You perform the most medical physics services.

At the end of this section, we also ask you to provide additional information on the numbers of patient and patient treatments and staffing patterns at your institution.

Number of Medical Physics Services Performed Annually

CPT Code	CPT Descriptor (*Source: American Medical Association: Current Procedure Terminology CPT 2002 Professional Edition, AMA Press, 2001, pp. 276-277.)*	Number of Services Performed per Year at Your Institution
77336	Continuing medical physics consultation, including assessment of treatment parameters, quality assurance of dose delivery, and review of patient treatment documentation in support of the radiation oncologist, per week of therapy	
77300	Basic radiation dosimetry calculation, central axis depth dose, TDF, NSD, gap calculation, off axis factor, tissue inhomogeneity factors, as required during course of treatment, only when prescribed by the treating physician	
77305	Teletherapy, isodose plan (whether hand or computer calculated); simple (one or two parallel opposed unmodified ports direct to a single area of interest)	
77310	Teletherapy, isodose plan (whether hand or computer calculated); intermediate (three or more treatment ports direct to a single area of interest)	
77315	Teletherapy, isodose plan (whether hand or computer calculated); complex (mantle or inverted Y, tangential ports, the use of wedges, compensators, complex blocking, rotational beam, or special beam considerations)	
77321	Special teletherapy port plan, particles, hemibody, total body	
77326	Brachytherapy isodose calculation; simple (calculation made from single plane, one to four sources/ribbons application, remote afterloading brachytherapy, 1 to 8 dwell positions)	
77327	Brachytherapy isodose calculation; intermediate (multiplane dosage calculations, application involving 5 to 10 sources/ribbons, remote afterloading brachytherapy, 9 to 12 dwell positions)	
77328	Brachytherapy isodose calculation; complex (multiplane isodose plan, volume implant calculations, over 10 sources/ribbons used, special spatial reconstruction, remote afterloading brachytherapy, over 12 dwell positions)	
77331	Special dosimetry (e.g., TLD, microdosimetry) (specify), only when prescribed by the treating physician	
77332	Treatment devices, design and construction; simple (simple block, simple bolus)	
77333	Treatment devices, design and construction; intermediate (multiple blocks, stents, bite blocks, special bolus)	
77334	Treatment devices, design and construction; complex (irregular blocks, special shields, compensators, wedges, molds or casts)	
77370	Special medical radiation physics consultation	
77295	Therapeutic radiology simulation-aided field setting	
77301	IMRT Treatment Planning	
773XX	IMRT Special Physics Consultation	

Number of Patients and Patient Treatments

6. How many **new patients** (teletherapy and brachytherapy) were treated at your institution in the most recent year for which you have complete data…….. …..…_____

7. How many **total patients** (teletherapy and brachytherapy) were treated at your institution in the most recent year for which you have complete data? *(Count each patient one time)* …… _____

8. What **percentage of the total patients** had the majority of their treatments on the clinic's most heavily utilized teletherapy unit? ……. _____

9. What is the **total number of patient treatments** performed on the clinic's most heavily utilized teletherapy unit during the most recent year for which you have complete data? …… _____

10. What is the **total number of teletherapy patient treatments** performed at your institution during the most recent year for which you have complete data? ……..._____

Staffing Patterns:

Below, we ask you to provide estimates of the total number of full-time equivalent (FTE) qualified medical physicists (QMPs) and other support staff who are involved in providing the number of services that you indicated above in the table on pages 14 and 15. In making your estimate, please keep in mind that for the purposes of this survey, an *FTE is defined as someone who works 40 hours per week on average (or approximately 2,000 hours per year annually) on clinical tasks related to radiation oncology. Time spent on activities related to diagnostic radiology, administration, and research should not be included in your FTE counts.* Count part-time personnel or staff you share with another clinic or department as fractions depending on the portion of 2,000 annual hours (or 40 weekly hours) that they work. For example, a QMP who works 20 hours per week for your organization would be counted as 0.50 FTEs (20/40 = 0.50).

1. Please provide the number of full-time equivalent (FTE) staff who are involved in performing the services that you listed for your institution for the following staff categories. If you employ no staff in a particular category, please record a "0.0" in that category.

   a.) Qualified Medical Physicists (QMPs) ……..…….._____ FTEs

   b.) Radiation Oncologists ……..……..……..…….._____ FTEs

   c.) Dosimetrists and/or Junior Physicists ……..…….._____ FTEs

   d.) Physics Assistants ……..…….._____ FTEs

   e.) Brachytherapy Technologists ……...…….…….._____ FTEs

   f.) Maintenance Engineers ……..…….._____ FTEs

g.) Radiation Therapists ……..…._____ FTEs

h.) Radiation Oncology Nurses……..……..…….._____ FTEs

Section 6: Special Procedures and Advanced Technologies

Please check which of the following procedures are currently offered by the institution where you perform most of your medical physics procedures. *Check all that apply:*

Total Skin Electron Irradiation ……..…… ☐

Total Body Irradiation …… ☐

Electron Arc Irradiation ……..…… ☐

Remote (HDR or LDR) Afterloading Brachytherapy …… ☐

Stereotactic Brachytherapy …… ☐

Sterotactic External Beam Irradiation – Radiosurgery (Single Fraction) ..…… ☐

Sterotactic External Beam Irradiation – Radiotherapy (Multiple Fraction) ..…… ☐

Intraoperative Radiotherapy …..…… ☐

Prostate Seed Brachytherapy ……..…… ☐

Intensity Modulated Radiation Therapy …… ☐

3-D Conformal Radiation Therapy (Non-IMRT) ..…… ☐

Endovascular Brachytherapy …… ☐

Please check which of the following new technology features are currently offered by the institution where you perform most of your medical physics procedures. *Check all that apply:*

Record and Verify System ……..…… ☐

Dynamic Wedge …… ☐

Multileaf Collimator ……..…… ☐

Electronic Portal Imaging …..…… ☐

Dynamic Multileaf Collimator (for Intensity Modulated Radiotherapy) …….. ☐

Please provide your name, address and telephone number (and email address, if you would prefer) in case we need to contact you for clarification of any of your responses.

Qualified Medical Physicist or Alternate Contact _____

Mailing Address: _____

_____

Telephone/Fax Number: Phone: _____ **Fax:** _____

Email Address: _____

Please be assured that all your responses to this survey will be strictly confidential; no individual information will ever be identified. After you have completed the questionnaire, please return it as soon as possible in the enclosed postage-paid envelope and mail it to the following address:

Medical Physics Survey
Abt Associates, Inc.
55 Wheeler Street
Cambridge MA 02138-1168

THANK YOU AGAIN FOR YOUR COOPERATION

Appendix 1 – Time Estimation for 77370

Sample Worksheet

Disclaimer: The number of procedures and median hour entries in the following sample worksheet are for illustrative purposes only. Please fill out the blank worksheet with the corresponding data from your own practice; please do not use the sample worksheet entries to complete this worksheet for your practice.

77370 Procedure	# Procedures per year	Median time in hours for procedure	Product of previous 2 columns (hours)	Overall Median Time (Z) = Total Hours (X) Divided by Total Procedures (Y) Use this number as an estimate of 77370 procedure time.
Routine 77370 procedure	40	4	160	
Total skin electron irradiation	8	9	72	
Total body irradiation	9	9	81	
Electron arc irradiation	2	12	24	
Remote afterloading brachytherapy	50	8	400	
Stereotactic brachytherapy	1	5	5	
Stereotactic radiosurgery (single fx)	30	11	330	
Stereotactic radiotherapy (multiple fx)	50	11	550	
Intraoperative radiotherapy	20	6	120	
Prostate Seed Brachytherapy	50	5	250	
Intensity Modulated Radiation Therapy	10	12	120	
3-D Conformal Radiation Therapy (Non-IMRT)	10	5	50	
Endovascular Brachytherapy	30	4	120	
Total	310 (Y)	----------	2282 (X)	7.36 (Z)

Worksheet

77370 Procedure	# Procedures per year	Median time in hours for procedure	Product of previous 2 columns (hours)	Overall Median Time (Z) = Total Hours (X) Divided by Total Procedures (Y) Use this number as an estimate of 77370 procedure time.
Routine 77370 procedure				
Total skin electron irradiation				
Total body irradiation				
Electron arc irradiation				
Remote afterloading brachytherapy				
Stereotactic brachytherapy				
Stereotactic radiosurgery (single fx)				
Stereotactic radiotherapy (multiple fx)				
Intraoperative radiotherapy				
Prostate Seed Brachytherapy				
Intensity Modulated Radiation Therapy				
3-D Conformal Radiation Therapy (Non-IMRT)				
Endovascular Brachytherapy				
Total	(Y)	----------	(X)	(Z)

Appendix 2 – Intensity Estimation for 77370

Sample Worksheet

Disclaimer: The number of procedures and intensity entries in the following sample worksheet are for illustrative purposes only. Please fill out the blank worksheet with the corresponding data from your own practice; please do not use the sample worksheet entries to complete this worksheet for your practice.

77370 Procedure	# Procedures per year	Intensity estimate for this procedure	Product of previous 2 columns	Overall Median Intensity (Z) = Total Intensity (X) Divided by Total Procedures (Y) Use this number as an estimate of 77370 median intensity.
Routine 77370 procedure	40	3	120	
Total skin electron irradiation	8	3	24	
Total body irradiation	9	2	18	
Electron arc irradiation	2	4	8	
Remote afterloading brachytherapy	50	2	100	
Stereotactic brachytherapy	1	5	5	
Stereotactic radiosurgery (single fx)	30	4	120	
Stereotactic radiotherapy (multiple fx)	50	4	200	
Intraoperative radiotherapy	20	3	60	
Prostate Seed Brachytherapy	50	4	200	
Intensity Modulated Radiation Therapy	10	6	60	
3-D Conformal Radiation Therapy (Non-IMRT)	10	5	50	
Endovascular Brachytherapy	30	3	90	
Total	310 (Y)	----------	1055 (X)	3.40 (Z)

Worksheet

77370 Procedure	# Procedures per year	Intensity estimate for this procedure	Product of previous 2 columns	Overall Median Intensity (Z) = Total Intensity (X) Divided by Total Procedures (Y) Use this number as an estimate of 77370 median intensity.
Routine 77370 procedure				
Total skin electron irradiation				
Total body irradiation				
Electron arc irradiation				
Remote afterloading brachytherapy				
Stereotactic brachytherapy				
Stereotactic radiosurgery (single fx)				
Stereotactic radiotherapy (multiple fx)				
Intraoperative radiotherapy				
Prostate Seed Brachytherapy				
Intensity Modulated Radiation Therapy				
3-D Conformal Radiation Therapy (Non-IMRT)				
Endovascular Brachytherapy				
Total	(Y)	----------	(X)	(Z)

APPENDIX VI: Members of the Second Technical Consulting Panel

AAPM	
Michael D. Mills, Ph.D., MSPH, Chairman* Department of Radiation Oncology University of Louisville Brown Cancer Center 529 South Jackson Street Louisville, KY 40202 (502) 852-7722 (voice) (502) 852-7725 (fax) Email: mdm@bcc.louisville.edu	Edward S. Sternick, Ph.D.* The Cancer Center Tufts-New England Medical Center 750 Washington Street Boston, MA 02111 (617) 636-2626 (voice) (617) 636-4367 (fax) Email: esternick@tufts-nemc.org
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ACMP	
Herbert W. Mower, Sc.D.* Radiation Oncology Department Lahey Clinic 41 Mall Road Burlington, MA 01805 (781) 744-8061 (voice) (781) 744-5247 (fax) Email: Herbert.W.Mower@Lahey.org	Rene J. Smith, Ph.D.* Radiation Oncology Department Reading Hospital and Medical Center 6th Avenue and Spruce Street West Reading, PA 19603 (610) 988-8144 (voice) (610) 373-8594 (fax) Email: smithre@readinghospital.org
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**** Indicates members who also participated in the First Technical Consulting Panel.***

APPENDIX VII: Time and Intensity Estimates

Table A.7.1: Aggregate Non-Procedural QMP Time Estimates Reported for Groups of Surveyed Radiation Oncology Physicists (in Annualized Hours)*

CPT Code and Type of Commissioning	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295, 77300, 77301, 77305, 77310, 77315, and 77321: Initial Commissioning(annualized over 5 years)	20.8	60.0	120.0	238.7	860.0	167.4	155.6	51
Recalibration (annualized over 5 years)	3.4	15.8	29.0	47.0	160.0	38.8	36.3	52
Annual Calibrations	8.0	39.0	48.0	80.0	300.0	67.6	55.4	52
Daily, Weekly, and Monthly Checks	24.0	96.0	225.0	390.0	1,200.0	278.3	237.3	52
Total Commissioning Time	118.0	270.7	455.0	668.5	1,670.0	551.0	357.2	52
77326, 77327, and 77328: Initial Commissioning	2.4	8.0	16.0	31.7	113.0	22.3	21.4	51
Annual Checks	3.0	11.5	25.0	40.0	150.0	32.2	31.2	51
Total Commissioning Time	5.4	20.0	47.0	64.0	190.0	54.5	43.9	51
77331: Initial Commissioning	1.6	4.3	7.6	14.5	48.0	10.7	10.1	50
Monthly Checks	0.0	24.0	48.0	96.0	240.0	64.2	55.5	50
Total Commissioning Time	6.4	38.4	52.2	99.6	260.0	74.9	60.0	50
77332: Total Commissioning Time	0.0	1.0	2.0	4.0	35.0	4.3	6.5	53
77333: Total Commissioning Time	0.0	1.8	3.0	9.0	45.0	6.6	8.4	51
77334: Initial Commissioning	0.1	0.8	2.0	4.9	13.0	3.4	3.2	53
Monthly Checks	0.0	12.0	36.0	57.0	720.0	71.2	117.0	52
Total Commissioning Time	0.8	15.2	36.2	60.7	729.8	73.9	118.6	52

* ***All commissioning times are reported in hours per year.***

Table A.7.2: Non-Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336*	Continuing medical physics consultation	NA	NA	NA	NA	NA	NA	NA	NA
77295	Therapeutic radiology simulation-aided field testing	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77300	Basic dosimetry calculation	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77301	IMRT treatment planning	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77305	Simple isodose plan	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77310	Intermediate isodose plan	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77315	Complex isodose plan	0.01	0.06	0.15	0.25	0.66	0.18	0.15	50
77321	Simple teletherapy port plan	0.01	0.06	0.15	0.25	0.66	0.18	1.02	49
77326	Simple brachytherapy isodose plan	0.02	0.19	0.38	0.68	4.92	0.73	1.02	49
77327	Intermediate brachytherapy isodose plan	0.02	0.19	0.38	0.68	4.92	0.73	1.02	49
77328	Complex brachytherapy isodose plan	0.02	0.19	0.38	0.68	4.92	0.73	1.02	49
77331	Special dosimetry	0.00	0.09	0.57	1.46	40.80	2.37	6.51	47
77332	Simple treatment device	0.00	0.00	0.02	0.05	0.67	0.04	0.10	45
77333	Intermediate treatment device	0.00	0.01	0.06	0.10	14.50	0.60	2.32	48
77334	Complex treatment device	0.00	0.01	0.02	0.06	0.90	0.09	0.18	51
77370*	Special medical physics consultation	NA	NA	NA	NA	NA	NA	NA	NA
773xx*	IMRT special physics consultation (under consideration)	NA	NA	NA	NA	NA	NA	NA	NA

** Non-procedural tasks are not applicable to CPT codes 77336, 77370, and 77xxx.*

Table A.7.3A: Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	0.20	0.55	1.50	2.23	8.00	1.87	1.71	52
77295	Therapeutic radiology simulation-aided field testing	0.25	0.50	1.00	2.00	8.00	1.63	1.57	51
77300	Basic dosimetry calculation	0.08	0.20	0.25	0.30	3.00	0.33	0.42	53
77301	IMRT treatment planning	1.00	3.88	5.25	8.00	24.00	6.91	5.54	42
77305	Simple isodose plan	0.15	0.25	0.30	0.75	4.00	0.56	0.62	53
77310	Intermediate isodose plan	0.15	0.30	0.50	0.75	3.00	0.62	0.51	53
77315	Complex isodose plan	0.20	0.50	0.50	1.00	4.00	0.86	0.71	53
77321	Simple teletherapy port plan	0.20	0.50	0.75	1.20	6.00	0.99	0.88	53
77326	Simple brachytherapy isodose plan	0.20	0.50	0.75	1.35	10.58	1.11	1.06	52
77327	Intermediate brachytherapy isodose plan	0.20	0.50	1.00	2.00	8.00	1.55	1.49	51
77328	Complex brachytherapy isodose plan	0.50	1.50	2.50	4.00	16.00	3.18	2.85	51
77331	Special dosimetry	0.20	0.75	1.00	2.50	8.00	1.80	1.58	52
77332	Simple treatment device	0.00	0.10	0.10	0.25	1.00	0.19	0.24	52
77333	Intermediate treatment device	0.00	0.20	0.25	0.50	2.00	0.40	0.35	51
77334	Complex treatment device	0.00	0.10	0.25	0.50	2.75	2.75	0.52	52
77370	Special medical physics consultation	1.00	4.00	5.60	8.00	12.00	5.94	2.87	49
773xx	IMRT special physics consultation (under consideration)	3.00	4.00	6.00	9.50	30.00	7.28	5.05	42

Table A.7.3B: Procedural Support Staff Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	NA	NA	NA	NA	NA	NA	NA	NA
77295	Therapeutic radiology simulation-aided field testing	1.25	2.63	3.75	4.75	30.00	4.40	4.34	50
77300	Basic dosimetry calculation	0.00	0.20	0.25	0.50	2.00	0.37	0.32	51
77301	IMRT treatment planning	0.00	1.25	3.00	5.00	14.00	4.06	3.57	36
77305	Simple isodose plan	0.25	0.50	0.75	1.00	3.00	0.99	0.67	51
77310	Intermediate isodose plan	0.20	0.90	1.00	2.00	7.00	1.54	1.24	51
77315	Complex isodose plan	0.25	1.00	2.00	2.50	14.00	2.39	2.27	51
77321	Simple teletherapy port plan	0.25	1.00	2.00	3.00	8.00	2.33	1.67	50
77326	Simple brachytherapy isodose plan	0.00	0.50	1.00	2.00	8.00	1.32	1.27	49
77327	Intermediate brachytherapy isodose plan	0.00	1.00	1.50	2.50	10.00	1.84	1.55	49
77328	Complex brachytherapy isodose plan	0.00	2.00	2.50	4.00	12.00	3.04	2.58	49
77331	Special dosimetry	0.00	0.25	1.00	1.06	4.00	0.90	0.98	45
77332	Simple treatment device	0.00	0.25	0.50	0.71	2.00	0.51	0.40	51
77333	Intermediate treatment device	0.00	0.50	0.67	1.50	3.00	0.94	0.66	52
77334	Complex treatment device	0.00	0.75	1.00	2.00	4.00	1.35	0.79	52
77370	Special medical physics consultation	NA	NA	NA	NA	NA	NA	NA	NA
773xx	IMRT special physics consultation (under consideration)	NA	NA	NA	NA	NA	NA	NA	NA

Table A.7.4: Total QMP Time Estimates (Non-Procedural + Procedural) per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	**Continuing medical physics consultation**	0.20	0.55	1.50	2.23	8.00	1.87	1.71	52
77295	**Therapeutic radiology simulation-aided field testing**	0.29	0.89	1.16	2.11	8.33	1.65	1.42	50
77300	**Basic dosimetry calculation**	0.11	0.29	0.56	0.60	3.15	0.51	0.44	52
77301	**IMRT treatment planning**	1.16	3.91	5.53	8.30	24.16	7.08	5.50	43
77305	**Simple isodose plan**	0.21	0.40	0.54	0.86	4.15	0.74	0.63	51
77310	**Intermediate isodose plan**	0.28	0.47	0.63	0.95	3.00	0.80	0.53	51
77315	**Complex isodose plan**	0.28	0.56	0.83	1.15	4.00	1.04	0.73	51
77321	**Simple teletherapy port plan**	0.26	0.62	1.06	1.34	6.00	1.17	0.90	51
77326	**Simple brachytherapy isodose plan**	0.31	0.75	1.20	2.43	7.92	1.79	1.50	50
77327	**Intermediate brachytherapy isodose plan**	0.31	0.87	1.90	3.15	7.42	2.17	1.57	50
77328	**Complex brachytherapy isodose plan**	0.52	2.12	3.18	4.47	16.35	3.77	2.71	50
77331	**Special dosimetry**	0.29	1.18	1.61	4.85	41.80	4.30	6.73	50
77332	**Simple treatment device**	0.00	0.09	0.17	0.30	1.01	0.25	0.27	49
77333	**Intermediate treatment device**	0.01	0.24	0.36	0.78	15.00	1.00	2.36	51
77334	**Complex treatment device**	0.00	0.19	0.30	0.50	2.81	0.47	0.54	50
77370	**Special medical physics consultation**	1.00	4.00	5.60	8.00	12.00	5.94	2.87	50
773xx	**IMRT special physics consultation (under consideration)**	3.00	4.00	6.00	9.50	30.00	7.28	5.05	44

Table A.7.5: Relative Intensity Estimates for Radiation Oncology Physics Services (Increasing Order of Median Intensity)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77332	Simple treatment device	0.00	0.50	0.70	1.00	2.00	0.73	0.41	53
77336*	Continuing medical physics consultation	1.00	1.00	1.00	1.00	1.00	1.00	0.00	53
77300	Basic dosimetry calculation	0.20	0.50	1.00	1.00	2.00	0.78	0.37	53
77305	Simple isodose plan	0.30	0.75	1.00	1.50	3.00	1.11	0.50	52
77333	Intermediate treatment device	0.30	0.75	1.00	1.50	4.00	1.14	0.62	52
77310	Intermediate isodose plan	0.50	1.00	1.20	1.50	3.50	1.34	.64	52
77334	Complex treatment device	0.00	1.00	1.20	1.63	20.00	1.77	2.79	52
77315	Complex isodose plan	0.80	1.25	1.50	2.00	6.00	1.88	1.05	53
77321	Simple teletherapy port plan	0.50	1.30	1.50	2.00	12.00	2.04	1.75	53
77326	Simple brachytherapy isodose plan	0.50	1.00	1.50	2.00	5.00	1.57	0.83	51
77327	Intermediate brachytherapy isodose plan	0.50	1.50	2.00	2.25	6.00	2.13	1.13	51
77331	Special dosimetry	0.50	1.00	2.00	2.50	4.00	1.83	0.85	53
77295	Therapeutic radiology simulation-aided field testing	1.00	2.00	2.50	3.00	8.00	2.82	1.52	51
77328	Complex brachytherapy isodose plan	1.00	2.00	3.00	4.00	16.00	3.50	2.86	51
77370	Special medical physics consultation	2.00	2.94	3.87	4.51	15.00	4.13	2.26	50
77301	IMRT treatment planning	1.50	3.00	4.50	6.63	24.00	5.43	3.95	43
773xx	IMRT special physics consultation (under consideration)	1.50	3.00	5.00	6.00	36.00	5.86	5.54	43

** CPT code 77336 was selected as the benchmark services for the survey and therefore has an intensity of 1.00. All other service intensities were measured relative to 77336.*

Table A.7.6: QMP Procedural Time Estimates for 77370 Procedures (in Hours)

77370 Procedure	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Routine 77370 procedure	1.00	2.00	3.00	4.00	9.00	3.53	2.07	17
Total skin electron irradiation	0.50	4.38	8.50	10.00	10.00	7.00	3.66	10
Total body irradiation	1.00	3.00	4.50	8.00	10.00	5.23	3.19	13
Electron arc irradiation	12.00	12.00	12.00	12.00	12.00	12.00	0.00	1
Remote afterloading brachytherapy	1.00	2.00	4.50	6.00	10.00	4.50	2.76	14
Stereotactic brachytherapy	4.00	4.75	5.50	7.50	12.00	6.75	3.59	4
Stereotactic radiosurgery (single fraction)	2.00	4.50	8.00	10.75	15.00	8.04	3.84	14
Stereotactic radiotherapy (multiple fractions)	3.00	5.50	7.00	10.00	15.00	8.09	3.70	11
Intraoperative radiotherapy	4.00	4.75	5.50	6.00	6.00	5.25	0.96	4
Prostate seed brachytherapy	3.00	4.63	6.00	9.00	36.00	8.81	8.18	18
Intensity modulated radiation therapy (IMRT)	1.00	7.25	10.00	13.50	40.00	12.59	10.49	11
3-D conformal radiation therapy (non-IMRT)	0.50	1.88	3.75	5.00	10.00	3.78	2.60	16
Endovascular brachytherapy	1.50	2.00	3.00	4.00	10.00	3.33	2.07	15

Table A.7.7: Relative Intensity Estimates for 77370 Procedures

77370 Procedure	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Routine 77370 procedure	2.00	2.25	3.00	3.50	5.00	3.10	1.00	15
Total skin electron irradiation	1.50	2.00	2.50	5.00	5.00	3.11	1.47	9
Total body irradiation	1.00	2.00	3.00	3.00	10.00	3.18	2.41	11
Electron arc irradiation	4.00	4.00	4.00	4.00	4.00	4.00	0.00	1
Remote afterloading brachytherapy	1.50	2.00	2.75	3.00	10.00	3.21	2.24	12
Stereotactic brachytherapy	2.50	3.25	4.00	4.00	4.00	3.50	0.87	4
Stereotactic radiosurgery (single fraction)	3.00	3.00	5.00	6.25	10.00	5.25	2.38	12
Stereotactic radiotherapy (multiple fractions)	3.00	3.00	3.00	4.00	10.00	4.11	2.32	9
Intraoperative radiotherapy	2.00	2.75	3.00	4.75	10.00	4.50	3.70	4
Prostate seed brachytherapy	2.00	2.88	4.00	5.00	10.00	4.13	2.00	16
Intensity modulated radiation therapy (IMRT)	3.00	4.00	6.00	7.00	12.00	6.33	2.96	9
3-D conformal radiation therapy (non-IMRT)	2.00	3.00	3.15	4.75	5.00	3.56	1.11	14
Endovascular brachytherapy	1.00	2.00	2.50	3.00	10.00	3.08	2.21	14

APPENDIX VIII: Work Estimates

Table A.8.1: QMP Work Estimates for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	0.20	0.55	1.50	2.23	8.00	1.87	1.71	51
77295	Therapeutic radiology simulation-aided field testing	0.36	1.52	3.21	5.58	32.00	5.14	6.22	48
77300	Basic dosimetry calculation	0.03	0.17	0.29	0.43	3.15	0.40	0.47	51
77301	IMRT treatment planning	3.47	11.96	18.64	51.71	576.00	54.09	100.45	40
77305	Simple isodose plan	0.13	0.38	0.54	0.82	4.98	0.81	0.87	50
77310	Intermediate isodose plan	0.27	0.49	0.72	1.15	9.00	1.17	1.47	50
77315	Complex isodose plan	0.42	0.83	1.30	2.11	24.00	2.31	3.63	51
77321	Simple teletherapy port plan	0.26	0.93	1.52	2.23	72.00	3.46	10.03	51
77326	Simple brachytherapy isodose plan	0.36	1.07	1.87	2.96	15.84	2.73	2.82	49
77327	Intermediate brachytherapy isodose plan	0.40	1.44	3.53	6.31	18.55	4.52	4.09	48
77328	Complex brachytherapy isodose plan	0.78	4.94	8.67	16.68	130.78	14.31	20.72	48
77331	Special dosimetry	0.43	1.84	3.60	10.08	83.60	8.54	13.76	45
77332	Simple treatment device	0.00	0.06	0.11	0.20	1.01	0.19	0.23	42
77333	Intermediate treatment device	0.01	0.17	0.42	0.95	19.50	1.27	3.29	46
77334	Complex treatment device	0.00	0.16	0.40	0.78	7.03	0.86	1.36	47
77370	Special medical physics consultation	2.85	11.41	20.92	33.35	64.00	24.40	15.03	46
773xx	IMRT special physics consultation (under consideration)	8.75	15.75	24.50	47.50	1,080.00	63.11	168.93	41

Table A.8.2 QMP Work Estimates for Radiation Oncology Physics Services (Relative to 77336 Median)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	**Continuing medical physics consultation**	0.13	0.37	1.00	1.48	5.33	1.25	1.14	51
77295	**Therapeutic radiology simulation-aided field testing**	0.24	1.02	2.14	3.72	21.33	3.43	4.14	48
77300	**Basic dosimetry calculation**	0.02	0.11	0.19	0.29	2.10	0.27	0.32	51
77301	**IMRT treatment planning**	2.32	7.97	12.43	34.48	384.00	36.06	66.97	40
77305	**Simple isodose plan**	0.09	0.26	0.36	0.54	3.32	0.54	0.58	50
77310	**Intermediate isodose plan**	0.18	0.32	0.48	0.77	6.00	0.78	0.98	50
77315	**Complex isodose plan**	0.28	0.55	0.87	1.41	16.00	1.54	2.42	51
77321	**Simple teletherapy port plan**	0.17	0.62	1.02	1.49	48.00	2.31	6.69	51
77326	**Simple brachytherapy isodose plan**	0.24	0.71	1.25	1.97	10.56	1.82	1.88	49
77327	**Intermediate brachytherapy isodose plan**	0.27	0.96	2.35	4.20	12.37	3.01	2.72	48
77328	**Complex brachytherapy isodose plan**	0.52	3.29	5.78	11.12	87.19	9.54	13.81	48
77331	**Special dosimetry**	0.29	1.23	2.40	6.72	55.73	5.69	9.17	45
77332	**Simple treatment device**	0.00	0.04	0.07	0.13	0.68	0.13	0.15	42
77333	**Intermediate treatment device**	0.01	0.12	0.28	0.63	13.00	0.85	2.20	46
77334	**Complex treatment device**	0.00	0.11	0.27	0.52	4.69	0.57	0.90	47
77370	**Special medical physics consultation**	1.90	7.60	13.95	22.23	42.67	16.27	10.02	46
773xx	**IMRT special physics consultation (under consideration)**	5.83	10.50	16.33	31.67	720.00	42.08	112.62	41

Table A.8.3 QMP Work Estimates for Radiation Oncology Physics Services (Relative to 77336 Median): Weighted by Census Division Region (Based on 2000 AAPM Professional Information Survey)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	0.13	0.40	1.00	1.55	5.33	1.32	1.20	51
77295	Therapeutic radiology simulation-aided field testing	0.24	1.02	2.18	4.24	21.33	3.62	4.24	48
77300	Basic dosimetry calculation	0.02	0.12	0.20	0.33	2.10	0.30	0.35	51
77301	IMRT treatment planning	2.32	8.22	16.38	45.49	384.00	42.24	75.30	40
77305	Simple isodose plan	0.09	0.26	0.35	0.56	3.32	0.59	0.63	50
77310	Intermediate isodose plan	0.18	0.32	0.50	0.77	6.00	0.84	1.07	40
77315	Complex isodose plan	0.31	0.76	1.01	1.89	16.00	1.70	2.71	51
77321	Simple teletherapy port plan	0.17	0.55	1.02	1.53	48.00	2.69	7.62	51
77326	Simple brachytherapy isodose plan	0.24	0.86	1.25	1.97	10.56	1.74	1.60	49
77327	Intermediate brachytherapy isodose plan	0.27	1.02	2.47	4.15	12.37	2.98	2.45	48
77328	Complex brachytherapy isodose plan	0.52	3.48	6.21	11.19	87.19	10.35	13.39	48
77331	Special dosimetry	0.29	1.23	2.68	6.72	55.73	5.58	9.00	45
77332	Simple treatment device	0.00	0.04	0.07	0.17	0.68	0.14	0.17	42
77333	Intermediate treatment device	0.01	0.19	0.33	0.71	13.00	0.98	2.27	46
77334	Complex treatment device	0.00	0.15	0.27	0.54	4.69	0.68	1.10	47
77370	Special medical physics consultation	1.90	8.00	13.89	22.53	42.67	16.56	10.00	46
773xx	IMRT special physics consultation (under consideration)	5.83	11.67	18.67	31.67	720.00	46.50	127.97	41

APPENDIX IX: Caseload and Staffing Estimates

Table A.9.1: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Overall

Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Patient caseload of institution for the most recent year for which data were available:								
Number of new patients (teletherapy and brachytherapy) treated	140	520	923	1,363	4,249	1,050	737	52
Number of total patients (teletherapy and brachytherapy) treated at institution	310	626	1,080	1,594	4,809	1,288	926	48
Percentage of total patients treated on most heavily utilized teletherapy unit	10%	30%	48%	74%	100%	53%	28%	45
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	42.9	215.9	325.3	416.4	850.0	335.1	175.4	49
Number of patient treatments done on most heavily utilized teletherapy unit	300	3,098	7,400	9,015	24,333	6,895	4,744	44
Number of teletherapy patient treatments at institution	400	8,467	17,005	31,000	90,000	21,615	18,658	47
Number of FTE staff employed by institution								
Medical physicists	0.5	2.0	3.5	5.7	16.0	4.2	3.0	53
Radiation oncologists	1.0	2.0	4.0	8.0	25.0	5.6	4.6	53
Dosimetrists or junior medical physicists	0.0	1.5	2.5	5.0	20.0	3.6	3.5	53
Physics assistants	0.0	0.0	0.0	1.0	6.0	0.8	1.3	52
Brachytherapy technologists	0.0	0.0	0.0	0.0	3.0	0.3	0.7	50
Maintenance engineers	0.0	0.0	1.0	1.0	6.0	1.0	1.4	52
Radiation therapists	0.6	4.5	7.0	14.0	46.0	10.6	9.0	53
Radiation oncologist nurses	1.0	1.5	2.8	5.0	9.0	3.1	2.1	40

Table A.9.2: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Private/Community Hospitals

Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Patient caseload of institution for the most recent year for which data were available:								
Number of new patients (teletherapy and brachytherapy) treated	270	401	639	975	2,557	809	570	20
Number of total patients (teletherapy and brachytherapy) treated at institution	310	450	816	1,175	3,393	982	740	18
Percentage of total patients treated on most heavily utilized teletherapy unit	33%	44%	58%	93%	100%	65%	25%	16
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	100.5	330	366.7	484.7	850.0	412.2	196.7	18
Number of patient treatments done on most heavily utilized teletherapy unit	410	3,112	6,921	8,147	14,000	6,324	3,943	16
Number of teletherapy patient treatments at institution	400	7,927	10,502	20,300	65,933	15,208	15,326	17
Number of FTE staff employed by institution								
Medical physicists	1.0	1.0	2.0	3.6	7.0	2.6	1.7	20
Radiation oncologists	1.0	2.0	2.8	4.0	11.0	3.3	2.3	20
Dosimetrists or junior medical physicists	0.0	1.0	1.9	2.6	10.0	2.5	2.4	20
Physics assistants	0.0	0.0	0.0	1.0	1.4	0.4	0.5	20
Brachytherapy technologists	0.0	0.0	0.0	0.0	1.0	0.1	0.2	19
Maintenance engineers	0.0	0.0	0.0	0.8	4.0	0.5	1.0	19
Radiation therapists	3.0	4.4	6.0	10.6	27.0	8.8	6.4	20
Radiation oncologist nurses	1.0	1.0	1.6	2.0	7.0	2.1	1.6	13

Table A.9.3: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Medical School/University Hospital

Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Patient caseload of institution for the most recent year for which data were available:								
Number of new patients (teletherapy and brachytherapy) treated	351	959	1,325	1,538	4,249	1,390	799	23
Number of total patients (teletherapy and brachytherapy) treated at institution	488	1,094	1,500.0	2,029	4,809	1,708	1,014	22
Percentage of total patients treated on most heavily utilized teletherapy unit	10%	25%	30%	43%	100%	41%	28%	20
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	42.9	210.8	257.5	343.8	533.3	274.6	115.2	22
Number of patient treatments done on most heavily utilized teletherapy unit	300	1,540	7,500	9,765	24,333	7,325	6,081	19
Number of teletherapy patient treatments at institution	544	16,000	28,000	37,422	90,000	29,309	20,953	21
Number of FTE staff employed by institution								
Medical physicists	1.5	3.9	5.4	7.6	16.0	6.0	3.3	24
Radiation oncologists	1.0	5.0	7.5	10.0	25.0	8.1	5.0	24
Dosimetrists or junior medical physicists	0.0	2.5	4.0	6.3	20.0	4.9	4.1	24
Physics assistants	0.0	0.0	1.0	2.0	6.0	1.4	1.6	23
Brachytherapy technologists	0.0	0.0	0.0	0.9	3.0	0.5	1.0	22
Maintenance engineers	0.0	1.0	1.0	1.6	6.0	1.7	1.5	24
Radiation therapists	1.0	6.0	10.5	16.0	46.0	13.0	10.4	24
Radiation oncologist nurses	1.5	3.0	4.5	5.0	9.0	4.3	2.0	19

Table A.9.4: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Medical Physics Consulting Group

Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Patient caseload of institution for the most recent year for which data were available:								
Number of new patients (teletherapy and brachytherapy) treated	140	260	425	559	587	394	212	4
Number of total patients (teletherapy and brachytherapy) treated at institution	350	373	465	578	663	486	147	4
Percentage of total patients treated on most heavily utilized teletherapy unit	67%	69%	78%	89%	100%	81%	15%	4
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	220.0	317.5	396.0	521.5	760.0	443.0	230.1	4
Number of patient treatments done on most heavily utilized teletherapy unit	1,800	5,418	6,812	7,250	8,000	5,856	2,766	4
Number of teletherapy patient treatments at institution	1,800	5,700	8,443	10,540	12,500	7,797	4,586	4
Number of FTE staff employed by institution								
Medical physicists	0.5	0.9	1.3	1.8	2.5	1.4	0.9	4
Radiation oncologists	1.0	1.0	1.5	2.0	2.0	1.5	0.6	4
Dosimetrists or junior medical physicists	0.0	0.8	1.3	1.5	1.6	1.0	0.7	4
Physics assistants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
Brachytherapy technologists	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
Maintenance engineers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
Radiation therapists	2.0	2.4	3.8	5.5	7.0	4.1	2.3	4
Radiation oncologist nurses	1.0	1.0	1.3	1.6	2.0	1.4	0.5	4

Table A.9.5: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Physician Group

Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Patient caseload of institution for the most recent year for which data were available:								
Number of new patients (teletherapy and brachytherapy) treated	295	561	833	1,186	1,700	915	600	4
Number of total patients (teletherapy and brachytherapy) treated at institution	635	728	1,019	1,456	1,983	1,164	614	4
Percentage of total patients treated on most heavily utilized teletherapy unit	18%	33%	44%	50%	50%	39%	15%	4
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	68.2	149.6	194.2	277.3	474.1	232.7	172.1	4
Number of patient treatments done on most heavily utilized teletherapy unit	7,000	7,713	7,975	8,438	9,750	8,175	1,146	4
Number of teletherapy patient treatments at institution	16,000	16,038	17,275	23,513	38,550	22,275	10,913	4
Number of FTE staff employed by institution								
Medical physicists	2.2	2.6	2.9	4.3	8.0	4.0	2.7	4
Radiation oncologists	3.0	3.8	4.0	6.5	14.0	6.3	5.2	4
Dosimetrists or junior medical physicists	2.0	2.0	2.0	3.8	9.0	3.8	3.5	4
Physics assistants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
Brachytherapy technologists	0.0	0.0	0.0	0.3	1.0	0.3	0.5	4
Maintenance engineers	0.0	0.0	0.0	0.3	1.0	0.3	0.5	4
Radiation therapists	0.6	5.4	7.5	14.0	32.0	11.9	13.8	4
Radiation oncologist nurses	2.0	2.5	3.0	4.0	5.0	3.3	1.5	3

APPENDIX X: Service Volumes

Table A.10.1: Service Volumes for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	510	2,293	3,100	5,581	16,000	4,494	3,441	51
77295	Therapeutic radiology simulation-aided field testing	0	168	421	711	2,500	570	577	52
77300	Basic dosimetry calculation	38	1,072	2,484	4,675	15,000	3,683	3,630	52
77305	Simple isodose plan	0	8	68	119	700	104	144	52
77310	Intermediate isodose plan	0	5	50	163	1,300	136	233	49
77315	Complex isodose plan	5	269	450	761	2,000	580	487	51
77321	Simple teletherapy port plan	0	2	58	200	728	143	188	51
77326	Simple brachytherapy isodose plan	0	3	10	23	350	27	58	50
77327	Intermediate brachytherapy isodose plan	0	3	15	45	280	36	54	52
77328	Complex brachytherapy isodose plan	0	25	71	202	656	125	104	52
77331	Special dosimetry	0	31	114	524	8,600	765	1.642	52
77332	Simple treatment device	0	52	150	250	800	209	219	52
77333	Intermediate treatment device	0	30	132	250	1,266	189	241	52
77334	Complex treatment device	0	872	1,833	3,965	14,000	2,988	3,180	52
77370	Special medical physics consultation	0	37	132	367	1,560	233	284	52

Note: Two codes (77301 and 773xx) are not included in Table A.10. An insufficient number of respondents reported providing either service, rendering any service volume statistics for these two services suspect.

Table A.10.2: Service Volumes per QMP for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing medical physics consultation	200.0	809.7	1,100.0	1,532.0	4,000.0	1,279.6	771.8	51
77295	Therapeutic radiology simulation-aided field testing	0.0	62.7	122.5	187.6	4,400.0	222.9	602.7	52
77300	Basic dosimetry calculation	12.7	431.9	906.5	1,265.9	8,400.0	1,031.7	1,186.2	52
77305	Simple isodose plan	0.0	1.7	18.8	48.0	300.0	33.0	51.1	52
77310	Intermediate isodose plan	0.0	0.9	16.3	48.2	400.0	43.9	75.1	49
77315	Complex isodose plan	1.7	75.0	133.3	214.5	1,700.0	187.8	239.3	51
77321	Simple teletherapy port plan	0.0	0.8	20.0	51.7	400.0	39.0	62.5	51
77326	Simple brachytherapy isodose plan	0.0	0.5	2.5	7.0	70.0	7.3	12.8	50
77327	Intermediate brachytherapy isodose plan	0.0	1.0	4.8	9.1	70.0	8.8	13.5	52
77328	Complex brachytherapy isodose plan	0.0	7.1	23.4	46.0	149.3	30.2	30.6	52
77331	Special dosimetry	0.0	8.8	31.0	187.2	1,440.0	194.5	354.1	52
77332	Simple treatment device	0.0	13.0	40.0	85.0	800.0	79.1	125.0	52
77333	Intermediate treatment device	0.0	5.1	34.0	94.4	850.0	77.1	137.7	52
77334	Complex treatment device	0.0	303.9	719.6	1,042.6	3,000.0	755.3	562.9	52
77370	Special medical physics consultation	0.0	13.5	31.3	90.4	346.7	61.1	71.8	52

Note: Two codes (77301 and 773xx) are not included in Table A.11. An insufficient number of respondents reported providing either service, rendering any service volume per QMP statistics for these two services suspect.