

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

Final Report

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

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

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

Internal Review

Project Director

Technical Reviewer

Management Reviewer

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Section 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) specializing in medical therapy are the professionals responsible for maintaining the equipment used to provide radiation therapy to patients 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 2007* 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 in conjunction with their support staffs. It is these 77300 series codes, along with 77295 ("Therapeutic Radiology Simulation-Aided Field Setting, Three-Dimensional") and 77781-77784 ("High Intensity Brachytherapy," one to four, five to eight, nine to 12, or over 12 dwell positions) 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 the many changes in medical physics practice and technology, the ACMP and AAPM engaged Abt Associates Inc. to conduct a second study measuring QMP work for medical physics services, including a relative work value scale depicting the amount of QMP work required for each medical physics service, was completed in 2003.³ This current Abt Associates, Inc. study is the third QMP medical physics services work study commissioned by the ACMP and the AAPM.

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

¹ American College of Medical Physic and American Association of Physicist in Medicine: *Scope of Practice of Medical Physics*, November, 2005, Policy Number 17-A, www.aapm.org/policies.

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.

³ Abt Associates, Inc., *The Abt Study for Medical Physicist Work Values for Radiation Oncology Physics Services: Round II*, prepared for the American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM), June, 2003 (referred to in this report as Abt Associates Inc., 2003).

- 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 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 report describes the Abt study’s (2007) 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.

Section Two: Methodology

This section discusses Abt’s methodology for measuring QMP relative work values for radiation oncology physics services. The methodology in this third study replicated that of the first two studies. A four-member Technical Consulting Panel (TCP) reviewed the survey instrument and other survey materials used in the first two studies and proposed a series of changes and updates (e.g., including new physics CPT codes as well as revising the list of special procedures and technologies). The TCP then met in person to discuss and finalize the survey instrument. The survey was then sent to a purposive sample of 100 QMP practices that varied by region of the country and practice type (i.e., medical school/university (MSU), private/community hospital (PCH), medical physics consulting group (MPCG), and medical (physician) group (MPG)). Returned surveys were then entered into a project database and analyzed as described below.

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 Scale Update Committee (AMA/RUC) continues to define professional work as the product of a professional’s time and intensity. These sample concepts were applied to the 20 medical physics services analyzed in this study (see **Table 1** below).

This study divided QMP work into two parts – *non-procedural* and *procedural time*. 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 and 77370). Procedural time is the time a QMP spends in support of patients during treatment; there is no 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 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 studies (Abt Associates Inc., 1995, Abt Associates, Inc., 2003), 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 1: Radiation Oncology Physics Codes Studied in the Abt Survey

CPT Code	Description
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 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, 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)
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
77781	High intensity brachytherapy, one (1) to four (4) dwell positions
77782	High intensity brachytherapy, five (5) to eight (8) dwell positions
77783	High intensity brachytherapy, nine (9) to 12 dwell positions
77784	High intensity brachytherapy, over 12 dwell positions

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

$$\text{QMP Work (W)} = \text{Time (T)} * \text{Intensity (I)}$$

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 first 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 Scale 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.

In the second study (Abt Associates, 2003), a second four person QMP TCP was convened. That panel reviewed and updated the service vignettes, survey instrument and other survey materials and reviewed and approved the study's methodology.

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 four new codes – 77781, 77782, 77783, and 77784. The revised medical physics service vignettes used during the current study are presented in **Appendix III**.

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 studies (Abt Associates Inc., 1995 and 2003) 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 2006 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.⁴

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 and 2003) surveys as much as possible. A copy of the current survey instrument is presented in **Appendix IV**. The current survey is composed of the same six sections as the previous survey:

⁴ The 2006 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.

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;
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 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, 77328, 77781, 77782, 77783, and 77784);
- 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. Two services – 77336 and 77370 were not included in the non-procedural time section of the survey instrument, because these two 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. Practices that had not responded to the survey were then repeatedly contacted by phone by AAPM staff and asked to complete and return their surveys. 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 members were available by phone for responding QMPs to ask questions about the survey materials or for clarification of specific survey questions.

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 (25th and 75th 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 two consultation codes 77336 and, 77370 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 $1,000 \text{ hours} / 3,000 \text{ units} = 1/3 \text{ hour per unit per service}$ 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.⁵

The intensity (relative to the 77336 benchmark code) and total time estimates were then multiplied together to yield raw work values. Median raw work estimates were then calculated for each code. An additional set of normalized median work estimates were calculated by dividing each median raw work estimate by median raw work estimate for the benchmark code.

⁵ 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.

Section Three: 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

Forty-one (41) of the 100 QMP practices provided a survey response, yielding a response rate of 41 percent. This compares to 70 (1995) and 53 (2003) percent response rates from the two previous Abt surveys.⁶ There were no significant differences in the practice type distribution between those responding to the survey and the results from the 2006 AAPM Professional Information Survey (see **Table 2**). **Table 3** provides the number and percentage of survey respondents by state and census division region, while **Table 4** presents a comparison of the distribution by census division region of survey respondents and respondents to the 2006 AAPM Professional Information Survey.⁷ There were no significant differences between the 2007 Survey Population and the 2006 AAPM Professional Information Survey in the distribution of practices by region or census division region.

**Table 2:
Responding Medical Physicist Practice Type Distribution**

Practice Type	Number of Respondents	% of Total Abt Survey Sample	% of 2006AAPM Professional Information Survey	Significant Difference (5% Level, 2-Tailed Test)
Private/Community Hospital	19	46.3%	46.0%	No
Medical School/University Hospital	13	31.7	36.1	No
Medical Physics Consulting Group	5	12.2	9.5	No
Medical (Physician) Group	4	9.8	8.4	No

⁶ Declining response rates of surveys of medical professionals are becoming more and more common, in parts because more and more surveys continue to be conducted. Respondents may be beginning to suffer from “survey fatigue” and become more reluctant to participate.

⁷ The 2006 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 3:
Survey Respondent Distribution by Census Region/Division Region and State**

State	Number of Respondents	% of Respondents	State	Number of Respondents	% of Respondents
Northeast	11	26.8%	South	20	34.1%
New England	6	14.6	South Atlantic	7	17.1
Maine	1	2.4	Delaware	0	0.0
New Hampshire	0	0.0	District of Columbia	0	0.0
Vermont	1	2.4	Maryland	0	0.0
Massachusetts	2	4.9	Virginia	0	0.0
Connecticut	1	2.4	West Virginia	0	0.0
Rhode Island	1	2.4	North Carolina	1	2.4
Mid Atlantic	5	12.2	South Carolina	1	2.4
New York	2	4.9	Georgia	1	2.4
Pennsylvania	2	4.9	Florida	4	9.8
New Jersey	1	2.4	East South Central	3	7.3
Midwest	8	19.5	Kentucky	2	4.9
East North Central	5	12.2	Tennessee	0	0.0
Ohio	1	2.4	Alabama	0	0.0
Indiana	0	0.0	Mississippi	1	2.4
Michigan	1	2.4	West South Central	4	9.8
Illinois	2	4.9	Arkansas	0	0.0
Wisconsin	1	2.4	Louisiana	1	0.0
West North Central	3	7.3	Oklahoma	1	0.0
Minnesota	1	2.4	Texas	2	4.9
Iowa	0	0.0	West	8	19.5
Missouri	1	2.4	Mountain	4	9.8
North Dakota	0	0.0	Montana	1	2.4
South Dakota	0	0.0	Wyoming	0	0.0
Nebraska	1	2.4	Colorado	1	2.4
Kansas	0	0.0	New Mexico	1	2.4
Unknown	0	0.0	Idaho	0	0.0
Thirty (30) of 51 states and District of Columbia represented. Note: Forty-four (44) of 51 states and the District of Columbia were represented in the 2006 AAPM Professional Information Survey.			Utah	0	0.0
			Arizona	1	2.4
			Nevada	0	0.0
			Pacific	4	9.8
			Alaska	0	0.0
			Washington	0	0.0
			Oregon	1	2.4
			California	3	7.3
			Hawaii	0	0.0

Table 4:
Comparison: Percentages of Respondents to Abt and 2006 AAPM Professional Information Survey: Region and Census Division Region

Region or Census Division Region	Abt Survey %	2006AAPM Survey %	Significant Difference (5% Level, 2-Tailed Test)
Northeast	26.8	24.1%	No
New England	14.6	7.4	No
Mid Atlantic	12.2	16.7	No
Midwest	19.5	26.2	No
East North Central	12.2	19.2	No
West North Central	7.3	7.1	No
South	34.1	33.6	No
South Atlantic	17.1	18.4	No
East South Central	7.3	5.2	No
West South Central	9.8	9.9	No
West	19.5	16.2	No
Mountain	9.8	3.5	No
Pacific	9.8	12.7	No
Unknown	0.0	0.0	No

Time, Intensity, and QMP Work Estimates

QMP non-procedural and procedural and total (non-procedural plus procedural) time estimates are provided in **Tables 5A, 5B, and 5C 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 V**. For comparison, time estimates from previous (1995 and 2003) and current (2007) surveys are provided. Please note that the non-procedural QMP time estimates are identical for 77295-77321 and for 77326-77328 (or 77326-77784) in each year, because these non-procedural time estimates were calculated for each of the two groups of codes.

The QMP non-procedural median time estimate for radiation field testing, dosimetry, and isodose plans (77295-77321) for 2007 (0.25 hours) was between the values for the two previous surveys (0.15 hours in 2003 and 0.38 hours in 1995). For brachytherapy (77326-77784), the median non-procedural time estimate in 2007 (0.90 hours) was much closer to the value for the first survey (0.83 hours in 1995) than in the second survey (0.38 hours in 2003). Interestingly, the QMP non-procedural median time estimate for special dosimetry (77331) has consistently fallen over time, from 1.15 hours in the 1995 survey to 0.35 hours in the 2007 survey. Median non-procedural QMP time estimates for treatment devices (77332, 77333, and 77334) were all quite low but similar across the three surveys.

Sixteen (16) of the 20 CPT codes included in the 2007 survey can have their QMP median procedural time estimates compared with the two previous surveys (codes 77781-77784 were codes new to the 2007 survey). Of the 16 codes, six (6) had QMP procedural time estimates that were identical in 2003 and 2007, and another three had differences of 20 percent or less in absolute value from 2003 to 2007. Only two codes had changes of more than 50 percent from 2003 to 2007 – intermediate

brachytherapy isodose plan, whose QMP median procedural time estimate increased from 1.00 hours in 2003 (and 1995) to 1.75 hours in 2007, and simple treatment device (77332) whose QMP median procedural time estimate declined from 0.10 hours in 2003 (and 1995) to 0.00 hours by 2007.

Total (non-procedural plus procedural) QMP median time estimates are presented in Table 5.C. While the differences in the total QMP time estimates between the 2003 and 2007 surveys tended to be larger in absolute value than those for procedural time alone, many of the differences remained small. Of the 16 CPT codes that could be compared, four (4) had differences of less than 10 percent and an additional three (3) had differences of less than 20 percent in absolute value between 2003 and 2007. Of the two codes whose median total QMP time differed by more than 50 percent in absolute value between the 2003 and 2007 surveys, both 2007 medians became closer (in absolute percentage differences) to the values from the first survey (1995):

- Simple brachytherapy isodose plan (77326) – the total median QMP time estimates were 2.13 hours in 1995, 1.20 hours in 2003, and 2.52 hours in 2007; and
- Complex brachtherapy isodose plan (77328) – the total median QMP time estimates were 3.87 hours in 1995, 3.18 hours in 2003, and 4.78 hours in 2007.

Fully ten (10) of the 16 CPT codes had median total QMP time differences of less than 20 percent in absolute value terms for the 1995 and 2007 surveys.

Table 5A:
Median QMP Non-Procedural Time (in Hours) for Surveyed Radiation Oncology Physics Services

CPT Code	Procedure Description	1995 Abt Survey	2003 Abt Survey	2007 Abt Survey
77295	Therapeutic radiology simulation-aided field testing	NA	0.15	0.25
77300	Basic dosimetry calculation	0.38	0.15	0.25
77301	IMRT treatment planning	NA	0.15	0.25
77305	Simple isodose plan	0.38	0.15	0.25
77310	Intermediate isodose plan	0.38	0.15	0.25
77315	Complex isodose plan	0.38	0.15	0.25
77321	Simple teletherapy port plan	0.38	0.15	0.25
77326	Simple brachytherapy isodose plan	0.83	0.38	0.90
77327	Intermediate brachytherapy isodose plan	0.83	0.38	0.90
77328	Complex brachytherapy isodose plan	0.83	0.38	0.90
77781	High intensity brachytherapy, 1-4 dwell positions	NA	NA	0.90
77782	High intensity brachytherapy, 5-8 dwell positions	NA	NA	0.90
77783	High intensity brachytherapy, 9-12 dwell positions	NA	NA	0.90
77784	High intensity brachytherapy, 12 or more dwell positions	NA	NA	0.90
77331	Special dosimetry	1.15	0.57	0.35
77332	Simple treatment device	0.01	0.02	0.02
77333	Intermediate treatment device	0.01	0.06	0.05
77334	Complex treatment device	0.04	0.02	0.02

**Table 5B:
Median QMP Procedural Time (in Hours) for Surveyed Radiation Oncology Physics Services**

CPT Code	Procedure Description	1995 Abt Survey	2003 Abt Survey	2007 Abt Survey
77295	Therapeutic radiology simulation-aided field testing	NA	1.00	1.00
77300	Basic dosimetry calculation	0.17	0.25	0.25
77301	IMRT treatment planning	NA	5.25	4.00
77305	Simple isodose plan	0.25	0.30	0.33
77310	Intermediate isodose plan	0.40	0.50	0.50
77315	Complex isodose plan	0.50	0.50	0.50
77321	Simple teletherapy port plan	0.70	0.75	0.60
77326	Simple brachytherapy isodose plan	1.00	0.75	1.00
77327	Intermediate brachytherapy isodose plan	1.00	1.00	1.75
77328	Complex brachytherapy isodose plan	3.00	2.50	3.00
77781	High intensity brachytherapy, 1-4 dwell positions	NA	NA	1.50
77782	High intensity brachytherapy, 5-8 dwell positions	NA	NA	2.50
77783	High intensity brachytherapy, 9-12 dwell positions	NA	NA	3.25
77784	High intensity brachytherapy, over 12 dwell positions	NA	NA	2.50
77331	Special dosimetry	1.50	1.00	1.00
77332	Simple treatment device	0.10	0.10	0.00
77333	Intermediate treatment device	0.25	0.25	0.25
77334	Complex treatment device	0.25	0.25	0.17
77336	Continuing medical physics consultation	1.50	1.50	1.00
77370	Special medical physics consultation	4.00	5.60	3.43

**Table 5C:
Median QMP Total (Non-Procedural and Procedural) Time (in Hours)
for Surveyed Radiation Oncology Physics Services**

CPT Code	Procedure Description	1995 Abt Survey	2003 Abt Survey	2007 Abt Survey
77295	Therapeutic radiology simulation-aided field testing	NA	1.16	1.18
77300	Basic dosimetry calculation	0.63	0.56	0.55
77301	IMRT treatment planning	NA	5.53	4.53
77305	Simple isodose plan	0.82	0.54	0.69
77310	Intermediate isodose plan	0.93	0.63	0.78
77315	Complex isodose plan	1.15	0.83	0.98
77321	Simple teletherapy port plan	1.21	1.06	1.07
77326	Simple brachytherapy isodose plan	2.13	1.20	2.52
77327	Intermediate brachytherapy isodose plan	2.45	1.90	2.70
77328	Complex brachytherapy isodose plan	3.87	3.18	4.78
77781	High intensity brachytherapy, 1-4 dwell positions	NA	NA	2.70
77782	High intensity brachytherapy, 5-8 dwell positions	NA	NA	3.79
77782	High intensity brachytherapy, 9-12 dwell positions	NA	NA	4.79
77784	High intensity brachytherapy, over 12 dwell positions	NA	NA	3.43
77331	Special dosimetry	2.76	1.61	2.06
77332	Simple treatment device	0.11	0.17	0.13
77333	Intermediate treatment device	0.30	0.36	0.34
77334	Complex treatment device	0.34	0.30	0.24
77336	Continuing medical physics consultation	1.50	1.50	1.00
77370	Special medical physics consultation	4.00	5.60	3.45

Median relative intensity estimates ranked in increasing (2007) order of intensity for the 1995, 2003, and 2007 surveys are presented in **Table 6**. Of the 15 CPT codes that can be compared (Continuing medical physics consultation is the reference code whose relative intensity is set at 1.00 in each survey), eight (8) have equal relative intensities in 2003 and 2007, while another five (5) have relative intensities that differed less than 20 percent between 2003 and 2007. Similarly, five (5) of the 15 CPT codes had identical relative intensities in 1995 and 2007, while six more had relative intensities within 20 percent of each other in 1995 and 2007. There were no differences of more than one third in the relative intensity medians for any code between 2003 and 2007.

Table 6: Median Relative Intensity Estimates for Surveyed Radiation Oncology Physics Services (Increasing Order of Intensity (2007))

CPT Code	Procedure Description	Median Relative Intensity: 1995	Median Relative Intensity: 2003	Median Relative Intensity: 2007
77332	Simple treatment device	0.50	0.70	0.70
77300	Basic dosimetry calculation	0.50	1.00	1.00
77333	Intermediate treatment device	1.00	1.00	1.00
77336*	Continuing medical physics consultation	1.00	1.00	1.00
77305	Simple isodose plan	1.00	1.00	1.00
77334	Complex treatment device	1.23	1.20	1.00
77310	Intermediate isodose plan	1.30	1.20	1.28
77315	Complex isodose plan	1.55	1.50	1.50
77321	Simple teletherapy port plan	1.50	1.50	1.50
77331	Special dosimetry	2.00	2.00	1.65
77295	Therapeutic radiology simulation-aided field testing	NA	2.50	2.00
77326	Simple brachytherapy isodose plan	1.50	1.50	2.00
77327	Intermediate brachytherapy isodose plan	1.95	2.00	2.00
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	NA	NA	2.00
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	NA	NA	2.50
77328	Complex brachytherapy isodose plan	3.00	3.00	3.00
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	NA	NA	3.00
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	NA	NA	3.00
77370	Special medical physics consultation	3.10	3.87	3.38
77301	IMRT treatment planning	NA	4.50	6.00

* 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, 2003 and 2007, including estimates where median work for the reference code (77336) has been normalized to 1.00. Comparing the normalized median work estimates for 2003 and 2007, there are a considerable number of differences of more than 50 percent in absolute value, including:

- Basic dosimetry calculation (77300): 158% increase (from 2003 to 2007);
- IMRT treatment planning (77301): 131% increase;
- Simple isodose plan (77305): 92% increase;
- Intermediate isodose plan (77310): 73% increase;
- Complex isodose plan (77315): 90% increase;
- Simple teletherapy port plan (77321): 61% increase;
- Simple brachytherapy isodose plan (77326): 210% increase;
- Intermediate brachytherapy isodose plan (77327): 140% increase;
- Complex brachytherapy isodose plan (77328): 107% increase;
- Simple treatment device (77332): 71% increase; and
- Complex treatment device (77334): 67% increase.

There were only three CPT codes with differences in normalized median work values of less than 20 percent between 2003 and 2007.

Two factors appear to account for the large differences in normalized median work values between 2003 and 2007. First, the median work value (not normalized) for the reference code, continuing medical physics consultation (77336), decreased from 1.50 in 2003 (and 1995) to 1.00 by 2007.⁸ The second factor is that median work value estimates in 2007 are reverting more closely to values from the 1995 survey.

⁸ An argument may be made for the median work value for medical physics consultations (77336) to either increase or decrease over time. As the intensity of the average mix of services provided by medical physicists increases, treatment plans could become more complex, increasing the work associated with a medical physics consultation. Conversely, improvements in technology, most notably the diffusion of electronics record keeping, may make it easier to conduct a medical physics consultation. Instead of having to gather numerous paper records and inspect films, with an electronic records keeping system, a medical physicist can access all these records at once, saving time and work.

**Table 7:
QMP Work Estimates for Surveyed Radiation Oncology Services**

CPT Code	Procedure Description	1995	2003	2007
		Median Survey Work Estimate	Median Survey Work Estimate	Median Survey Work Estimate
77295	Therapeutic radiology simulation-aided field testing	NA	3.21	1.63
77300	Basic dosimetry calculation	0.33	0.29	0.49
77301	IMRT treatment planning	NA	18.64	28.66
77305	Simple isodose plan	0.75	0.54	0.69
77310	Intermediate isodose plan	1.24	0.72	0.83
77315	Complex isodose plan	1.69	1.30	1.65
77321	Simple teletherapy port plan	1.81	1.52	1.64
77326	Simple brachytherapy isodose plan	3.18	1.87	3.88
77327	Intermediate brachytherapy isodose plan	4.73	3.53	5.64
77328	Complex brachytherapy isodose plan	11.67	8.67	11.98
77781	High intensity brachytherapy, 1-4 dwell positions	NA	NA	5.72
77782	High intensity brachytherapy, 5-8 dwell positions	NA	NA	10.34
77783	High intensity brachytherapy, 9-12 dwell positions	NA	NA	14.67
77784	High intensity brachytherapy, over 12 dwell positions	NA	NA	13.85
77331	Special dosimetry	4.35	3.60	2.66
77332	Simple treatment device	0.06	0.11	0.12
77333	Intermediate treatment device	0.31	0.42	0.30
77334	Complex treatment device	0.39	0.40	0.45
77336	Continuing medical physics consultation	1.50	1.50	1.00
77370	Special medical physics consultation	15.00	20.92	13.94

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. 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 2006 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.⁹

All 20 codes had differences of less than 20 percent. Six (6) of the 20 codes had identical weighted and unweighted normalized median work estimates, and 14 of the 20 codes had differences of less than 10 percent. Weighting does not significantly affect the findings. Given that unweighted work values were presented in both earlier studies, it was decided to focus on unweighted work value estimates in 2007 as well.

⁹ One other anomaly was the median work values for high intensity brachytherapy (codes 77781, 77782, 77783, and 77784). One would expect the median work values to increase from code 77781 through 77784, because the number of dwell positions increases. While median work values increase from 77781 to 77782 and from 77782 to 77783, the median work value for 77784 is lower than for 77783. One explanation for the decrease is that the number of responding practices for 77784 (29) was one fewer than for 77783 (30). If the "missing" practice for code 77784 reported a work value higher than the current median (13.85), it is likely that the median work value for 77784 would have increased above the median work value for 77783 (14.34).

**Table 8:
Normalized Median Unweighted and Weighted Work Values (77336 Normalized to 1.00): 2007**

CPT Code	Procedure Description	Unweighted	Weighted	(Weighted - Unweighted)/Unweighted %
77336	Continuing Medical Physics Consultation	1.00	1.00	0.0%
77300	Basic Dosimetry Plan	0.49	0.50	2.0
77305	Simple Isodose Plan	0.69	0.73	5.8
77310	Intermediate Isodose Plan	0.83	0.85	2.4
77315	Complex Isodose Plan	1.65	1.64	-0.6
77321	Special Teletherapy Port Plan	1.64	1.64	0.0
77326	Simple Brachytherapy Isodose Plan	3.88	4.20	8.2
77327	Intermediate Brachytherapy Isodose Plan	5.64	5.63	-0.2
77328	Complex Brachytherapy Isodose Plan	11.98	11.98	0.0
77331	Special Dosimetry	2.66	3.10	16.5
77332	Simple Treatment Device	0.12	0.11	-8.3
77333	Intermediate Treatment Device	0.30	0.30	0.0
77334	Complex Treatment Device	0.45	0.41	-8.9
77370	Special Medical Physics Consultation	13.94	13.94	0.0
77295	Therapeutic Radiology Simulation-Aided Field Testing	1.63	1.47	-9.8
77301	IMRT Treatment Planning	28.66	30.31	5.8
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	5.72	5.56	-2.8
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	10.34	10.37	0.3
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	14.67	14.34	-2.2
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	13.85	13.85	0.0

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.¹⁰

Finally, information on the percentage of practices offering special procedures and advanced technologies in 1995, 2003 and 2007 are presented in **Table 10**. Of the eight special procedures that were surveyed in both 2003 and 2007, more practices reported performing the procedure in 2007 in four (4) instances, while fewer practices reported performing the procedure in 2007 for the other four (4) instances. Examples where the percentage of practices who reported performing the procedure increased from 2003 to 2007 include:

- Remote (HDR or LDR) afterloading brachytherapy (from 66 to 68%);
- Stereotactic external beam irradiation -- radiosurgery (single fraction) (from 57 to 68%);
- Stereotactic external beam irradiation -- radiotherapy (multiple fraction) (from 43 to 61%); and
- Intensity modulated radiation therapy (IMRT) (from 57 to 95%).

The four procedures where a lower percentage of practices reported performing the procedure in 2007 than in 2003 included:

- Total skin electron irradiation (from 38 to 34%);
- Total body irradiation (from 57 to 37%);
- Intraoperative radiotherapy (from 25 to 17%); and
- Prostate seed brachytherapy (from 89 to 78%).

The percentage of practices in 2007 that reported performing two newly surveyed procedures included 78 percent for imaged guided radiation therapy and 39 percent for stereotactic body irradiation. The proliferation of advanced technologies steadily increased from 2003 to 2007, including: (1) record and verify system (from 87 to 95%); (2) dynamic wedge (from 40 to 59%); (3) multileaf collimator (from 79 to 95%); (4) electronic portal dosimetry (from 53 to 80%); and (5) dynamic multileaf collimator (for IMRT) (from 58 to 88%). In addition, 39 percent of practices in 2007 reported having one newly surveyed advanced technology, a respiratory gating system.

¹⁰ The median total number of teletherapy and brachytherapy patients at physician groups (2,500) is not a misprint, even though it is lower than the median number of new patients (6,733) – this information appears to have been misreported or misinterpreted by one practice.

**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*	595	591	999	382	415
Total Number of Patients Treated	700	660	1,111	572	422
Percentage of Total Patients treated on most heavily utilized teletherapy unit	50%	56%	33%	60%	78%
Number of Patients per QMP	304.2	368.0	220.0	464.1	260.0
Patient treatments:					
Number of patient treatments done on most heavily utilized teletherapy unit	6,240	6,451	6,300	6,733	7,975
Number of teletherapy patient treatments at institution	13,259	13,250	24,222	2,500	17,275
Number of FTE Staff					
Medical physicists	2.0	2.0	5.7	1.5	2.9
Radiation oncologists	3.0	2.5	5.6	2.0	4.0
Dosimetrists and/or junior physicists	3.0	3.0	3.3	1.3	2.0
Physics assistants	0.0	0.0	0.3	0.5	0.0
Brachytherapy technologists	0.0	0.0	0.0	0.0	0.0
Maintenance engineers	0.0	0.0	1.6	0.1	0.0
Radiation therapists	8.0	7.0	14.0	4.5	7.5
Radiation oncology nurses	3.0	2.5	4.1	3.2	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	2007
Special Procedures			
Total skin electron irradiation	31%	38%	34%
Total body irradiation	46	57	37
Electron arc irradiation	11	15	NA
Remote (HDR or LDR) afterloading brachytherapy	46	66	68
Stereotactic brachytherapy	21	17	NA
Stereotactic external beam irradiation (including radiosurgery)	43	NA	NA
Stereotactic external beam irradiation -- radiosurgery (single fraction)	NA	51	68
Stereotactic external beam irradiation -- radiotherapy (multiple fraction)	NA	43	61
Intraoperative radiotherapy	13	25	17
Prostate seed brachytherapy	NA	89	78
Intensity modulated radiation therapy (IMRT)	NA	57	95
3-D conformal radiation therapy (non-IMRT)	NA	92	NA
3-D treatment planning	47	NA	NA
Endovascular brachytherapy	NA	74	NA
Independent jaw treatments	79	NA	NA
Image guided radiation therapy	NA	NA	78
Stereotactic body irradiation	NA	NA	39
Advanced Technologies			
Record and verify system	NA	87	95
Dynamic wedge	16	40	59
Multileaf collimator	19	79	95
Electronic portal imaging	20	53	80
Dynamic multileaf collimator (for intensity modulated radiotherapy)	NA	58	88
Respiratory gating system	NA	NA	39

Conclusions

Using a methodology and survey approach similar to that employed in the earlier (1995 and 2003) surveys, Abt has completed a new (2007) 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 2006 AAPM Professional Information Survey.

The resulting study concluded the following:

- Response rate of 41 percent – this was lower than the response rates for the 1995 (70 percent) and 2003 (53 percent) surveys;
- The distributions of (2007) respondents by Census Division Region and practice type was quite similar to those observed for the 2006 AAPM Professional Information Survey;
- The resulting estimates for time and intensity for the 2007 Survey were similar to those determined by the earlier 1995 and 2003 surveys. Differences in median work values for 2007 compared to 1995 and especially 2003 were due to two factors: (1) the median work value for the reference procedure was lower in 2007 than in 1995 or 2003, which increased the normalized median work values for the other CPT codes; and (2) raw median work value estimates in 2007 appeared to be closer to the 1995 than to 2003 raw medians (values in 1995 and 2007 tended to be higher than raw median work estimates in 2003);
- 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 was relatively flat between 2003 and 2007, where the percentages of practices reporting providing individual procedures were as likely to increase as to decrease from 2003 to 2007. In contrast, the prevalence of advanced technologies was consistently higher in 2007 than in 2003 (or 1995).

Bibliography

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

Abt Associates Inc. *The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services*. October 3, 1995. www.acmp.org

Abt Associates, Inc., *The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round II*. June, 2003. www.acmp.org

American College of Medical Physics. *Scope of Practice of Medical Physics*, February 2002. www.acmp.org

American College of Medical Physics. *The Survey of Physics Resources for Radiation Oncology Special Procedures*. 1998. www.acmp.org

Herman, MG, Mills MD, and Gillin MT. "Reimbursement versus effort in medical physics practice in radiation oncology." In *Journal of Applied Clinical Medical Physics*, Volume 4, Issue 2, Spring, 2003, pp. 179-187. www.ojps.aip.org/acm

Institute of Physics & Engineering in Medicine. *Guidelines for the Provision of a Physics Service to Radiotherapy*. www.ipem.org.uk/publications/role_doc.pdf

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 2006 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:

- The therapeutic applications of x-rays, gamma rays, electron and charged particle beams, neutrons and radiations from sealed radionuclide sources
- The equipment associated with their production, use, measurement and evaluation
- The quality of images resulting from their production and use
- Medical health physics associated with this subfield

II. Diagnostic Radiological Physics

This particular field pertains to:

- The diagnostic applications of x rays, gamma rays from sealed sources, ultrasonic radiation, radio frequency radiation and magnetic fields
- The equipment associated with their production, use, measurement and evaluation
- The quality of images resulting from their production and use
- Medical health physics associated with this subfield

III. Medical Nuclear Physics

This particular field pertains to:

- The therapeutic and diagnostic applications of radionuclides (except those used in sealed sources for therapeutic purposes)
- The equipment associated with their production, use, measurement and evaluation
- The quality of images resulting from their production and use
- Medical health physics associated with this subfield

IV. Medical Health Physics

This particular field pertains to:

- 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
- The instrumentation required to perform appropriate radiation surveys

Definition of 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:

- The American Board of Radiology
- The American Board of Medical Physics
- The American Board of Health Physics
- The American Board of Science in Nuclear Medicine
- The Canadian College of Physics in Medicine

The American Association of Physicists in Medicine regards board certification in the appropriate medical subfield 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 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, 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)
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
77781	High intensity brachytherapy, one (1) to four (4) dwell positions
77782	High intensity brachytherapy, five (5) to eight (8) dwell positions
77783	High intensity brachytherapy, nine (9) to 12 dwell positions
77784	High intensity brachytherapy, over 12 dwell positions

American Medical Association. *Current Procedure Terminology CPT 2006: Professional Edition*. AMA Press, 2007.

APPENDIX III: Vignettes of Surveyed Medical Physics Services

CPT Code	Procedure Vignette
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
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 dose calculation is performed.
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 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 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 to be delivered in 72 hours, using 3 Cesium-137 sources.

CPT Code	Procedure Vignette
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.
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 carcinoma 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.
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.

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.
77301	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.
77781	High Intensity Brachytherapy; 1 to 4 Dwell Positions: A 44-year-old female requiring a boost to the cervical os receives two fractions of HDR brachytherapy. The treatment is optimized for two dwell positions at the tip of a dome cylinder application. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.
77782	High Intensity Brachytherapy; 5 to 8 Dwell Positions: A 52-year-old male with a squamous cell carcinoma involving the lip is treated with a series of four fractions using a custom appliance with HDR brachytherapy. 7 dwell positions are optimized and treated during each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.
77783	High Intensity Brachytherapy; 9 to 12 Dwell Positions: A 46-year-old female with cervical cancer is treated with a series of six HDR tandem and ovoid applications. The treatment is optimized according to Gynecological Oncology Group guidelines. 10 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.
77784	High Intensity Brachytherapy; Over 12 Dwell Positions: A 56-year-old male with small cell lung cancer is treated using two catheter placements in the right lower lobe. The treatment is optimized for the volume encompassed by the treatment. 18 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.

APPENDIX IV: 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

1.1. Purpose of Survey

The survey's purpose is to measure "Qualified Medical Physicist (QMP)" work rendered during medical physics services. The American Association of Physicists in Medicine (AAPM) has authorized this investigation. To assist your completing 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 similar surveys¹¹ conducted by Abt Associates Inc. for the American College of Medical Physics (ACMP) and AAPM, and Abt has been selected again to conduct the new survey.

1.2. 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 20 medical physics services (Current Procedure Terminology (CPT) codes) – the 15 77300 series ("physics series") codes, one additional code (77295), and 4 high dose rate afterloading codes.¹² The enclosed sheet presents complete

¹¹ Abt Associates Inc., *The Abt Study of Physicist Work Values for Radiation Oncology Physics Services: Round II*, prepared for the American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM), June, 2003.

¹² Further information on each of the 16 codes is contained in American Medical Association (AMA), *Current Procedure Terminology CPT 2007 Professional Edition*, AMA Press, 2006.

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 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, 77301, 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, 77301, 77305, 77310, 77315, and 77321: Three-dimensional therapeutic radiology simulation-aided field setting, basic dosimetry calculations and simple, intermediate, complex, IMRT 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:
<p>Time to:</p> <ul style="list-style-type: none"> • 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 and CT-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 	<p>Time to Commission</p> <ul style="list-style-type: none"> • Tissue compensating filters • Microdosimetry (TLD) • Block cutting • Independent jaw treatment • Multileaf collimator • Dynamic, Electronic or Virtual wedge • Electronic portal imaging • Total body photons • Total skin electrons • Stereotactic radiosurgery • Stereotactic radiotherapy • Stereotactic body radiotherapy • Intraoperative radiotherapy • Intensity modulated radiotherapy • Image guided radiation therapy • Respiratory gating • 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 six (6) electron energies and an associated simulator and CT-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:	
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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
<p><i>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.</i></p>	

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:	
<ul style="list-style-type: none"> • X-ray output constancy • Audiovisual monitors • Electron output constancy • Door interlock • Distance indicator (ODI) • Field size indicators • Other daily checks 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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
<p><i>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.</i></p>		

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 intracavity (Fletcher type) and interstitial applicators
- Check and verify brachytherapy algorithm in treatment planning computer
- Check and verify remote (HDR or LDR) afterloading system
- 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:
<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 dose calculation is performed.		
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 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 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.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
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 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 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.		
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.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
77333	Intermediate treatment device: 65-year-old female with squamous cell carcinoma 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.		
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

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
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	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.		
77781	High Intensity Brachytherapy; 1 to 4 Dwell Positions: A 44-year-old female requiring a boost to the cervical os receives two fractions of HDR brachytherapy. The treatment is optimized for two dwell positions at the tip of a dome cylinder application. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.		

Procedural Time Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Time-Related Estimates	
		Medical Physics Services	
		Support Staff Time	QMP Time
77782	<p>High Intensity Brachytherapy; 5 to 8 Dwell Positions: A 52-year-old male with a squamous cell carcinoma involving the lip is treated with a series of four fractions using a custom appliance with HDR brachytherapy. 7 dwell positions are optimized and treated during each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>		
77783	<p>High Intensity Brachytherapy; 9 to 12 Dwell Positions: A 46-year-old female with cervical cancer is treated with a series of six HDR tandem and ovoid applications. The treatment is optimized according to Gynecological Oncology Group guidelines. 10 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>		
77784	<p>High Intensity Brachytherapy; Over 12 Dwell Positions: A 56-year-old male with small cell lung cancer is treated using two catheter placements in the right lower lobe. The treatment is optimized for the volume encompassed by the treatment. 18 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>		

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 $\text{Work} = \text{Time} * \text{Intensity}$. This relationship in turn implies that $\text{Intensity} = \text{Work}/\text{Time}$, 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 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-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 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 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.	

Relative Intensity Estimates for Medical Physics Services (continued)

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
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 carcinoma 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.	
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

Relative Intensity Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Relative Intensity Estimate
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	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.	
77781	High Intensity Brachytherapy; 1 to 4 Dwell Positions: A 44-year-old female requiring a boost to the cervical os receives two fractions of HDR brachytherapy. The treatment is optimized for two dwell positions at the tip of a dome cylinder application. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.	

Relative Intensity Estimates for Medical Physics Services (continued)

CPT Code	Procedure Vignette	Relative Intensity Estimate
77782	<p>High Intensity Brachytherapy; 5 to 8 Dwell Positions: A 52-year-old male with a squamous cell carcinoma involving the lip is treated with a series of four fractions using a custom appliance with HDR brachytherapy. 7 dwell positions are optimized and treated during each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>	
77783	<p>High Intensity Brachytherapy; 9 to 12 Dwell Positions: A 46-year-old female with cervical cancer is treated with a series of six HDR tandem and ovoid applications. The treatment is optimized according to Gynecological Oncology Group guidelines. 10 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>	
77784	<p>High Intensity Brachytherapy; Over 12 Dwell Positions: A 56-year-old male with small cell lung cancer is treated using two catheter placements in the right lower lobe. The treatment is optimized for the volume encompassed by the treatment. 18 Dwell positions are used for each fraction. The physicist checks the applicator position and connections. The physicist also reviews the plan for safety considerations. The physicist is present during the entire duration of the treatment.</p>	

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	
77781	High intensity brachytherapy; 1 to 4 dwell positions	
77782	High intensity brachytherapy; 5 to 8 dwell positions	
77783	High intensity brachytherapy; 9 to 12 dwell positions	
77784	High intensity brachytherapy; over 12 dwell positions	

Number of Patients and Patient Treatments

7. How many **new patients** (teletherapy and brachytherapy) were treated at your institution in the most recent year for which you have complete data..... _____
8. 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)* _____
9. What **percentage of the total patients** had the majority of their treatments on the clinic's most heavily utilized teletherapy unit? _____
10. 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? _____
11. 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

Remote (HDR or LDR) Afterloading Brachytherapy

Intensity Modulated Radiation Therapy

Image Guided Radiation Therapy

Stereotactic External Beam Irradiation – Radiosurgery (Single Fraction)

Stereotactic External Beam Irradiation – Radiotherapy (Multiple Fraction)

Stereotactic Body Irradiation

Intraoperative Radiotherapy

Prostate Seed 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	
Remote afterloading brachytherapy	50	8	400	
Stereotactic body radiotherapy	5	15	75	
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	100	8	800	
Image Guided Radiation Therapy	50	12	600	
Total	412 (Y)	-----	3437 (X)	8.34 (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				
Remote afterloading brachytherapy				
Stereotactic body radiotherapy				
Stereotactic radiosurgery (single fx)				
Stereotactic radiotherapy (multiple fx)				
Intraoperative radiotherapy				
Prostate Seed Brachytherapy				
Intensity Modulated Radiation Therapy				
Image Guided Radiation Therapy				
Total	(Y)	-----	(X)	

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	
Remote afterloading brachytherapy	50	4	200	
Stereotactic body radiotherapy	5	2	10	
Stereotactic radiosurgery (single fx)	30	5	150	
Stereotactic radiotherapy (multiple fx)	50	4	200	
Intraoperative radiotherapy	20	4	80	
Prostate Seed Brachytherapy	50	3	150	
Intensity Modulated Radiation Therapy	100	4	400	
Image Guided Radiation Therapy	50	6	300	
Total	412 (Y)	-----	1652 (X)	4.01 (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				
Remote afterloading brachytherapy				
Stereotactic body radiotherapy				
Stereotactic radiosurgery (single fx)				
Stereotactic radiotherapy (multiple fx)				
Intraoperative radiotherapy				
Prostate Seed Brachytherapy				
Intensity Modulated Radiation Therapy				
Image Guided Radiation Therapy				
Total	(Y)	-----	(X)	(Z)

APPENDIX V: Time and Intensity Estimates

Table A.5.1: 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	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295, 77300, 77301, 77305, 77310, 77315, and 77321								
Initial Commissioning (Annualized Over 5 Years)	24.0	50.0	98.4	125.6	416.0	112.1	82.3	41
Total Recalibration (Annualized Over 5 Years)	4.0	10.2	20.0	35.0	160.0	30.7	34.7	39
Annual Calibration	10.0	30.0	45.0	80.0	180.0	59.4	39.5	41
Total Daily, Weekly, and Monthly Checks	0.0	94.5	144.0	240.0	708.0	188.5	146.2	41
Total Annualized Time	205.6	298.4	308.3	471.4	1464.0	390.2	426.8	39
77326, 77327, 77328, 77781, 77782, 77783, and 77784								
Initial Commissioning	2.0	7.8	9.0	18.5	140.0	21.9	31.8	40
Annual Checks	4.0	30.0	40.0	87.5	199.0	62.6	50.6	39
Total Annualized Time	8.0	35.3	79.0	104.0	339.0	84.1	68.8	38
77331								
Initial Commissioning	0.4	4.2	7.2	13.2	24.0	9.3	6.7	38
Monthly Checks	12.0	24.0	45.0	72.0	300.0	60.8	56.9	38
Total Annualized Time	12.6	45.2	53.2	82.7	324.0	70.1	53.6	38
77332								
Total Commissioning Time	0.0	1.0	2.0	4.0	40.0	4.2	7.2	39
77333								
Total Commissioning Time	0.5	1.5	2.5	4.0	70.0	5.7	11.3	38
77334								
Initial Commissioning Time	0.2	0.7	1.4	3.2	18.0	2.6	3.4	38
Monthly Checks	0.0	12.0	36.0	48.0	240.0	54.0	65.2	39
Total Annualized Time	0.2	15.2	40.4	51.2	258.0	56.8	67.9	38

* All commissioning times are reported in hours per year.

Table A.5.2: Non-Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77300	Basic Dosimetry Plan	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77301	IMRT Treatment Planning	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77305	Simple Isodose Plan	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77310	Intermediate Isodose Plan	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77315	Complex Isodose Plan	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77321	Special Teletherapy Port Plan	0.04	0.14	0.25	0.54	3.97	0.58	0.82	36
77326	Simple Brachytherapy Isodose Plan	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77327	Intermediate Brachytherapy Isodose Plan	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77328	Complex Brachytherapy Isodose Plan	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.07	0.48	0.90	1.81	26.67	2.34	4.76	33
77331	Special Dosimetry	0.03	0.15	0.35	2.18	25.33	2.95	6.20	31
77332	Simple Treatment Device	0.00	0.01	0.02	0.08	1.50	0.10	0.26	34
77333	Intermediate Treatment Device	0.00	0.03	0.05	0.31	6.00	0.38	1.14	34
77334	Complex Treatment Device	0.00	0.01	0.02	0.09	3.20	0.15	0.54	34

Table A.5.3A: Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.10	0.31	1.00	2.13	6.00	1.55	1.60	40
77300	Basic Dosimetry Plan	0.00	0.19	0.25	0.25	1.00	0.26	0.18	40
77305	Simple Isodose Plan	0.00	0.25	0.33	0.50	1.00	0.38	0.20	39
77310	Intermediate Isodose Plan	0.00	0.25	0.50	0.62	4.00	0.57	0.62	40
77315	Complex Isodose Plan	0.00	0.30	0.50	1.00	4.00	0.80	0.75	40
77321	Special Teletherapy Port Plan	0.00	0.32	0.60	1.25	8.00	1.05	1.33	39
77326	Simple Brachytherapy Isodose Plan	0.20	0.50	1.00	2.00	26.67	1.48	1.17	40
77327	Intermediate Brachytherapy Isodose Plan	0.20	0.71	1.75	3.00	6.00	1.94	1.40	40
77328	Complex Brachytherapy Isodose Plan	0.25	1.50	3.00	4.00	12.00	3.56	2.65	39
77331	Special Dosimetry	0.10	0.50	1.00	2.00	5.00	1.34	0.98	40
77332	Simple Treatment Device	0.00	0.00	0.00	0.20	2.50	0.16	0.40	40
77333	Intermediate Treatment Device	0.00	0.08	0.25	0.39	1.00	0.25	0.22	39
77334	Complex Treatment Device	0.00	0.00	0.17	0.50	1.00	0.27	0.31	40
77370	Special Medical Physics Consultation	0.25	2.00	3.43	5.16	16.00	4.01	3.00	39
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.00	0.50	0.73	1.13	4.00	0.98	0.80	40
77301	IMRT Treatment Planning	1.25	3.00	4.00	6.00	11.00	4.91	2.81	39
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.50	1.00	1.50	2.25	4.50	1.80	1.06	37
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0.50	1.50	2.50	4.00	8.00	2.74	1.67	36
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	0.50	2.00	3.25	4.88	9.00	3.70	2.19	36
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.00	1.88	2.50	4.00	8.00	3.13	1.92	36

Table A.5.3B: Procedural Support Staff Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77300	Basic Dosimetry Plan	0.00	0.23	0.50	0.50	1.50	0.47	0.39	39
77305	Simple Isodose Plan	0.10	0.71	1.00	1.50	2.50	1.08	0.55	38
77310	Intermediate Isodose Plan	0.00	0.88	1.50	2.00	3.50	1.46	0.77	39
77315	Complex Isodose Plan	0.00	1.50	2.00	3.00	5.00	2.20	1.16	39
77321	Special Teletherapy Port Plan	0.00	1.25	2.00	2.50	5.00	2.07	1.15	39
77326	Simple Brachytherapy Isodose Plan	0.00	0.05	1.00	2.00	3.00	1.11	0.90	39
77327	Intermediate Brachytherapy Isodose Plan	0.00	0.00	1.67	2.25	3.00	1.40	1.14	39
77328	Complex Brachytherapy Isodose Plan	0.00	0.00	2.00	4.00	6.00	1.98	1.85	39
77331	Special Dosimetry	0.00	0.00	0.63	1.00	6.00	0.86	1.11	38
77332	Simple Treatment Device	0.00	0.24	0.50	0.81	1.50	0.53	0.41	40
77333	Intermediate Treatment Device	0.00	0.48	0.50	1.00	3.00	0.83	0.71	40
77334	Complex Treatment Device	0.00	0.50	1.00	1.50	4.00	1.05	0.87	40
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.30	1.50	2.75	4.00	8.00	2.88	1.71	38
77301	IMRT Treatment Planning	0.00	2.00	4.25	6.00	10.00	4.29	2.48	37
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.00	0.00	0.50	1.50	3.00	0.85	0.89	35
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0.00	0.00	0.88	2.00	8.00	1.36	1.78	34
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	0.00	0.00	1.00	2.00	12.00	1.72	2.45	34
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.00	0.00	1.13	2.75	5.00	1.58	1.57	34

Table A.5.4: Total QMP Time Estimates (Non-Procedural + Procedural) per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.10	0.37	1.00	2.00	6.00	1.50	1.57	39
77300	Basic Dosimetry Plan	0.14	0.37	0.55	0.93	4.17	0.84	0.85	36
77305	Simple Isodose Plan	0.28	0.48	0.69	1.08	4.17	1.00	0.85	34
77310	Intermediate Isodose Plan	0.32	0.53	0.78	1.32	4.27	1.16	1.00	36
77315	Complex Isodose Plan	0.32	0.56	0.98	1.78	4.79	1.39	1.10	36
77321	Special Teletherapy Port Plan	0.32	0.68	1.07	2.30	8.07	1.66	1.54	35
77326	Simple Brachytherapy Isodose Plan	0.57	1.69	2.52	3.82	26.67	3.83	4.76	33
77327	Intermediate Brachytherapy Isodose Plan	1.01	2.23	2.70	4.48	27.27	4.20	4.72	33
77328	Complex Brachytherapy Isodose Plan	1.06	2.97	4.78	7.57	27.67	5.96	5.00	32
77331	Special Dosimetry	0.15	0.90	2.06	3.23	25.57	3.57	4.95	31
77332	Simple Treatment Device	0.00	0.01	0.13	0.28	2.51	0.32	0.53	30
77333	Intermediate Treatment Device	0.00	0.10	0.34	0.54	6.38	0.62	1.23	25
77334	Complex Treatment Device	0.00	0.06	0.24	0.53	3.20	0.40	0.58	32
77370	Special Medical Physics Consultation	0.25	2.00	3.45	5.25	16.00	4.06	3.03	38
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.15	0.60	1.18	2.33	4.67	1.54	1.13	35
77301	IMRT Treatment Planning	1.32	3.15	4.53	6.23	12.08	5.18	2.77	37
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.57	1.57	2.70	3.80	27.67	3.70	4.75	30
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0.57	2.31	3.79	5.00	27.67	4.62	4.78	30
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	0.57	3.16	4.79	6.62	27.87	5.68	4.93	30
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.57	2.60	3.43	6.05	27.87	5.13	4.98	30

Table A.5.5: Relative Intensity Estimates for Radiation Oncology Physics Services (Increasing Order of Median Intensity)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77332	Simple Treatment Device	0.10	0.50	0.70	1.00	4.00	0.85	0.72	40
77300	Basic Dosimetry Plan	0.10	0.48	1.00	1.00	3.00	0.88	0.57	40
77336	Continuing Medical Physics Consultation	1.00	1.00	1.00	1.00	1.00	1.00	0.00	41
77333	Intermediate Treatment Device	0.20	0.50	1.00	1.10	5.00	1.05	0.82	40
77305	Simple Isodose Plan	0.25	0.70	1.00	1.50	5.00	1.29	0.94	40
77334	Complex Treatment Device	0.10	0.86	1.00	1.70	6.00	1.41	1.12	40
77310	Intermediate Isodose Plan	0.50	1.00	1.28	1.50	8.00	1.65	1.31	40
77315	Complex Isodose Plan	0.20	1.08	1.50	2.00	16.00	2.13	2.41	40
77321	Special Teletherapy Port Plan	1.00	1.23	1.50	2.35	16.00	2.31	2.45	39
77331	Special Dosimetry	0.50	1.08	1.65	2.63	6.00	2.08	1.34	40
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.50	1.38	2.00	3.00	12.00	2.28	1.85	40
77326	Simple Brachytherapy Isodose Plan	0.50	1.20	2.00	2.00	15.00	2.31	2.48	40
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.50	2.00	2.00	3.00	15.00	2.90	2.60	36
77327	Intermediate Brachytherapy Isodose Plan	1.00	1.50	2.00	2.50	20.00	2.93	3.30	40
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	1.00	2.00	2.50	4.00	15.00	3.55	3.08	36
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	1.00	2.00	3.00	4.00	18.00	4.06	3.58	36
77328	Complex Brachytherapy Isodose Plan	1.00	2.00	3.00	4.00	30.00	4.12	4.93	40
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.00	3.00	3.00	5.00	22.00	4.60	4.13	36
77370	Special Medical Physics Consultation	0.83	2.64	3.38	5.18	32.00	4.50	4.79	40
77301	IMRT Treatment Planning	1.50	4.50	6.00	8.00	36.00	7.68	6.30	40

* 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.5.6: QMP Procedural Time Estimates for 77370 Procedures (in Hours)

77370 Procedure	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Routine 77370 Procedure	0.50	1.00	2.00	3.00	8.00	2.35	1.75	23
Total Skin Electron Irradiation	1.00	6.50	8.50	9.75	10.00	7.33	3.14	6
Total Body Irradiation	1.00	7.00	9.50	10.00	10.00	7.50	3.77	8
Remote Afterloading Brachytherapy	1.00	1.50	2.00	4.50	8.00	3.09	2.01	19
Sterotactic Body Radiotherapy	2.00	2.50	4.00	4.00	12.00	4.90	3.64	5
Stereotactic Radiosurgery (Single Fraction)	1.00	4.00	6.00	8.00	10.00	6.00	2.85	19
Stereotactic Radiotherapy (Multiple Fractions)	1.00	2.00	3.50	5.00	10.00	3.97	2.64	15
Intraoperative Radiotherapy	2.00	3.00	4.00	5.00	6.00	4.00	2.00	2
Prostate Seed Brachytherapy	0.30	2.50	4.00	5.00	8.00	3.85	2.16	23
Intensity Modulated Radiation Therapy	0.50	2.00	4.00	5.75	10.00	4.31	2.46	22
Image Guided Radiation Therapy	0.10	1.00	1.00	2.50	12.00	2.98	3.72	13

Table A.5.7: Relative Intensity Estimates for 77370 Procedures

77370 Procedure	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Routine 77370 Procedure	0.50	2.00	2.00	3.00	6.00	2.68	1.31	19
Total Skin Electron Irradiation	2.00	2.25	5.00	9.25	30.00	9.00	9.83	6
Total Body Irradiation	2.00	3.00	3.00	3.50	6.00	3.43	1.18	7
Remote Afterloading Brachytherapy	1.50	3.00	3.00	4.00	5.00	3.29	1.09	17
Sterotactic Body Radiotherapy	2.00	4.00	4.00	4.00	4.00	3.60	0.80	5
Stereotactic Radiosurgery (Single Fraction)	3.00	4.00	5.00	6.00	10.00	5.26	1.75	17
Stereotactic Radiotherapy (Multiple Fractions)	2.00	3.00	4.00	5.75	7.00	4.32	1.66	14
Intraoperative Radiotherapy	3.00	3.38	3.75	4.50	6.00	4.13	1.14	4
Prostate Seed Brachytherapy	1.00	2.00	3.00	4.63	6.00	3.43	1.44	20
Intensity Modulated Radiation Therapy	1.50	3.00	4.50	6.00	8.00	4.55	1.96	20
Image Guided Radiation Therapy	0.50	2.00	4.50	6.00	8.00	4.17	2.28	12

APPENDIX VI: Work Estimates

Table A.6.1: QMP Work Estimates for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.10	0.37	1.00	2.00	6.00	1.50	1.57	39
77300	Basic Dosimetry Plan	0.07	0.14	0.49	0.89	6.25	0.76	1.10	36
77305	Simple Isodose Plan	0.14	0.41	0.69	1.32	10.42	1.23	1.79	34
77310	Intermediate Isodose Plan	0.25	0.65	0.83	2.19	12.80	1.83	2.29	36
77315	Complex Isodose Plan	0.09	0.89	1.65	3.28	17.07	2.75	3.28	36
77321	Special Teletherapy Port Plan	0.33	1.00	1.64	3.60	17.07	3.31	3.97	35
77326	Simple Brachytherapy Isodose Plan	0.57	2.52	3.88	6.46	81.50	9.68	16.75	32
77327	Intermediate Brachytherapy Isodose Plan	2.02	4.19	5.64	11.27	95.43	13.13	20.67	32
77328	Complex Brachytherapy Isodose Plan	2.12	8.68	11.98	24.95	161.32	24.51	34.23	31
77331	Special Dosimetry	0.19	1.14	2.66	7.60	51.50	7.79	11.70	30
77332	Simple Treatment Device	0.02	0.05	0.12	0.34	2.51	0.35	0.56	22
77333	Intermediate Treatment Device	0.01	0.12	0.30	0.57	3.19	0.51	0.69	23
77334	Complex Treatment Device	0.01	0.09	0.45	0.86	9.60	0.85	1.77	28
77370	Special Medical Physics Consultation	0.21	6.75	13.94	23.60	256.00	22.01	40.53	37
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.00	0.94	1.63	5.42	23.34	3.72	4.60	35
77301	IMRT Treatment Planning	2.63	18.14	28.66	47.92	161.90	39.68	33.60	37
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.57	3.07	5.72	10.45	83.00	11.04	16.52	30
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	1.14	4.72	10.34	17.34	96.83	15.94	19.30	30
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	1.72	8.67	14.67	21.31	97.53	21.21	22.17	30
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	1.72	8.24	13.85	23.74	105.89	22.74	23.49	29

Table A.6.2 QMP Work Estimates for Radiation Oncology Physics Services (Relative to 77336 Median)

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.10	0.37	1.00	2.00	6.00	1.50	1.57	39
77300	Basic Dosimetry Plan	0.07	0.14	0.49	0.89	6.25	0.76	1.10	36
77305	Simple Isodose Plan	0.14	0.41	0.69	1.32	10.42	1.23	1.79	34
77310	Intermediate Isodose Plan	0.25	0.65	0.83	2.19	12.80	1.83	2.29	36
77315	Complex Isodose Plan	0.09	0.89	1.65	3.28	17.07	2.75	3.28	36
77321	Special Teletherapy Port Plan	0.33	1.00	1.64	3.60	17.07	3.31	3.97	35
77326	Simple Brachytherapy Isodose Plan	0.57	2.52	3.88	6.46	81.50	9.68	16.75	32
77327	Intermediate Brachytherapy Isodose Plan	2.02	4.19	5.64	11.27	95.43	13.13	20.67	32
77328	Complex Brachytherapy Isodose Plan	2.12	8.68	11.98	24.95	161.32	24.51	34.23	31
77331	Special Dosimetry	0.19	1.14	2.66	7.60	51.50	7.79	11.70	30
77332	Simple Treatment Device	0.02	0.05	0.12	0.34	2.51	0.35	0.56	22
77333	Intermediate Treatment Device	0.01	0.12	0.30	0.57	3.19	0.51	0.69	23
77334	Complex Treatment Device	0.01	0.09	0.45	0.86	9.60	0.85	1.77	28
77370	Special Medical Physics Consultation	0.21	6.75	13.94	23.60	256.00	22.01	40.53	37
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.00	0.94	1.63	5.42	23.34	3.72	4.60	35
77301	IMRT Treatment Planning	2.63	18.14	28.66	47.92	161.90	39.68	33.60	37
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.57	3.07	5.72	10.45	83.00	11.04	16.52	30
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	1.14	4.72	10.34	17.34	96.83	15.94	19.30	30
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	1.72	8.67	14.67	21.31	97.53	21.21	22.17	30
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	1.72	8.24	13.85	23.74	105.89	22.74	23.49	29

**Table A.6.3 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	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.10	0.33	1.00	2.00	6.00	1.47	1.53	39
77300	Basic Dosimetry Plan	0.07	0.14	0.50	0.95	6.25	0.87	1.68	36
77305	Simple Isodose Plan	0.14	0.47	0.73	1.40	10.42	1.37	2.14	34
77310	Intermediate Isodose Plan	0.25	0.65	0.85	2.15	12.80	1.98	2.69	36
77315	Complex Isodose Plan	0.09	0.75	1.64	3.19	17.07	2.79	3.67	36
77321	Special Teletherapy Port Plan	0.33	0.97	1.64	3.51	17.07	3.55	4.54	35
77326	Simple Brachytherapy Isodose Plan	0.57	2.56	4.20	6.78	81.50	10.38	17.74	32
77327	Intermediate Brachytherapy Isodose Plan	2.02	4.42	5.63	12.13	95.43	14.25	22.59	32
77328	Complex Brachytherapy Isodose Plan	2.12	8.64	11.98	25.18	161.32	27.76	39.49	31
77331	Special Dosimetry	0.19	1.27	3.10	10.54	51.50	9.08	13.37	30
77332	Simple Treatment Device	0.02	0.05	0.11	0.32	2.51	0.33	0.56	22
77333	Intermediate Treatment Device	0.01	0.11	0.30	0.58	3.19	0.47	0.55	23
77334	Complex Treatment Device	0.01	0.11	0.41	0.71	9.60	0.80	1.78	28
77370	Special Medical Physics Consultation	0.21	6.75	13.94	23.60	256.00	21.64	39.90	37
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.00	0.93	1.47	4.62	23.34	3.68	5.18	35
77301	IMRT Treatment Planning	2.63	18.14	30.31	47.92	161.90	40.98	36.10	37
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.57	2.81	5.56	11.56	83.00	11.72	17.67	30
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	1.14	3.78	10.37	17.43	96.83	16.31	20.18	30
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	1.72	6.03	14.34	21.41	97.53	21.20	22.70	30
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	1.72	6.58	13.85	23.74	105.89	22.27	24.21	29

APPENDIX VII: Caseload and Staffing Estimates

Table A.7.1: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Overall

Caseload or Staffing Measure	Minimum	First Quartile	Median	3rd 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 treated (teletherapy and brachytherapy)	100	453	595	750	2,900	700	518	33
Total number of patients treated at institution (teletherapy and brachytherapy)	40	567	700	1,000	3,300	858	590	35
Percentage of total patients treated on most heavily utilized teletherapy unit	12%	33%	50%	80%	100%	56%	27%	36
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	40.0	227.5	304.2	409.0	790.0	332.6	159.1	35
Number of patient treatments done on most heavily utilized teletherapy unit	240	656	6,240	7,629	12,744	5,624	3,702	33
Total number of teletherapy treatments	350	7,415	13,259	21,240	61,000	15,871	13,617	37
Number of FTE Staff Employed by Institution								
Medical physicists	0.5	1.7	2.0	5.0	23.0	3.8	4.2	40
Radiation oncologists	1.0	2.0	3.0	4.6	19.0	4.1	3.7	40
Dosimetrists or junior medical physicists	0.0	2.0	3.0	3.1	12.0	3.2	2.5	40
Physics assistants	0.0	0.0	0.0	1.0	2.0	0.3	0.5	40
Brachytherapy technologists	0.0	0.0	0.0	0.0	2.0	0.1	0.4	40
Maintenance engineers	0.0	0.0	0.0	1.0	4.0	0.7	1.0	40
Radiation therapists	2.0	5.0	8.0	12.0	50.0	11.0	10.2	40
Radiation oncologist nurses	0.5	2.0	3.0	4.0	10.0	3.4	2.4	31

Table A.7.2: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Private/Community Hospitals

Caseload or Staffing Measure	Minimum	First Quartile	Median	3rd 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 treated (teletherapy and brachytherapy)	250	455	591	738	1,332	630	281	18
Total number of patients treated at institution (teletherapy and brachytherapy)	40	511	660	898	1,521	717	326	19
Percentage of total patients treated on most heavily utilized teletherapy unit	32%	39%	56%	78%	100%	61%	24%	18
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	40.0	275.0	368.0	480.0	790.0	383.0	174.4	19
Number of patient treatments done on most heavily utilized teletherapy unit	240	1,419	6,451	8,500	12,744	5,973	4,077	18
Total number of teletherapy treatments	350	7,479	13,250	19,968	27,807	13,127	8,022	20
Number of FTE Staff Employed by Institution								
Medical physicists	0.5	1.0	2.0	2.6	9.0	2.6	2.1	21
Radiation oncologists	1.0	2.0	2.5	3.0	7.0	2.9	1.5	21
Dosimetrists or junior medical physicists	0.6	2.0	3.0	3.0	7.0	2.8	1.6	21
Physics assistants	0.0	0.0	0.0	0.0	1.5	0.2	0.4	21
Brachytherapy technologists	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21
Maintenance engineers	0.0	0.0	0.0	0.2	3.0	0.4	0.8	21
Radiation therapists	3.0	6.0	7.0	9.5	31.0	8.8	5.8	21
Radiation oncologist nurses	1.0	2.0	2.5	4.0	10.0	3.1	2.1	17

Table A.7.3: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Medical School/University Hospital

Caseload or Staffing Measure	Minimum	First Quartile	Median	3rd 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 treated (teletherapy and brachytherapy)	500	732	999	1,311	2,900	1,185	674	10
Total number of patients treated at institution (teletherapy and brachytherapy)	700	798	1,111	1,729	3,300	1,378	750	11
Percentage of total patients treated on most heavily utilized teletherapy unit	12%	22%	33%	46%	100%	41%	26%	12
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	123.4	167.4	220.0	339.3	358.5	245.4	88.8	11
Number of patient treatments done on most heavily utilized teletherapy unit	249	2,962	6,300	7,250	10,000	5,350	3,293	11
Total number of teletherapy treatments	650	10,817	24,222	31,895	61,000	24,467	18,223	12
Number of FTE Staff Employed by Institution								
Medical physicists	2.0	4.8	5.7	8.3	23.0	7.6	5.7	12
Radiation oncologists	2.0	4.0	5.6	9.3	19.0	7.5	5.0	12
Dosimetrists or junior medical physicists	1.0	2.6	3.3	6.3	12.0	5.0	3.4	12
Physics assistants	0.0	0.0	0.3	1.0	2.0	0.5	0.6	12
Brachytherapy technologists	0.0	0.0	0.0	0.0	1.0	0.2	0.4	12
Maintenance engineers	0.0	1.0	1.6	2.0	4.0	1.6	1.1	12
Radiation therapists	6.4	10.3	14.0	19.3	50.0	18.8	13.6	12
Radiation oncologist nurses	2.0	3.3	4.1	7.3	9.0	4.9	2.4	11

Table A.7.4: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Medical Physics Consulting Group

Caseload or Staffing Measure	Minimum	First Quartile	Median	3rd 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 treated (teletherapy and brachytherapy)	150	266	382	497	613	382	232	2
Total number of patients treated at institution (teletherapy and brachytherapy)	475	524	572	621	669	572	97	2
Percentage of total patients treated on most heavily utilized teletherapy unit	50%	55%	60%	70%	80%	63%	12%	3
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	334.5	399.3	464.1	528.9	593.8	464.1	129.6	2
Number of patient treatments done on most heavily utilized teletherapy unit	4,925	5,254	5,583	5,911	6,240	5,583	658	2
Total number of teletherapy treatments	8,250	10,365	12,480	12,870	13,259	11,330	2,201	3
Number of FTE Staff Employed by Institution								
Medical physicists	0.8	1.7	2.0	2.0	2.0	1.7	0.5	4
Radiation oncologists	1.6	1.9	2.0	2.5	4.0	2.4	0.9	4
Dosimetrists or junior medical physicists	1.5	1.9	2.3	2.6	3.0	2.3	0.6	4
Physics assistants	0.0	0.0	0.0	0.3	1.0	0.3	0.4	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	4.3	5.0	5.3	6.0	4.5	1.5	4
Radiation oncologist nurses	0.5	0.6	0.8	0.9	1.0	0.8	0.3	2

Table A.7.5: Patient Caseloads and Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Physician Group

Caseload or Staffing Measure	Minimum	First Quartile	Median	3rd 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 treated (teletherapy and brachytherapy)	200	233	415	590	600	408	186	4
Total number of patients treated at institution (teletherapy and brachytherapy)	200	233	422	623	690	434	214	4
Percentage of total patients treated on most heavily utilized teletherapy unit	30%	50%	78%	100%	100%	72%	30%	4
Number of patients (teletherapy and brachytherapy) per qualified medical physicist	200.0	233.0	260.0	282.0	300.0	255.0	37.5	4
Number of patient treatments done on most heavily utilized teletherapy unit	480	3,607	6,733	7,117	7,500	4,904	3,144	3
Total number of teletherapy treatments	480	1,490	2,500	7,215	11,930	4,970	4,990	3
Number of FTE Staff Employed by Institution								
Medical physicists	1.0	1.0	1.5	2.1	2.5	1.6	0.6	4
Radiation oncologists	1.0	1.0	2.0	3.3	4.0	2.3	1.3	4
Dosimetrists or junior medical physicists	0.0	0.0	1.3	2.6	3.0	1.4	1.4	4
Physics assistants	0.0	0.0	0.5	1.0	1.0	0.5	0.5	4
Brachytherapy technologists	0.0	0.0	0.0	0.5	2.0	0.5	0.9	4
Maintenance engineers	0.0	0.0	0.1	0.6	2.0	0.5	0.9	4
Radiation therapists	2.0	3.5	4.5	5.8	8.0	4.8	2.2	4
Radiation oncologist nurses	1.0	2.1	3.2	3.6	4.0	2.7	1.3	3

APPENDIX VIII: Service Volumes

Table A.8.1: Service Volumes for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	90	1,950	2,495	4,021	12,882	3,366	2,565	39
77300	Basic Dosimetry Plan	0	1,911	3,014	4,461	16,350	3,903	3,491	39
77305	Simple Isodose Plan	0	6	25	90	250	59	67	39
77310	Intermediate Isodose Plan	0	1	10	75	400	64	95	39
77315	Complex Isodose Plan	0	184	299	381	1,502	318	263	39
77321	Special Teletherapy Port Plan	0	0	73	134	335	95	96	39
77326	Simple Brachytherapy Isodose Plan	0	0	5	15	127	13	24	39
77327	Intermediate Brachytherapy Isodose Plan	0	0	2	17	87	12	19	39
77328	Complex Brachytherapy Isodose Plan	0	11	45	88	246	59	59	39
77331	Special Dosimetry	0	24	114	400	5,000	427	871	39
77332	Simple Treatment Device	0	31	57	205	1,000	143	197	39
77333	Intermediate Treatment Device	0	0	13	72	1,712	101	280	39
77334	Complex Treatment Device	0	504	2,200	3,528	16,270	2,846	3,119	39
77370	Special Medical Physics Consultation	0	51	142	283	754	223	229	39
77295	Therapeutic Radiology Simulation-Aided Field Testing	0	206	300	492	1,648	409	378	39
77301	IMRT Treatment Planning	0	70	150	250	1,500	241	271	39
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0	0	0	20	351	36	79	39
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0	0	3	13	150	15	32	39
77783	High Intensity Brachytherapy: 9 to 124 Dwell Positions	0	0	25	42	116	36	36	39
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0	0	53	78	158	57	30	39

Table A.8.2: Service Volumes per QMP for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	3rd Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77336	Continuing Medical Physics Consultation	0.0	644.9	1,023.9	1,504.2	2,600.0	1,128.4	640.4	39
77300	Basic Dosimetry Plan	0.0	800.0	1,030.2	1,717.4	20,437.5	1,702.8	3,110.5	39
77305	Simple Isodose Plan	0.0	2.4	9.4	44.2	102.0	27.4	34.3	39
77310	Intermediate Isodose Plan	0.0	0.0	2.5	33.0	287.5	30.1	62.7	39
77315	Complex Isodose Plan	0.0	46.3	103.0	160.2	462.0	125.6	108.1	39
77321	Special Teletherapy Port Plan	0.0	0.0	23.0	40.6	250.0	33.1	46.4	39
77326	Simple Brachytherapy Isodose Plan	0.0	0.0	1.1	5.6	73.0	5.4	12.4	39
77327	Intermediate Brachytherapy Isodose Plan	0.0	0.0	0.5	7.5	33.5	4.5	7.1	39
77328	Complex Brachytherapy Isodose Plan	0.0	3.5	13.8	29.4	59.0	18.3	17.3	39
77331	Special Dosimetry	0.0	8.9	17.9	155.4	1,500.0	173.4	326.7	39
77332	Simple Treatment Device	0.0	8.9	23.6	74.0	500.0	56.4	87.8	39
77333	Intermediate Treatment Device	0.0	0.0	4.0	20.8	342.4	39.1	83.3	39
77334	Complex Treatment Device	0.0	196.7	809.7	1,541.4	3,000.0	926.5	766.6	39
77370	Special Medical Physics Consultation	0.0	28.4	50.1	82.3	250.0	66.3	61.5	39
77295	Therapeutic Radiology Simulation-Aided Field Testing	0.0	71.0	115.3	233.9	1,000.0	164.2	169.6	39
77301	IMRT Treatment Planning	0.0	37.8	61.4	90.7	500.0	76.4	82.3	39
77781	High Intensity Brachytherapy: 1 to 4 Dwell Positions	0.0	0.0	0.0	5.2	307.0	17.7	53.4	39
77782	High Intensity Brachytherapy: 5 to 8 Dwell Positions	0.0	0.0	0.1	3.5	66.0	4.4	11.4	39
77783	High Intensity Brachytherapy: 9 to 12 Dwell Positions	0.0	0.0	0.8	10.5	48.0	22.2	11.7	39
77784	High Intensity Brachytherapy: Over 12 Dwell Positions	0.0	0.0	1.7	21.1	68.0	30.7	15.8	39