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

Final Report

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Introduction

In the medical specialty of radiation oncology, qualified medical physicists (QMPs)[1] are highly trained professionals who are responsible for the safe and effective delivery of radiation treatments to patients as prescribed by physicians. In order to fairly compensate medical physicists for their work, employing organizations and insurers must have accurate estimates of the effort required to implement these procedures.

Reimbursement of medical providers is performed based on a set of procedure codes, called Current Procedure Terminology (CPT®) codes, which uniquely designate each service or procedure. A set of such codes exists for the services provided by medical physicists in radiation oncology (Current Procedure Terminology: CPT® 2014 manual). Payments for these services are divided into a technical component received by the employer of the QMP and a professional component paid to the physician or the physician's employer.

For this system to work, the payers need to have accurate estimates of effort by providers. In 1995, The American College of Medical Physics (ACMP) and the American Association of Physicists in Medicine (AAPM) engaged Abt Associates Inc. (Abt) to conduct a study that measured QMP work for medical physics services. Because the technology and practice of medical physics is evolving, the study was repeated in 2003, 2007, and 2014; these four studies are referred to as Abt I-IV. This report summarizes the results of the last study (Abt IV conducted in 2014) and discusses observed trends when data are available.

To maintain consistency, the current study adopted a methodology similar to that of the three previous studies, including:

- Measuring the length of time required by QMPs to perform services such as (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;
- Measuring work consistent with the definition used by the Centers for Medicare and Medicaid Services (CMS), as a combination of the time used to provide the service and the intensity of the service. Intensity is defined as a combination of mental and physical efforts, including judgment, technical skill, and psychological stress, associated with providing the service.

This report is organized as follows. The Methodology section provides a step-by-step explanation of the approach used to calculate relative work values for QMP services. The Results section presents Abt's findings and the Conclusions section presents conclusions and recommendations for future studies. Extensive supporting data are included in appendices to this report.

[1] As defined in AAPM Professional Policy 1. Definition of A Qualified Medical Physicist. Available from: http://www.aapm.org/org/policies/details.asp?id=316&type=PP

Methodology

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.

The professional work that is the subject of this study includes the professional time needed to perform a service, mental effort and judgment, technical skill and physical effort, and 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." The American Medical Association Relative Value Scale Update Committee (AMA/RUC) defines work as the product of a professional's time and intensity.

The first component of work, professional time, was in turn divided in the study into two parts: non-procedural and procedural time. This represented a departure from common practice, where professional time is divided into three parts: pre-service - time spent with the patient before the service; intra-service - time spent with the patient during the service; and post-service - time spent with the patient after the service. This change was necessary because medical physics services do not include post-service time. The remaining components of work are similar to what is broadly used in medical practice. Non-procedural time (analogous to pre-service) 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 (analogous to intra-service) is the time a QMP spends in support of patients during treatment.

The three remaining components of work (mental effort, skill, and stress) are collectively called intensity. When surveying professionals to update work values, the AMA/RUC asks respondents to estimate each intensity component separately. In practice, however, the three are so interwoven that estimating them separately is difficult and may result in errors. Consequently, in all four Abt studies QMPs were asked to provide a single intensity estimate for each service that includes all of the components.

To help QMPs determine work intensity, a "magnitude estimation" approach was used. This technique relies on a commonly provided, consistently performed procedure as a benchmark service against which all other services are measured. The first Abt study selected CPT® Code 77336 (Continuing Medical Physics Consultation) as the benchmark service, and this benchmark code has remained consistent across all Abt studies. This benchmark service was assigned an intensity level of 1.00 and QMPs were asked to estimate the intensity of all other medical physics services relative to this benchmark. For example, if a QMP believed that 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.

The following equation was used to calculate work for each medical physics service:

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

Where:

Time was equal to non-procedural plus procedural time for the service; and

Intensity was the single estimate for mental effort and judgment, technical skill and physical effort, and the psychological stress associated with the service.

This definition of work was applied to the 20 medical physics services shown in **Table 1** (additional information on the services covered in the study is included in as Appendix II).

Table 1. Radiation Oncology Physics Codes* Studies in the Abt IV Survey

CPT® Code	Description
77295	Therapeutic radiology simulation-aided field testing
77300	Basic dosimetry calculation
77301	IMRT Treatment Planning
77305	Simple isodose plan
77310	Intermediate isodose plan
77315	Complex isodose plan
77321	Special teletherapy port plan
77326	Simple brachytherapy isodose plan
77327	Intermediate brachytherapy isodose plan
77328	Complex brachytherapy isodose plan
77331	Special dosimetry
77332	Simple treatment device
77333	Intermediate treatment device
77334	Complex treatment device
77336	Continuing medical physics consultation
77338**	Multileaf Collimator for IMRT
77370	Special medical physics consultation
77785**	High Intensity Brachytherapy; 1 Dwell Position
77786**	High Intensity Brachytherapy; 2 to 12 Dwell Positions
77787**	High Intensity Brachytherapy; Over 12 Dwell Positions
***These codes were the codes in place at the time of the survey. ****These codes were not included in the Abt I-III surveys.**	

Technical Consulting Panel

All four Abt studies included a Technical Consulting Panel (TCP). In the first study, the TCP performed the following tasks:

- Provided 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;
- Selected 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
- Defined 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.

The TCPs convened for Abt II and III reviewed and updated the service vignettes, survey instrument and other survey materials and reviewed and approved the study's methodology. For the current study, the initial 4-member TCP performed similar services and, along with ten additional medical physicists, also pilot tested the survey in its new online format. The medical physics service vignettes used in the current study are presented in Appendix III.

A second, 8-member Technical Consulting Panel was convened after the survey data were analyzed, to assist with the interpretation of the results. Due to the panelists' busy schedules, Abt organized several conference calls to enable all panel members to participate in the discussion. A list of the TCP members can be found in Appendix IV.

Survey of Radiation Oncology Physics Codes

Survey Sample

A sample of 200 QMPs was selected from among AAPM members and approved by the first TCP. The sample size was double relative to the previous studies due to the falling response rates. It was carefully chosen to reflect the full range of geographic regions and practice settings of the entire medical physicist population using data from the 2013 AAPM Professional Survey Report. The geographic distribution included 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. The practice settings included medical schools/university hospitals, medical physics consulting groups, private/community hospitals, and medical (physician) groups.[2]

[2] The 2013 AAPM Professional Survey Report 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 200 QMP practices selected for this survey.

Two important study limitations 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 QMPs working in these environments are usually not involved in the day-to-day practice of providing radiation oncology physics services to patients. Second, the survey sample is a purposive, not a random, sample. This type of sample was chosen due to the anticipated low response rate and consequent non-response bias, and was an attempt to mitigate this problem by shaping the study population.

Survey Instrument

While the previous three surveys were conducted through paper mailings, the current survey (Abt IV) was administered online using *SurveyMonkey* software. The survey (included in Appendix V) included the following sections:

Section 1 - General Instructions and Demographics. This section presented the study's purpose and methodology and provided definitions of key terms including work, time, intensity, nonprocedural and procedural time, and magnitude estimation. In addition, the four remaining sections' structures were detailed, and contact information was provided for respondents with questions regarding the survey and study. Finally, respondents were asked to confirm their clinical or industry employment status, contact information, practice type, and geographic region.

Section 2 - Non-Procedural Time. This section collected information on non-procedural time data. The medical physics services were grouped into the following categories:

- Radiation field testing, dosimetry, and isodose plans (CPT® codes 77295, 77300, 77301,77305, 77310, 77315, and 77321)
- Brachytherapy (CPT® codes 77326, 77327, 77328, 77785, 77786, and 77787)
- Special dosimetry (CPT® code 77331)
- Simple and intermediate treatment devices (CPT® codes 77332 and 77333)
- Complex treatment devices and multileaf collimator for intensity modulated radiation therapy (CPT® codes 77334 and 77338).

These groupings were made based on codes that shared equipment. Two non-procedural consultation services (77336 and 77370) were not included in this section. 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.

As part of the new online format of the survey, respondents were given response options for non-procedural time that spanned the range of answers provided in previous surveys, rather than open text fields. For example, the response options for the question which asked for an estimate of the number of hours required to commission fully an external beam dual photon linear accelerator ranged from 0 to >1,500 in specific increments. For analysis, any answers of greater than the maximum (e.g., ">1,500") were set equal to the maximum (e.g., 1,500).

Section 3 - Procedural Time and Intensity. QMPs were asked to provide the procedural time spent on the single occurrence of each medical physics service based on vignettes that briefly described

patient diagnosis and the required procedure. Respondents were also prompted to provide intensity estimates relative to the benchmark 77336 code.

Section 4 – Institutional Volume and Staffing Patterns. Respondents were asked to report on institutional data for their practice in 2013. QMPs practicing at multiple facilities provided institutional data for the one facility where they performed the highest number of 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 (e.g., the number of full time equivalent (FTE) staff).

Section 5 – Special Procedures and Advanced Techniques. Respondents were asked whether their institutions provide specific new technologies and services.

One update was made to the survey after it was released to the field. The vignette for code 77295 (therapeutic radiology simulation-aided field testing) was deemed inaccurate by one of the survey respondents, and was updated to more accurately reflect its current use. Because the survey had already been opened up for responses, all subjects were contacted after completing the survey and given a chance to revise their procedural time and intensity responses for the code.

Survey Implementation

The survey was programmed and reviewed by AAPM members and Abt researchers, who suggested several changes to shorten its length and to collect data more efficiently. The resulting instrument was pilot-tested by several Abt researchers, four TCP members, and 10 additional QMPs. All problems identified during this process were corrected.

An introductory email announcing the survey was sent to all 200 subjects on October 8, 2014. One email bounced back, and a new working email for this subject was found. Abt followed with an email containing the survey link on October 15, 2014. Eight reminder emails were sent over the course of the nine weeks the survey was in the field.

Using Survey Data to Calculate QMP Work Values

Summary statistics were calculated for non-procedural and procedural time, QMP total time, intensity, total work values, service mix, number of patients and patient treatment, staffing, and technologies. These 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).

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. Each service would be allocated 1,000 hours/3,000 units = 1/3 hour per unit per service of non-procedural

time. The non-procedural time estimates were then added to the service-specific procedural time estimates to yield total times for each service.

The intensity relative to the 77336 benchmark code and the total time estimates were multiplied to yield raw work values. Median raw work estimates were calculated for each code. Normalized median work estimates were derived by dividing each median raw work estimate by median raw work estimate for the benchmark code.

Due to the small sample size of respondents, extreme values for non-procedural time and procedural time had the potential to greatly affect the median values for QMP work, and were considered outliers. Upon the recommendation of the TCP, extremely high outliers for these items (defined as greater than two standard deviations higher than the mean) were excluded from analysis. In addition, the values for one caseload estimate (the number of patient treatments performed on the clinic's most heavily utilized teletherapy unit) provided by the medical physics consulting group respondents (n=3) were also excluded based on the recommendation of the TCP.

Finally, data from previous surveys were used to identify trends in work values.

Results

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

Thirty-nine (39) of the 200 QMPs invited completed the survey, yielding a response rate of 19.5%. This compares to 70 (1995), 53 (2003), and 41 (2008) percent response rates from the three previous surveys.[3] Twenty-five (25) of the 39 respondents to the current survey provided revised procedural time and intensity estimates for CPT code 77295 based on the updated vignette, and only their responses were used for analysis of that code.

There were no significant differences in the practice type distribution between those responding to the survey and the results from the 2013 AAPM Professional Survey Report (**Table 2**). **Table 3** provides the number and percentage of survey respondents by state, while **Table 4** presents a comparison of the distribution by census division region of survey respondents and respondents to the 2013 AAPM Professional Survey.[4] There was one significant difference between the 2014 survey population and the 2013 AAPM Professional Survey in the geographic distribution of respondents. 12.8% of survey respondents were from the Midwest, while 24.8% of the 2013 AAPM Professional Survey respondents were from the Midwest. This difference may be due to the relatively small sample size of survey respondents. Twenty-three of 51 states and District of Columbia were represented in the study.

Table 2. Responding Medical Physicist Practice Type Distribution

Practice Type	Number of Respondents	% of Abt IV Sample	% of 2013 AAPM Survey*	Significant Difference†
Private/Community Hospital	14	35.9%	39.2	No
Medical School/University Hospital	19	48.7	39.1	No
Medical Physics Consulting Group	3	7.7	14.1	No
Medical (Physician) Group	3	7.7	7.6	No

*** The 2013 AAPM Professional Survey Report displays the total number of survey respondents by employment sector (practice type). The percentage by practice type was calculated by dividing the number in each practice type by the total number of respondents across the four practice types used in the Abt survey.**
† 5% level, 2-tailed test.

[3] 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.

[4] The 2013 AAPM Professional Survey Report is a document published by the AAPM and reflects national professional medical physics information.

Table 3. Survey Respondent Distribution by State

State	Number of Respondents	% of Respondents	State	Number of Respondents	% of Respondents
AK	0	0	**MT**	0	0
AL	2	5.1	**NC**	0	0
AR	0	0	**ND**	0	0
AZ	2	5.1	**NE**	0	0
CA	3	7.7	**NH**	1	2.6
CO	1	2.6	**NJ**	1	2.6
CT	2	5.1	**NM**	0	0
DC	0	0	**NY**	3	7.7
DE	0	0	**OH**	0	0
FL	3	7.7	**OK**	0	0
GA	0	0	**OR**	0	0
HI	1	2.6	**PA**	1	2.6
IA	0	0	**RI**	0	0
ID	0	0	**SC**	2	5.1
IL	1	2.6	**SD**	0	0
IN	1	2.6	**TN**	0	0
KS	0	0	**TX**	4	10.3
KY	1	2.6	**UT**	0	0
LA	0	0	**VA**	1	2.6
MA	1	2.6	**VT**	1	2.6
MD	0	0	**WA**	1	2.6
ME	0	0	**WI**	0	0
MI	2	5.1	**WV**	1	2.6
MN	0	0	**WY**	0	0
MO	0	0	**Unknown**	2	5.2
MS	1	2.6			

Table 4. Comparison between Abt IV and 2013 AAPM Professional Survey: Census Region and Division

Census Region or Division	Abt IV Survey %	2013 AAPM Survey %*	Significant Difference†
Northeast	25.6	22.8	No
New England	12.8	6.5	No
Mid Atlantic	12.8	16.3	No
Midwest	12.8	24.8	Yes
East North Central	10.3	17.6	No
West North Central	2.6	7.2	No

South	38.5	34.1	No
South Atlantic	18.0	20.0	No
East South Central	10.3	4.5	No
West South Central	10.3	9.6	No
West	23.1	17.9	No
Mountain	7.7	5.2	No
Pacific	15.4	12.7	No
Unknown	0.0	0.4	No

*** The 2013 AAPM Professional Survey Report displays the total number of survey respondents by state. The percentage by census division was calculated by summing the number in each state located in each division and dividing by the total number of survey respondents.**
† 5% level, 2-tailed test.

Time, Intensity, and QMP Work Estimates

QMP non-procedural, procedural, and total (non-procedural plus procedural) time estimates are provided in **Tables 5A, 5B, and 5C**. 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 VI. Time estimates from the three previous studies are provided for comparison. Please note that the non-procedural QMP time estimates are identical for codes 77295-77321, 77326-77328, and 77785-77787 in each year, because these non-procedural time estimates were calculated for each of the three groups of codes.

The QMP non-procedural median time estimate for radiation field testing, dosimetry, and isodose plans (77295-77321) for Abt IV (0.19 hours) was between the values for the two previous surveys (0.25 hours for Abt III and 0.15 hours for Abt II). For brachytherapy (77326-77784), the median non-procedural time estimate in the current study (0.88 hours) was very close to that of the third survey (0.90 hours). 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 0.22 hours in the 2014 survey. Median non-procedural QMP time estimates for treatment devices (77332, 77333, and 77334) were all quite low but similar across the four surveys. The median non-procedural time for high intensity brachytherapy (77785-77787), which was newly examined in this survey, was 0.45 hours.

Sixteen of the 20 CPT codes included in the current study can be compared to the previous survey, Abt III. Of these, one had a QMP procedural time estimate that was the same, and another six had differences of less than 50 percent in absolute value. Nine codes had differences of greater than 50 percent in absolute value between Abt III and the current study:

- Basic dosimetry calculation (77300) – the median QMP procedural time estimates were 0.25 hours in 2007 and 0.50 hours in 2014.
- Simple isodose plan (77305) – the median QMP procedural time estimates were 0.33 hours in 2007 and 0.75 hours in 2014.

- Intermediate isodose plan (77310) – the median QMP procedural time estimates were 0.50 hours in 2007 and 0.88 hours in 2014.
- Complex isodose plan (77315) – the median QMP procedural time estimates were 0.50 hours in 2007 and 1.0 hours in 2014.
- Special teletherapy port plan (77321) – the median QMP procedural time estimates were 0.60 hours in 2007 and 2.0 hours in 2014.
- Simple brachytherapy isodose plan (77326) – the median QMP procedural time estimates were 1.00 hours in 2007 and 2.0 hours in 2014.
- Simple treatment device (77332) – the median QMP procedural time estimates were 0.00 hours in 2007 and 0.43 hours in 2014.
- Intermediate treatment device (77333) – the median QMP procedural time estimates were 0.25 hours in 2007 and 0.73 hours in 2014.
- Complex treatment device (77334) – the median QMP procedural time estimates were 0.17 hours in 2007 and 0.78 hours in 2014.

Total (non-procedural plus procedural) QMP median time estimates are presented in Table 5C. The differences in total QMP time estimates between Abt III and IV tended to be smaller in absolute value than those for procedural time alone. Twelve codes had differences of less than 50 percent, while four codes had differences of greater than 50 percent:

- Special teletherapy port plan (77321) – the total median QMP time estimates were 1.07 hours in 2007 and 2.63 hours in 2014.
- Simple treatment device (77332) – the total median QMP time estimates were 0.13 hours in 2007 and 0.51 hours in 2014.
- Intermediate treatment device (77333) – the total median QMP time estimates were 0.34 hours in 2007 and 0.79 hours in 2014.
- Complex treatment device (77334) – the total median QMP time estimates were 0.24 hours in 2007 and 0.75 hours in 2014.

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

CPT Code	Procedure Description	Abt I†	Abt II†	Abt III†	Abt IV†
77295	Therapeutic radiology simulation-aided field testing	NA	0.15	0.25	0.19
77300	Basic dosimetry calculation	0.38	0.15	0.25	0.19
77301	IMRT Treatment Planning	NA	0.15	0.25	0.19
77305	Simple isodose plan	0.38	0.15	0.25	0.19
77310	Intermediate isodose plan	0.38	0.15	0.25	0.19
77315	Complex isodose plan	0.38	0.15	0.25	0.19
77321	Special teletherapy port plan	0.38	0.15	0.25	0.19
77326	Simple brachytherapy isodose plan	0.83	0.38	0.90	0.88
77327	Intermediate brachytherapy isodose plan	0.83	0.38	0.90	0.88
77328	Complex brachytherapy isodose plan	0.83	0.38	0.90	0.88
77331‡	Special dosimetry	1.15	0.57	0.35	0.22
77332	Simple treatment device	0.01	0.02	0.02	0.01
77333	Intermediate treatment device	0.01	0.06	0.05	0.06
77334	Complex treatment device	0.04	0.02	0.02	0.01
77338	Multileaf Collimator for IMRT	NA	NA	NA	0.10
77785	High Intensity Brachytherapy; 1 Dwell Position	NA	NA	NA	0.45
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	NA	NA	NA	0.45
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	NA	NA	NA	0.45

***QMP non-procedural time is not reported for consultation codes 77336 and 77370. Non-procedural time is 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. The non-procedural time estimates were then added to the service-specific procedural time estimates to yield total times for each service. 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.**

† Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)

‡ Extreme high outliers for non-procedural time for this code in 2014 were excluded from analysis.

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

CPT Code	Procedure Description	Abt I†	Abt II†	Abt III†	Abt IV†
77295‡	Therapeutic radiology simulation-aided field testing	NA	1.00	1.00	1.25
77300	Basic dosimetry calculation	0.17	0.25	0.25	0.50
77301	IMRT Treatment Planning	NA	5.25	4.00	2.50
77305‡	Simple isodose plan	0.25	0.30	0.33	0.75
77310‡	Intermediate isodose plan	0.40	0.50	0.50	0.88
77315‡	Complex isodose plan	0.50	0.50	0.50	1.00
77321	Special teletherapy port plan	0.70	0.75	0.60	2.00
77326	Simple brachytherapy isodose plan	1.00	0.75	1.00	2.00
77327	Intermediate brachytherapy isodose plan	1.00	1.00	1.75	2.50
77328	Complex brachytherapy isodose plan	3.00	2.50	3.00	4.00
77331	Special dosimetry	1.50	1.00	1.00	1.00
77332‡	Simple treatment device	0.10	0.10	0.00	0.43
77333‡	Intermediate treatment device	0.25	0.25	0.25	0.73
77334‡	Complex treatment device	0.25	0.25	0.17	0.78
77336	Continuing medical physics consultation	1.50	1.50	1.00	0.75
77338	Multileaf Collimator for IMRT	NA	NA	NA	1.00
77370	Special medical physics consultation	4.00	5.60	3.43	3.00
77785	High Intensity Brachytherapy; 1 Dwell Position	NA	NA	NA	1.50
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	NA	NA	NA	2.00
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	NA	NA	NA	2.75

***QMP procedural time was reported directly for each medical physics service.**
† Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)
‡ Extreme high outliers for non-procedural time for these codes in 2014 were excluded from analysis.

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

CPT Code	Procedure Description	Abt I†	Abt II†	Abt III†	Abt IV†
77295‡	Therapeutic radiology simulation-aided field testing	NA	1.16	1.18	1.00
77300	Basic dosimetry calculation	0.63	0.56	0.55	0.65
77301	IMRT Treatment Planning	NA	5.53	4.53	2.85
77305‡	Simple isodose plan	0.82	0.54	0.69	0.87
77310‡	Intermediate isodose plan	0.93	0.63	0.78	0.96
77315‡	Complex isodose plan	1.15	0.83	0.78	1.15
77321	Special teletherapy port plan	1.21	1.06	1.07	2.63
77326	Simple brachytherapy isodose plan	2.13	1.20	2.52	3.00
77327	Intermediate brachytherapy isodose plan	2.45	1.90	2.70	3.15
77328	Complex brachytherapy isodose plan	3.87	3.18	4.78	5.00
77331‡	Special dosimetry	2.76	1.61	2.06	2.00
77332‡	Simple treatment device	0.11	0.17	0.13	0.51
77333‡	Intermediate treatment device	0.30	0.36	0.34	0.79
77334‡	Complex treatment device	0.34	0.30	0.24	0.75
77336	Continuing medical physics consultation	1.50	1.50	1.00	0.75
77338	Multileaf Collimator for IMRT	NA	NA	NA	1.04
77370	Special medical physics consultation	4.00	5.60	3.45	3.00
77785	High Intensity Brachytherapy; 1 Dwell Position	NA	NA	NA	1.60
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	NA	NA	NA	2.00
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	NA	NA	NA	3.00

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**
† Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)
‡ Extreme high outliers for procedural time for these codes in 2014 were excluded from analysis.

Median relative intensity estimates ranked in increasing order of intensity 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 have equal relative intensities in Abt III and IV, while another five have relative intensities that differed less than 50 percent. Two codes have relative intensities that differed by more than 50 percent: special dosimetry and IMRT treatment planning.

Of note, the median relative intensity for IMRT treatment planning decreased from 6.00 in Abt III to 2.00 in the current study. The TCP expressed concern about this trend, as the scope of clinical applications under this code has broadened over time. The vignette associated with this code was for a routine IMRT, which may have resulted in an under-estimate.

Table 6. Median Relative Intensity Estimates for Surveyed Radiation Oncology Physics Services (Increasing Order of Intensity, 2014)

CPT Code	Procedure Description	Abt I*	Abt II*	Abt III*	Abt IV*
77332	Simple treatment device	0.50	0.70	0.70	0.90
77300	Basic dosimetry calculation	0.50	1.00	1.00	1.00
77305	Simple isodose plan	1.00	1.00	1.00	1.00
77333	Intermediate treatment device	1.00	1.00	1.00	1.00
77334	Complex treatment device	1.23	1.20	1.00	1.00
77336†	Continuing medical physics consultation	1.00	1.00	1.00	1.00
77310	Intermediate isodose plan	1.30	1.20	1.28	1.10
77331	Special dosimetry	2.00	2.00	2.65	1.20
77295	Therapeutic radiology simulation-aided field testing	NA	2.50	2.00	1.50
77315	Complex isodose plan	1.55	1.50	1.50	1.50
77338	Multileaf Collimator for IMRT	NA	NA	NA	1.50
77301	IMRT Treatment Planning	NA	4.50	6.00	2.00
77321	Special teletherapy port plan	1.50	1.50	1.50	2.00
77326	Simple brachytherapy isodose plan	1.50	1.50	2.00	2.00
77327	Intermediate brachytherapy isodose plan	1.95	2.00	2.00	2.00
77785	High Intensity Brachytherapy; 1 Dwell Position	NA	NA	NA	2.00
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	NA	NA	NA	2.00
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	NA	NA	NA	2.00
77328	Complex brachytherapy isodose plan	3.00	3.00	3.00	3.00
77370	Special medical physics consultation	3.10	3.87	3.38	3.00

*** Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)**

† 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 the four studies, including estimates where median work for the reference code (77336) has been normalized to 1.00. There were a number of differences between Abt III and Abt IV exceeding 50 percent in absolute value. With the exception of IMRT Treatment Planning, these were all increases:

- IMRT Treatment Planning (77301) - 74% decrease;
- Therapeutic radiology simulation-aided field testing (77295) - 86% increase;
- Simple isodose plan (77305) - 135% increase;
- Intermediate isodose plan (77310) - 117% increase;
- Complex isodose plan (77315) - 54% increase;
- Special teletherapy port plan (77321) - 420% increase;
- Intermediate brachytherapy isodose plan (77327) - 65% increase;
- Simple treatment device (77332) - 183% increase;
- Intermediate treatment device (77333) - 343% increase; and
- Complex treatment device (77334) - 124% increase.

Several factors appear to account for the large differences in normalized median work values between the two studies. First, the median work value (not normalized) for the reference code, continuing medical physics consultation (77336), decreased from 1.0 in 2007 to 0.75 by 2014.[5] In addition, procedures that are performed less often could have produced more volatile estimates.

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 2013 AAPM Professional Survey Report. Normalized median unweighted and weighted work values are presented in Appendix VII.

All 20 codes had differences of less than 50 percent between weighted and unweighted normalized median work estimates, and fourteen of these were differences less than 20 percent. The TCP felt that the weighting differences were not significant, and chose to focus on the unweighted estimates as was done in the previous studies.

[5] 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	Abt I†	Abt II†	Abt III†	Abt IV†
77295§	Therapeutic radiology simulation-aided field testing	NA	3.21	1.63	3.03
77300	Basic dosimetry calculation	0.33	0.29	0.49	0.72
77301	IMRT Treatment Planning	NA	18.64	28.66	7.46
77305§	Simple isodose plan	0.75	0.54	0.69	1.62
77310§	Intermediate isodose plan	1.24	0.72	0.83	1.80
77315§	Complex isodose plan	1.69	1.30	1.65	2.54
77321	Special teletherapy port plan	1.81	1.52	1.64	8.53
77326	Simple brachytherapy isodose plan	3.18	1.87	3.88	5.80
77327	Intermediate brachytherapy isodose plan	4.73	3.53	5.64	9.33
77328	Complex brachytherapy isodose plan	11.67	8.67	11.98	16.00
77331‡	Special dosimetry	4.35	3.60	2.66	2.93
77332§	Simple treatment device	0.06	0.11	0.12	0.34
77333§	Intermediate treatment device	0.31	0.42	0.30	1.33
77334§	Complex treatment device	0.39	0.40	0.45	1.01
77336	Continuing medical physics consultation	1.50	1.50	1.00	1.00
77338	Multileaf Collimator for IMRT	NA	NA	NA	2.18
77370	Special medical physics consultation	15.00	20.92	13.94	11.67
77785	High Intensity Brachytherapy; 1 Dwell Position	NA	NA	NA	4.00
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	NA	NA	NA	7.46
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	NA	NA	NA	11.35

***The intensity (relative to the 77336 benchmark code) and total time estimates were multiplied together to yield raw work values. Normalized median work estimates were calculated by dividing each median raw work estimate by median raw work estimate for the benchmark code.**

† Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)

‡ Extreme high outliers for non-procedural time for this code in 2014 were excluded from analysis.

§ Extreme high outliers for procedural time for these codes in 2014 were excluded from analysis

Caseload, Staffing, and Technology

Information on patient caseloads, number of patient treatments, and staffing by practice type are provided in **Tables 8 and 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. Respondents were also asked to provide the number of staff in a variety of roles at their practices. The data for Physics Assistants were excluded from the report based on the recommendation of the TCP, as the role for these staff is still being defined in the medical physics community. The number of Physics Assistants in QMP practices will be assessed in future studies. Patient caseload estimates per QMP are shown in **Table 10**.

Table 8. Patient Caseloads and Treatments at Institutions Where Medical Physicists Practice, by Practice Type

	Abt III*	Abt IV*				
Patient Caseload and Treatments	**Overall**	**Overall**	**Private/ Community Hospital**	**Medical School/ University Hospital**	**Medical Physics Consulting Group**	**Physician Group**
Number of new patients (teletherapy and brachytherapy)	595	800	789	961.5	240	247
Total number of patients (teletherapy and brachytherapy)	700	900	900	1055.5	241	727.5
Total number of complex external beam cases	NA	450	415.5	750	185	300
Total number of total body photon, total skin electron, and radiosurgery cases	NA	70.5	66	75	91	9
Total number of LDR and HDR brachytherapy fractions	NA	150	150	235.5	58	68
Total number of brachytherapy interstitial seed cases	NA	12	20.5	10.5	13	20
Total number of linear accelerators	NA	3.5	3	4	3	3
Total number of major ancillary radiotherapy equipment units	NA	5	5	6	5	6
Total number of minor ancillary radiotherapy equipment units	NA	4	3	5	5	1
Percentage of total patients that had majority of their treatment on the clinic's most heavily utilized teletherapy unit	50.0%	40.0%	62.5%	30.0%	87.5%	40.0%
Total number of patient treatments performed on the clinic's most heavily utilized teletherapy unit	6240	4440	5888	2728	†	5082
Total number of teletherapy patient treatments performed at institution	13259	12050	12650	16000	5660	5000

*** Abt III (2007), Abt IV (2014)**

† Medical physics consulting group respondents (n=3) are excluded from this estimate.

Table 9. Median Staffing Patterns of Institutions Where Medical Physicists Practice, by Practice Type

	Abt III*	Abt IV*				
FTE Staff	**Overall**	**Overall**	**Private/ Community Hospital**	**Medical School/University Hospital**	**Medical Physics Consulting Group**	**Physician Group**
Number of FTE Staff Employed by Institution in 2013						
Qualified Medical Physicists	2.0	4.0	3.0	6.0	2.0	3.0
Qualified Medical Dosimetrists†	3.0	3.5	2.55	4.5	2.3	3.0
Non-Certified Medical Dosimetrists	NA	0.0	0.0	0.0	1.0	0.0
Radiation Oncologists	3.0	5.0	3.5	7.0	4.0	4.0
Brachytherapy Technologists	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Engineers	0.0	0.0	0.25	0.0	0.0	2.0
Radiation Therapists	8.0	12.0	9.5	15.0	6.0	12.0
Radiation Oncology Nurses	3.0	4.0	3.0	5.0	3.0	4.0
Number of Students Employed by Institution in 2013						
Clinical Medical Physics Residents	NA	0.0	0.0	2.0	0.0	0.0
Medical Physics Graduate Students	NA	0.0	0.0	0.0	0.0	0.0
Radiation Oncology Residents	NA	0.0	0.0	7.0	0.0	0.0
Medical Dosimetry Students	NA	0.0	0.0	0.0	0.0	0.0
Radiation Therapy (RTT) Students	NA	0.0	0.0	2.0	0.0	0.0

*** Abt III (2007), Abt IV (2014)**
† In Abt III, this category was called "Dosimetrists or junior medical physicists."

Table 10. Patient Caseloads and Treatments of Institutions Where Medical Physicists Practice Per QMP, 2014

Patient Caseload and Treatments Per QMP	Median
Number of new patients (teletherapy and brachytherapy)	166.7
Total number of patients (teletherapy and brachytherapy)	250.0
Total number of complex external beam cases	109.8
Total number of total body photon, total skin electron, and radiosurgery cases	14.6
Total number of LDR and HDR brachytherapy fractions	40.0
Total number of brachytherapy interstitial seed cases	4.4
Total number of linear accelerators	0.9
Total number of major ancillary radiotherapy equipment units	1.3
Total number of minor ancillary radiotherapy equipment units	0.9
Total number of patient treatments performed on the clinic's most heavily utilized teletherapy unit*	1121.7
Total number of teletherapy patient treatments performed at institution	3902.0
*Medical physics consulting group respondents (n=3) are excluded from this estimate	

Finally, information on the percentage of practices offering special procedures and advanced technologies collected in the four studies are presented in **Table 11**. Of the ten special procedures that were surveyed in both Abt III and Abt IV and thus could be compared, only one procedure, Intraoperative Radiotherapy, was performed less frequently in 2014 than in 2007 (17 percent versus 15 percent). All other procedures were performed more commonly in 2014 than in 2007. We also noticed fluctuation in the frequency of the procedures that could be compared across all four studies: Total Body Irradiation and Intraoperative Radiotherapy remained the same or similar between Abt I and IV, but went up and down in the other two studies. Total Skin Electron Irradiation was virtually unchanged and Remote Afterloading Brachytherapy increased steadily.

Table 11. Special Procedures and Advanced Technologies Offered By Institutions Where Responding QMPs Practice

Special Procedure or Advanced Technology	Abt I*	Abt II*	Abt III*	Abt IV*
Total Skin Electron Irradiation	31%	38%	34%	38%
Total Body Irradiation	46	57	37	46
Remote (HDR or LDR) Afterloading Brachytherapy	46	66	68	87
Intensity Modulated Radiation Therapy	NA	57	95	100
Image Guided Radiation Therapy	NA	NA	78	98
Stereotactic Radiosurgery (Single Fraction)	NA	51	68	82
Stereotactic Radiotherapy (Multiple Fraction)	NA	43	61	85
Stereotactic Body Irradiation	NA	NA	39	90
Intraoperative Radiotherapy	13	25	17	15
Prostate Seed Brachytherapy	NA	89	78	69
Respiratory Gated Radiotherapy	NA	NA	NA	74
Proton Radiotherapy	NA	NA	NA	5
*** Abt I (1995), Abt II (2003), Abt III (2007), Abt IV (2014)**				

Conclusions

The goal of this study was to measure QMP work for medical physics services. The study used a similar methodology to Abt III, other than switching from paper to online survey format, starting with a larger sample of respondents, and collecting data only on QMP (not support staff) efforts. The methodology for analysis of QMP time, intensity, work (time * intensity), caseload, staffing, and technology remained similar across studies to enable examination of trends.

The following conclusions can be drawn from the current study:

- Despite the more user-friendly online format of the survey, the response rate was 19.5 percent, lower than for the previous three surveys. Numerous reminders were sent to non-respondents and the reason for such low response rate is unclear. One possibility is that with more and more survey invitations from different sources, respondents may be beginning to suffer from "survey fatigue" and would not participate in any study, no matter how important. Note that response rate declined steadily for the first three surveys as well.
- The distributions of respondents by Census Division Region and practice type in this round were not significantly different than those observed for the 2013 AAPM Professional Survey Report, with one exception. There were a smaller percentage of respondents from the Midwest that took the Abt IV survey.
- The estimates for time and intensity for the Abt IV survey were generally higher than for Abt III. This difference was primarily due to an increase in procedural time and work intensity. The trend remained after excluding extreme high outliers from the data.
- Academic practices, those associated with medical schools and university hospitals, tended to treat more patients, provide more treatments, and employ larger staffs.
- The prevalence of all but one of the special procedures that were surveyed in both Abt III and Abt IV increased.

One recommendation for future studies is to ask respondents to specify the number of special procedures and advanced technologies performed at their practice in the past 12 months. The current study and all past studies only asked to indicate as a yes or no whether the procedure was offered at respondents' practices. Quantifying the number of procedures would be more informative as a metric to characterize the use of these technologies.

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

3. Abt Associates, Inc., *The Abt Study of Medical Physicist Work Values for Radiation Oncology Physics Services: Round III*. June, 2008.

4. American Association of Physicists in Medicine. *AAPM Professional Policy 1. Definition of a Qualified Medical Physicist*. Available from: http://www.aapm.org/org/policies/details.asp?id=316&type=PP

Appendix I: AAPM Professional Policy 1: Definition of A Qualified Medical Physicist

For the purpose of providing clinical professional services, a Qualified Medical Physicist (QMP) is an individual who is competent to independently provide clinical professional services in one or more of the subfields[1] of medical physics. The subfields of medical physics are:

1. Therapeutic Medical Physics
2. Diagnostic Medical Physics
3. Nuclear Medical Physics
4. Medical Health Physics

The scope of practice of each subfield is defined in the AAPM Professional Policy 17 "Scope of Practice of Clinical Medical Physics."[2]

A Qualified Medical Physicist meets each of the following credentials:

1. Has earned a master's and/or doctoral degree in physics, medical physics, biophysics, radiological physics, medical health physics, or equivalent disciplines from an accredited college or university; and
2. Has been granted certification in the specific subfield(s) of medical physics with its associated medical health physics aspects by an appropriate national certifying body and abides by the certifying body's requirements for continuing education.

The following certifying bodies have been deemed appropriate:

1. ***For the subfield of Therapeutic Medical Physics***, *certification by*:
   - The American Board of Radiology; or
   - The American Board of Medical Physics; or
   - The Canadian College of Physicists in Medicine.

2. ***For the subfield of Diagnostic Medical Physics,*** *certification by*:
   - The American Board of Radiology; or
   - The American Board of Medical Physics; or
   - The Canadian College of Physicists in Medicine.

[1] Previous certification categories in medical physics included radiological physics, therapeutic radiological physics, medical nuclear physics, diagnostic radiological physics and diagnostic imaging physics.

[2] AAPM Professional Policy 17-B. Scope of Practice of Clinical Medical Physics. Available from: http://www.aapm.org/org/policies/details.asp?id=317&type=PP

3. ***For the subfield of Nuclear Medical Physics***, *certification by*:
   - The American Board of Radiology; or
   - The American Board of Medical Physics; or
   - The Canadian College of Physicists in Medicine; or
   - The American Board of Science in Nuclear Medicine.

4. ***For the subfield of Medical Health Physics***, *certification by*:
   - The American Board of Medical Physics; or
   - The American Board of Health Physics including a minimum of three years relevant experience in the subfield of medical health physics.

Appendix II: CPT Descriptors of Medical Physics Codes

The following CPT code descriptions were provided to survey respondents. Further information on each of the 20 codes is contained in American Medical Association (AMA), Current Procedure Terminology CPT 2013 Professional Edition, AMA Press, 2013.

CPT® CODE 77295: Therapeutic radiology simulation-aided field setting; 3-dimensional. One or more of the following exists:

- Volume of interest lies in close proximity to normal structures that must be protected.
- Volume of interest can only be defined by MRI or CT.
- Multiple or conformal portals are necessary to cover the volume of interest with close margins to protect immediately adjacent structures.
- Beam's eye view of multiple portals must be established for conformal treatment delivery.
- An immediately adjacent area has been irradiated, and abutting portals must be established with high precision.
- Three-dimensional reconstruction of the tumor volume, and the critical structure volume in brachytherapy cases, is used to develop dose-volume histograms for the tumor and critical structures.

CPT® CODE 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. To report dosimetry calculations that arrive at the relationship between monitor units (or time) and dose, and the physician's verification, review and approval.

CPT® CODE 77301: Intensity modulated radiotherapy plan, including dose-volume histograms for target and critical structure partial tolerance specifications. (Dose plan is optimized using inverse or forward planning technique for modulated beam delivery [eg, binary, dynamic MLC] to create highly conformal dose distribution. Computer plan distribution must be verified for positional accuracy based on dosimetric verification of the intensity map with verification of treatment setup and interpretation of verification methodology). Report once per course of therapy.

CPT® CODE 77305: Teletherapy, isodose plan (whether hand or computer calculated); simple. One or two parallel opposed unmodified ports directed to a single area of interest.

CPT® CODE 77310: Teletherapy, isodose plan (whether hand or computer calculated); intermediate. Three or more treatment ports directed to a single area of interest.

CPT® CODE 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.

CPT® CODE 77321: Special teletherapy port plan, particles, hemibody, total body. Use for particle beam isodose planning. Use for electrons, protons and neutron therapy; half body or total body therapy.

CPT® CODE 77326: Brachytherapy isodose plan; simple. Calculation made from single plane, one to four sources/ribbon application, remote afterloading brachytherapy, 1 to 8 sources.

CPT® CODE 77327: Brachytherapy isodose plan; intermediate. Multiplane dosage calculations, application involving 5 to 10 sources/ribbons, remote afterloading brachytherapy, 9 to 12 sources.

CPT® CODE 77328: Brachytherapy isodose plan; complex. Multiplane isodose plan, volume implant calculations, over 10 sources/ribbons used, special spatial reconstruction, remote afterloading brachytherapy, over 12 sources.

CPT® CODE 77331: Special dosimetry (e.g., TLD, microdosimetry) (specify), only when prescribed by the treating physician. Explanation of medical necessity may be required.

CPT® CODE 77332: Treatment devices, design and construction; simple. (simple block, simple bolus)

Simple block: Treatment blocks made in the form of squares, rectangles, circles and other irregular, multi-use shapes that are placed by hand on the blocking tray each day at the time of the patient's setup constitute simple blocks. The physician selects the shape and designs the placement of these blocks with the intent to protect certain areas of a radiation port during treatment. No special fabrication is necessary for these blocks.

Bolus: The use of bolus material to modify the radiation beam as it transitions from air to tissue constitutes a simple treatment device. These pre-made, reusable articles are typically used with other treatment devices. Bolus material is billable only in the situation where it is used as the only treatment device for a particular radiation port; i.e., no other, more complex treatment devices are being used. In the latter case, the bolus charge becomes subordinate to the more complex charge, with no charge being submitted for the bolus material.

Passive, multiuse devices: Passive restraints, pillows, straps, sandbags, amorphous devices and other minor devices are widely used in radiation oncology. Their reimbursement is blended into treatment delivery, and they are not billable as separate treatment devices.

CPT® CODE 77333: Treatment devices, design and construction; intermediate. (multiple blocks, stents, bite blocks, special bolus)

Blocks: A pre-cast or pre-made standard-shaped block used from patient to patient, where there is no particular custom fabrication to the patient's individual anatomy, constitutes an intermediate treatment device.

Stents: A pre-fabricated stent used to modify a patient's anatomy for the proper delivery of a radiation dose is billed as an intermediate treatment device.

Bite blocks: A custom-fabricated bite block for manipulation of the oral cavity and oropharyngeal anatomy is billed as an intermediate treatment device.

Special bolus: Custom fabrication of bolus material to compensate for tissue defects is billed as an intermediate treatment device.

CPT® CODE 77334: Treatment devices, design and construction; complex. (irregular blocks, special shields, compensators, wedges, molds or casts)

Blocks: A custom-fabricated cast block designed specifically for one patient and not reusable constitutes a complex treatment device. These devices require direct input from the physician for design, selection, placement and daily reproduction.

Immobilization devices: Treatment devices may be used for patient immobilization to accurately reproduce the anatomic isocenter on a daily basis. These include any of the thermal plastic devices, solidifying polymers or vacuum devices. These devices are fabricated under the direct supervision of a physician and are specifically designed for an individual patient's treatment course.

Wedges: Wedges, or treatment devices that shape the profile of a treatment beam to compensate for an angular plane of entry, are mechanical devices usually affixed to the machine head and are considered complex treatment devices. They are billable in this fashion only when used alone. In the more common circumstance, when they are used in conjunction with other complex treatment devices on the same port, only a single complex treatment device may be billed. An exception to this rule is when the wedge has been specifically fabricated for a particular patient's situation.

Compensators: Custom-fabricated compensators designed to eliminate dose inhomogeneities secondary to irregular surface contours are billed as complex treatment devices. When custom designed for a particular port, such compensators may be billed individually and in addition to other complex treatment devices that may be used.

Eye shields: Eye shields are multiple-use devices whose application is highly complex and precise. They are used under the direct supervision of the radiation oncologist and are clinically placed for each treatment. When used, they are billed as complex treatment devices.

CPT® CODE 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 Reported per 5 fractions of therapy.

CPT® CODE 77338: Multi-leaf collimator (MLC) device(s) for intensity modulated radiation therapy (IMRT), design and construction per IMRT plan. This code is only used for treatment delivered by linear accelerators, which utilize MLC devices for beam modulation. This code captures the work and practice expense of the design and construction of the MLC device used in IMRT delivery. Use of the code 77334 (ie, complex treatment device) as it relates to the use of the MLC(s) in IMRT will be reported with code 77338 after January 1, 2010. Code 77338 is not to be used when compensator-based treatment delivery (0073T) is used in the treatment of the patient. For compensator-based IMRT, code 77334 describes the use of the compensator.

CPT® CODE 77370: Special medical physics consultation should be used for consultative purposes when a problem or special situation arises during radiation therapy. This code requires a detailed written report describing the problem to be given to the requesting physician.

CPT® CODE 77785: Remote Afterloading High Intensity Brachytherapy HDR Brachytherapy – 1 channel

CPT® CODE 77786: Remote Afterloading High Intensity Brachytherapy HDR Brachytherapy – 2-12 channels

CPT® CODE 77787: Remote Afterloading High Intensity Brachytherapy HDR Brachytherapy – more than 12 channels

Appendix III: Vignettes of Surveyed Medical Physics Services

CPT Code	Procedure Vignette
77295	63-year-old male with lung cancer presents for 3-dimensional conformal radiation therapy involving 7 irregular fields with 6 MV photons. CT scans are performed throughout the chest, and CT planning is performed, including generation of dose volume histograms for the target and normal structures.[1]
77300	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.
77301	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 oncologist 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, the QMP and the QMD review each iteration. The review includes both the dose distribution in multiple planes and the dose volume histogram. The QMP and certified medical dosimetrist (CMD) also review the plan for safety and feasibility considerations. After the oncologist approves the final plan, the QMP and CMD transfer the planning data from the treatment planning system to the Record and Verify System. The computer plan distribution must be verified by the QMP for positional accuracy based on dosimetric verification of the intensity map with verification of treatment setup and interpretation of verification methodology.
77305	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	68-year-old man with squamous carcinoma in the middle third of the esophagus. Postoperative 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.

[1] As noted in the Methodology section of the report, the vignette for 77295 was deemed inaccurate by one of the survey respondents, and was updated to more accurately reflect its current use. This is the updated vignette.

CPT Code	Procedure Vignette
77315	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	55-year-old female with mycosis fungoides involving the total skin. Twelve field total skin irradiation is planned with 6 MeV electrons. Six fields are treated on the first fraction with the other six fields treated during the second fraction. Six fields are then treated every other day until the course of treatment is complete.
77326	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 Cesium137 sources.
77327	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 Cesium137 sources for 72 hours.
77328	55-year-old male with squamous cell carcinoma involving the base of the tongue. Irradiation is planned using IR192 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	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	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 by the QMP.
77333	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 fabricated by the QMP.
77334	47-year-old male with mucoepidermoid carcinoma of the parotid. External beam irradiation is planned using 6 MV photons and 15 MeV electrons. A custom immobilization mask is fabricated using a heated thermoplastic mesh reinforced with solid thermoplastic strips. The mask covers the patients head and shoulders anatomy to adequately restrict movement during treatment.

CPT Code	Procedure Vignette
77336	65-year-old male with adenocarcinoma of the prostate. Volumetric Modulated Arc Therapy (VMAT) is planned using 10 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered. Two conedowns are scheduled during the course of treatment. The QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations.
77338	53-year-old male with H&N cancer requires delivery for a 5 field IMRT treatment plan utilizing 6 MV photons. The MLC is verified to be working properly to deliver the IMRT plan with an acceptable dose magnitude and precision.
77370	56-year-old male presents with an arteriovenous malformation (AVM) and is referred for stereotactic radiosurgery. The AVM is treated to a dose of 2500 cGy in a single fraction. The special consideration is that the patient has experienced a previous treatment to the contralateral parotid bed. This previous treatment must be accounted in the treatment plan to the AVM. 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 noncoplanar 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 taking into account the previous treatment to the contralateral parotid bed.
77785	A 44-year-old female requiring a boost to the cervical os receives two fractions of HDR brachytherapy. The treatment is optimized for one dwell position at the tip of a dome cylinder application. The QMP checks the applicator position and connections and reviews the plan for safety considerations. The QMP is present during the entire duration of the treatment.
77786	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 QMP checks the applicator position and connections and review the plan for safety considerations. The QMP is present during the entire duration of the treatment.
77787	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. 14 Dwell positions are used for each fraction. The QMP checks the applicator position and connections and review the plan for safety considerations. The QMP is present during the entire duration of the treatment.

Appendix IV: Members of the Second Technical Consulting Panel

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Appendix V: Survey of Medical Physicist Work Values for Radiation Oncology

The Abt Study of Medical Physicist Work Values for Radiation Oncology

1. Survey Introduction

The American Association of Physicists in Medicine (AAPM) needs your help for this most important survey which is administered by Abt Associates on its behalf. You were selected based on your practice type, geographic location and clinical experience. Your voluntary cooperation to complete the survey is essential, and we thank you in advance for your efforts. The results from the Abt survey are the only validated resource that exists to defend the work of the medical physicist from being devalued in the health care system. Results from the survey will define a procedure-based practice profile for Radiation Oncology Physics practice. This information is designed to benchmark and defend the manpower, work and staffing for radiation oncology departments.

WHO SHOULD PARTICIPATE?

This survey is intended for Qualified Medical Physicists (QMP) with access to clinical procedure workload data and its purpose is to measure QMP work rendered during medical physics services. The AAPM's definition of a "Qualified Medical Physicist" is included in the AAPM Survey Reference Document provided here:

AAPM Survey Reference Guide

If you think you may not qualify to participate in the survey, we still ask that you proceed to the first question on the next page, which will enable you to exit the survey. This way, we can record your status and you will not receive any reminder emails. We thank you in advance for your time.

SURVEY ORGANIZATION

There are five sections in the survey. The sections include (a) respondent contact information; (b) non-procedural time estimates; (c) procedural time estimates and work values; (d) institutional volume and staffing patterns; and (e) special procedures and advanced techniques.

Only the work of the QMP should be reported in columns that designate QMP work. An asterisk (*) in front of the question means a response to this question is required. If you need to stop at any point in the survey, Survey Monkey will return you to that spot the next time you log in. All of the data that you have entered will be saved.

For your reference in completing this survey, CPT Codes with Descriptions and Comments for Medical Dosimetry Procedures are provided in the AAPM Survey Reference Document (linked to above). Further information on each of the 19 codes is contained in American Medical Association (AMA), Current Procedure Terminology CPT 2013 Professional Edition, AMA Press, 2013.

In order to complete the institutional volume section, you will need to acquire information about the procedure workload of the clinic where you spend most of your time. Considering the clinic where you are employed primarily, you will need to determine the number of procedures that were completed and billed in 2013 for the following CPT numbers:

77295, 77300, 77301, 77305, 77310, 77315, 77321, 77326, 77327, 77328, 77331, 77332, 77333, 77334, 77336, 77338, 77370, 77785, 77786, 77787

You should be able to obtain the numbers of billed procedures through your department administrator or through your billing representative. These numbers are needed to build an accurate model of medical physicist effort with respect to staffing, time and intensity of work.

You should be able to complete the questionnaire in about 45 minutes. We request that you do so by November 8, 2014.

USE OF SURVEY RESULTS

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.

Page 1

The Abt Study of Medical Physicist Work Values for Radiation Oncology

IMPORTANT - SAVING YOUR RESPONSES AND RETURNING LATER

If you need to stop in the middle of the survey, you must select/use the "Exit Survey" button on the top right of the page. This will save your responses when you return later to complete the survey.

CONFIDENTIALITY OF YOUR ANSWERS

Your answers will be kept confidential; deidentified data will be given to AAPM. There is a small risk of loss of confidentiality; however, we have many procedures in place to prevent this from happening.

WHO TO CONTACT

If you have questions or difficulties completing the survey, please contact:

Michael D. Mills, PhD
Chair of Workforce Assessment Committee
Email: mdmill03@exchange.louisville.edu
Telephone: (502) 561-2700

The AAPM thanks you for your participation in this survey.

2. Employment Venue - Clinical or Industry

***1. The following best describes my day to day employment in Medical Physics:**

- ◯ I am a working Clinical Medical Physicist. I have access to clinical procedure workload (charge capture) data.
- ◯ I am a working Clinical Medical Physicist but I do not have access to charge capture data.
- ◯ I am a working Clinical Medical Physicist, but I work in Industry and do not treat patients.
- ◯ I am retired and I no longer work as a Clinical Medical Physicist
- ◯ None of the above

3. Demographics

***2. Please enter the demographic information requested below:**

Name:

Email Address:

4. Demographics

Page 2

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***3. Please select your practice type from the following options:**

- ◯ Private/Community Hospital
- ◯ Medical School/University Hospital
- ◯ Medical Physics Consulting Group
- ◯ Medical (Physician) Group
- ◯ None of the above

5. Demographics

***4. Indicate your geographic region of the United States or indicate if you live outside the US:**

- ◯ Pacific: Alaska, California, Hawaii, Oregon, Washington
- ◯ New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
- ◯ Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
- ◯ South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
- ◯ Middle Atlantic includes: New Jersey, New York, Pennsylvania
- ◯ West South Central: Arkansas, Louisiana, Oklahoma, Texas
- ◯ East South Central: Alabama, Kentucky, Mississippi, Tennessee
- ◯ East North Central: Illinois, Indiana, Michigan, Ohio, Wisconsin
- ◯ West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
- ◯ Canada
- ◯ Other country than USA or Canada

6. Physics Services - Non-Procedural Time Estimates

Non-Procedural Time - Instructions for Completion

In this section you will be asked to estimate the time required to perform tasks that are not specific to a procedure (nonprocedural time) including daily, weekly, and monthly checks. You will be asked to make time estimates for commissioning the equipment and to performing regularly scheduled quality assurance and equipment maintenance and updates.

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.

Please report only the work of the Qualified Medical Physicist, expressed as hours typically spent in rendering a single occurrence of each service. 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.

Page 3

The Abt Study of Medical Physicist Work Values for Radiation Oncology

7. Physics Services - Non-Procedural Time Estimates

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.

For this section the equipment consists of a dual photon energy unit with both conventional and flattening filter free photon beams and with six (6) electron energies, with an associated simulator and treatment planning computer. Please refer to the lists below for specific directions regarding what to include for the initial commissioning time estimate and the annual calibration estimate.

Initial Commissioning - Please include time to:

- Design radiation shielding
- Perform radiation surveys
- Commission local standard chambers, electrometers, field instruments, beam scanning and film dosimetry
- Adjust and verify accuracy of all position, angle and distance indicators
- Accept linear accelerator
- Accept and commission simulator and CTsimulator
- Measure CAX profile for each beam
- Measure off-axis profiles for each beam
- Measure wedge and tray factors
- Measure output factors
- Reduce data to usable SSD and TMR charts
- Determine and verify output calibrations
- Determine and verify output and energy checks
- Check leakage radiation
- Accept treatment planning computer
- Enter and verify data in computer
- Prepare reports on calibration, acceptance tests, commissioning and radiation survey
- Complete additional commissioning tasks
- Time to commission: tissue compensating filters, microdosimetry (TLD), block cutting, independent jaw treatment, multileaf collimator, dynamic, 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

Annual Calibration - Please include time for verification of:

- X-ray output for all energies
- Electron output for all energies and applicators
- CAX dosimetry (PDD/TMR)
- Transmission factors for all accessories
- Wedge factors
- Monitor chamber linearity
- X-ray constancy and beam uniformity versus gantry angle
- Multileaf collimator verification
- Electronic portal imaging verification
- Total body photon irradiation verification
- Electron output and beam uniformity versus gantry angle
- Collimator rotation isocenter
- Gantry and couch rotation isocenter
- Coincidence of radiation and mechanical isocenter
- Coincidence of collimator, gantry and couch axis with isocenter
- Table top sag
- Vertical travel of table
- Light field intensity
- Validation of all daily and monthly checks
- Total skin electron verification

The Abt Study of Medical Physicist Work Values for Radiation Oncology

- Intensity modulated radiotherapy verification
- Stereotactic radiotherapy and radiosurgery verification
- Also include in your estimate time spent each year performing quality assurance of ion chamber and film dosimetry equipment (including the processor), beam scanner, diodes and other measurement and support equipment.

***5. Estimate the number of hours required for the QMP to provide equipment support services for:**

	Commission fully the radiation oncology equipment for patient treatments (hours)	Perform recalibration procedures due to catastrophic or non-routine events over a five (5) year period (hours)	Perform an annual calibration for radiation oncology equipment for patient treatments (hours)
An external beam dual photon energy linear accelerator with both conventional and flattening filter free beams and with six (6) electron energies and an associated simulator and CT-simulator, treatment planning computer, beam scanning and film dosimetry system.			

8. Physics Services - Non-Procedural Time Estimates

Page 5

The Abt Study of Medical Physicist Work Values for Radiation Oncology

Please refer to the following list in making your estimate for time for daily, weekly and monthly checks.

Daily checks include:
- X-ray output constancy
- Audiovisual monitors
- Electron output constancy
- Door interlock
- Distance indicator (ODI)
- Field size indicators
- Other daily checks

Monthly checks include:
- X-ray output constancy
- Electron output constancy
- X-ray central axis dosimetry (PDD/TMR)
- Electron central axis dosimetry (PDD)
- X-ray and electron beam uniformity
- Emergency off switches
- Dosimetry, symmetry, wedge, and electron cone interlocks
- Collision avoidance interlocks
- Light/radiation field coincidence
- Electron portal imaging device verification
- Total body photon irradiation verification
- Gantry/collimator angle indicators
- Wedge position
- Tray position
- Field size indicators
- Cross-hair centering
- Treatment couch position indicators
- Latching of wedges and blocking trays
- Jaw symmetry and field light intensity
- Total skin electron verification
- Intensity modulated Radiotherapy verifications
- Stereotactic radiosurgery and radiotherapy

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.

***6. Time for Daily, Weekly and Monthly Checks**

Estimate the number of hours required for the QMP (Qualified Medical Physicist) 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.

9. Physics Services - Non-Procedural Time Estimates

Page 6

The Abt Study of Medical Physicist Work Values for Radiation Oncology

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

Please refer to the lists below when making your estimates.

Time to commission - please 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

Time for annual checks - please 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

***7. Estimate the number of hours required for the QMP to commission your Low Dose Rate (LDR) brachytherapy system and the number of hours per year for the QMP to perform quality assurance tasks for the LDR brachytherapy system.**

	Time in Hours to Commission	Annual time in Hours for Ongoing Quality Assurance and Other Support
Low Dose Rate (LDR) brachytherapy system		

10. Physics Services - Non-Procedural Time Estimates

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

***8. Estimate the number of hours required for the QMP to commission completely a TLD and/or diode system for dose measurements for two photon (2) energies both conventional and flattening filter free, and six (6) electron energies. Estimate the number of hours required per month for the QMP (Qualified Medical Physicist) to perform quality assurance checks on the TLD and/or diode system.**

	Time in Hours to Commission	Monthly time in Hours for Ongoing Quality Assurance and Other Support
TLD and/or diode system		

Page 7

The Abt Study of Medical Physicist Work Values for Radiation Oncology

11. Physics Services - Non-Procedural Time Estimates

IV. CPT Code 77332: Simple treatment device system (e.g., non-custom block, blocking tray or simple bolus)
V. CPT Code 77333: Intermediate treatment devices (e.g., shaped bolus, stent, or bite block)

***9. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to commission completely a simple and intermediate treatment device system for clinical use.**

	Hours
Simple treatment device system	
Intermediate treatment device system	

12. Physics Services - Non-Procedural Time Estimates

VI. CPT Code 77334: Complex treatment device systems (e.g., custom low temperature alloy blocking system, custom face mask system and tissue compensation system), and
VII. 77338 Multileaf collimator (MLC) device(s) for intensity modulated radiation therapy (IMRT)

***10. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to commission completely a complex treatment device; also estimate the monthly hours required to perform quality assurance checks on a complex treatment device system for clinical use. Next, estimate the number of hours required in QMP (Qualified Medical Physicist) work to commission completely a multileaf collimator (MLC) device for intensity modulated radiation therapy (IMRT); also estimate the hours required per month to perform quality assurance checks and verify operation of a multileaf collimator system.**

	Hours for Initial Commissioning	Monthly Hours for QA Checks
Complex treatment device		
Multileaf collimator (MLC) system		

13. Physics Services - Non-Procedural Time Estimates

***11. Does your practice include High Dose Rate Brachytherapy?**

◯ Yes
◯ No

14. Physics Services - Non-Procedural Time Estimates

Page 8

The Abt Study of Medical Physicist Work Values for Radiation Oncology

VIII 77785 - Remote Afterloading High Intensity Brachytherapy 1 Channel; 77786 - Remote Afterloading High Intensity Brachytherapy 2-12 Channels; 77787 - Remote Afterloading High Intensity Brachytherapy More than 12 Channels.

Please refer to the lists below when making your estimates.

Time to commission - please include time to:
- Commission the treatment planning system for the HDR source
- 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 HDR brachytherapy algorithm in treatment planning computer
- Check and verify remote HDR afterloading control system
- Check and verify remote HDR afterloading source guide tubes
- Develop, test, validate and train for HDR emergency procedures

Time for HDR annual checks - please include:
- Performance of spot checks and wiping of test sources for your HDR brachytherapy system
- Source guide inspection
- Applicators' source positioning accuracy
- Source calibration
- Applicators' mechanical integrity
- Brachytherapy system calibration
- Remote HDR afterloading system evaluation
- Also include time to simulate and train for emergency conditions

***12. Estimate the number of hours required in QMP work to commission completely a high dose rate (HDR) afterloading brachytherapy system for clinical use. Next, estimate the number of hours per year for the QMP to perform quality assurance tasks for the high dose rate (HDR) brachytherapy system.**

	Commissioning Hours	Annual Quality Assurance Hours
(HDR) brachytherapy system		

15. Physics Services - Procedural Time and Intensity Estimates

The Abt Study of Medical Physicist Work Values for Radiation Oncology

In this section, you will be asked to estimate procedural time and work intensity for 19 medical dosimetry services (Current Procedure Terminology (CPT) codes) – fifteen 77300 series ("physics series") codes, one additional code (77295), and three high dose rate afterloading codes (77785-7). The Reference Guide presents complete definitions of each code. The questions include vignettes describing a "typical" patient to represent each service. Please base the time and intensity data you record for each service's vignette on your own recent clinical experience. Make your estimates for a single patient.

The following definitions are provided to help you complete this section.

Work = Time * Intensity, where

Time is the time spent preparing for and conducting each medical dosimetry service, and

Intensity combines the mental effort and judgment, technical skill and physical effort, and psychological stress associated with each service.

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

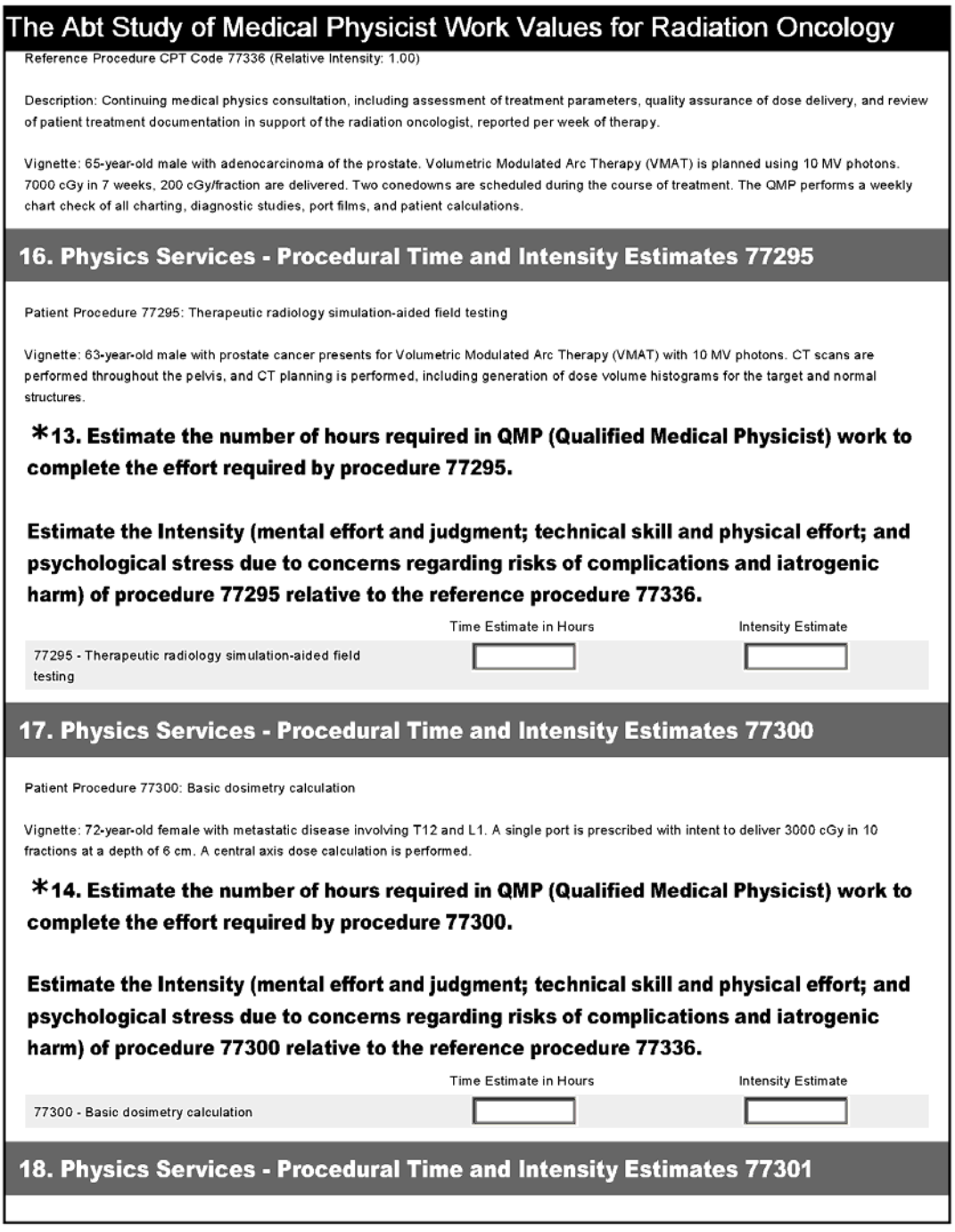
In making your time estimates INCLUDE time to:
- Obtain patient measurements and treatment parameters
- Accompany patient to imaging procedure
- Retrieve, load, and digitize patient data
- Perform dosimetry calculations
- Perform brachytherapy plans
- Perform isodose curve plans
- Custom make or fit a treatment device
- Check and issue verifications for:
- Dosimetry calculations
- Isodose treatment plans
- Delivery quality assurance
- Brachytherapy plans (including time that the qualified medical physicist is physically present during loading and unloading of the sources)
- Treatment devices

DO NOT INCLUDE time for:
- 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
- Performing final chart check and validation

To estimate intensity, you will be asked to employ a technique referred to as magnitude estimation to rate each service's intensity. Magnitude estimation is performed by selecting a commonly provided reference procedure, in this case, "continuing medical physics consultation" (CPT 77336). The intensity for this "benchmark service" is set equal to 1.0. You will be asked to rate the intensity of each of the other 19 medical dosimetry services relative to the benchmark service. For example, if you believe service X's intensity is twice as great as that of the reference procedure 77336, you would assign service X an intensity of 2.0. The reference procedure and associated vignette are provided below.



The Abt Study of Medical Physicist Work Values for Radiation Oncology

Reference Procedure CPT Code 77336 (Relative Intensity: 1.00)

Description: 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.

Vignette: 65-year-old male with adenocarcinoma of the prostate. Volumetric Modulated Arc Therapy (VMAT) is planned using 10 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered. Two conedowns are scheduled during the course of treatment. The QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations.

16. Physics Services - Procedural Time and Intensity Estimates 77295

Patient Procedure 77295: Therapeutic radiology simulation-aided field testing

Vignette: 63-year-old male with prostate cancer presents for Volumetric Modulated Arc Therapy (VMAT) with 10 MV 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.

*13. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77295.

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77295 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77295 - Therapeutic radiology simulation-aided field testing		

17. Physics Services - Procedural Time and Intensity Estimates 77300

Patient Procedure 77300: Basic dosimetry calculation

Vignette: 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.

*14. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77300.

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77300 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77300 - Basic dosimetry calculation		

18. Physics Services - Procedural Time and Intensity Estimates 77301

Page 11

1

[1] As noted in the Methodology section of the report, the vignette for 77295 was deemed inaccurate by one of the survey respondents, and was updated to more accurately reflect its current use. The vignette shown here was the original version used in the survey, and the updated version can be found in Appendix III.

The Abt Study of Medical Physicist Work Values for Radiation Oncology

Patient Procedure 77301: IMRT Treatment Planning

Vignette: 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 oncologist 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, the QMP and the QMD review each iteration. The review includes both the dose distribution in multiple planes and the dose volume histogram. The QMP and certified medical dosimetrist (CMD) also review the plan for safety and feasibility considerations. After the oncologist approves the final plan, the QMP and CMD transfer the planning data from the treatment planning system to the Record and Verify System. The computer plan distribution must be verified by the QMP for positional accuracy based on dosimetric verification of the intensity map with verification of treatment set-up and interpretation of verification methodology.

***15. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77301.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77301 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77301 - IMRT Treatment Planning		

19. Physics Services - Procedural Time and Intensity Estimates 77305

Patient Procedure 77305: Simple isodose plan

Vignette: 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.

***16. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77305.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77305 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77305 - Simple isodose plan		

20. Physics Services - Procedural Time and Intensity Estimates 77310

Patient Procedure 77310: Intermediate isodose plan

Vignette: 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.

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***17. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77310.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77310 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77310 - Intermediate isodose plan		

21. Physics Services - Procedural Time and Intensity Estimates 77315

Patient Procedure 77315: Complex isodose plan

Vignette: 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.

***18. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77315.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77315 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77315 - Complex isodose plan		

22. Physics Services - Procedural Time and Intensity Estimates 77321

Patient Procedure 77321: Special teletherapy port plan

Vignette: 55-year-old female with mycosis fungoides involving the total skin. Twelve field total skin irradiation is planned with 6 MeV electrons. Six fields are treated on the first fraction with the other six fields treated during the second fraction. Six fields are then treated every other day until the course of treatment is complete.

***19. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77321.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77321 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77321 - Special teletherapy port plan		

Page 13

The Abt Study of Medical Physicist Work Values for Radiation Oncology

23. Physics Services - Procedural Time and Intensity Estimates 77326

Patient Procedure 77326: Simple brachytherapy isodose plan

Vignette: 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.

***20. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77326.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77326 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77326 - Simple brachytherapy isodose plan		

24. Physics Services - Procedural Time and Intensity Estimates 77327

Patient Procedure 77327: Intermediate brachytherapy isodose plan

Vignette: 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.

***21. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77327.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77327 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77327 - Intermediate brachytherapy isodose plan		

25. Physics Services - Procedural Time and Intensity Estimates 77328

Patient Procedure 77328: Complex brachytherapy isodose plan

Vignette: 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.

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***22. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77328.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77328 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77328 - Complex brachytherapy isodose plan		

26. Physics Services - Procedural Time and Intensity Estimates 77331

Patient Procedure 77331: Special dosimetry

Vignette: 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.

***23. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77331.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77331 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77331 - Special dosimetry		

27. Procedural Time and Intensity Estimates 77332

Patient Procedure 77332: Simple treatment device

Vignette: 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 by the QMP.

***24. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77332.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77332 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77332 - Simple treatment device		

The Abt Study of Medical Physicist Work Values for Radiation Oncology

28. Physics Services - Procedural Time and Intensity Estimates 77333

Patient Procedure 77333: Intermediate treatment device

Vignette: 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 fabricated by the QMP.

***25. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77333.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77333 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77333 - Intermediate treatment device		

29. Physics Services - Procedural Time and Intensity Estimates 77334

Patient Procedure 77334: Complex treatment device

Vignette: 47-year-old male with mucoepidermoid carcinoma of the parotid. External beam irradiation is planned using 6 MV photons and 15 MeV electrons. A custom immobilization mask is fabricated using a heated thermoplastic mesh reinforced with solid thermoplastic strips. The mask covers the patients head and shoulders anatomy to adequately restrict movement during treatment.

***26. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77334.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77334 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77334 - Complex treatment device		

30. Physics Services - Procedural Time Estimates 77336

Patient Procedure 77336: Continuing medical physics consultation

65-year-old male with adenocarcinoma of the prostate. Volumetric Modulated Arc Therapy (VMAT) is planned using 10 MV photons. 7000 cGy in 7 weeks, 200 cGy/fraction are delivered. Two conedowns are scheduled during the course of treatment. The QMP performs a weekly chart check of all charting, diagnostic studies, port films, and patient calculations.

This is the reference procedure and by definition, the Intensity of this procedure is assigned the value of 1.00.

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***27. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by patient procedure 77336.**

	Time Estimate in Hours
77336 - Continuing medical physics consultation	

31. Physics Services - Procedural Time and Intensity Estimates 77338

Patient Procedure 77338: Multileaf Collimator for IMRT

Vignette: 53-year-old male with H&N cancer requires delivery for a 5 field IMRT treatment plan utilizing 6 MV photons. The MLC is verified to be working properly to deliver the IMRT plan with an acceptable dose magnitude and precision.

***28. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77338.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77338 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77338 - Multileaf Collimator for IMRT		

32. Physics Services - Procedural Time and Intensity Estimates 77370

Patient Procedure 77370: Special medical physics consultation

Vignette: 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 special consideration is that the patient has experienced a previous treatment to the contralateral parotid bed. This previous treatment must be accounted in the treatment plan to the AVM. 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 noncoplanar 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 taking into account the previous treatment to the contralateral parotid bed.

***29. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77370.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77370 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77370 - Special medical physics consultation		

33. Physics Services - Procedural Time and Intensity Estimates

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***30. Does your practice include High Dose Rate Brachytherapy?**

◯ Yes

◯ No

34. Physics Services - Procedural Time and Intensity Estimates 77785

Patient Procedure 77785: High Intensity Brachytherapy; 1 Dwell Position

Vignette: A 44-year-old female requiring a boost to the cervical os receives two fractions of HDR brachytherapy. The treatment is optimized for one dwell position at the tip of a dome cylinder application. The QMP checks the applicator position and connections and reviews the plan for safety considerations. The QMP is present during the entire duration of the treatment.

***31. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77785.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77785 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77785 - High intensity brachytherapy; 1 dwell position		

35. Physics Services - Procedural Time and Intensity Estimates 77786

Patient Procedure 77786: High Intensity Brachytherapy; 2 to 12 Dwell Positions

Vignette: 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 QMP checks the applicator position and connections and review the plan for safety considerations. The QMP is present during the entire duration of the treatment.

***32. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77786.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77786 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77786 - High intensity brachytherapy; 2-12 dwell positions		

36. Physics Services - Procedural Time and Intensity Estimates 77787

The Abt Study of Medical Physicist Work Values for Radiation Oncology

Patient Procedure 77787: High Intensity Brachytherapy; Over 12 Dwell Positions

Vignette: 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. 14 Dwell positions are used for each fraction. The QMP checks the applicator position and connections and review the plan for safety considerations. The QMP is present during the entire duration of the treatment.

***33. Estimate the number of hours required in QMP (Qualified Medical Physicist) work to complete the effort required by procedure 77787.**

Estimate the Intensity (mental effort and judgment; technical skill and physical effort; and psychological stress due to concerns regarding risks of complications and iatrogenic harm) of procedure 77787 relative to the reference procedure 77336.

	Time Estimate in Hours	Intensity Estimate
77787 - High intensity brachytherapy; over 12 dwell positions		

37. Institutional Physics Service Volumes and Staffing Patterns

In this section of the survey, you will be asked to report the total number of times that each physics service was performed in your institution during the 2013 calendar year. 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 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.

This information is critical for us to provide a workforce and staffing benchmark based on procedures. Please fill out these questions if at all possible.

38. Institutional Physics Service Volumes and Staffing Patterns

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***34. Enter the number of services performed in 2013 at your institution for the following CPT codes. Enter zero only if you do not have access to this information and cannot report these values for your institution.**

77295 Therapeutic radiology simulation	
77300 Basic radiation dosimetry calculation	
77301 IMRT Treatment Planning	
77305 Teletherapy isodose plan simple	
77310 Teletherapy, isodose plan intermediate	
77315 Teletherapy, isodose plan complex	
77321 Special teletherapy port plan	
77326 Brachytherapy isodose calculation; simple	
77327 Brachytherapy isodose calculation; intermediate	
77328 Brachytherapy isodose calculation; complex	
77331 Special dosimetry	
77332 Simple treatment device	
77333 Intermediate treatment device	
77334 Complex treatment device	
77336 Continuing medical physics consultation	
77338 Multileaf Collimator for IMRT	
77370 Special medical physics consultation	
77785 High intensity brachytherapy; 1 dwell position	
77786 High intensity brachytherapy; 2 to 12 dwell positions	
77787 High intensity brachytherapy; Over 12 dwell positions	

39. Institutional Physics Service Volumes and Staffing Patterns

For the following questions, please report data from the 2013 calendar year. Enter zero only if do not have access to this information and cannot report these values for your institution.

***35. How many new patients (teletherapy and brachytherapy) were treated at your primary institution in 2013?**

New Patients:

***36. How many total patients (old and new; teletherapy and brachytherapy) were treated at your institution in 2013? (Count each patient one time)**

Total Patients:

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***37. Report the total number of complex external beam cases in 2013 (inverse IMRT, tomotherapy, clinical trial protocol cases, gated cases, 4D cases, multi-modality image fusion cases)**

Total complex external beam cases in 2013:

***38. Report the number of total body photon, total skin electron and radiosurgery cases in 2013.**

Total TBE, TSE and Radiosurgery cases in 2013:

40. Institutional Physics Service Volumes and Staffing Patterns

***39. Report the number of LDR and HDR brachytherapy fractions in 2013 (count each after-loading insertion one time).**

Total LDR and HDR fractions in 2013:

***40. Report the number of brachytherapy interstitial seed cases in 2013.**

Total prostate seed implant cases in 2013:

***41. Report the total number of linear accelerators (all linacs, including tomotherapy and robotic linacs) operational in your primary institution in 2013.**

Total linear accelerators in 2013:

***42. Report the number of major ancillary radiotherapy equipment units (Treatment planning systems - 1 vendor per 10 workstations, PET-CT, MR-simulation, 4D CT-simulation, HDR brachytherapy, Gamma Knife, View Ray) operational in your primary institution in 2013.**

Total major ancillary equipment units in 2013:

41. Institutional Physics Service Volumes and Staffing Patterns

***43. Report the number of minor ancillary radiotherapy equipment units (X-ray simulator, CT simulator, LDR unit, Cobalt unit, orthovoltage, ultrasound unit, gating/motion monitoring device) operational in your primary institution in 2013.**

Total minor ancillary equipment units in 2013:

Page 21

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***44. In 2013, what percentage of the total patients had the majority of their treatments on the clinic's most heavily utilized teletherapy unit? Please round to the nearest percent and report your answer as a whole number between 0 and 100 (for example, 75% would be reported as 75, not 0.75).**

Percentage of total patients treated on most heavily used unit:

***45. What is the total number of patient treatments performed on the clinic's most heavily utilized teletherapy unit during 2013?**

Number of Patient Treatments:

***46. What is the total number of teletherapy patient treatments performed at your institution during 2013?**

Number of Patient Treatments:

42. Institutional Physics Service Volumes and Staffing Patterns

Staffing Patterns:

Below, we ask you to provide estimates of the total number of full-time equivalent (FTE) Qualified Medical Physicists (QMPs) and other staff and students who were involved in providing the number of services that you indicated above in the table in the calendar year 2013. In making your estimates, 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. 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).

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***47. 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 in 2013. Please respond using tenths of an FTE; for example, if your clinic employs two and one half radiation oncologists, respond 2.5. If you employ no staff in a particular category, please record a "0" in that category. If you do not know the staffing numbers for your institution, please enter "0" as your response.**

Qualified Medical Physicists (QMPs) FTEs	
Qualified Medical Dosimetrists (QMDs) FTEs	
Non-Certified Medical Dosimetrists FTE	
Physics Assistants FTEs	
Radiation Oncologists FTEs	
Brachytherapy Technologists FTEs	
Maintenance Engineers FTEs	
Radiation Therapists FTEs	
Radiation Oncology Nurses FTEs	

***48. Report the number of students in each of the following categories enrolled in training programs at your primary employment organization. If you do not know the number if students in these categories, please enter "0" as your response.**

Clinical Medical Physics Residents	
Medical Physics Graduate Students	
Radiation Oncology Residents	
Medical Dosimetry Students	
Radiation Therapy (RTT) Students	

43. Special Procedures and Advanced Technologies

Page 23

The Abt Study of Medical Physicist Work Values for Radiation Oncology

***49. Please check which of the following procedures are currently offered by the institution where you perform most of your medical dosimetry procedures.**

	Yes	No
Total Skin Electron Irradiation	◯	◯
Total Body Irradiation	◯	◯
Remote (HDR or LDR) Afterloading Brachytherapy	◯	◯
Intensity Modulated Radiation Therapy	◯	◯
Image Guided Radiation Therapy	◯	◯
Stereotactic Radiosurgery (Single Fraction)	◯	◯
Stereotactic Radiotherapy (Multiple Fraction)	◯	◯
Stereotactic Body Irradiation	◯	◯
Intraoperative Radiotherapy	◯	◯
Prostate Seed Brachytherapy	◯	◯
Respiratory Gated Radiotherapy	◯	◯
Proton Radiotherapy	◯	◯

44. Thank You!

50. Please share with us any thoughts you may have about the manpower issues of the practice of medical physics:

***51. This is the final question. If you answer that you have completed the survey, you will no longer be able to edit any of the answers and your survey answers will be final.**

Thank you for completing the survey.

◯ I have not completed the survey and need to edit my answers.

◯ I have completed the survey and wish to finalize my responses.

Page 24

Appendix VI: Time and Intensity Estimates

Table 6.1: Aggregate Non-Procedural QMP Time Estimates Reported for Groups of Surveyed Radiation Oncology Physicists (in Annualized Hours)*

CPT Code and Type of Commissioning	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295, 77300, 77301, 77305, 77310, 77315, and 77321								
Initial Commissioning	150.0	250.0	400.0	650.0	1500.0	537.2	412.8	39
Total Recalibration (Annualized Over 5 Years)	5.0	10.0	20.0	30.0	200.0	30.3	38.8	39
Annual Calibration	8.0	20.0	40.0	50.0	80.0	39.6	21.8	39
Total Daily, Weekly, and Monthly Checks	24.0	96.0	144.0	240.0	1200.0	230.5	249.0	39
Total Annualized Time	240.0	417.0	710.0	1125.0	2560.0	837.5	532.8	39
77326, 77327, and 77328								
Initial Commissioning	0.0	16.0	40.0	60.0	100.0	37.0	25.5	39
Annual Checks	0.0	8.0	16.0	30.0	100.0	28.1	32.2	39
Total Annualized Time	0.0	30.0	52.0	90.0	200.0	65.0	50.4	39
77331								
Initial Commissioning	0.0	6.0	10.0	16.0	100.0	15.1	17.4	38
Monthly Checks	0.0	1.0	2.0	4.0	16.0	3.1	3.6	38
Total Annualized Time	0.0	22.0	36.5	56.0	220.0	52.8	55.0	38
77332								
Total Commissioning Time	0.0	1.0	3.0	4.0	30.0	3.6	5.1	39
77333								
Total Commissioning Time	0.0	1.0	3.0	8.0	60.0	6.8	10.5	39
77334								
Initial Commissioning	0.0	3.0	8.0	16.0	60.0	12.4	13.7	39
Monthly Checks	0.0	0.5	1.0	2.0	20.0	1.9	3.3	39
Total Annualized Time	0.0	11.0	22.0	40.0	280.0	35.4	48.0	39
77338								
Initial Commissioning	3.0	8.0	20.0	40.0	100.0	26.8	24.3	39
Monthly Checks	0.3	1.0	2.0	4.0	40.0	3.3	6.4	39

Total Annualized Time	9.0	26.0	46.0	64.0	580.0	66.7	92.5	39
77785, 77786, and 77787								
Total Commissioning Time	8.0	30.0	40.0	80.0	100.0	50.9	28.3	35
Annual Quality Assurance Hours	3.0	10.0	16.0	20.0	100.0	30.0	34.7	35
Total Annualized Time	12.0	43.0	60.0	110.0	200.0	80.9	53.8	35
***All commissioning times are reported in hours per year.** **† Extreme high outliers for non-procedural time for this code were excluded from analysis.**								

Table 6.2: Non-Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295	Therapeutic radiology simulation-aided field testing	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77300	Basic dosimetry calculation	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77301	IMRT Treatment Planning	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77305	Simple isodose plan	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77310	Intermediate isodose plan	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77315	Complex isodose plan	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77321	Special teletherapy port plan	0.03	0.12	0.19	0.24	1.66	0.23	0.3	30
77326	Simple brachytherapy isodose plan	0.00	0.32	0.88	1.75	4.00	1.32	1.21	25
77327	Intermediate brachytherapy isodose plan	0.00	0.32	0.88	1.75	4.00	1.32	1.21	25
77328	Complex brachytherapy isodose plan	0.00	0.32	0.88	1.75	4.00	1.32	1.21	25
77331*	Special dosimetry	0.00	0.07	0.22	1.67	45.33	2.55	8.65	27
77332	Simple treatment device	0.00	0.00	0.01	0.03	10.00	0.56	2.04	29
77333	Intermediate treatment device	0.00	0.03	0.06	0.75	10.00	1.12	2.38	24
77334	Complex treatment device	0.00	0.00	0.01	0.02	0.24	0.02	0.05	29
77338	Multileaf Collimator for IMRT	0.00	0.06	0.1	0.19	0.48	0.14	0.12	29
77785	High Intensity Brachytherapy; 1 Dwell Position	0.05	0.19	0.45	0.73	1.45	0.50	0.38	25
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.05	0.19	0.45	0.73	1.45	0.50	0.38	25
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.05	0.19	0.45	0.73	1.45	0.50	0.38	25

*** Extreme high outliers for non-procedural time for this code were excluded from analysis.**

Table 6.3: Procedural QMP Time Estimates per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295*	Therapeutic radiology simulation-aided field testing	0.40	0.75	1.25	3.00	5	2.08	1.58	22
77300	Basic dosimetry calculation	0.10	0.25	0.50	1.00	3	0.70	0.70	39
77301	IMRT Treatment Planning	0.25	2.00	2.50	4.50	10	3.47	2.55	39
77305*	Simple isodose plan	0.10	0.50	0.75	1.55	2	0.97	0.65	36
77310*	Intermediate isodose plan	0.10	0.50	0.88	1.60	2	1.00	0.65	36
77315*	Complex isodose plan	0.15	0.50	1.00	2.00	4	1.46	1.14	37
77321	Special teletherapy port plan	0.10	2.00	2.00	4.00	10	3.23	2.50	39
77326	Simple brachytherapy isodose plan	0.00	1.00	2.00	3.00	8	2.25	1.70	39
77327	Intermediate brachytherapy isodose plan	0.00	2.00	2.50	3.25	8	2.81	1.69	39
77328	Complex brachytherapy isodose plan	0.00	3.00	4.00	5.00	10	4.47	2.44	39
77331	Special dosimetry	0.30	0.60	1.00	2.00	4	1.51	0.99	39
77332*	Simple treatment device	0.00	0.25	0.43	0.75	1.5	0.51	0.42	34
77333*	Intermediate treatment device	0.00	0.38	0.73	1.50	2.5	0.96	0.71	36
77334*	Complex treatment device	0.00	0.48	0.78	2.00	3	1.10	0.88	36
77336	Continuing medical physics consultation	0.15	0.35	0.75	2.00	6	1.37	1.52	39
77338	Multileaf Collimator for IMRT	0.00	0.50	1.00	1.50	5	1.17	1.05	39
77370	Special medical physics consultation	0.25	2.00	3.00	5.00	10	3.72	2.42	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.15	1.00	1.50	2.00	8	1.76	1.64	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.15	1.50	2.00	4.00	8	2.47	1.72	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.25	1.50	2.75	4.00	10	3.22	2.31	35

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**

Table 6.4: Total QMP Time Estimates (Non-Procedural + Procedural) per Surveyed Radiation Oncology Physics Service (in Hours)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295*	Therapeutic radiology simulation-aided field testing	0.04	0.30	1.00	3.03	5.34	1.60	1.61	33
77300	Basic dosimetry calculation	0.10	0.37	0.65	1.21	3.00	0.88	0.70	39
77301	IMRT Treatment Planning	0.38	2.03	2.85	4.70	10.2	3.65	2.55	39
77305*	Simple isodose plan	0.17	0.56	0.87	1.70	3.66	1.13	0.76	37
77310*	Intermediate isodose plan	0.06	0.50	0.96	1.83	3.66	1.14	0.78	38
77315*	Complex isodose plan	0.17	0.63	1.15	2.03	4.17	1.61	1.19	38
77321	Special teletherapy port plan	0.20	2.00	2.63	4.17	10.09	3.41	2.48	39
77326	Simple brachytherapy isodose plan	0.00	1.50	3.00	4.25	8.74	3.10	1.90	39
77327	Intermediate brachytherapy isodose plan	0.00	2.35	3.15	4.88	8.74	3.65	1.89	39
77328	Complex brachytherapy isodose plan	0.00	3.31	5.00	7.09	13.20	5.31	2.64	39
77331†	Special dosimetry	0.30	1.04	2.00	3.00	47.33	3.28	7.43	38
77332*	Simple treatment device	0.00	0.25	0.51	1.00	10.00	0.96	1.83	35
77333*	Intermediate treatment device	0.00	0.51	0.79	2.00	11.50	1.66	2.18	37
77334*	Complex treatment device	0.00	0.50	0.75	2.00	3.01	1.09	0.88	37
77336	Continuing medical physics consultation	0.15	0.35	0.75	2.00	6.00	1.37	1.52	39
77338	Multileaf Collimator for IMRT	0.15	0.50	1.04	1.50	5.19	1.28	1.05	39
77370	Special medical physics consultation	0.25	2.00	3.00	5.00	10.00	3.72	2.42	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.37	1.00	1.60	2.73	8.45	2.12	1.73	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.81	1.50	2.00	4.00	8.96	2.83	1.83	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.91	1.90	3.00	4.35	10.96	3.58	2.42	35

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**
† Extreme high outliers for non-procedural time for this code were excluded from analysis.

Table 6.5: Relative Intensity Estimates for Radiation Oncology Physics Services (Increasing Order of Median Intensity)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77332	Simple treatment device	0.05	0.50	0.90	1.00	3.00	0.93	0.70	39
77300	Basic dosimetry calculation	0.15	0.75	1.00	1.20	4.00	1.14	0.77	39
77305	Simple isodose plan	0.20	0.85	1.00	1.80	3.00	1.27	0.69	39
77333	Intermediate treatment device	0.10	0.60	1.00	2.00	6.00	1.34	1.12	39
77334	Complex treatment device	0.00	0.50	1.00	2.00	6.00	1.47	1.26	39
77336	Continuing medical physics consultation	1.00	1.00	1.00	1.00	1.00	1.00	0.00	39
77310	Intermediate isodose plan	0.30	1.00	1.10	2.00	3.00	1.46	0.86	39
77331	Special dosimetry	0.30	1.00	1.20	2.00	5.00	1.59	1.16	39
77295	Therapeutic radiology simulation-aided field testing	0.30	1.00	1.50	2.00	8.50	2.40	2.19	25
77315	Complex isodose plan	0.30	1.00	1.50	2.00	4.00	1.60	0.92	39
77338	Multileaf Collimator for IMRT	0.10	1.00	1.50	2.00	8.00	1.67	1.38	39
77301	IMRT Treatment Planning	0.40	1.00	2.00	3.00	10.00	2.68	2.34	39
77321	Special teletherapy port plan	0.50	1.10	2.00	3.00	10.00	2.60	1.98	39
77326	Simple brachytherapy isodose plan	0.00	1.00	2.00	3.00	6.00	2.35	1.61	39
77327	Intermediate brachytherapy isodose plan	0.00	1.20	2.00	3.50	6.00	2.48	1.70	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.15	1.00	2.00	3.00	8.00	2.21	1.68	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.25	1.50	2.00	4.00	8.00	2.71	1.94	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.25	1.50	2.00	5.00	8.00	3.11	2.17	35
77328	Complex brachytherapy isodose plan	0.00	1.50	3.00	4.50	10.00	3.36	2.53	39
77370	Special medical physics consultation	0.25	1.50	3.00	6.00	10.00	3.79	2.93	39

Appendix VII: Work Estimates

Table 7.1: QMP Work Estimates for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295*	Therapeutic radiology simulation-aided field testing	0.11	0.67	2.27	5.07	32.02	6.59	10.04	25
77300	Basic dosimetry calculation	0.05	0.28	0.54	1.42	11.00	1.13	1.80	39
77301	IMRT Treatment Planning	0.81	3.17	5.59	12.00	74.69	9.89	13.42	39
77305*	Simple isodose plan	0.17	0.36	1.22	1.83	6.00	1.42	1.31	37
77310*	Intermediate isodose plan	0.02	0.50	1.35	2.17	6.00	1.69	1.50	38
77315*	Complex isodose plan	0.20	0.64	1.90	4.00	8.34	2.44	2.02	38
77321	Special teletherapy port plan	0.16	3.00	6.40	10.80	62.15	9.41	11.26	39
77326	Simple brachytherapy isodose plan	0.00	2.75	4.35	10.48	42.00	8.37	9.84	39
77327	Intermediate brachytherapy isodose plan	0.00	3.72	7.00	12.21	48.00	9.87	10.26	39
77328	Complex brachytherapy isodose plan	0.00	6.33	12.00	24.00	100.00	19.55	21.28	39
77331†	Special dosimetry	0.21	0.96	2.20	5.50	189.33	8.12	29.96	38
77332*	Simple treatment device	0.00	0.13	0.26	1.00	20.00	1.19	3.41	35
77333*	Intermediate treatment device	0.00	0.33	1.00	2.40	15.00	2.38	3.50	37
77334*	Complex treatment device	0.00	0.30	0.75	2.80	9.03	1.83	2.25	37
77336	Continuing medical physics consultation	0.15	0.35	0.75	2.00	6.00	1.37	1.52	39
77338	Multileaf Collimator for IMRT	0.02	0.54	1.63	3.00	19.83	2.30	3.32	39
77370	Special medical physics consultation	0.06	4.00	8.75	27.00	100.00	17.75	22.67	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.10	1.05	3.00	7.60	67.62	6.04	11.38	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.29	2.36	5.59	12.00	51.62	8.63	9.88	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.29	3.38	8.51	16.78	83.62	12.52	15.36	35

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**
† Extreme high outliers for non-procedural time for this code were excluded from analysis.

Table 7.2: QMP Work Estimates for Radiation Oncology Physics Services (Relative to 77336 Median)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295*	Therapeutic radiology simulation-aided field testing	0.15	0.90	3.03	6.76	42.69	8.79	13.38	25
77300	Basic dosimetry calculation	0.06	0.37	0.72	1.89	14.67	1.50	2.40	39
77301	IMRT Treatment Planning	1.08	4.23	7.46	16.00	99.59	13.18	17.90	39
77305*	Simple isodose plan	0.23	0.48	1.62	2.44	8.00	1.90	1.75	37
77310*	Intermediate isodose plan	0.02	0.67	1.80	2.90	8.00	2.25	2.00	38
77315*	Complex isodose plan	0.27	0.85	2.54	5.33	11.12	3.26	2.70	38
77321	Special teletherapy port plan	0.21	4.00	8.53	14.40	82.87	12.55	15.01	39
77326	Simple brachytherapy isodose plan	0.00	3.67	5.80	13.97	56.00	11.16	13.13	39
77327	Intermediate brachytherapy isodose plan	0.00	4.96	9.33	16.28	64.00	13.16	13.69	39
77328	Complex brachytherapy isodose plan	0.00	8.44	16.00	32.00	133.33	26.07	28.37	39
77331†	Special dosimetry	0.28	1.28	2.93	7.33	252.44	10.83	39.94	38
77332*	Simple treatment device	0.00	0.17	0.34	1.33	26.67	1.58	4.54	35
77333*	Intermediate treatment device	0.00	0.44	1.33	3.20	20.00	3.17	4.67	37
77334*	Complex treatment device	0.00	0.40	1.01	3.73	12.04	2.43	2.99	37
77336	Continuing medical physics consultation	0.20	0.47	1.00	2.67	8.00	1.82	2.03	39
77338	Multileaf Collimator for IMRT	0.02	0.72	2.18	4.00	26.44	3.06	4.43	39
77370	Special medical physics consultation	0.08	5.33	11.67	36.00	133.33	23.66	30.23	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.13	1.40	4.00	10.13	90.16	8.06	15.18	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.38	3.15	7.46	16.00	68.83	11.51	13.17	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.38	4.51	11.35	22.37	111.50	16.69	20.48	35

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**
† Extreme high outliers for non-procedural time for this code were excluded from analysis.

Table 7.3: QMP Work Estimates for Radiation Oncology Physics Services (Relative to 77336 Median): Weighted by Census Division Region (Based on 2013 AAPM Professional Survey)

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295*	Therapeutic radiology simulation-aided field testing	0.22	1.12	3.48	7.27	64.04	11.67	18.98	25
77300	Basic dosimetry calculation	0.11	0.42	0.77	2.16	18.00	2.00	3.16	39
77301	IMRT Treatment Planning	0.73	3.96	9.45	19.99	149.38	16.53	24.77	39
77305*	Simple isodose plan	0.18	0.79	1.80	2.66	9.82	2.29	2.27	37
77310*	Intermediate isodose plan	0.04	0.73	2.05	3.66	10.18	2.73	2.58	38
77315*	Complex isodose plan	0.18	1.20	2.81	4.50	19.35	4.22	4.43	38
77321	Special teletherapy port plan	0.32	3.95	9.66	20.12	122.18	18.40	27.44	39
77326	Simple brachytherapy isodose plan	0.00	3.57	8.02	19.64	52.46	13.03	12.80	39
77327	Intermediate brachytherapy isodose plan	0.00	6.51	9.21	21.82	61.2	15.75	14.82	39
77328	Complex brachytherapy isodose plan	0.00	10.7	23.63	33.22	131.29	32.55	34.74	39
77331†	Special dosimetry	0.30	1.55	4.05	8.00	172.12	9.93	27.27	38
77332*	Simple treatment device	0.00	0.25	0.46	1.39	32.73	1.98	5.52	35
77333*	Intermediate treatment device	0.00	0.51	1.82	5.32	26.66	4.23	6.23	37
77334*	Complex treatment device	0.00	0.44	1.07	5.09	21.34	3.16	4.26	37
77336	Continuing medical physics consultation	0.11	0.57	1.00	3.09	18.55	2.48	3.64	39
77338	Multileaf Collimator for IMRT	0.01	0.82	2.56	4.36	18.03	3.53	3.65	39
77370	Special medical physics consultation	0.19	6.55	12.00	37.09	185.45	31.19	43.98	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.30	1.64	4.17	13.43	110.66	10.75	19.21	35
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.88	2.73	8.53	24.11	84.47	15.65	18.39	35
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.88	4.36	10.78	33.88	136.84	23.04	28.07	35

*** Extreme high outliers for procedural time for these codes were excluded from analysis.**
† Extreme high outliers for non-procedural time for this code were excluded from analysis.

Table 7.4: Normalized Median Unweighted and Weighted* Work Values

CPT Code	Procedure Description	Unweighted	Weighted	(Weighted – Unweighted)/ Unweighted %
77295†	Therapeutic radiology simulation-aided field testing	3.03	3.48	14.9%
77300	Basic dosimetry calculation	0.72	0.77	6.9
77301	IMRT Treatment Planning	7.46	9.45	26.7
77305†	Simple isodose plan	1.62	1.80	11.1
77310†	Intermediate isodose plan	1.80	2.05	13.9
77315†	Complex isodose plan	2.54	2.81	10.6
77321	Special teletherapy port plan	8.53	9.66	13.2
77326	Simple brachytherapy isodose plan	5.80	8.02	38.3
77327	Intermediate brachytherapy isodose plan	9.33	9.21	-1.3
77328	Complex brachytherapy isodose plan	16.00	23.63	47.7
77331‡	Special dosimetry	3.12	4.05	29.8
77332†	Simple treatment device	0.34	0.46	35.3
77333†	Intermediate treatment device	1.33	1.82	36.8
77334†	Complex treatment device	1.01	1.07	5.9
77336	Continuing medical physics consultation	1.00	1.00	0.0
77338	Multileaf Collimator for IMRT	2.18	2.56	17.4
77370	Special medical physics consultation	11.67	12.00	2.8
77785	High Intensity Brachytherapy; 1 Dwell Position	4.00	4.17	4.3
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	7.46	8.53	14.3
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	11.35	10.78	-5.0

*** 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 2013 AAPM Professional Survey.**

† **Extreme high outliers for procedural time for these codes were excluded from analysis.**

‡ **Extreme high outliers for non-procedural time for this code were excluded from analysis.**

Appendix VIII: Caseload and Staffing Estimates

Table 8.1: Patient Caseloads and Treatments of Institutions Where Medical Physicists Practice by Practice Setting: Overall

Patient Caseload and Treatments	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Number of new patients (teletherapy and brachytherapy)	129.0	422.5	800.0	1105.5	2300.0	877.6	572.9	32
Total number of patients (teletherapy and brachytherapy)	200.0	650.0	900.0	1205.0	2450.0	998.8	554.5	29
Total number of complex external beam cases	80.0	281.0	450.0	750.0	1826.0	573.5	414.6	30
Total number of total body photon, total skin electron, and radiosurgery cases	5.0	20.0	70.5	165.0	505.0	122.0	132.6	26
Total number of LDR and HDR brachytherapy fractions	15.0	80.0	150.0	328.0	1361.0	275.8	314.5	29
Total number of brachytherapy interstitial seed cases	1.0	10.0	12.0	25.0	1500.0	24.9	33.8	21
Total number of linear accelerators	1.0	3.0	3.5	5.0	10.0	3.9	2.0	36
Total number of major ancillary radiotherapy equipment units	2.0	4.0	5.0	7.0	16.0	5.8	2.9	37
Total number of minor ancillary radiotherapy equipment units	1.0	3.0	4.0	5.0	10.0	4.1	2.0	37
Percentage of total patients that had majority of their treatment on the clinic's most heavily utilized teletherapy unit	1.0	30.0	40.0	66.0	100.0	48.0	25.3	33
Total number of patient treatments performed on the clinic's most heavily utilized teletherapy unit*	30.0	324.5	4440.0	7495.5	40000.0	5177.39	7636.3	28
Total number of teletherapy patient treatments performed at institution	650.0	5456.0	12050.0	21528.0	40000.0	13839.3	10211.4	31

*** The values for the three medical physics consulting group respondents for this estimate were excluded based on the panel's recommendation..**

Table 8.2: Staffing Patterns of Institutions Where Medical Physicists Practice by Practice Setting: Overall

FTE Staff	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Number of FTE Staff Employed by Institution in 2013								
Qualified Medical Physicists	1.0	3.0	4.0	6.0	21.0	5.2	4.1	39
Qualified Medical Dosimetrists	1.0	2.5	3.5	5.0	14.0	4.1	2.5	39
Non-Certified Medical Dosimetrists	0.0	0.0	0.0	1.0	4.0	0.5	0.9	39
Physics Assistants	0.0	0.0	0.0	0.0	3.0	0.3	0.7	39
Radiation Oncologists	0.0	3.0	5.0	7.0	16.0	5.3	3.4	39
Brachytherapy Technologists	0.0	0.0	0.0	1.0	2.0	0.3	0.6	39
Maintenance Engineers	0.0	0.0	0.0	1.0	3.0	0.7	0.8	39
Radiation Therapists	0.0	6.0	12.0	15.0	34.0	12.0	6.6	39
Radiation Oncology Nurses	0.0	2.0	4.0	6.0	12.0	4.6	2.9	39
Number of Students Employed by Institution in 2013								
Clinical Medical Physics Residents	0.0	0.0	0.0	2.0	5.0	1.2	1.4	39
Medical Physics Graduate Students	0.0	0.0	0.0	0.0	15.0	1.1	3.0	39
Radiation Oncology Residents	0.0	0.0	0.0	7.0	12.0	3.1	3.9	39
Medical Dosimetry Students	0.0	0.0	0.0	1.0	8.0	0.8	1.8	39
Radiation Therapy (RTT) Students	0.0	0.0	0.0	4.0	15.0	2.5	3.8	39

Table 8.3: Patient Caseloads and Treatments of Institutions Where Medical Physicists Practice Per QMP

Patient Caseload and Treatments Per QMP	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
Number of new patients (teletherapy and brachytherapy)	43.0	119.6	166.7	264.3	600.0	202.6	112.9	32
Total number of patients (teletherapy and brachytherapy)	100.0	180.0	250.0	300.0	676.7	257.4	126.3	29
Total number of complex external beam cases	35.2	83.3	109.8	149.5	410.0	124.5	70.1	30
Total number of total body photon, total skin electron, and radiosurgery cases	1.5	5.0	14.6	30.0	85.7	22.1	22.5	26
Total number of LDR and HDR brachytherapy fractions	7.5	18.3	40.0	68.3	1130.0	91.6	206.6	29
Total number of brachytherapy interstitial seed cases	0.2	1.0	4.4	8.3	15.7	5.6	5.2	21
Total number of linear accelerators	0.3	0.75	0.9	1.0	2.0	0.9	0.3	36
Total number of major ancillary radiotherapy equipment units	0.3	0.8	1.3	2.0	4.0	1.6	1.0	37
Total number of minor ancillary radiotherapy equipment units	0.3	0.5	0.9	1.45	2.5	1.0	0.6	37
Total number of patient treatments performed on the clinic's most heavily utilized teletherapy unit*	2.7	68.8	1121.7	2282.3	7611.0	1652.5	2073.7	28
Total number of teletherapy patient treatments performed at institution	104.8	2000.0	3902.0	5469.0	8560.0	3780.5	2393.1	31
*** The values for the three medical physics consulting group respondents for this estimate were excluded based on the panel's recommendation.**								

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Appendix IX: Service Volumes

Table 9.1: Service Volumes for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295	Therapeutic radiology simulation-aided field testing	0.0	0.0	298.0	563.0	1200.0	359.1	338.5	39
77300	Basic dosimetry calculation	0.0	200.0	2348.0	5075.0	12456.0	3458.8	3720.1	39
77301	IMRT Treatment Planning	0.0	70.0	209.0	454.0	1000.0	275.5	257.9	39
77305	Simple isodose plan	0.0	0.0	6.0	23.0	200.0	20.5	37.9	39
77310	Intermediate isodose plan	0.0	0.0	0.0	4.0	300.0	21.1	68.0	39
77315	Complex isodose plan	0.0	0.0	145.0	369.0	1434.0	237.3	301.0	39
77321	Special teletherapy port plan	0.0	0.0	54.0	101.0	635.0	92.8	139.4	39
77326	Simple brachytherapy isodose plan	0.0	0.0	0.0	24.0	100.0	15.2	26.8	39
77327	Intermediate brachytherapy isodose plan	0.0	0.0	0.0	8.0	150.0	10.8	28.0	39
77328	Complex brachytherapy isodose plan	0.0	0.0	4.0	52.0	192.0	32.4	49.9	39
77331	Special dosimetry	0.0	0.0	30.0	205.0	1292.0	158.0	277.0	39
77332	Simple treatment device	0.0	0.0	78.0	228.0	1185.0	159.9	232.8	39
77333	Intermediate treatment device	0.0	0.0	4.0	50.0	400.0	48.9	96.1	39
77334	Complex treatment device	0.0	0.0	1291.0	2746.0	12603.0	2095.2	2789.0	39
77336	Continuing medical physics consultation	0.0	50.0	2196.0	4928.0	11000.0	2746.8	2623.5	39
77338	Multileaf Collimator for IMRT	0.0	0.0	221.0	532.0	9000.0	707.9	1808.6	39
77370	Special medical physics consultation	0.0	4.0	81.0	303.0	2000.0	233.5	392.0	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.0	0.0	15.0	93.0	243.0	51.7	63.1	39
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.0	0.0	23.0	104.0	1052.0	76.9	174.2	39
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.0	0.0	0.0	31.0	239.0	24.9	48.9	39

Table 9.2: Service Volumes per QMP for Radiation Oncology Physics Services

CPT Code	Procedure Description	Minimum	First Quartile	Median	Third Quartile	Maximum	Mean	Standard Deviation	Number of Responses
77295	Therapeutic radiology simulation-aided field testing	0.0	0.0	78.4	142.9	382.0	90.0	85.4	39
77300	Basic dosimetry calculation	0.0	100.0	782.7	1270.5	2973.0	807.2	763.3	39
77301	IMRT Treatment Planning	0.0	35.2	64.3	90.5	226.7	65.0	52.6	39
77305	Simple isodose plan	0.0	0.0	0.9	7.7	28.6	4.7	7.0	39
77310	Intermediate isodose plan	0.0	0.0	0.0	1.3	85.7	4.9	15.8	39
77315	Complex isodose plan	0.0	0.0	25.0	100.0	294.0	56.8	70.4	39
77321	Special teletherapy port plan	0.0	0.0	11.0	30.9	87.0	20.4	25.0	39
77326	Simple brachytherapy isodose plan	0.0	0.0	0.0	4.7	19.2	3.0	5.2	39
77327	Intermediate brachytherapy isodose plan	0.0	0.0	0.0	2.0	13.5	1.9	3.8	39
77328	Complex brachytherapy isodose plan	0.0	0.0	1.0	11.7	38.4	6.8	10.3	39
77331	Special dosimetry	0.0	0.0	8.0	55.6	861.3	55.2	145.5	39
77332	Simple treatment device	0.0	0.0	20.9	54.8	246.7	37.4	49.8	39
77333	Intermediate treatment device	0.0	0.0	1.2	17.3	100.0	11.9	22.2	39
77334	Complex treatment device	0.0	0.0	325.6	891.3	2100.5	487.6	501.2	39
77336	Continuing medical physics consultation	0.0	14.3	561.2	963.3	1807.3	634.8	537.4	39
77338	Multileaf Collimator for IMRT	0.0	0.0	73.7	153.2	692.3	107.2	137.9	39
77370	Special medical physics consultation	0.0	3.3	20.0	65.4	200.0	45.4	54.7	39
77785	High Intensity Brachytherapy; 1 Dwell Position	0.0	0.0	6.57	24.0	75.0	11.6	16.4	39
77786	High Intensity Brachytherapy; 2 to 12 Dwell Positions	0.0	0.0	4.8	18.2	1052.0	37.6	167.5	39
77787	High Intensity Brachytherapy; Over 12 Dwell Positions	0.0	0.0	0.0	6.7	79.7	7.3	16.0	39