

# **CTR Guide to Coding Radiation Therapy Treatment in the STORE**

*Version 3.0 February 2021*

Prepared by

Ted Williamson, MD, PhD, CTR  
Salem Health Radiation Oncology (Emeritus)  
Medical Director, Onco, Inc.

Wilson Apollo, MS, CTR  
WHA Consulting

Susanne Kessler, MSM, RHIT, CTR  
Manager, NCDB Information and Data Standards,  
Commission on Cancer

John Christodouleas, MD, MPH  
Department of Radiation Oncology,  
Hospital of the University of Pennsylvania  
Medical Affairs, Elekta Inc.

On behalf of the Commission on Cancer  
Radiation Oncology Working Group

# Table of Contents

Revision History.....	4
Introduction.....	5
Summary of Coding Principles.....	5
Sources.....	7
Changes.....	8
Looking to the Future .....	8
Case Studies.....	9
1 No Radiation Therapy.....	9
2 Radiation Given – Details Unknown.....	10
3 Bladder Cancer – Patient Takes a Flyer .....	11
4 Single Target Volume – Single Phase.....	12
5 Thyroid Cancer Treated with Radioiodine.....	13
6 Prostate Cancer, Boost First, Elsewhere .....	14
7 Breast and Regional Nodes with Breast and Axillary Boost .....	15
8 Prostate Cancer: Concurrent Prostate and SV Boost .....	16
9 Multiple Metastatic Sites Treated Concurrently.....	17
10 Lung: How Many Phases?.....	18
11 Prophylactic Cranial Irradiation (PCI): How Many Phases?.....	19
12 Total Body Irradiation for Transplant.....	20
13 Head and Neck: Simultaneous Integrated Boost (SIB).....	21
14 Lung: Off-line Adaptive Re-plan.....	23
15 Bladder: On-line Adaptive Therapy with an MR-Linac.....	25
16 Gyn-Brachytherapy + External Beam Radiotherapy (EBRT).....	26
17 Multiple Brain Mets: Treated with Gamma Knife .....	27
18 Prostate and Rectal: Treated with One Plan.....	28
19 Unknown Primary, Head and Neck: with Simultaneous Integrated Boost .....	30
20 Head and Neck: Unknown Primary with Staged Boost .....	31
21 Breast: Simultaneous Integrated Boost (SIB).....	32
22 Prostate and Seminal Vesicles with IMRT .....	33
23 Cervical Cancer: HDR Brachytherapy with Variable Dose per Fraction.....	34
24 Pelvis, Prostate and Seminal Vesicles with VMAT .....	35
25 Breast: Treatment Interrupted – Big Time.....	36

26 Prostate: VMAT to Pelvis with SBRT Boost.....	37
Appendix A – STORE Radiation Data Field Items.....	38
Summary Fields.....	38
Phase Fields .....	39
Appendix B – Coding Modality for the Heavy Equipment of Modern Radiation Therapy .....	40
Appendix C – Radiation Therapy Useful Abbreviations .....	41
Appendix D – Summary of Coding Rules .....	43

# Revision History

Date	Version	Remarks
03/15/2019	1.0	Initial release
02/2020	2.0	First revision
02/2021	3.0	Third revision/release

# Introduction

By now you undoubtedly know that, with the STORE, coding for radiation treatment has changed significantly. These changes were introduced to provide the NCDB with a more complete and accurate description of contemporary radiation treatment. Consistent coding and reporting of treatment across multiple registry platforms is critical in many dimensions:

- Optimizing quality measure performance scores
- Providing meaningful outcome results for future analysts of NCDB data
- Allowing accurate comparisons of patterns of care by type, size, and location of treating facilities
- Monitoring practice patterns over time
- Offering in-house reports of service utilization, and predictions of growth for facility planning.

While the STORE changes offer a significant improvement in the value of radiation treatment data, they also present a challenge for the cancer registrar charged with translating the radiation record into the 31 data fields defined by STORE. To that end, this document has been prepared as a platform for “learning by example”. It is our hope that the clinical examples provided will lead the way to efficient and uniform reporting of radiation data. This third edition contains several new examples drawn from contact with registrars at meetings and webinars, as well as questions submitted to CAnswer. We expect this to continue to be a living document that evolves as technology changes or we are presented with new clinical situations. To that end, we invite the CTR community to continue submit cases that do not seem to be covered within to the Commission on Cancer CAnswer.

## Note to Cancer Registry Software Developers and Vendors

You will observe that (a) this document does not bear a copyright statement, and (b) it has been provided in a standard, editable, word processing platform. We encourage you to supplement the document with text and graphics that will assist your client registrars in applying the coding standards provided in these case studies to your particular implementation of the radiation data fields. However, in doing so please do not alter the coding guidance of the individual case studies without consulting with the Commission on Cancer.

## Summary of Coding Principles

### 1. First Course

You are responsible for, and the NCDB wants, documentation only of treatment given in the “first course of treatment for this cancer”. Nothing more. Nothing less. Forget the old 4-month rule. The first course of treatment is clearly defined in the STORE as this snippet from STORE2021, page 52, shows.

#### First Course of Treatment

The first course of treatment includes all methods of treatment recorded in the treatment plan and administered to the patient before disease progression or recurrence.

This doesn't mean you can't collect data from subsequent courses. Just don't put it in the first three (reportable) phases. For an example of treatment that you would not document in these three sets of fields, see Case #10.

We know that, in some cases, you, or your administration, or your radiation oncology team (often the registrar's best friend) may want to collect data on additional first course phases, or treatment given in later courses. If your registry software can support this data, you should put it outside the set of three phases designated by your software vendor as reportable.

2. **Words:** There are few words in the oncology treatment lexicon with more possible interpretations than "course". To the medical oncologist it typically means a series of treatments with a specific combination of drugs, including periodic dose adjustments. To many, if not most, radiation oncologists, it usually describes a series of treatments to one specific target irrespective of possible changes along the way. As we have just seen, the STORE has its own definition.

"Phase" is another term with confusion potential. It appears briefly in the ROADS radiation treatment discussions, and with more conviction in the FORDS, but has now become an anchor term for separating the distinct components of a "course" of radiation. Each phase is meant to reflect a "delivered radiation prescription". At the start of the radiation planning process, physicians write radiation prescriptions to treatment volumes and specify the dose per fraction (session), the number of fractions, the modality, and the planning technique. A phase simply represents the radiation prescription that has actually been delivered (as sometimes the intended prescription differs from the delivered prescription.) The STORE2021 definition on page 58 is quite specific:

Note that phases can be delivered sequentially or simultaneously. In sequential phases, a new phase begins when there is a change in the anatomic target volume of a body site, treatment fraction size, modality or technique.

Many of the case examples that follow are designed to emphasize this definition. Please note that phases can be delivered sequentially or simultaneously which can generate confusion. Case # 9 and #13 highlight potential areas of confusion with this definition of phase.

With respect to the order in which phases should be summarized, our recommendation is:

- Phases should be summarized first in chronological order.
- If multiple phases start on the same date, then list the phases in order from highest 'Total Phase Dose' to lowest 'Total Phase Dose',
- If multiple phases start on the same date and have the same Total Phase Dose, then any order is acceptable.

3. **When there are more than three phases:** In most treatment settings this will occur in a relatively small number of cases, typically with unusually complex treatment plans, occasionally with cases with multiple metastatic sites treated simultaneously. The STORE guidelines are clear. Collect and report details of the first three phases, but report the actual number of first course phases treated in the field "Number of Phases of Radiation Treatment in this Course".
4. **Phase Total Dose:** Compared to STORE2018, STORE2021 provides a more transparent explanation of rules for documenting Total Dose which can be reviewed on page 285.

5. **Phase N Radiation Primary Treatment Volume:** Don't let the word "primary" confuse you. In a large percentage of cases, you will be choosing an item from the list that closely matches the diagnostic primary site code. But not always. The first volume treated may be metastatic and remote from the site of origin of the tumor. From the list presented for this data field, choose the best match to the treatment target volume.
6. **Brachytherapy, radioisotopes and infusion therapy:** Early reports from registrars indicate some confusion here in part because the initial version of this guidance document differed from the STORE manual. Herein we attempt to correct and clarify.

If any phase of treatment to a volume has the Treatment Modality coded to anything between 07 and 16, the dose for that phase should be coded in cGy, when available. If there is only one phase in the entire course of radiation, then the phase total dose can be used to record the Radiation Course Total Dose.

However, if there are multiple phases in a radiation course and any of the phases use a brachytherapy, radioisotopes or infusion therapy, then the Radiation Course Total Dose should be coded to 999998 (five 9's). This is because there is no agreed upon standard for summing doses across radiation modalities. For example, it is not biologically meaningful to sum dose from a brachytherapy treatment with dose from an external beam treatment (EBRT). If a radiation phase dose is not prescribed in cGy or Gy, then code the Dose per Fraction 99998 (four 9's), the Total Phase Dose to 999998 (five 9's) and the Radiation Course Total Dose to 999998 (five 9's).

7. **Where to find the data:** Hopefully, in most cases, you will find all the information you need in the treatment summary letter written by the Radiation Oncologist and generally available promptly after completion of treatment to a volume. Unfortunately, at this time, there is no standard for the content of these letters. There may be times when you must look at more detailed radiation records or need expert guidance. Happily, there are usually several resources within the radiation department. Certainly, the radiation oncologist is a consideration but think also of the physicist(s) and dosimetrist(s). They speak the language and may be more available.

## Sources

This edition draws on four sources for case studies:

1. The original set of cases (Case 1 and Cases 4-15) with adjustments for changes in coding policy.
2. Situations posed to the CAnswer staff in the interim since the 1<sup>st</sup> Edition was published (Cases 17-28). These are identified as such in the Clinical description and information provided to CAnswer is in italics (with occasional additions by editorial staff for clarity)
3. Examples provided in Webinars delivered by the authors (for example, Case 29).
4. The authors imaginations (Cases 2 and 3).

## Changes

STORE2021 brings only one change to coding options with the addition of code 98 to Radiation Modality in each phase:

### **98 Radiation therapy administered; modality unknown**

Use this in place of code 99 when you know the patient has had treatment but details, such as modality, are unknown.

Changes to coding rules are summarized in pages 52-59 and should be reviewed carefully.

## Looking to the Future

Someday most of the radiation data may be automatically downloaded into the registry from the “record and verify” computer systems that control the treatment machines. But don’t go making retirement arrangements just yet. For the more immediate future a plan is afoot.

Inspired by the work of Dr. James Connolly and his team in developing the “synoptic pathology report”, the CoC Radiation Therapy Data Standards Committee organized a diverse group of oncology, physics, and data specialists to develop a model for synoptic radiation treatment reporting based on the STORE data set. The result was published in the November-December 2020 journal “Practical Radiation Oncology”.

We hope that if this model is adopted widely it will greatly simplify the registrar’s task and at the same time proved a template for standardized electronic transfer.

SPECIAL ARTICLE | [VOLUME 10, ISSUE 6, P389-401, NOVEMBER 01, 2020](#)

## A Multidisciplinary Consensus Recommendation on a Synoptic Radiation Treatment Summary: A Commission on Cancer Workgroup Report

[John P. Christodouleas, MD, MPH](#)   • [Nathan Anderson, MS](#) • [Peter Gabriel, MD, MSE](#) • [Rick Greene, MD](#) • [Carol Hahn, MD](#) • [Susanne Kessler, MS](#) • [Charles S. Mayo, PhD](#) • [Todd McNutt, PhD](#) • [Lawrence N. Shulman, MD](#) • [Benjamin D. Smith, MD](#) • [Jeff West, BA](#) • [Ted Williamson, MD, PhD, CTR](#) •

Published: January 24, 2020 • DOI: <https://doi.org/10.1016/j.prro.2020.01.002> •

# Case Studies

## 1 No Radiation Therapy

### Clinical

- 87-year-old man with mild fatigue is found to have an elevated lymphocyte count on CBC.
- Bone marrow biopsy in your facility confirms a diagnosis of chronic lymphocytic leukemia.
- Physician and patient agree that no treatment is indicated at this time.

### Coding Logic

- #2 Though not required by EDITS, this field has research value, and we encourage everyone to apply the appropriate code for all untreated cases.
- #9 SEER registries only: Code Phase I Modality to 00.
- #9 All other registries, code the Volume for Phase I to 00.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	
	2	Reason No Rad	1 Not part of planned 1st
	3	Location of Rad	
	4	Date Started/Flag	
	5	Date Ended/Flag	
	6	Number of Phases	
	7	Discontinued Early	
	8	Course Total Dose	
Phase 1	9	Volume	00 No Radiation Treatment
	10	Rad to Nodes	
	11	Modality	00 No Rad Treatment (SEER)
	12	Planning Technique	
	13	Number of Fractions	
	14	Dose per Fraction	
Phase 2	15	Total Phase 1 Dose	
	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
28	Dose per Fraction		
29	Total Phase 3 Dose		

## 2 Radiation Given – Details Unknown

### Clinical

- A 56-year-old man is first seen in your emergency room with a history of rapid onset of weight loss, and inability to swallow solids.
- He is scoped and a tight mid-esophagus lesion is identified. Biopsy shows adenocarcinoma.
- He is treated with neo-adjuvant chemotherapy at your facility and then referred to a nearby university for surgery. He chooses to have all further care and follow-up at the university.
- Sometime later you notice a letter from someone at the university to your medical oncologist. The letter mentions post-operative radiation but provides no details.
- You contact the university for information but the clerk you speak to pleads HIPAA and refuses to provide any information.

### Coding Logic

It is important to code anything you have available and, hopefully, enough information so that any future reviewer or analyst will have a clear picture of what is going on.

- #1, #2: Because you know these to be true.
- #3: This tells much of the story.
- #9: It might be tempting, given the available history, to code the volume to esophagus but we don't know that for sure so 99 is the honest and safest choice.
- #11: Code 98, new in STORE2021, resolves the ambiguity in #9. This is useful because analysis of Phase data, in the proper context, can stand alone from Summary data.
- #16: It is standard to code the first untreated volume this way (of course, if the information was available, we might learn that the radiation required 2 or more phases).

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 RT administered
	3	Location of Rad	4 All RT elsewhere
	4	Date Started/Flag	
	5	Date Ended/Flag	
	6	Number of Phases	
	7	Discontinued Early	
	8	Course Total Dose	
Phase 1	9	Volume	99 Unknown
	10	Rad to Nodes	
	11	Modality	98 RT given, modality unk
	12	Planning Technique	
	13	Number of Fractions	
	14	Dose per Fraction	
Phase 2	15	Total Phase 1 Dose	
	16	Volume	00
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
28	Dose per Fraction		
29	Total Phase 3 Dose		

### 3 Bladder Cancer – Patient Takes a Flyer

#### Clinical

- Jicama, a 42-year-old vegetarian of Austrian decent, has enjoyed fiddlehead and bracken fern salads nightly for years.
- When she tells her naturopath she is having painful urination with blood, he wisely refers her to a urologist on your hospital’s staff.
- Cystoscopy shows a large, invasive bladder cancer, stage III.
- She is advised to have surgery and warned that she will likely need post-operative radiation and chemotherapy.
- Like so many patients, she turns to the internet for advice and finds a clinic in Bermuda that reports a high cure rate with infusions of Vitamin C during radiation treatment with their 1956 vintage Picker Cobalt machine.
- She tells the urologist she is going for alternative therapy and is never heard from again.

#### Coding Logic

Some Class 00 patients can be a frustrating challenge so we just go with what we know.

- #2: Tells most of the story
- #9: A code of 00 is technically not correct since we don’t know if she was ever treated.
- #16: It is reasonable to leave this blank when field #9 is coded to 99.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	9 Unknown
	2	Reason No Rad	8 Recommended, unknown if administered
	3	Location of Rad	9 Unknown
	4	Date Started/Flag	
	5	Date Ended/Flag	
	6	Number of Phases	
	7	Discontinued Early	
	8	Course Total Dose	
Phase 1	9	Volume	99 Unknown
	10	Rad to Nodes	
	11	Modality	
	12	Planning Technique	
	13	Number of Fractions	
	14	Dose per Fraction	
Phase 2	15	Total Phase 1 Dose	
	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 4 Single Target Volume – Single Phase

### Clinical

- 78 y/o female with new diagnosis of multiple myeloma
- R hip pain
- Lytic lesion, threatening fracture

### Treatment

- Treated locally using opposed conformal<sup>1</sup> 15Mv photons
- 5 fractions at 400 cGy per day - 4/5/18 to 4/9/18
- Chemo started on completion of radiation treatment

### Coding Logic

- #1: Code 0 in this field because there was no surgery.
- #8: Simple math, 400 x 5, but you should always find the total dose in the summary letter.
- #10: Inguinal lymph nodes may be exposed to radiation during treatment of the hip, but they are not being intentionally targeted.
- #12: Here you need to read the record carefully. However, the hip is a complex structure adjacent to radiosensitive organs (bowel and bladder) so, even for palliative treatment, the radiation “ports” (the radiation oncologist’s term for radiation beams, a.k.a. “fields”) for hip treatment are usually conformally shaped to avoid adjacent soft tissue and organs as much as possible.
- #16: STORE rules say you must code the Volume of the first unused phase to 00. In this case all the fields in phase 3 can be left blank.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was admin..
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	04/05/2018
	5	Date Finished/Flag	04/09/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Radiation completed
	8	Course Total Dose	002000
Phase 1	9	Volume	84 Hip
	10	Rad to Nodes	00 No RT to nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	04 Conformal or 3D...
	13	Number of Fractions	005
	14	Dose per Fraction	00400*
	15	Total Phase 1 Dose	002000
Phase 2	16	Volume	00 No Treatment
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
Phase 3	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

<sup>1</sup> “Conformal” simply means that the fields were shaped to was created to “conform” the radiation dose to the target and/or avoid normal tissue. With “3D Conformal” treatment a CT simulation is obtained and a plan generated using 3-dimensional information. In conformal treatments, beams are shaped using lead blocks or a multi-leafed collimator to something other than the basic rectangular beams used in 2D therapy.

\*Vendor software generally populates leading zeros.

## 5 Thyroid Cancer Treated with Radioiodine

### Clinical

- Thirty-seven-year-old female
- Painless lump in her right lower neck (level VI)
- Ultrasound guided needle biopsy
- Follicular carcinoma, clinical T1bN0M0.

### Treatment

- Thyroidectomy, pathologic T2N0M0
- Radiation treatment is delivered with a single injection of 150 millicuries of radioiodine (I-131) on August 7.

### Coding Logic

- #5: Our recommendation is to consider the injection of a radioisotope as the treatment and thus to set the Date Finished equal to the Date Started.<sup>2</sup> The STORE makes a similar recommendation for brachytherapy treatments; however, with some brachytherapy procedures, the radioactive seeds are left in place for two or three days then removed. In those situations, code the date of removal as the Date Finished.
- #9: Technically I-131 may be effective wherever there are thyroid cancer cells in the body, so there is no specific anatomic treatment volume here. Therefore, we recommend coding radioisotope treatments as “98 Other”. You might think another reasonable option would be to code the volume as “93 Whole Body”. Traditionally, however, the code 93 (Whole Body) has been reserved for whole body treatment with external beam radiation such as is done prior to bone marrow transplantation. So, for the sake of historic consistency, our preference is “98 Other”.
- #8, 14, 15: These dose fields are coded as 99998 and 999998 because dose was not prescribed in cGy or Gy.
- #12: We code this to “88 Not applicable” because with I-131 and other systemic isotopes there is no planning in the conventional sense. The physician selects a dose level based on risks of residual disease and the risk of complications.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	08/07/2018
	5	Date Finished/Flag	08/07/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	999998
Phase 1	9	Volume	98 Other
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	13 Radioisotopes, NOS
	12	Planning Technique	88 Not applicable
	13	Number of Fractions	1
	14	Dose per Fraction	99998
	15	Total Phase 1 Dose	999998
Phase 2	16	Volume	00 No Treatment
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
	22	Total Phase 2 Dose	
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

<sup>2</sup> Like other radioisotopes, I-131 “decays” with a “half-life”. That means that, from any given point in time, only half as much will remain after an elapsed time equal to the half-life. The half-life of I-131 is 8.06 days. With a typical injection it will be between 21 and 24 months before the last I-131 atom spits out its radiation.

## 6 Prostate Cancer, Boost First, Elsewhere

### Clinical

- Otherwise healthy 69 y/o man
- Gleason 9, cT1c prostate Ca.

### Treatment

- Treated with iodine seed implant (2/21/2018) at a university hospital
- Returned home for additional treatment.
- 4-field conformal pelvic radiation with 15Mv photons (3/5/2018 to 4/6/2018, 4500cGy in 25 fractions) at your facility.

### Coding Logic

- #4: The date of the implant marks the beginning of treatment.<sup>3</sup>
- #5: The last date of external beam is the only logical choice. For permanent implants and systemic radioisotopes, there is no good choice for a Date Finished. See Case #5.
- #8: There is no standard for summing a dose from brachytherapy with an external beam dose, so always code a mixed modality treatment using 999998 (**5 9's**) for Total Dose in this situation.
- #11: With an iodine implant, seeds are permanently placed in the prostate tissue and radiation is emitted continuously over a long period of time as described in Case 6. The “dose rate” is much lower with iodine implants than it is with iridium-192 seeds, which are in tubes that are removed after a day or two.
- #12: There is actually a lot of planning involved with prostate implants, both before and after the procedure, but code 88 is the only reasonable option from the choices available.
- #14, 15: Four 9's before the terminal “8” because no dose for brachytherapy is provided in the treatment summary. If a brachytherapy dose was given, then it can be entered here.
- #16: The prostate is still the primary target. The next field tells us that pelvic lymph nodes were treated. In FORDS you would have used Volume code 35, “Prostate and pelvis.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	2 Regional RT at this Facility
	4	Date Started/Flag	02/21/2018
	5	Date Finished/Flag	04/06/2018
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	999998
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	10 BrachyTx, Interstitial, LDR
	12	Planning Technique	88 Not applicable
	13	Number of Fractions	001
	14	Dose per Fraction	99998
	15	Total Phase 1 Dose	99998
Phase 2	16	Volume	64 Prostate - whole
	17	Rad to Nodes	06 Pelvic lymph nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	04 Conformal or 3D...
	20	Number of Fractions	025
	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	04500
Phase 3	23	Volume	00 No Treatment
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

- 
- <sup>3</sup> Registrars have asked us why the STORE did not include date ranges for each phase. There are two good reasons:
    - Limited clinical or analytic value,
    - Avoid unnecessary work for registrars.

## 7 Breast and Regional Nodes with Breast and Axillary Boost

### Clinical

- 46 y/o female with T2N1M0 breast cancer, and conservation surgery. 3 of 5 axillary nodes positive. ER 100%, PR 10%, Her-2 negative.

### Treatment

- Whole breast RT, 5040 cGy in 28 fractions given between 8/13/2018 and 9/19/2018 using 6Mv photons, conformal fields.
- Axillary and supraclavicular (SC) nodes treated concurrently with 6Mv photons using an anterior field covering both regions to deliver a daily dose of 180 cGy to a depth of 3 cm. Because the radiation intensity diminishes with depth, a posterior axillary field (PAB) was added delivering 30cGy per day to the midplane of the axilla so this region also received the prescribed daily dose of 180cGy.
- The medial portion of the anterior field was blocked for the last three treatments to hold the SC region to a maximum of 4500cGy to minimize the risk of brachial plexus injury.
- Between 9/20 and 9/26 the surgical bed received an electron boost of 1000cGy in 5 fractions using fields shaped to surround surgical bed with 1.5 cm margins.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	08/13/2018
	5	Date Finished/Flag	09/26/2018
	6	Number of Phases	3
	7	Discontinued Early	01 Completed
	8	Course Total Dose	006040
Phase 1	9	Volume	40 Breast - whole
	10	Rad to Nodes	04 Breast/chest wall LN region
	11	Modality	02 External beam photon
	12	Planning Technique	04 Conformal or 3D Conformal
	13	Number of Fractions	025
	14	Dose per Fraction	00180
Phase 2	15	Total Phase 1 Dose	004500
	16	Volume	40 Breast - whole
	17	Rad to Nodes	04 Breast/chest wall LN region
	18	Modality	02 External beam photon
	19	Planning Technique	04 Conformal
	20	Number of Fractions	003
Phase 3	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	000540
	23	Volume	41 Breast - partial
	24	Rad to Nodes	00 No RT to draining nodes
	25	Modality	04 External beam, electrons
	26	Planning Technique	04 Conformal
	27	Number of Fractions	005
	28	Dose per Fraction	00200
	29	Total Phase 3 Dose	001000

### Coding Logic

- #8: The sum the doses reported in Phase 1 2 and 3 (#15 + #22 + #29). In general, the “total dose” to be reported will be the dose at the point in the volume receiving the most radiation. This dose is meant to represent the “cumulative” dose across phases to the same point or region (receiving the highest dose). Importantly, this field should report the cumulative dose to the highest dose treatment volume so long as the phases were performed using the same modality (i.e. external beam, brachytherapy, etc.).
- #10: In this phase the code “04” represents both axillary and SC regions as a single target. STORE coding does not provide enough granularity to distinguish between the possible combination of targets in this region.
- #17: In this field, code 04 represents just the axilla as it receives three additional treatments. Note that the PAB is simply regarded as part of the axillary plan and not coded as a phase.
- #23: This is what is commonly called the “boost” or “cone down” to deliver additional radiation to the region at greatest risk for recurrence, the surgical bed.

## 8 Prostate Cancer: Concurrent Prostate and SV Boost

### Clinical

- 76 y/o man with T3b prostate cancer.

### Treatment

- 7/9/2018 to 8/10/2018: Treated initially with whole pelvis RT to 4500 cGy in 25 fractions of 180 cGy using a four-field approach, all fields shaped conformally to pelvic anatomy.
- 8/13/2018 to 9/07/2018: IMRT boost of 19 fractions in which the seminal vesicles receive an additional 3420 cGy while the prostate receives 3800 cGy.

### Coding Logic

- #6: Although the volumes described in Phase 2 and Phase 3 were delivered at the same time with the same beams, they represent different organs receiving different daily and total doses and, under STORE rules, are treated as separate but concurrent phases. This is typically accomplished using an IMRT capability known as “dose painting” or “simultaneous integrated boosts” (SIB).
- #8: Add the regional dose from Phase 1 to the highest dose delivered within the boost target volumes. That would be the prostate dose.  $4500 + 3800 = 8300\text{cGy}$
- #23: The standard setters had to draw the line somewhere for the list of volumes and, since seminal vesicles are very rarely the primary target volume, they were omitted. That is why we have always (ROADS -> FORDS -> STORE) had a code 98. For the benefit of future local<sup>4</sup> users of the data it would be a good idea to document treatment of seminal vesicles in the radiation comments field.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or surg
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	07/09/2018
	5	Date Finished/Flag	09/07/2018
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	008300
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam photons
	12	Planning Technique	04 Conformal or 3-D
	13	Number of Fractions	025
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	64 Prostate - whole
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	02 External beam photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	019
	21	Dose per Fraction	00200
22	Total Phase 2 Dose	003800	
Phase 3	23	Volume	98 Other
	24	Rad to Nodes	00 No Treatment to Nodes
	25	Modality	02 External beam photons
	26	Planning Technique	05 IMRT
	27	Number of Fractions	019
	28	Dose per Fraction	00180
	29	Total Phase 3 Dose	003420

<sup>4</sup> Comments are transmitted to state registries (primarily for quality control purposes) but are not transmitted to NCDB.

## 9 Multiple Metastatic Sites Treated Concurrently.

### Clinical

65-year-old male smoker presents with Stage IV adenocarcinoma of the lung and multiple symptomatic sites of metastases:

- Proximal right humerus, lytic, painful, but not thought to be at risk of fracture.
- Left hip, minimal radiographic changes but positive on bone scan and painful.
- Mid-shaft right femur, minimal pain but judged to be at risk for path fracture
- T7 lesion with no fracture but extension of tumor into spinal canal and rapid onset of lower extremity weakness.

### Treatment

1. Treatment to thoracic spine was initiated evening of Saturday, 11/10/2018 and continued until 11/21/2018. Unblocked photon field, 3000 cGy in 10 fractions
2. 11/12/2018 to 11/23/2018: Treatment to right femur, unblocked photon field, 3000 cGy in 10 fractions
3. 11/12/2018 to 11/16/2018: Left hip treated with conformal fields designed to spare adjacent bowel, bladder, and soft tissues. 2000 cGy in 5 equal fractions.
4. 11/12/2018 to 11/16/2018: Right humerus, open square field, 2000cGy in 5 equal fractions.

### Coding Logic

- #4 The earliest date of treatment in the first course.
- #5 The last date of treatment in the first course even though it may not be associated with any of the radiation phases that have been documented here.
- #6 Four distinct volumes treated with each treatment represented by a distinct phase.
- #8 Record the maximum dose to first volume/phase. Do not add doses to different treatment volumes.
- #9 Chronology is the primary determinant of phase. The spine was treated first
- #16 After chronology we look at dose. The femur received a higher dose than either the hip or the humerus.
- #23 Two targets with the same dose. Toss a coin.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All treatment at this facility
	4	Date Started/Flag	11/10/2018
	5	Date Finished/Flag	11/23/2018
	6	Number of Phases	04 '4 or more phases'
	7	Discontinued Early	01 Completed
	8	Course Total Dose	003000
Phase 1	9	Volume	81 Spine
	10	Rad to Nodes	00 No RT to nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	03 2-D therapy
	13	Number of Fractions	10
	14	Dose per Fraction	00300
Phase 2	15	Total Phase 1 Dose	003000
	16	Volume	88 Extremity Bone, NOS
	17	Rad to Nodes	00 No RT to nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	03 2-D therapy
	20	Number of Fractions	010
Phase 3	21	Dose per Fraction	00300
	22	Total Phase 2 Dose	003000
	23	Volume	84 Hip
	24	Rad to Nodes	00 No RT to nodes
	25	Modality	02 External beam, photons
	26	Planning Technique	03 2-D therapy
	27	Number of Fractions	05
	28	Dose per Fraction	00400
	29	Total Phase 3 Dose	002000

## 10 Lung: How Many Phases?

### Clinical

72-year-old male diagnosed with small cell lung cancer on 2/22/2018.

- PET-CT scan shows activity limited to the right upper lobe and right hilum.
- Brain MRI is interpreted as showing a pattern consistent with scattered, age-related microvascular infarcts.
- The patient refuses chemotherapy.

### Treatment

- 3/5 – 4/6/2018: Area of PET activity treated with 6Mev photons using an IMRT plan to minimize esophagitis, 180 cGy per day, 25 fractions, 4500 cGy.
- 4/6/2018: Repeat simulation CT scan shows greater than 50% reduction in gross tumor volume. A new plan is developed.
- 4/10 – 4/16/2018: IMRT to upper lobe and hilar nodes (same target as before), 180cGy per day, 900cGy in 5 fractions
- 6/5/2018: Patient presents with confusion and aphasia. Brain MRI shows numerous sub-centimeter lesions consistent with metastases, most at locations previously interpreted as infarcts.
- 6/7 – 6/13/2018: Whole brain radiation, conformal opposed photon fields. 2000cGy in 5 fractions.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	03/05/2018
	5	Date Finished/Flag	04/16/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	005400
Phase 1	9	Volume	30 Lung or bronchus
	10	Rad to Nodes	02 Thoracic lymph nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	030
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	005400
Phase 2	16	Volume	00
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
	22	Total Phase 2 Dose	
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

### Coding Logic

- #6 and #16: We have coded only one phase for chest treatment. The patient had a new plan developed in the middle of therapy; but, because the treatment was to the same target volumes (primary and node) using the same modality, planning technique and dose per fraction, the new plan does NOT represent a new phase of radiation. This patient had “off-line” plan adaptation, which adapted the radiation targeting to changes in shape of the tumor or surrounding normal tissues. In some cases, this can occur several times throughout the course of radiation. So long as there is no change of targeted organs, modality, planning technique and dose per fraction, all of the adapted plans should be considered one phase. The second important consideration in this case is that treatment to the brain is not coded under STORE rules because treatment to the brain did not occur until after progression occurred in the brain. STORE collects only first course treatment data where first course is defined as:

#### First Course of Treatment

The first course of treatment includes all methods of treatment recorded in the treatment plan and administered to the patient before disease progression or recurrence.

## 11 Prophylactic Cranial Irradiation (PCI): How Many Phases?

### Clinical

72-year-old male diagnosed with small cell lung cancer on 2/22/2018.

- PET-CT scan shows activity limited to the right upper lobe and right hilum.
- He was treated with concurrent cisplatin, etoposide and radiation as summarized below.
- After completion of his thoracic radiation, he had follow-up imaging including brain MRI which showed no evidence of disease. He then had prophylactic cranial irradiation.

### Treatment

- 3/5 – 4/13/2018: Area of PET activity treated with 6Mev photons using an IMRT plan to minimize esophagitis, 200 cGy per day, 30 fractions, 6000 cGy.
- 5/7 – 5/18/2018: whole brain radiation at 25Gy in 10 fractions.

### Coding Logic:

- #5: Date finished should be the last day of the last phase of the entire radiation course even if there are gaps between phases, as in this case.
- #10: When the hilum of the lung is listed as a target, it almost invariably means that the lymph nodes of the hilar region are the targets.
- #8: It is a universal rule that you should NEVER add doses from different target volumes. In the Total Dose field, you will most often be simply recording the phase 1 dose. If the target volume in phase 1 is given a boost, in phase 2 you should add the doses. You should rarely have to add the phase 3 dose, unless it represents a further change in the size or technique used to give additional radiation within the first boost.
- #6 and #16: We have coded two phases in the first course of therapy, one for the chest treatment and another for the brain treatment. In this case, the whole brain radiation treatment is coded as part of the first course of therapy because it occurred prior to any evidence of progression or recurrence (i.e. it was done prophylactically).

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	03/05/2018
	5	Date Finished/Flag	5/18/2018
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	006000
Phase 1	9	Volume	30 Lung or bronchus
	10	Rad to Nodes	02 Thoracic lymph nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	030
	14	Dose per Fraction	00200
	15	Total Phase 1 Dose	006000
Phase 2	16	Volume	12 Brain
	17	Rad to Nodes	00 No RT to nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	01 External beam, NOS
	20	Number of Fractions	010
	21	Dose per Fraction	00250
	22	Total Phase 2 Dose	002500
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 12 Total Body Irradiation for Transplant

### Clinical

43-year-old woman with advanced multiple myeloma is referred for total body irradiation in preparation for a bone marrow transplant.

### Treatment

- 11/14 – 11/16/2018: Treated twice daily for three consecutive days in a total body stand at extended distance with open rectangular photon fields, 200cGy to mid-body per treatment.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/14/2018
	5	Date Finished/Flag	11/16/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	001200
Phase 1	9	Volume	93 Whole Body
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	02 External beam, photons
	12	Technique	03 2-D therapy
	13	Number of Fractions	006
	14	Dose per Fraction	00200
	15	Total Phase 1 Dose	001200
Phase 2	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
	22	Total Phase 2 Dose	
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

### Coding Logic:

- #9: Volume code 93 is reserved for this circumstance and the now somewhat rare whole-body treatment for bone metastases. Use code 98 for systemic treatment with radioisotopes.
- #10: Obviously lymph nodes are included in a whole-body beam, but they are not the primary target and there is no code describing total lymph node irradiation.
- #12: Without other information in the record, we would assume 2-D planning (open field, no blocks) was used. In some centers, particularly if the total dose is greater than 1200cGy, the record may describe lung, liver, or kidney blocks. In these situations, it may be appropriate to code planning technique to 3-D conformal.

## 13 Head and Neck: Simultaneous Integrated Boost (SIB)

### Clinical

61-year-old man with stage IVa, T3N2cM0, HPV-negative squamous cell carcinoma of the tonsil completed his course of radiation therapy (delivered with concurrent weekly cisplatin and, on study, with concurrent nelfinavir for hypoxia modification).

### Treatment

- Dates of treatment: 9/10/2018 to 10/29/2018.
- Proton pencil beam scanning
- Area: Primary site + bilateral neck.
- Over the course of 35 treatments, areas of gross disease received 7000 cGy, high risk elective neck regions received 6300 cGy, low-risk elective neck including the supraclavicular regions received 5600 cGy.

### Coding Logic

- #6: This course of RT is an example of a simultaneous integrated boost. Three regions of the neck (gross disease, high risk neck nodes, low risk neck nodes) were treated simultaneously using different daily fractions of radiation. In the past, these three regions were usually treated using sequential radiation phases (the first radiation plan treated gross disease, high- and low-risk neck regions to 5000 cGy in 25 fractions; then, the second plan treated gross disease and high-risk neck regions to 6000 cGy in 30 fractions; finally, the third plan treated gross disease to 7000cGy in 35 fractions). The sequential approach requires three separate radiation plans to be made by the physics team, which is a lot of work! More and more, simultaneous integrated boost (or dose painting) treatments are being used because this approach allows only one radiation plan to be developed, which greatly reduces the planning burden on physics teams.
- #10: Note that we coded “01 neck lymph node regions” in this phase. We know from his nodal staging (N2c) that he had gross disease in his neck nodes and the treatment summary that areas of gross disease received 7000cGy in 35 fractions.
- #12: We recommend that protons should be coded as conformal planning technique unless intensity modulated proton therapy (IMPT) is explicitly referenced.
- #17 and #24: In phase 2 and 3, neck nodal regions were the primary treatment volume so there is no secondary nodal treatment volume. Radiation to Nodes code 88 is reserved for this situation.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	9/10/2018
	5	Date Finished/Flag	10/29/2018
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	007000
Phase 1	9	Volume	22 Oropharynx
	10	Rad to Nodes	01 Neck lymph node regions
	11	Modality	03 External beam, protons
	12	Technique	04 Conformal
	13	Number of Fractions	035
	14	Dose per Fraction	00200
	15	Total Phase 1 Dose	007000
Phase 2	16	Volume	01 Neck lymph node regions
	17	Rad to Nodes	88 N/A, nodes are primary vol
	18	Modality	03 External beam, protons
	19	Technique	04 Conformal
	20	Number of Fractions	035
	21	Dose per Fraction	00180
22	Total Phase 2 Dose	006300	
Phase 3	23	Volume	03 Neck and thoracic LN reg
	24	Rad to Nodes	88 N/A, nodes are primary vol
	25	Modality	03 External beam, protons
	26	Technique	04 Conformal
	27	Number of Fractions	035
	28	Dose per Fraction	00160
	29	Total Phase 3 Dose	005600

- #24: Because the summary states that the low-risk neck volume includes the supraclavicular regions, this is coded as 03 Neck and thoracic lymph node regions.

## 14 Lung: Off-line Adaptive Re-plan

### Clinical

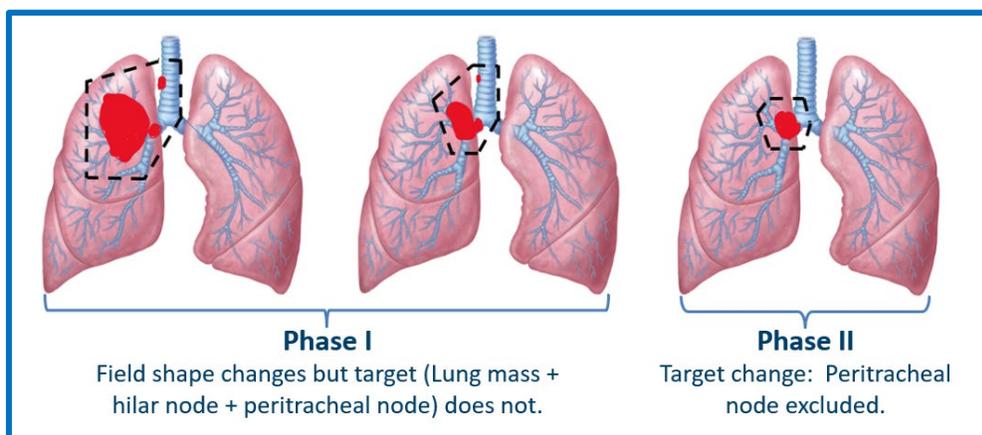
72 y/o man with NSCLC diagnosed on 2/22/2018 with a mass limited to the right upper lobe and right hilum. Patient was treated with radiation alone. He refused chemotherapy.

### Treatment

- D3/5/2018-4/6/2018: Area of PET activity was treated with 6MV photons using an IMRT plan to minimize esophagitis, 180cGy per day, 25 fractions, 4500 cGy.
- 4/6/2018: at 4500 cGy a repeat CT simulation showed dramatic shrinkage of the primary tumor volume, so a new plan was generated.
- 4/10/2018- 4/12/2018: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.
- 4/14/2018 – 4/16/2018: Third CT simulation scan showed even further shrinkage of the primary tumor and no evidence of the peritracheal node. Field revised to an opposed pair of ports angled off esophagus and spinal cord and reduced to include only the primary tumor and residual hilar node. 900 cGy prescribed and delivered in 5 fractions

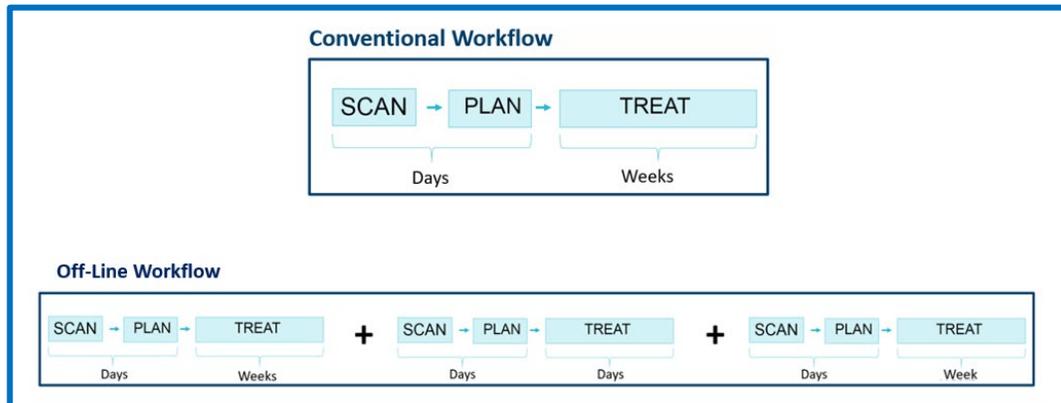
Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	03/052018
	5	Date Finished/Flag	04/16/2018
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	005940
Phase 1	9	Volume	30 Lung or bronchus
	10	Rad to Nodes	02 Thoracic lymph nodes
	11	Modality	02 External beam, photons
	12	Technique	05 IMRT
	13	Number of Fractions	028
	14	Dose per Fraction	00180
15	Total Phase 1 Dose	005040	
Phase 2	16	Volume	30 Lung or bronchus
	17	Rad to Nodes	02 Thoracic lymph nodes
	18	Modality	02 External beam, photons
	19	Technique	04 - Conformal
	20	Number of Fractions	005
	21	Dose per Fraction	00180
22	Total Phase 2 Dose	000900	
Phase 3	23	Volume	00
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

The concept of off-line adaptive planning is illustrated below. Note that in Phase I, there is a change in the shape of the radiation field but the target volume (primary + hilar node + paratracheal node) does not change.



In the diagram below we illustrate the workflow for conventional and off-line plans.

- In the majority of cases, a patient will have a single CT scan and over the course of a few days a treatment plan will be generated and then applied daily for several days or weeks.
- In an off-line adaptive plan, the scan-plan-treat sequence may be repeated two or three times on the same time scales. Short treatment interruptions may occur to allow time for planning. Off-line planning has been part of the radiation oncologists play book for decades. It has been most frequently employed with tumors that respond very quickly to radiation, such as lymphomas and small cell lung cancer.



### Coding Logic

- During the first adaptation, the physical volume has changed but the target volume (diseased organs), modality, planning technique and daily fraction size have not changed. Therefore, we do not code a second phase at this point.
- In the second adaptation, the target volume changes and paratracheal nodes are now excluded. This alone is reason for a second phase, as is the change to conformal therapy.

## 15 Bladder: On-line Adaptive Therapy with an MR-Linac

### Clinical

75-year-old woman with average risk muscle-invasive bladder cancer treated with selective bladder preservation. She had a complete transurethral resection followed by neoadjuvant chemotherapy with gemcitabine and cisplatin and finally concurrent mitomycin/5FU and radiation.

### Treatment

- Dates of treatment: 9/10/2018 to 10/30/2018.
- She received 180 cGy x 36 to 6480cGy to the whole bladder.
- Her radiation was performed on the MR-linac with IMRT and daily on-line treatment adaptation to account for changes in bladder filling. Seventeen of 36 fraction required a full re-plan.

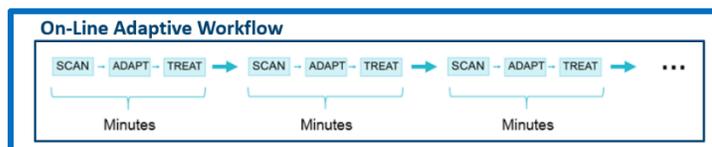
### Coding Logic

- #12: Some new linear accelerators are attached to such high-quality imaging devices that they can function as both simulation scanners for planning and radiation delivery systems. If a new radiation plan is created while the patient is on the radiation delivery table to take into

account that day's anatomy, this is referred to "on-line" (or on-table) adaptive radiation. If a new radiation plan is created while the patient is elsewhere, then it is referred to as "off-line" adaptive therapy. Off-line adaptive therapy treatments are relatively common, but MR-guided and CT-guided online adaptive therapy treatments are just emerging. Applicability is limited to situations where tumor anatomy is variable with time as can be the case with bladder tumors.

This case describes MR-guided online adaptive therapy<sup>5</sup>. If a treatment is described as both MR-guided (or CT-guided) on-line adaptive as well as another external beam planning technique (e.g. IMRT, SBRT, etc.), then it should be categorized as MR-guided online adaptive therapy. Online adaptive techniques are the most complex and usually include IMRT and/or SBRT techniques within them, so the online adaptive component is most important to capture.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	9/10/2018
	5	Date Finished/Flag	10/29/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	006480
Phase 1	9	Volume	60 Bladder - whole
	10	Rad to Nodes	00 No radiation to nodes
	11	Modality	02 External beam, photons
	12	Technique	10 MR-guided on-line adaptive
	13	Number of Fractions	036
	14	Dose per Fraction	00180
Phase 2	15	Total Phase 1 Dose	006480
	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	



<sup>5</sup> For more information see: Apollo, W., "Online Adaptive Radiation Therapy", Journal of Registry Management, Summer 2018, Vol45 #2, page 91.

## 16 Gyn-Brachytherapy + External Beam Radiotherapy (EBRT)

### Clinical

67 y/o patient, G2P2, presented with postmenopausal bleeding with positive findings on endometrial bx. Patient underwent TAH/BSO with pelvic lymphadenectomy, pT3b, pN0 w/ +margins, and then concurrent RT/cisplatin followed by carboplatin + paclitaxel.

### Treatment

- 1/7/21-2/11/21, Whole pelvis RT w/ 6X/IMRT, 180 cGy x 25 fx<sup>6</sup> to 45 Gy.
- 2/13/21-2/18/21, Vaginal cuff HDR brachytherapy via Ir-192 seeds, 600 cGy x 2 fx for a total of 1200 cGy.

### Coding Logic

- #8: You cannot add dose from a brachytherapy phase with dose from EBRT phase.
- #9: When possible, phases are captured in chronological order based on phase start date. If a primary site in the pelvic region is surgically resected, code the primary irradiated volume to the primary site
- #10: RT treatment summary tells us that the whole pelvis was irradiated. This includes regional lymph nodes.
- #15 180 x 25 = 4500
- #16: When intracavitary HDR brachytherapy is administered to the vaginal cuff for endometrial or cervical cancer, post TAH/BSO, primary irradiated volume is vagina (72) because the vaginal surface is the organ at risk. Note that in this setting, the effective range of the treatment is limited to the vaginal wall. This is an exception to general rule of coding to the organ of origin and a code 71 would be technically correct, just less informative.
- #21-22: If dose per fraction and total dose is given in cGy, code it as such in the abstract for that phase.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	02/07/2021
	5	Date Finished/Flag	03/18/2021
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	999998
Phase 1	9	Volume	71 Uterus or Cervix
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam, photons
	12	Technique	05 IMRT
	13	Number of Fractions	025
	14	Dose per Fraction	00180
15	Total Phase 1 Dose	004500	
Phase 2	16	Volume	72 Vagina
	17	Rad to Nodes	00 No RT to draining LNs
	18	Modality	09 Brachytherapy, intracavitary, HDR
	19	Technique	88 NA
	20	Number of Fractions	02
	21	Dose per Fraction	00600
22	Total Phase 2 Dose	001200	
Phase 3	23	Volume	00
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
29	Total Phase 3 Dose		

<sup>6</sup> “fx” is a common abbreviation for “fraction” which, in turn, simply means a treatment event.

## 17 Multiple Brain Mets: Treated with Gamma Knife

### Clinical

67 y/o with a history of stage IV Lung adenocarcinoma (NSCLC), T2N0M1c, EGFR+, s/p left frontal craniotomy for resection of brain mets, now presents for Gamma Knife treatment to multiple (7) intracranial lesions.

### Treatment

- On 11/4/19, patient was treated to 7 CNS lesions via Gamma Knife SRS. Dose ranged from 16-20 Gy prescribed to the 50% isodose line.
- # of shots: 51

### Coding Logic

- #6/#13: The Gamma Knife teletherapy unit can target multiple CNS lesions simultaneously in a single session (1 fraction, 1 phase). Regardless of whether 4 or 15 CNS lesions are targeted by the Gamma Knife unit in a single session, consider this a single fraction and a single phase.
- #15: It is not unusual with Gamma Knife SRS for the dose to vary among the targeted CNS lesions. Select the highest delivered dose as the total dose for this single-phase treatment.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/04/2019
	5	Date Finished/Flag	11/04/2019
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	002000
Phase 1	9	Volume	13 Brain-limited
	10	Rad to Nodes	00 No radiation to nodes
	11	Modality	02 External beam, photons
	12	Technique	08 SRS, Gamma Knife
	13	Number of Fractions	001
	14	Dose per Fraction	02000
	15	Total Phase 1 Dose	002000
Phase 2	16	Volume	00
	17	Rad to Nodes	
	18	Modality	
	19	Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
Phase 3	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

### Historical Note

Gamma Knife treatment is an example of a very old concept that took a long time to reach general use. It was invented in 1951 by a Swedish physician, Dr. Lars Leksell and took advantage of a newly available source of gamma radiation, Cobalt-60. The first commercial Gamma Knife machine was not available until 1967 and general availability is much more recent.

In simple terms, the original Gamma Knife machine is spherical lead "helmet" with 210 holes distributed over the surface and drilled in a fashion such that they come to a common small focus in the open center of the helmet. Each hole contains a small source of Cobalt-60 (a radioactive metal with a long half-life). Ignoring the complexity of turning the radiation on and off, the net result is 210 narrow beams of radiation coming together to a small region with a very high dose rate.

## 18 Prostate and Rectal: Treated with One Plan

**Clinical** (This case was submitted to CANSWER.)

*"In the course of a workup for prostate cancer (cT1c cN0 cM0, Gleason 6) the patient was also found to have an adjacent rectal cancer (cT2 cN1b cM0)."*

### Treatment

*"The radiation record shows that the two malignancies were treated simultaneously within a single planned volume using SBRT (stereotactic body radiation therapy). 10Mv x-rays were utilized and treatment was completed in 5 fractions starting on 11/18/2021 and ending on 11/27/2021.*

- *The prostate received a dose of 3625 cGy.*
- *Clinically suspicious nodes in the "neighborhood" received 2750 cGy*
- *The rectal primary and remaining pelvic lymph nodes received 2500 cGy."*

### Coding Logic

This is obviously a unique and very infrequent situation. The key fact here is that the patient has two primaries and each one must be reported separately to NCDB with a complete STORE compatible record (demographics / diagnostics / treatment / follow-up). Registry software may vary in how this is accomplished, but the end result should always be the same. Treatment will be reported twice, in one record for the prostate cancer and another for the rectal cancer since both were targeted by the plan.

On this page we show coding for the prostate record:

#8: As usual, record the maximum dose delivered to the primary tumor volume (prostate).

#10: Unlike case # 8, the target for this phase of the prescription is just the prostate. Normally, for T1c disease, Gleason 6, nodes would not be deliberately treated. If there are suspicious nodes on imaging, they are statistically (but not certainly) more likely to be associated with the rectum. Pathology might resolve the ambiguity. If the nodes are positive and consistent with a prostate origin, you might have to re-code these two cases.

#12: The summary explicitly references SBRT.

### Prostate

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/18/2021
	5	Date Ended/Flag	11/27/2021
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	003625
Phase 1	9	Volume	64 Prostate - Whole
	10	Rad to Nodes	00 No Radiation to Nodes
	11	Modality	02 External Beam, Photons
	12	Planning Technique	06 Stereotactic radiotherapy, NOS
	13	Number of Fractions	5
	14	Dose per Fraction	00725
	15	Total Phase 1 Dose	003625
Phase 2	16	Volume	00
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
	22	Total Phase 2 Dose	
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 18 (Continued)

### Clinical

While it was not mentioned in the available record, the registrar recognized the dose schedule for the rectal mass and remaining pelvic lymph nodes as a standard for pre-operative treatment. A simple call to the treating radiation oncologist confirmed this fact.

### Treatment

- The rectal primary received 2500 cGy.
- Adjacent nodes, thought to be metastatic from the rectum, receive 2750 cGy

### Coding Logic

- #8 Record the highest dose given even if it is not to the primary
- #9 This is an example of two simultaneous phases (or a simultaneous integrated boost). When two phases are delivered simultaneously, list the one with the highest dose first.

Rectum
--------

Seg	#	Field	Code/Definition
<b>Summary</b>	1	Rad/Surg Sequence	2 Radiation Before Surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/18/2021
	5	Date Ended/Flag	11/27/2021
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Course Total Dose	002750
<b>Phase 1</b>	9	Volume	06 Radiation to Pelvic Nodes
	10	Rad to Nodes	88 Not Applicable
	11	Modality	02 External Beam, Photons
	12	Planning Technique	06 Stereotactic radiotherapy, NOS
	13	Number of Fractions	5
	14	Dose per Fraction	550
	15	Total Phase 1 Dose	002750
<b>Phase 2</b>	16	Volume	54 Rectum
	17	Rad to Nodes	06 Pelvic Lymph nodes
	18	Modality	02 External Beam, Photons
	19	Planning Technique	06 Stereotactic radiotherapy, NOS
	20	Number of Fractions	5
	21	Dose per Fraction	500
	22	Total Phase 2 Dose	002500
<b>Phase 3</b>	23	Volume	00 No Radiation Treatment
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

# 19 Unknown Primary, Head and Neck: with Simultaneous Integrated Boost

**Clinical** <sup>7</sup> (This case, amended to provide more detail - was submitted to CAnswer.)

The patient, fond of alcohol and cigarettes, presented with a large, bilateral, lymph nodes that appeared to originate at levels IIA and IIB (upper neck), pushing down into level III (mid-neck). Biopsy of the left neck mass showed squamous carcinoma. Examination under anesthesia by an otolaryngologist, with multiple biopsies, failed to identify the primary site.

## Treatment

The radiation oncologist defined three areas of interest for planning and treatment was delivered using an IMRT class of plan (VMAT) with simultaneous integrated boosts (SIB's). Thirty-five identical treatments were delivered between 11/02/2020 and 12/17/2020.

- The palpable lymph nodes received 7000 cGy.
- Immediately adjacent lymph nodes, clinically negative but considered to be high risk, received 5950 cGy.
- Lymph nodes in the low neck, considered to be low risk, received 5600cGy

## Coding Logic

While treatment was delivered simultaneously, there were dose prescriptions to 3 adjacent but separate volumes. As with Case #17, each prescription volume is considered a phase with the highest dose volume assigned to Phase I.

- #8 Document the highest dose delivered to any one volume; with SIB this would be the dose recorded for Phase I. With older techniques (See Case #17), it may be appropriate to add doses for each phase.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/02/2020
	5	Date Ended/Flag	12/17/2020
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	007000
Phase 1	9	Volume	02 Neck Lymph Node Regions
	10	Rad to Nodes	88 Not Applicable
	11	Modality	02 External Beam, Photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	35
	14	Dose per Fraction	200
	15	Total Phase 1 Dose	007000
Phase 2	16	Volume	02 Neck Lymph Node Regions
	17	Rad to Nodes	88 Not Applicable
	18	Modality	02 External Beam, Photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	35
	21	Dose per Fraction	170
	22	Total Phase 2 Dose	005950
Phase 3	23	Volume	02 Neck Lymph Node Regions
	24	Rad to Nodes	88 Not Applicable
	25	Modality	02 External Beam, Photons
	26	Planning Technique	05 IMRT
	27	Number of Fractions	35
	28	Dose per Fraction	160
	29	Total Phase 3 Dose	005600

<sup>7</sup> Case originally presented to CAnswer with the question: "Is the total dose the sum of phase I and phase II doses (12950 cGy) or the sum for all 3 phases (18550 cGy)."

## 20 Head and Neck: Unknown Primary with Staged Boost

### Clinical

The patient, twin brother of the patient in Case #16, is also fond of alcohol and cigarettes, and presented with a large, bilateral, lymph nodes that appeared to originate at levels IIA and IIB (upper neck), pushing down into level III (mid-neck). Biopsy of the left neck mass showed squamous carcinoma. Examination under anesthesia by an otolaryngologist, with multiple biopsies, failed to identify the primary site.

### Treatment

The radiation oncologist defined three areas of interest for planning but, lacking the equipment for IMRT, he used a classic, time-proven, staged approach:

- The entire neck, masses, adjacent high-risk nodes, and more distant nodes were treated to a uniform dose of 5600 cGy in 28 equal “fractions” of 200cGy each.
- The field was reduced and an additional 2 fractions of 200cGy were given to the masses and high-risk regions.
- Finally, the field was reduced again, and treatment continued for an additional 5 fractions bringing the palpable masses to a total dose of 7000cGy

### Coding Logic

Unlike the situation with case #16, the three phases here are delivered consecutively, each with its own plan.

- #8 Document the highest dose delivered to any one volume. That volume is the volume of Phase III which also has dose contributions from phases I and II. Here it is appropriate to add the doses across all three phases.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/02/2020
	5	Date Ended/Flag	12/17/2019
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	007000
Phase 1	9	Volume	02 Neck Lymph Node Regions
	10	Rad to Nodes	88 Not Applicable
	11	Modality	02 External Beam, Photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	28
	14	Dose per Fraction	00200
Phase 2	15	Total Phase 1 Dose	005600
	16	Volume	02 Neck Lymph Node Regions
	17	Rad to Nodes	88 Not Applicable
	18	Modality	02 External Beam, Photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	2
Phase 3	21	Dose per Fraction	00200
	22	Total Phase 2 Dose	000400
	23	Volume	02 Neck Lymph Node Regions
	24	Rad to Nodes	88 Not Applicable
	25	Modality	02 External Beam, Photons
	26	Planning Technique	05 IMRT
	27	Number of Fractions	5
28	Dose per Fraction	00200	
29	Total Phase 3 Dose	001000	

## 21 Breast: Simultaneous Integrated Boost (SIB)

**Clinical** (This case was submitted to CAnswer.)

A 74-year-old woman underwent lumpectomy followed by breast irradiation for a pT2 (2.3cm) pN1a cM0, ER 100%, PR 90%, Her-2 negative, left breast cancer.

### Treatment

- Dates of treatment: 5/20/20 to 6/8/2020 (hypo-fractionated).
- Cardiac sparing IMRT with simultaneous integrated boost.
- Regional (breast plus axillary lymph nodes) treatment to a prescribed dose of 4005 cGy (267 cGy per day) in 15 fractions.
- Simultaneous treatment of lumpectomy bed with margins to a prescribed dose of 320 cGy per day for a total of 4800cGy

### Coding Logic

- While treatment to both prescription areas occurred simultaneously, there were two prescriptions and therefore two phases. The only question is which should be considered Phase I, the prescription with the larger volume or the prescription with the higher total dose. It is a bit of a chicken-egg thing, but for consistency the standard in this setting is to assign Phase I to the target volume receiving the highest dose.
- SIB is not a new technique. It was in use long before we had IMRT but it was a lot more bother with fixed fields.
- #17: Axillary treatment is a physical extension of breast treatment and therefore assigned to Phase II.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	5/20/2020
	5	Date Finished/Flag	6/8/2020
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	004800
Phase 1	9	Volume	41 Breast, partial
	10	Rad to Nodes	00 No radiation to nodes
	11	Modality	02 External beam, photons
	12	Technique	05 IMRT
	13	Number of Fractions	015
	14	Dose per Fraction	00320
	15	Total Phase 1 Dose	004800
Phase 2	16	Volume	40 Breast - whole
	17	Rad to Nodes	04 Breast/chest wall nodes
	18	Modality	02 External beam, photons
	19	Technique	05 IMRT
	20	Number of Fractions	015
	21	Dose per Fraction	00267
	22	Total Phase 2 Dose	004005
Phase 3	23	Volume	00 No Radiation
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 22 Prostate and Seminal Vesicles with IMRT

**Clinical** (This case was submitted to CAnswer.)

*“This radiation was given at another facility. All I have is the treatment summary. The Rad Onc physician states in his note that “He was treated as per the above radiation chart” [provided below]. How would this be entered in the abstract? What is the Total Dose to Volume? (12,600? - doesn't seem right). Case #6 in the guide isn't quite the same. Here is the treatment summary:*

### Treatment

Treatment Site	Energy	Technique	Dose	Fractions	Dates	Elapsed Days
Prostate + SV	6 MV	RapidArc	2 Gy x28=56 Gy	28	3/18/19- 4/25/19	38
Prostate	6 MV	RapidArc	2.5 Gy x28= 70 Gy	28	3/18/19- 4/25/19	38”

- “RapidArc” is a marketing name (Varian) for one implementation of IMRT
- STORE does not collect “Elapsed Days” because it is easily calculated from the start and end dates.

### Coding Logic

- This case shares some elements with cases 8, 13, and 18 and 20. From a coding point of view, it presents the same issues as phases II and III of case 6. There, the “boost” was managed with IMRT in a manner such that the prostate received a higher dose than the adjacent seminal vesicles, i.e., two prescriptions, therefore two phases.
- #8 Following the general rule, record the dose to the prescribed volume receiving the highest dose (prostate).
- Doses are added across phases only when they are attributed to the same target volume, and treatment was with some form of external beam.
- As a general rule, if your calculated Total Dose is greater than 10000 cGy it may be wrong.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	4 All RT elsewhere
	4	Date Started/Flag	3/18/20
	5	Date Finished/Flag	4/25/20
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	007000
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	00 No Treatment to Nodes
	11	Modality	02 External beam photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	028
	14	Dose per Fraction	00250
	15	Total Phase 1 Dose	007000
Phase 2	16	Volume	98 Other
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	02 External beam photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	028
	21	Dose per Fraction	00200
	22	Total Phase 2 Dose	005600
Phase 3	23	Volume	00 No Radiation
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 23 Cervical Cancer: HDR Brachytherapy with Variable Dose per Fraction

**Clinical** (This case was submitted to CAnswer.)

*“The end of treatment summary for HDR brachytherapy for cervical cancer states 5 fractions and dose per fraction for the first 3 fractions is 800 cGy and fraction 4 and 5 were 550 cGy. Volume, modality and treatment planning are the same. Due to the change in dose, would this be considered 2 phases? If considered same phase, can the doses be added together? Or would it be coded 999998?”*

### **Treatment**

- Let us fill in the details by assuming that treatment was done at the reporting facility between 11/9/2020 and 11/18/2020.
- Missing from the description is whether or not the patient has had a hysterectomy.

### **Coding Logic**

Under the 2021 guidelines a change in daily dose fraction constitutes a change in phase

- #3 Treatment was administered by the same modality (HDR) in each case so the doses for each phase can be added.
- #9,16 If the patient has had a hysterectomy, code the Volume to vagina, since it is the primary target.
- #9,16 If the patient has not had a hysterectomy, code the Volume to 71 Cervix.
- #10, 16 Lymph nodes are rarely the target of intracavitary therapy.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	11/9/2020
	5	Date Finished/Flag	11/18/2020
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	003500
Phase 1	9	Volume	71 – Cervix or 72 - Vagina
	10	Rad to Nodes	00 No Treatment to Nodes
	11	Modality	09 Brachy, intracavitary, HDR
	12	Planning Technique	88 NA
	13	Number of Fractions	003
	14	Dose per Fraction	00800
Phase 2	15	Total Phase 2 Dose	002400
	16	Volume	71 – Cervix or 2 - Vagina
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	09 Brachy, intracavitary, HDR
	19	Planning Technique	88 NA
	20	Number of Fractions	002
Phase 3	21	Dose per Fraction	00550
	22	Total Phase 2 Dose	001100
	23	Volume	00 Not Treated
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

## 24 Pelvis, Prostate and Seminal Vesicles with VMAT

**Clinical** (This case was submitted to CAnswer.)

*“Is the following coded correctly into 3 phases?”*

**Ph 1:** 10/4/19-11/8/19 6MV-VMAT Pelvis PTV1 180x25=4500cGy.

**Ph 3:** 11/11/19-11/15/19 6MV-VMAT Pelvis PTV2 (Prostate + SV) 180x5=900cGy.

**Ph 2:** 11/18/19-12/4/19 6MV-VMAT Pelvis PTV3 (Prostate) 180x12=2160cGy.

TOTAL 7560cGy.

*Rad Onc Note = I will be following NCCN and [XYZ] guidelines and delivering 7560cGy in 42 fractions to Prostate + SV w/ at least 4500cGy to high risk Pelvic LN region w/ IMRT/IGRT.”*

### Treatment

The short answer to their question is, “not quite”<sup>8</sup>, and the primary factor is that the record shows treatment divided into three consecutive date intervals with a different target volume definition (prescription) in each case. Each time interval defines a phase because the volume also changes. Phases to a common volume are recorded in the order they are given and not on the basis of phase dose.

### Coding Logic

- #4 Record first date of Phase I
- #5 Record last date of treatment (Phase III)
- #8 The prostate is included in all three phases so the doses can be summed across all three phases.
- #9,10 When a region like the pelvis is treated, code the primary site. Pelvic lymph nodes are identified as a target in field #10.
- #12 VMAT is just a form of IMRT (an “advanced” form for marketing purposes)
- #16 We code this to 98 because there is no specific Volume code for prostate plus seminal vesicles.
- #23 In the final phase just the prostate is covered.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	10/4/2019
	5	Date Finished/Flag	12/4/2019
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	007560
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	028
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	98 Other
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	02 External beam photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	005
	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	000900
Phase 3	23	Volume	64 Prostate - whole
	24	Rad to Nodes	00 No Treatment to Nodes
	25	Modality	02 External beam photons
	26	Technique	05 IMRT
	27	Number of Fractions	012
	28	Dose per Fraction	00180
	29	Total Phase 3 Dose	002160

<sup>8</sup> The caller had reversed phases II and III, perhaps because the phase III had a higher delivered dose. We would guess that this confusion came from a rule that says when two or more different sites start treatment on the same date and have different prescribed doses, put the highest dose target in Phase I, next highest in Phase II, etc. In this situation, for Total Dose, record the dose delivered to the volume recorded in Phase I.

## **25 Breast: Treatment Interrupted – Big Time**

**Clinical** (This case was submitted to CAnswer.)

*Lumpectomy was done and path came back as 1/5 lymph nodes positive. Oncotype results led to a decision to omit chemotherapy. Radiation was started and the patient had received 3 of 16 planned fractions (hypo-fractionation, often referred to as the “Canadian protocol”) when word was received that the specimen had been re-examined and path report was amended to 5/5 lymph nodes positive.*

*Radiation treatment was stopped and chemotherapy initiated with a plan to have the patient return to Radiation Oncology to be re-simulated and treated upon completion of chemo.*

*How would I code this XRT? Would I code it as completed since they will be re-simulating and re-planning when the patient returns? Or would I code it as not completed due to other reasons?*

### **Coding Logic**

This patient is not going to be back in two weeks to complete radiation, it will be more like four to six months, by which time any tumoricidal benefit from the first radiation will have been lost and any tissue injury will have been largely repaired. Many, if not most, radiation oncologists would make little or no adjustment and simply treat the patient as though they had not had any prior radiation. That said, the right answer here is to code what occurred starting from the first fraction of radiotherapy, even if there is a very long break in the middle of the course or phase.

With this strategy, any PUF file researcher should, from the elapsed time alone, determine that this treatment was interrupted (remember, PUF file recipients do not get dates because of HIPAA; they get intervals between dates).

## 26 Prostate: VMAT to Pelvis with SBRT Boost

### Clinical

67 y.o. male with high-risk prostatic adenocarcinoma (cT3a by MRI(suspicious for EPE), Gleason 4+3=7, 14/17 total cores, PSA 14.5).He has been referred for radiation therapy. How would you code the VMAT (05) & SBRT/SRS (06)?

### Treatment

Volume	First Tx	Last Tx	Frac	Dose/Fx	Dose	Technique
Pelvis (incl. Prostate)	5/14/19	6/18/19	25	180	4500	VMAT
Prostate	6/19/19	6/25/19	3	650	1950	SBRT

### Coding Logic

VMAT (an IMRT variant) is typically used when the target is complex. In this case we have a pelvic organ, prostate, and pelvic lymph nodes of concern, and there is a desire to reduce the risk of injury to small bowel and bladder (with fixed fields, options for such protection are limited).

SBRT is another IMRT variant with steps taken to maximize precision of targeting. It is generally reserved for small target volumes (less than 5cm in diameter – prostate dimensions are usually less than 5cm) often with large doses per fraction.

- #8 Since the two phases were consecutive, had a common target and modality we can add the two-phase doses. This sum of phase doses may seem a bit low for fractionated prostate treatment but the 3 fractions of 650 cGy have a biologic effect (cell kill) that is substantially greater than the same total dose at 180cGy per fraction.
- #9, #10 Code to the organ of diagnosis and let the coding for nodes show that the pelvis was treated.
- #19 Although closely related to IMRT, SBRT has it own set of codes. We use code 06 as the most likely form since the record does not mention Gamma Knife or robotics.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	5/14/19
	5	Date Finished/Flag	6/25/19
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	006450
Phase 1	9	Volume	64 Prostate -
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	025
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	64 Prostate -
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	02 External beam photons
	19	Planning Technique	06 Stereotactic Radiotherapy
	20	Number of Fractions	003
	21	Dose per Fraction	00650
	22	Total Phase 2 Dose	001950
Phase 3	23	Volume	00 No Radiation
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

# Appendix A – STORE Radiation Data Field Items

## Summary Fields

Code	Location of Radiation Treatment
0	No radiation treatment
1	All radiation treatment at this facility
2	Regional treatment at this facility, boost elsewhere
3	Boost radiation at this facility, regional elsewhere
4	All radiation treatment elsewhere
8	Other
9	Unknown

Code	Radiation/Surgery Sequence
0	No radiation therapy and/or surgical procedures
2	Radiation therapy before surgery
3	Radiation therapy after surgery
4	Radiation therapy both before and after surgery
5	Intraoperative radiation therapy
6	Intraoperative radiation therapy with other therapy administered before or after surgery
7	Surgery both before and after radiation
9	Sequence unknown

Code	Reason for No Radiation
0	Radiation therapy was administered.
1	Radiation therapy was not administered because it was not part of the planned first course treatment. Diagnosed at autopsy.
2	Radiation therapy was not recommended/administered because it was contraindicated due to other patient risk factors (comorbid conditions, advanced age, progression of tumor prior to planned radiation etc.).
5	Radiation therapy was not administered because the patient died prior to planned or recommended therapy.
6	Radiation therapy was not administered; it was recommended by the patient's physician, but was not administered as part of first course treatment. No reason was noted in patient record.
7	Radiation therapy was not administered; it was recommended by the patient's physician, but this treatment was refused by the patient, the patient's family member, or the patient's guardian. The refusal was noted in patient record.
8	Radiation therapy was recommended, but it is unknown whether it was administered.
9	It is unknown if radiation therapy was recommended or administered. Death certificate cases only.

Code	Radiation Treatment Discontinued Early
00	No radiation treatment
01	Radiation treatment completed as prescribed
02	Radiation treatment discontinued early - toxicity
03	Radiation treatment discontinued early - contraindicated due to other patient risk factors (comorbid conditions, advanced age, progression of tumor prior to planned radiation etc.)
04	Radiation treatment discontinued early - patient decision
05	Radiation discontinued early - family decision
06	Radiation discontinued early - patient expired
07	Radiation discontinued early - reason not documented
99	Unknown if radiation treatment discontinued; Unknown whether radiation therapy administered

## Phase Fields

Phase N Volume	
Value	Description
00	No radiation treatment
01	Neck lymph node regions
02	Thoracic lymph node regions
03	Neck and thoracic lymph node regions
04	Breast/chestwall lymph node regions
05	Abdominal lymph nodes
06	Pelvic lymph nodes
07	Abdominal and pelvic lymph nodes
09	Lymph node primary, NOS
10	Eye/orbit/optic nerve
11	Pituitary
12	Brain
13	Brain (limited)
14	Spinal cord
20	Nasopharynx
21	Oral cavity
22	Oropharynx
23	Larynx (glottis) or hypopharynx
24	Sinuses/nasal tract
25	Parotid or other salivary glands
26	Thyroid
29	Head and neck (NOS)
30	Lung or bronchus
31	Mesothelium
32	Thymus
39	Chest/lung (NOS)
40	Breast - whole
41	Breast - partial
42	Chest wall
50	Esophagus
51	Stomach
52	Small bowel
53	Colon
54	Rectum
55	Anus
56	Liver
57	Biliary tree or gallbladder
58	Pancreas or hepatopancreatic ampulla
59	Abdomen (NOS)
60	Bladder - whole
61	Bladder - partial
62	Kidney
63	Ureter
64	Prostate - whole
65	Prostate - partial
66	Urethra
67	Penis
68	Testicle or scrotum
70	Ovaries or fallopian tubes
71	Uterus or cervix
72	Vagina
73	Vulva
80	Skull
81	Spine/vertebral bodies
82	Shoulder
83	Ribs
84	Hip
85	Pelvic bones
86	Pelvis (NOS, non-visceral)
88	Extremity bone, NOS
90	Skin
91	Soft tissue
92	Hemibody
93	Whole body
94	Mantle, mini-mantle (obsolete after 2017)
95	Lower extended field (obsolete after 2017)
96	Inverted Y (obsolete after 2017)
98	Other
99	Unknown

Phase N Radiation to Draining Lymph Nodes	
Value	Description
00	No radiation treatment to draining lymph nodes
01	Neck lymph node regions
02	Thoracic lymph node regions
03	Neck and thoracic lymph node regions
04	Breast/chestwall lymph node regions
05	Abdominal lymph nodes
06	Pelvic lymph nodes
07	Abdominal and pelvic lymph nodes
08	Lymph node region, NOS
88	Not applicable; Radiation Primary Treatment Volume is lymph nodes
99	Unknown if any radiation to draining lymph nodes

Phase N Modality	
Code	Label
00	No radiation treatment
01	External beam, NOS
02	External beam, photons
03	External beam, protons
04	External beam, electrons
05	External beam, neutrons
06	External beam, carbon ions
07	Brachytherapy, NOS
08	Brachytherapy, intracavitary, LDR
09	Brachytherapy, intracavitary, HDR
10	Brachytherapy, Interstitial, LDR
11	Brachytherapy, Interstitial, HDR
12	Brachytherapy, electronic
13	Radioisotopes, NOS
14	Radioisotopes, Radium-232
15	Radioisotopes, Strontium-89
16	Radioisotopes, Strontium-90
98	Treatment administered, modality unknown
99	Unknown if radiation treatment administered

Phase N Planning Technique	
Value	Description
00	No radiation treatment
01	External beam, NOS
02	Low energy x-ray/photon therapy
03	2-D therapy
04	Conformal or 3-D conformal therapy
05	Intensity modulated therapy
06	Stereotactic radiotherapy or radiosurgery, NOS
07	Stereotactic radiotherapy or radiosurgery, robotic
08	Stereotactic radiotherapy or radiosurgery, Gamma Knife?
09	CT-guided online adaptive therapy
10	MR-guided online adaptive therapy
88	Not applicable
98	Other, NOS
99	Unknown

## Appendix B – Coding Modality for the Heavy Equipment of Modern Radiation Therapy

Associating the Radiation Modality and Radiation Planning Techniques can be confusing when all you have is the name of the piece of “heavy equipment” used to deliver the treatment. We present the following table to help you find the correct codes. Many thanks to Wilson Apollo, MS, CTR, RTT, for sharing his heavy equipment research.

<b>Product</b>	<b>Modality</b>	<b>Applicable Planning Technique(s)</b>
Varian TrueBeam, Halcyon or Ethos	02	03,04,05, 06, 09
ViewRay MRIdian MR-Linac	02	10
Elekta Unity MR-Linac	02	10
Elekta VersaHD, Infinity, Synergy	02	03,04,05, 06, 09
GammaKnife	02	08
GammaPod	02	06
Cyberknife	02	07
Tomotherapy	02	05, 06, 09
VMAT, RapidArc, Hyperarc	02	05, 06
Zeiss, Xoft, Esteya	02	02
LIAC, NOVAC	04	03, 04
MammoSite, SAVI, Contura	09	88
Accubost (NIBB)	07	88

## Appendix C – Radiation Therapy Useful Abbreviations

Abbreviation	Term	Abbreviation	Term
<b>AP</b>	Anterior-Posterior	<b>LAO</b>	Left Anterior Oblique
<b>BED</b>	Biological Equivalent Dose	<b>LET</b>	Linear Energy Transfer
<b>BID</b>	Twice a day	<b>LL</b>	Left Lateral
<b>BT</b>	Brachytherapy	<b>LPO</b>	Left Posterior Oblique
<b>CAX</b>	Central Axis	<b>M-IMRT</b>	Multifield IMRT
<b>cGy</b>	Centigray, 1/100 <sup>th</sup> of a Gy	<b>MP</b>	Midplane
<b>CIRT</b>	Carbon Ion Radiation Therapy	<b>MU</b>	Monitor Unit
<b>CTV</b>	Clinical Tumor Volume	<b>OAR</b>	Organs at Risk
<b>CW</b>	Chest wall	<b>OBI</b>	On-Board Imaging
<b>DART</b>	Dynamic Adaptive Radiation Therapy	<b>ODI</b>	Optical Distance Indicator
<b>Dmax</b>	Depth of Maximum Dose	<b>OTT</b>	Overall Treatment Time
<b>DMLC</b>	Dynamic Multileaf Collimator	<b>PA</b>	Posterior-Anterior
<b>DRR</b>	Digitally Reconstructed Radiograph	<b>PRRT</b>	Peptide Receptor Radionuclide Therapy
<b>DVH</b>	Dose-Volume Histogram	<b>PSA</b>	Patient Support Assembly (treatment couch)
<b>Dx</b>	Diagnosis	<b>PTV</b>	Planning Tumor Volume
<b>EBRT</b>	External Beam Radiation Therapy	<b>R&amp;V</b>	Record and Verify
<b>e-comp</b>	Electronic compensator: describes 3D-conformal technique		
<b>EFRT</b>	Extended Field Radiation Therapy	<b>RAO</b>	Right Anterior Oblique
<b>ENLs</b>	Extranodal Lymphomas	<b>RBE</b>	Relative Biological Effect
<b>EPID</b>	Electronic Portal Imaging Device	<b>RL</b>	Right Lateral
<b>FF</b>	Filter-Flattened	<b>RPO</b>	Right Posterior Oblique
<b>FFF</b>	Flattening-Filter-Free	<b>Rx</b>	Prescription
<b>FiF</b>	Field-in-Field Technique (3D)	<b>SAD</b>	Source-to-Axis Distance
<b>Field-in Field</b>	Described 3D-conformal technique		
<b>Fx</b>	Fraction	<b>SART</b>	Stereotactic Ablative RT
<b>GTV</b>	Gross Tumor Volume	<b>SBPT</b>	Stereotactic Body Proton Therapy
<b>Gy</b>	Gray, unit of absorbed dose	<b>SBRT</b>	Stereotactic Body RT
<b>H-IMRT</b>	Hybrid IMRT	<b>SCT</b>	Stem Cell Transplant
<b>HR-CTV</b>	High-Risk Clinical Target Volume	<b>SCV (S'clav)</b>	Supraclavicular
<b>HT</b>	Helical Tomotherapy	<b>SDD</b>	Source-to-Diaphragm Distance
<b>IC-BT</b>	Intracavitary Brachytherapy	<b>SGRT</b>	Surface Guided RT

<b>IC/IS BT</b>	Intracavitary/Interstitial Brachytherapy	<b>SIB</b>	Simultaneous Integrated Boost
<b>IFD</b>	Intra-field Distance	<b>SIRMIT</b>	Single Isocenter Radiosurgery for Multiple Intracranial Targets
<b>IFRT</b>	Involved Field Radiation Therapy	<b>SMART</b>	Simultaneous Accelerated RT
<b>IGART</b>	Image-guided Adaptive RT	<b>SSD</b>	Source-to-Skin Distance
<b>IGRT</b>	Image-guided RT	<b>STD</b>	Source-to-Target Distance
<b>IMPT</b>	Intensity Modulated Proton Therapy	<b>T-IMRT</b>	Tangential IMRT
<b>INRT</b>	Involved Nodal RT	<b>T-VMAT</b>	Tangential Volumetric Modulated Arc Therapy
<b>IOERT</b>	Intraoperative Electron RT	<b>TBI</b>	Total Body Irradiation
<b>IORT</b>	Intraoperative RT	<b>TID</b>	Three times a day
<b>IS-BT</b>	Interstitial Brachytherapy	<b>TSEB</b>	Total Skin Electron Boost
<b>ISRT</b>	Involved Site RT		
<b>ITV</b>	Irradiated Tumor Volume		

## Appendix D – Summary of Coding Rules

1. **First Course of Treatment:** The first course of treatment includes all treatments recorded in the treatment plan and administered to the patient before disease progression or recurrence.
2. **Fraction:** One radiation treatment to one target volume.
3. **Target Volume:** The anatomic content being treated. For example (Case #14) primary lung tumor and adjacent regional nodes. Note that space occupied by the target volume may diminish (hopefully by shrinking) as treatment progresses, but that alone does not change the phase. However, if the anatomic content being treated changes (i.e. the field is modified to exclude some of the lymph node regions), a new phase begins.
4. **Treatment Volume:** The three-dimensional space around the target volume that is receiving therapeutic doses of radiation. A change in target volume (because of tumor shrinkage) does not by itself means a new phase.
5. **Phase:** A phase of treatment is a set of treatments delivered with a unique combination of target volume, treatment fraction size, treatment modality, and treatment technique. Phases can be delivered sequentially or simultaneously. A new phase begins when there is a change in any of these four parameters.
6. **Phase Order Rules:**
  - a. First phase first. Phases should be summarized first in chronological order.
  - b. If multiple phases start on the same date, then list the phases in order from highest 'Total Phase Dose' to lowest 'Total Phase Dose',
  - c. If multiple phases start on the same date and have the same Total Phase Dose, then any order is acceptable.
  - d. If there are more than three phases you only need to document the first three (additional phases will not be reported to NCDB) but be sure to record the actual total number of phases.
7. **Unknown Modality:** If patient had treatment but Modality details are not available code Modality to 98.
8. **When a Patient Has No Treatment:**
  - a. **Non-SEER** facilities code Phase I Volume to 00. Leave other fields blank.
  - b. **SEER** Facilities code Modality to 00. Leave other fields blank.
  - c. Code the Reason for No Radiation field. It is not required by EDITS but it might be useful to future researchers.
9. **First Untreated Phase:**
  - a. **Non-SEER** facilities code Volume to 00. Leave other fields blank.
  - b. **SEER** Facilities code Modality to 00. Leave other fields blank.
10. **Adding Doses**
  - a. If multiple phases are directed at the same target volume using an external beam modality, you can add the doses.

- b. If multiple phases are directed at the same target volume using brachytherapy you can add the doses.
- c. If treatment uses a mix of external beam and brachytherapy you cannot add doses. Code Course Total Dose to 999998.

### **11. Coding Volume when the Site of Cancer Origin has been Removed:**

- a. In most cases code the volume to the organ removed. After prostatectomy, code the volume to prostate. If the whole pelvis is treated after prostatectomy, hysterectomy or cystectomy, code the volume to the organ of organ and lymph nodes to pelvic.
- b. Exception: If the vaginal apex is treated with brachytherapy after hysterectomy for cervical or uterine cancer, code the volume to 71 – Vagina because that is the target organ for treatment.

### **12. When Treatment is Interrupted**

- a. Treatment may be interrupted as part of a plan, or because of unplanned circumstances.
- b. For treatment dates code the first date of the first treatment to the volume and the last date of treatment given after the interruption.

### **13. Avoid Isotope Confusion**

- a. With the exception of electronic brachy therapy (Modality Code 12), most brachytherapy (codes 07-11) is delivered with radioactive isotopes. Generally, this is in the form of seeds or rods of radioactive metal, radium and cobalt historically, cesium and iridium today, that are inserted in to tissue (interstitial) or body cavities (intracavitary).
- b. Codes 13 to 16 are modalities specifically described as radioisotopes but not as brachytherapy. Most commonly these are available in liquid form and inserted into the blood stream or a body cavity.
- c. A common coding mistake is to use modality code 13 – Radioisotopes, NOS, when the record shows, for example, intracavitary treatment to the vagina, cervix, uterine canal, or some combination. Yes, radioisotopes were used but no, that is not the correct code. You should use a brachytherapy code, high dose rate (HDR) if the isotope is iridium, low dose rate if it is cesium or iodine.
- d. Eye plaque brachytherapy is a form of surface brachytherapy and should be coded Brachytherapy, NOS (Modality Code 07).