**ANNOTATION GUIDELINES**

**UMLS Entity: RadiOTHERAPY**

**\*\*\* CONFIDENTIAL AND PRIVILIGED \*\*\***

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# General guidelines

The annotation guidelines are created for the purpose of parsing clinical text to extract radiotherapy information. The annotation guideline was created to align with [NAACCR v18](http://datadictionary.naaccr.org/?c=10) (revised 9/4/2019) and the [ASTRO consensus minimum data elements](https://www.practicalradonc.org/article/S1879-8500(19)30232-2/fulltext) (Hayman et al., *PRO* 2019) wherever possible. When NAACCR and ASTRO entities conflicted, priority was given to NAACCR entities.

* Annotate only what is in the text. Do not apply inferencing.
* If a span is required, span the minimal amount of text that signals the information. Do not span entire sentences or most of the sentence.

The annotation tool we are using is Anafora, available open source at <https://github.com/weitechen/anafora>.

Please note that in-text cross-reference hyperlinks are included throughout.

The scope of this project is the annotation of external beam radiotherapy and brachytherapy treatments. External beam radiotherapy is the delivery of directly or indirectly ionizing radiation to a patient via an external source, such as a linear accelerator or cyclotron. Currently, this is the most common form of radiotherapy. Brachytherapy is the use of radioactive isotopes (also known as radioactive sources) to deliver radiation therapy by either 1) temporarily or permanently implanting the radioactive source within a treatment site, or 2) temporarily or permanently placing the radioactive source within a body cavity where it is very close to the treatment site, such as a vessel, biliary tract, vagina, esophagus, or tracheobronchial tree. Radiopharmaceuticals, which are unsealed radioisotopes that are delivered orally or intravenously for diagnostic or therapeutic purposes, are outside the scope of this project and should not be annotated using these guidelines. Examples of radiopharmaceutals are iodine-123 (used for imaging), iodine-131 (used to treat thyroid cancer (radioiodine ablation) and neuroendocrine cancers when used in MIBG), strontium-89 (Metastron, used to treat bone metastases), technetium-99m (used for a wide range of imaging), lutetium-177 dotatate (Lutathera, used to treat gastroenteropancreatic neuroendocrine cancers), radium-223 (Xofigo, used to treat prostate cancer bone metastases), and samarium-153 lexidronam (Quadramet, used to treat bone metastases). These radiopharmaceuticals are generally similarly to traditional medications, with a dose (in radiation dose/mass), frequency, and route. Of note, some intracavitary brachytherapy radioisotopes are unsealed, such as yttrium-90, however this falls within the scope of this project as it is delivered as intracavitary brachytherapy and described similarly to other brachytherapy treatments.

**Of note, all examples are either entirely fabricated clinical text, or taken from** [**HemOnc.org**](https://hemonc.org/wiki/Main_Page)**, a publicly available website. No personal health information is included.**

# Radiotherapy Span

Each radiotherapy annotation is anchored on a span, i.e. the text that refers to radiotherapy. A radiation treatment is delivered in one or more phases, which are often referred to as “courses”, “boosts”, or “conedowns” (abbreviated as “CD”). If there is more than 1 phase, each phase results in a different total dose for a general treatment area. Each radiotherapy instance refers to an individual phase *or* the total\_course (documentation that summarizes the total treatment, summing over all the phases, see examples below and section 4.15). Span the shortest possible span that encompasses the radiotherapy details for the particular radiotherapy instance. Phrases such as “then”, “second course”, “third course”, “and then a”, and “followed by” should be included in the span because they signal temporality. If the radiotherapy instance is a total course (section 4.15), only annotate the span and properties that *are not* included within the component phase instances of the total treatment.

Sometimes, more than one site receives radiotherapy in a single course. When the treatment to the sites are described in the same phrase(s), often with a shared radiotherapy dose, span them together. When there are separate phrases to describe the treatment to each site, span them separately

*Example 1*: In this example, separate annotations would be made for the first course (olive text) and second course (purple text).

*Document:*

“45 Gy in 1.8 Gy fractions to the initial tumor volume; additional treatment up to a total of 55.8 Gy was administered to original bony tumors and the postinduction chemotherapy soft tissue volumes plus a 2 cm margin”

*Example 1a:* Radiotherapy span (in yellow) for first radiotherapy instance:

“45 Gy in 1.8 Gy fractions to the initial tumor volume; additional treatment up to a total of 55.8 Gy was administered to original bony tumors and the postinduction chemotherapy soft tissue volumes plus a 2 cm margin”

*Example 1b:* Radiotherapy span (in yellow) for second radiotherapy instance:

““45 Gy in 1.8 Gy fractions to the initial tumor volume; additional treatment up to a total of 55.8 Gy was administered to original bony tumors and the postinduction chemotherapy soft tissue volumes plus a 2 cm margin”

# Properties: Radiotherapy

* 1. treatment\_site

Create an Anatomical\_site instance under UMLS entity, fill in the treatment\_site attribute with the relevant Anatomical\_site instance, and link to Treatment\_site. This is the anatomical site receiving radiotherapy. If site is specified more than once, annotate the span that is spatially closest to the radiation dose and fraction details. This may be a true anatomical site (generally the case for external beam radiotherapy), or a point, distance, volume, or other span (generally the case for brachytherapy). If treatment\_site is a relative anatomic site (e.g., “tumor”, “high risk region”, “surgical bed”, “cavity”, “tumor bed”, “Point A”, “5mm depth”, “PTV”, “planning tumor volume”, “CTV”, “clinical tumor volume”, “GTV”, “gross tumor volume”, “boost”, “cone-down”, “CD”, “2cm margin”, “margin”), then annotate *both* the relative anatomical site and the immediate antecedent true anatomical site, if present, even if it falls outside the Radiotherapy Span for that instance. Of note, if the relative anatomic site is the same span as the for the boost annotation, then this span will be annotated twice (for both treatment\_site and for boost). If multiple true and/or relative treatment sites are listed for a single radiotherapy instance, create an Anatomical\_site instance for each, and link each to Treatment\_site. If the radiotherapy instance is a subsequent phase/ boost course (see below) and the treatment site is not explicitly stated, then link to the phase 1 Anatomical\_site instance. Do not include adjectives such as “adjacent”, “nearby”, or “surrounding”, “initial”, “residual” in the treatment\_site span, *except* when the site is uninterpretable without the adjective such as “involved fields”, “secondary volume”. If there are defined abbreviations (e.g., “planning tumor volume (PTV)” or more than one name for the same site, span both and include as separate treatment sites.

*Example 1:* Point A is a site within the pelvis. It is included in the DeepPhe ontology. A similar anatomic site, Point B, is also within the pelvis and is included in the DeepPhe ontology.

“40 Gy to point A given in 1 to 2 fractions”

*Example 2:* Two anatomical\_sites are included here: both a relative and a true anatomical site are included. Create seperate Anatomical\_site entities for both, and link both to treatment\_site.

“Vaginal cylinder HDR brachytherapy to a dose of 21 Gy in 3 weekly fractions prescribed at 5 mm depth to the vagina.”

*Example 3:*

*Document:*

“The patient was treated with external beam radiotherapy to 45 Gy in 25 fractions to the pelvis, with a dose-painted simultaneous integrated boost to 54 Gy.”

*Example 3a:* This example shows the treatment\_site annotation if annotating the first radiotherapy instance:

“The patient was treated with external beam radiotherapy to 45 Gy in 25 fractions to the pelvis, with a dose-painted simultaneous integrated boost to 54 Gy.”

*Example 3b:* This example shows the treatment\_site annotation if annotating the second phase (boost) instance. Because the treatment site for the second phase is a relative anatomic site, both the relative anatomic site (in blue) and the immediate antecedent true Anatomic\_Site from the first radiotherapy instance (in yellow) is annotated. NB: “boost” would be annotated twice for this radiotherapy instance – for treatment\_site and for boost.

“The patient was treated with external beam radiotherapy to 45 Gy in 25 fractions to the pelvis, with a dose-painted simultaneous integrated boost to 54 Gy.”

*Example 4*: Annotate all relative (“boost”, “tumor bed”, “2 cm margin”) and true (“right breast” anatomic sites separately, and link all to the treatment\_site. Of note, “boost” will be annotated twice (for both treatment\_site and for boost).

“10 Gy boost to the right breast tumor bed and a 2 cm margin”

*Example 5*: In this case, “bladder” is a critical adjective for “tumor”, and so annotate both in a single span (yellow) and link to treatment\_site.

*“*66 Gy to the bladder tumor”

*Example 6:* Annotate both the full name of the site and the abbreviation separately, and link both the treatment\_site.

*“*30 Gy to the planning tumor volume (PTV-1)”

* 1. start\_date

Start\_date is the start date of the radiotherapy instance. Create RT\_Date under Attributes\_radiotherapy and fill in with relevant details. Fill in start\_date with the relevant RT\_Date. If there are multiple phases within a treatment, the start\_date should refer to the start date of the specific instance being annotated, not the first date of the overall treatment. Future planned dates should be annotated.

* 1. end\_date

End\_date is the end date of the radiotherapy instance. Create RT\_Date under Attributes\_radiotherapy and fill in with relevant details. Fill in end\_date with the relevant RT\_Date. If there are multiple phases within a treatment, the end\_date should refer to the end date of the specific instance being annotated, not the overall treatment. Future planned dates should be annotated.

* 1. Planned\_RT\_Total\_Dose

Planned\_RT\_Total\_Dose is the planned total radiation dose delivered during the radiotherapy instance. Sometimes, the planned and delivered doses are not the same, for example if treatment is stopped early. Sometimes, a radiation course is described before treatment is started, and so this is also planned.  **If it is not explicitly stated whether the dose is planned or delivered, it can be assumed to be delivered dose.** Common ranges are 8-80 Gy (800-8000 cGy). Create an RT\_Dosage instance under Attributes\_radiotherapy (see section 5.2) and link to Planned\_RT\_Total\_Dose. For individual phases (see section 3 and 4.13), annotate only if the planned total dose refers to the dose planned for the treatment site during that phase. For a total course (see section 3 and 4.15), annotate only the total cumulative planned dose for the total treatment, if stated.

*Example 1:* There is no explicit statement whether dose is planned or delivered, and so it is assumed to be the delivered dose. Planned dose is not included in this document, and so it is not annotated. **This is the more common way to convey radiotherapy details.**

“2 Gy fractions x 25 fractions, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

*Example 2:* When dose is described as a fraction, e.g. X Gy/Y Gy, it means that X Gy were delivers of a planned Y Gy. Here, the yellow shows the Planned\_RT\_Total\_Dose, and the blue shows the Delivered\_RT\_Total\_Dose.

“He received 20 Gy/30 Gy to the right femur”

* 1. Delivered\_RT\_Total\_Dose

RT\_Total\_Dose is the total radiation dose delivered during the radiotherapy instance. Common ranges are 8-80 Gy (800-8000 cGy). **If it is not explicitly stated whether the dose is planned or delivered, it can be assumed to be delivered dose.** Create an RT\_Dosage instance under Attributes\_radiotherapy (see section 5.2) and link to Delivered\_RT\_Total\_Dose. For individual phases (see section 3 and 4.13), annotate only if the total dose refers to the dose delivered to the treatment site during that phase. For a total course (see section 3 and 4.15), annotate only to total cumulative dose delivered during the total treatment, if stated. The below examples show the total RT dose for the radiotherapy instance being annotated.

*Example 1:*

“The patient received 18 Gy in 10 fractions.”

*Example 2:*

“2 Gy fractions x 25 fractions, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

*Example 3:*

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17 (total induction dose: 24 Gy), administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

*Example 4:* This is read as “60 Gy in 30 fractions” or “60 Gy divided by 30 fractions”, and so the total dose if 60 Gy. The dose per fraction would have to be inferred as 2 Gy per fraction (60/30 = 2).

“60 Gy/30 fractions”

*Example 5:* A total of 60 Gy is delivered in fractions of 2 Gy. The number of fractions would have to be inferred as 30 fractions.

“60 Gy in 2 Gy per fraction”

*Example 6:*  RT\_Total\_Dose is not annotated because the total dose is not given. This notation means that 10 fractions, each fraction of dose 3 Gy were given. The total dose would have to be inferred as 30 Gy (3 x 10 = 30 Gy).

“3 Gy x 10 fractions to the whole brain”

*Example 7:*

“30 Gy to point A given in 5 fractions, starting week 4 of XRT”

*Example 8:* RT\_Total\_Dose is not annotated because the total dose is not given. It would have to be inferred from the dose per fraction (3 Gy) and the number of fractions (8 fractions).

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17, administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

*Example 9:*

“40 Gy in daily fractions of 1.80 to 2.00 Gy”

*Example 10:*

Document:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10a.* This example shows the RT\_Total\_Dose if annotating the first radiotherapy instance. Note that “(4300 rads)” is not included in the span because it is redundant and secondary to “4300 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10b.* This example shows the RT\_Total\_Dose if annotating the second (boost) radiotherapy instance. Note that “(1720 rads)” is not included in the span because it is redundant and secondary to “1720 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10c.* This example shows the RT\_Total\_Dose if annotating the third (cumulative) radiotherapy instance. Note that “(6020 rads)” is not included in the span because it is redundant and secondary to “6020 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 11.* Total body irradiation treatments are sometimes presented this way. Since a single dose of 2 Gy was given on one day (“day 0” refers to a date in relation to stem cell transplant), 2 Gy is both the total dose and the dose per fraction.

“2 Gy at a rate of 0.07 Gy/min on day 0.”

*Example 12.* In this example, the total treatment was given in two phases, but with an overlapping timeline because it is a *simultaneous* boost (AKA dose-painted boost), which means that a higher dose per fraction is given to a smaller area, while a larger area is given a lower dose per fraction. Here, the pancreas received 50.4 Gy in 28 fractions (1.8 Gy per fraction), while areas within the pancreas at highest risk of tumor recurrence (“high-risk-regions), received 59.4 Gy in 28 fractions (2.12 Gy per fraction) *at the same time*. In this example, the dose per fraction is not explicitly stated.

Document:

“The patient received 50.4 Gy in 28 fractions to the pancreas, with a simultaneous integrated boost to 59.4 in 28 fractions to the high-risk regions from 12/1/2019-1/9/2020.”

*Example 12a*. This is the RT\_Total\_Dose annotation for the first phase (to the pancreas):

“The patient received 50.4 Gy in 28 fractions to the pancreas, with a simultaneous integrated boost to 59.4 in 28 fractions to the high-risk regions from 12/1/2019-1/9/2020.”

Example 12b. This is the RT\_Total\_Dose annotation for the second phase (to the high risk regions):

“The patient received 50.4 Gy in 28 fractions to the pancreas, with a simultaneous integrated boost to 59.4 Gy in 28 fractions to the high-risk regions from 12/1/2019-1/9/2020.”

*Example 13:* When dose is described as a fraction, e.g. X Gy/Y Gy, it means that X Gy were delivers of a planned Y Gy. Here, the yellow shows the Delivered\_RT\_Total\_Dose, and the blue shows the Planned\_RT\_Total\_Dose.

“He received 20 Gy/30 Gy to the left humerus”

* 1. RT\_Dose\_Per\_Fx

RT\_Dose\_Per\_Fx is the radiation dose per fraction of radiation. Common ranges are 1.2-3 Gy (150-300 cGy) for conventional radiotherapy, and up to 34 Gy (3400 cGy) for radiosurgery. Create an RT\_Dosage instance under Attributes\_radiotherapy (see section 5.2) and link to RT\_Dose\_Per\_Fx. For individual phases (see section 3 and 4.13), annotate only if the total dose refers to the dose delivered to the treatment site during that phase. For a total course (see section 3 and 4.15), annotate only to total cumulative dose given during the total treatment, if stated. The below examples show the RT dose per fraction for the radiotherapy instance being annotated.

*Example 1:* No RT\_Dose\_Per\_Fx because not explicitly stated.

“The patient received 18 Gy in 10 fractions.”

*Example 2:*

“2 Gy fractions x 25 fractions, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

*Example 3:*

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17 (total induction dose: 24 Gy), administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

*Example 4:* No RT\_Dose\_Per\_Fx because not explicitly stated. The dose per fraction would have to be inferred as 2 Gy per fraction (60/30 = 2).

“60 Gy/30 fractions”

*Example 5:* This means that a total of 60 Gy is delivered in fractions of 2 Gy. The number of fractions would have to be inferred as 30 fractions.

“60 Gy in 2 Gy per fraction”

*Example 6:*  This notation means that 10 fractions, each fraction of dose 3 Gy were given. The total dose would have to be inferred as 30 Gy (3 x 10 = 30 Gy).

“3 Gy x 10 fractions to the whole brain”

*Example 7:* No RT\_Dose\_Per\_Fx because not explicitly stated. The dose per fraction would have to be inferred as 6 Gy per fraction (30/5 = 6).

“30 Gy to point A given in 5 fractions, starting week 4 of XRT”

*Example 8:*

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17, administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

*Example 9:*

“40 Gy in daily fractions of 1.80 to 2.00 Gy”

*Example 10:*

Document:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10a.* This example shows the RT\_Dose\_Per\_Fx span if annotating the first radiotherapy instance. Note that “(172 rads)” is not included in the span because it is redundant and secondary to “172 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10b.* This example shows the RT\_Dose\_Per\_Fx span if annotating the second (boost) radiotherapy instance. Note that “(172 rads)” is not included in the span because it is redundant and secondary to “172 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10c.* If annotating the third (total) radiotherapy instance in this document, RT\_Dose\_Per\_Fx is not annotated because it is not explicitly stated.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 11.* Total body irradiation treatments are sometimes presented this way. Since a single dose of 2 Gy was given on one day (“day 0” refers to a day in relation to the date of stem cell transplant), 2 Gy is both the total dose and the dose per fraction.

“2 Gy at a rate of 0.07 Gy/min on day 0.”

*Example 12:* “1.8 Gy daily”

Example 13: “2 Gy/day”

Example 15: “1.5 Gy BID”

* 1. Planned\_RT\_Dose\_Per\_Fx

Planned\_RT\_Fx\_Number is the number of planned radiation fractions. Sometimes, the planned and delivered fraction number are not the same, for example if treatment is stopped early. Sometimes, a radiation course is described before treatment is started, and so this is also planned. **If planned or delivered is not explicitly stated, assume the number of fraction is delivered.** Create RT\_Fraction\_Number under Attributes\_radiotherapy and fill in with relevant details. Fill in RT\_Fraction\_Number with Planned\_RT\_Fx\_Number.

*Example 1:* There is no explicit statement whether fraction number is planned or delivered, and so it is assumed to be delivered. Planned fraction number is not included in this document, and so it is not annotated. **This is the more common way to convey radiotherapy details.**

“2 Gy fractions x 25 fractions, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

*Example 2:* When fractions are described as a fraction, e.g. X/Y, it means that X fractions were delivered of a planned Y fractions. Here, the yellow shows the Planned\_RT\_Fx\_Number, and the blue shows the Delivered\_RT\_Fx\_Number.

“He received 10/15 fractions to the right humerus”

* 1. Delivered\_RT\_Fx\_Number

Delivered\_RT\_Fx\_Number is the number of delivered radiation fractions. **If planned or delivered is not explicitly stated, assume the number of fraction is delivered.** Create RT\_Fraction\_Number under Attributes\_radiotherapy and fill in with relevant details. Fill in RT\_Fraction\_Number with Delivered\_RT\_Fx\_Number. The following symbol should be included in the span, if presenet: ~ , - , > , < , ≥ , and ≤.

*Example 1:*

Document:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 1a.* This example shows the RT\_Fx\_Number span if annotating the first radiotherapy instance:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 1b.* This example shows the RT\_Fx\_Number if annotating the second (boost) radiotherapy instance:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 1c.* RT\_Fx\_Number is left blank if annotating the third (total) radiotherapy instance, because it is not explicitly stated.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 3:*

“2 Gy fractions x 25, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

*Example 4.* Total body irradiation treatments are sometimes presented this way. A single dose of 2 Gy was given on one day (“day 0” refers to a date in relation to stem cell transplant). Although it can be inferences that only 1 fraction was given, the should not be annotated as it is not explicitly stated.

“2 Gy at a rate of 0.07 Gy/min on day 0.”

*Example 5:* When fractions are described as a fraction, e.g. X/Y, it means that X fractions were delivered of a planned Y fractions. Here, the yellow shows the Planned\_RT\_Fx\_Number, and the blue shows the Delivered\_RT\_Fx\_Number.

“He received 10/15 fractions to the right femur”

* 1. radiation\_technique

Radiation\_technique is the delivery technique/procedure. Create RT\_Technique under Attributes\_radiotherapy and fill in with relevant details. Fill in radiation\_technique with RT\_Technique. Do not infer technique; only annotate if the technique is explicitly stated. See examples under section 5.5 RT\_Technique.

* 1. radiation\_frequency

Radiation\_frequency is the frequency of radiation fraction delivery. Create FractionFrequency under Attributes\_radiotherapy and fill in with relevant details. Fill radiation\_frequency with FractionFrequency. See examples in section 5.4 FractionFrequency.

* 1. modality

Modality is the radiation modality used for the instance of radiotherapy. Create RT\_Modality under Attributes\_radiotherapy and fill in with relevant details. Fill in modality with RT\_Modality. See examples under section 5.6 RT\_Modality.

* 1. radiation\_energy

Radiation\_energy is the energy of the radiation beam. Create RT\_Energy under Attributes\_radiotherapy and fill in with relevant details. Fill radiation\_energy with RT\_Energy. See examples under section 5.7 RT\_Energy.

* 1. phase\_number

Radiotherapy treatments are generally given in 1-3+ phases, where each phase treats a different, often overlapping, site to a different dose level. Phase\_number is the number of the course, in order from least to most additional dose. First phase = 1, second phase = 2, etc. Phase 1 may be referred to as a “first course/plan”, or “initial course/plan”. Subsequent phases are often referred to as “cone-down”, “boost”, or “dose-painted” course. If there is only one phase, phase = 1. Do not complete for a total course radiotherapy instance (see section 3 and 4.15).

Example 1.This example shows the phase\_number annotation for the second radiotherapy instance (the boost course). In this example, the total treatment was given in two phases, but with an overlapping timeline because it is a *simultaneous* boost (AKA dose-painted boost), which means that a higher dose per fraction is given to a smaller area, while a larger area is given a lower dose per fraction. Here, the pancreas received 50.4 Gy in 28 fractions (1.8 Gy per fraction), while areas within the pancreas at highest risk of tumor recurrence (“high-risk-regions), received 59.4 Gy in 28 fractions (2.12 Gy per fraction) *at the same time*. Although the second phase is delivered simultaneous to the first course, it is still annotated as the second phase because it goes to a higher dose.

“The patient received 50.4 Gy in 28 fractions to the pancreas, with a simultaneous integrated boost to 59.4 in 28 fractions to the high-risk regions from 12/1/2019-1/9/2020.”

Phase\_number = 2

* 1. boost

Radiotherapy treatments are generally given in 1-3+ phases, where each phase treats a different, often overlapping, site to a different dose. A boost refers to a specific type of phase within an overall treatment which has a smaller treatment volume than the first phase, and so the smaller volume goes to a higher dose. Generally, areas that receive a boost are areas at highest risk of tumor recurrence (e.g. the surgical cavity where the tumor was removed from, an area where there was a positive margin after surgery, or gross tumor). The boost treatment\_site is always within the phase 1 treatment\_site. Boosts can be either sequential (follow the first course sequentially), or simultaneous (higher dose per fraction delivered to a boost volume within a larger treatment area that is getting a smaller dose per fraction). Boosts are also known as “cone-downs”, “field-in-field”, “dose-painting”, “SIB”, or “dose painting”. The boost property indicates whether the phase being annotated is explicitly referred to as a boost course. Create Boost\_span under Attributes\_radiotherapy and fill in with relevant details. Fill boost with Boost\_span. Although most radiotherapy instances with phase\_number > 1 will be boost courses, only annotate this property if the instance being annotated explicitly refers to a boost. See examples under section 5.8 Boost.

* 1. total\_course

Total\_course indicates whether the radiotherapy instance refers to the cumulative treatment. Only choose yes if it is explicitly referred to as the total treatment or cumulative treatment. The default for total\_course is set to “no”. As discussed in section 3, if the radiotherapy instance it a total course, only annotate the span and properties that *are not* included within the sub-courses of the total treatment.

*Example 1:* If annotating the first instance, total\_course is not annotated (default = no). If annotating the second (boost) instance, total\_course is not annotated (default = no). If annotating the this instance, total course = yes because it explicitly states that the instance refers to cumulative treatment.

“172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 2:* In this example, total\_course is not annotated (default = no) because there is no explicit mention that this instance refers to cumulative or total treatment.

“She was treated to 60 Gy in 30 fractions from 7/1/2019-8/10/2019.

* 1. component\_phases

Component\_phases indicates radiotherapy instances that are summarized by a total course radiotherapy instance. Fill in component\_phases with every radiotherapy instance that is a component of the total course radiotherapy instance being annotated. This field should be left blank if total\_course= “no”. Default value = “no”.

* 1. table

Whether the radiotherapy details are present in a table (yes or no). This is for tracking and future table parsing efforts. This should be annotated for every radiotherapy instance. The default value for table is “no”.

* 1. difficulty

Subjective level of difficulty of annotation (low, medium, or high). Missing data that do not contribute to incomprehensibility should not raise the level of difficulty. This should be annotated for every radiotherapy instance. We assume the default is low, so if it is low difficulty do not annotate anything. Annotate only medium and high.

* 1. isotope

Isotope is the isotope used during brachytherapy. This property should only be annotated if it is a brachytherapy treatment. Create Brachy \_Isotope under Attributes\_radiotherapy and fill in with relevant details. Fill isotope with Brachy\_Isotope. See examples under section 5.9 Brachy\_Isotope.

# Radiotherapy-related attributes (under Attributes\_radiotherapy)

* 1. RT\_Date

Normalized date associated with radiation instance being annotated. If there are multiple courses within a treatment, the date should refer to the specific course being annotated, not the overall treatment course. Future planned dated should be annotated. See examples in start\_date and end\_date above.

Normalize the date to a two digit date, month to a two digit month, the year to a four-digit year, in order to conform with ISO standards..

*Example:*

“Left lung 3DCRT from February 20, 2020 to March 19, 2020”

There are two dates in this example.

Radiation\_Date span: “March 19, 2020”

Radiation\_Date\_day: 19 (this is the normalized value)

Radiation\_Date\_month: 03 (this is the normalized value)

Radiation\_Date\_year: 2020 (this is the normalized value)

* 1. RT\_Dosage

RT\_Dosage is the normalized radiation dose for the radiotherapy instance.

* Radiation\_Dose\_Number is the dose, excluding non-significant figures (e.g. trailing zeros). Use “-“ instead of “to” if a range is stated (e.g. 30-40 instead of 30 to 40).
  + Example: “50.4” in “50.4 Gy”
  + Example: “3000” in “3000 cGy”
* Radiation\_Dose\_Unit is the unit of radiation as stated in the text. Do not convert units.
  + Example: “Gy” in “50.4 Gy”
  + Example: “cGy” in “3000 cGy”

*Example 1:* This RT\_Dosage is the total RT dose. The dose per fraction is not explicitly stated, and so there is not RT\_Dosage annotation for the dose per fraction.

“The patient received 18 Gy in 10 fractions.”

RT\_Dosage span: “18 Gy”

Radiation\_Dose\_Number: 18

Radiation\_Dose\_Unit: Gy

*Example 2:* Link 2 separate RT\_Dosage annotations in the radiotherapy entity. RT\_Dosage attribute in blue is the RT dose per fraction; the RT\_Dosage attribute in yellow is the total RT dose.

“2 Gy fractions x 25 fractions, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

* RT\_Dosage instance 1 (blue, for dose per fraction):
  + RT\_Dosage span: “2 Gy”
  + Radiation\_Dose\_Number: 2
  + Radiation\_Dose\_Unit: Gy
* RT\_Dosage instance 2 (yellow, for total RT dose):
  + RT\_Dosage span: “50 Gy”
  + Radiation\_Dose\_Number: 50
  + Radiation\_Dose\_Unit: Gy

*Example 3:* Link 2 separate RT\_Dosage annotations in the radiotherapy entity. The RT\_Dosage attribute in blue is the RT dose per fraction for this radiotherapy instance; the RT\_Dosage attribute in yellow is the total RT dose for this radiotherapy instance.

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17 (total induction dose: 24 Gy), administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

* RT\_Dosage instance 1 (blue, for dose per fraction):
  + RT\_Dosage span: “3 Gy”
  + Radiation\_Dose\_Number: 3
  + Radiation\_Dose\_Unit: Gy
* RT\_Dosage instance 2 (yellow, for total RT dose):
  + RT\_Dosage span: “50 Gy”
  + Radiation\_Dose\_Number: 50
  + Radiation\_Dose\_Unit: Gy

*Example 4:* This is read as “60 Gy in 30 fractions” or “60 Gy divided by 30 fractions”, and so the total dose if 60 Gy. The dose per fraction would have to be inferred as 2 Gy per fraction (60/30 = 2), and so there is no RT\_Dosage annotation for dose per fraction.

“60 Gy/30 fractions”

RT\_Dosage span: “60 Gy”

Radiation\_Dose\_Number: 60

Radiation\_Dose\_Unit: Gy

*Example 5:* This notation means that total of 60 Gy is delivered in fractions of 2 Gy. The number of fractions would have to be inferred as 30 fractions, and so there is no RT\_Dosage annotation for dose per fraction.

“60 Gy in 2 Gy per fraction”

RT\_Dosage span: “60 Gy”

Radiation\_Dose\_Number: 60

Radiation\_Dose\_Unit: Gy

*Example 6:*  This notation means that 10 fractions, each fraction of dose 3 Gy were given. The total dose would have to be inferred as 30 Gy (3 x 10 = 30 Gy), and so there is no RT\_Dosage annotation for total dose.

“3 Gy x 10 fractions to the whole brain”

RT\_Dosage span: “3 Gy”

Radiation\_Dose\_Number: 3

Radiation\_Dose\_Unit: Gy

*Example 7:* In this document, only the total dose is given. The dose per fraction would have to be inferred as 6 Gy (30/5 = 6), and so there is not RT\_Dosage annotation for dose per fraction.

“30 Gy to point A given in 5 fractions, starting week 4 of XRT”

RT\_Dosage span: “30 Gy”

Radiation\_Dose\_Number: 30

Radiation\_Dose\_Unit: Gy

*Example 8:* In this document, only the RT dose per fraction is given. The total RT dose would have to be inferred from the dose per fraction (3 Gy) and the number of fractions (8 fractions), and so there is no RT\_Dosage annotation for total dose.

“3 Gy fractions twice per day, with the first fraction of each day given 1 to 2 hours after completion of chemotherapy and at least 4 hours between fractions, x 8 fractions, given on days 1, 3, 15, 17, administered to the whole bladder, bladder tumor volume, and pelvic lymph nodes.”

RT\_Dosage span: “3 Gy”

Radiation\_Dose\_Number: 3

Radiation\_Dose\_Unit: Gy

*Example 9:* Link 2 separate RT\_Dosage annotations in the radiotherapy entity. The RT\_Dosage attribute in blue is the RT dose per fraction for this radiotherapy instance; the RT\_Dosage attribute in yellow is the total RT dose for this radiotherapy instance.

“40 Gy in daily fractions of 1.80 to 2.00 Gy”

* RT\_Dosage instance 1 (blue, for dose per fraction):
  + RT\_Dosage span: “1.800 to 2.00 Gy”
  + Radiation\_Dose\_Number: 1.8-2 (note that only significant figures are included)
  + Radiation\_Dose\_Unit: Gy
* RT\_Dosage instance 2 (yellow, for total RT dose):
  + RT\_Dosage span: “40 Gy”
  + Radiation\_Dose\_Number: 40
  + Radiation\_Dose\_Unit: Gy

*Example 10:*

Document:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10a.* This example shows the RT\_Dosage if annotating the first radiotherapy instance. Link 2 separate RT\_Doage annotations in the radiotherapy entity. The RT\_Dosage attribute in blue is the RT dose per fraction for this radiotherapy instance; the RT\_Dosage attribute in yellow is the total RT dose for this radiotherapy instance. Note that “(rads)” and “(4300 rads)” are not included in the RT\_Dosage spans because it is redundant and secondary to “4300 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10b.* This example shows the RT\_Dosage if annotating the second radiotherapy instance. Link 2 separate RT\_Dosage annotations in the radiotherapy entity. The RT\_Dosage attribute in blue is the RT dose per fraction for this radiotherapy instance; the RT\_Dosage attribute in yellow is the total RT dose for this radiotherapy instance. Note that “(rads)” is not included in either RT\_Dosage span because it is redundant.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 10c.* This example shows the RT\_Dosage if annotating the third (cumulative) radiotherapy instance. Dose per fraction is not explicitly stated, and so there is no RT\_Dosage span for this. Note that “(6020 rads)” is not included in the span because it is redundant and secondary to “6020 cGy”.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 11.* Total body irradiation treatments are sometimes presented this way. Since a single dose of 2 Gy was given on one day (“day 0” refers to a date in relation to stem cell transplant), 2 Gy is both the total dose and the dose per fraction. Link the below RT\_Dosage attribute to both RT\_Total\_Dose and RT\_Dose\_Per\_Fraction.

“2 Gy at a rate of 0.07 Gy/min on day 0.”

Radiation\_dosage span: “2 Gy”

Radiation\_Dose\_Number: 2

Radiation\_Dose\_Unit: Gy

* 1. RT\_Fraction\_Number

RT\_Fraction\_Number is the number of RT fractions. Annotate the most concise span that conveys the number of fractions. If the text states “fraction #X”, it means there has been X fractions of radiotherapy. Do not include if not explicitly stated. If fraction number is presented as X/X (e.g. 33/33 fractions which means 33 out of 33 planned fraction have been delivered), annotate both separately.

* Radiation\_Fraction\_Number: Enter the number of radiation fractions.

*Example 1:*

Document:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

*Example 1a.* This example shows the RT\_Fraction\_Number span if annotating the first radiotherapy instance:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

RT\_Fraction\_Number span: “25”

Radiation\_Fraction\_Number: 25

*Example 1b.* This example shows the RT\_Fraction\_Number if annotating the second radiotherapy instance:

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

RT\_Fraction\_Number span: “10”

Radiation\_Fraction\_Number: 10

*Example 1c.* RT\_Fraction\_Number is left blank if annotating the third radiotherapy instance, because it is not explicitly stated.

“Radiation therapy summary: 172 cGy (rads) fractions x 25 fractions, given over 5 weeks for a total dose of 4300 cGy (4300 rads), then coned-down boost of 172 cGy (rads) fractions x 10 fractions, given over 2 weeks for a dose of 1720 cGy (rads), and a total cumulative dose of 6020 cGy (rads)”

Radiation\_Fraction\_Number:

*Example 2:* RT\_Fraction\_Number is left blank, because it is not explicitly stated. It would have to be inferred from the total dose, and the dose per fraction.

“40 Gy in daily fractions of 1.80 to 2.00 Gy”

Radiation\_Fraction\_Number:

*Example 3:*

“2 Gy fractions x 25, for a total dose of 50 Gy, to start within 4 hours after the first dose of chemotherapy.”

RT\_Fraction\_Number span: “25”

Radiation\_Fraction\_Number: 25

*Example 4.* Total body irradiation treatments are sometimes presented this way. A single dose of 2 Gy was given on one day (“day 0” refers to a date in relation to stem cell transplant). However, since fraction number is not explicitly stated and requires inferencing, it should not be annotated in this case.

“2 Gy at a rate of 0.07 Gy/min on day 0.”

RT\_Fraction\_Number span:

Radiation\_Fraction\_Number:

*Example 5:* Although this is likely the 5th fraction, this assumes once a day frequency and the fraction number is not explicitly stated, so should not be annotated in this case.

“Today was day 5 of radiation, she has received 10 Gy thus far.”

RT\_Fraction\_Number span:

Radiation\_Fraction\_Number:

*Example 6:* In this example, fraction number is explicitly stated and so should be annotated in this case.

“Today was fraction 5 of radiation, she has received 10 Gy thus far.”

RT\_Fraction\_Number span: “5”

Radiation\_Fraction\_Number: 5

* 1. FractionFrequency

The radiation fraction frequency. Do not infer frequency; only annotate if explicitly stated. Do not annotate durations such as “over 5 weeks” as frequency.

* Fraction\_frequency\_values is the frequency (choose from a list of 5 times per week, daily, twice daily, three times daily, every other day, once weekly, twice weekly, 3 times per week, other)

*Example 1:*

“2 Gy fractions (total dose: 58 to 66 Gy), given 5 days per week”

FractionFequency span: “5 times per week”

Fraction\_frequency\_values = 5 days per week

*Example 2:* Do not inference frequency from duration.

“172 cGy (rads) fractions x 35 fractions, given over 7 weeks for a total dose of 6020 cGy (6020 rads/~1700 rets)”

FractionFequency span:

Fraction\_frequency\_values =

*Example 3:*

“1.5 Gy fractions given twice per day on days 1 to 5, 8 to 12, 15 to 19, with at least 6 hours between fractions, for a total dose of 45 Gy”

FractionFequency span: “twice per day”

Fraction\_frequency\_values = twice daily

*Example 4:* Do not inference frequency from duration.

“He received 54 Gy over 6-7 weeks”

FractionFequency span:

Fraction\_frequency\_values =

* 1. RT\_Technique

The radiation technique. Do not infer technique (e.g., from energy unit); only annotate if technique is explicitly stated. Only annotate for external beam radiotherapy. If only photon, electron, or proton is listed and there is no mention of brachytherapy, external beam can be assumed. Please note that volumetric modulated arc therapy (VMAT) is a type of intensity modulated radiotherapy (IMRT). Do not include if modality is not explicitly stated. Annotate most concise span, and choose from the following list, which aligns with NAACCR v18:

* External beam NOS (examples: tangents, parallel opposed fields, AP fields, AP:PA, 4-field box)
* Low-energy xray or photon therapy
* 2D therapy
* Conformal or 3D conformal therapy
* Intensity modulated therapy
* Stereotactic radiotherapy or radiosurgery NOS
* Stereotactic radiotherapy or radiosurgery robotic
* Stereotactic radiotherapy or radiosurgery Gammaknife
* CT-guided online adaptive therapy
* MR-guided online adaptive therapy
* Other NOS

*Example 1:*

“54 Gy in 30 fractions to the left parietal lobe using intensity-modulated proton therapy.”

RT\_Technique span: “intensity-modulated proton therapy”

RT\_Technique\_Type: intensity modulated therapy

*Example 2:*

“54 Gy in 30 fractions to the left parietal lobe using IMRT.”

RT\_Technique span: “intensity-modulated proton therapy”

RT\_Technique\_Type: intensity modulated therapy

*Example 3:*

“50.4 Gy of proton or photon volumetric modulated arc therapy in 28 fractions”

RT\_Technique span: “volumetric modulated arc therapy”

RT\_Technique\_Type: intensity modulated therapy

*Example 4:*

“30 Gy in 10 fractions using 3D-conformal photon therapy.”

RT\_Technique span: “3D-conformal”

RT\_Technique\_Type: conformal or 3D conformal

*Example 5:*

“30 Gy in 10 fractions using 3D planning.”

RT\_Technique span: “3D planning”

RT\_Technique\_Type: conformal or 3D conformal

*Example 6:*

“30 Gy in 10 fractions using 2D planning.”

RT\_Technique span: “2D planning”

RT\_Technique\_Type: 2D therapy

*Example 7:*

“SBRT 54 Gy in 3 fractions”

RT\_Technique span: “SBRT”

RT\_Technique\_Type: stereotactic radiotherapy or radiosurgery, NOS

*Example 8:*

“54 Gy in 3 fractions using stereotactic body radiotherapy”

RT\_Technique span: “stereotactic body radiotherapy”

RT\_Technique\_Type: stereotactic radiotherapy or radiosurgery, NOS

*Example 9:*

“54 Gy in 3 fractions with CyberKnife”

RT\_Technique span: “Cyberknife”

RT\_Technique\_Type: stereotactic radiotherapy or radiosurgery, robotic

*Example 10:*

“18 Gy in 1 fraction with GammaKnife”

RT\_Technique span: “Gammaknife”

RT\_Technique\_Type: stereotactic radiotherapy or radiosurgery, Gammaknife

*Example 11:*

“TBI 2 Gy x1”

RT\_Technique span: “TBI”

RT\_Technique\_Type: external beam, NOS

*Example 12:*

“Total body irradiation 2 Gy x1”

RT\_Technique span: “Total body irradiation”

RT\_Technique\_Type: external beam, NOS

*Example 13:*

“50.4 Gy of proton or photon VMAT in 28 fractions”

RT\_Technique span: “VMAT”

RT\_Technique\_Type: intensity modulated therapy

*Example 14:* No technique annotated because not explicitly stated.

“54 Gy in 30 fractions to the left parietal lobe using proton therapy.”

RT\_Technique span:

*Example 15:*

“50.4 Gy RapidArc in 28 fractions”

RT\_Technique span: “RapidArc”

RT\_Technique\_Type: intensity modulated therapy

*Example 16:*

“50.4 Gy tomotherapy in 28 fractions”

RT\_Technique span: “tomotherapy”

RT\_Technique\_Type: intensity modulated therapy

*Example 17:* In this example, two techniques are used. Link two separate radiation\_techniques in the radiotherapy property.

“50 Gy Tangents/IMRT”

RT\_Technique\_Type Span 1: “Tangents”

RT\_Technique\_Type: External beam NOS

RT\_Technique\_Type Span 2: “IMRT”

RT\_Technique\_Type: intensity modulated therapy

* 1. RT\_Modality

The radiation modality. Do not infer modality (e.g., from energy unit); only annotate if modality is explicitly stated. If only photon, electron, or proton is listed and there is no mention of brachytherapy, EBRT (external beam radiotherapy) can be assumed. Do not include if modality is not explicitly stated. Annotate the most concise span, and choose from the following list, which aligns with NAACCR v18:

* EBRT NOS
* EBRT photons
* EBRT protons
* EBRT electrons
* EBRT neutrons
* EBRT carbon
* Brachytherapy NOS
* LDR brachytherapy intracavitary
* HDR brachytherapy intracavitary
* LDR brachytherapy interstitial
* HDR brachytherapy interstitial
* Electronic brachytherapy electronic
* Radioisotopes NOS
* Radioisotopes Radium-232
* Radioisotopes Strontium-89
* Radioisotopes Strontium-90

*Example 1:*

“54 Gy in 30 fractions to the left parietal lobe using proton therapy.”

Span = “proton”

modality\_type = EBRT protons

*Example 2:*

“54 Gy in 30 fractions to the left parietal lobe using intensity-modulated proton therapy.”

Span = “proton”

modality\_type = EBRT protons

*Example 3:*

“10 Gy in 5 fractions to the tumor bed with en face electrons.”

Span = “electrons”

modality\_type =EBRT electrons

*Example 4:*

“30 Gy in 10 fractions using 3D-conformal photon therapy.”

Span = “photons”

modality\_type = EBRT photons

*Example 15:*

“Vaginal cylinder intracavitary HDR brachytherapy to a dose of 21 Gy in 3 weekly fractions prescribed at 5 mm depth.”

Span = “intracavitary HDR brachytherapy”

modality\_type = HDR brachytherapy intracavitary

* 1. RT\_Energy

The radiation energy used. More than 1 value may be annotated per course. Do not infer energy; only annotate if explicitly stated.

* energy\_number is the energy value
* energy\_unit is the unit of energy
  + Any capitalization of “MV” should me normalized to MV
  + Any capitalization of “MEV” should be normalized to MeV

*Example 1:*

“SBRT 54 Gy in 3 fractions with 6 MV photons”

energy\_number = 6

energy\_unit = MV

*Example 2:*

“Left breast surgical cavity boost to a dose of 10 Gy in 5 fractions using 9 MEV electrons”

energy\_number = 9

energy\_unit = MeV

* 1. Boost

Boost\_span is the span notating whether the instance being annotated is explicitly referred to as a boost. Should only be annotated if the instance is a boost, otherwise leave blank.

*Example 1:*

“Cone down to tumor bed 10 Gy in 5 fractions”

Boost span: “Cone down”

*Example 2:* No boost annotation as it is not explicitly stated.

“1.8 Gy fractions x 28 fractions given 5 days per week, for a total dose of 50.4 Gy. The last 5.4 Gy of the 50.4 Gy is limited to the tumor bed.”

Example 3.This example shows the Boost annotation for the second radiotherapy instance. In this example, the total treatment was given in two phases, but with an overlapping timeline because it is a *simultaneous* boost (AKA dose-painted boost), which means that a higher dose per fraction is given to a smaller area, while a larger area is given a lower dose per fraction. Here, the pancreas received 50.4 Gy in 28 fractions (1.8 Gy per fraction), while areas within the pancreas at highest risk of tumor recurrence (“high-risk-regions), received 59.4 Gy in 28 fractions (2.12 Gy per fraction) *at the same time*.

“The patient received 50.4 Gy in 28 fractions to the pancreas, with a simultaneous integrated boost to 59.4 in 28 fractions to the high-risk regions from 12/1/2019-1/9/2020.”

Boost span: “boost”

* 1. Brachy \_Isotope

Brachy\_Isotope is the isotope that was used for a brachytherapy treatment. This should only be annotated for brachytherapy LDR treatments (e.g., RT\_Modality = Brachytherapy, NOS; Brachytherapy, intracavitary, LDR; Brachytherapy, intracavitary, HDR; Brachytherapy, interstitial, LDR; Brachytherapy, interstitial, HDR). Common LDR brachytherapy isotopes are: iodine-125 (I-125 or 125I), palladium-103 (Pd-103 or 103Pd), and cesium-131 (Cs-131 or 131Cs). Common HDR brachytherapy isotopes are: iridium-192 (Ir-192 or 192Ir), radium-226 (Ra-226 or 226Ra), cobalt-60 (Co-60 or 60Co), or cesium-137 (Cs-137 or 37Cs). Common other types of isotopes are: strontium-90 (Sr-90 or 90Sr), yttrium-90 (Y-90 or 90Y), and phosphorous-32 (P-32 or 32P). Annotate span, and choose source from list:

* iodine-125
* palladium-103
* cesium-131
* iridium-192
* radium-226
* cobalt-60
* cesium-137
* strontium-90
* yttrium-90
* phosphorous-32
* other

Example 1: “He received prostate LDR brachytherapy as monotherapy 145 Gy with 125I.”

Span = “125I”

Source = iodine-125