

# CureSearch

Children's Oncology Group

## **Long-Term Follow-Up Guidelines**

for Survivors of Childhood, Adolescent,  
and Young Adult Cancers

Version 3.0 – October 2008

A child and a young adult are running together, holding a flag on a string. The child is on the left, and the young adult is on the right. The flag is white and is flying in the air. The background is a light green color.

# **Radiation Reference Guide**

Copyright 2008 © Children's Oncology Group  
All rights reserved worldwide

*Children's Oncology Group*  
**Long-Term Follow-Up Guidelines for Survivors of Childhood,  
Adolescent, and Young Adult Cancers**  
*Version 3.0 – October 2008*

## RADIATION REFERENCE GUIDE

Content	Page
Instructions	2
Dose Calculation Examples	3
Radiation Fields Defined	6
Radiation Fields by Anatomic Region	7
Guideline Section Numbers by Anatomic Region	8
TBI	9
Skin, bones, soft tissues	10
Brain/neuroendocrine axis, cranium, face, eye, ear	11
Oral cavity	12
Neck/thyroid	13
Breast	14
Lungs	15
Heart	16
Spleen	17
Esophagus	18
Liver	19
Bowel	20
Kidneys	21
Bladder/urinary tract	22
Female reproductive system	23
Male reproductive system	24
Musculoskeletal system (growth problems, fracture)	25
Musculoskeletal system (scoliosis/kyphosis)	26

**Acknowledgment:**

*Special thanks to Shweta Bhatia for preparing all  
illustrations included in this Radiation Reference Guide*

## Determining Applicability of Radiation Sections for Specific Patients Based on Exposure

### **GENERAL CONSIDERATIONS:**

- The radiation sections of the *COG Long-Term Follow-Up Guidelines* (Sections 38 – 91) are organized by anatomic region from the head downward. For specifics regarding relevant exposures to each anatomic region and radiation field, refer to the applicable pages of this Radiation Reference Guide and to the Figures in this introductory section.
- To determine specific screening guidelines by section number for an individual patient, use the “Patient-Specific Guideline Identification Tool” in Appendix I together with this Radiation Reference Guide.

### **RADIATION DOSE CALCULATIONS:**

Some sections of the *COG Long-Term Follow-Up Guidelines* relevant to radiation exposure include dose specifications. These specifications indicate the minimum dose of radiation that is believed (based on available evidence and the recommendations of the expert panel) to place patients sufficiently at risk of the referenced late effect to recommend screening. For guideline sections that have a minimum specified dose, the following considerations apply in determining the applicability of the section for a patient based on his/her radiation exposure.

Sections with minimum dose specifications are applicable to a patient only if:

1. Patient received radiation to any field(s) relevant to the particular guideline section at  $\geq$  the specified minimum dose<sup>†</sup>  
OR
2. Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>‡</sup> **and/or** TBI, the sum of which is  $\geq$  the specified minimum dose<sup>§</sup>

<sup>†</sup>Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). *Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.*

<sup>‡</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section

<sup>§</sup>Whole lung radiation, if given, should be included in minimum dose calculations for Sections 65, 66, 67, 68, 73, and 91.

### **EXAMPLES:**

Examples of radiation dose calculations are provided on the following pages.

## RADIATION DOSE CALCULATION EXAMPLES

### Example 1

*Guideline section:*

Section 68 (female); potential late effect = breast cancer

*Minimum dose specification:*

Radiation  $\geq$  20 Gy

*Relevant radiation fields:*

Chest (thorax)

Whole lung

Mediastinal

Axilla

Mini-Mantle

Mantle

Extended Mantle

TLI

STLI

TBI

*Clinical example:*

Patient received the following radiation doses to these relevant fields:

- Axillary: 12 Gy
- Mediastinum: 18 Gy
- TBI: 10 Gy

Step 1:

If radiation was given to more than one field relevant to the guideline section, select the largest dose received:

= 18 Gy (Mediastinum)

Step 2:

Add TBI dose, if received:

	18 Gy
+ TBI	<u>10 Gy</u>
	28 Gy

This patient received a total dose of 28 Gy of radiation potentially impacting the breast. Therefore, Guideline Section 68 regarding screening for breast cancer, which is indicated for radiation doses  $\geq$  20 Gy, is applicable.

Note: See Info Link in Section 68 for patients who received TBI alone, as screening may also be indicated for these patient based on clinical considerations.

## Example 2

### *Guideline section:*

Section 73; potential late effect = esophageal stricture

### *Minimum dose specification*

Radiation  $\geq$  30 Gy

### *Relevant radiation fields:*

Spine (cervical, thoracic, whole)

Cervical (neck)

Supraclavicular

Chest (thorax)

Whole lung

Mediastinal

Mini-Mantle

Mantle

Extended mantle

Hepatic

Renal

Upper quadrant (right, left)

Spleen (partial, entire)

Paraortic

Flank/hemiabdomen (right, left)

Whole abdomen

Inverted Y

TLI

STLI

### *Clinical example:*

Patient received the following radiation doses:

- Chest (thorax): 25 Gy
- Hepatic: 20 Gy
- Thoracic spine: 18 Gy
- Lumbar spine: 24 Gy
- TBI: 12 Gy

### Step 1:

If radiation given to more than one non-spinal field, select the highest dose received:

= 25 Gy (Chest/thorax)

### Step 2:

Add the largest relevant\* spinal dose to highest non-spinal dose:

Thoracic spine = 18 Gy

+ Chest(thorax) 25 Gy

43 Gy

\*Largest dose of radiation delivered to the spinal field(s) specified in the guideline section

Step 3:

Add TBI dose, if received, to total:

$$\begin{array}{r} 43 \text{ Gy} \\ + \text{TBI} \quad \underline{12 \text{ Gy}} \\ \hline 55 \text{ Gy} \end{array}$$

This patient received a total dose of 55 Gy of radiation potentially impacting the esophagus.

Therefore, Guideline Section 73 regarding screening for esophageal stricture, which is indicated for radiation doses  $\geq 30$  Gy, is applicable.

### Example 3

*Guideline section:*

Section 55; potential late effect = central adrenal insufficiency

*Minimum dose specification:*

Radiation  $\geq 40$  Gy

*Relevant radiation fields:*

Cranial  
Orbital/eye  
Ear/infratemporal  
Nasopharyngeal  
Waldeyer's Ring

*Clinical example:*

Patient received 24 Gy cranial radiation at time of diagnosis. Five years later patient relapsed and was given an additional course of 24 Gy cranial radiation.

Step 1:

If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section

$$\begin{array}{r} 24 \text{ Gy (Cranial radiation at diagnosis)} \\ + \underline{24 \text{ Gy (Cranial radiation at relapse)}} \\ \hline 48 \text{ Gy} \end{array}$$

Step 2:

Add TBI dose, if received:

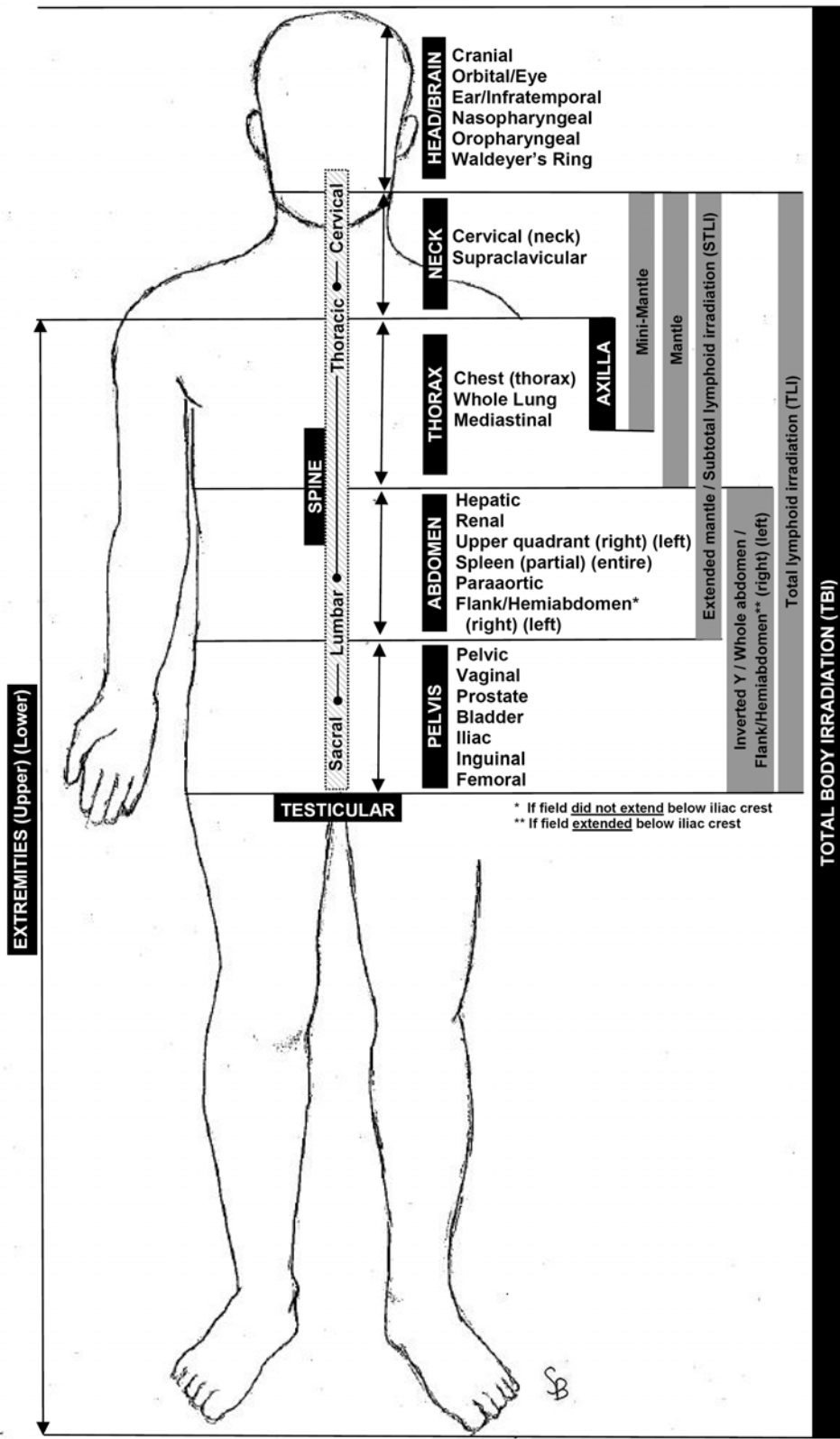
$$\begin{array}{r} 48 \text{ Gy} \\ + \text{TBI} \quad \underline{0 \text{ Gy}} \\ \hline 48 \text{ Gy} \end{array}$$

This patient received a total dose of 48 Gy of radiation potentially impacting the brain/neuroendocrine axis. Therefore, Guideline Section 55 regarding screening for central adrenal insufficiency, which is indicated for radiation doses  $\geq 40$  Gy, is applicable.

## RADIATION FIELDS DEFINED

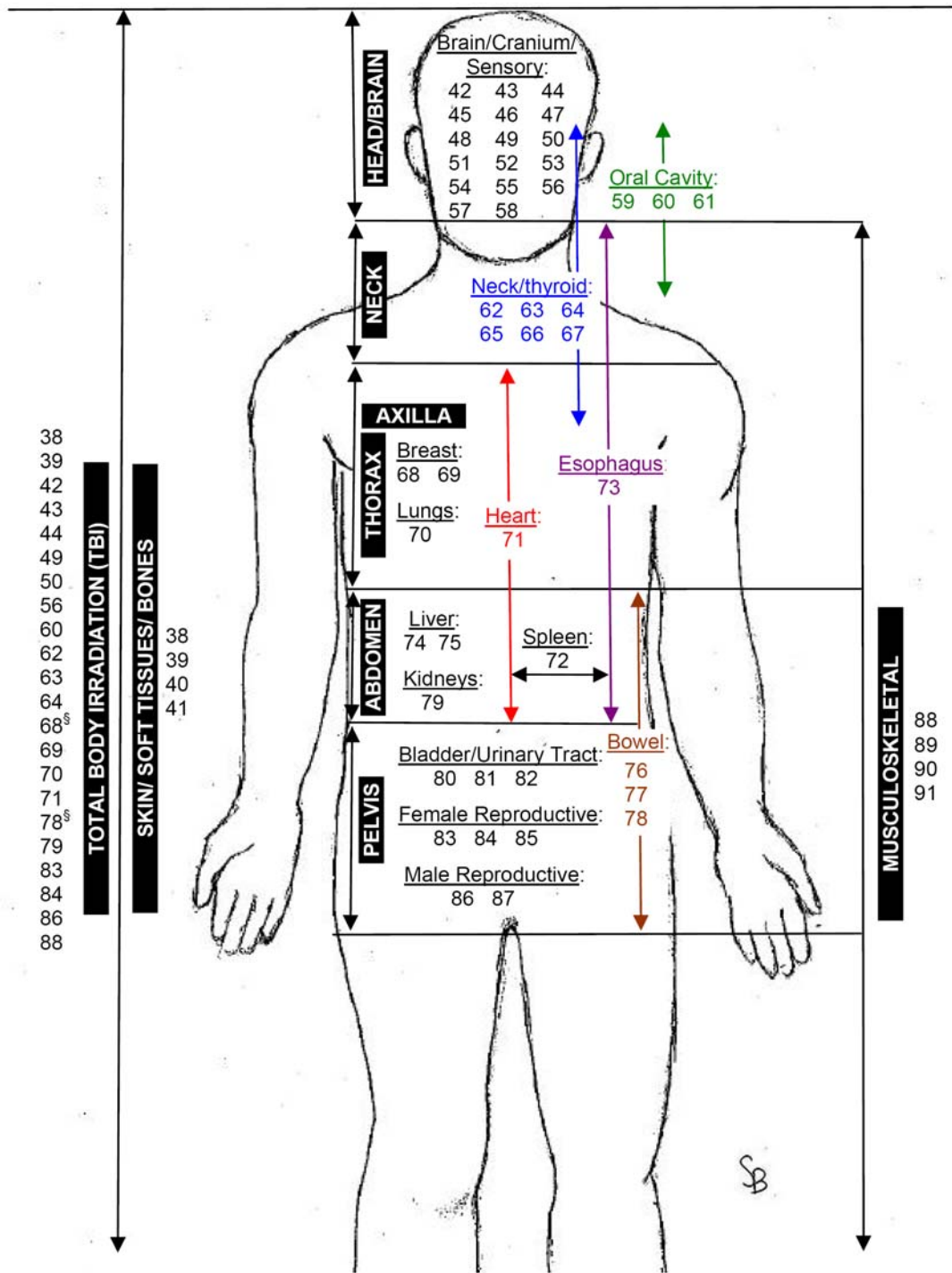
Field	Definition
Total body irradiation (TBI)	Entire body; encompassing all radiation fields
Cranial	Any field involving the cranium, head, brain and/or face
Waldeyer's Ring	Nasopharyngeal and oropharyngeal (tonsils and adenoids)
Spine – cervical	Including some or all of the cervical spine (C1 – C7)
Spine – thoracic	Including some or all of the thoracic spine (T1 – T12)
Spine – lumbar	Including some or all of the lumbar spine (L1 – L5)
Spine – sacral	Including some or all of the sacral spine (S1 – S5)
Spine – whole	Including the cervical, thoracic, lumbar and sacral spine
Mini-mantle	Bilateral cervical (neck), supraclavicular and axillary fields (excludes mediastinal and lung)
Mantle	Bilateral cervical (neck), supraclavicular, mediastinal, hilar, and axillary fields
Extended mantle	Mantle and paraaortic fields
Subtotal lymphoid (STLI)	Mantle + paraaortic + splenic
Inverted Y	Paraaortic + pelvic +/- splenic
Total lymphoid (TLI)	Mantle + inverted Y (paraaortic/pelvic) + splenic
Chest (thorax)	May include any of the following: Mediastinal, hilar, whole lung, chest wall
Mediastinal	Mediastinum and bilateral hilar fields
Abdomen (also commonly referred to as “upper abdomen”)	Top of diaphragm to iliac crests (bilaterally), including the following fields: <ul style="list-style-type: none"> <li>- Hepatic</li> <li>- Renal/renal bed</li> <li>- Spleen (partial, entire)</li> <li>- Upper quadrant (right, left)</li> <li>- Paraaortic</li> <li>- Flank/hemiabdomen (right, left)</li> </ul>
Paraaortic	Paraaortic lymph nodes (generally from T10 to L4 cephalad-caudad, and the transverse processes laterally) +/- splenic
Renal	Renal bed
Flank/hemiabdomen	Top of diaphragm to iliac crest (unilateral; medial border along contralateral vertebral bodies)  <i>Note: Most hemiabdominal fields do not extend beyond the iliac crest; however, in some cases, depending on tumor location, the hemiabdominal field may have extended into the pelvis. If the hemiabdominal field extended below the iliac crest, exposure to pelvic fields should be considered in assessing risk for late sequelae.</i>
Whole abdomen	Includes all abdominal and pelvic fields
Pelvis	Iliac crest to 3 cm below ischium, including the following fields: <ul style="list-style-type: none"> <li>- Pelvic</li> <li>- Vaginal</li> <li>- Prostate</li> <li>- Bladder</li> <li>- Iliac</li> <li>- Inguinal</li> <li>- Femoral</li> </ul>

# Radiation Fields by Anatomic Region





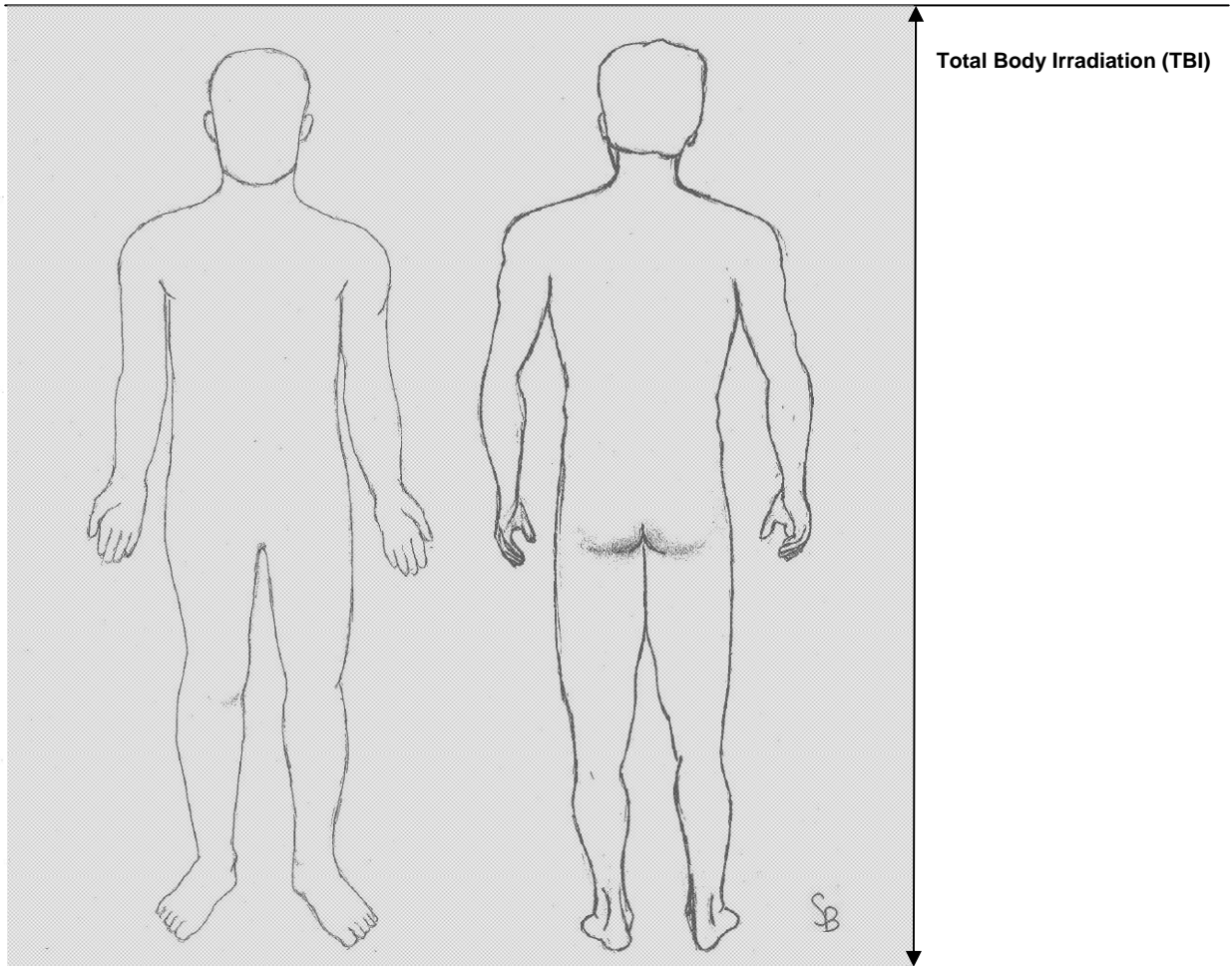
## Guideline Radiation Section Numbers by Anatomic Region



<sup>§</sup>Screening may be indicated for patients who received TBI alone - see Info Link in indicated section  
 Note: Oral cavity, neck/thyroid, heart, esophagus, and bowel are affected by radiation to multiple anatomic regions

**Relevant Guideline Radiation Sections for Patients who Received**

**TOTAL BODY IRRADIATION (TBI)**

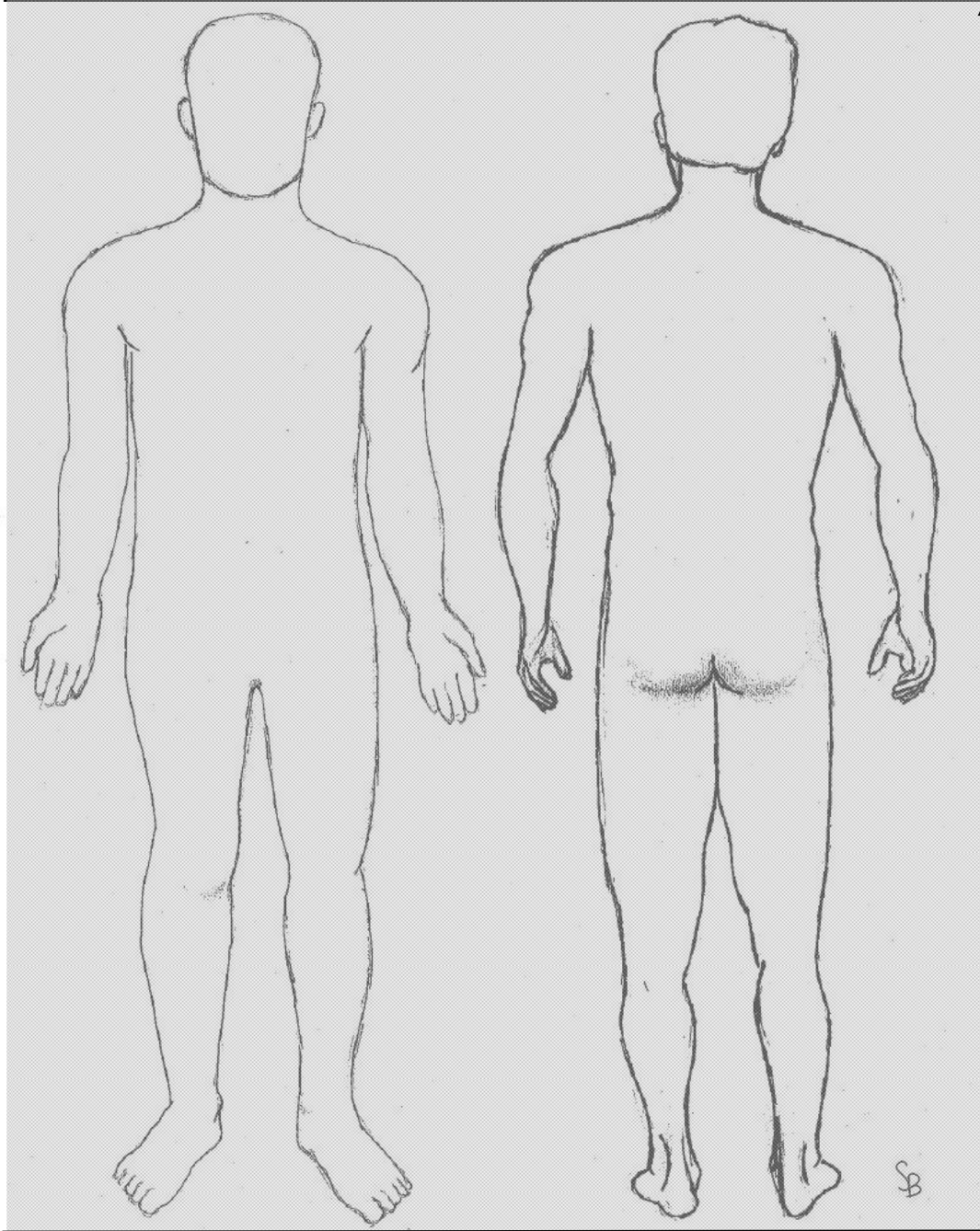


Fields	Dose	Section Numbers	Potential Late Effects
TBI	Any	38 39 42 43 44 49 50 56 60 62 63 64 68 <sup>§</sup> 69 70 71 78 <sup>§</sup> 79 83 84 86 88	Secondary benign or malignant neoplasms Dysplastic nevi/skin cancer Brain tumor Neurocognitive deficits Clinical leukoencephalopathy Metabolic syndrome Growth hormone deficiency Cataracts Dental abnormalities Thyroid nodules Thyroid cancer Hypothyroidism Breast cancer Breast tissue hypoplasia Pulmonary toxicity Cardiac toxicity Colorectal cancer Renal toxicity Uterine vascular insufficiency Gonadal dysfunction (ovarian) Gonadal dysfunction (testicular) Musculoskeletal growth problems

<sup>§</sup>Screening may be indicated for patients who received TBI alone - see Info Link in this section

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Skin, Bones, Soft Tissues**



**Skin, Soft Tissues, Bones -  
Relevant Fields**

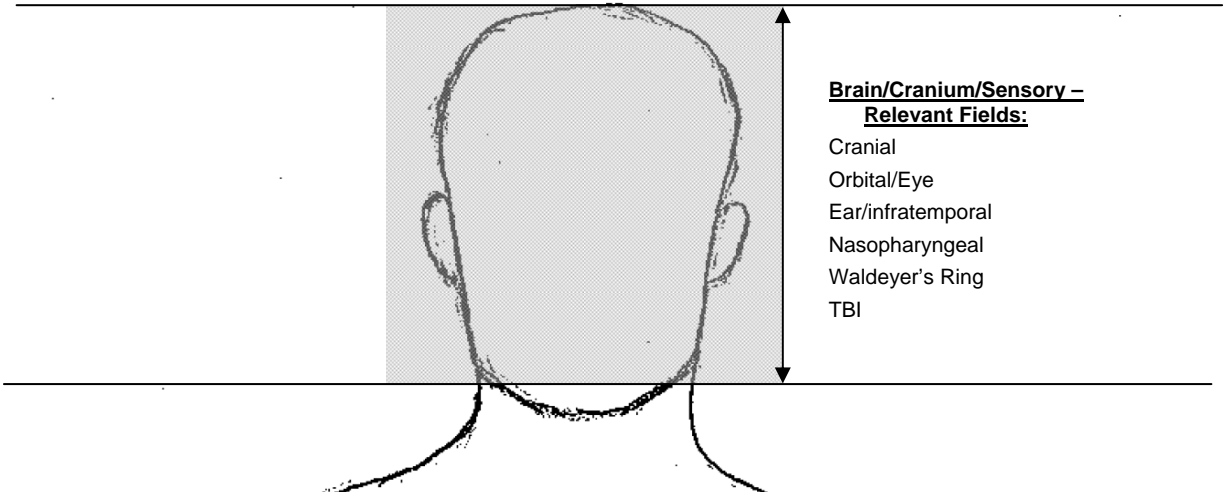
**All radiation fields:**

- Cranial
- Orbital/Eye
- Ear/Infratemporal
- Nasopharyngeal
- Oropharyngeal
- Waldeyer's Ring
- Spine (cervical, thoracic, lumbar, sacral, whole)
- Cervical (neck)
- Supraclavicular
- Chest (thorax)
- Whole lung
- Mediastinal
- Axilla
- Mini-Mantle
- Mantle
- Extended mantle
- Hepatic
- Renal
- Upper quadrant (right, left)
- Spleen (partial, entire)
- Paraaortic
- Flank/Hemiabdomen (right, left)
- Whole abdomen
- Inverted Y
- Pelvic
- Vaginal
- Prostate
- Bladder
- Iliac
- Inguinal
- Femoral
- Testicular
- Extremity (upper, lower)
- Total lymphoid irradiation (TLI)
- Subtotal lymphoid irradiation (STLI)
- Total body irradiation (TBI)

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Skin Bones Soft Tissues	All	Any	38, 39	Secondary benign or malignant neoplasms Dysplastic nevi Skin cancer
	All except TBI	Any	40, 41	Dermatologic changes Bone malignancies

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Brain/Neuroendocrine Axis, Cranium, Face, Eye, Ear**



**Brain/Cranium/Sensory –  
Relevant Fields:**

- Cranial
- Orbital/Eye
- Ear/infratemporal
- Nasopharyngeal
- Waldeyer's Ring
- TBI

Potential Impact To	Relevant Fields	Dose	Section Numbers	Potential Late Effects
Brain Neuroendocrine axis Cranium Face	Cranial Orbital/eye Ear/infratemporal Nasopharyngeal Waldeyer's Ring TBI	Any	42, 46*, 47*, 48*, 49, 50, 51*	Brain tumor, Craniofacial abnormalities*, Chronic sinusitis*, Overweight/ obesity*, Metabolic syndrome, Growth hormone deficiency, Precocious puberty*
		≥18 Gy***	45**	Cerebrovascular complications
		≥40 Gy***	52,** 53,** 54,** 55**	Hyperprolactinemia, Central hypothyroidism, Gonadotropin deficiency, Central adrenal insufficiency
Brain	Cranial Ear/infratemporal TBI	Any	43, 44	Neurocognitive deficit, Clinical leukoencephalopathy
Eye	Cranial Orbital/eye TBI	Any	56	Cataracts
		≥30 Gy***	57**	Ocular toxicity
Ear	Cranial Ear/infratemporal Nasopharyngeal Waldeyer's Ring TBI	≥30 Gy***	58**	Ototoxicity

\*TBI not associated with these sections

\*\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*\*This/these section(s) applicable to patient only if:

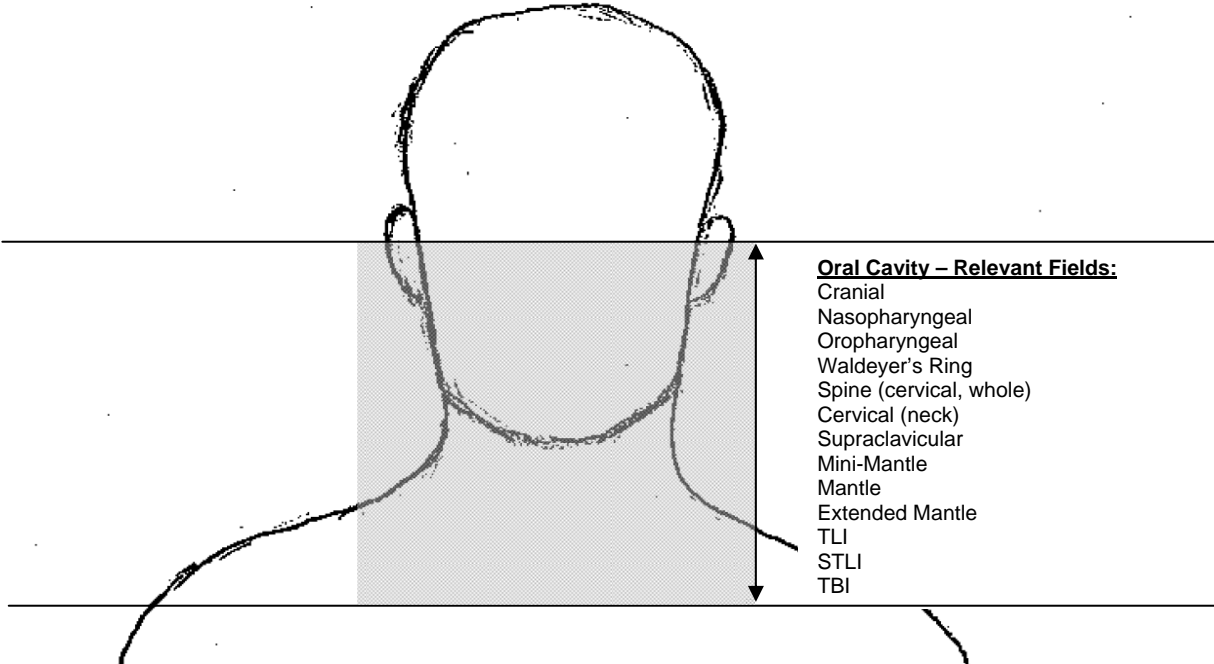
1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

OR 2) Patient received a combination of radiation to any relevant field(s) **and** TBI, the sum of which is ≥ the specified minimum dose<sup>†</sup>

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). **Exception:** *If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.*

Relevant Guideline Radiation Sections for Patients who Received

**RADIATION WITH POTENTIAL IMPACT TO:  
Oral Cavity**



Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Oral cavity	Cranial Nasopharyngeal Oropharyngeal Waldeyer's Ring Spine (cervical, whole) Cervical (neck) Supraclavicular Mini-Mantle Mantle Extended Mantle TLI STLI TBI	Any	59*, 60	Xerostomia Salivary gland dysfunction Dental abnormalities
		≥40 Gy***	61**	Osteoradionecrosis

\*TBI not associated with this section

\*\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*\*This section applicable to patient only if:

1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

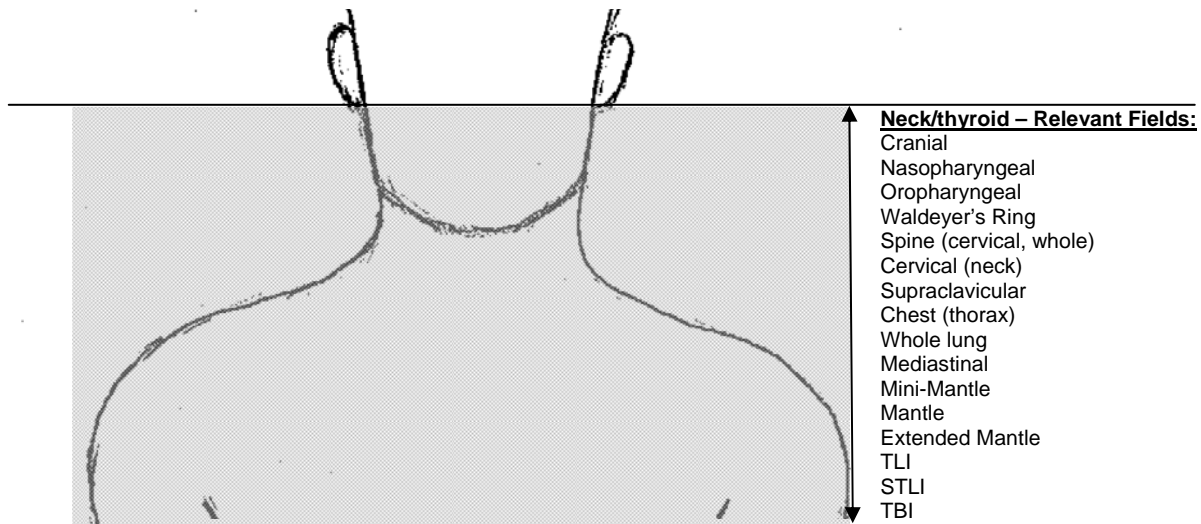
OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>†</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). *Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.*

<sup>‡</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Neck/Thyroid**



Potential impact to	Fields	Dose	Section #	Potential Late Effects
Thyroid Carotid artery	Cranial Nasopharyngeal Oropharyngeal Waldeyer's Ring Spine (cervical, whole) Cervical (neck) Supraclavicular Chest (thorax) Whole lung Mediastinal Mini-Mantle Mantle Extended Mantle TLI, STLI, TBI	Any	62, 63, 64	Thyroid nodules Thyroid cancer Hypothyroidism
		≥40 Gy**	65*	Hyperthyroidism
			66*	Carotid artery disease
Subclavian artery	Spine (cervical, whole) Cervical (neck) Supraclavicular Chest (thorax) Whole lung Mediastinal Mini-Mantle Mantle Extended Mantle TLI, STLI, TBI	≥40 Gy**	67*	Subclavian artery disease

\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

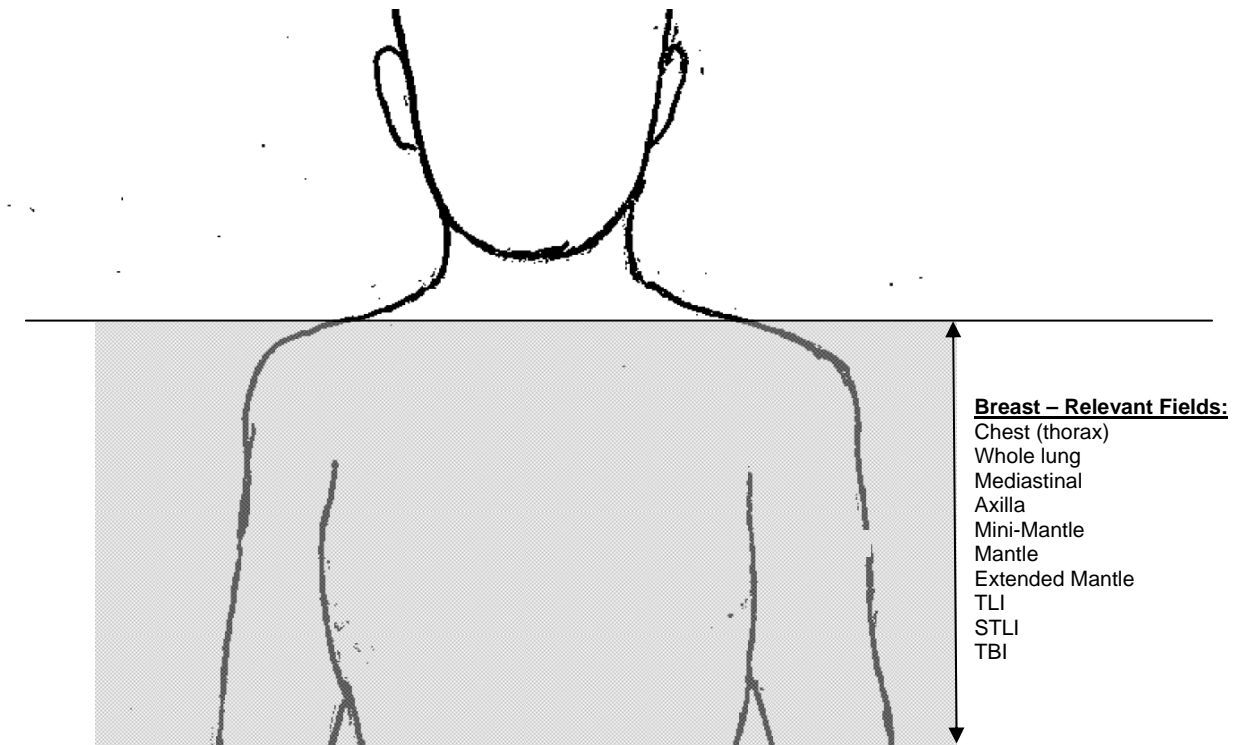
\*\*This section applicable to patient only if:  
 1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>  
 OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>†</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). *Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.*

<sup>†</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section

Relevant Guideline Radiation Sections for Females who Received

**RADIATION WITH POTENTIAL IMPACT TO THE:  
Breast**



**Breast – Relevant Fields:**  
 Chest (thorax)  
 Whole lung  
 Mediastinal  
 Axilla  
 Mini-Mantle  
 Mantle  
 Extended Mantle  
 TLI  
 STLI  
 TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Breast	Chest (thorax) Whole lung Mediastinal Axilla	Any	69	Breast hypoplasia
	Mini-Mantle Mantle Extended Mantle TLI STLI TBI	≥20 Gy*	68 <sup>§</sup>	Breast cancer

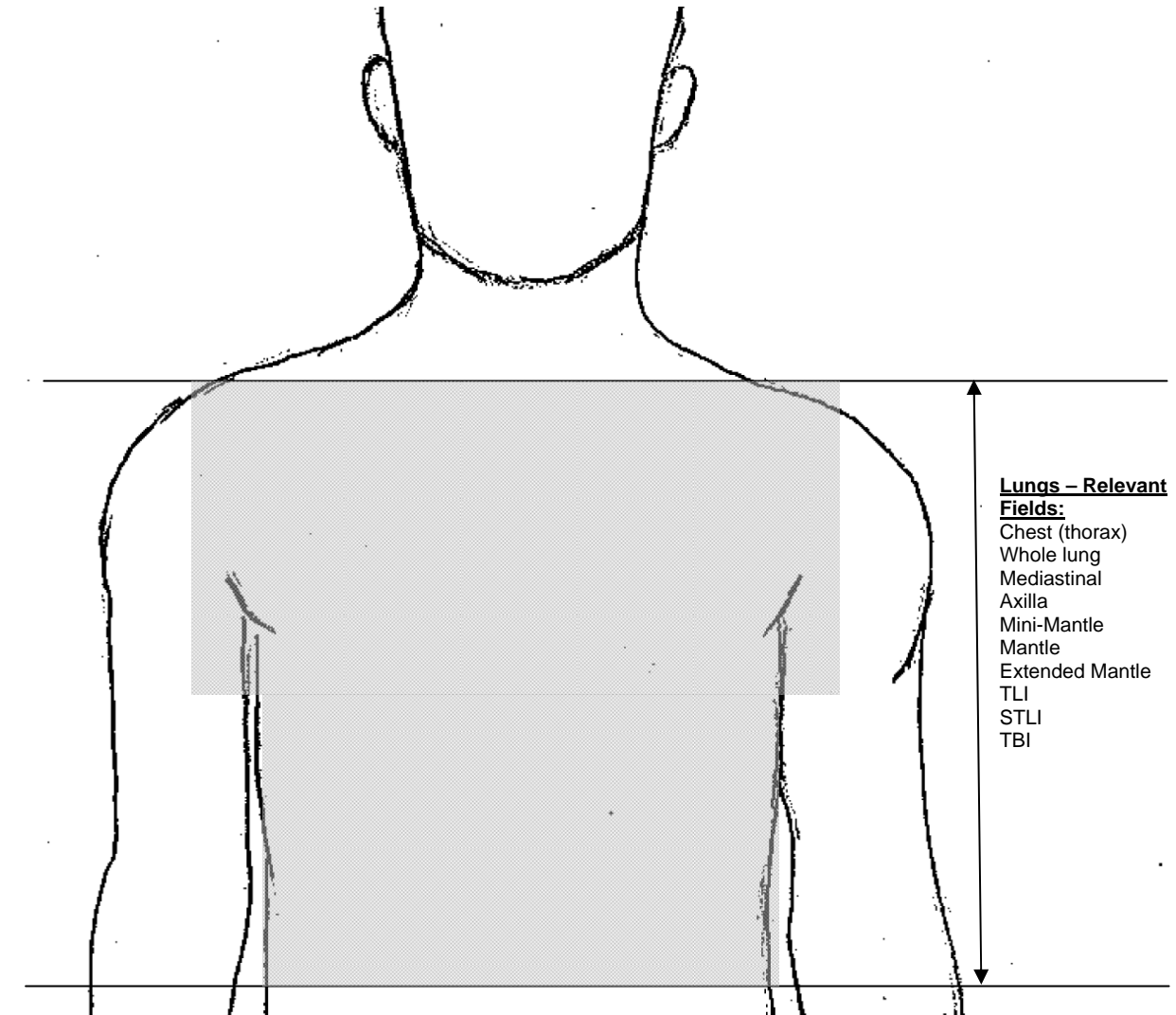
<sup>§</sup>Screening may be indicated for patients who received TBI alone - see Info Link in Section 68

\*This section applicable to patient only if:  
 1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>  
OR 2) Patient received a combination of radiation to any relevant field(s) and TBI, the sum of which is ≥ the specified minimum dose<sup>†</sup>

<sup>†</sup>Notes: Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Lungs**



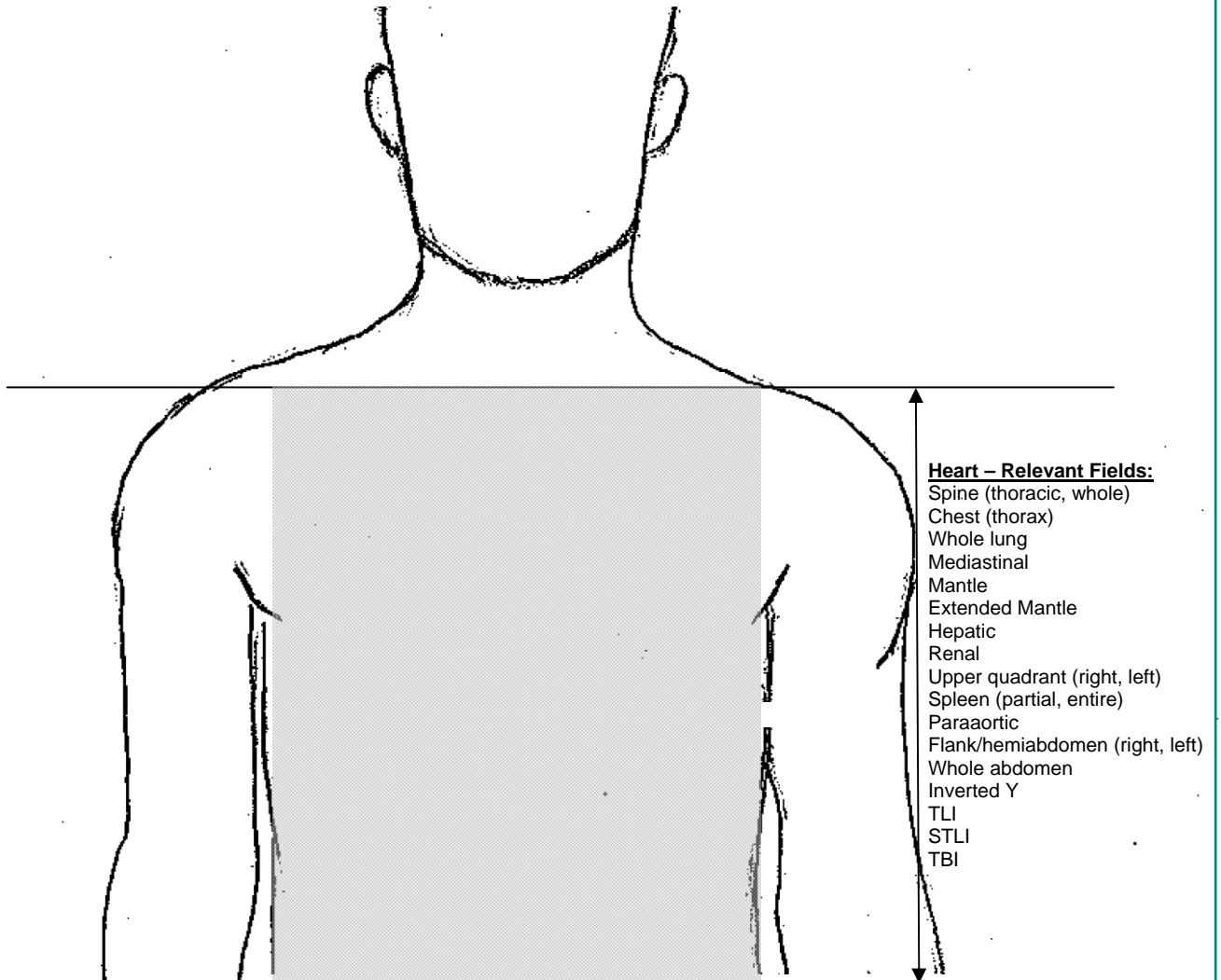
**Lungs – Relevant Fields:**  
 Chest (thorax)  
 Whole lung  
 Mediastinal  
 Axilla  
 Mini-Mantle  
 Mantle  
 Extended Mantle  
 TLI  
 STLI  
 TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Lungs	Chest (thorax) Whole lung Mediastinal Axilla Mini-Mantle Mantle Extended Mantle TLI STLI TBI	Any	70	Pulmonary toxicity



Relevant Guideline Radiation Sections for Patients who Received

**RADIATION WITH POTENTIAL IMPACT TO:  
Heart**



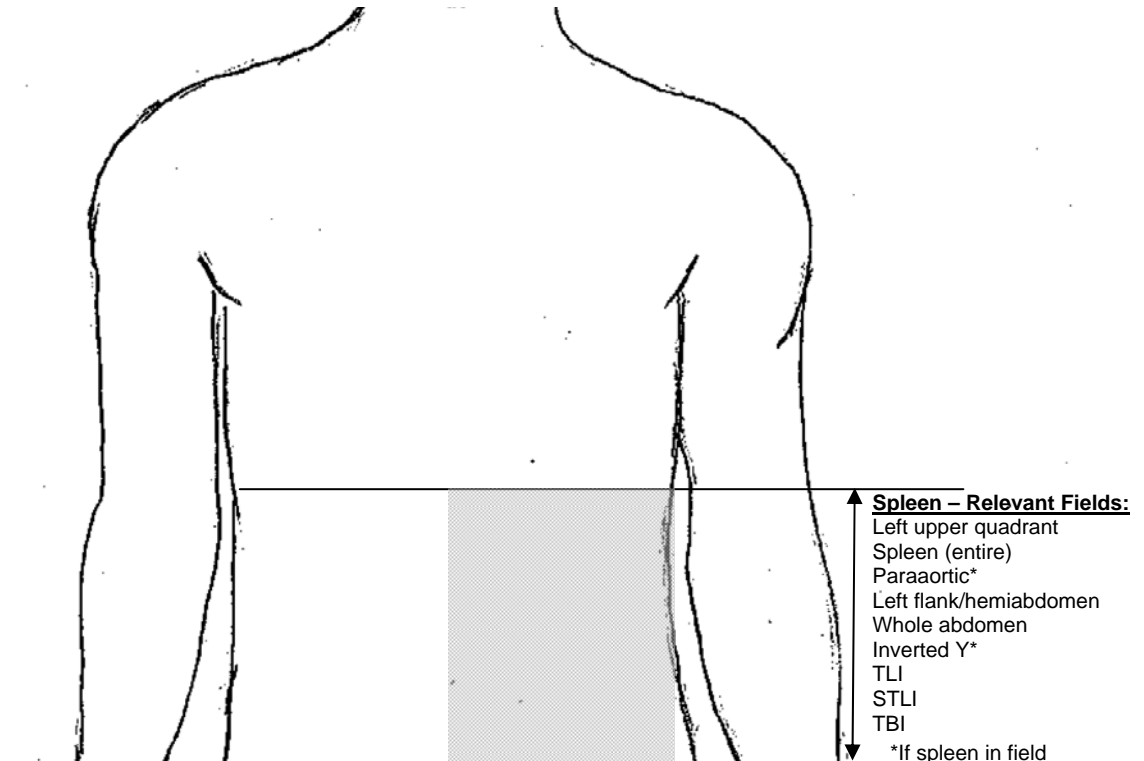
**Heart – Relevant Fields:**  
 Spine (thoracic, whole)  
 Chest (thorax)  
 Whole lung  
 Mediastinal  
 Mantle  
 Extended Mantle  
 Hepatic  
 Renal  
 Upper quadrant (right, left)  
 Spleen (partial, entire)  
 Paraaortic  
 Flank/hemiabdomen (right, left)  
 Whole abdomen  
 Inverted Y  
 TLI  
 STLI  
 TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Heart	Spine (thoracic, whole) Chest (thorax) Whole lung Mediastinal Mantle Extended Mantle Hepatic Renal Upper quadrant (right, left) Spleen (partial, entire) Paraaortic Flank/hemiabdomen (right, left) Whole abdomen Inverted Y TLI STLI TBI	Any*	71	Cardiac toxicity

\* Note: Frequency of screening is determined by dose and age at exposure

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Spleen**



Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Spleen	Left upper quadrant Spleen (entire) Paraaortic* Left flank/hemiabdomen Whole abdomen Inverted Y* TLI STLI TBI	≥40 Gy***	72**	Functional asplenia

\*If spleen in field

\*\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*\*This section applicable to patient only if:

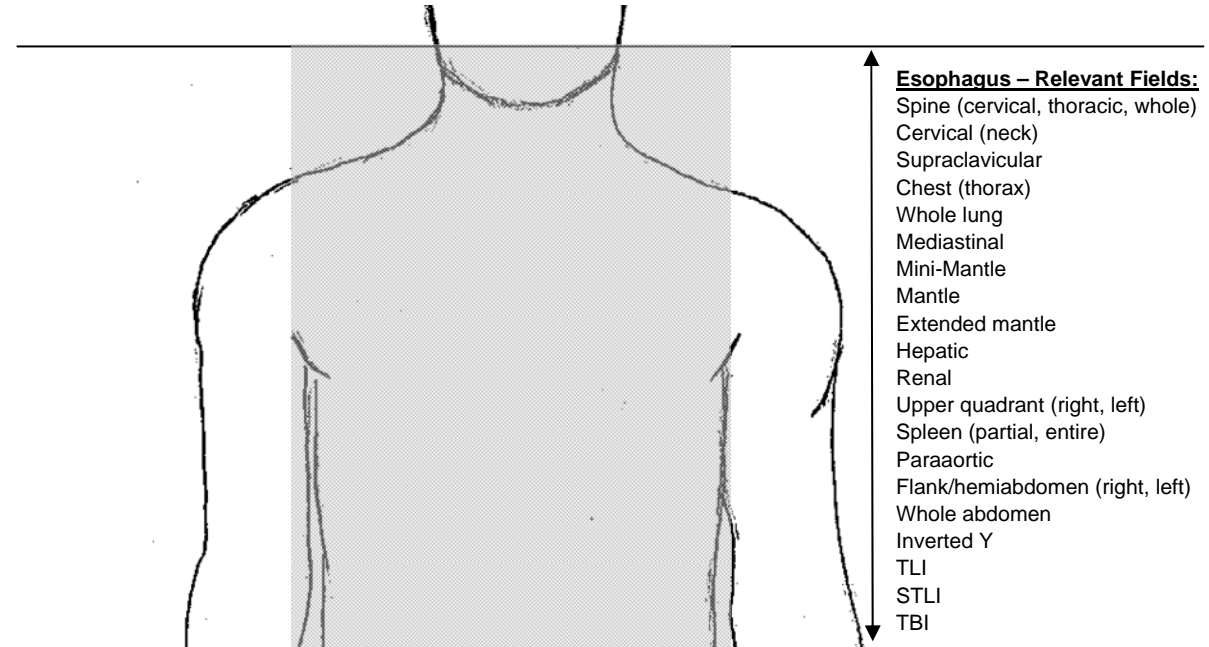
1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **and** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>Notes: Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Esophagus**



- Esophagus – Relevant Fields:**
- Spine (cervical, thoracic, whole)
  - Cervical (neck)
  - Supraclavicular
  - Chest (thorax)
  - Whole lung
  - Mediastinal
  - Mini-Mantle
  - Mantle
  - Extended mantle
  - Hepatic
  - Renal
  - Upper quadrant (right, left)
  - Spleen (partial, entire)
  - Paraortic
  - Flank/hemiabdomen (right, left)
  - Whole abdomen
  - Inverted Y
  - TLI
  - STLI
  - TBI

SB

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Esophagus	Spine (cervical, thoracic, whole) Cervical (neck) Supraclavicular Chest (thorax) Whole lung Mediastinal Mini-Mantle Mantle Extended mantle Hepatic Renal Upper quadrants (right, left) Spleen (partial, entire) Paraortic Flank/hemiabdomen (right, left) Whole abdomen Inverted Y TLI, STLI, TBI	≥30 Gy**	73*	Esophageal stricture

\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*This section applicable to patient only if:

1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

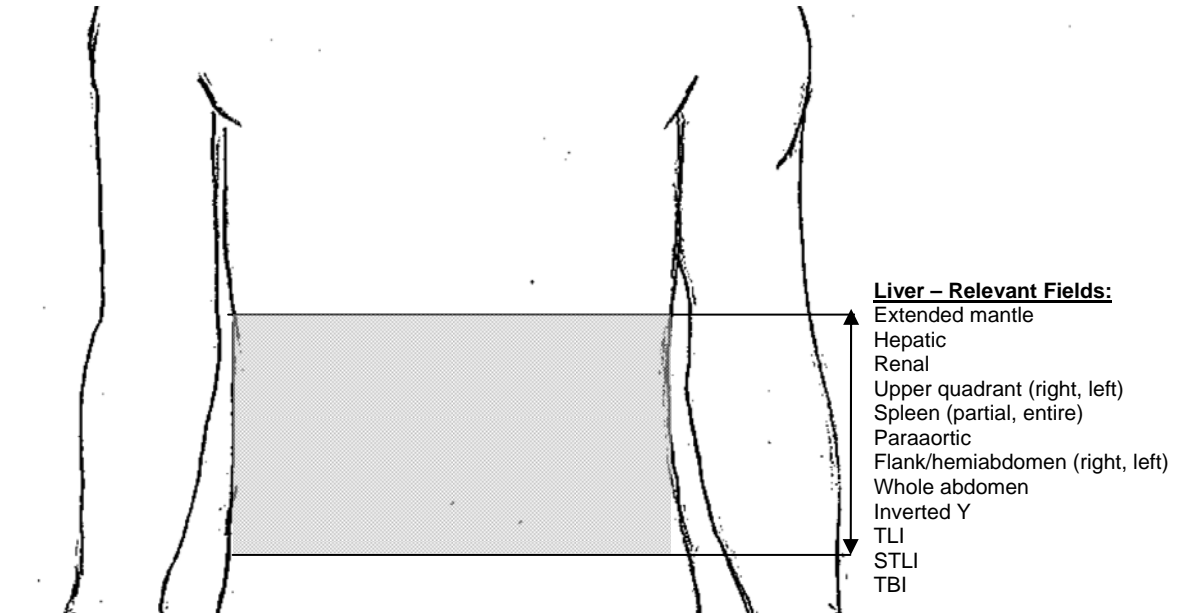
OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>‡</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). **Exception:** If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.

<sup>‡</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Liver**



- Liver – Relevant Fields:**  
 Extended mantle  
 Hepatic  
 Renal  
 Upper quadrant (right, left)  
 Spleen (partial, entire)  
 Paraaortic  
 Flank/hemiabdomen (right, left)  
 Whole abdomen  
 Inverted Y  
 TLI  
 STLI  
 TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Liver	Extended mantle Hepatic Renal Upper quadrant (right, left) Spleen (partial, entire) Paraaortic Flank/hemiabdomen (right, left) Whole abdomen Inverted Y TLI STLI TBI	≥30 Gy**	74*	Hepatic fibrosis Cirrhosis
			75*	Cholecystitis

\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*These sections applicable to patient only if:  
 1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>  
 OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **and** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Bowel**

Potential Impact To	Relevant Fields	Dose	Section Numbers	Potential Late Effects
Bowel	Spine (thoracic, lumbar, sacral, whole)	≥30 Gy**	76*	Bowel obstruction
	Extended mantle Hepatic Renal Upper quadrant (right, left) Spleen (partial, entire) Paraortic		77*	Chronic enterocolitis Fistula Strictures
	Flank/hemiabdomen (right, left) Whole abdomen Inverted Y Pelvic Vaginal Prostate Bladder Iliac Inguinal Femoral TLI, STLI, TBI		78 <sup>§</sup>	Colorectal cancer

<sup>§</sup>Screening for colorectal cancer may be indicated for patients who received TBI alone - see Info Link in Section 78

\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

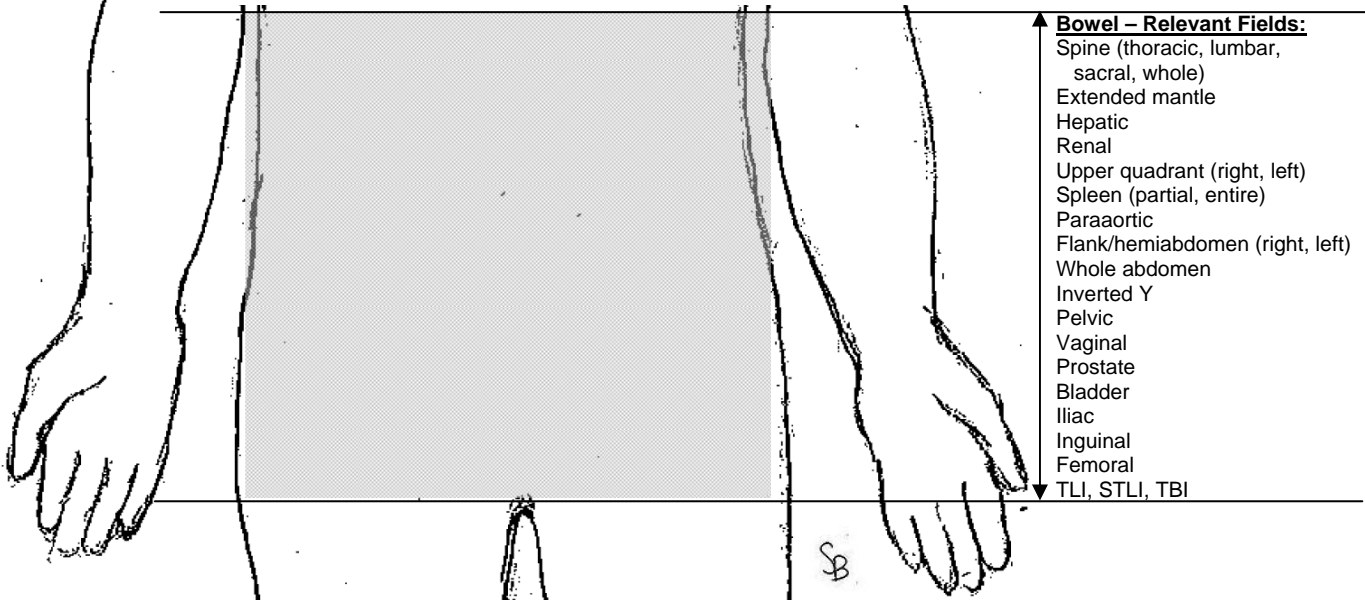
\*\*This section applicable to patient only if:

1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>†</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

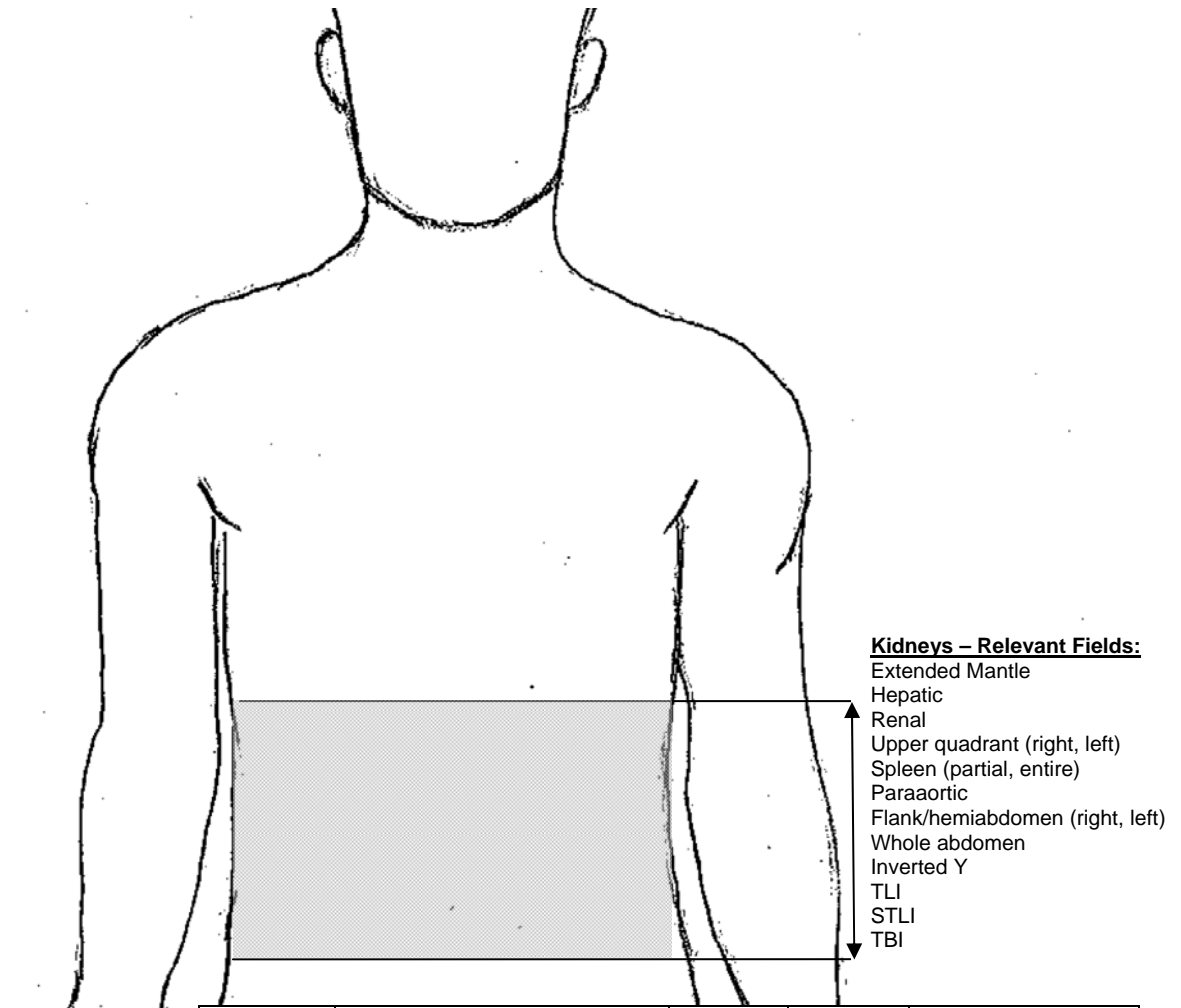
<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). *Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.*

<sup>‡</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section



**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Kidneys**



- Kidneys – Relevant Fields:**  
 Extended Mantle  
 Hepatic  
 Renal  
 Upper quadrant (right, left)  
 Spleen (partial, entire)  
 Paraaortic  
 Flank/hemiabdomen (right, left)  
 Whole abdomen  
 Inverted Y  
 TLI  
 STLI  
 TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Kidneys	Extended Mantle Hepatic Renal Upper quadrant (right, left) Spleen (partial, entire) Paraaortic Flank/hemiabdomen (right, left) Whole abdomen Inverted Y TLI STLI TBI	Any dose	79	Renal toxicity

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Bladder / Urinary Tract**

Potential Impact To	Relevant Fields	Dose	Section Numbers	Potential Late Effects
Bladder Urinary tract	Spine (sacral, whole)	Any dose	82 <sup>§</sup>	Bladder malignancy
	Flank/hemiabdomen (right, left)* Whole abdomen Inverted Y Pelvic Vaginal Prostate Bladder Iliac Inguinal TLI TBI	≥30 Gy***	80**	Hemorrhagic cystitis
			81**	Urinary tract toxicity

<sup>§</sup>TBI not applicable to this section

\*Only if field extended below iliac crest

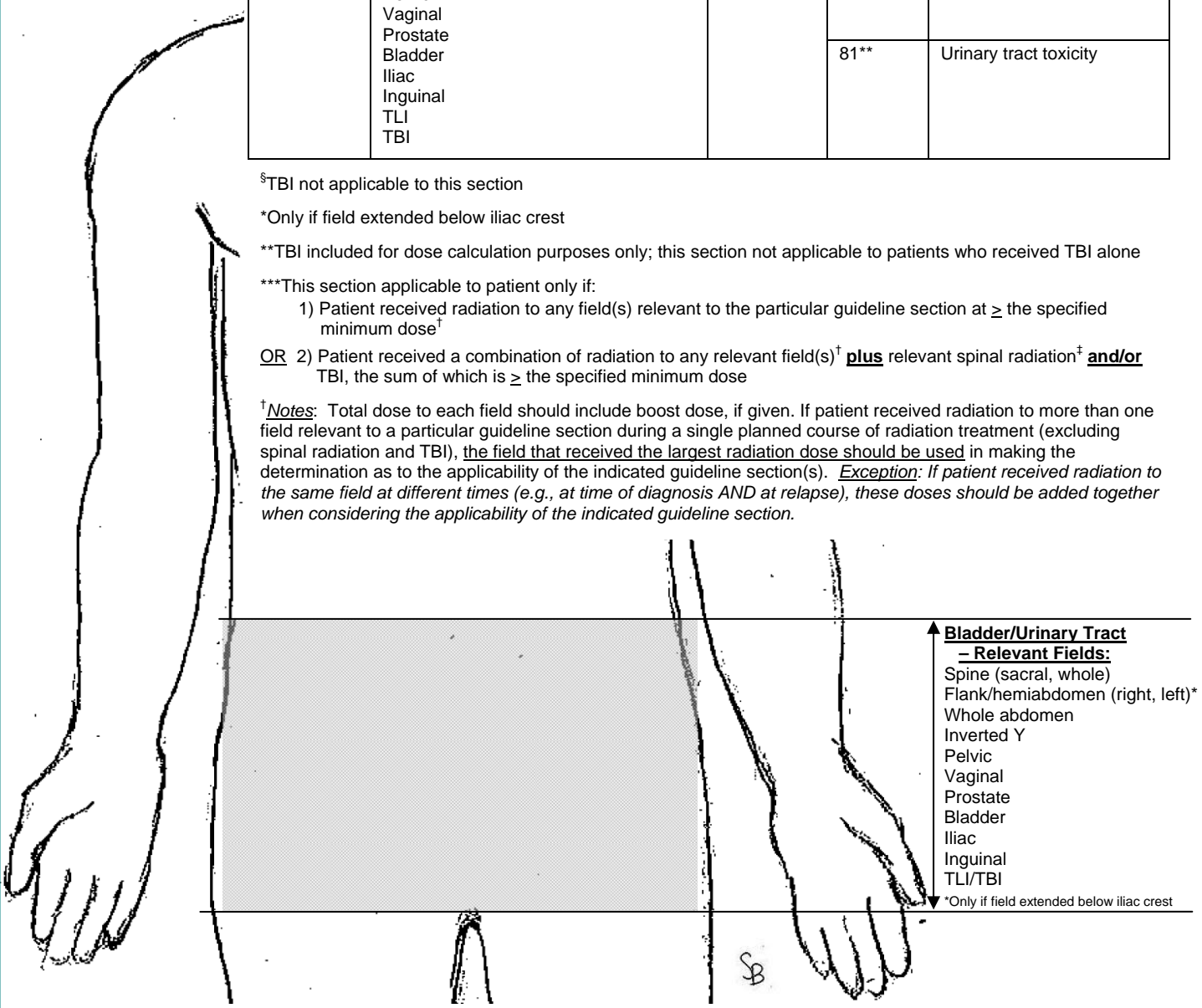
\*\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*\*This section applicable to patient only if:

1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

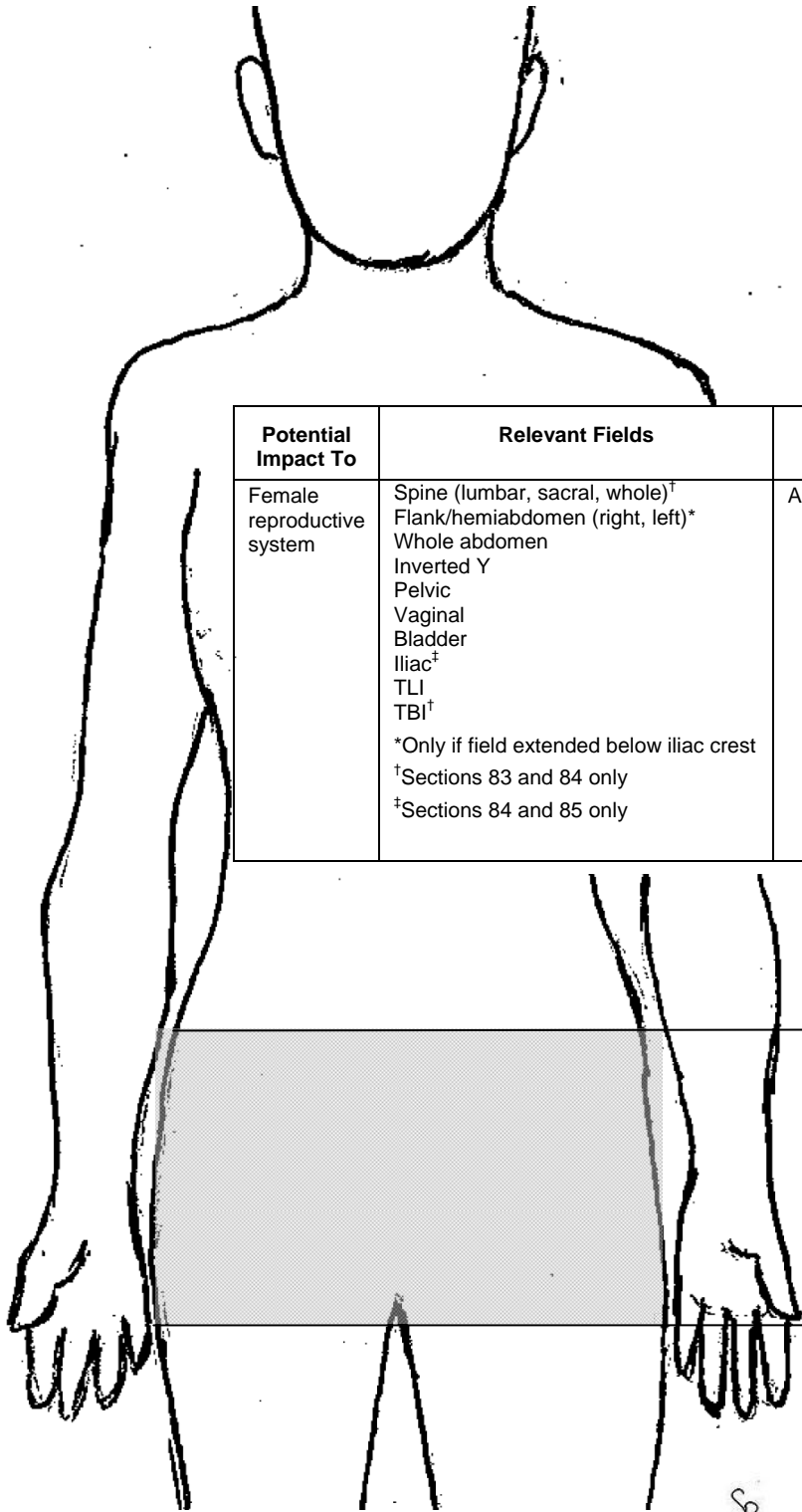
OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>†</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>Notes: Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.



**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Female Reproductive System**



Potential Impact To	Relevant Fields	Dose	Section Numbers	Potential Late Effects
Female reproductive system	Spine (lumbar, sacral, whole) <sup>†</sup> Flank/hemiabdomen (right, left)* Whole abdomen Inverted Y Pelvic Vaginal Bladder Iliac <sup>‡</sup> TLI <sup>†</sup> TBI <sup>†</sup>	Any dose	83	Uterine vascular insufficiency
			84	Gonadal dysfunction (ovarian)
			85	Vaginal fibrosis/stenosis
	*Only if field extended below iliac crest <sup>†</sup> Sections 83 and 84 only <sup>‡</sup> Sections 84 and 85 only			

**Female Reproductive System - Relevant Fields:**  
 Spine (lumbar, sacral, whole)<sup>†</sup>  
 Flank/hemiabdomen (right, left)\*  
 Whole abdomen  
 Inverted Y  
 Pelvic  
 Vaginal  
 Bladder  
 Iliac<sup>‡</sup>  
 TLI<sup>†</sup>  
 TBI<sup>†</sup>

\*Only if field extended below iliac crest  
<sup>†</sup>Sections 83 and 84 only  
<sup>‡</sup>Sections 84 and 85 only



**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO:  
Male Reproductive System**

Potential Impact To	Relevant Fields	Dose	Section Numbers	Potential Late Effects
Male reproductive system	Flank/hemiabdomen (right, left)* Whole abdomen Inverted Y Pelvic Prostate Bladder Iliac Inguinal Femoral Testicular TLI TBI	Any dose	86	Gonadal dysfunction (testicular): Germ cell failure
		≥20 Gy***	87**	Gonadal dysfunction (testicular): Leydig cell failure

\*Only if field extended below iliac crest

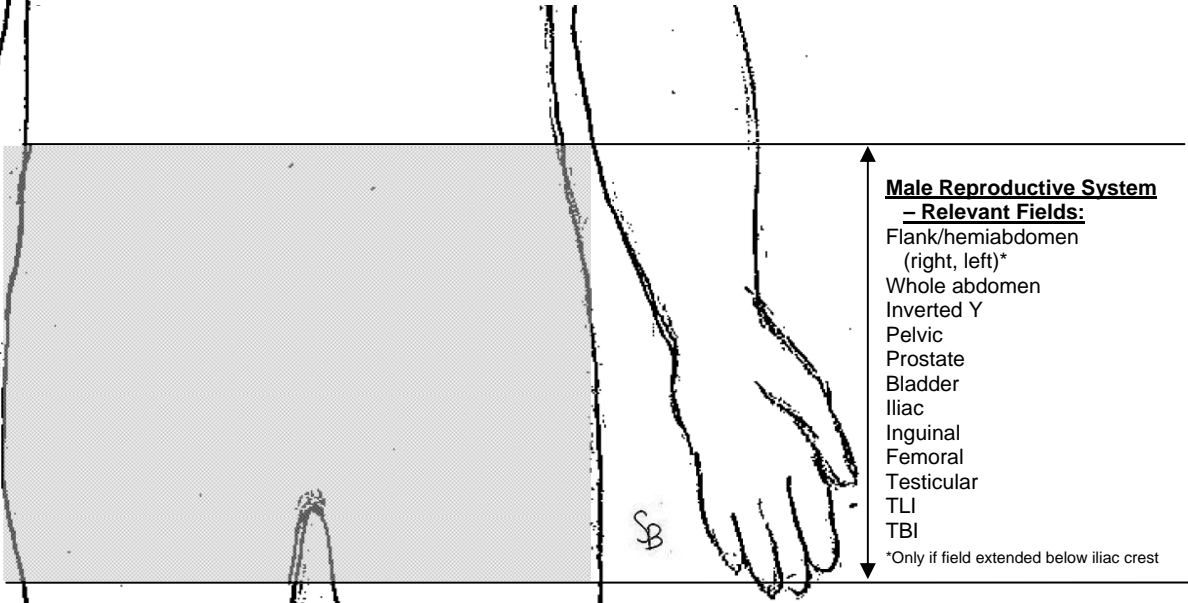
\*\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*\*This section is applicable to patient only if:

- 1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

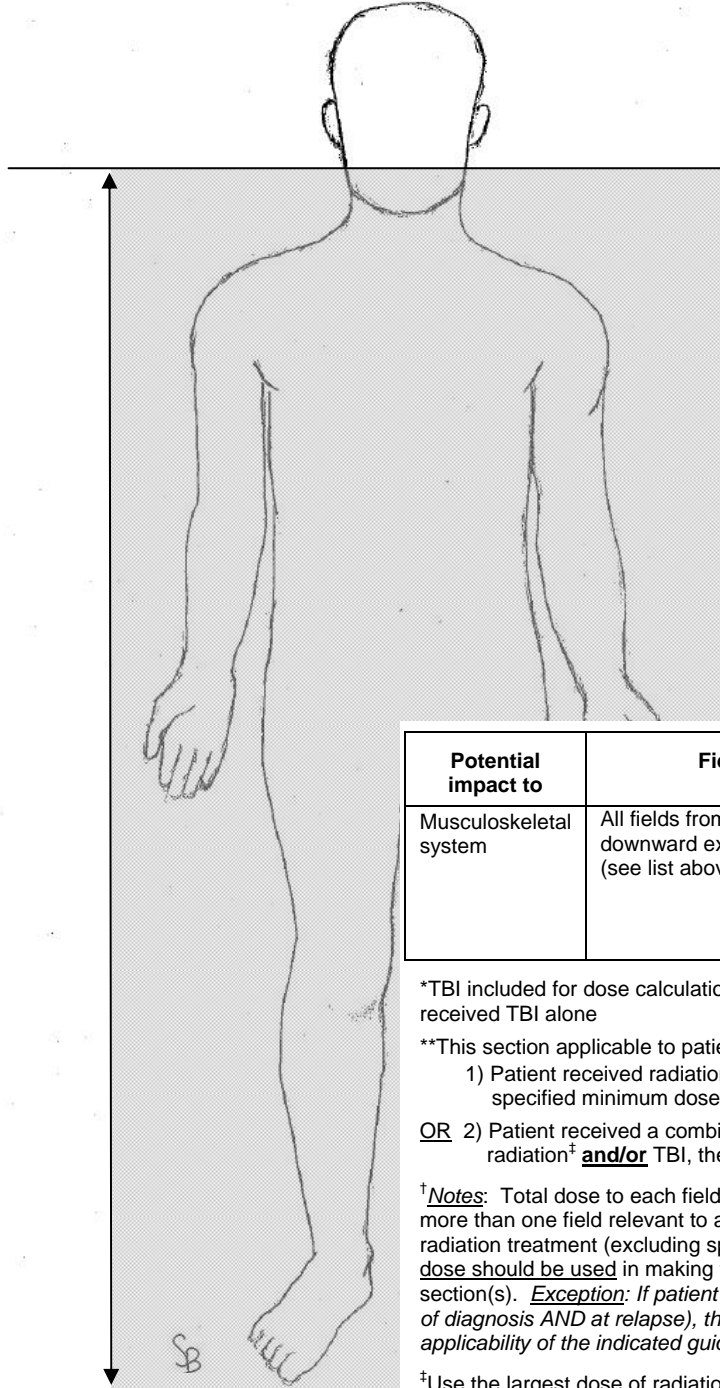
OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **and** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>Notes: Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). Exception: If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.



**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO THE:  
Musculoskeletal System  
(Growth Problems, Radiation-Induced Fracture)**



**Musculoskeletal System - Relevant Fields**

All fields from neck downward

- Spine (cervical, thoracic, lumbar, sacral, whole)
- Cervical (neck)
- Supraclavicular
- Chest (thorax)
- Whole lung
- Mediastinal
- Axilla
- Mini-Mantle
- Mantle
- Extended mantle
- Hepatic
- Renal
- Upper quadrant (right, left)
- Spleen (partial, entire)
- Paraortic
- Flank/hemiabdomen (right, left)
- Whole abdomen
- Inverted Y
- Pelvic
- Vaginal
- Prostate
- Bladder
- Iliac
- Inguinal
- Femoral
- Extremity (upper, lower)
- TLI
- STLI
- TBI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Musculoskeletal system	All fields from neck downward except testicular (see list above)	Any	88	Musculoskeletal growth problems
		≥40 Gy**	91*	Radiation-induced fracture

\*TBI included for dose calculation purposes only; this section not applicable to patients who received TBI alone

\*\*This section applicable to patient only if:

1) Patient received radiation to any field(s) relevant to the particular guideline section at ≥ the specified minimum dose<sup>†</sup>

OR 2) Patient received a combination of radiation to any relevant field(s)<sup>†</sup> **plus** relevant spinal radiation<sup>†</sup> **and/or** TBI, the sum of which is ≥ the specified minimum dose

<sup>†</sup>**Notes:** Total dose to each field should include boost dose, if given. If patient received radiation to more than one field relevant to a particular guideline section during a single planned course of radiation treatment (excluding spinal radiation and TBI), the field that received the largest radiation dose should be used in making the determination as to the applicability of the indicated guideline section(s). **Exception:** If patient received radiation to the same field at different times (e.g., at time of diagnosis AND at relapse), these doses should be added together when considering the applicability of the indicated guideline section.

<sup>‡</sup>Use the largest dose of radiation delivered to the spinal field(s) specified in the guideline section

**Relevant Guideline Radiation Sections for Patients who Received**

**RADIATION WITH POTENTIAL IMPACT TO THE:  
Musculoskeletal System  
(Scoliosis/Kyphosis)**

**Musculoskeletal System  
Scoliosis/Kyphosis –  
Relevant Fields:**

- Spine (thoracic, whole)
- Chest (thorax)
- Whole lung
- Mediastinal
- Mantle
- Extended Mantle
- Hepatic
- Renal
- Upper quadrant (right, left)
- Spleen (partial, entire)
- Paraaortic
- Flank/hemiabdomen (right, left)
- Whole abdomen
- Inverted Y
- TLI
- STLI

Potential impact to	Fields	Dose	Section Numbers	Potential Late Effects
Musculokeletal system	Spine (thoracic, whole) Chest (thorax) Whole lung Mediastinal Mantle	Any	89	Scoliosis
	Extended Mantle Hepatic Renal Upper quadrant (right, left) Spleen (partial, entire) Paraaortic Flank/hemiabdomen (right, left) Whole abdomen Inverted Y TLI STLI		90	Kyphosis

## Radiation Reference Guide - Index by Radiation Field

RADIATION FIELD	SEE PAGES	POTENTIALLY RELEVANT SECTION NUMBERS
<b>ALL RADIATION FIELDS:</b>		
All radiation fields including TBI	9-10	<b>Any dose:</b> Sections 38, 39
All radiation fields <u>except</u> TBI	10	<b>Any dose:</b> Sections 40, 41
<b>TOTAL BODY IRRADIATION (TBI):</b>		
Total body irradiation (TBI)	9	<b>Any dose:</b> Sections 38, 39, 42, 43, 44, 49, 50, 56, 60, 62, 63, 64, 68F <sup>†</sup> , 69F, 70, 71M/F, 78 <sup>‡</sup> , 79, 83F, 84F, 86M, 88 <sup>†</sup> Screening <u>may</u> be indicated; refer to Info Link in this section
<b>HEAD/BRAIN:</b>		
Cranial	10-13	<b>Any dose:</b> Sections 42, 43, 44, 46, 47, 48, 49, 50, 51M/F, 56, 59, 60, 62, 63, 64 <b>Minimum dose specifications apply:</b> Sections 45, 52M/F, 53, 54 M/F, 55, 57, 58, 61, 65, 66
Orbital/Eye	10-11	<b>Any dose:</b> Sections 42, 46, 47, 48, 49, 50, 51M/F, 56 <b>Minimum dose specifications apply:</b> Sections 45, 52M/F, 53, 54M/F, 55, 57
Ear/Infratemporal	10-11	<b>Any dose:</b> Sections 42, 43, 44, 46, 47, 48, 49, 50, 51M/F <b>Minimum dose specifications apply:</b> Sections 45, 52M/F, 53, 54M/F, 55, 58
Nasopharyngeal	10-13	<b>Any dose:</b> Sections 42, 46, 47, 48, 49, 50, 51M/F, 59, 60, 62, 63, 64 <b>Minimum dose specifications apply:</b> Sections 45, 52M/F, 53, 54M/F, 55, 58, 61, 65, 66
Oropharyngeal	10, 12-13	<b>Any dose:</b> Sections 59, 60, 62, 63, 64 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66
Waldeyer's Ring	10-13	<b>Any dose:</b> Sections 42, 46, 47, 48, 49, 50, 51M/F, 59, 60, 62, 63, 64 <b>Minimum dose specifications apply:</b> Sections 45, 52M/F, 53, 54M/F, 55, 58, 61, 65, 66
<b>SPINE:</b>		
Spine (cervical)	10, 12-13, 18, 25	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 88 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 73, 91
Spine (thoracic)	10, 16, 18, 20, 25-26	<b>Any dose:</b> Sections 71M/F, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 73, 76, 77, 78, 91
Spine (lumbar)	10, 20, 23, 25	<b>Any dose:</b> Sections 83F, 84F, 88 <b>Minimum dose specifications apply:</b> Sections 76, 77, 78, 91
Spine (sacral)	10, 20, 22-23, 25	<b>Any dose:</b> Sections 82, 83F, 84F, 88 <b>Minimum dose specifications apply:</b> Sections 76, 77, 78, 80, 81, 91
Spine (whole)	10, 12-13, 16, 18, 20, 22-23, 25-26	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 71M/F, 82, 83F, 84F, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 73, 76, 77, 78, 80, 81, 91

RADIATION FIELD	SEE PAGES	POTENTIALLY RELEVANT SECTION NUMBERS
<b>NECK:</b>		
Cervical (neck) Supraclavicular	10, 12-13, 18, 25	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 88 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 73, 91
Mini-Mantle	10, 12-15, 18, 25	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 69F, 70, 88 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 68F, 73, 91
Mantle	10, 12-16, 18, 25-26	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 69F, 70, 71M/F, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 68F, 73, 91
Extended Mantle	10, 12-16, 18-21, 25-26	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 69F, 70, 71M/F, 79, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 68F, 73, 74, 75, 76, 77, 78, 91
Subtotal Lymphoid (STLI)	10, 12-21, 25-26	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 69F, 70, 71M/F, 79, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 68F, 72, 73, 74, 75, 76, 77, 78, 91
Total Lymphoid (TLI)	10, 12-26	<b>Any dose:</b> Sections 59, 60, 62, 63, 64, 69F, 70, 71M/F, 79, 82, 83F, 84F, 85F, 86M, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 61, 65, 66, 67, 68F, 72, 73, 74, 75, 76, 77, 78, 80, 81, 87M, 91
<b>AXILLA:</b>		
Axilla	10, 14-15, 25	<b>Any dose:</b> Sections 69F, 70, 88 <b>Minimum dose specifications apply:</b> Sections 68F, 91
Mini-Mantle	See "Neck"	See "Neck" (above)
Mantle	See "Neck"	See "Neck" (above)
Extended Mantle	See "Neck"	See "Neck" (above)
Subtotal Lymphoid (STLI)	See "Neck"	See "Neck" (above)
Total Lymphoid (TLI)	See "Neck"	See "Neck" (above)
<b>THORAX:</b>		
Chest (thorax):	10, 13-16, 18, 25-26	<b>Any dose:</b> Sections 62, 63, 64, 69F, 70, 71M/F, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 65, 66, 67, 68F, 73, 91
Whole lung	10, 13-16, 25-26	<b>Any dose:</b> Sections 62, 63, 64, 69F, 70, 71M/F, 88, 89, 90
Mediastinal	10, 13-16, 18, 25-26	<b>Any dose:</b> Sections 62, 63, 64, 69F, 70, 71M/F, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 65, 66, 67, 68F, 73, 91
Mini-Mantle	See "Neck"	See "Neck" (above)
Mantle	See "Neck"	See "Neck" (above)
Extended Mantle	See "Neck"	See "Neck" (above)
Subtotal Lymphoid (STLI)	See "Neck"	See "Neck" (above)
Total Lymphoid (TLI)	See "Neck"	See "Neck" (above)

RADIATION FIELD	SEE PAGES	POTENTIALLY RELEVANT SECTION NUMBERS
<b>ABDOMEN:</b>		
Any abdominal field* *Includes: Hepatic, renal, upper quadrant (right, left), spleen (partial, entire), paraaortic, flank/hemiabdomen (right, left)	10, 16-21, 25-26	<b>Any dose:</b> Sections 71M/F, 79, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 72 (if spleen in field*), 73, 74, 75, 76, 77, 78, 91 *includes left upper quadrant, entire spleen, left flank/hemiabdomen, and paraaortic if spleen in field
Extended mantle	See "Neck"	See "Neck" (page 2)
Subtotal Lymphoid (STLI)	See "Neck"	See "Neck" (page 2)
Total Lymphoid (TLI)	See "Neck"	See "Neck" (page 2)
Inverted Y	10, 16-26	<b>Any dose:</b> Sections 71 M/F, 79, 82, 83F, 84F, 85F, 86M, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 72 (if spleen in field), 73, 74, 75, 76, 77, 78, 80, 81, 87M, 91
Whole abdomen	10, 16-26	<b>Any dose:</b> Sections 71M/F, 79, 82, 83F, 84F, 85F, 86M, 88, 89, 90 <b>Minimum dose specifications apply:</b> Sections 72, 73, 74, 75, 76, 77, 78, 80, 81, 87M, 91
<b>PELVIS:</b>		
Any pelvic field** **Iliac crest to 3 cm below ischium. Includes: Pelvic, vaginal, prostate, bladder, iliac, inguinal, femoral; Flank/hemiabdomen included only if field extended below iliac crest	10, 20, 22-25	<b>Any dose:</b> Sections 82 (except femoral), 83F (except iliac/inguinal/femoral), 84F (except inguinal/femoral), 85F (except inguinal/femoral), 86M, 88 <b>Minimum dose specifications apply:</b> Sections 76, 77, 78, 80 (except femoral), 81 (except femoral), 87M, 91
Inverted Y	See "Abdomen"	See "Abdomen" (above)
Whole abdomen	See "Abdomen"	See "Abdomen" (above)
Total Lymphoid (TLI)	See "Neck"	See "Neck" (page 2)
<b>TESTICULAR:</b>		
Testicular	10, 24	<b>Any dose:</b> Section 86M <b>Minimum dose specifications apply:</b> Section 87M
<b>EXTREMITIES:</b>		
Extremity (Upper, Lower)	10, 25	<b>Any dose:</b> Section 88 <b>Minimum dose specifications apply:</b> Section 91