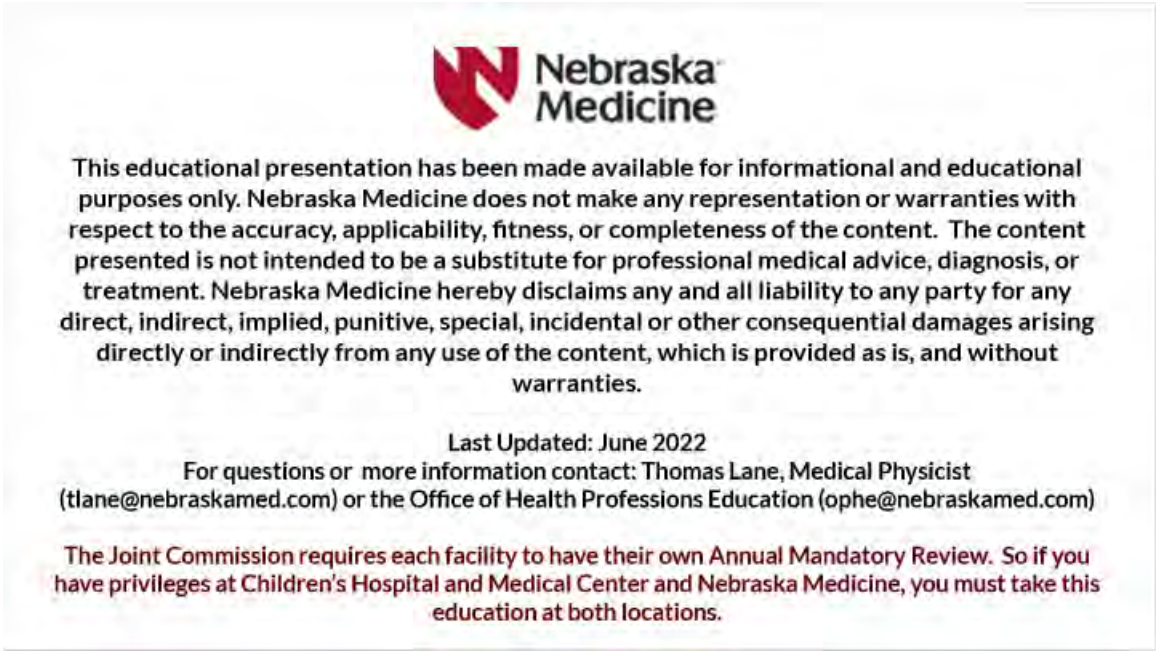
Initial Fluoroscopy Education for Providers

1. Initial Fluoroscopy Education for Providers

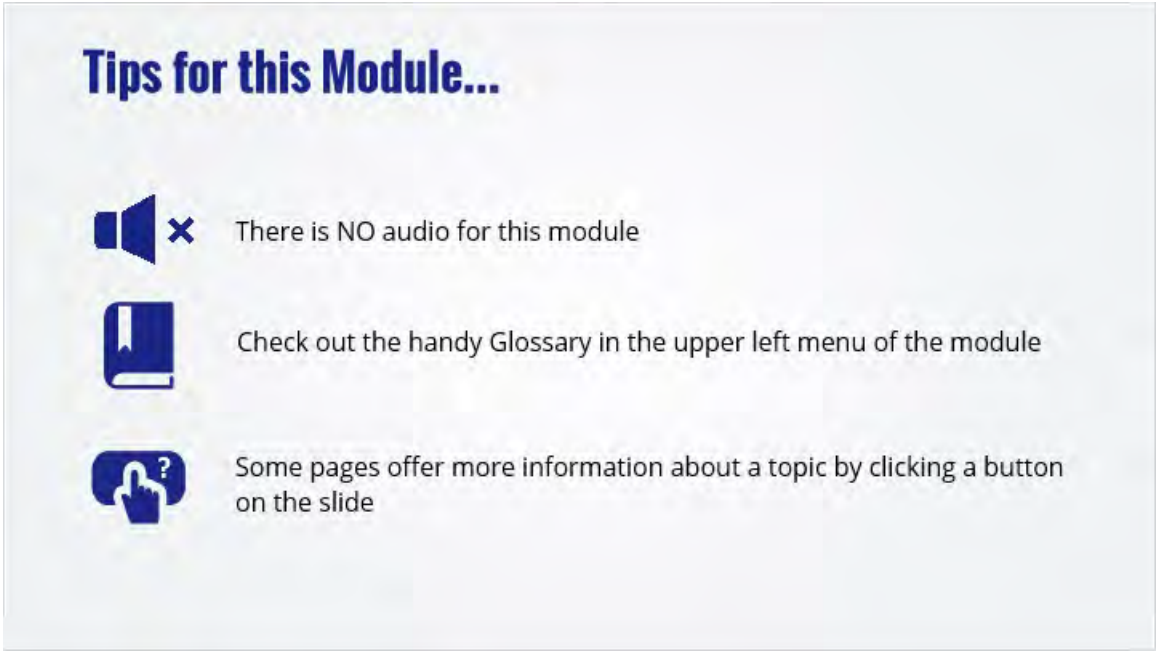
1.1 Title

Notes:

1.2 Nebraska Medicine Information

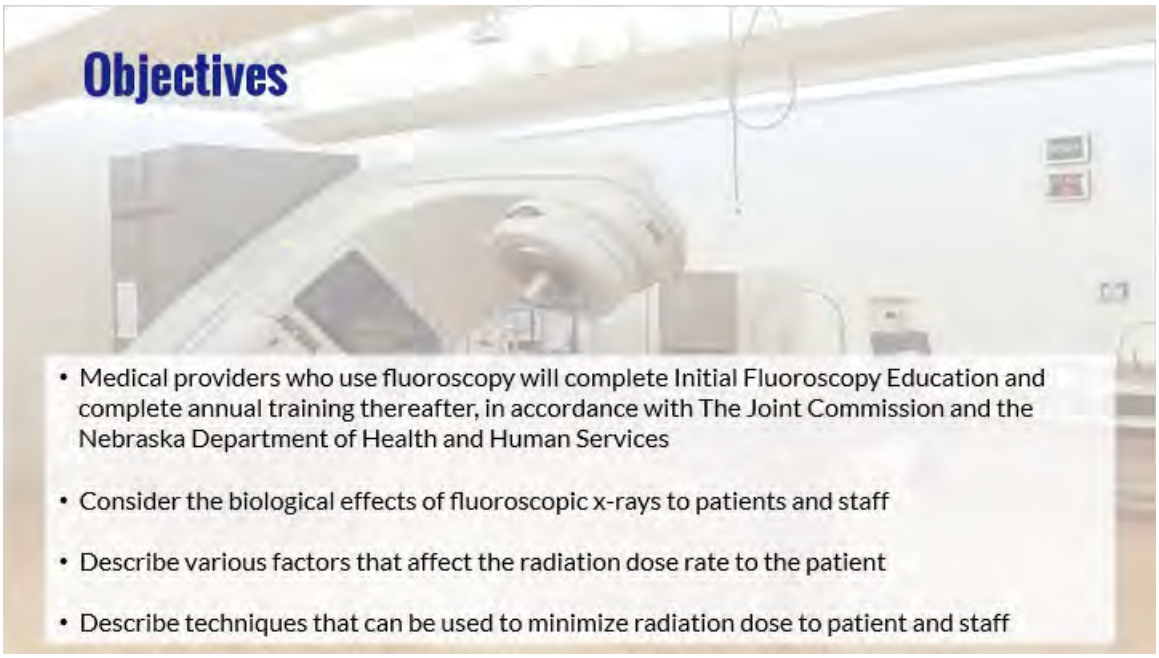


1.3 Tips for this Module…



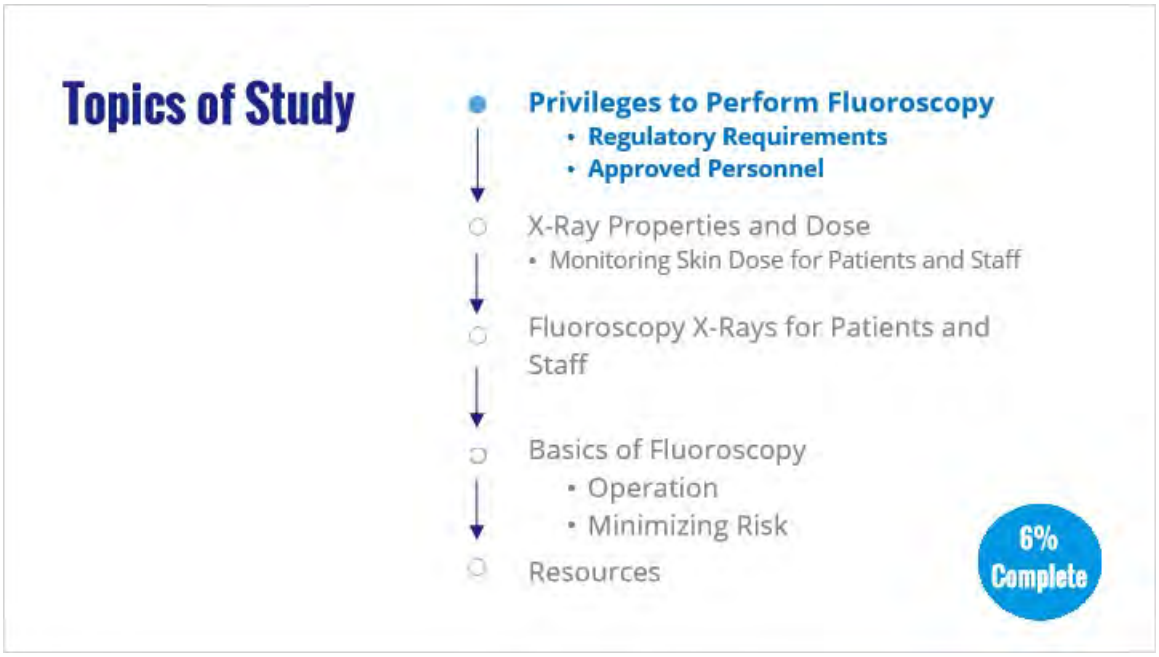
Notes:

1.4 Objectives

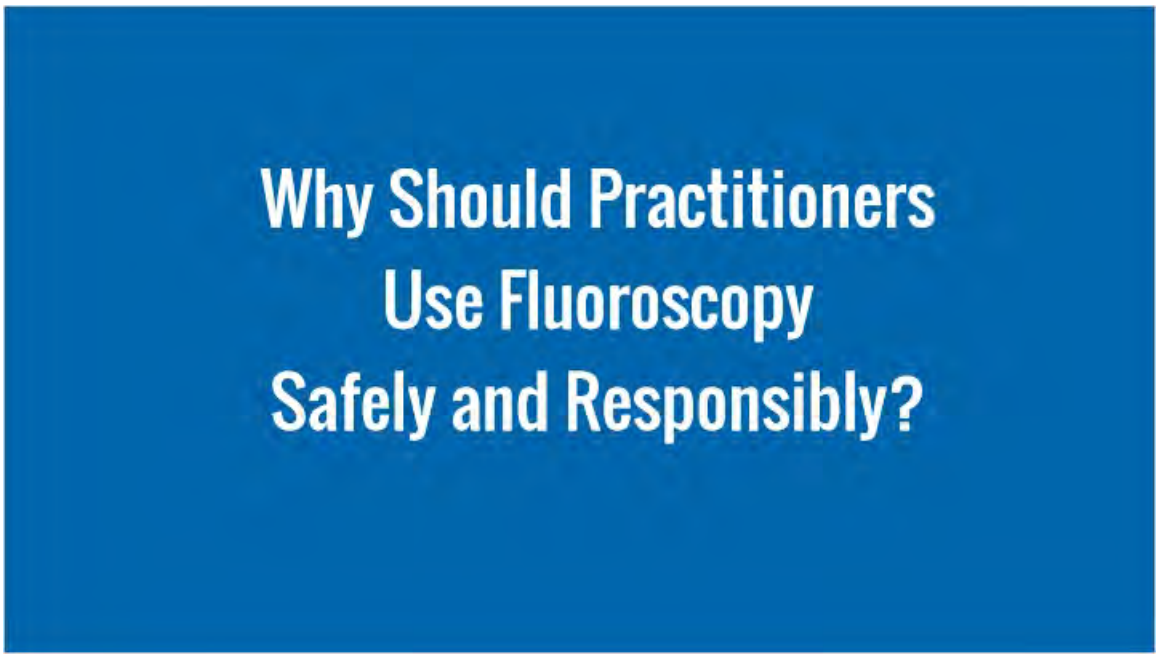


Notes:

1.5 Topics: Privileges to Perform Fluoroscopy

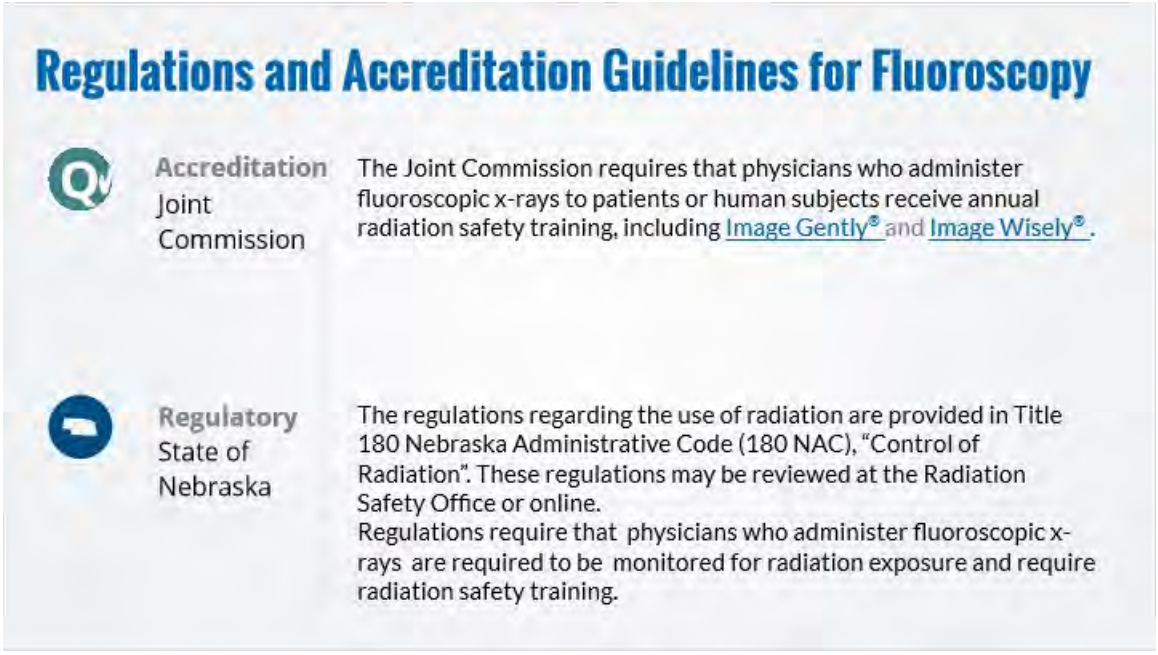


1.6 Worker's Right



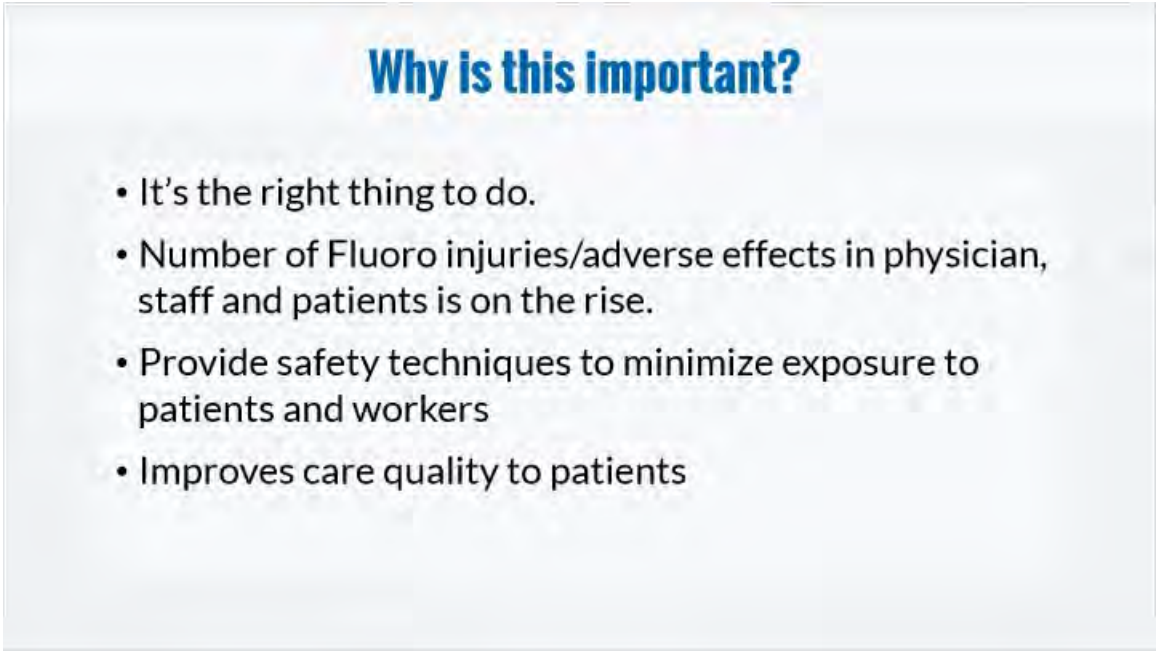
Notes:

1.7 Regulations and Accreditation Guidelines for Fluoroscopy



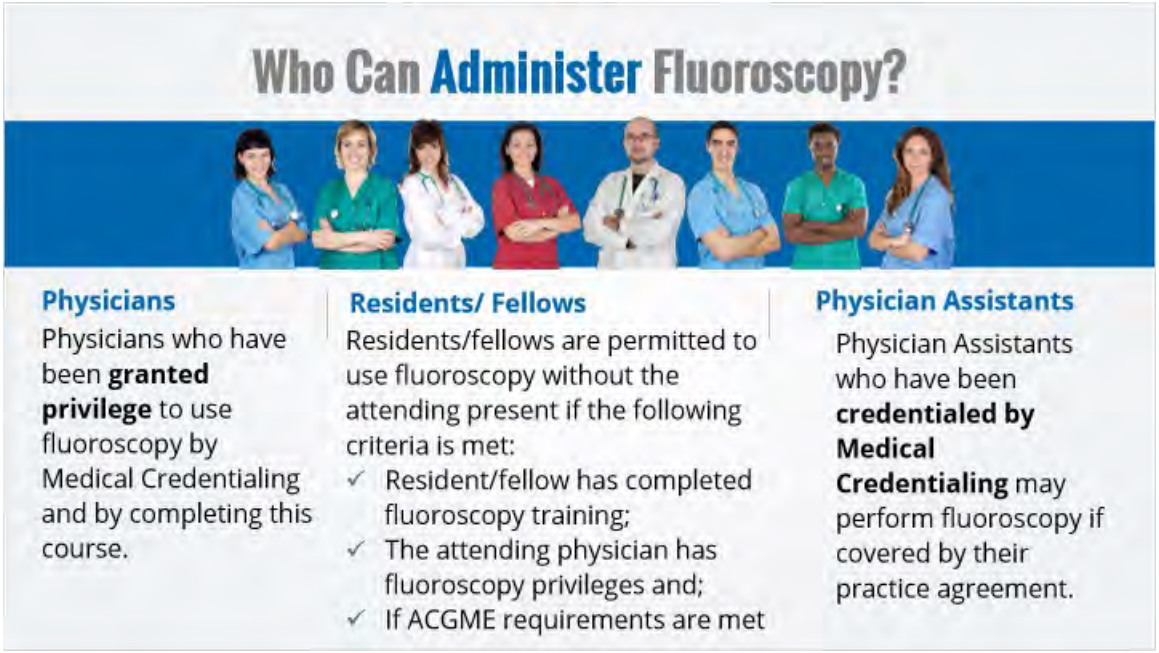
Notes:

1.8 Why is this important?

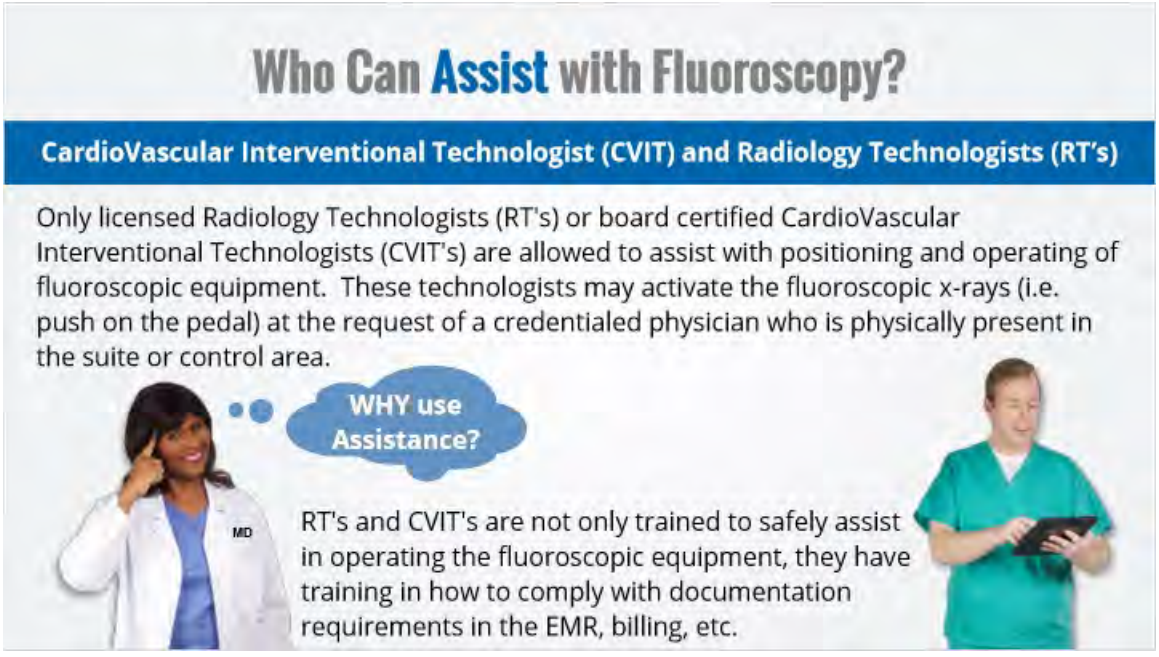


Notes:

1.9 Who Can Administer



1.10 Who Can Assist



1.11 Who Can NOT Administer

1.12 Who can administer fluoroscopic exams?

(Multiple Choice, 10 points, 3 attempts permitted)

Correct	Choice
	Nurse Practitioners (APRN) and nurses
X	Physicians who have been granted privileges, residents and fellows who have been fluor trained and supervised by privileged physicians, credentialed physician assistants
	All of the Above

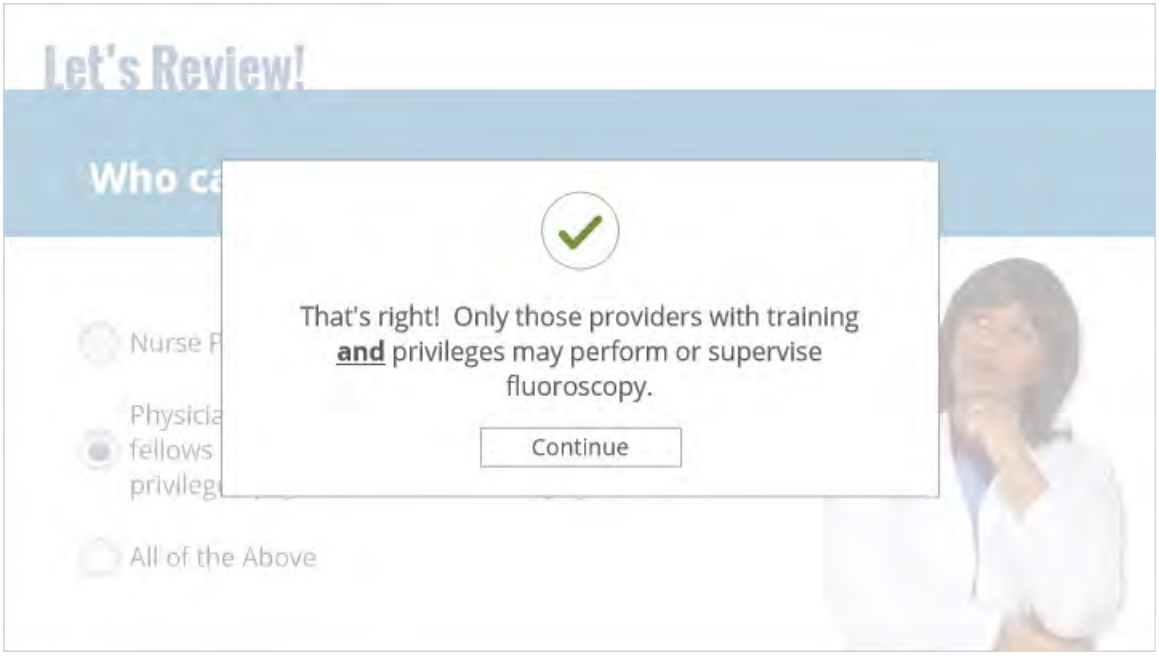
Feedback when correct:

That's right! Only those providers with training and privileges may perform or supervise fluoroscopy.

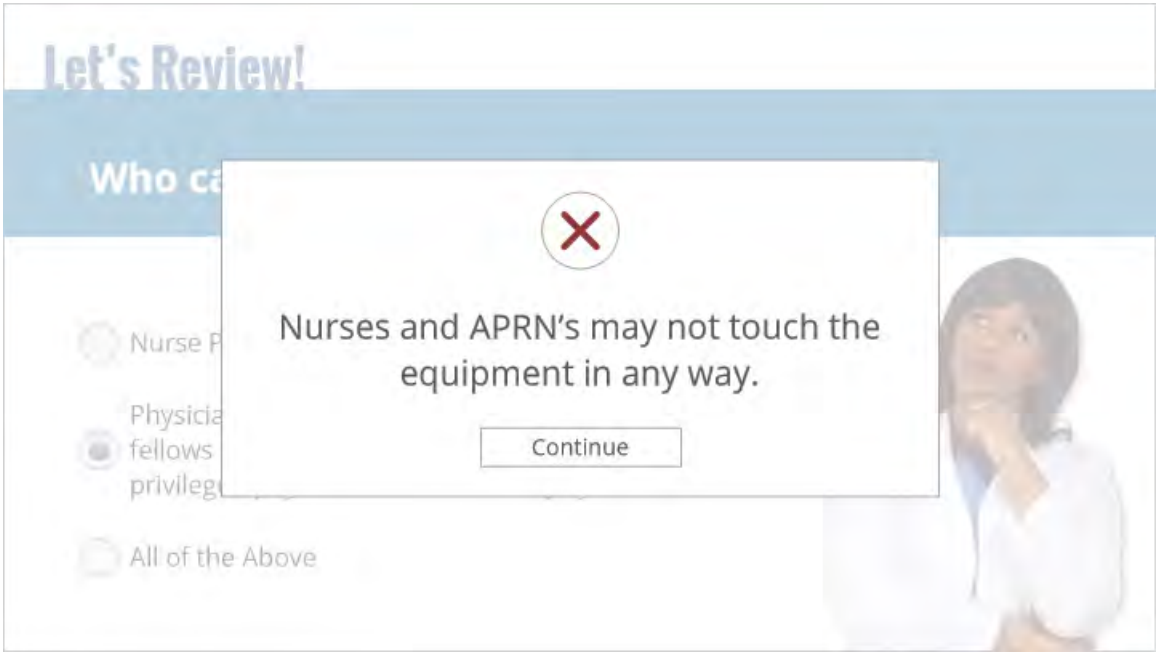
Feedback when incorrect:

Nurses and APRN's may not touch the equipment in any way.

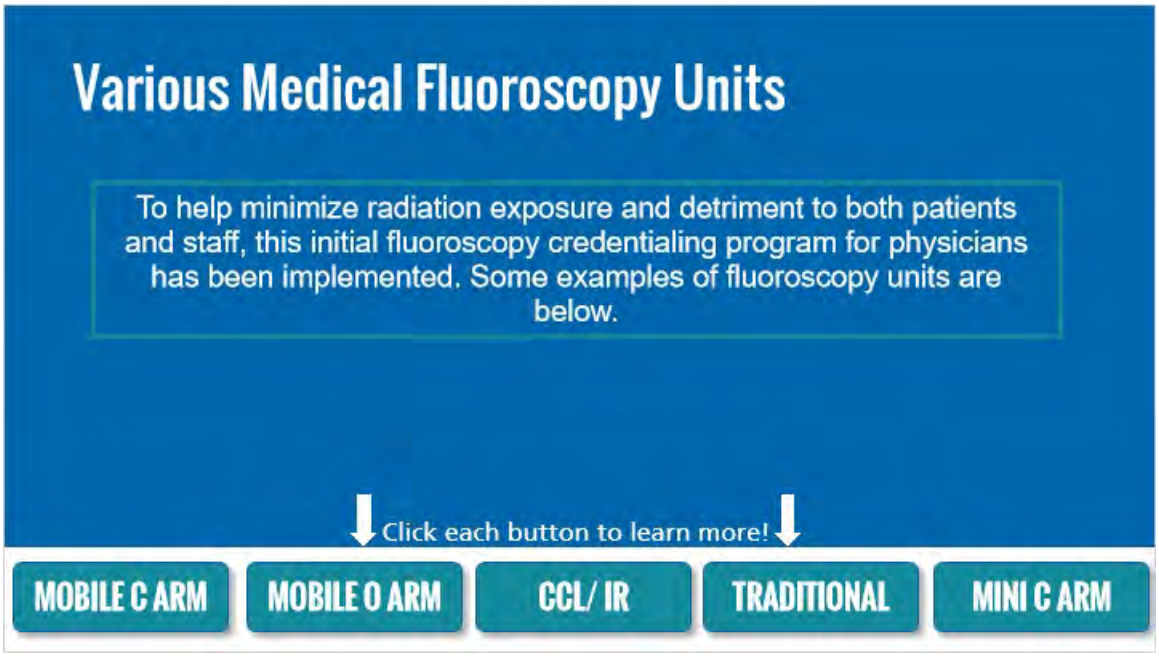
Correct (Slide Layer)



Incorrect (Slide Layer)



1.13 Examples of Fluoroscopy Units



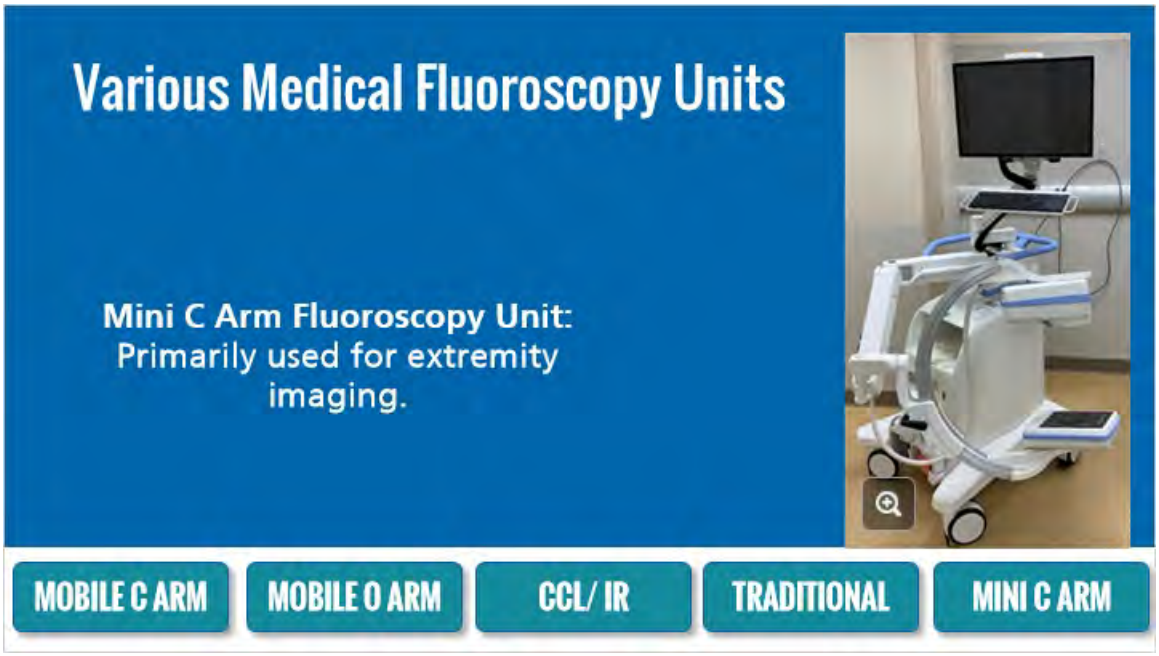
Mobile C (Slide Layer)

Mobile O (Slide Layer)

CCL (Slide Layer)

Traditional (Slide Layer)

Mini C (Slide Layer)



1.14 Does a physician need fluoroscopic privileges to use the mini-C arm, a unit used for extremities only?

(Multiple Choice, 10 points, 3 attempts permitted)

Correct	Choice
X	Yes
	No

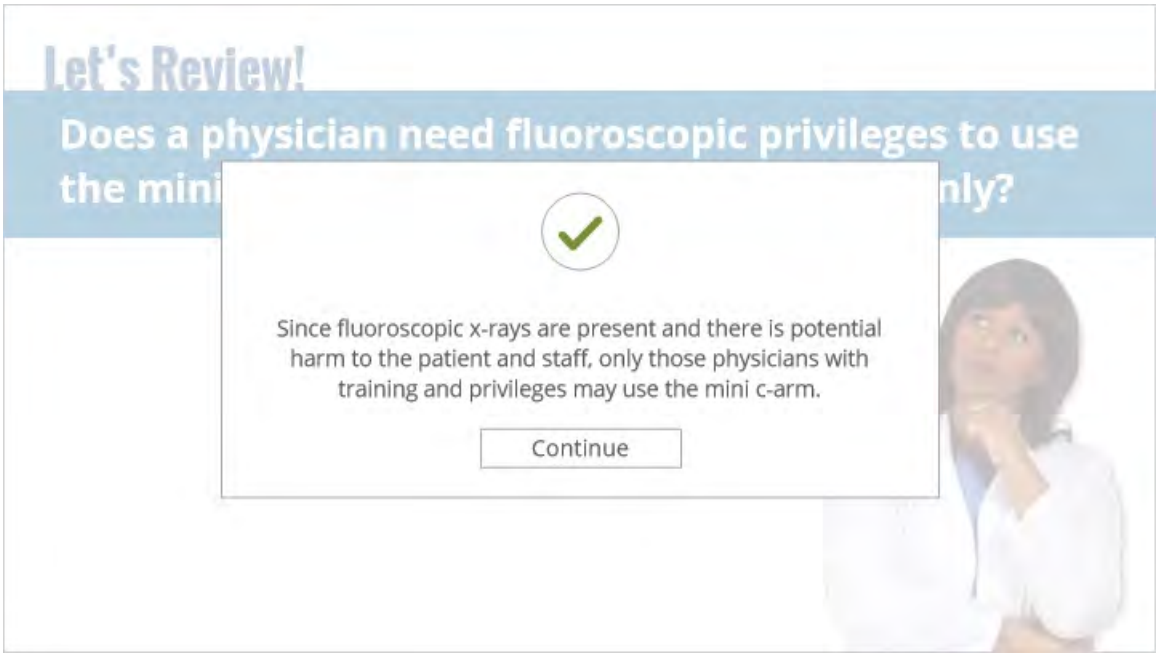
Feedback when correct:

Since fluoroscopic x-rays are present and there is potential harm to the patient and staff, only those physicians with training and privileges may use the mini c-arm.

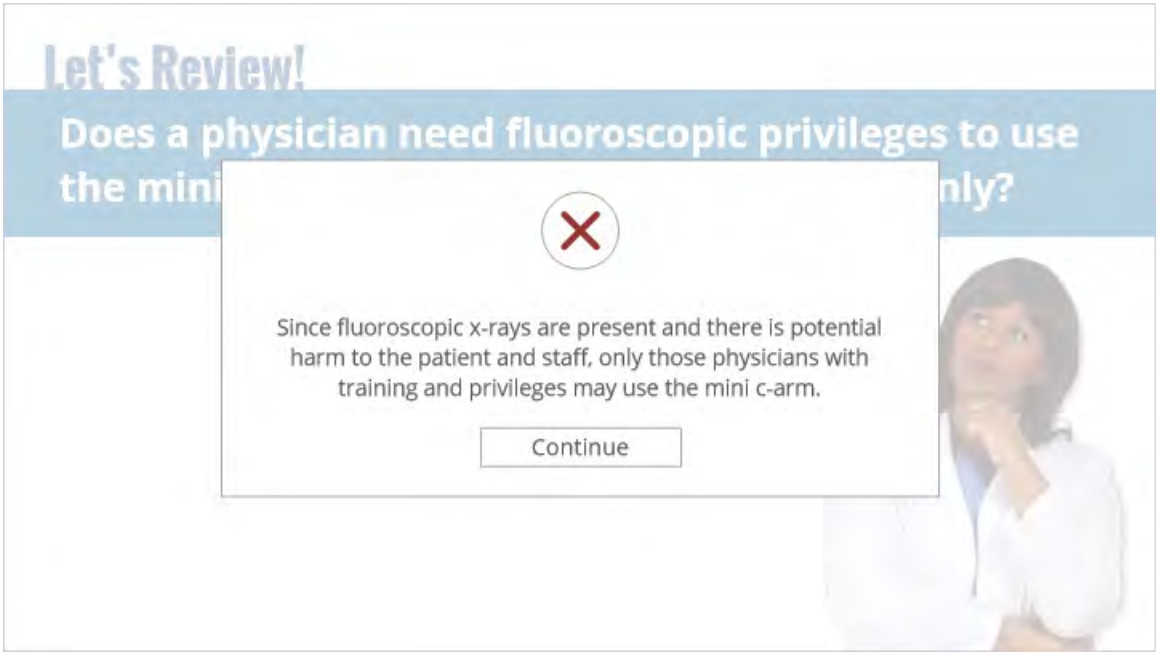
Feedback when incorrect:

Since fluoroscopic x-rays are present and there is potential harm to the patient and staff, only those physicians with training and privileges may use the mini c-arm.

Correct (Slide Layer)

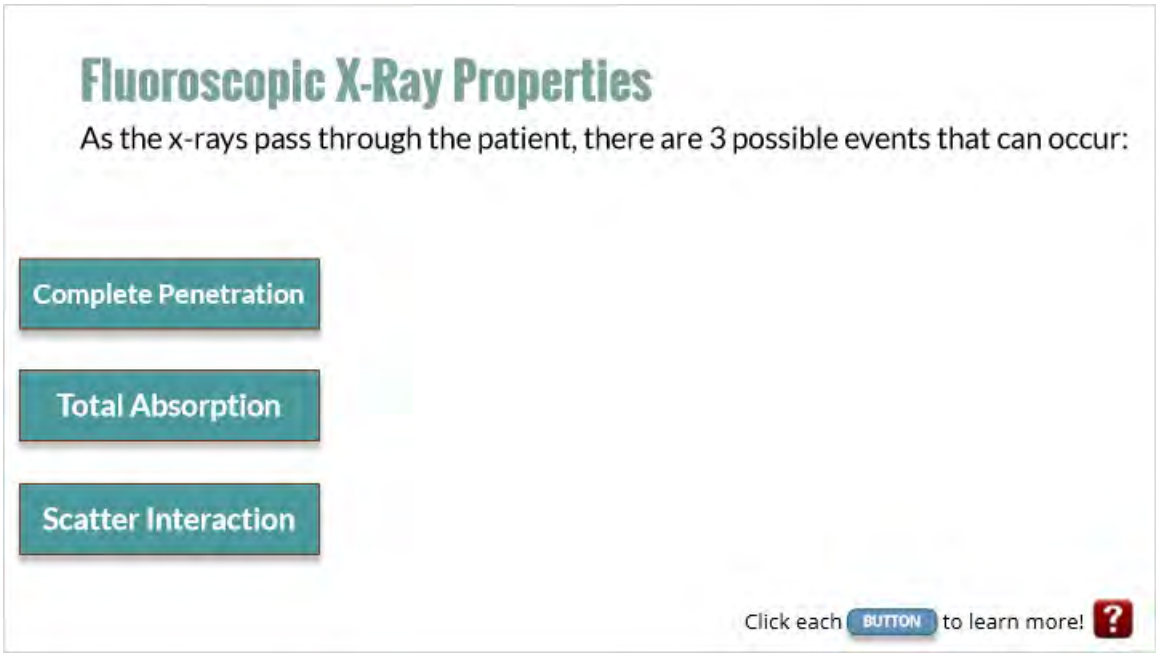


Incorrect (Slide Layer)



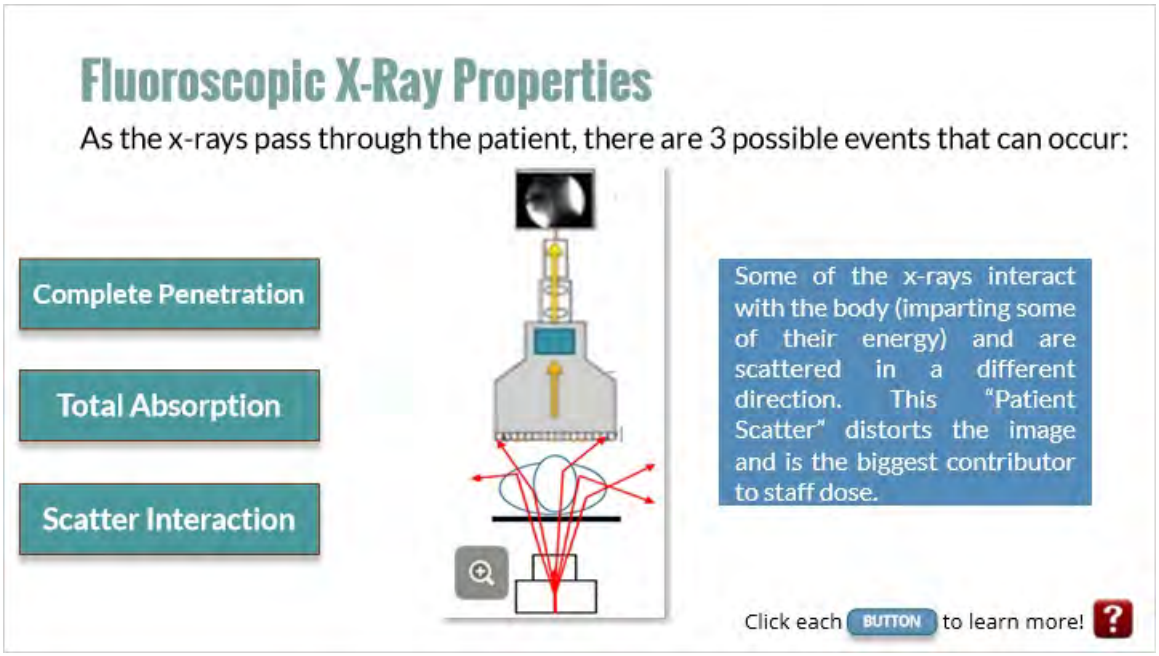
1.15 Topics: X-Ray Properties and Dose

1.16 Fluoroscopic X-Ray Properties

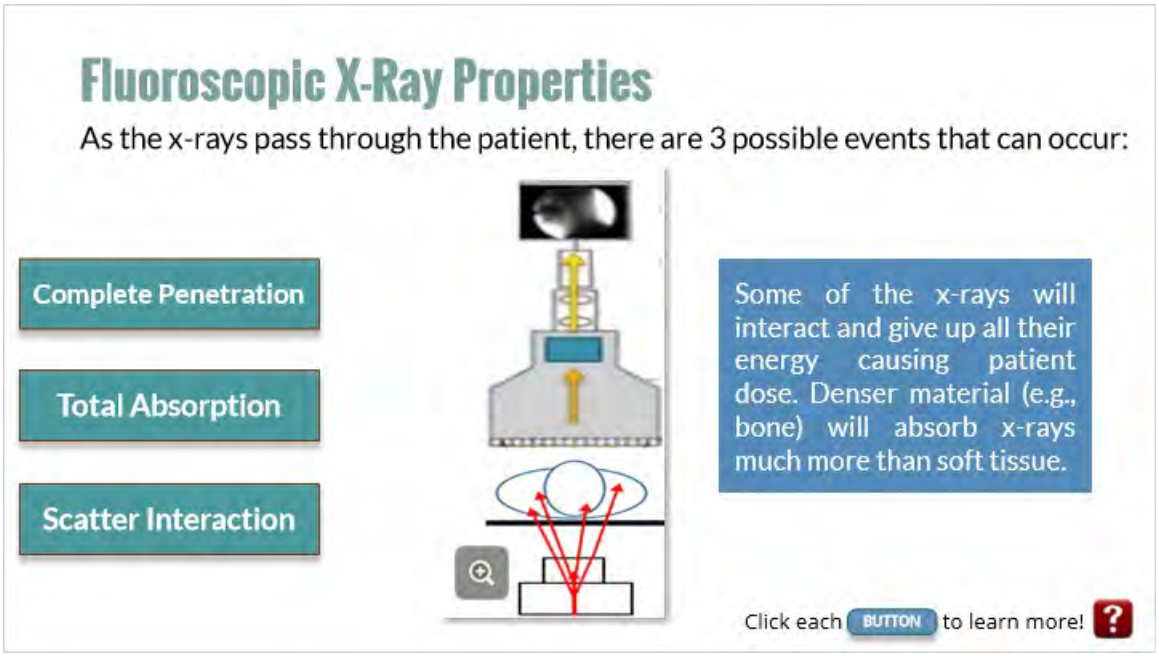


Notes:

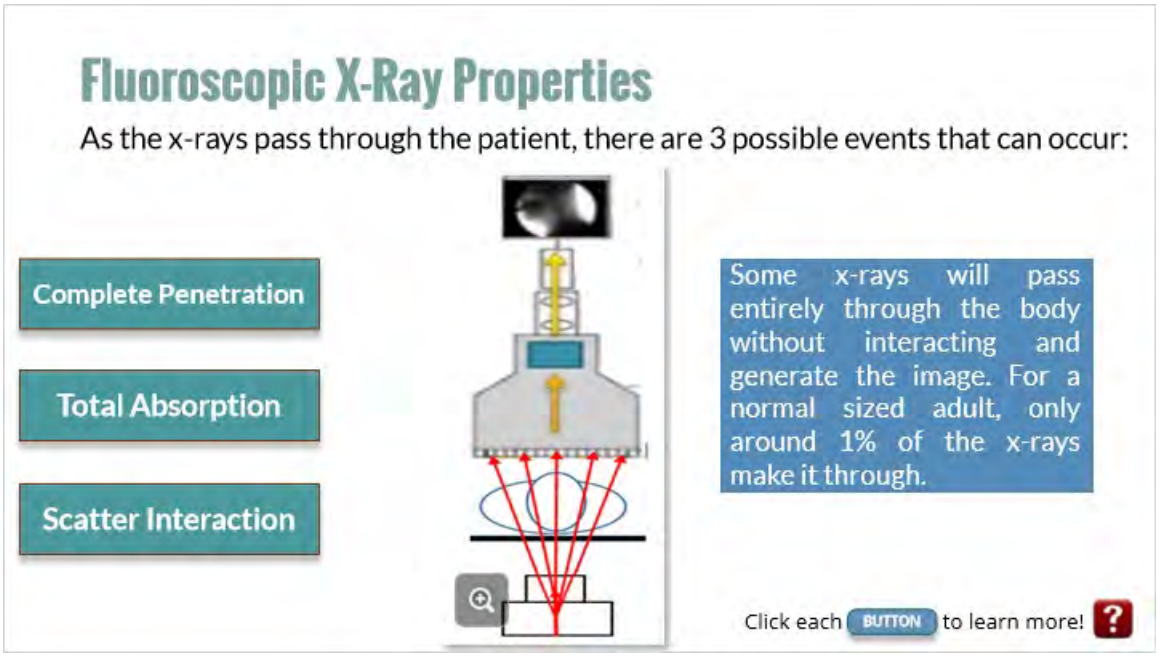
Scatter Interaction (Slide Layer)



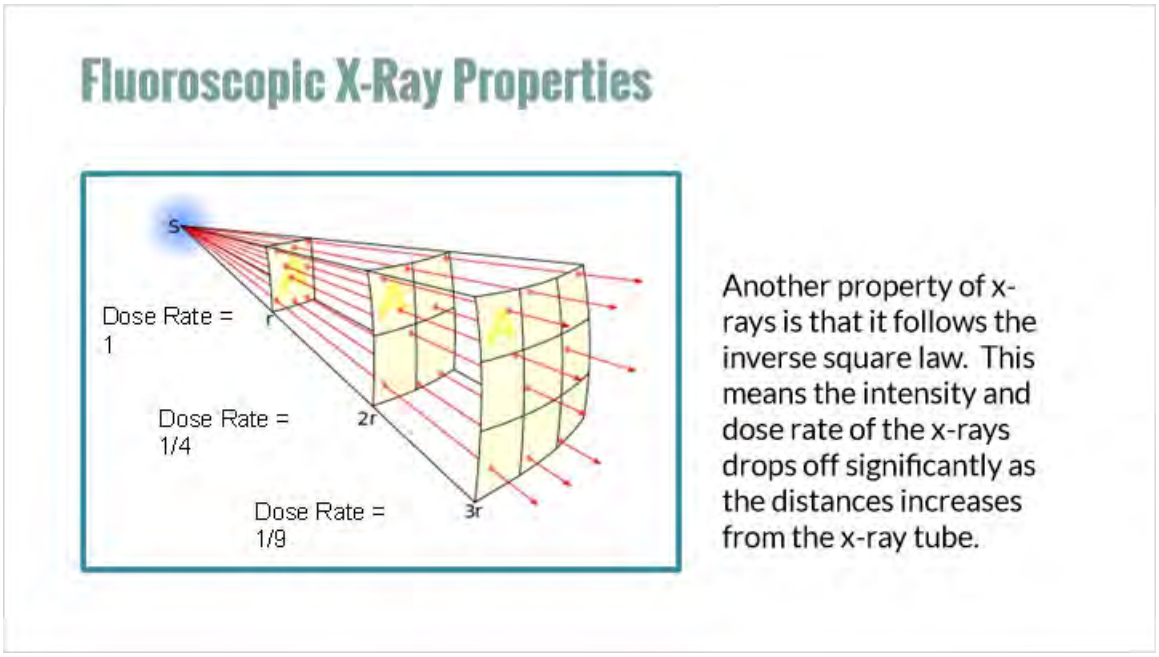
Total Absorption (Slide Layer)



Complete Penetration (Slide Layer)



1.17 Fluoroscopic X-Ray Properties

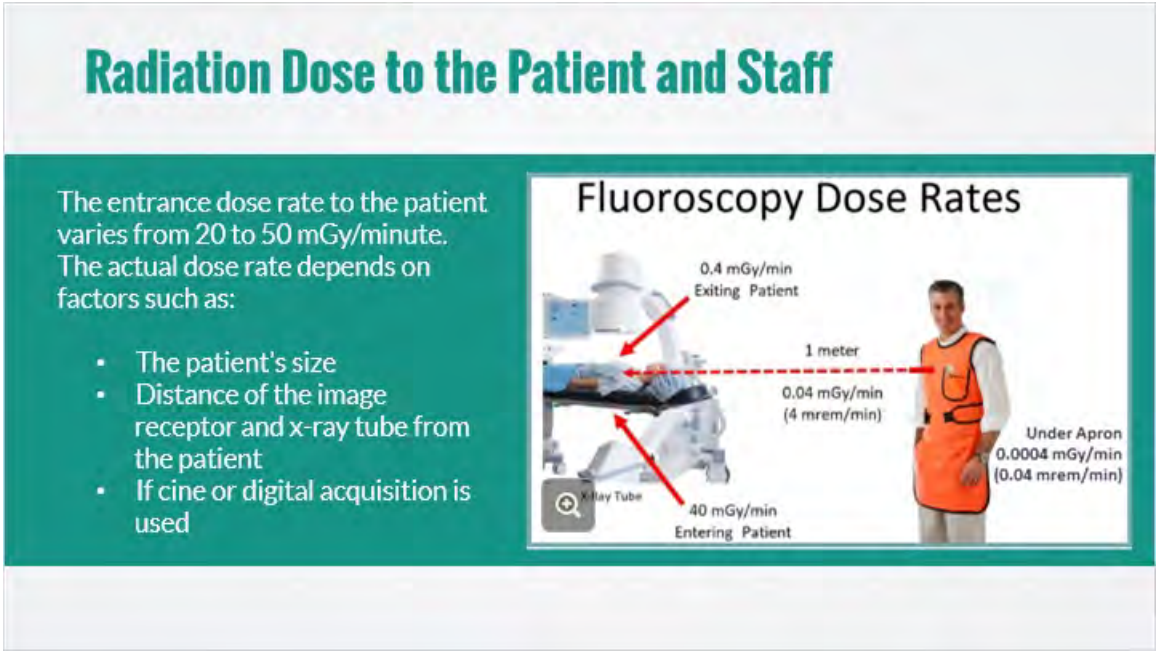


Notes:

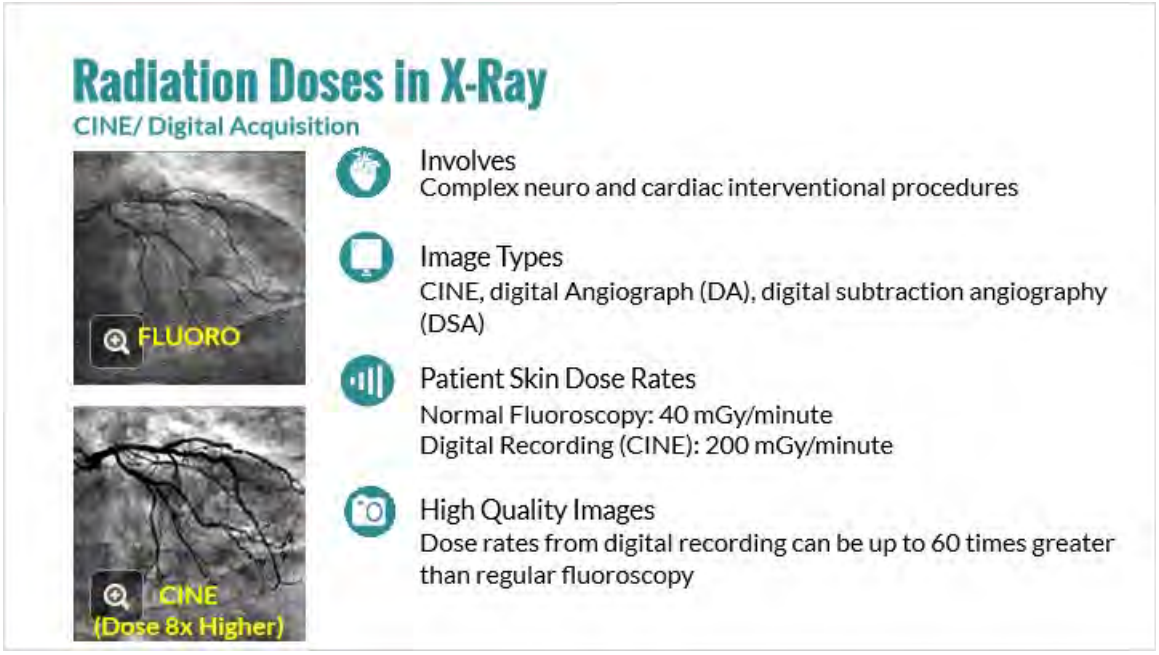
1.18 Units of Measure

Notes:

1.19 Radiation Dose to the Patient and Staff



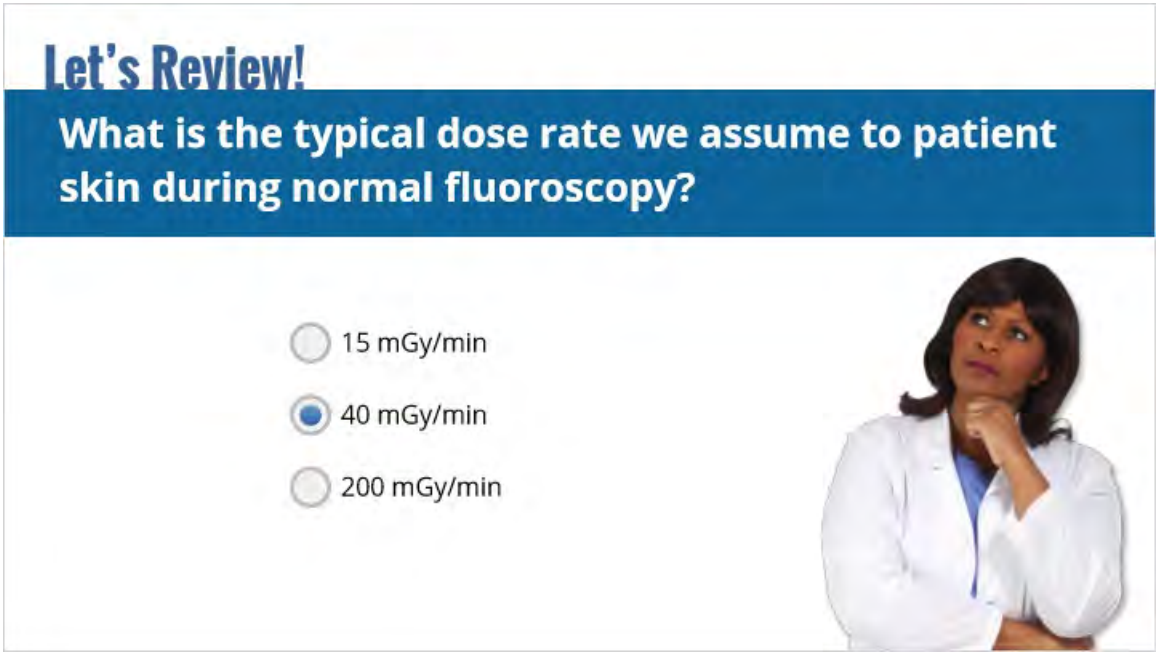
1.20 CINE/Digital Acquisition



Notes:

1.21 What is the typical dose rate we assume to patient skin during normal fluoroscopy?

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	15 mGy/min
X	40 mGy/min
	200 mGy/min

Feedback when correct:

The entrance dose rate to the patient varies from 20 to 50 mGy/minute, but

40 mGy/min is assumed.

Feedback when incorrect:

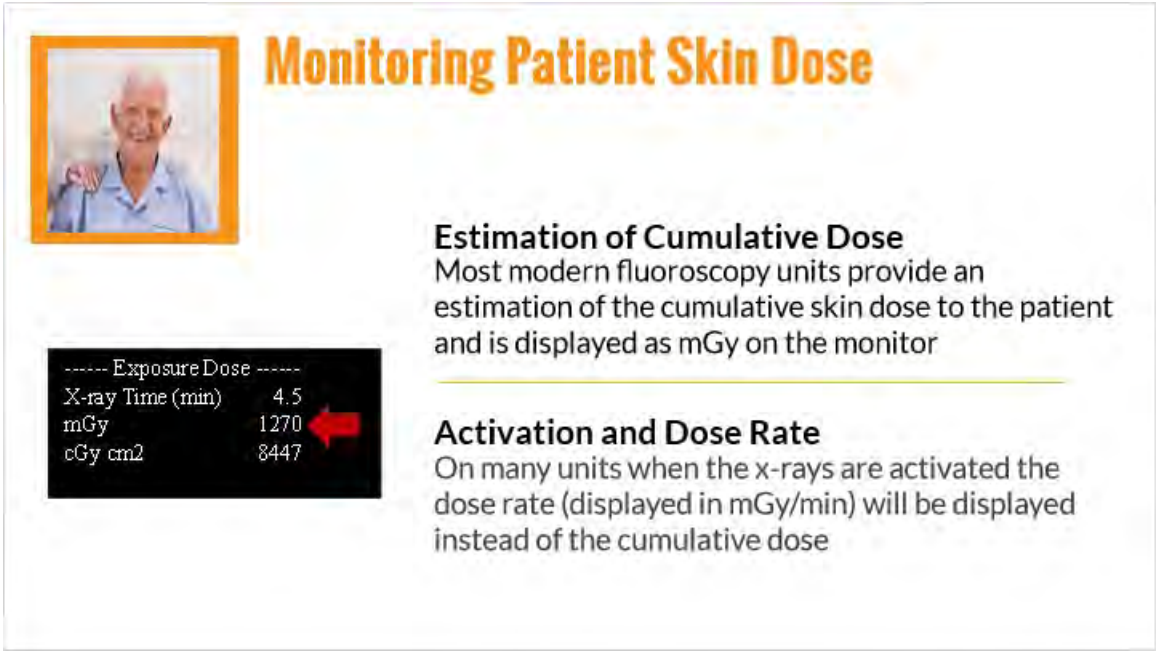
The entrance dose rate to the patient varies from 20 to 50 mGy/minute, but

40 mGy/min is assumed.

Correct (Slide Layer)

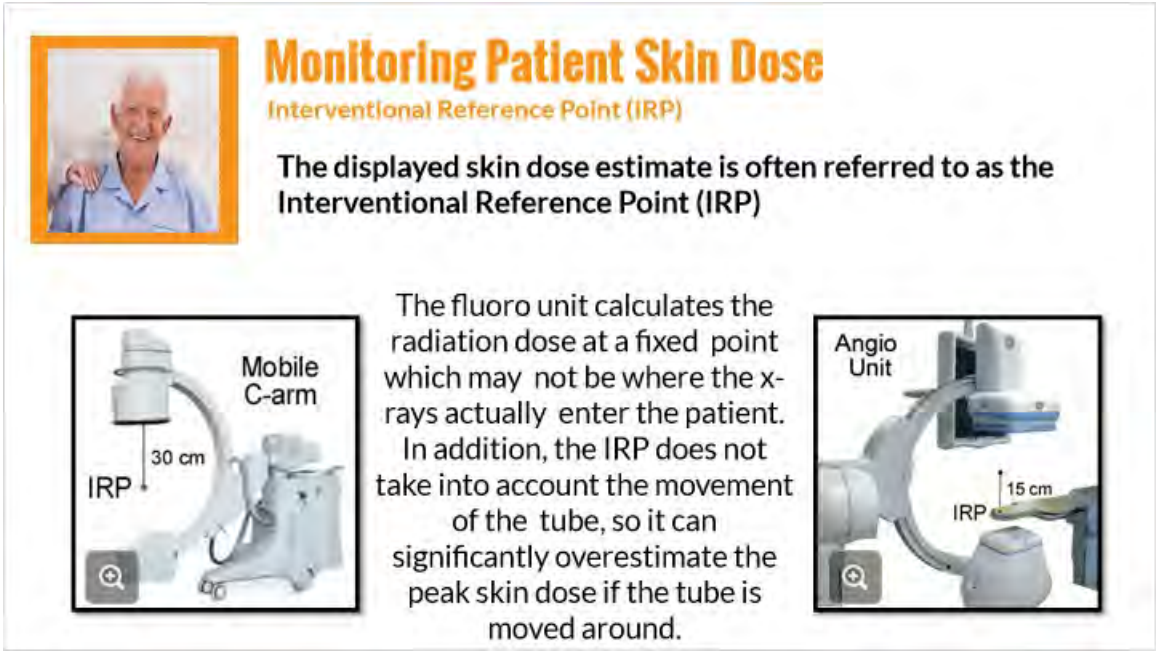
Incorrect (Slide Layer)

1.22 Monitoring Patient Skin Dose



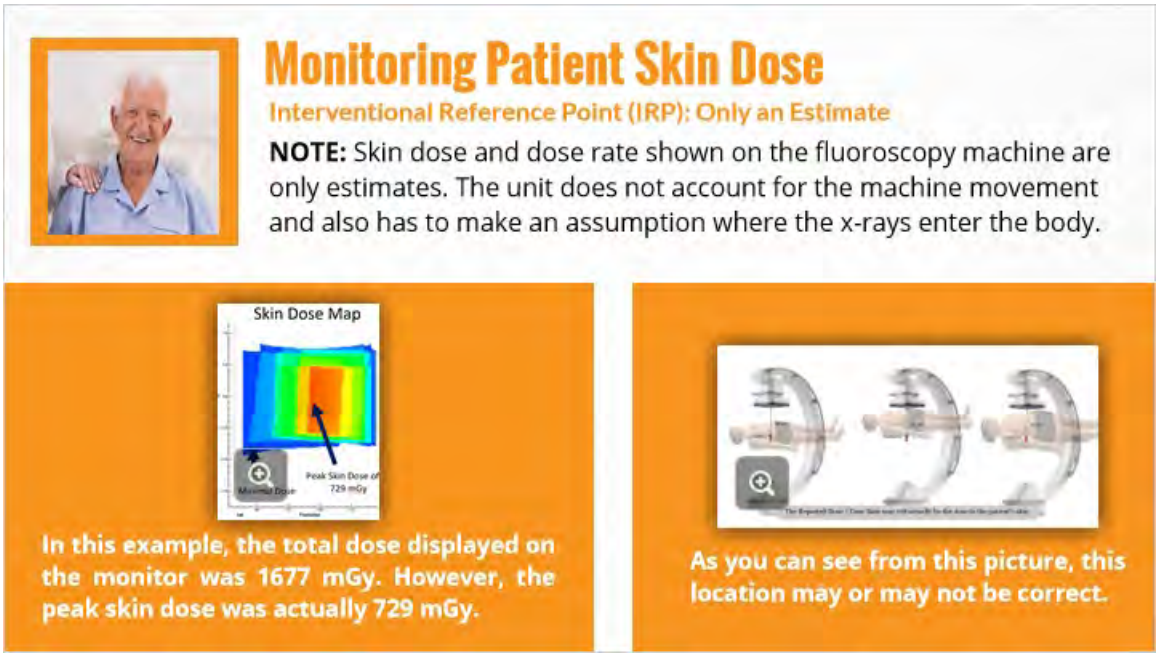
Notes:

1.23 Interventional Reference Point



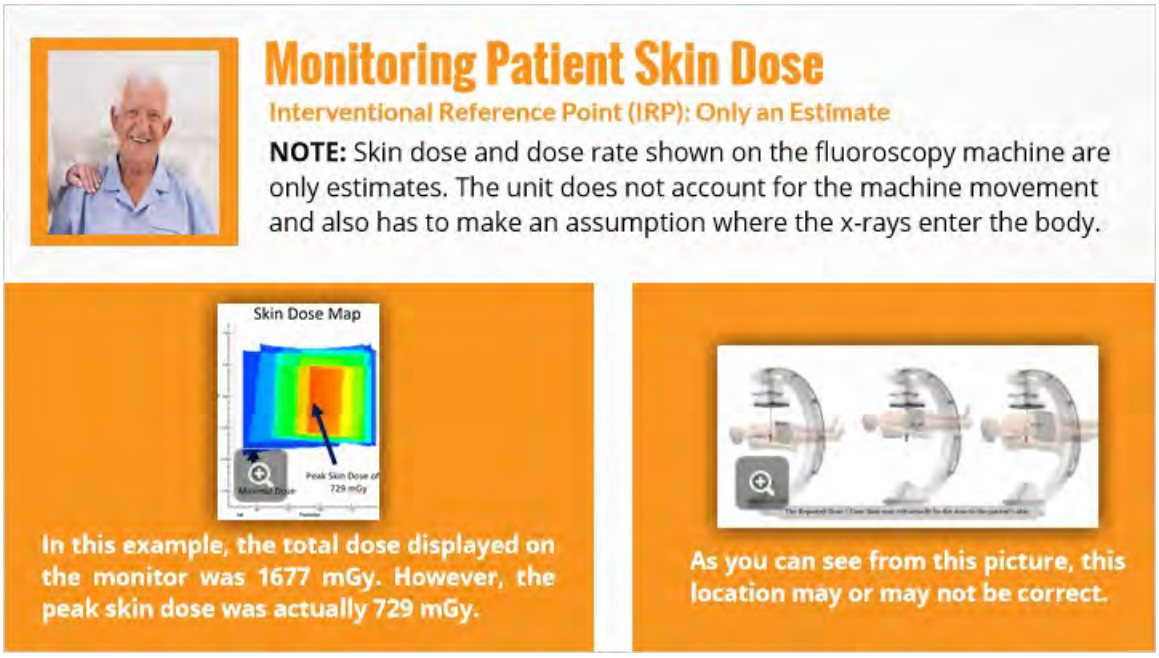
Notes:

1.24 Interventional Reference Point

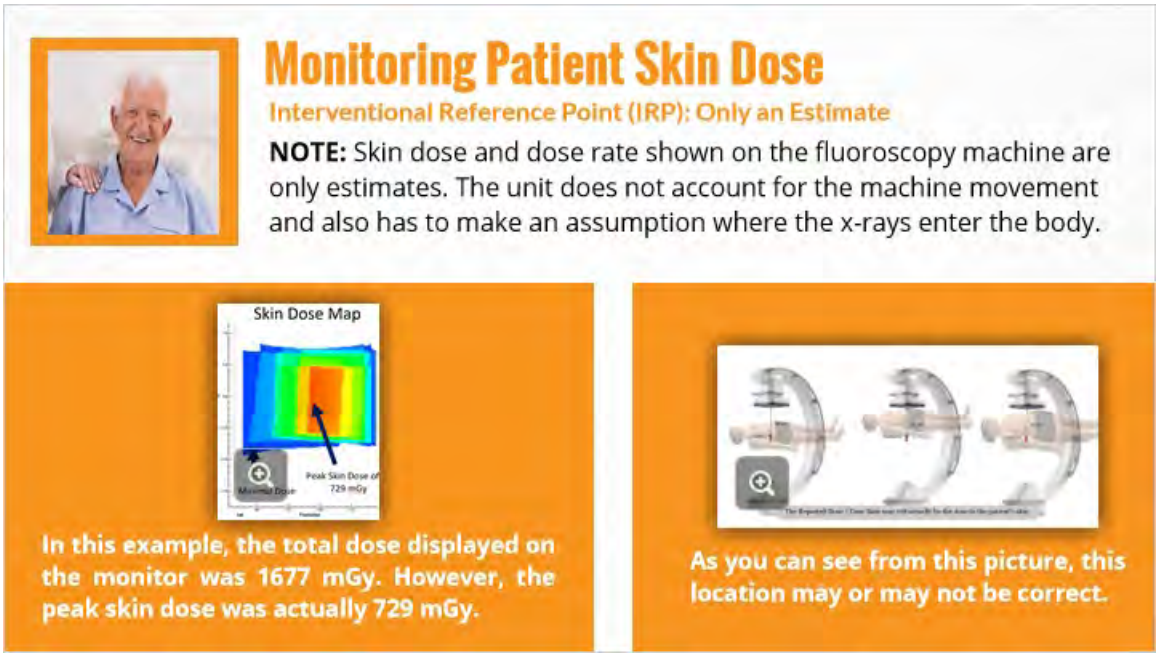


Notes:

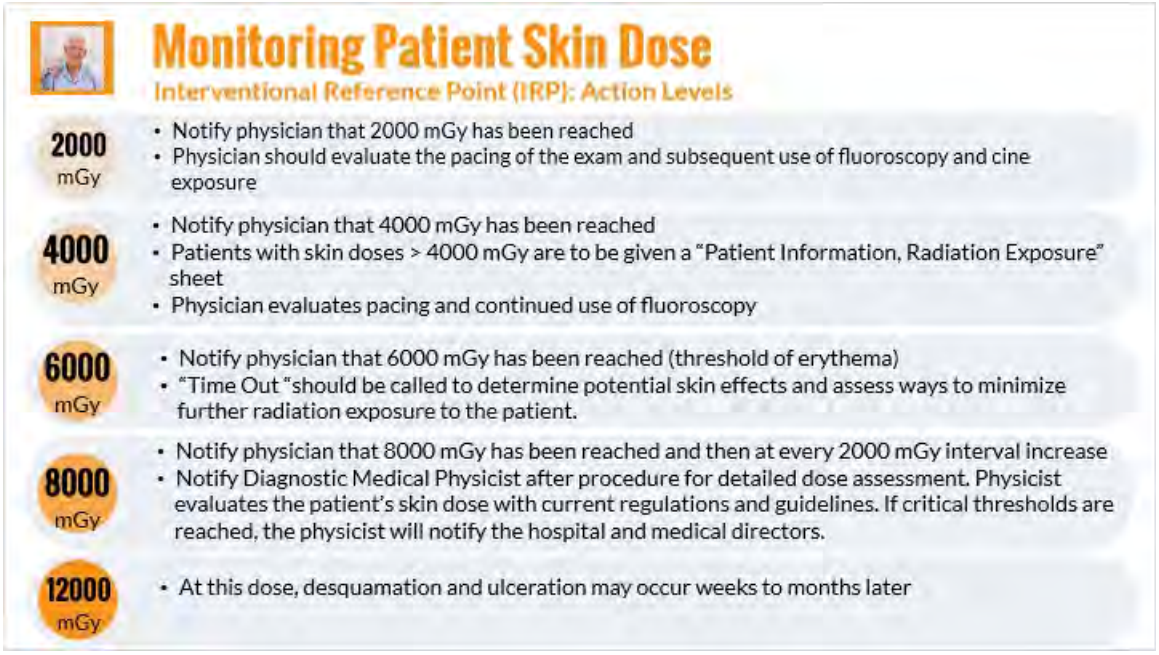
Exposure Dose (Slide Layer)



IRP (Slide Layer)



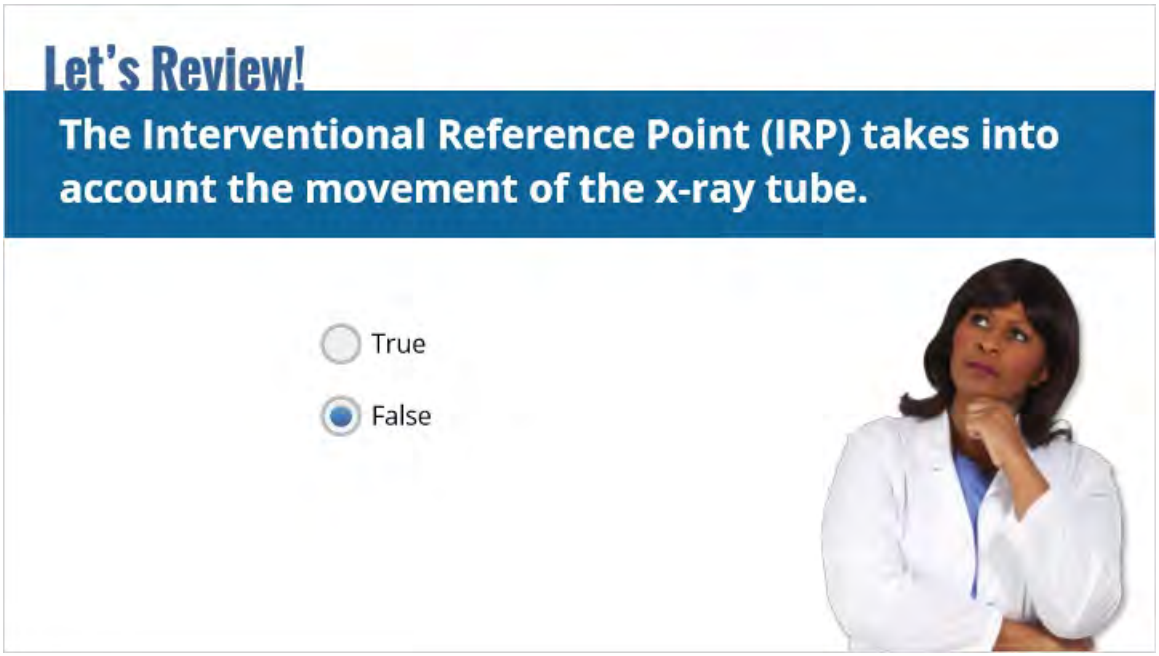
1.25 IRP: Action Levels



Notes:

1.26 The Interventional Reference Point (IRP) takes into account the movement of the x-ray tube.

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	True
X	False

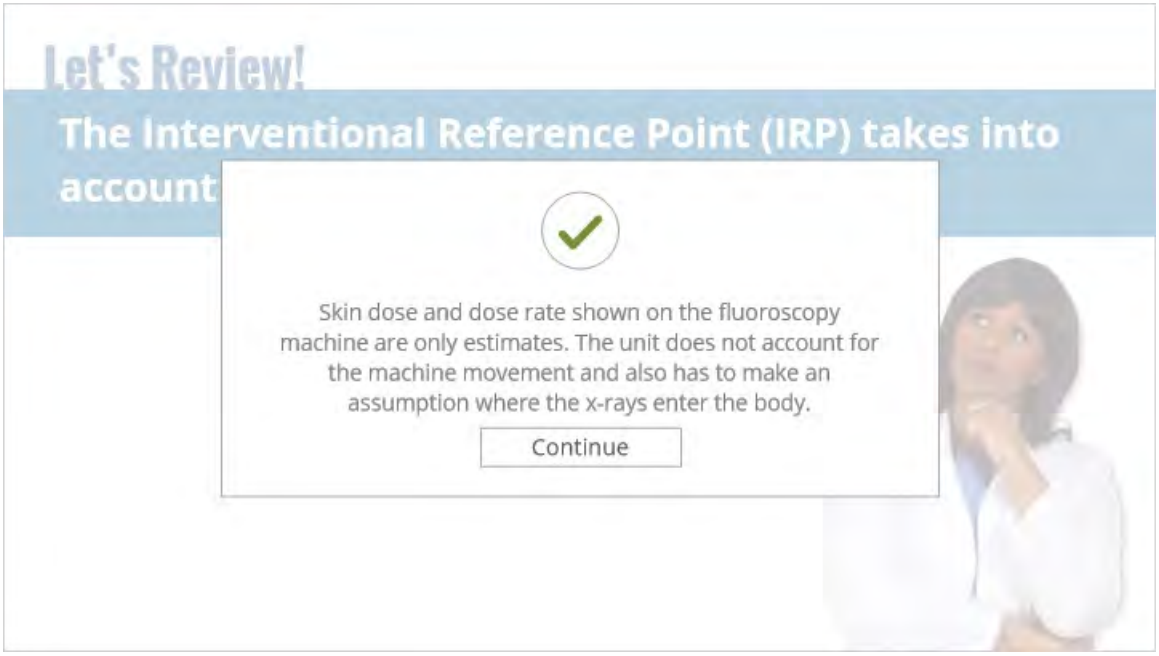
Feedback when correct:

Skin dose and dose rate shown on the fluoroscopy machine are only estimates. The unit does not account for the machine movement and also has to make an assumption where the x-rays enter the body.

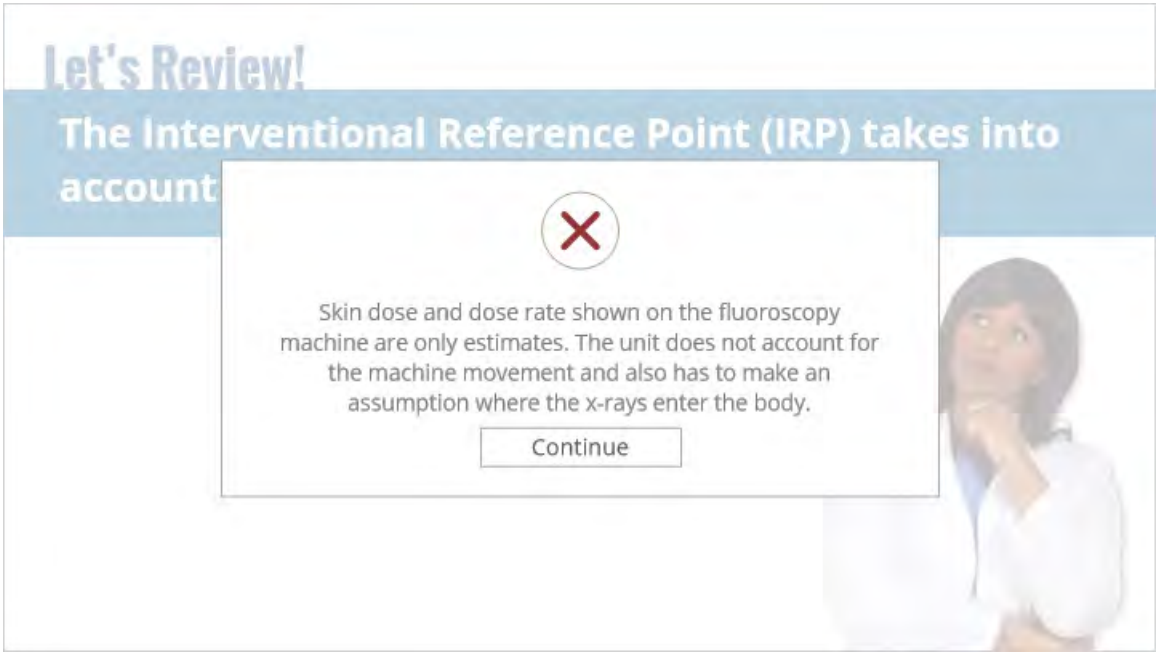
Feedback when incorrect:

Skin dose and dose rate shown on the fluoroscopy machine are only estimates. The unit does not account for the machine movement and also has to make an assumption where the x-rays enter the body.

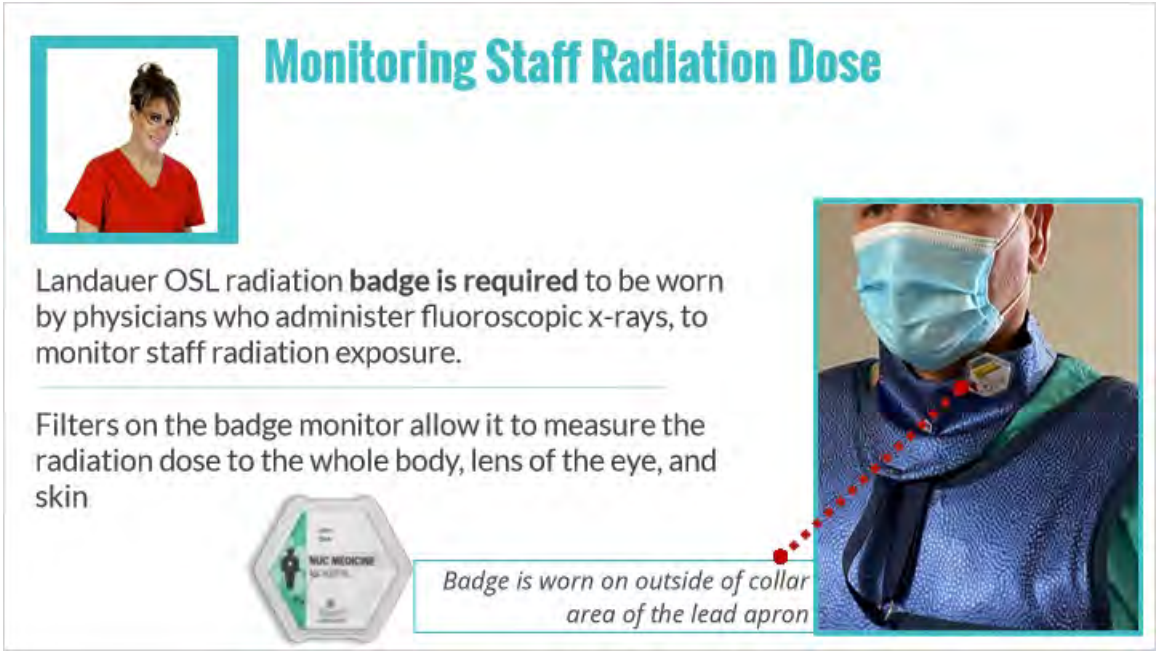
Correct (Slide Layer)



Incorrect (Slide Layer)

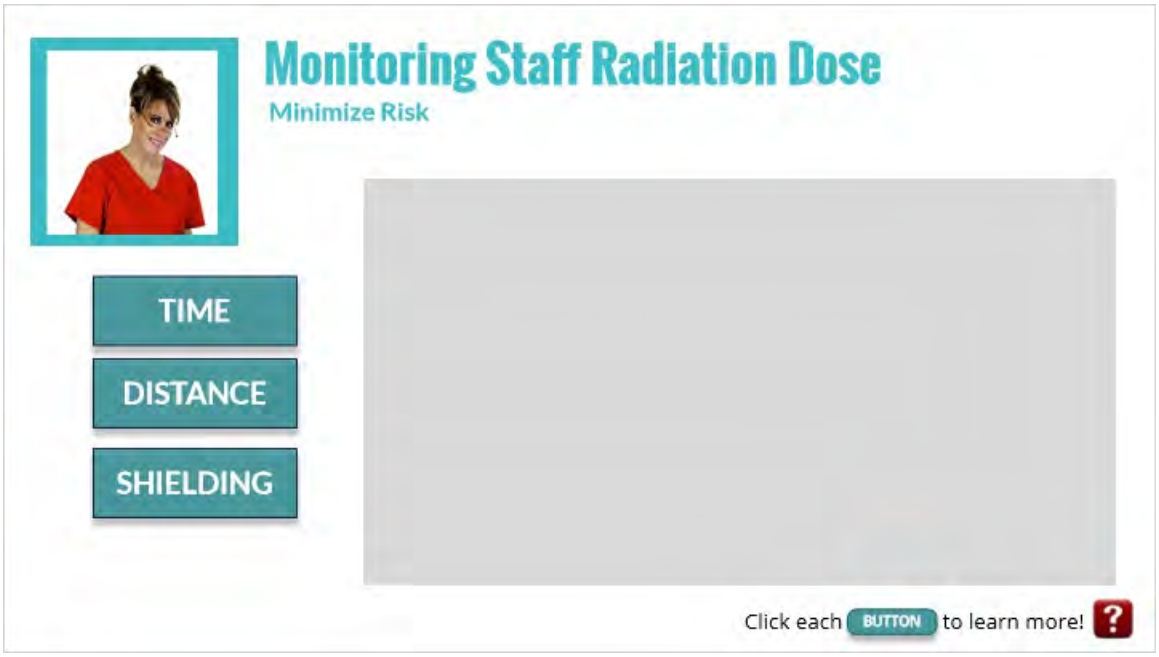


1.27 Monitoring Staff Radiation Dose



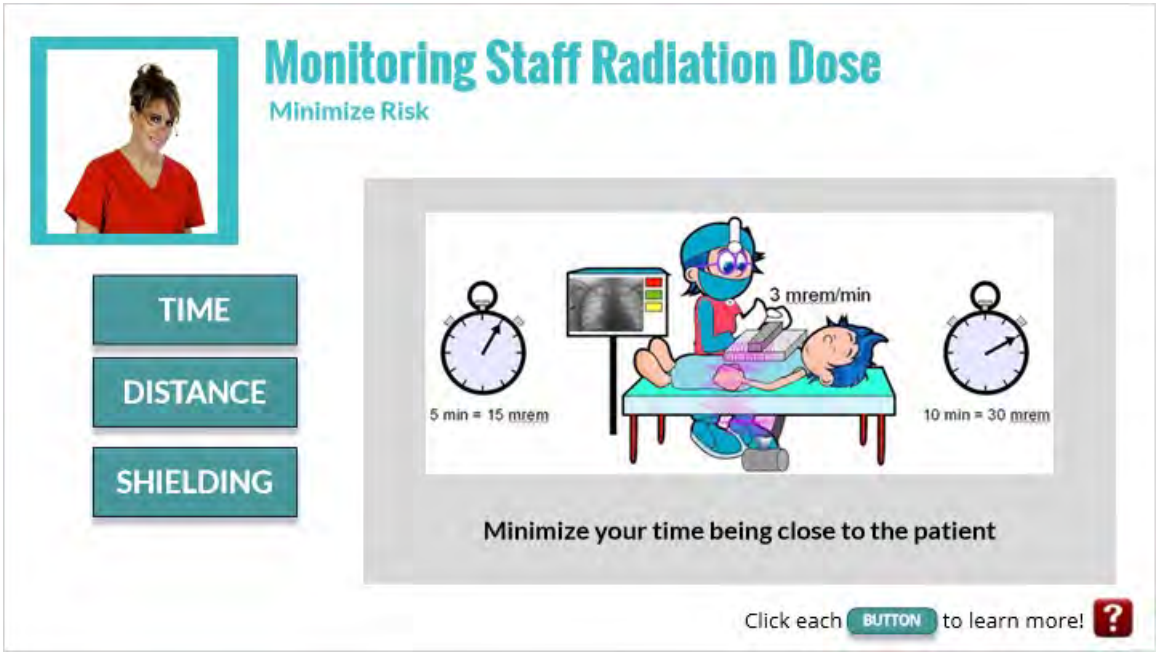
Notes:

1.28 Monitoring Staff Radiation Dose: Minimize Risk



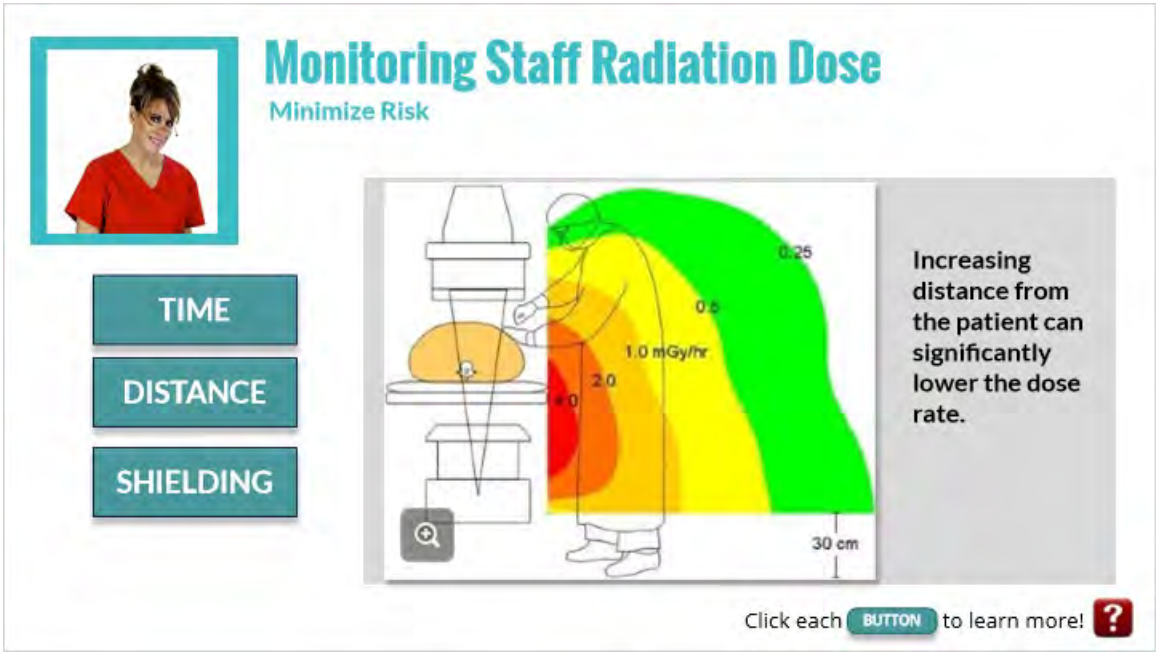
Notes:

Time (Slide Layer)

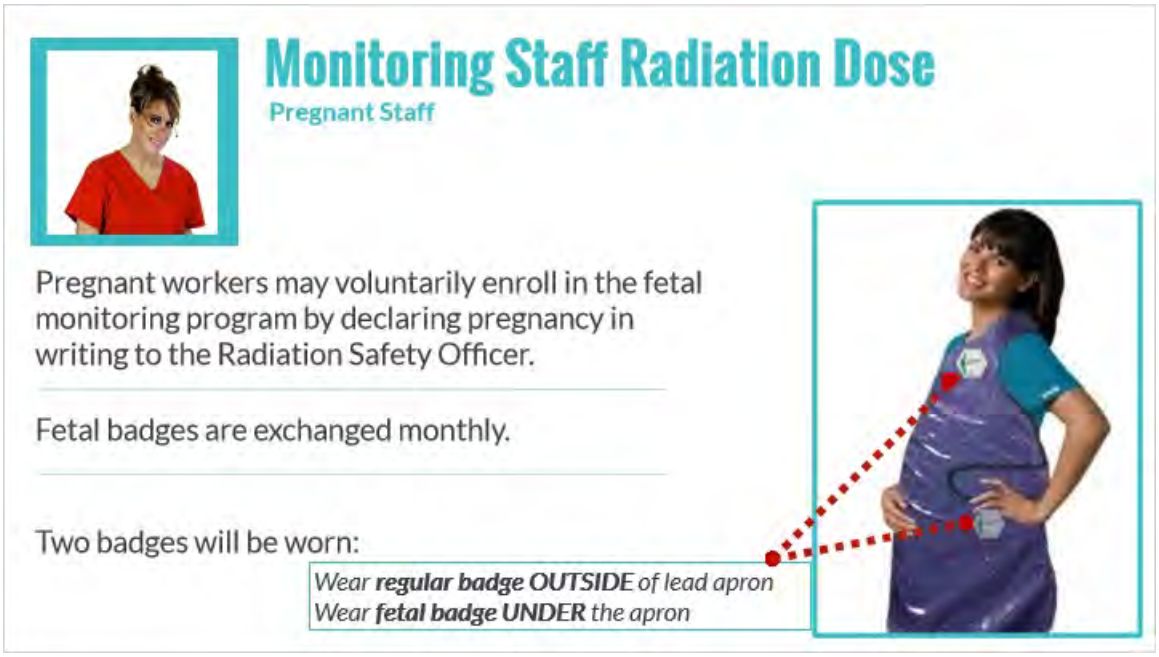


Shielding (Slide Layer)

Distance (Slide Layer)

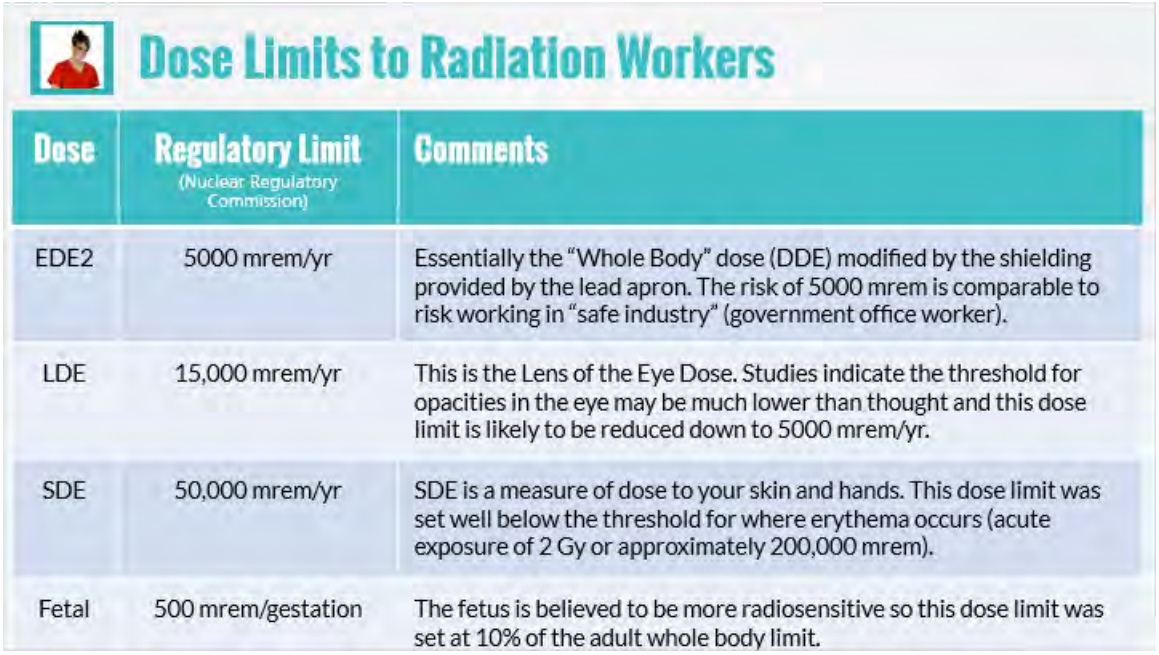


1.29 Pregnant Staff



Notes:

1.30 Dose Limits to Radiation Workers



Notes:

1.31 What is the EDE2 regulatory limit for occupational workers in fluoro?

(Multiple Choice, 10 points, 3 attempts permitted)

Correct	Choice
	10000 mGy
	7000 mGy
X	5000 mGy

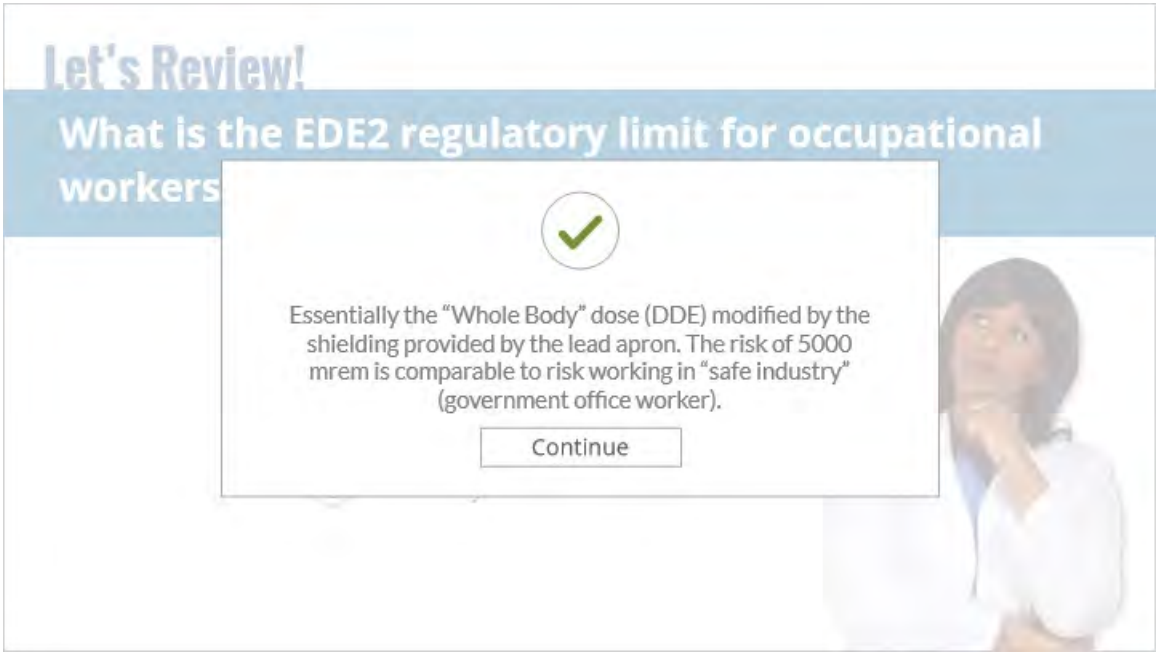
Feedback when correct:

Essentially the "Whole Body" dose (DDE) modified by the shielding provided by the lead apron. The risk of 5000 mrem is comparable to risk working in "safe industry" (government office worker).

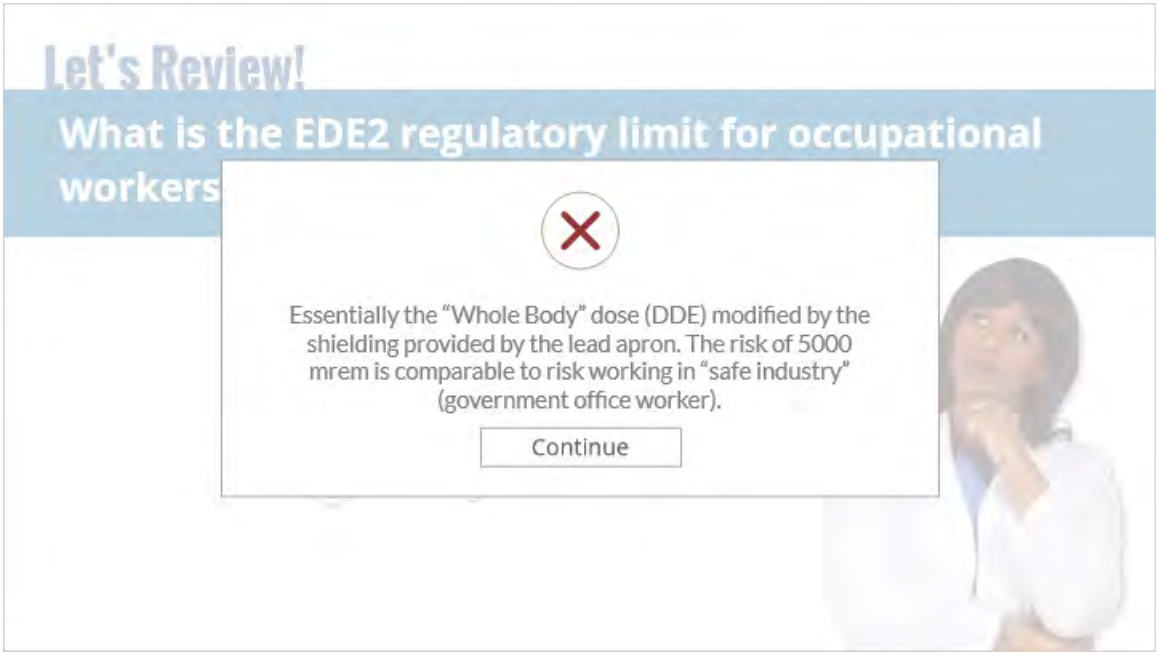
Feedback when incorrect:

Essentially the "Whole Body" dose (DDE) modified by the shielding provided by the lead apron. The risk of 5000 mrem is comparable to risk working in "safe industry" (government office worker).

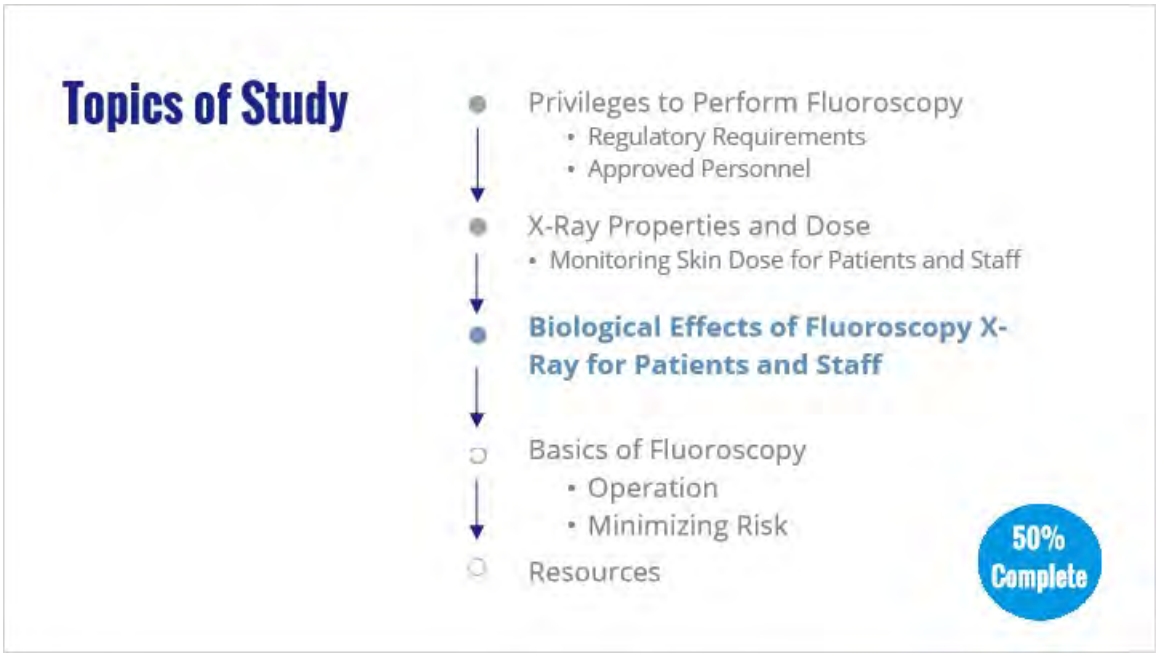
Correct (Slide Layer)



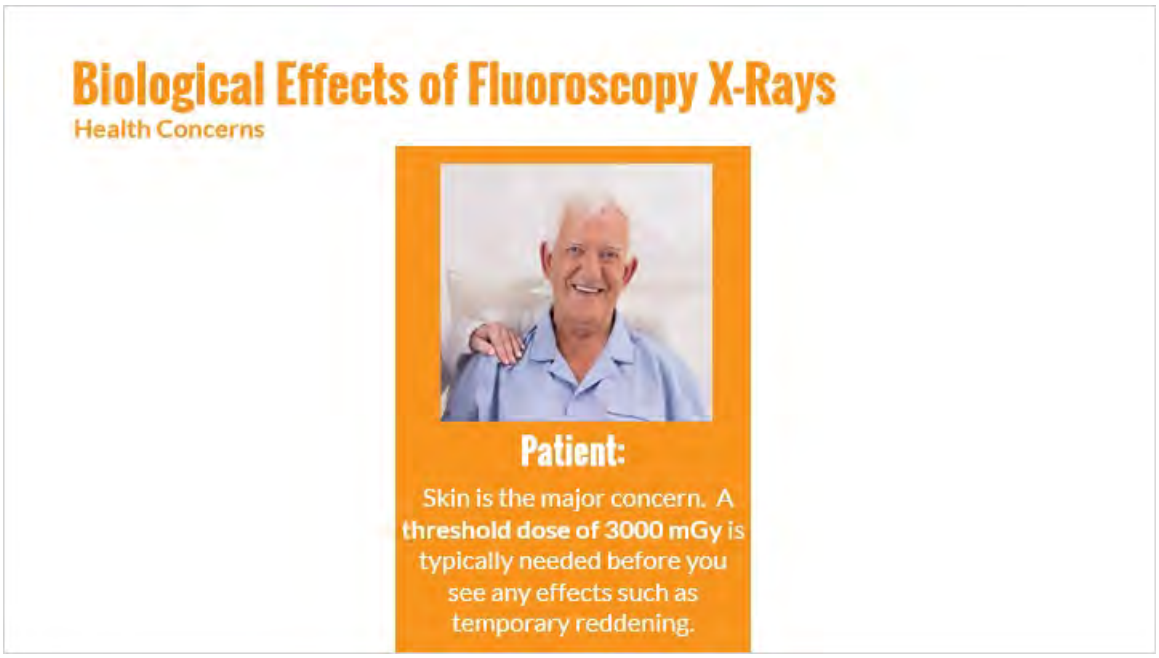
Incorrect (Slide Layer)



1.32 Topics: Biological Effect for Patients and Staff

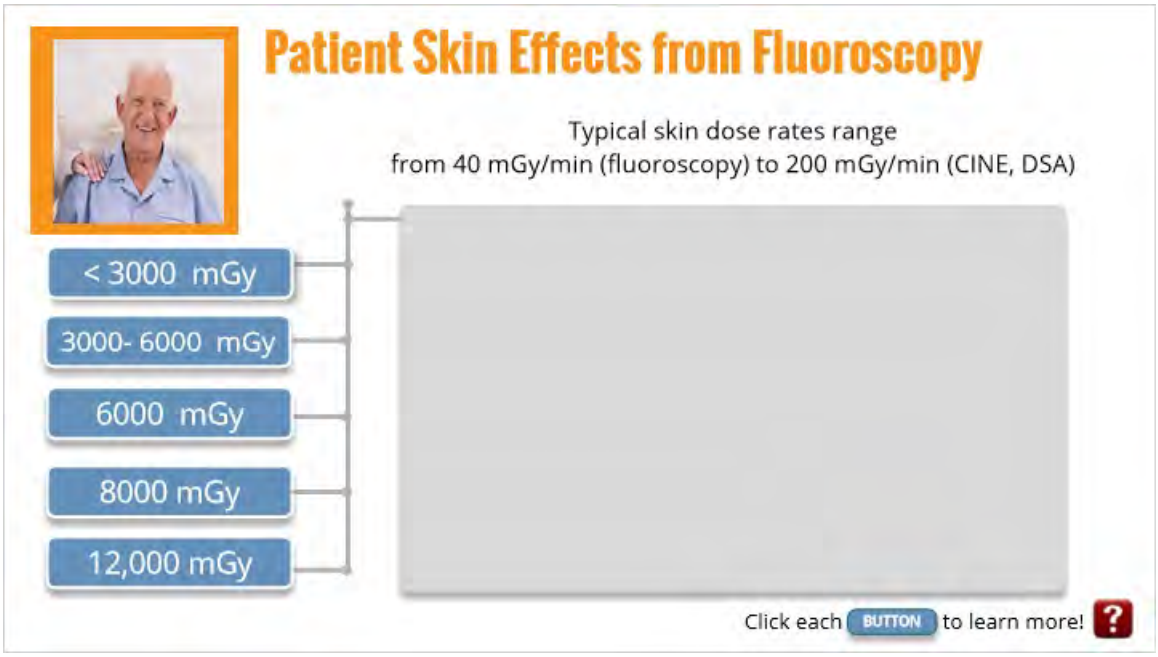


1.33 Patient Health Concerns



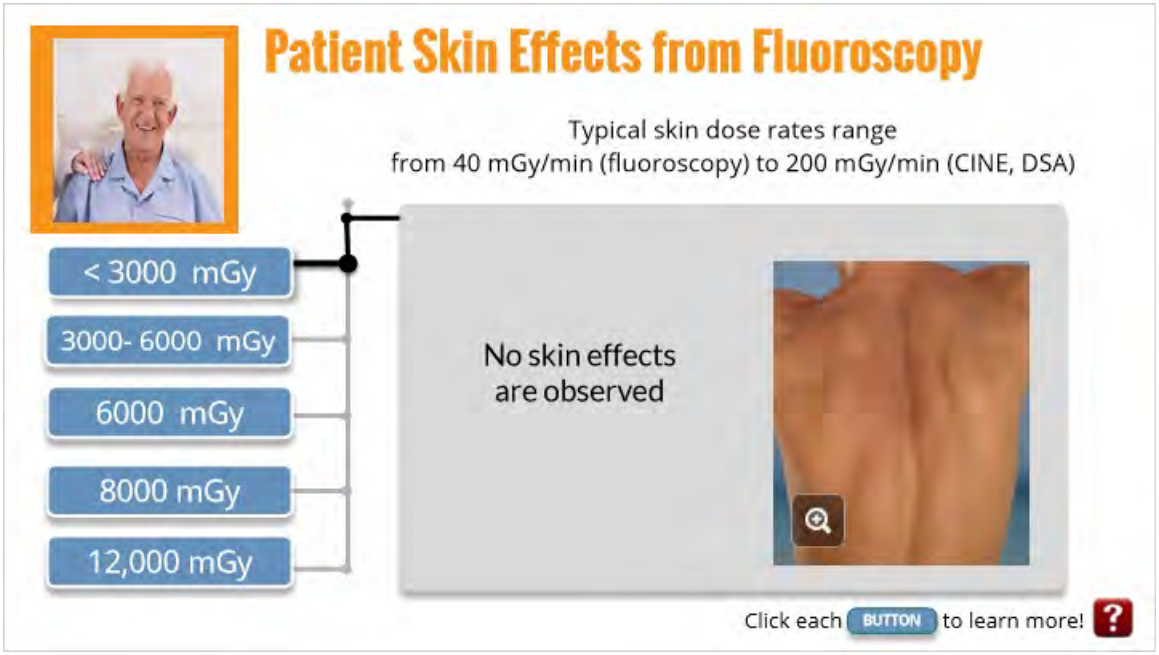
Notes:

1.34 Patient Skin Effects from Fluoroscopy

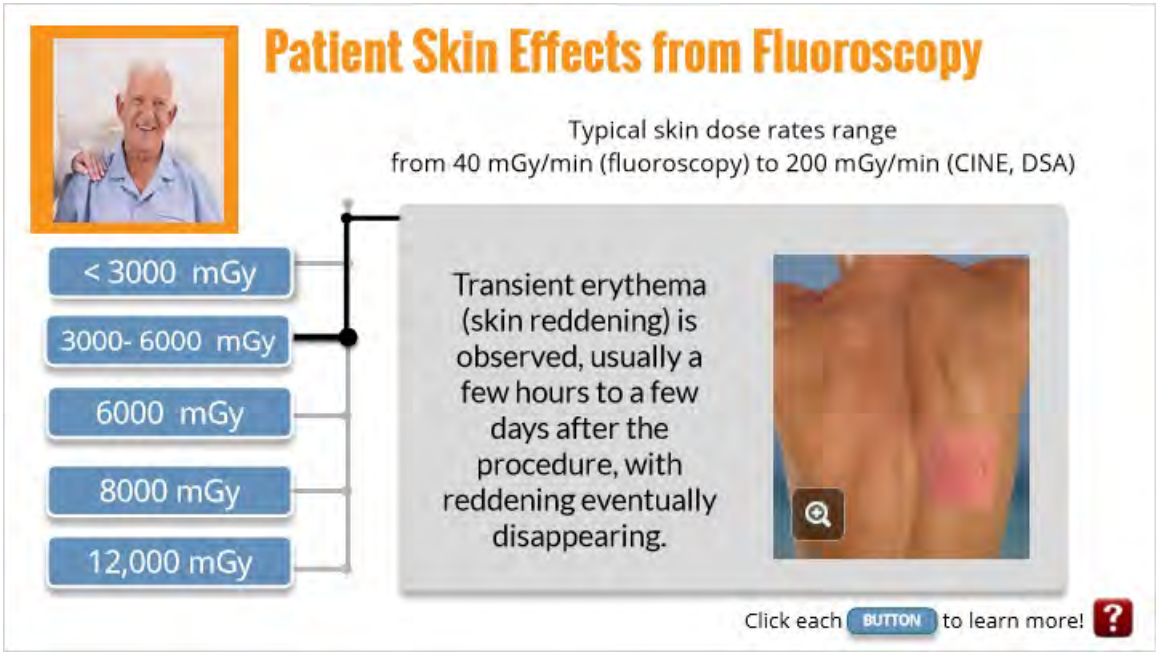


Notes:

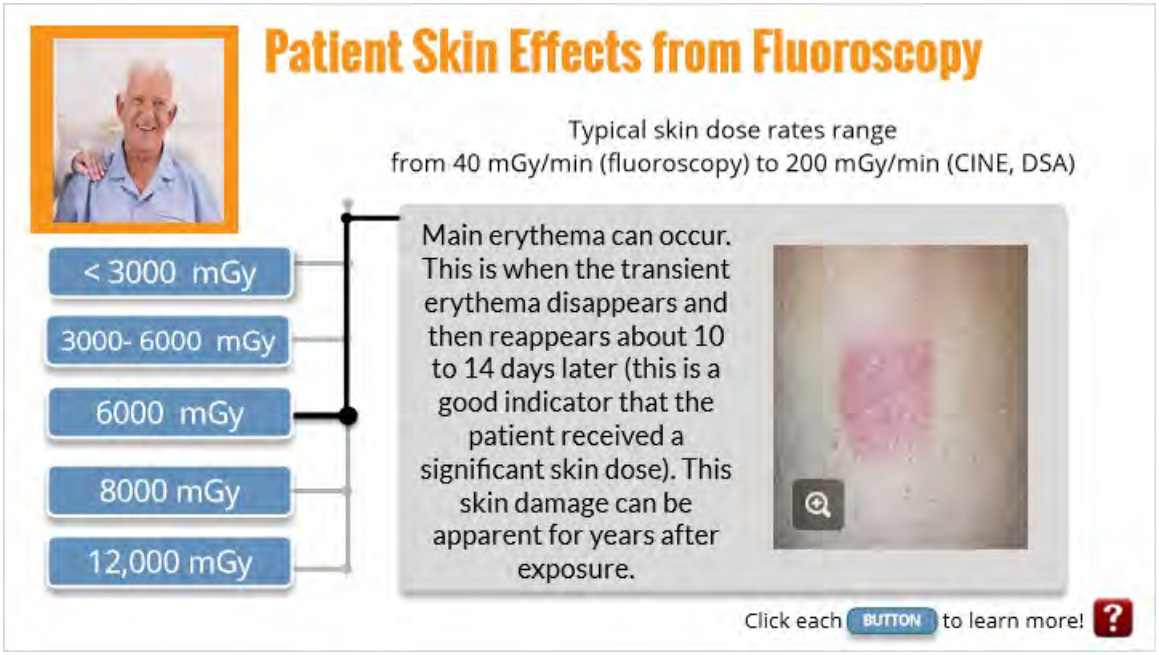
<2000 (Slide Layer)



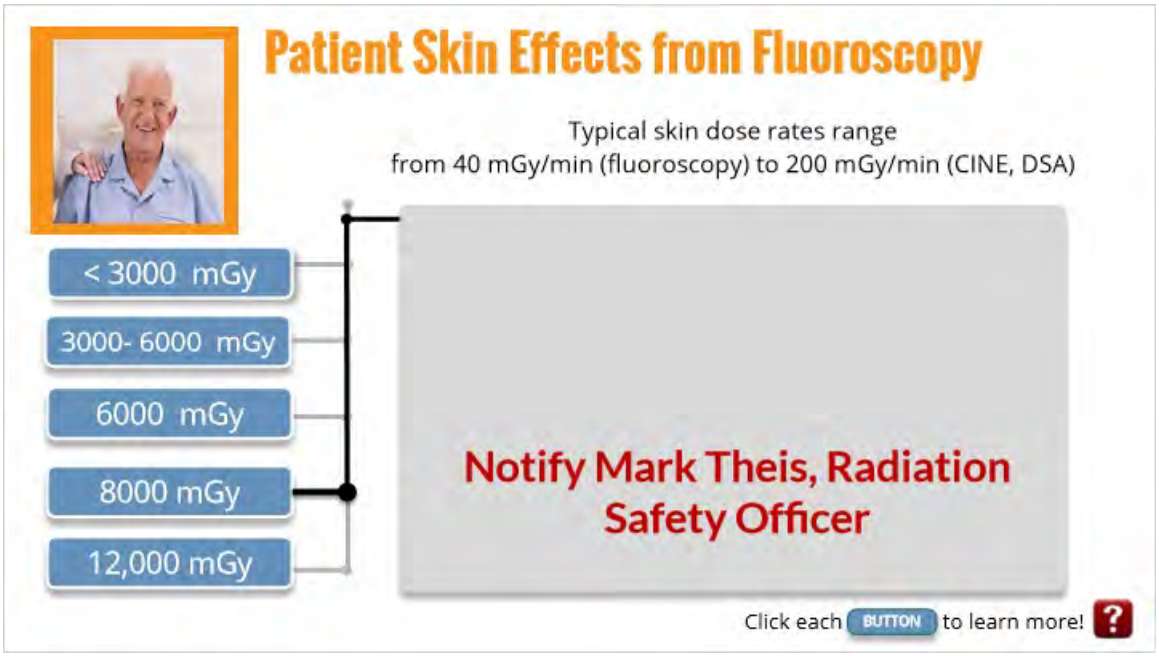
2000-6000 (Slide Layer)



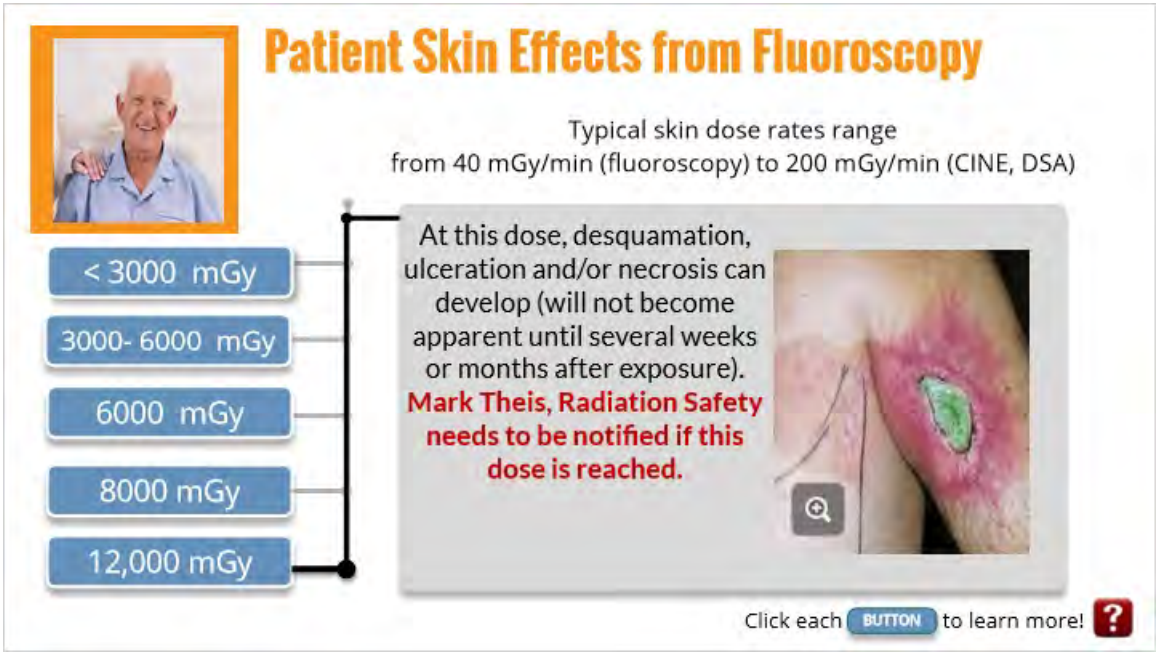
6000 (Slide Layer)



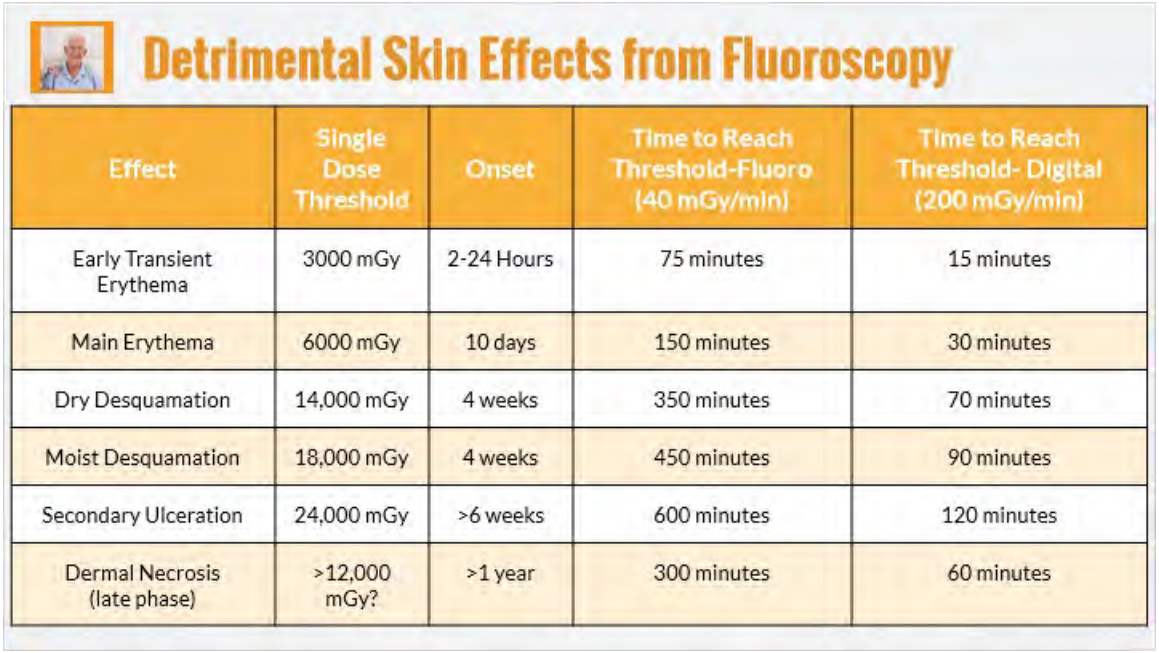
8000 (Slide Layer)



12,000 (Slide Layer)



1.35 Detrimental Skin Effects from Fluoroscopy

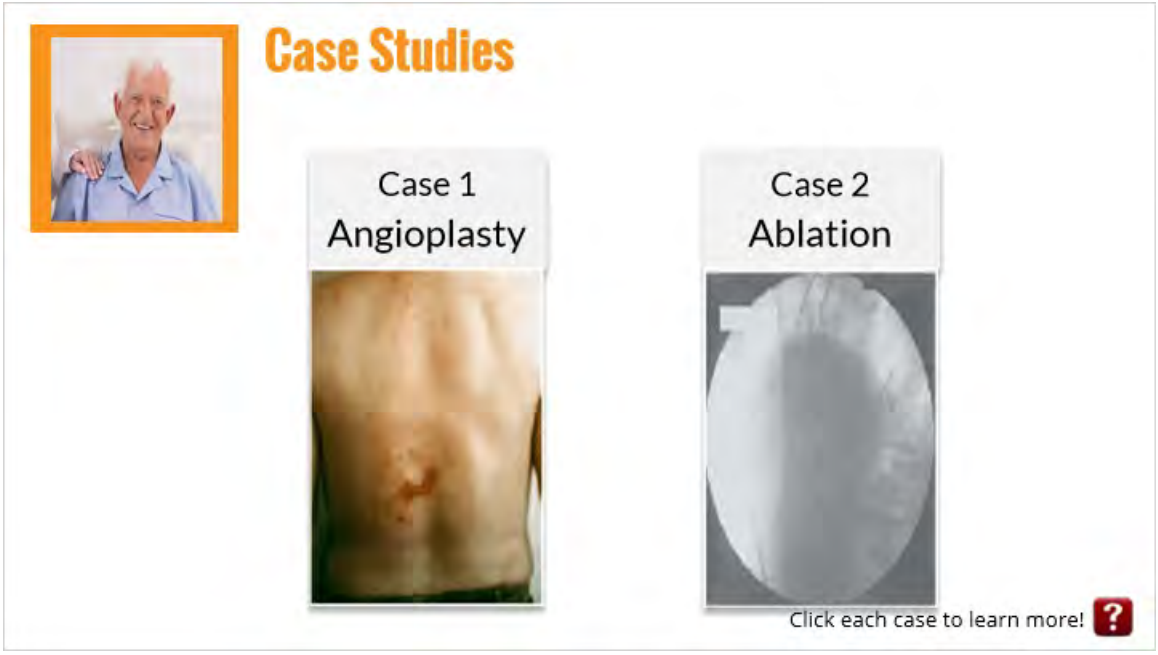


Detrimental Skin Effects from Fluoroscopy

Effect	Single Dose Threshold	Onset	Time to Reach Threshold-Fluoro (40 mGy/min)	Time to Reach Threshold- Digital (200 mGy/min)
Early Transient Erythema	3000 mGy	2-24 Hours	75 minutes	15 minutes
Main Erythema	6000 mGy	10 days	150 minutes	30 minutes
Dry Desquamation	14,000 mGy	4 weeks	350 minutes	70 minutes
Moist Desquamation	18,000 mGy	4 weeks	450 minutes	90 minutes
Secondary Ulceration	24,000 mGy	>6 weeks	600 minutes	120 minutes
Dermal Necrosis (late phase)	>12,000 mGy?	>1 year	300 minutes	60 minutes

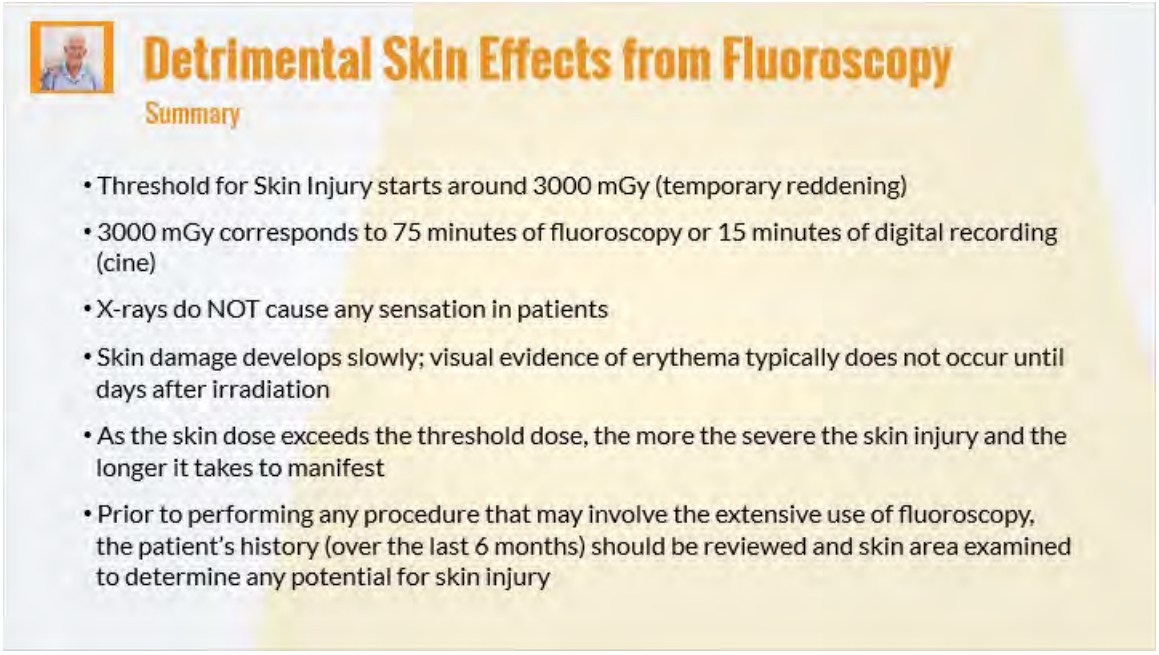
Notes:

1.36 Case Studies



Notes:

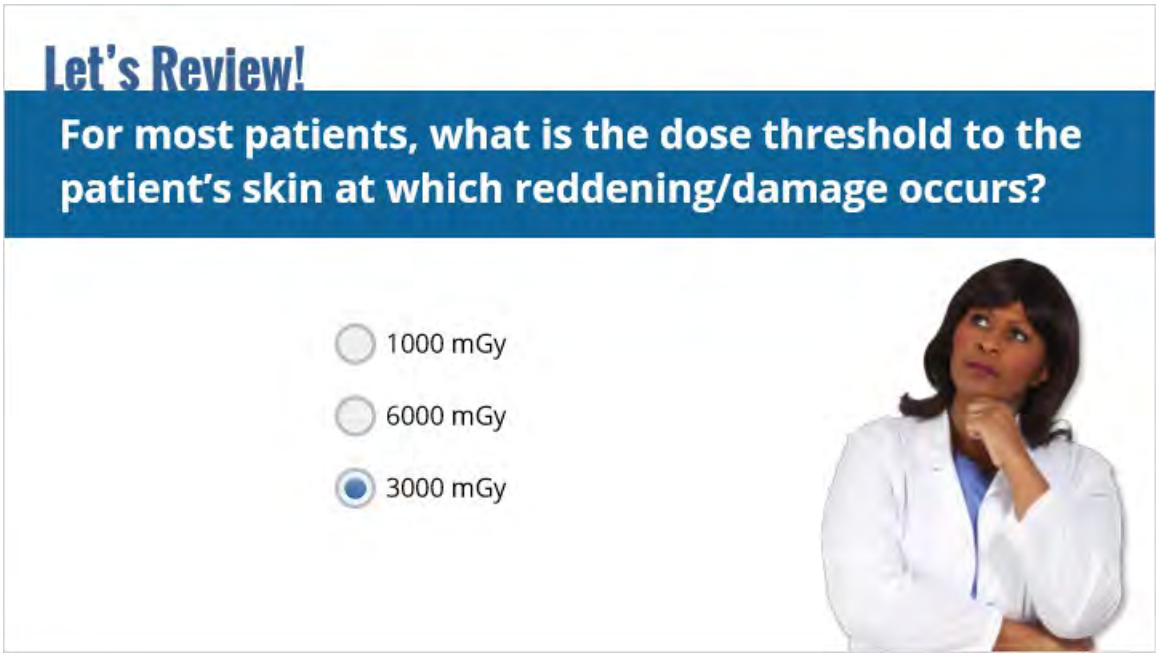
1.37 Detrimental Skin Effects Summary



Notes:

1.38 For most patients, what is the dose threshold to the patient's skin at which reddening/damage occurs?

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	1000 mGy
	6000 mGy
X	3000 mGy

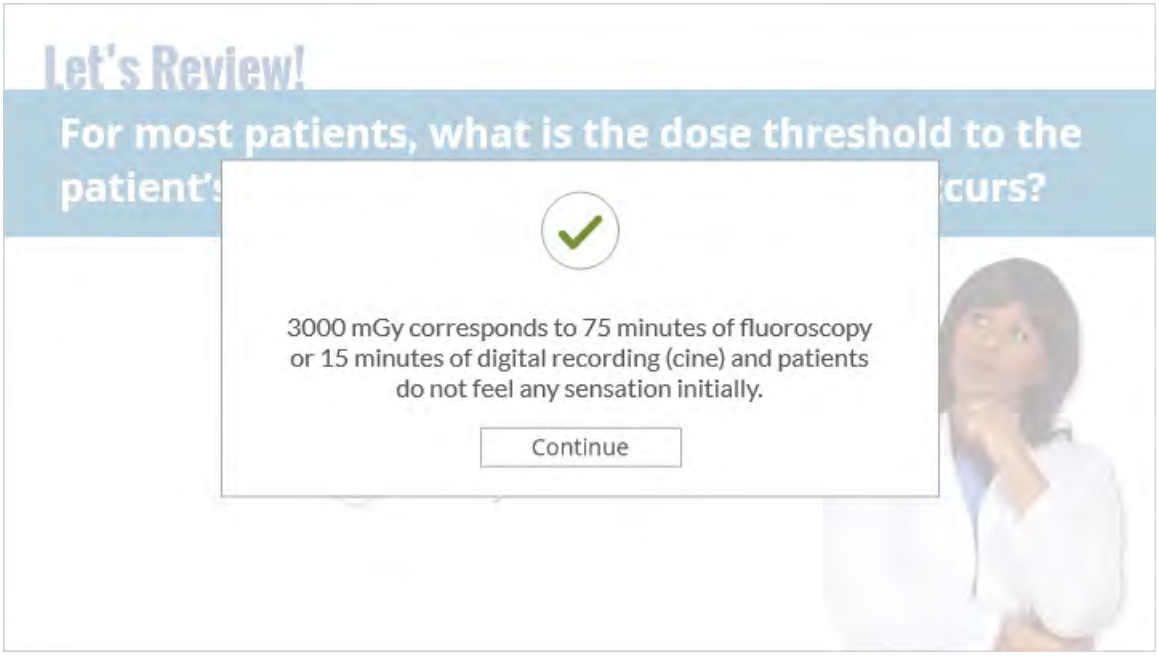
Feedback when correct:

3000 mGy corresponds to 75 minutes of fluoroscopy or 15 minutes of digital recording (cine) and patients do not feel any sensation initially.

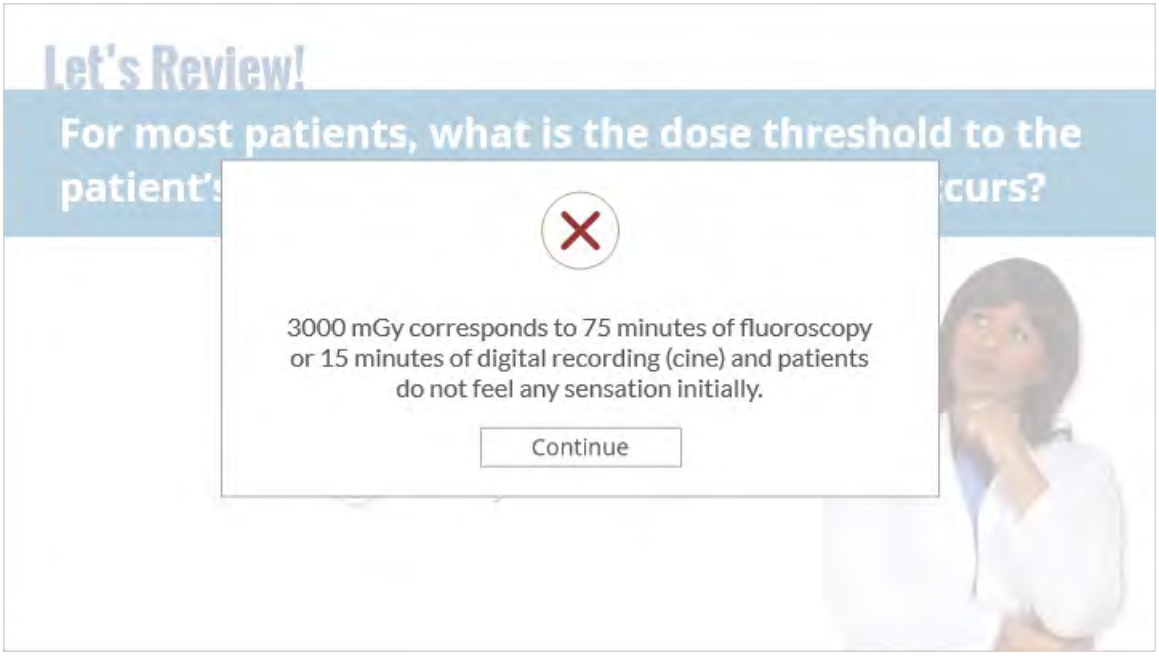
Feedback when incorrect:

3000 mGy corresponds to 75 minutes of fluoroscopy or 15 minutes of digital recording (cine) and patients do not feel any sensation initially.

Correct (Slide Layer)



Incorrect (Slide Layer)



1.39 If the patient skin dose threshold (3000 mGy) is reached, transient erythema can be seen:

(Multiple Choice, 10 points, 3 attempts permitted)

Correct	Choice
	immediately following the procedure
X	approximately 2-24 hours following the procedure
	at least one month following the procedure

Feedback when correct:

Transient Erythema (skin reddening) occurs initially between 3000 and 6000 mGy and appears few hours to a few days after the procedure, with reddening eventually disappearing.

Feedback when incorrect:

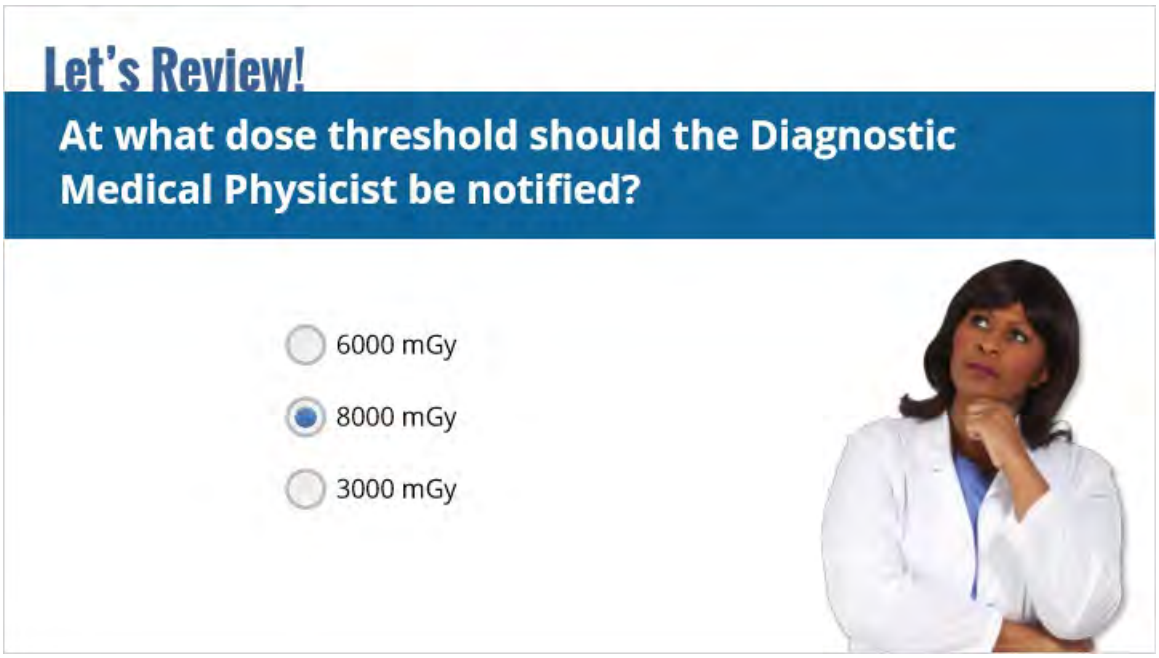
Transient Erythema (skin reddening) occurs initially between 3000 and 6000 mGy and appears few hours to a few days after the procedure, with reddening eventually disappearing.

Correct (Slide Layer)

Incorrect (Slide Layer)

1.40 At what dose threshold should the Diagnostic Medical Physicist be notified?

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	6000 mGy
X	8000 mGy
	3000 mGy

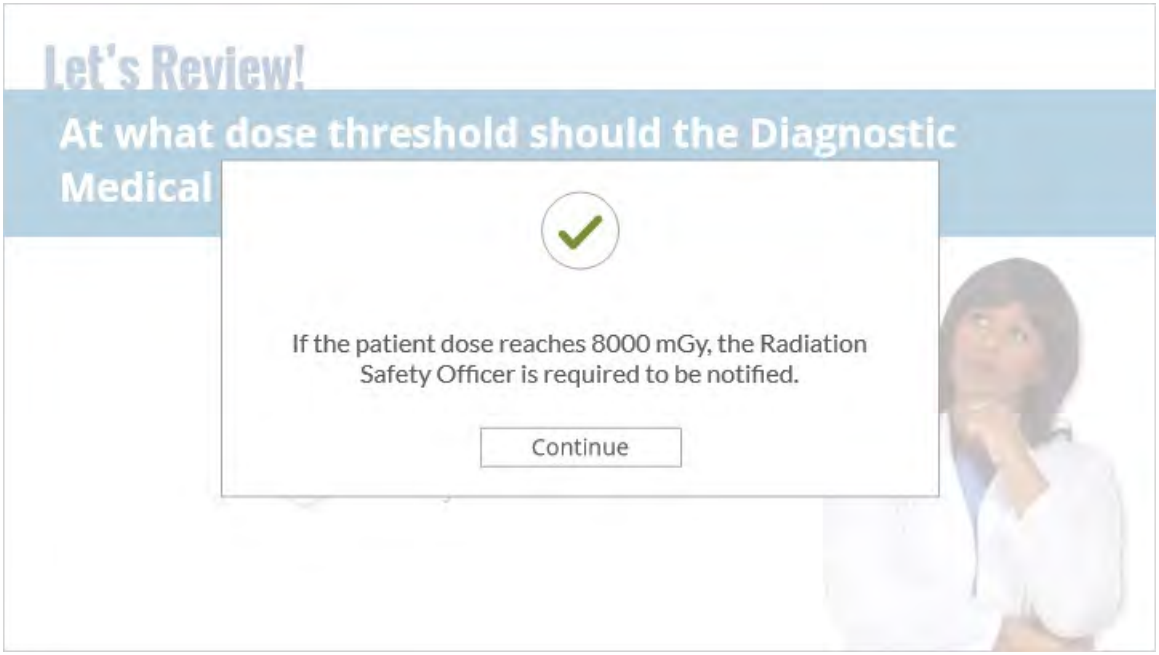
Feedback when correct:

If the patient dose reaches 8000 mGy, the Radiation Safety Officer is required to be notified.

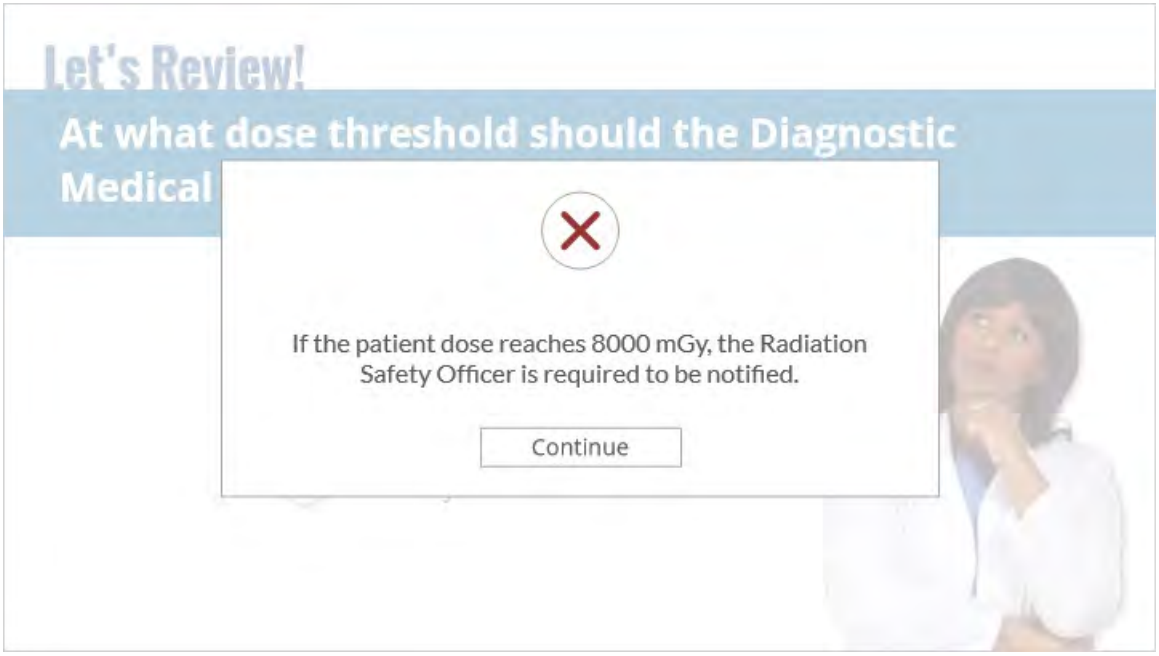
Feedback when incorrect:

If the patient dose reaches 8000 mGy, the Radiation Safety Officer is required to be notified.

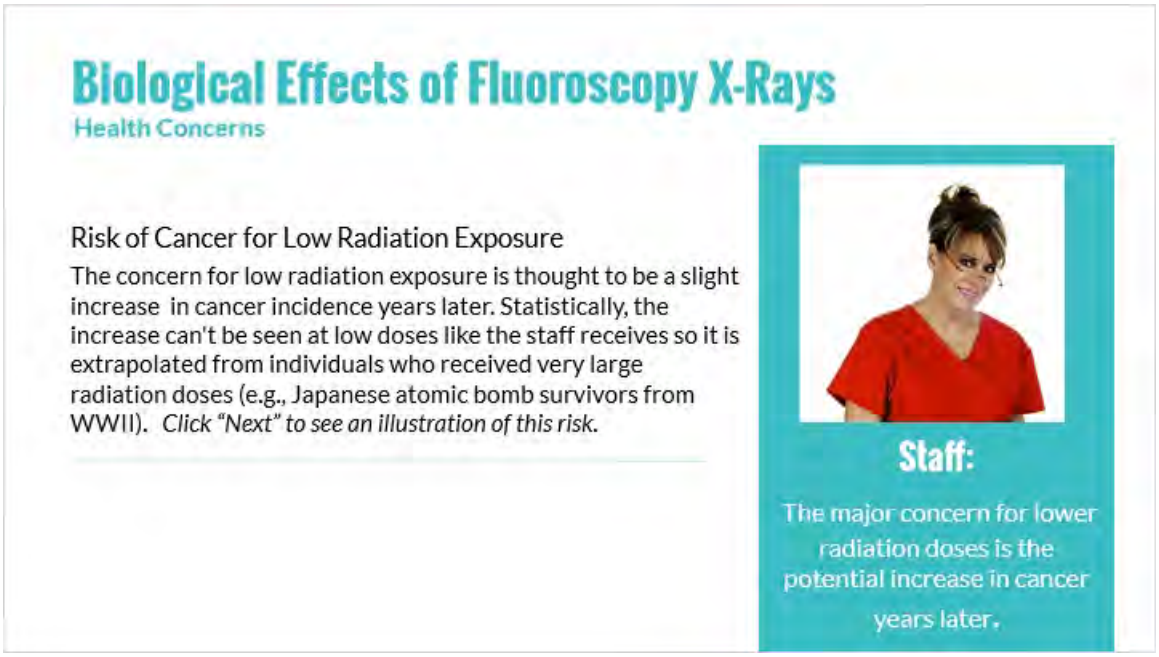
Correct (Slide Layer)



Incorrect (Slide Layer)

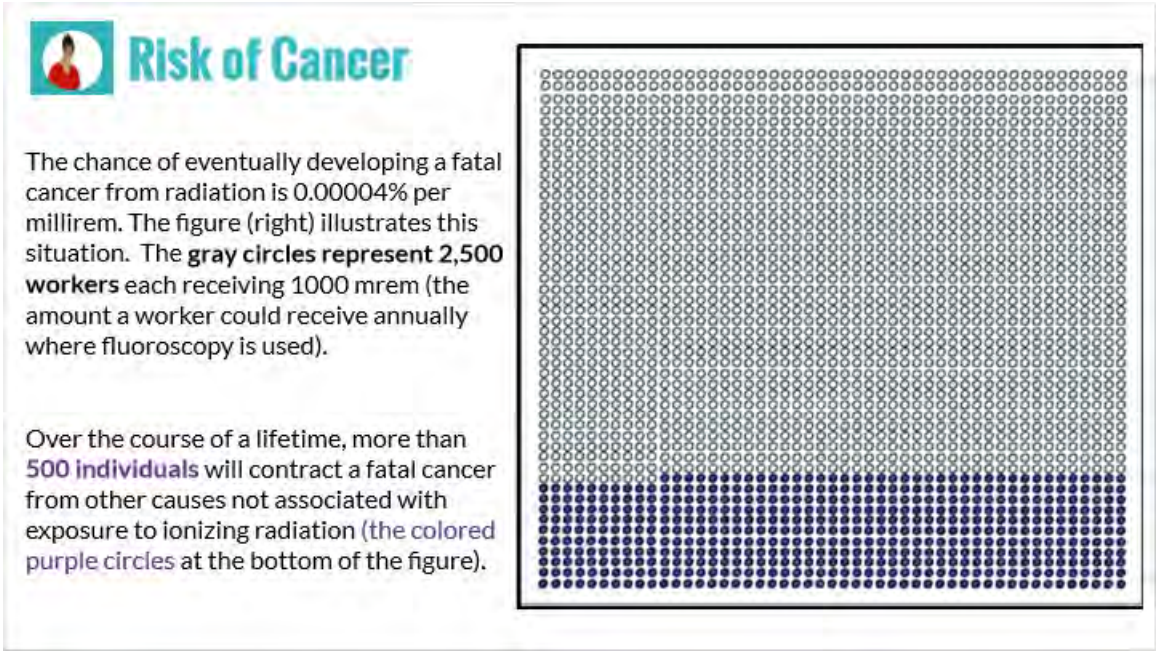


1.41 Staff Health Concerns



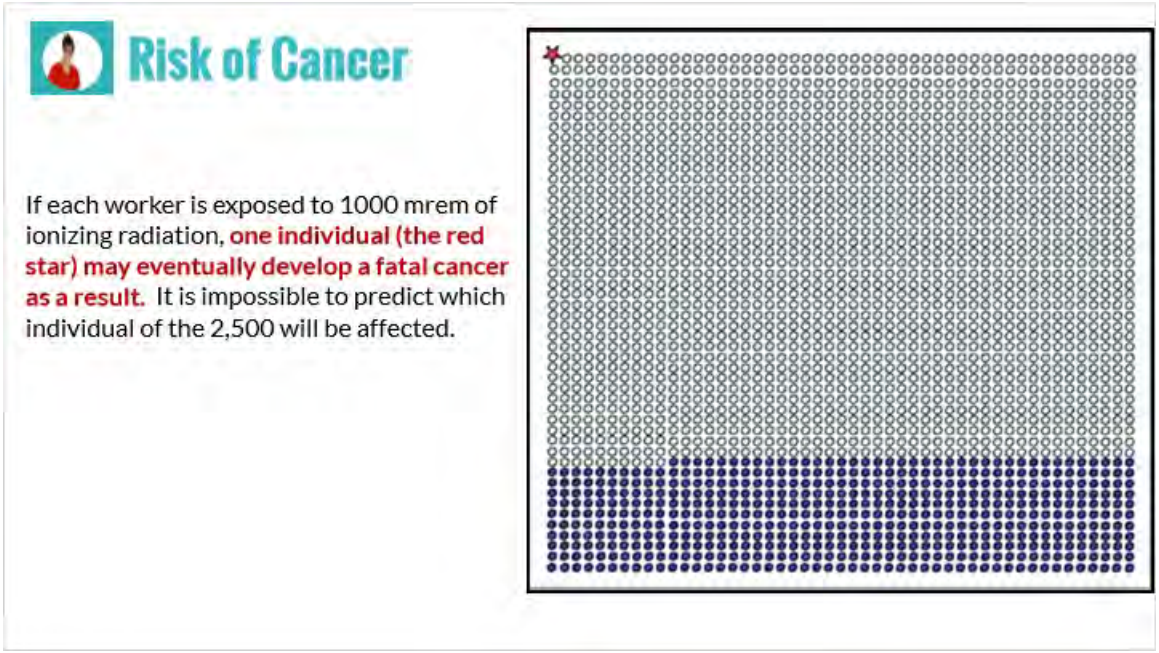
Notes:

1.42 Risk of Cancer



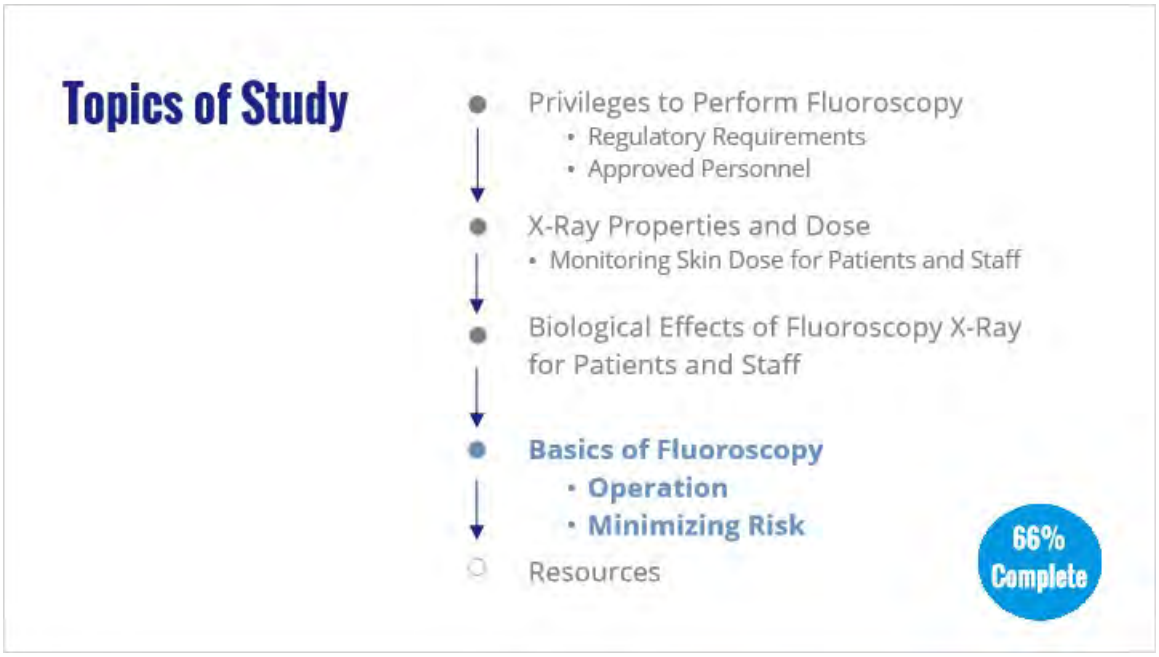
Notes:

1.43 Risk of Cancer

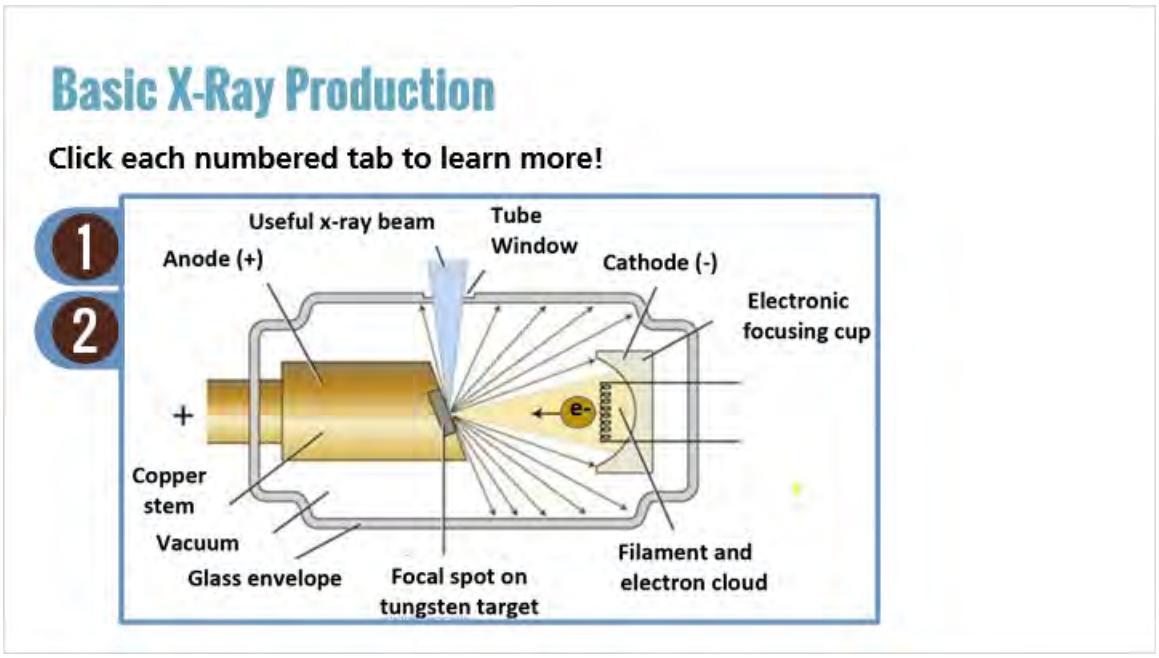


Notes:

1.44 Topics: Basics of Fluoroscopy

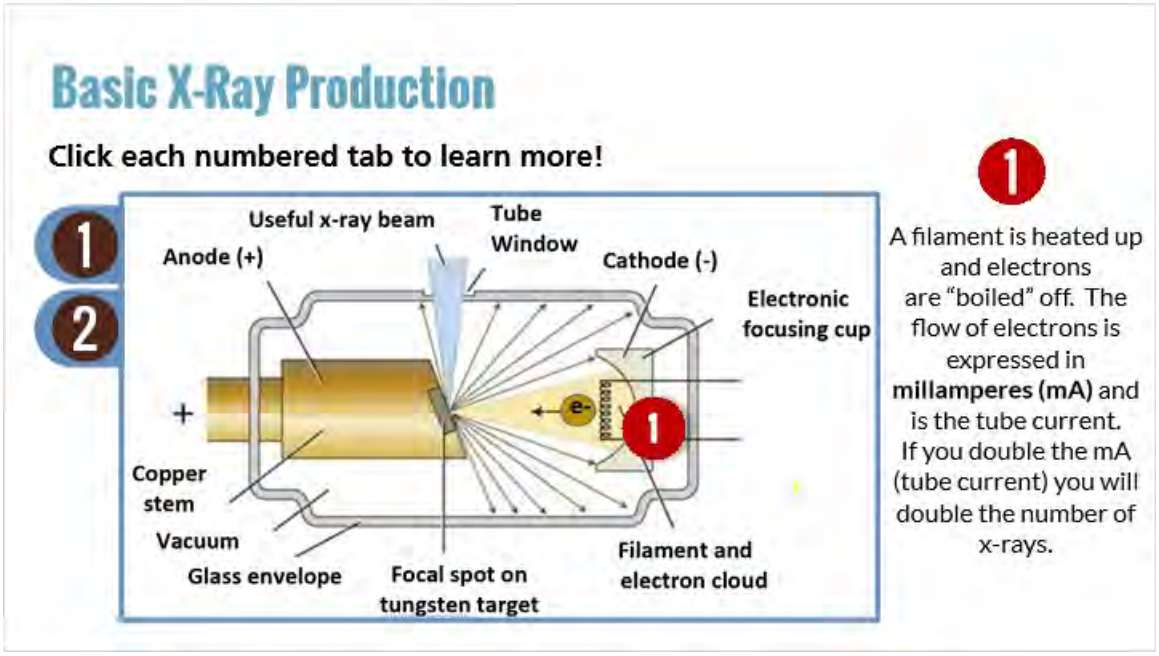


1.45 Basic X-Ray Production

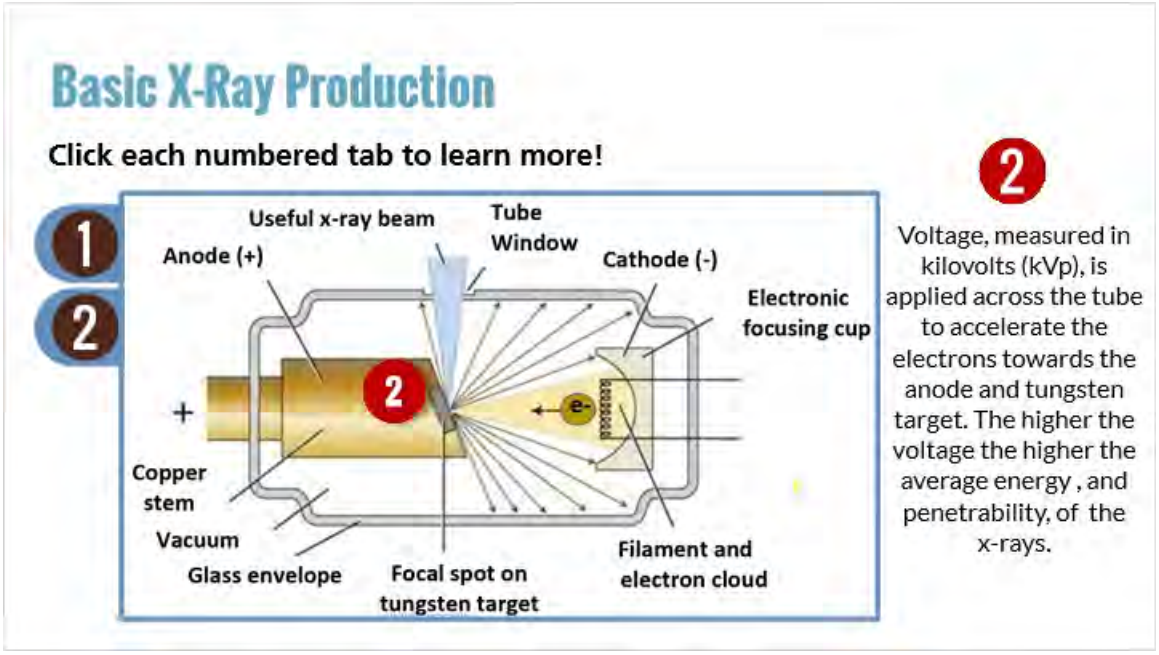


Notes:

Tab 01 (Slide Layer)

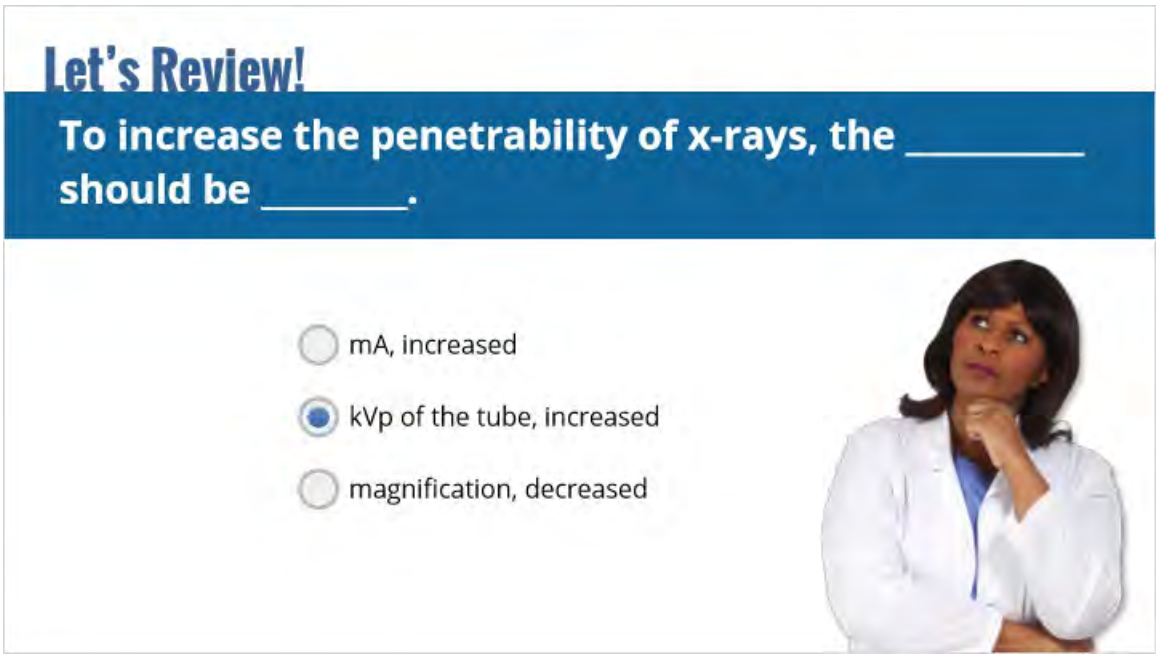


Tab 02 (Slide Layer)



1.46 To increase the penetrability of x-rays, the _____ should be _____.

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	mA, increased
X	kVp of the tube, increased
	magnification, decreased

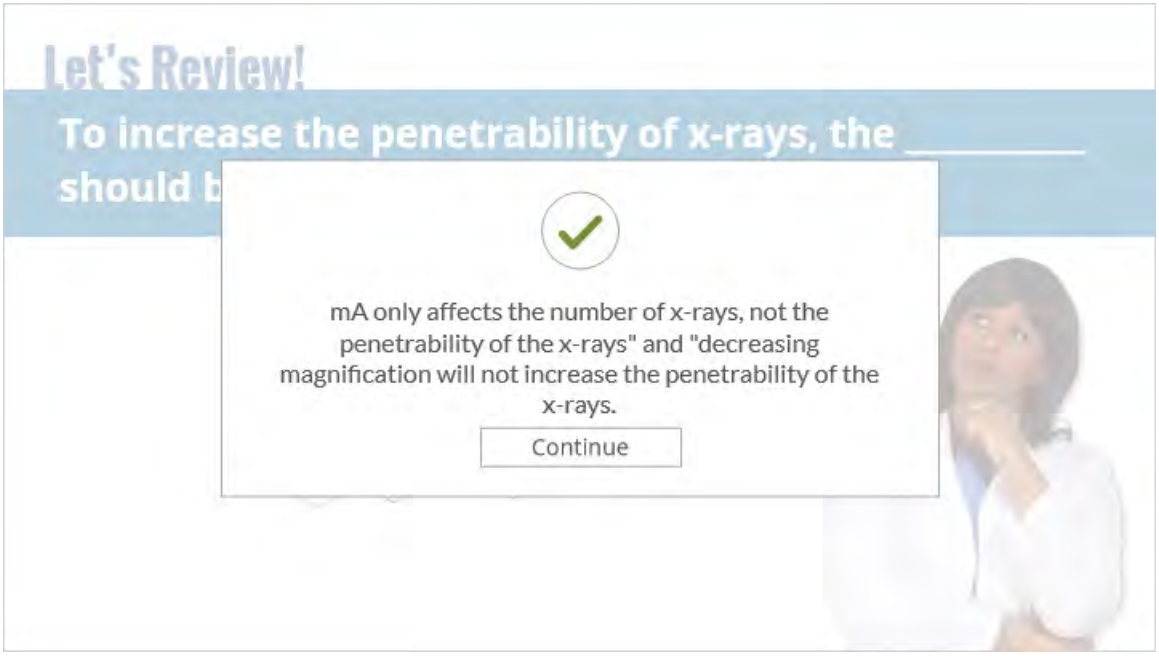
Feedback when correct:

mA only affects the number of x-rays, not the penetrability of the x-rays" and "decreasing magnification will not increase the penetrability of the x-rays.

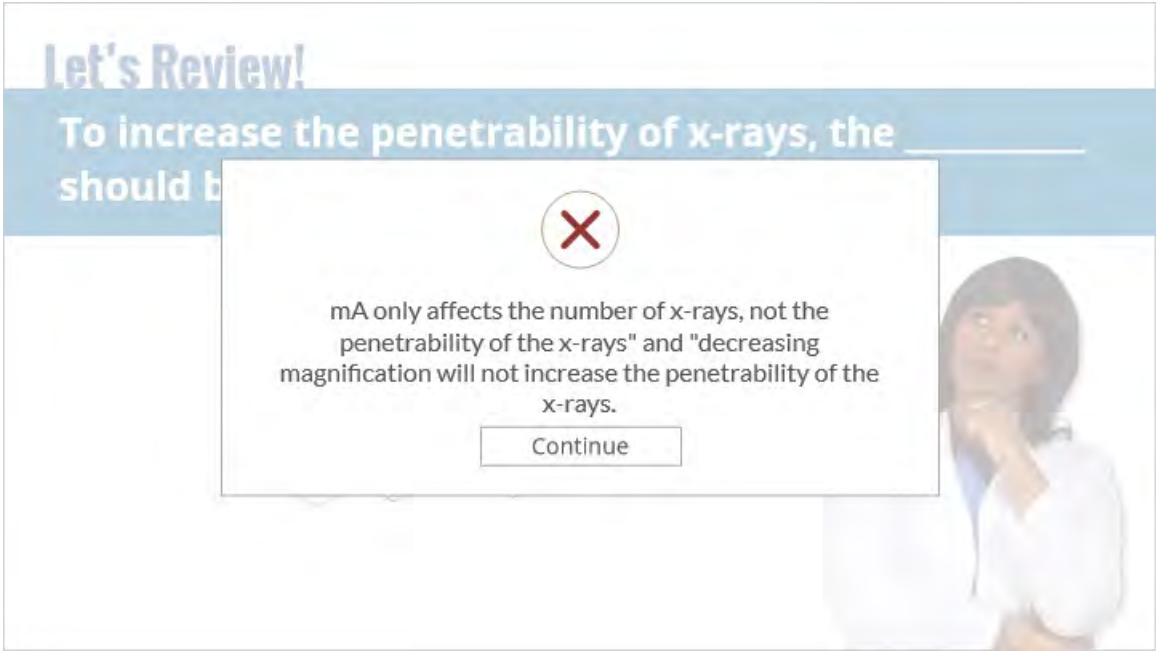
Feedback when incorrect:

mA only affects the number of x-rays, not the penetrability of the x-rays" and "decreasing magnification will not increase the penetrability of the x-rays.

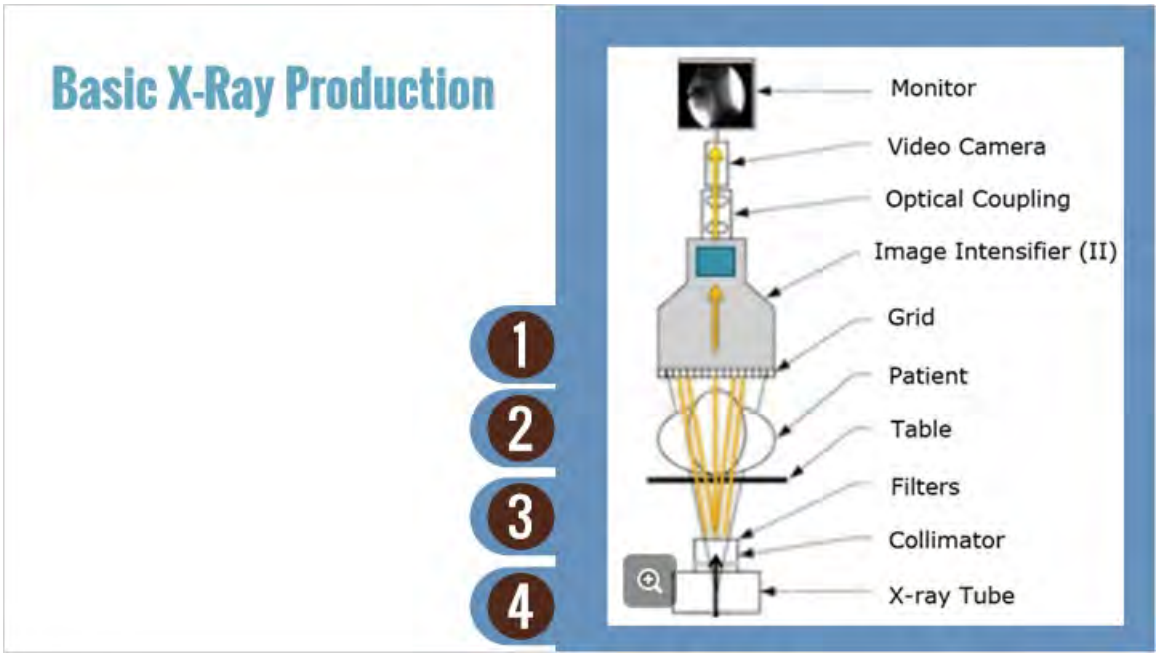
Correct (Slide Layer)



Incorrect (Slide Layer)

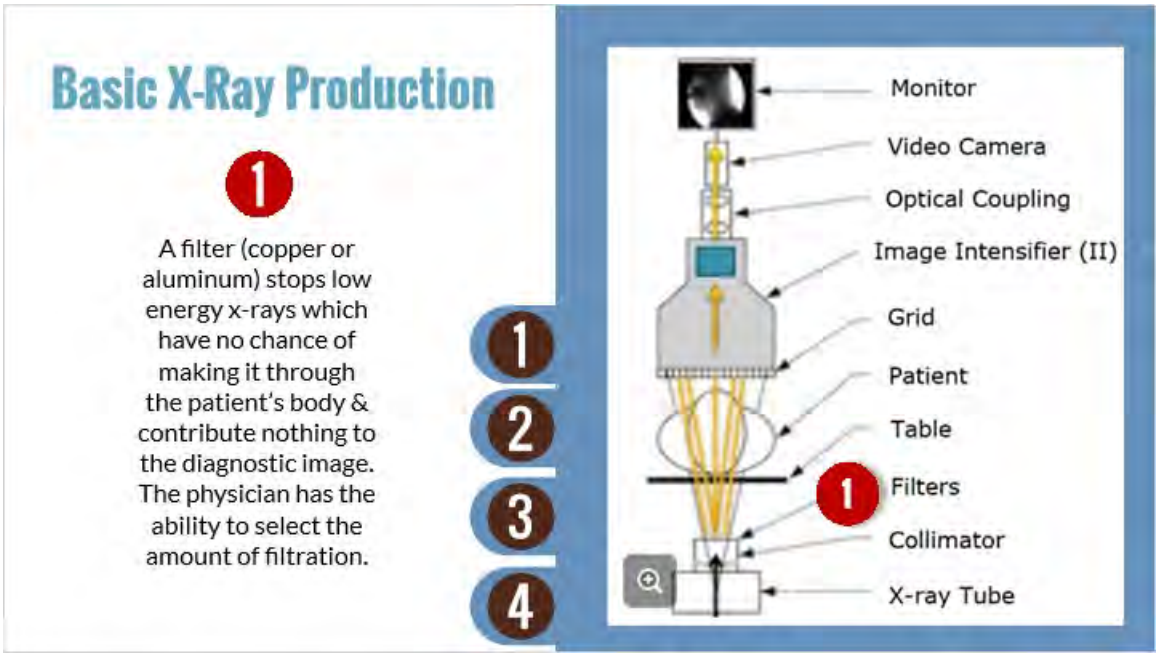


1.47 Basic X-Ray Production

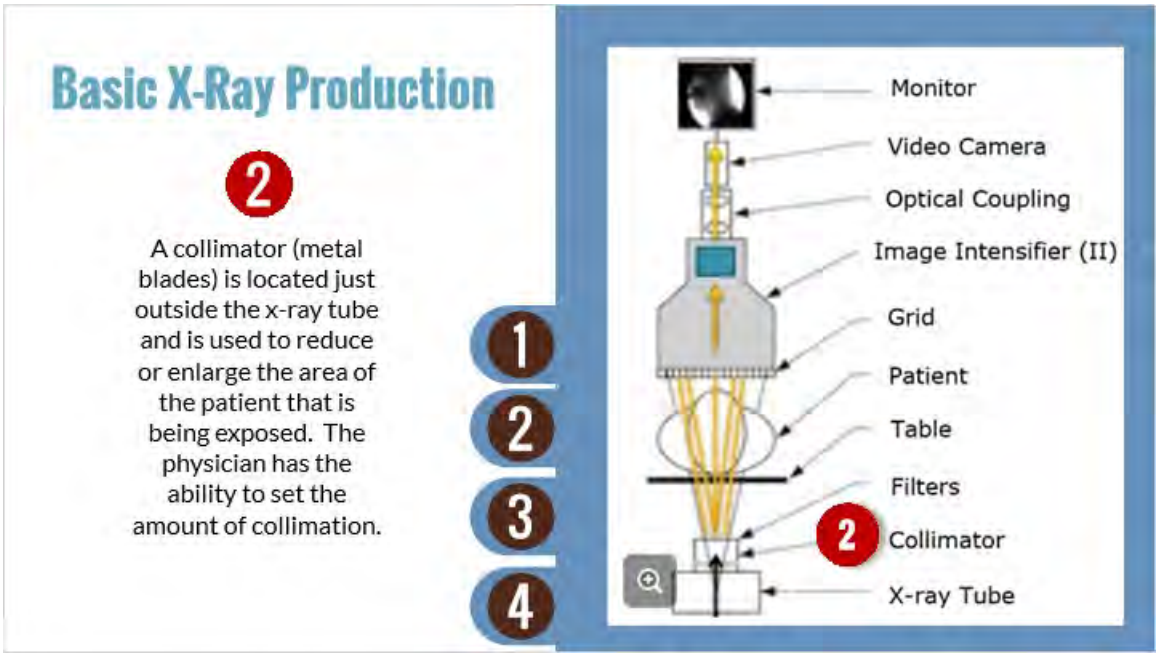


Notes:

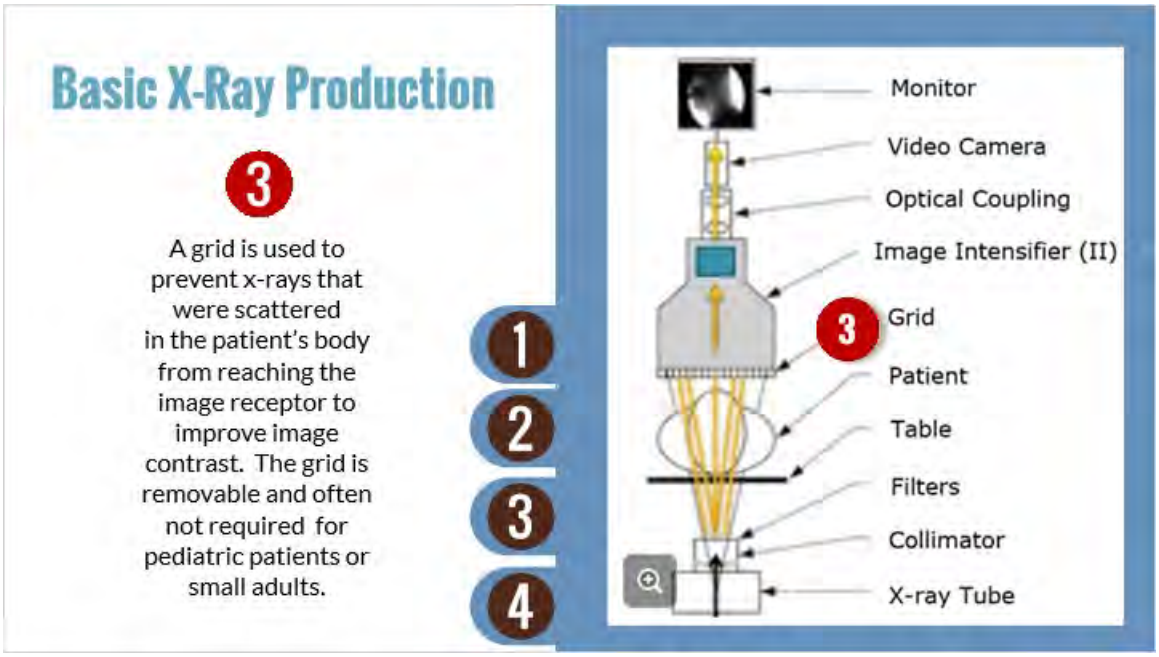
Tab 01 (Slide Layer)



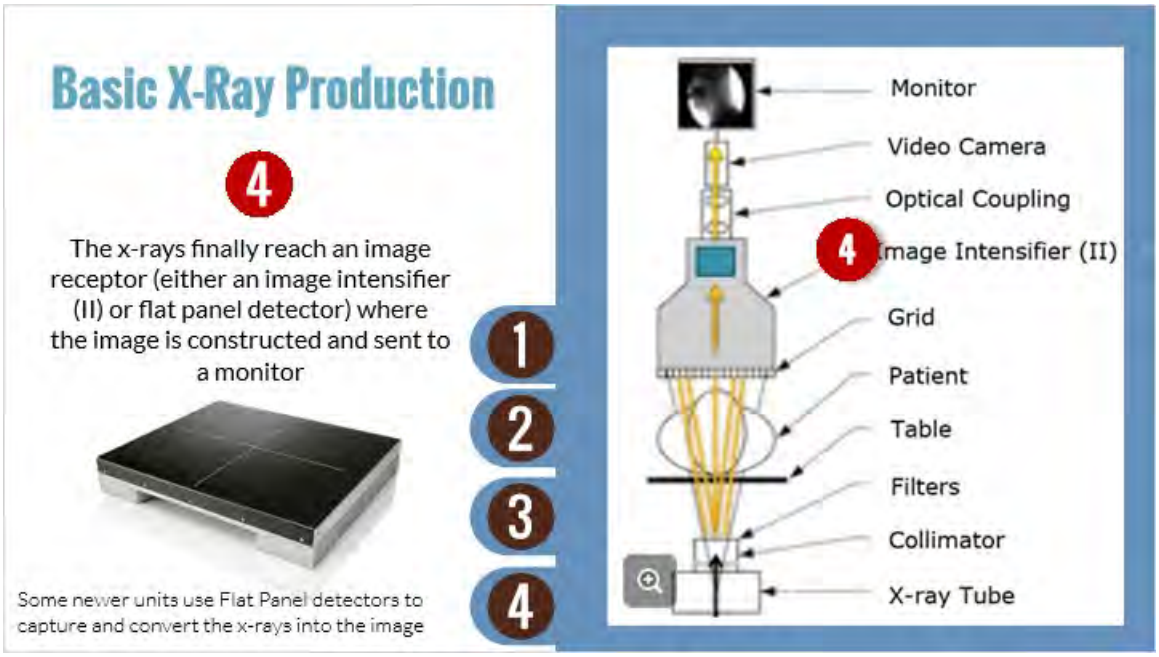
Tab 02 (Slide Layer)



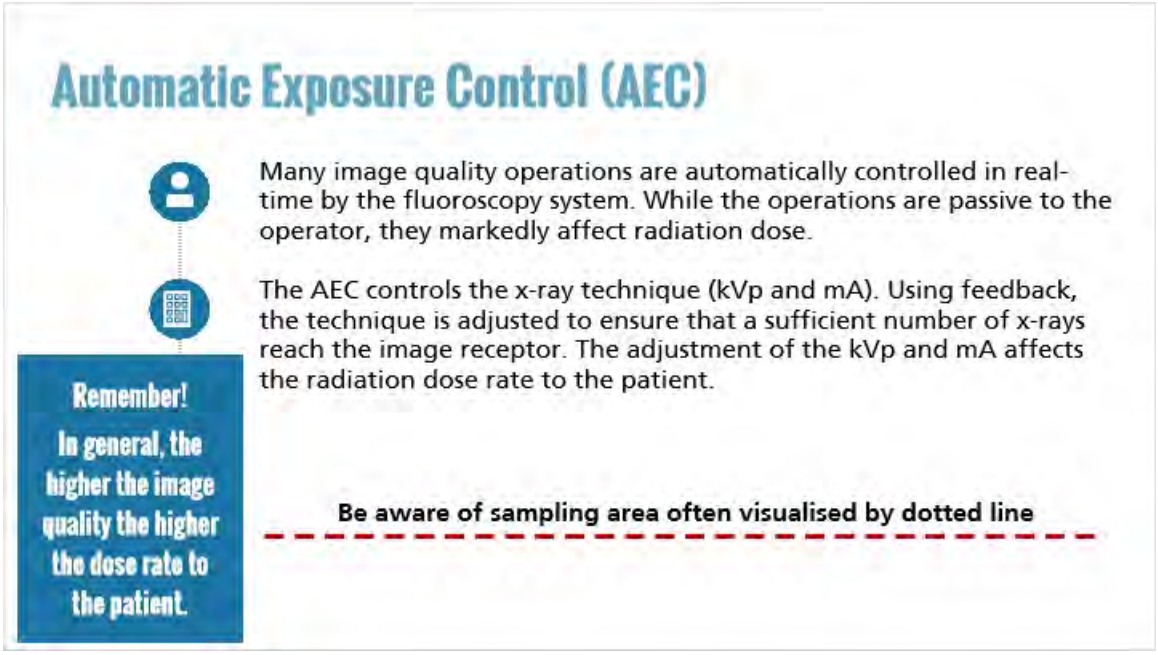
Tab 03 (Slide Layer)



Tab 04 (Slide Layer)



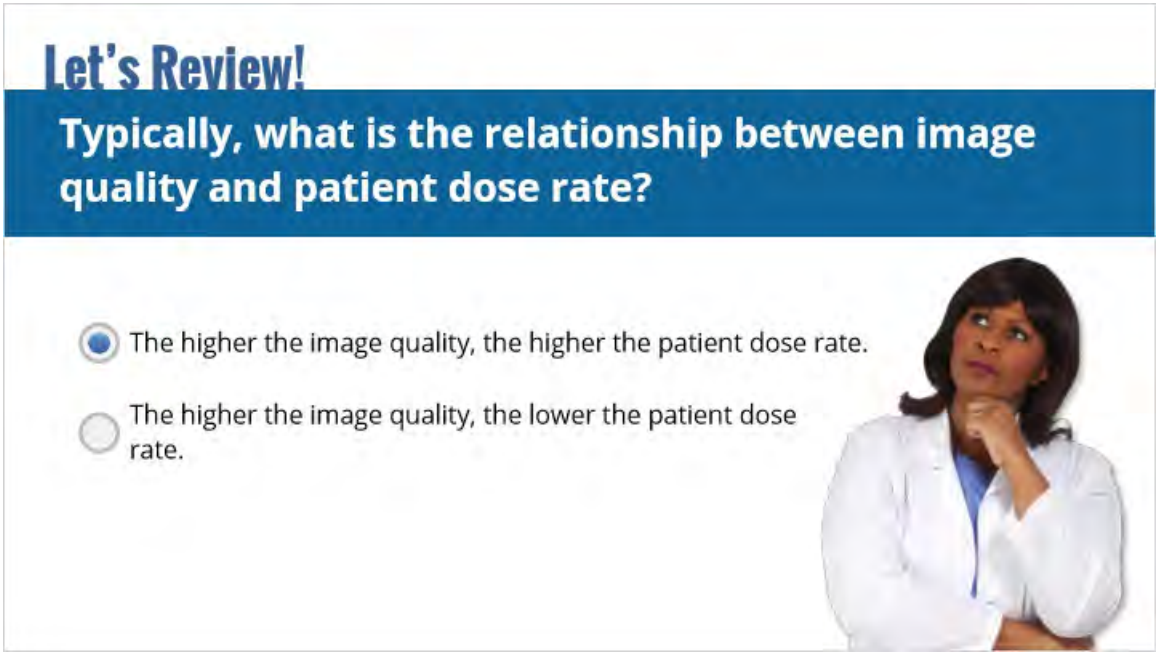
1.48 Automatic Exposure Control



Notes:

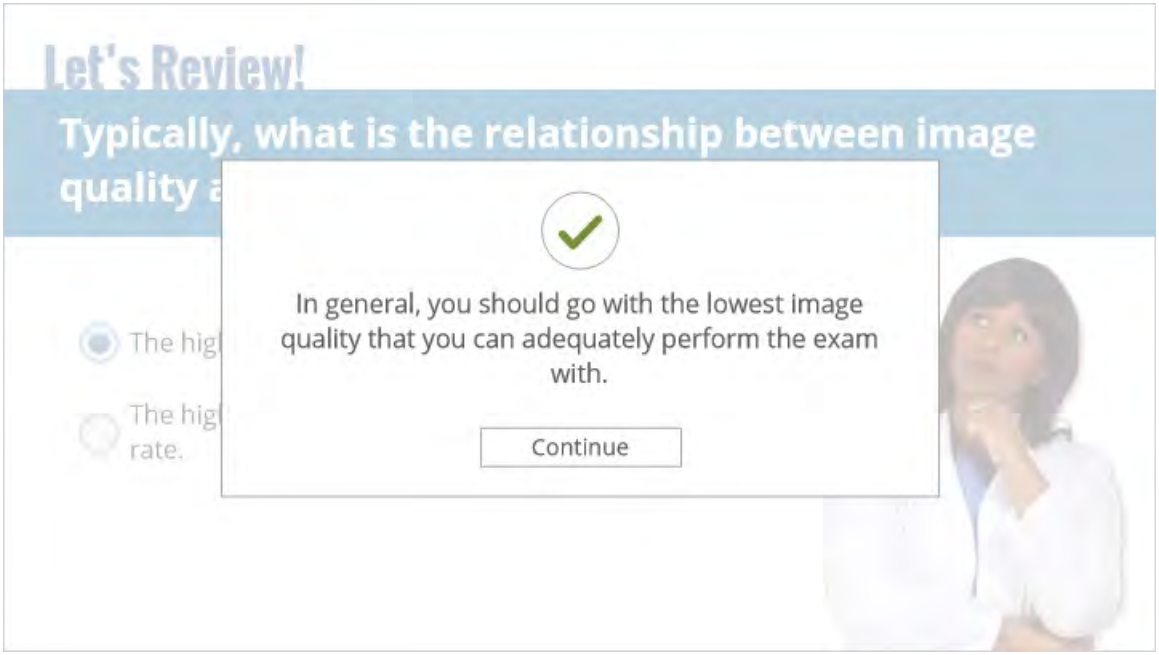
1.49 Typically, what is the relationship between image quality and patient dose rate?

(Multiple Choice, 10 points, 3 attempts permitted)

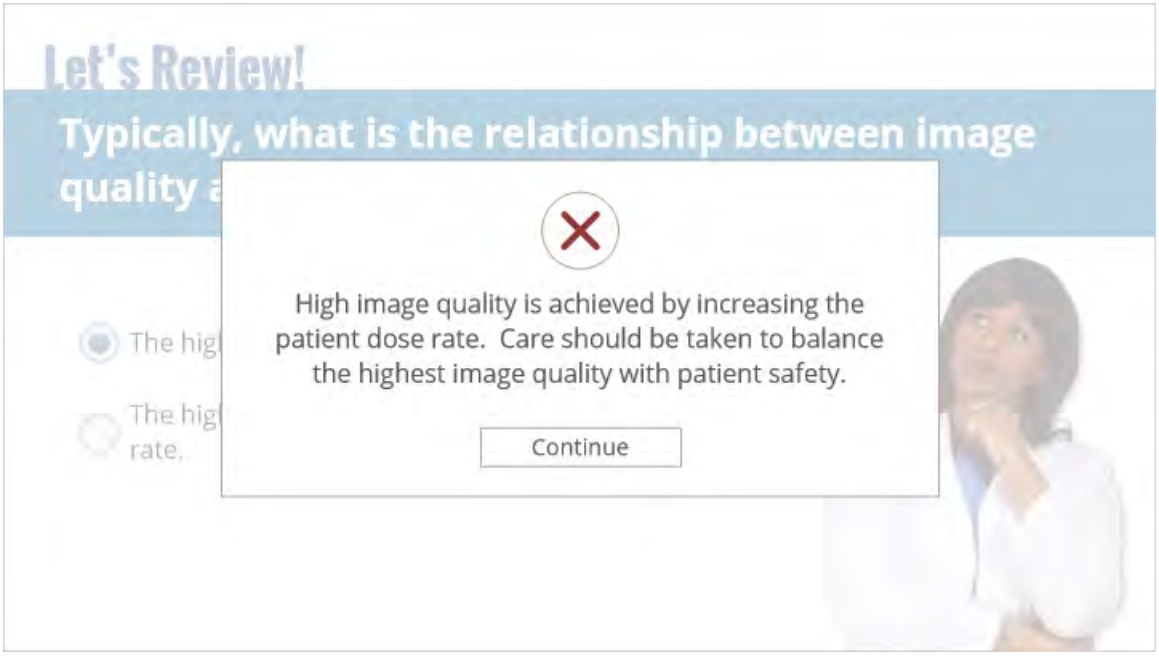


Correct	Choice	Feedback
X	The higher the image quality, the higher the patient dose rate.	In general, you should go with the lowest image quality that you can adequately perform the exam with.
	The higher the image quality, the lower the patient dose rate.	High image quality is achieved by increasing the patient dose rate. Care should be taken to balance the highest image quality with patient safety.

The higher the image quality, the higher the patient dose rate. (Slide Layer)

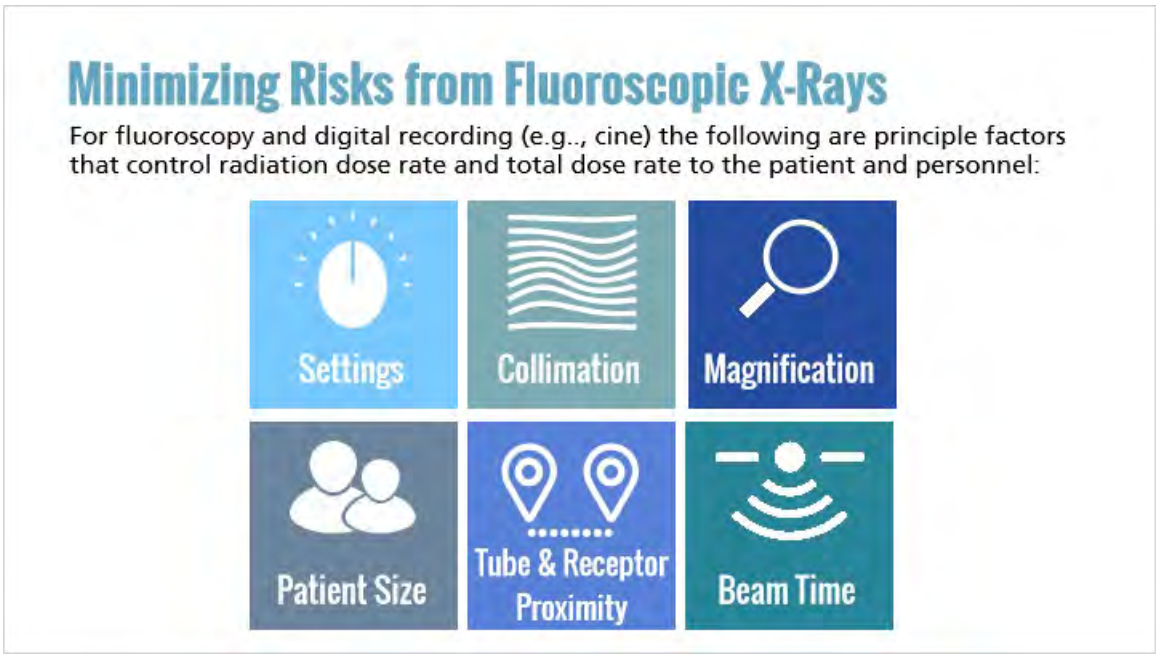


The higher the image quality, the lower the patient dose rate. (Slide Layer)

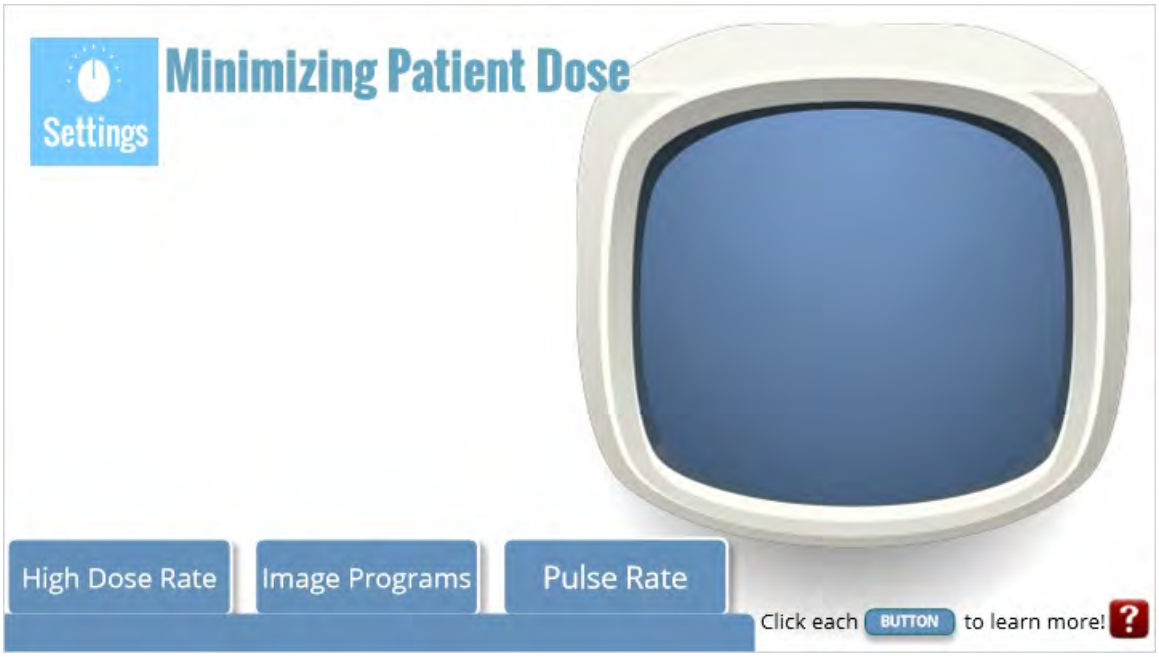


1.50 Operator Settings

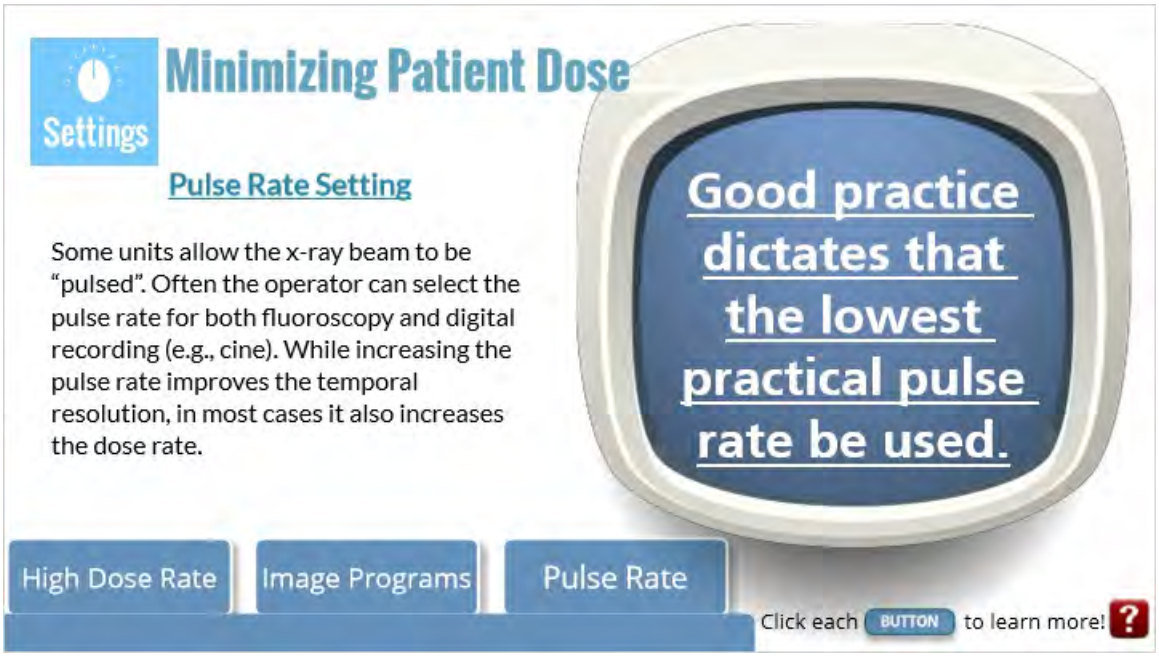
1.51 Minimizing Risk



1.52 Minimizing Patient Dose: Settings



Pulse Rate (Slide Layer)



high Dose Rate (Slide Layer)

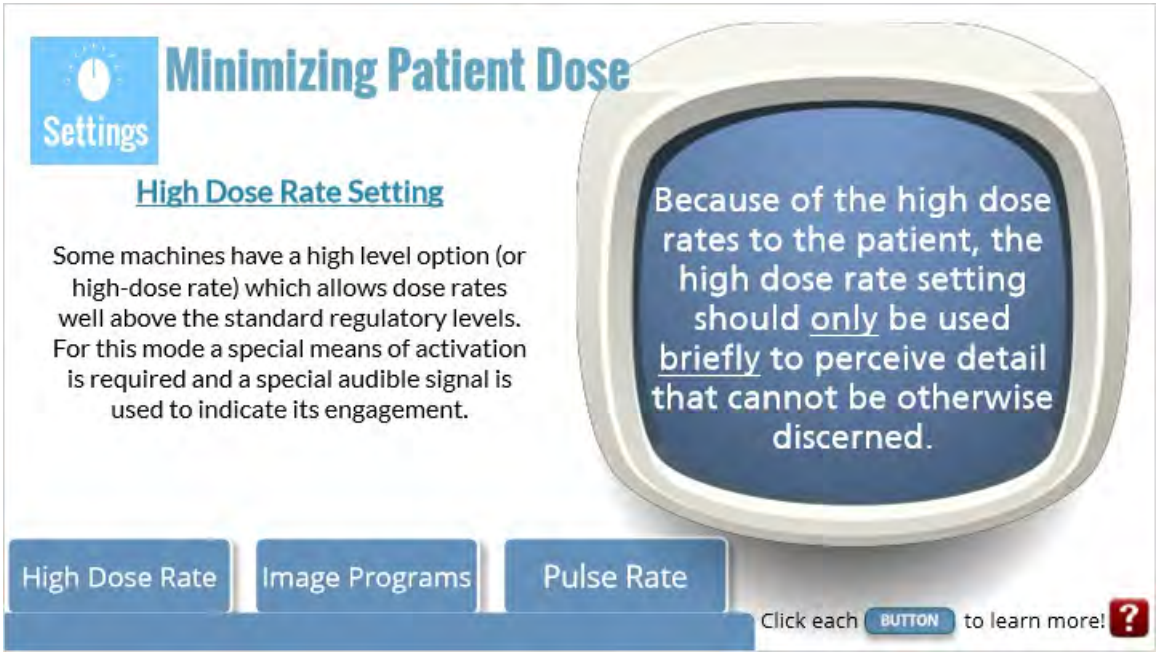


Image program 1 (Slide Layer)

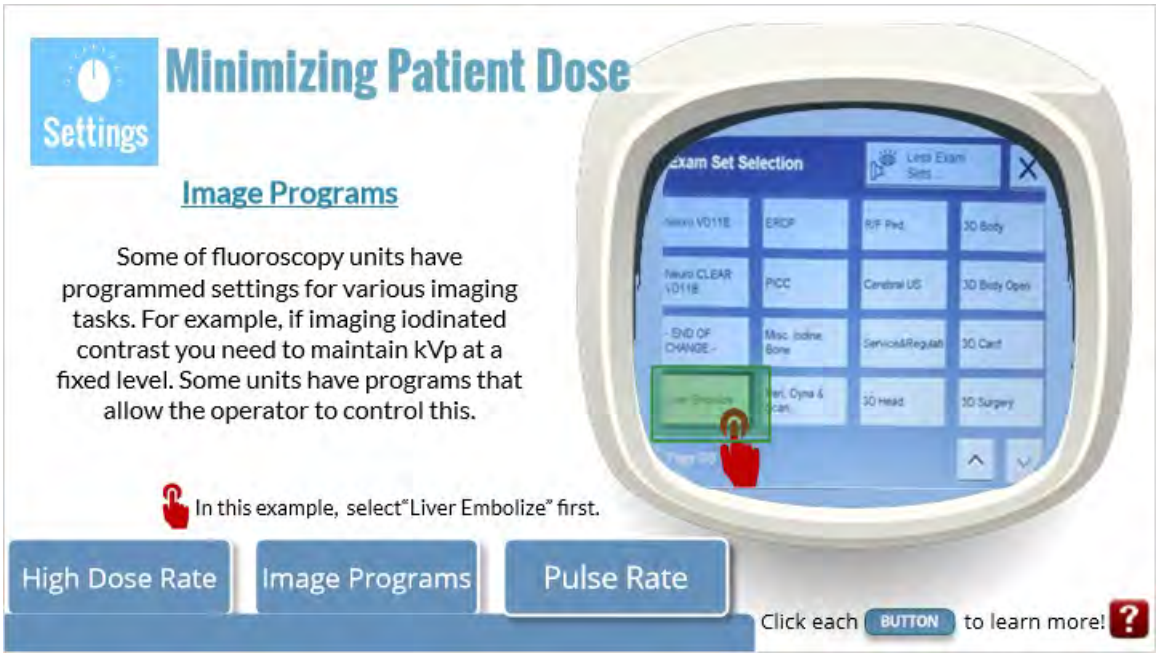
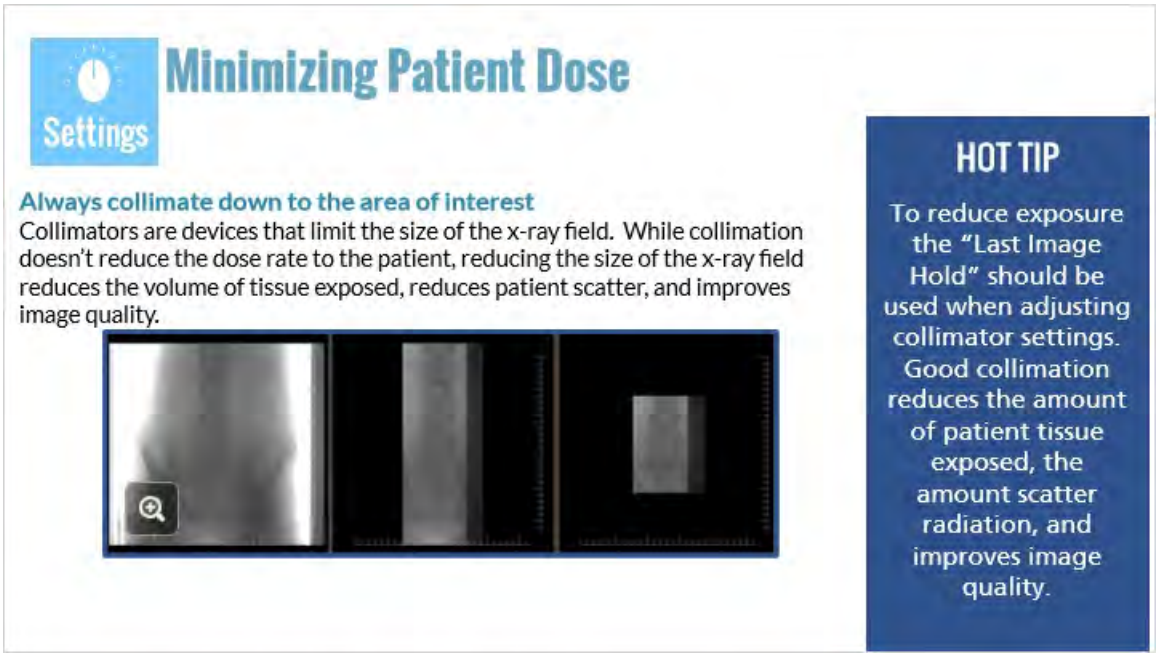


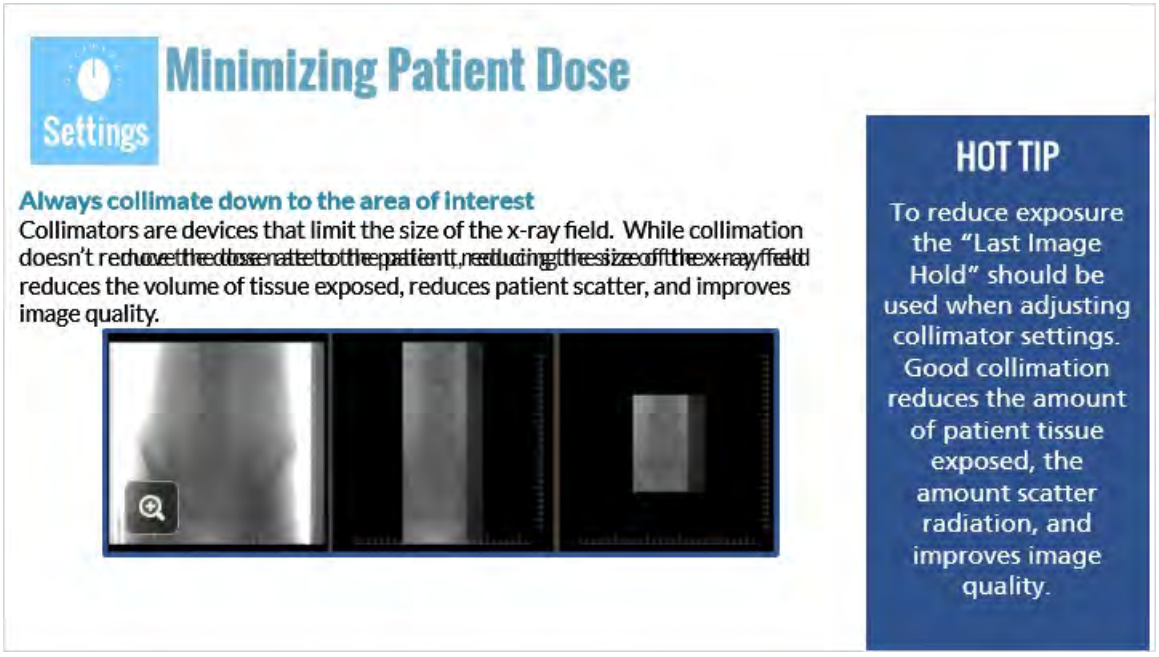
Image program 2 (Slide Layer)

1.53 Minimizing Patient Dose: Settings



Pulse Rate (Slide Layer)

collimate to area of interest (Slide Layer)



high Dose Rate (Slide Layer)

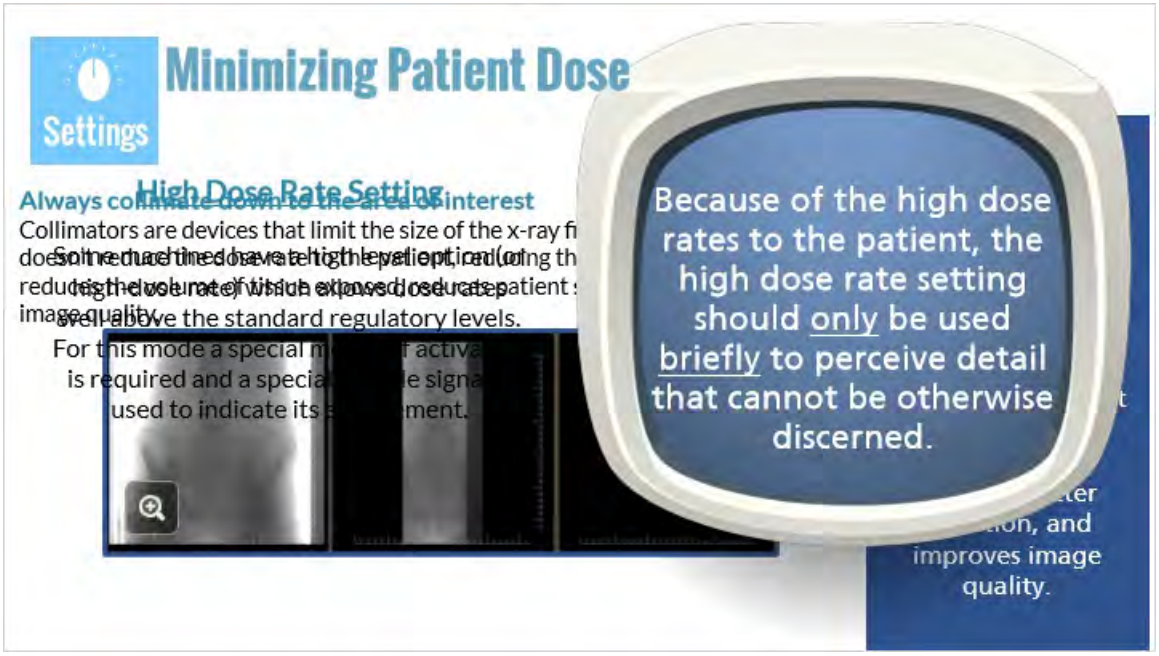


Image program 1 (Slide Layer)

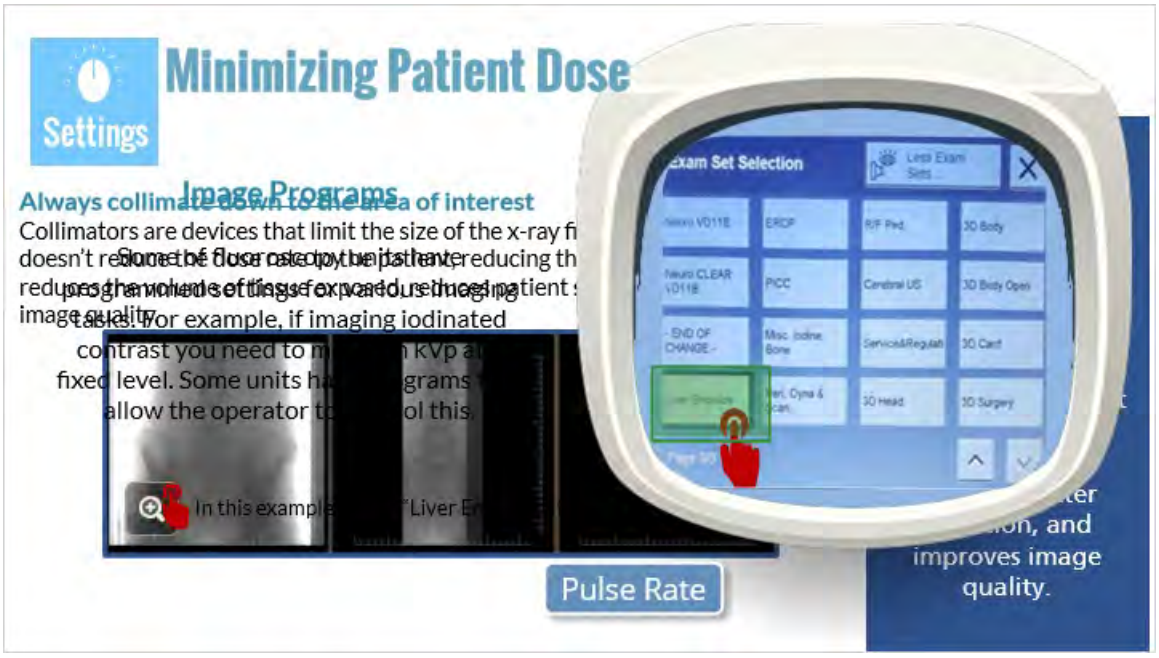
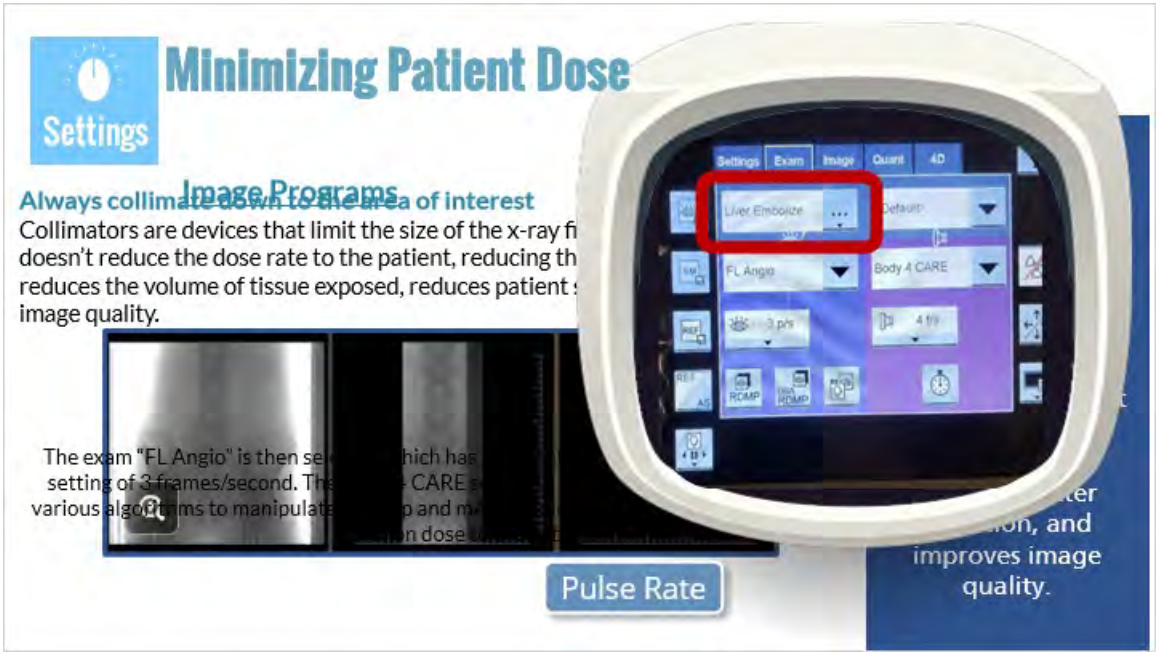
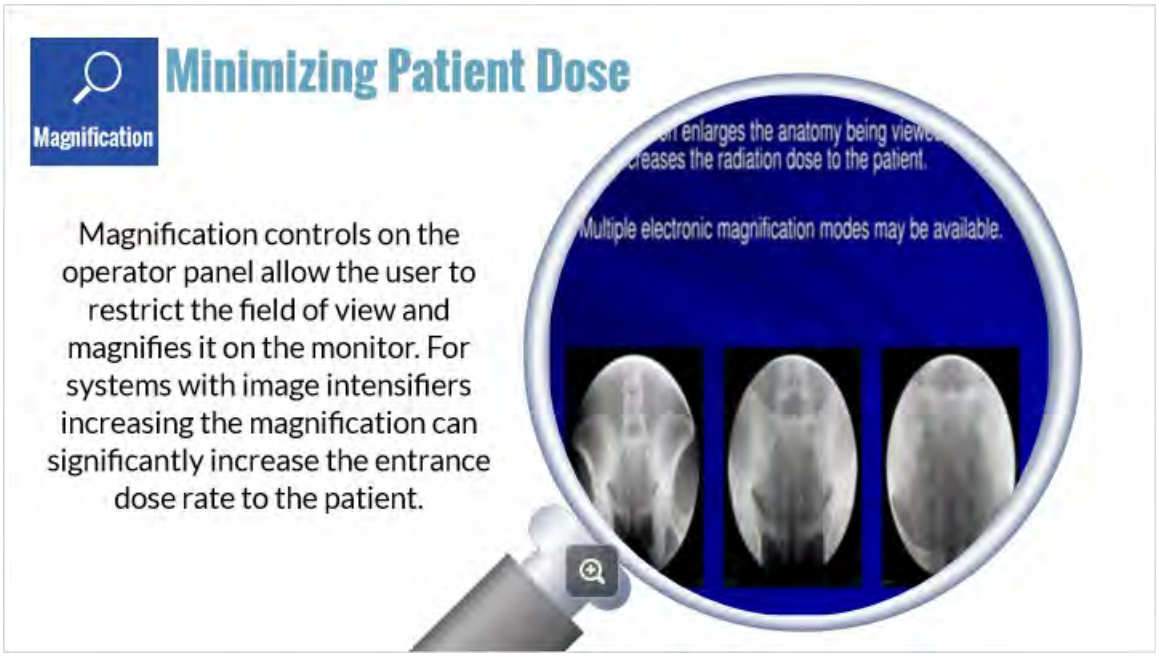


Image program 2 (Slide Layer)



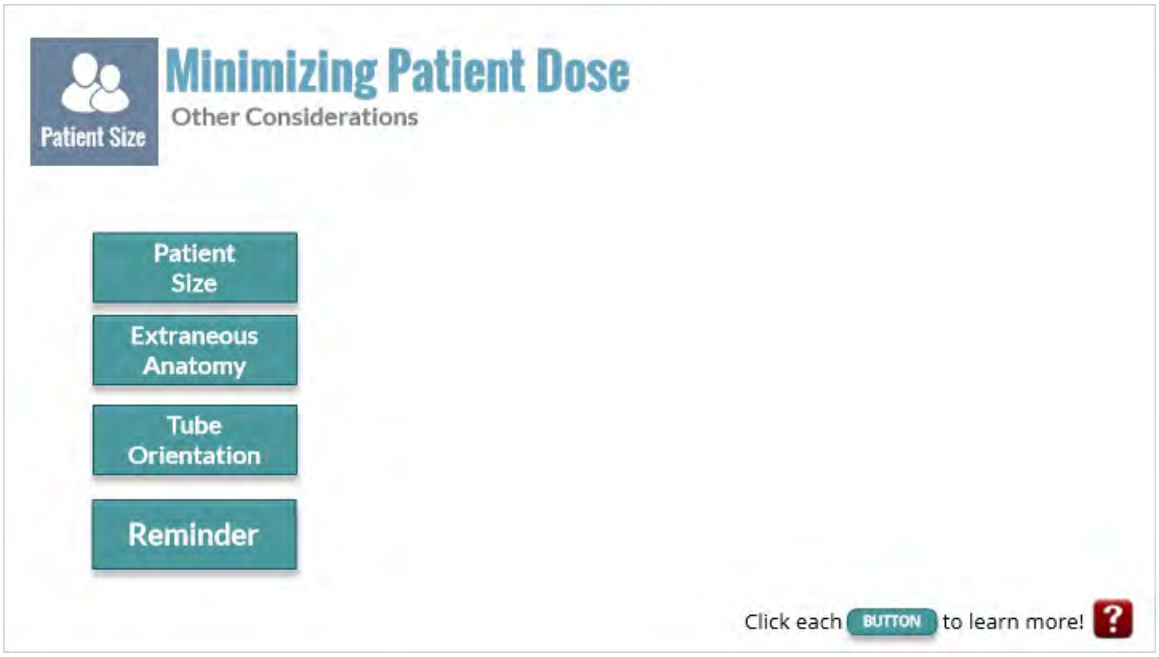
Pulse Rate - magnified (Slide Layer)

1.54 Minimizing Patient Dose: Magnification



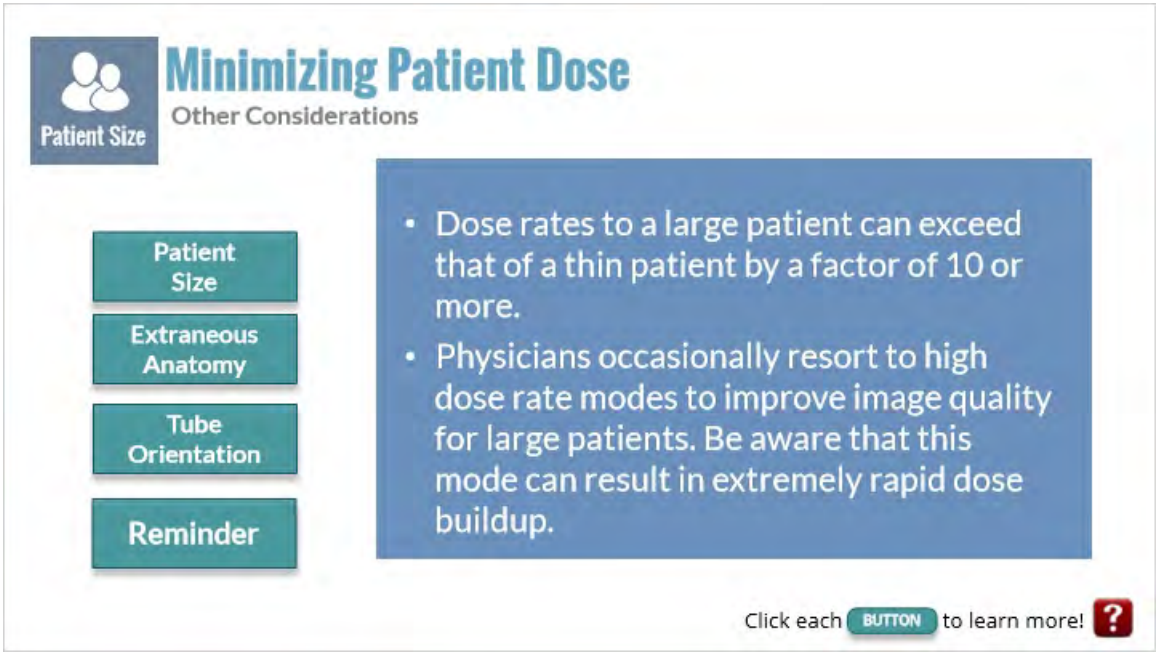
Notes:

1.55 Minimizing Patient Dose: Patient Size



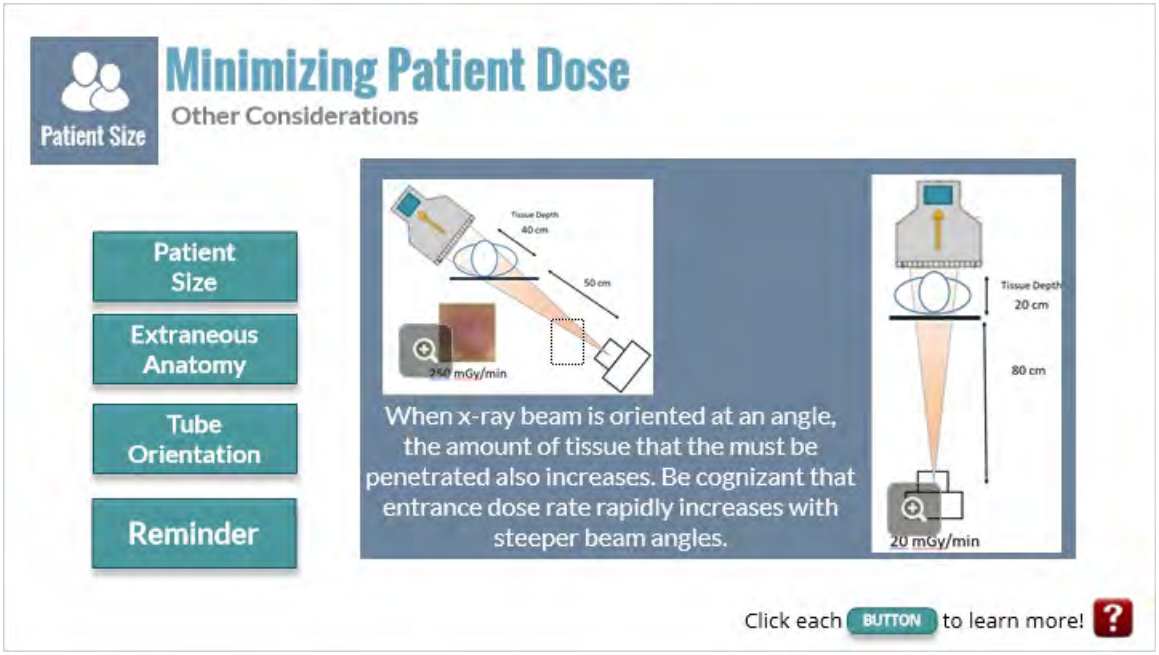
Notes:

Patient Size (Slide Layer)

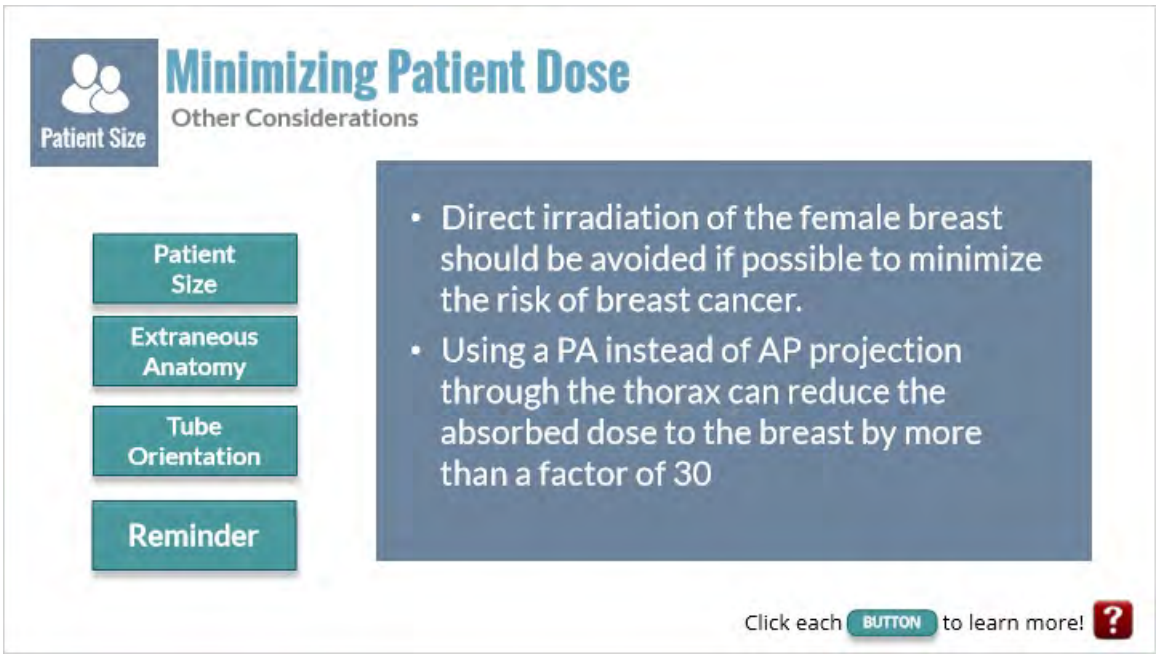


Extraneous Anatomy (Slide Layer)

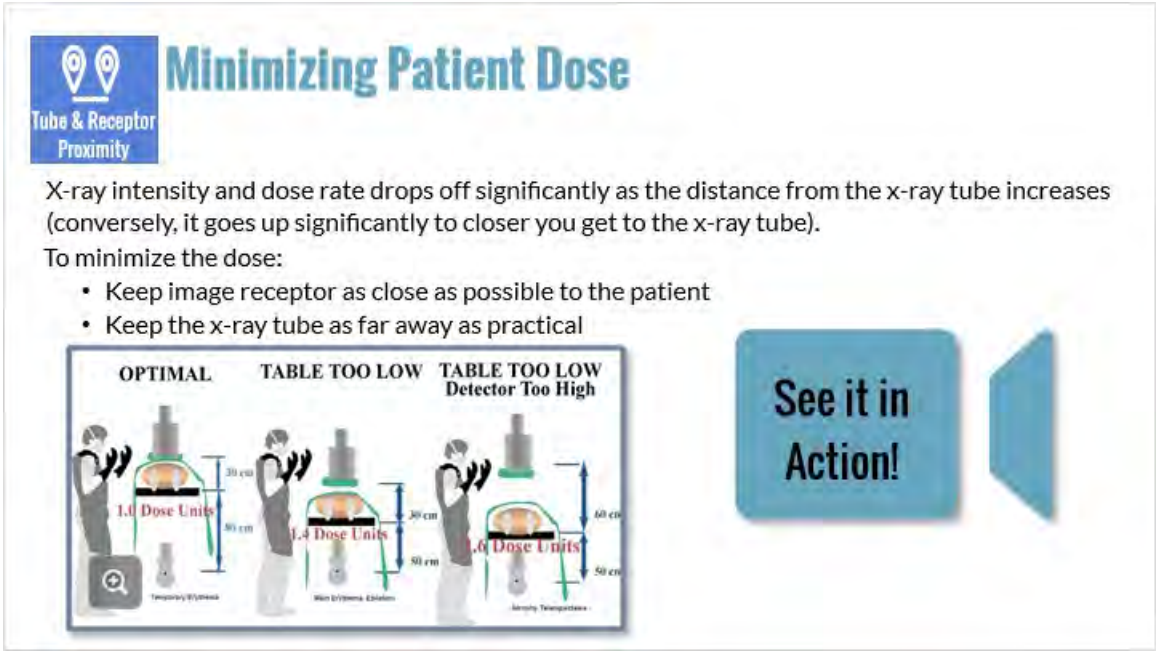
Tube Orientations (Slide Layer)



Reminder (Slide Layer)

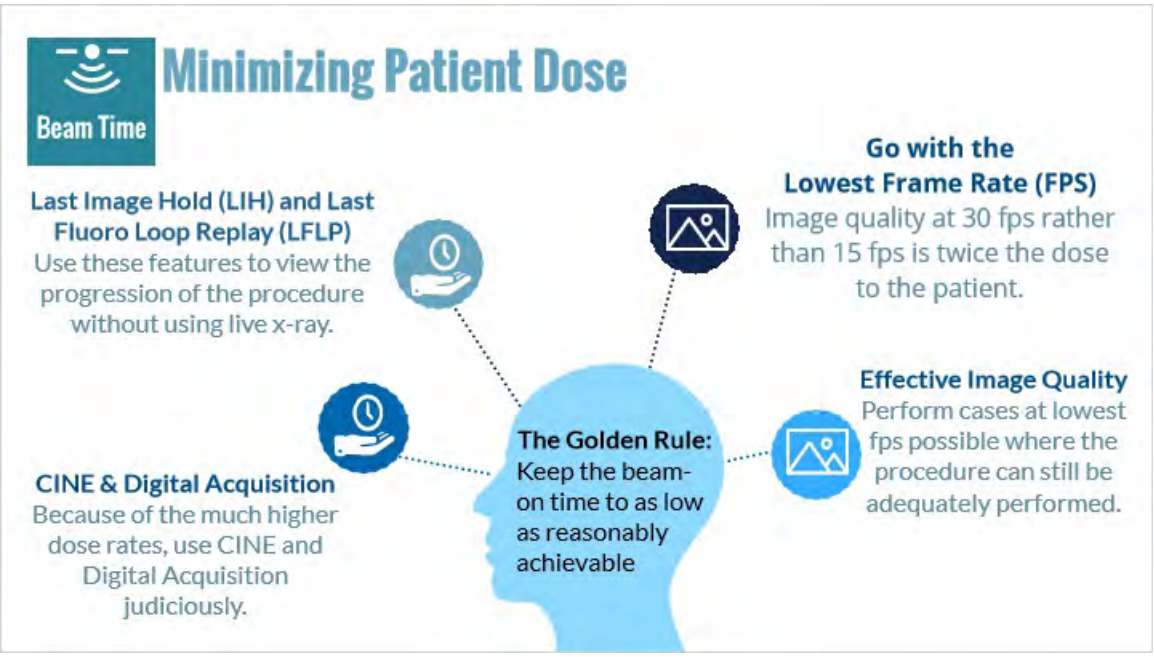


1.56 Minimizing Patient Dose:Tube & Receptor Proximity



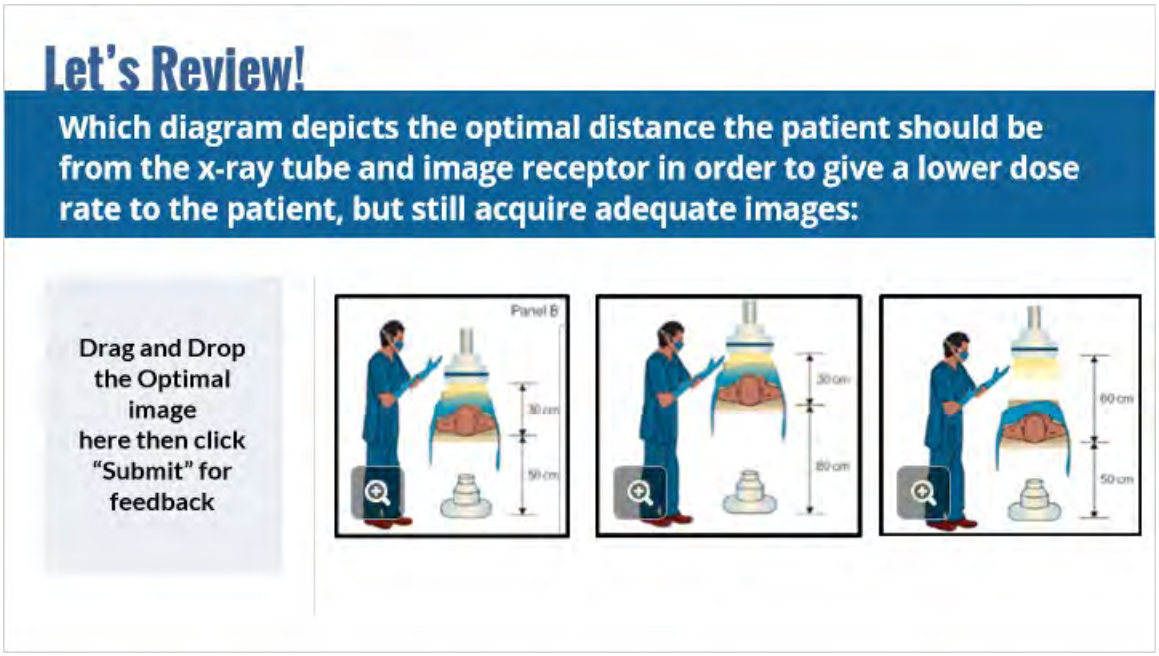
Notes:

1.57 Minimizing Patient Dose:Beam Time



1.58 Which diagram depicts the optimal distance the patient should be from the x-ray tube and image receptor in order to give a lower dose rate to the patient, but still acquire adequate images:

(Drag and Drop, 10 points, 4 attempts permitted)



Drag Item	Drop Target
Picture 2	Label 01
Picture 3	
Picture 1	

Drag and drop properties
Return item to start point if dropped outside the correct drop target
Snap dropped items to drop target (Stack random)
Delay item drop states until interaction is submitted

Feedback when correct:

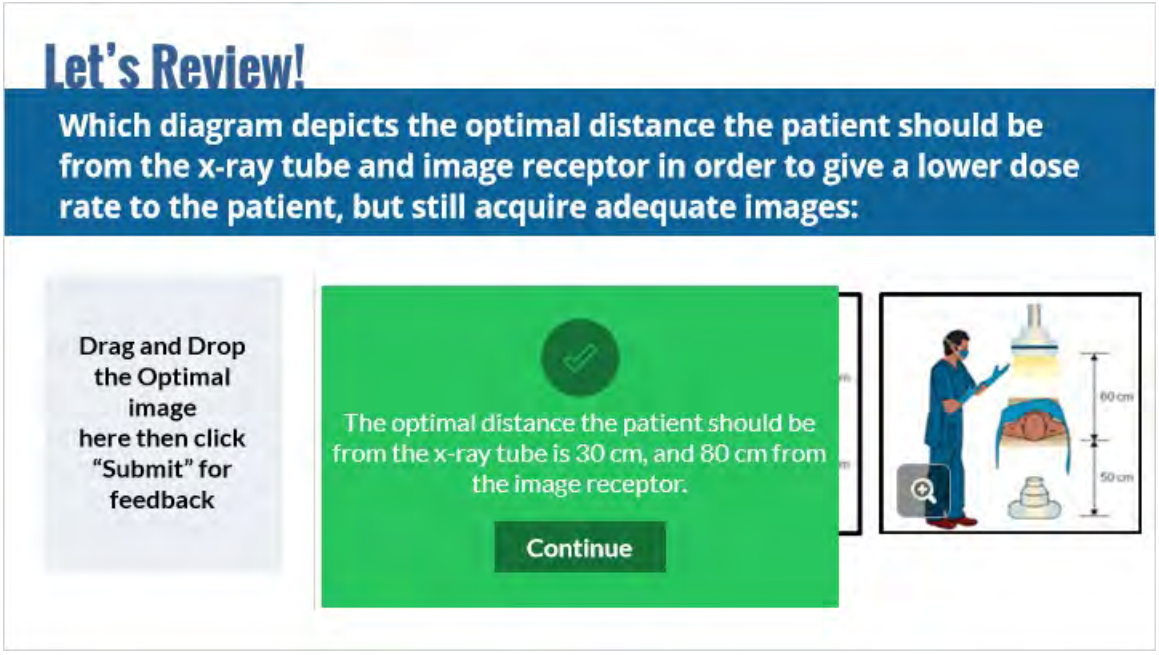
The optimal distance the patient should be from the x-ray tube is 30 cm, and 80 cm from the image receptor.

Feedback when incorrect:

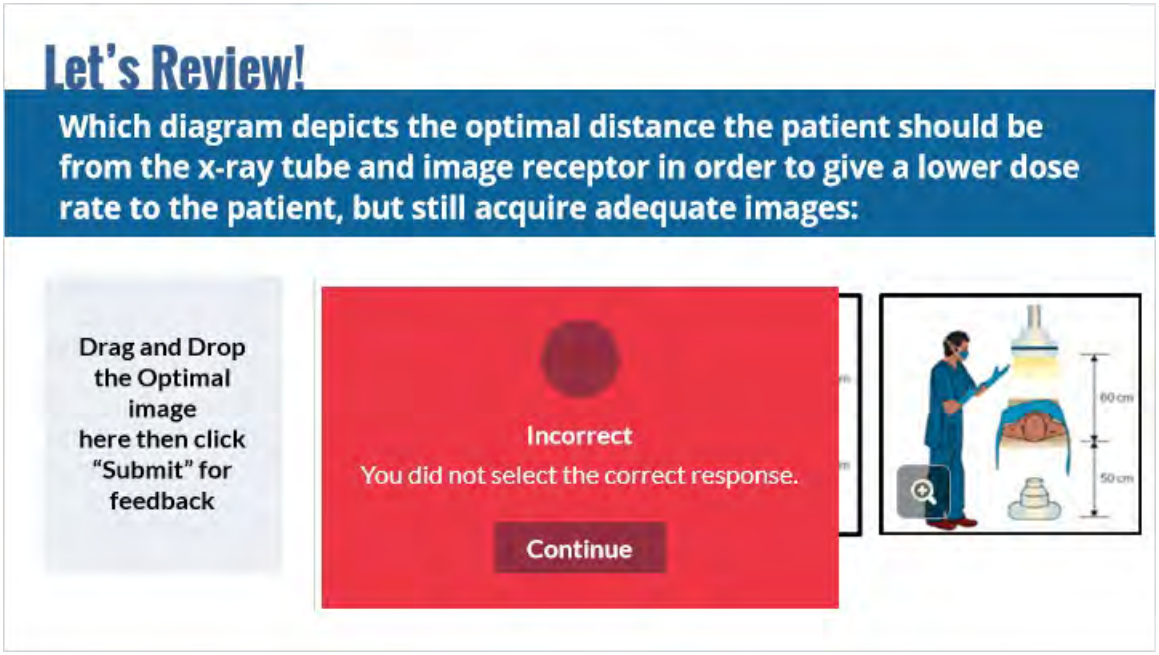
You did not select the correct response.

Notes:

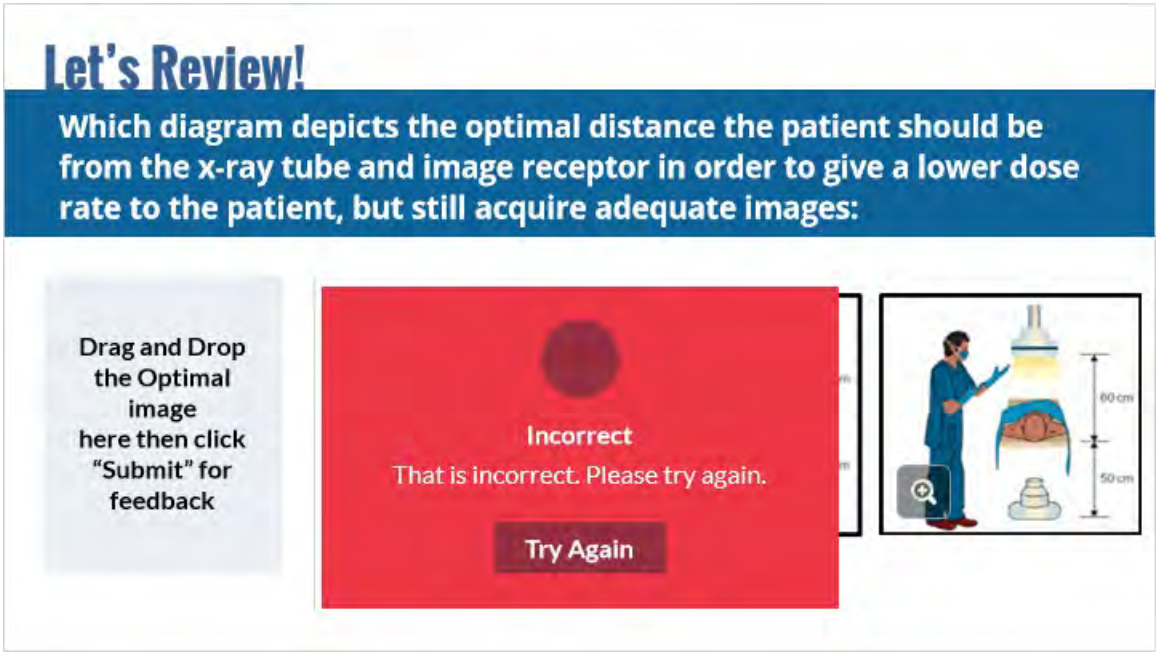
Correct (Slide Layer)



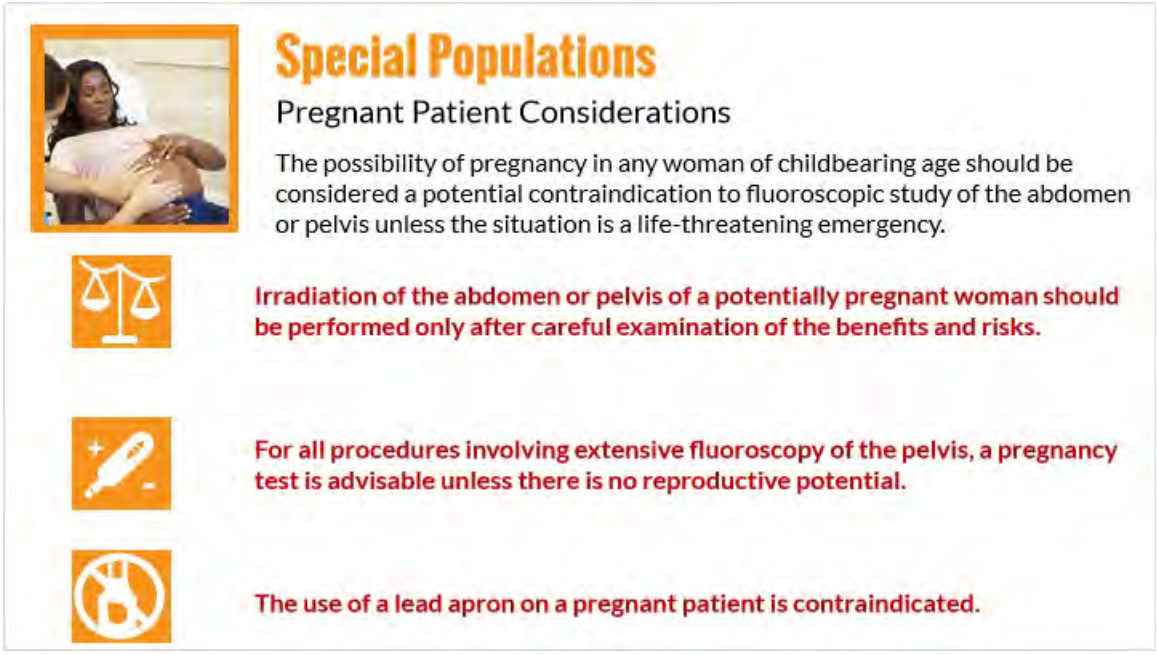
Incorrect (Slide Layer)



Try Again (Slide Layer)

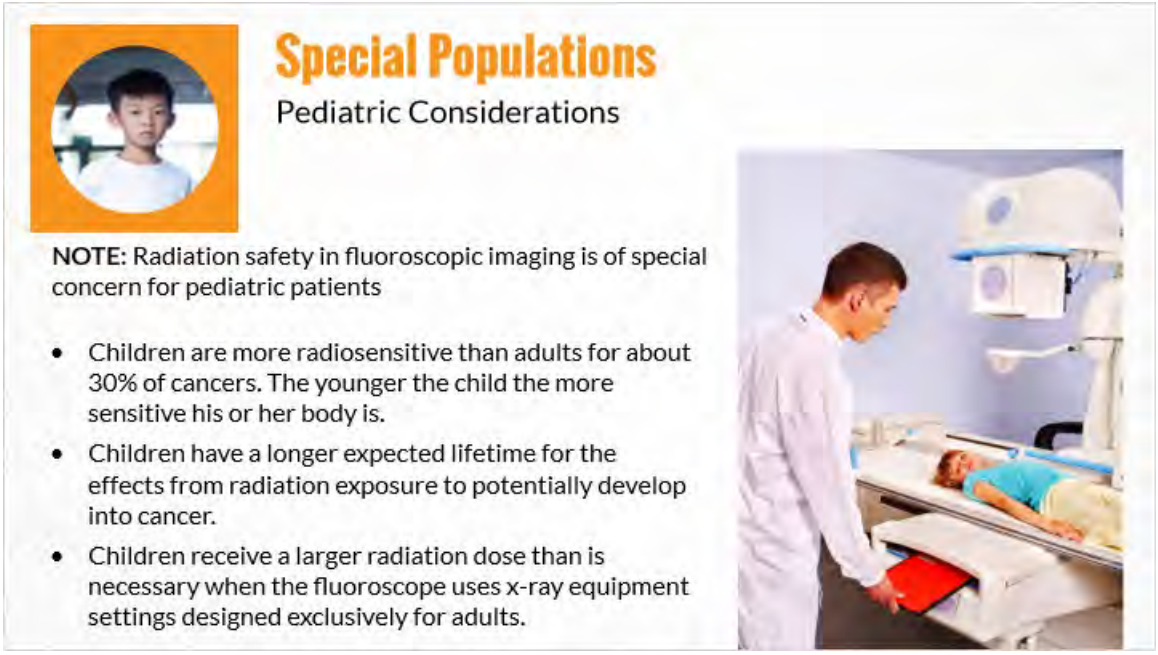


1.59 Minimizing Patient Dose: Pregnant Patients



Notes:

1.60 Special Populations: Pediatrics

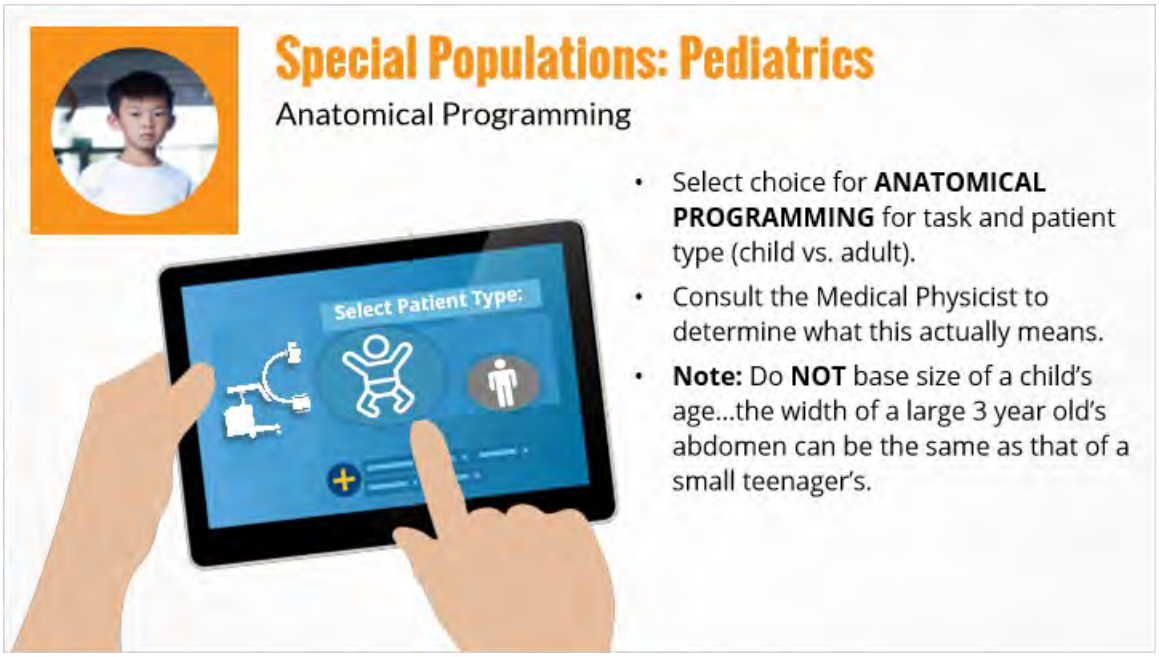


Notes:

1.61 Special Populations: Pediatrics

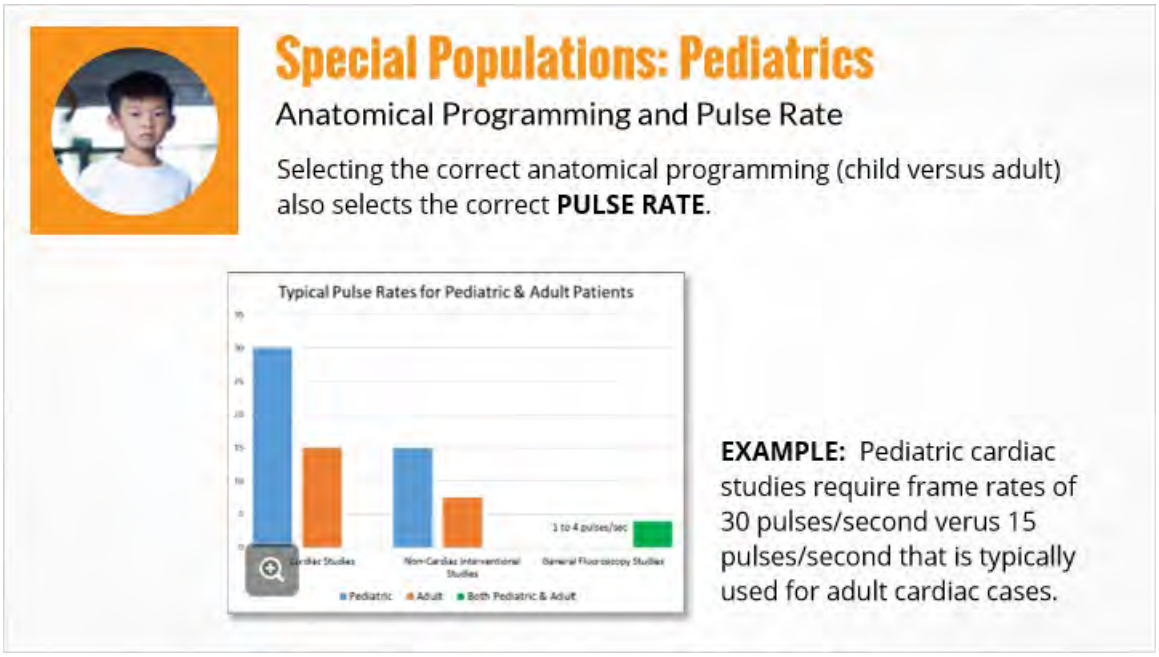
Notes:

1.62 Special Populations: Pediatrics



Notes:

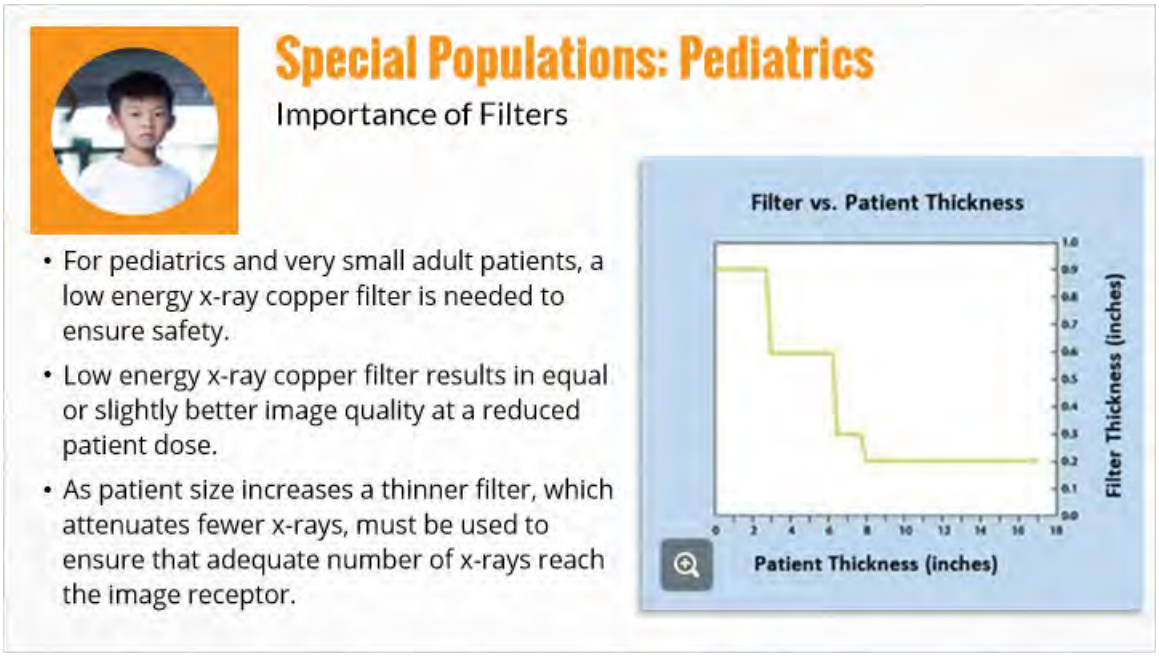
1.63 Special Populations: Pediatrics



Notes:

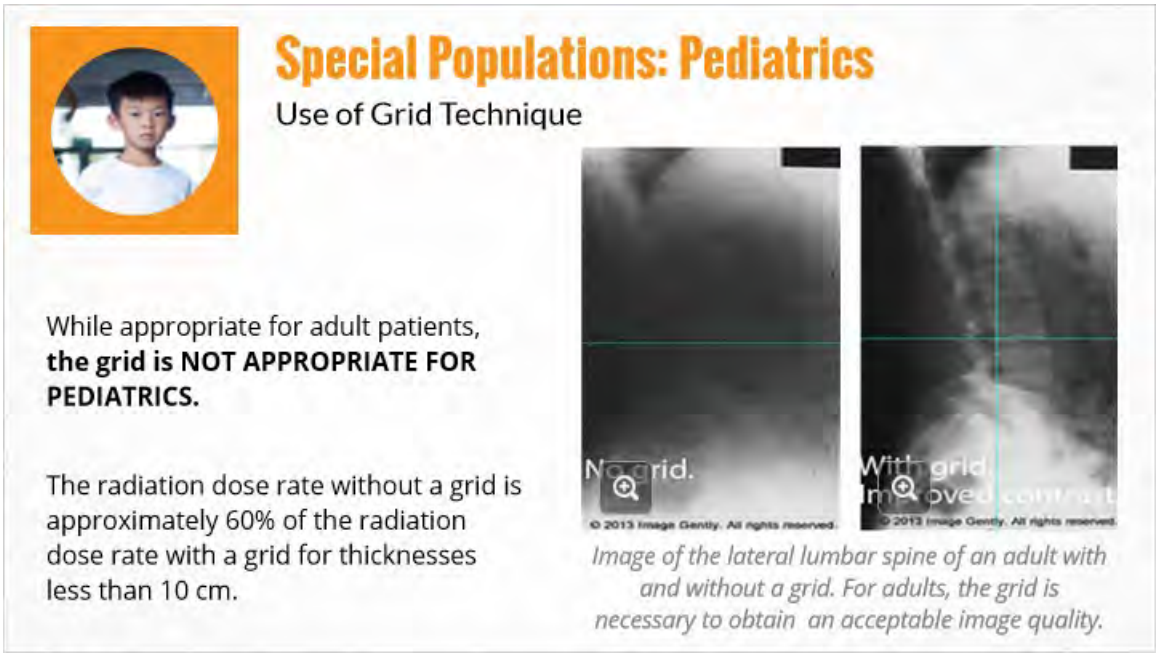
1.64 Special Populations: Pediatrics

Importance of Filters



Notes:

1.65 Special Populations: Pediatrics



Notes:

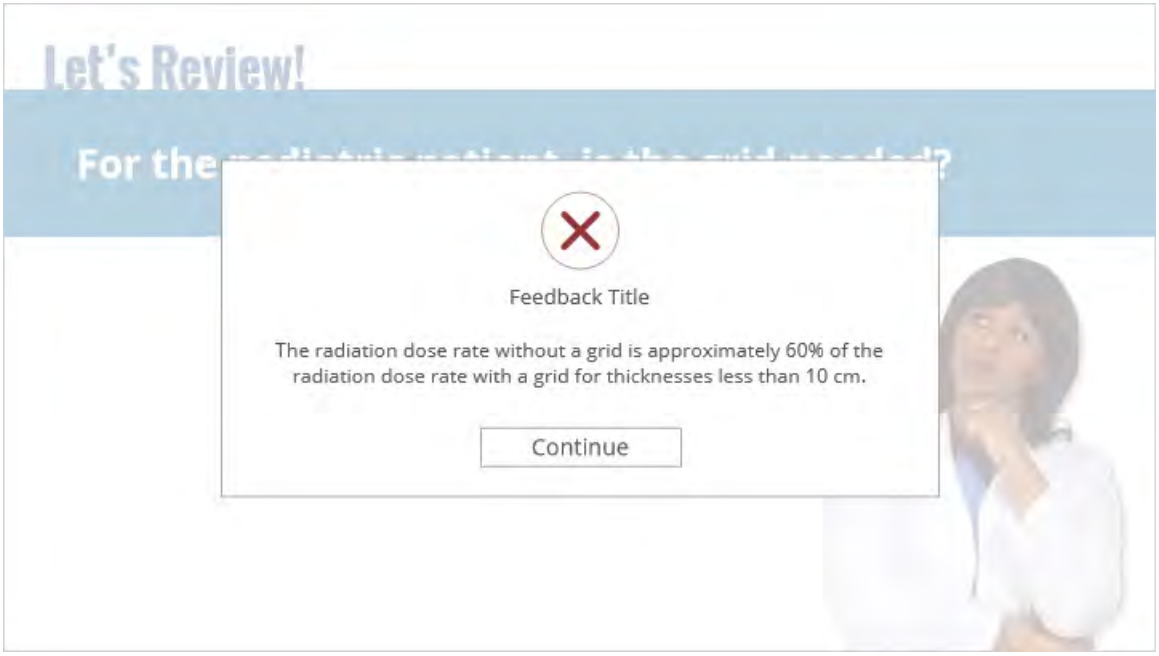
1.66 For the pediatric patient, is the grid needed?

(Multiple Choice, 10 points, 3 attempts permitted)

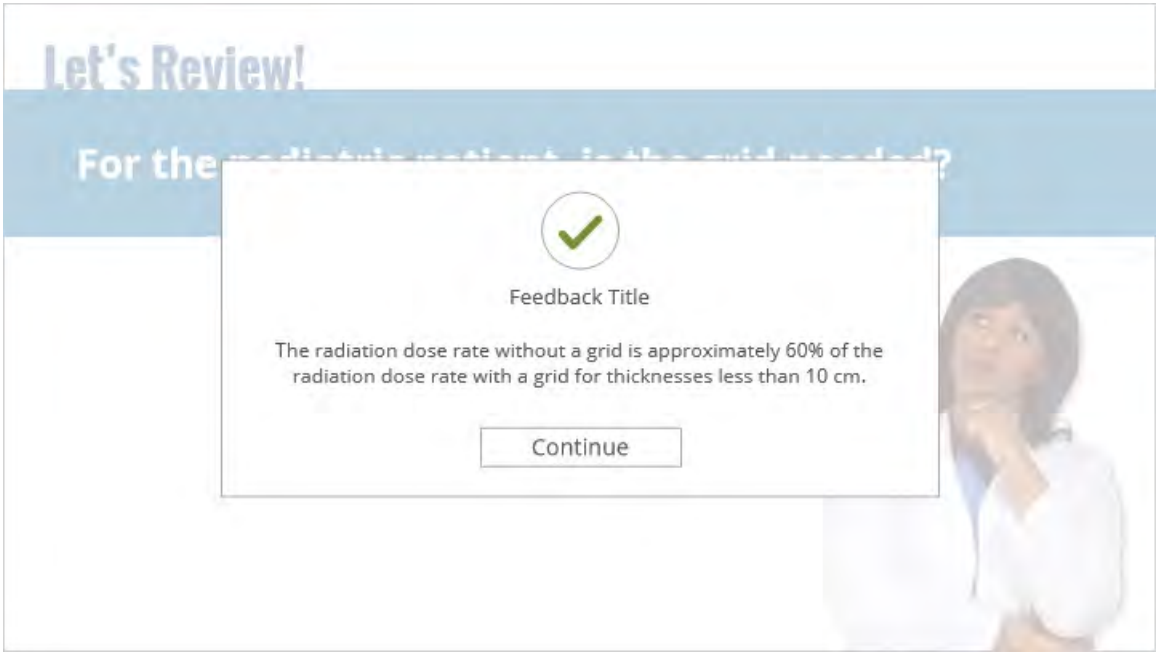
Correct	Choice	Feedback
	Yes	The radiation dose rate without a grid is approximately 60% of the radiation dose rate with a grid for thicknesses less than 10 cm.
X	No	The radiation dose rate without a grid is approximately 60% of the radiation dose rate with a grid for thicknesses less than 10 cm.

Notes:

Correct (Slide Layer)



Incorrect (Slide Layer)



1.67 As a Radiation Worker, Pledge your Responsibility…

(Multiple Response, 10 points, unlimited attempts permitted)

Correct	Choice
X	I will be responsible for correctly wearing a radiation badge at all times when working with or near a source of occupational radiation exposure.
X	I understand supervisors and managers have been instructed to enforce rules and consequences for noncompliance
X	I will follow any applicable rules and procedures for protection and safety specified by the hospital
X	I will cooperate with the radiation safety officer with respect to wearing dosimeter badges and notify them if my badge is lost/damaged in any way
X	I will abstain from any willful action that could put myself or others in situations that contravene the requirements of the standard
X	I will accept information, instruction, and training concerning radiation protection

and safety

Feedback when correct:

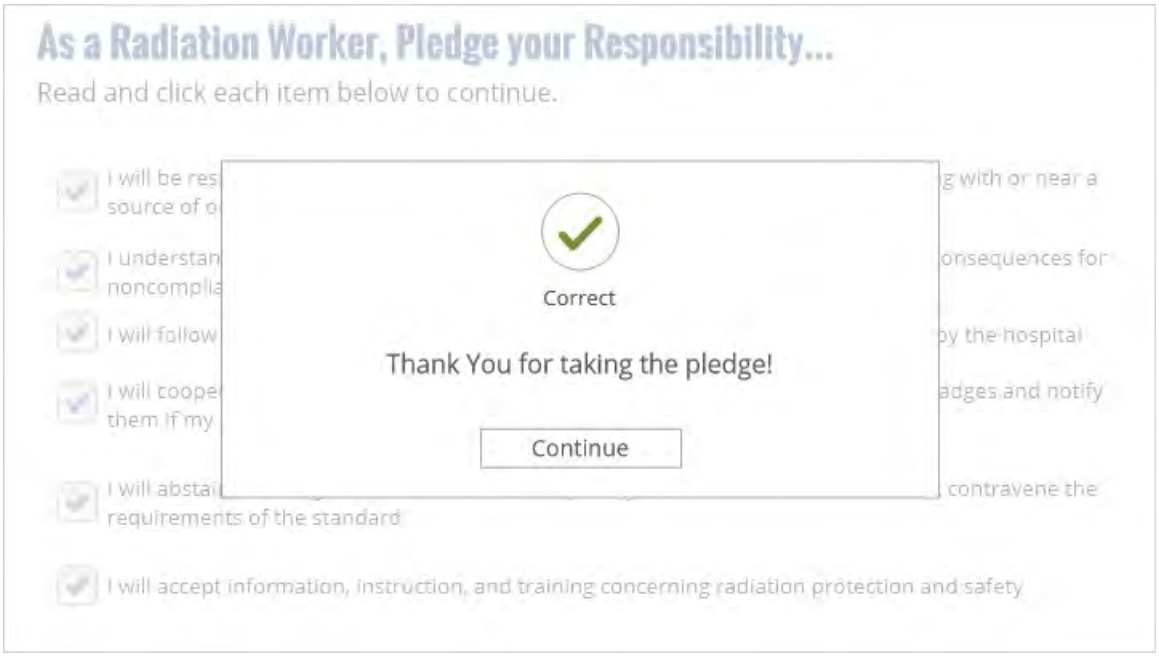
Thank You for taking the pledge!

Feedback when incorrect:

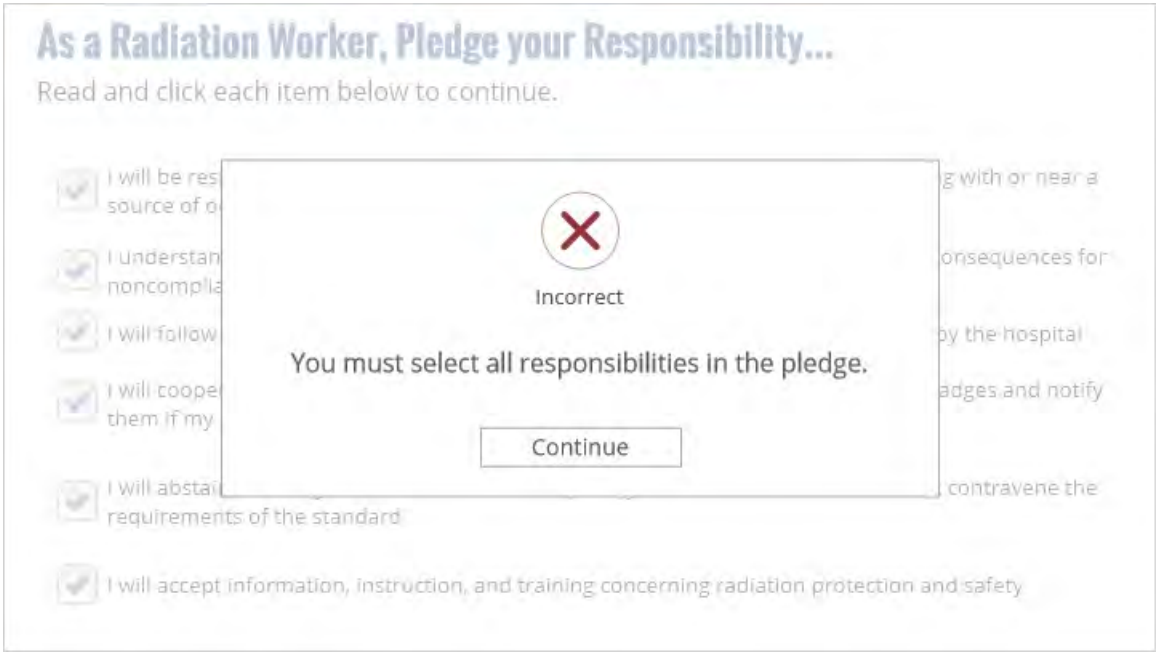
You must select all responsibilities in the pledge.

Notes:

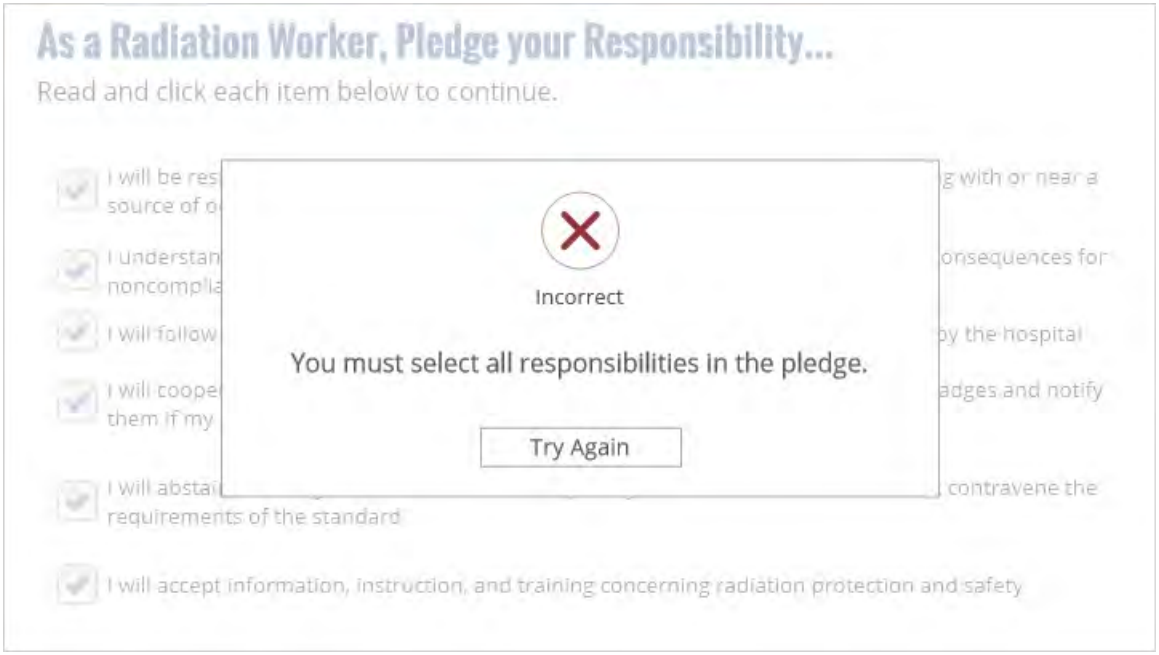
Correct (Slide Layer)



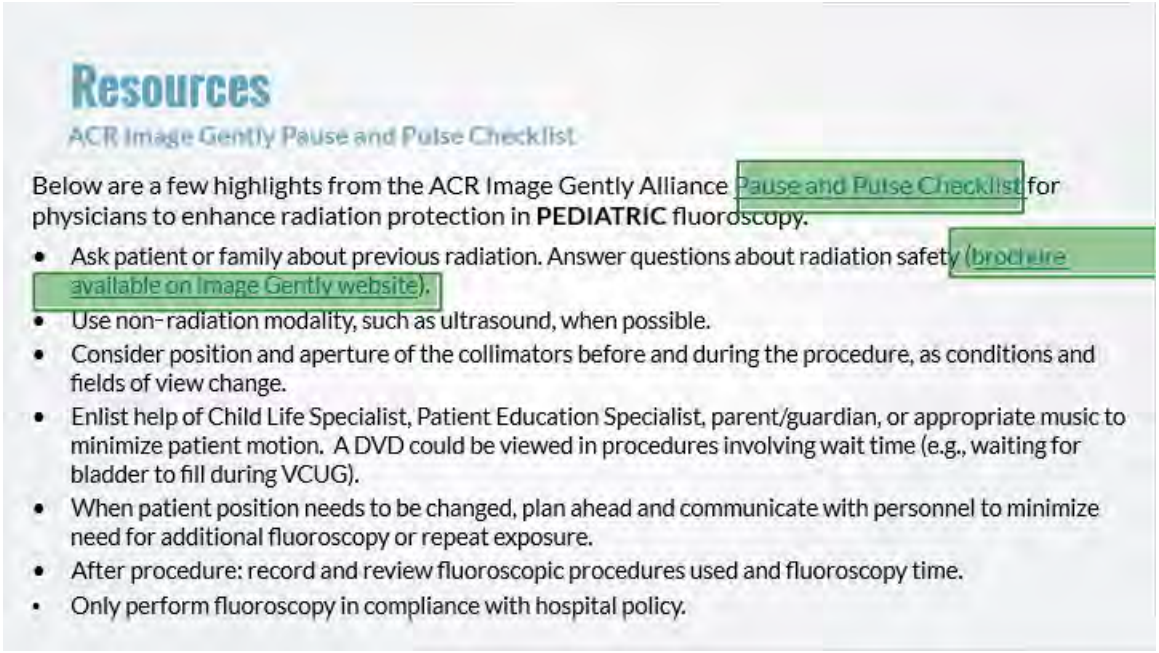
Incorrect (Slide Layer)



Try Again (Slide Layer)



1.68 Resource: ACR Image Gently Pause and Pulse Checklist



Resources

ACR Image Gently Pause and Pulse Checklist

Below are a few highlights from the ACR Image Gently Alliance Pause and Pulse Checklist for physicians to enhance radiation protection in **PEDIATRIC** fluoroscopy.

- Ask patient or family about previous radiation. Answer questions about radiation safety (brochure available on Image Gently website).
- Use non-radiation modality, such as ultrasound, when possible.
- Consider position and aperture of the collimators before and during the procedure, as conditions and fields of view change.
- Enlist help of Child Life Specialist, Patient Education Specialist, parent/guardian, or appropriate music to minimize patient motion. A DVD could be viewed in procedures involving wait time (e.g., waiting for bladder to fill during VCUG).
- When patient position needs to be changed, plan ahead and communicate with personnel to minimize need for additional fluoroscopy or repeat exposure.
- After procedure: record and review fluoroscopic procedures used and fluoroscopy time.
- Only perform fluoroscopy in compliance with hospital policy.

1.69 Resource: Radiation Safety Office

Radiation Safety Contacts

Mark Theis
Radiation Safety Officer

402-559-3013 (office)
402-250-6402 (cell)

mtheis@unmc.edu

Prestan Kiichler, BS, CNMT, NMTCB(RS), R.T., (R) (N) (CT)
Children's Hospital & Medical Center
Radiation Safety Liaison

402-955-5617

pkiichler@childrensomaha.org

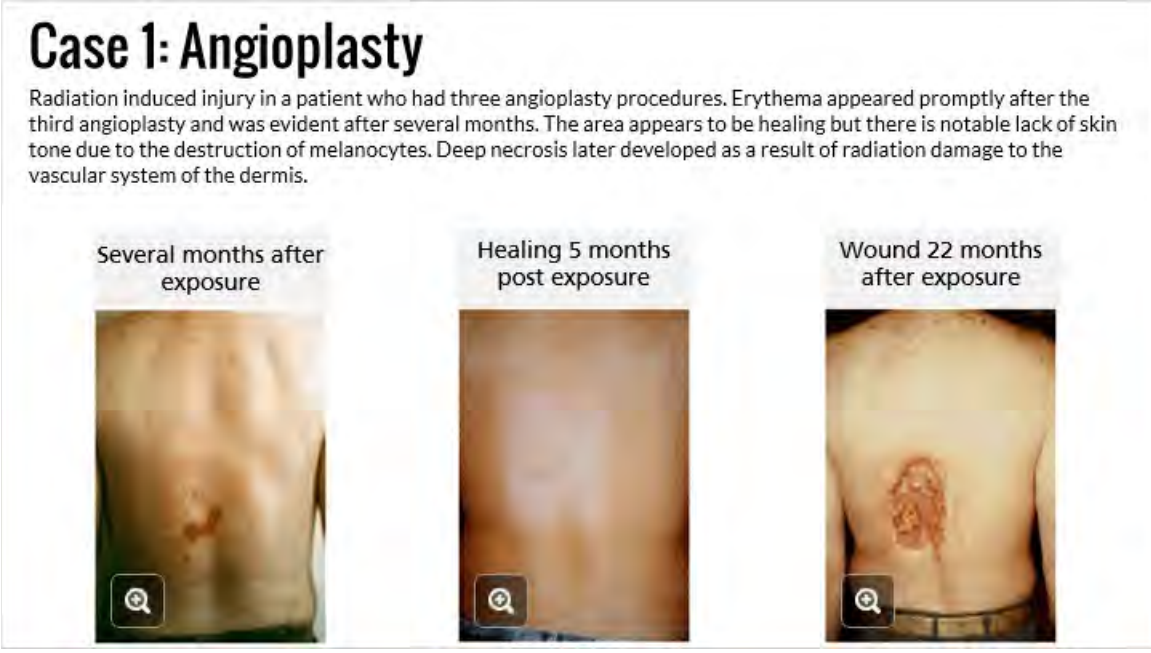
Notes:

1.70 Exit

Notes:

2. Lightboxes

2.1 Angioplasty



Notes:

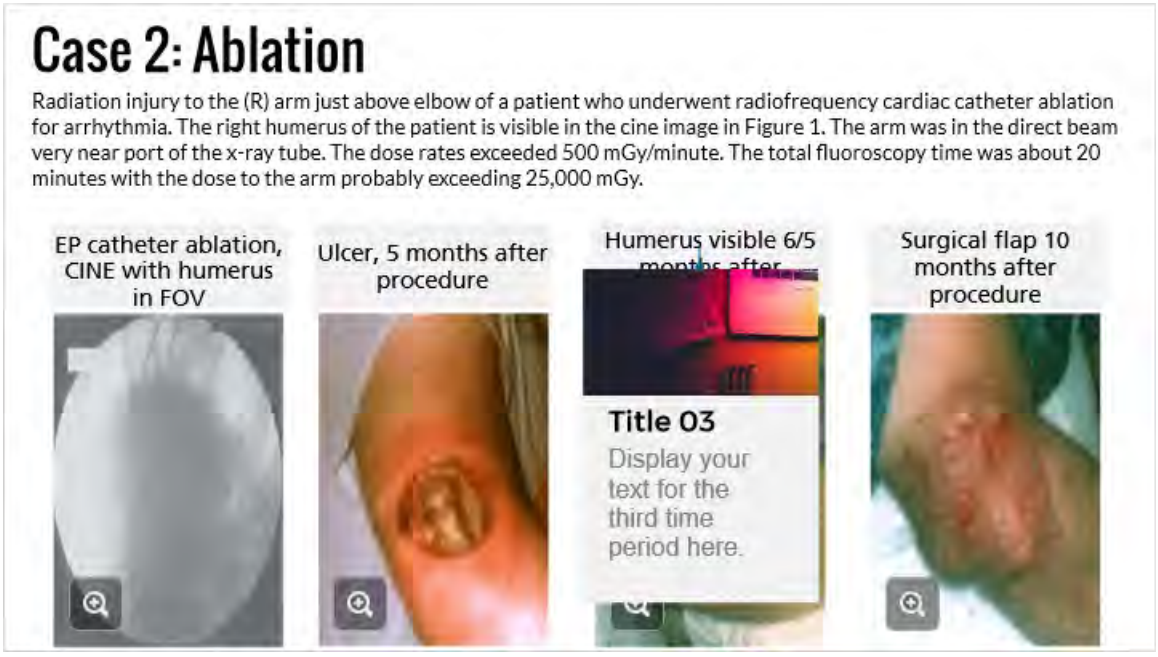
2.2 Ablation

Notes:

Date 01 (Slide Layer)

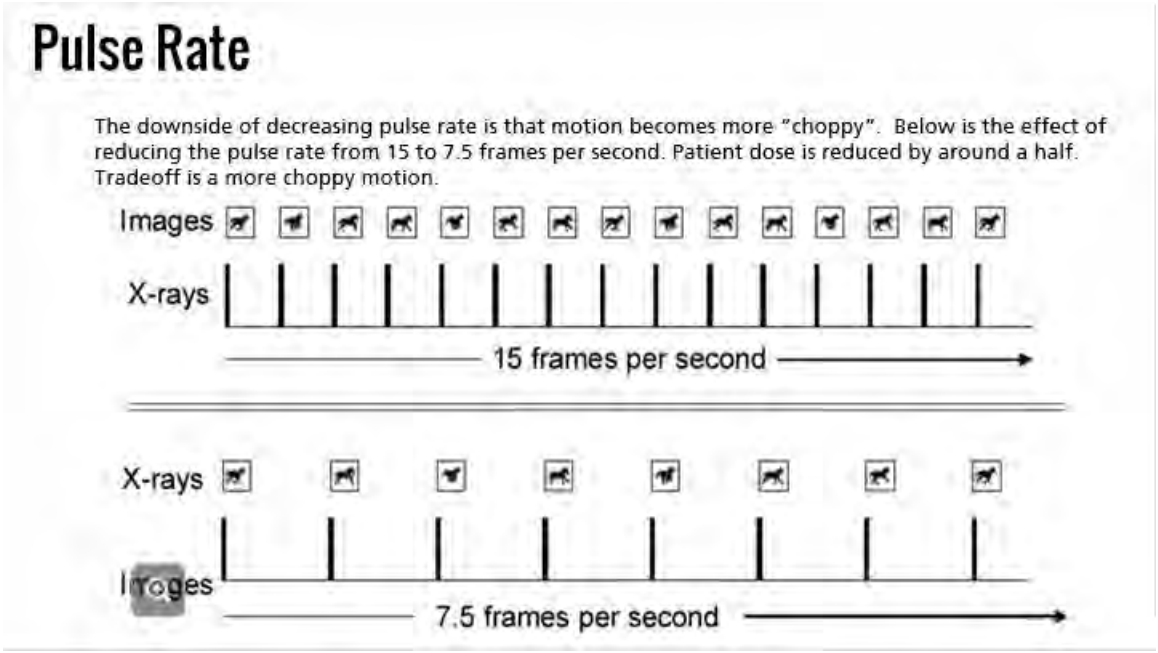
Date 02 (Slide Layer)

Date 03 (Slide Layer)



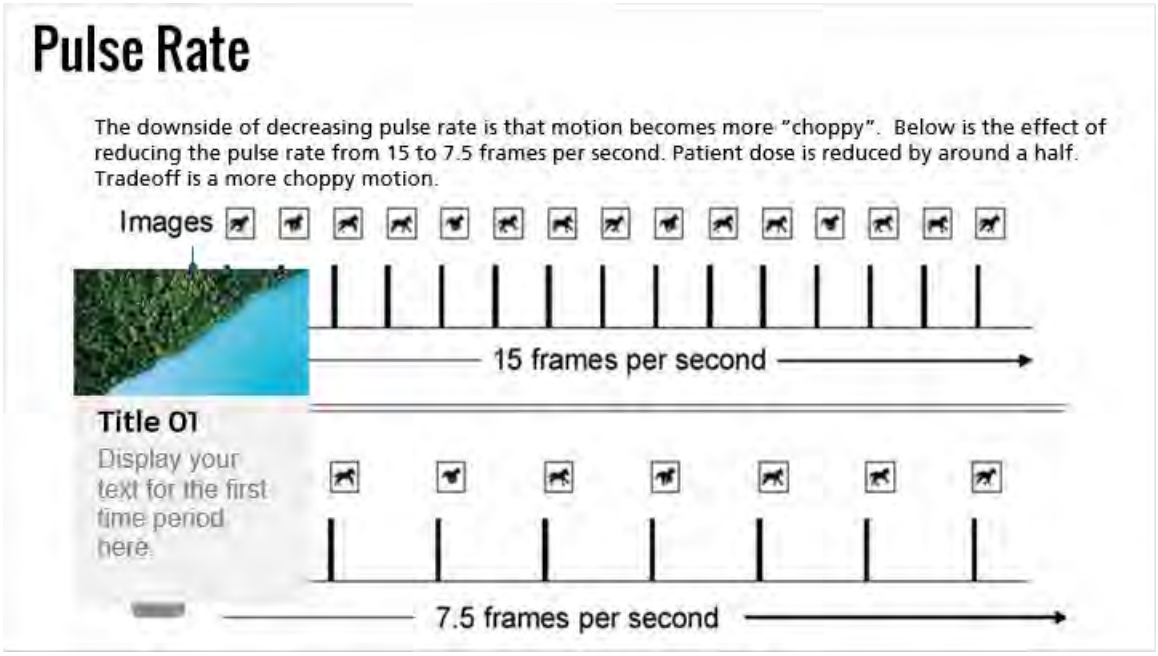
Date 04 (Slide Layer)

2.3 Pulse Rate

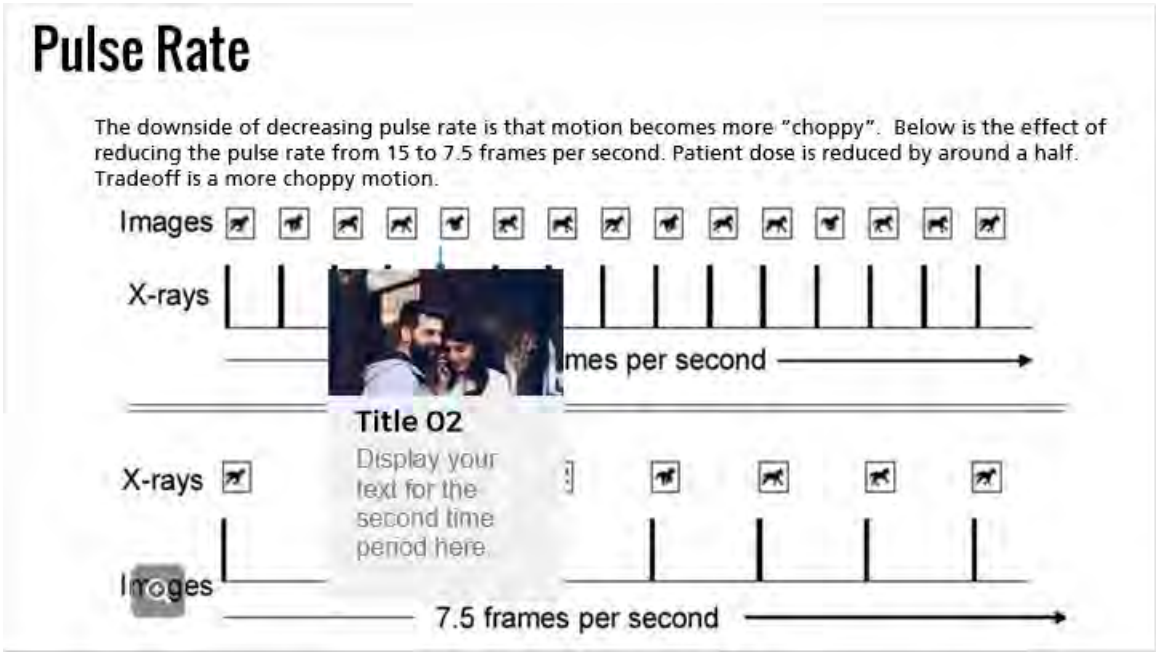


Notes:

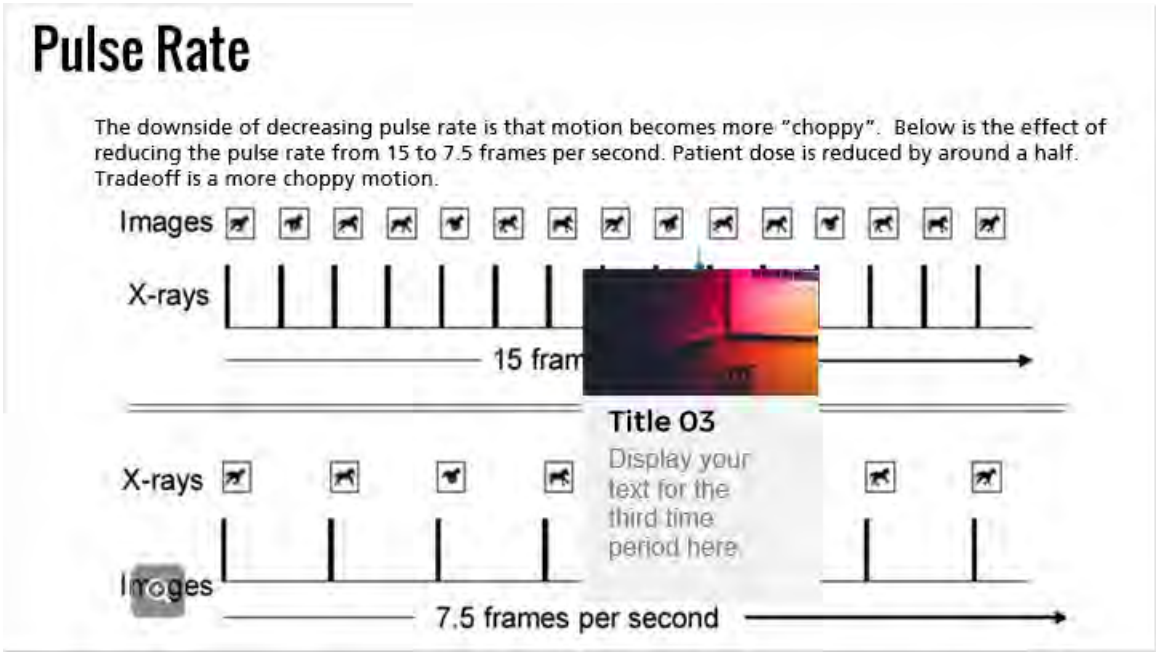
Date 01 (Slide Layer)



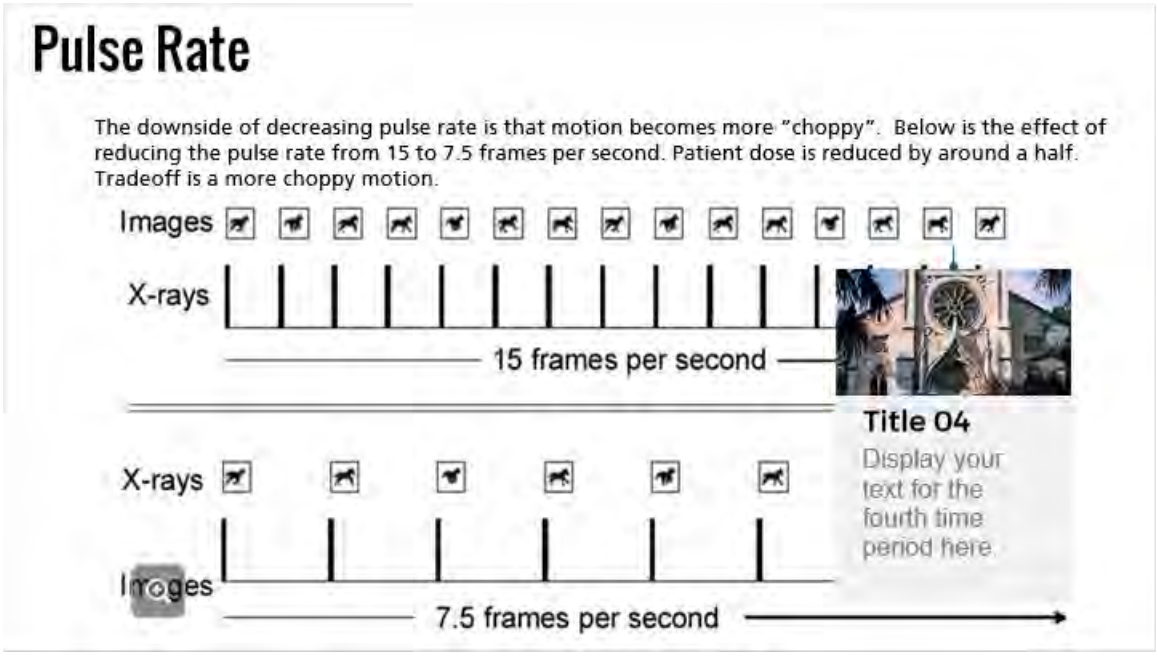
Date 02 (Slide Layer)



Date 03 (Slide Layer)



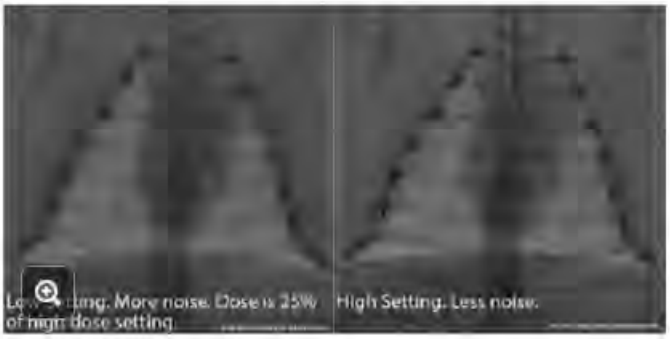
Date 04 (Slide Layer)



2.4 Dose Rate

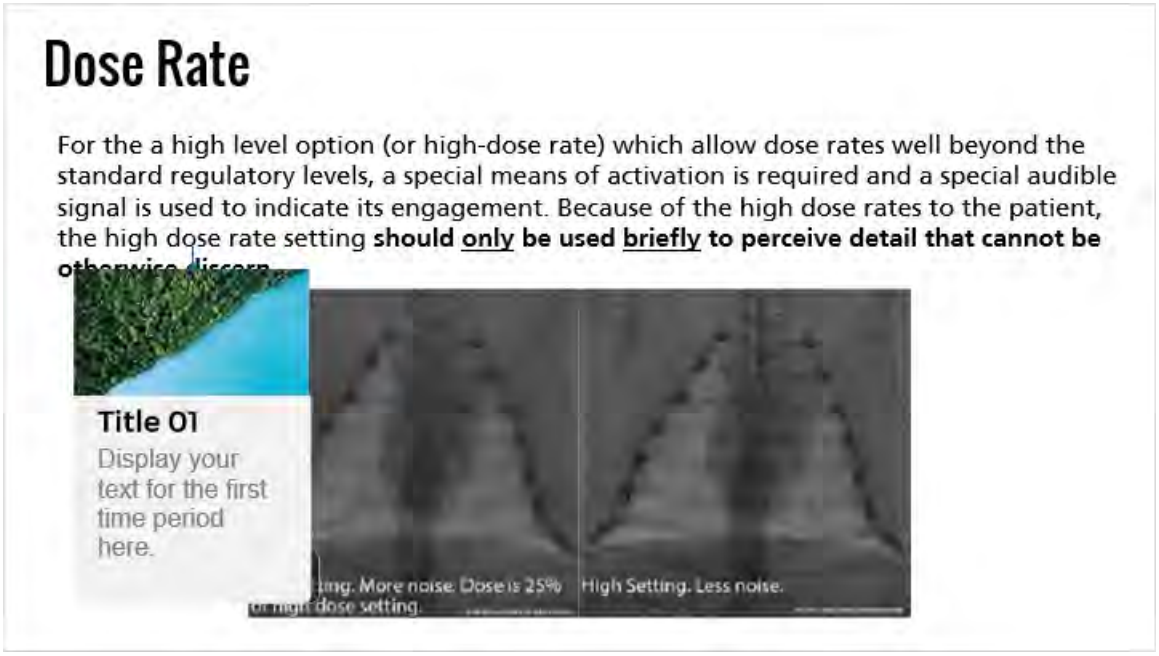
Dose Rate

For the a high level option (or high-dose rate) which allow dose rates well beyond the standard regulatory levels, a special means of activation is required and a special audible signal is used to indicate its engagement. Because of the high dose rates to the patient, the high dose rate setting **should only be used briefly to perceive detail that cannot be otherwise discern.**

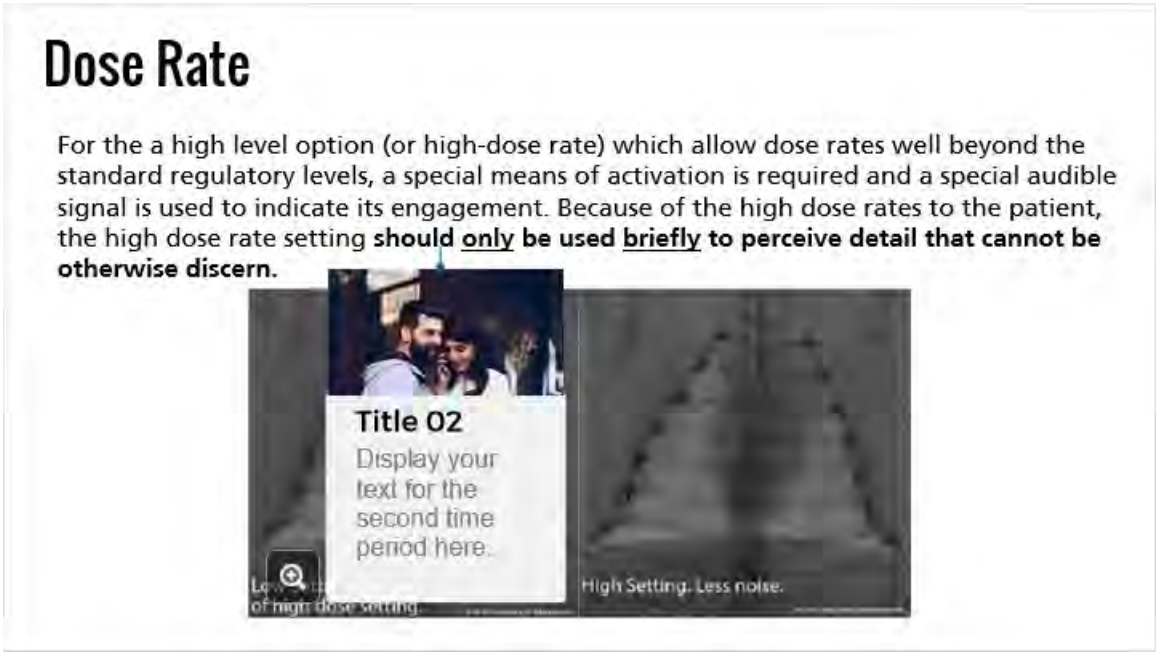


Notes:

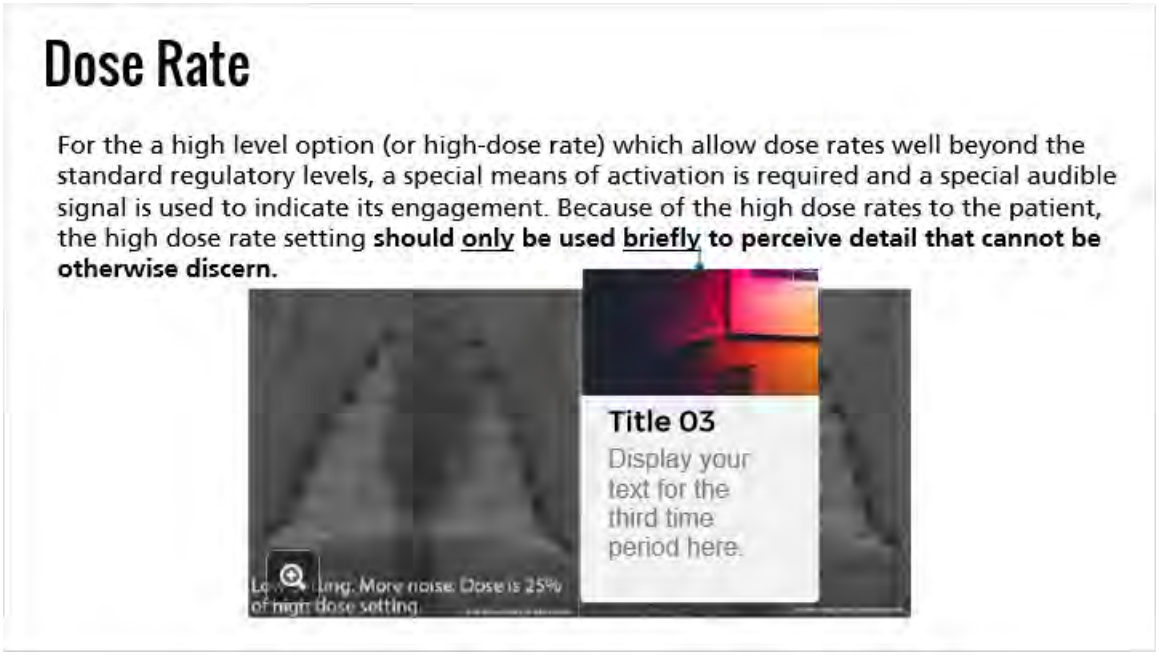
Date 01 (Slide Layer)



Date 02 (Slide Layer)



Date 03 (Slide Layer)



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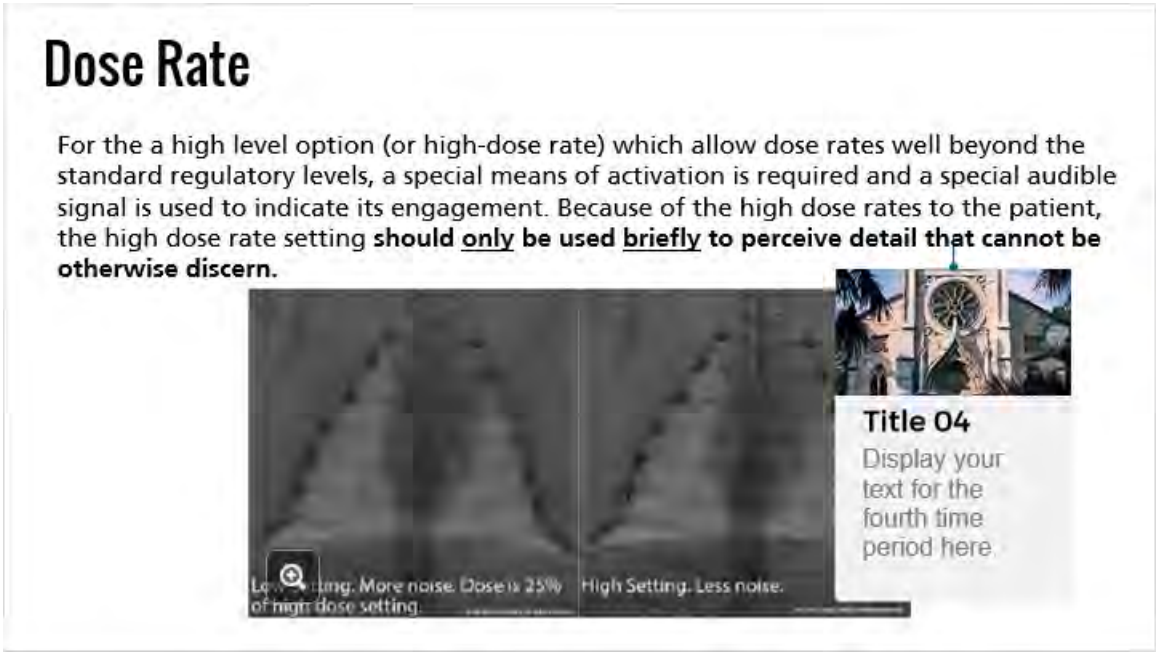
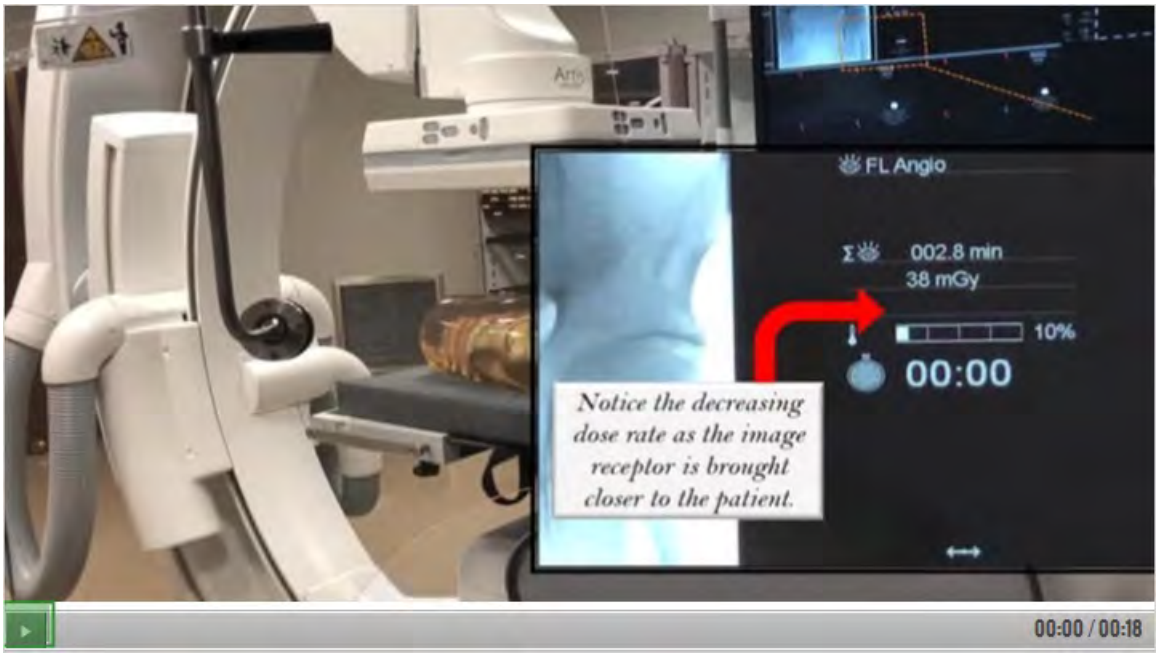
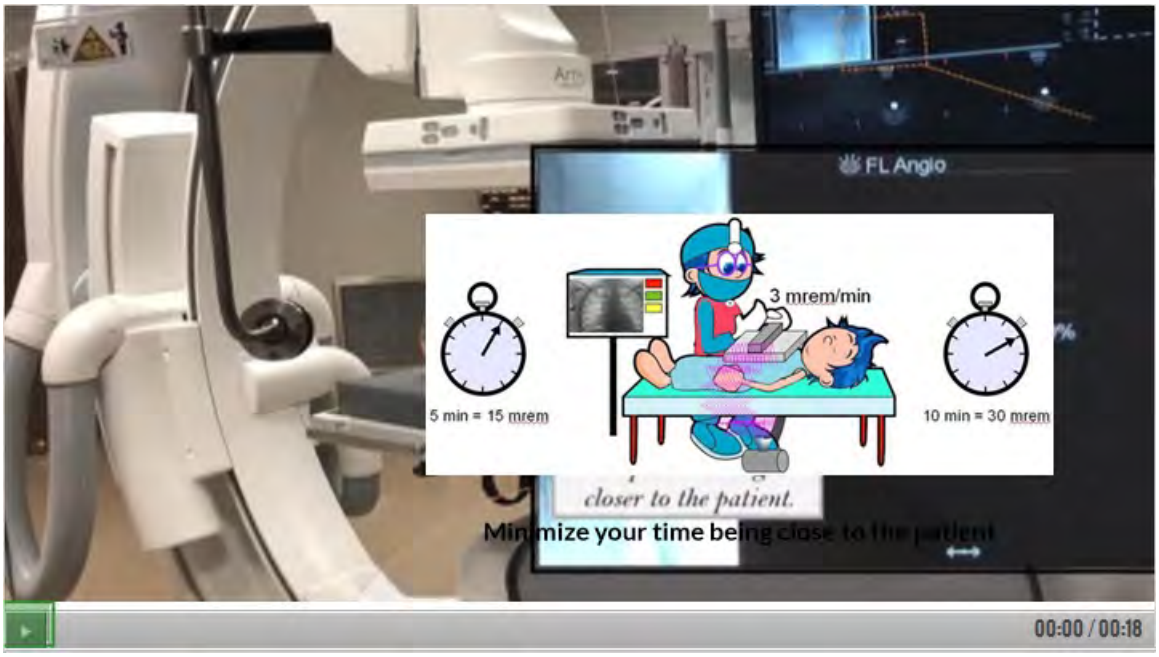


2.5 Monitoring Staff Radiation Dose: Minimize Risk

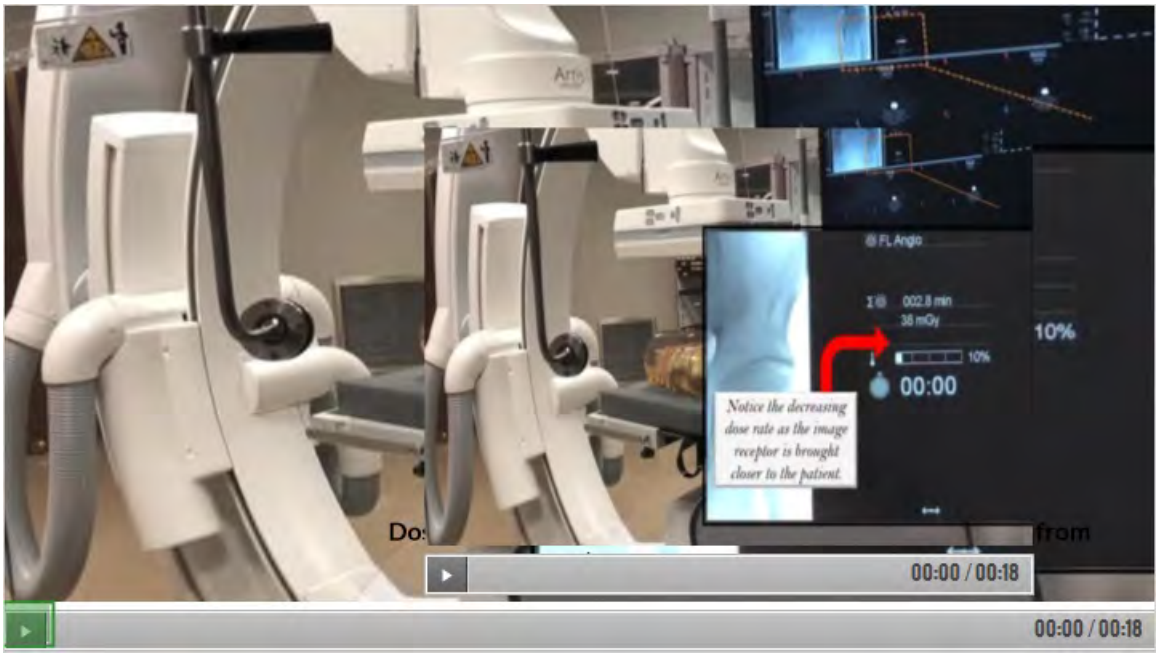


Notes:

Time (Slide Layer)



Distance (Slide Layer)



Shielding (Slide Layer)