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COLLEGE OF ENGINEERING

Educating the Engineer of 2020 Workshop

PREVENTION THROUGH DESIGN INNOVATION COMPETITION

PREVENTION THROUGH DESIGN: MINIMIZATION OF RADIATION EXPOSURE AND REDUCTION OF MUSCULOSKELETAL DISORDERS IN A NUCLEAR PHARMACY

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NUCLEAR ERGO
SANDRA S. COLE
JAMES D. MCGLOTHLIN

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Project Description

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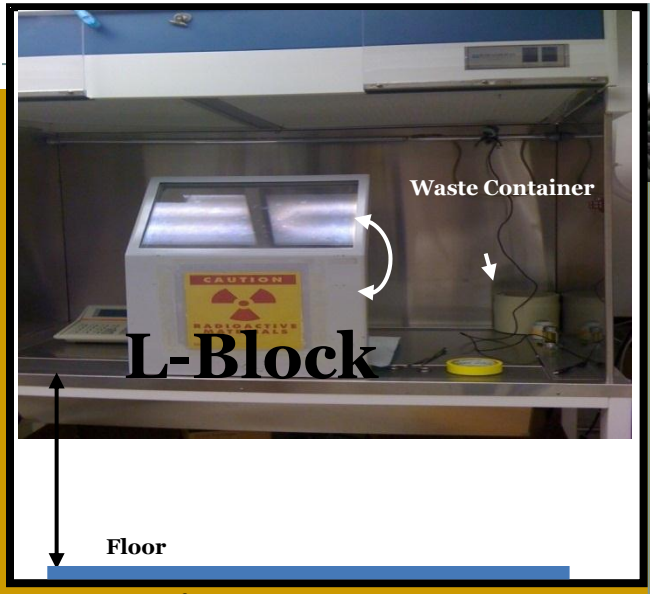
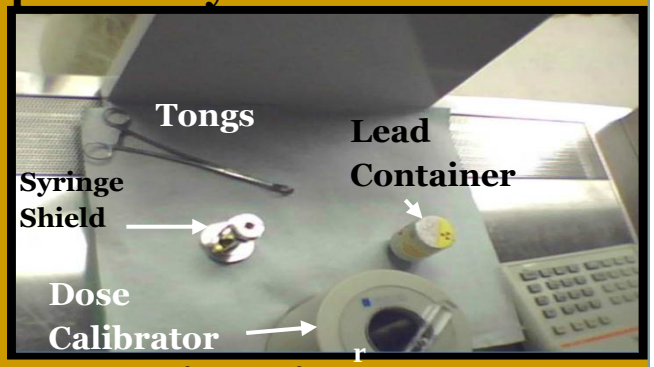
This project was the integration of PtD into a nuclear pharmacy by using video exposure monitoring (VEM) with a real-time radiation dosimeter to identify ways to lessen the risk of musculoskeletal disorders while reducing radiation exposure to "As Low As Reasonably Achievable" (ALARA).



Front View of nuclear pharmacy workstation



Top-Inside View of nuclear pharmacy workstation.

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Project Objectives

The objectives of this project were:

- Use Video Exposure Monitoring (VEM) to identify excessive radiation exposure
- Use VEM to identify excessive work risk factors for musculoskeletal stress to the body
- Use results to provide a new design of the workstation to protect from radiation and musculoskeletal hazards

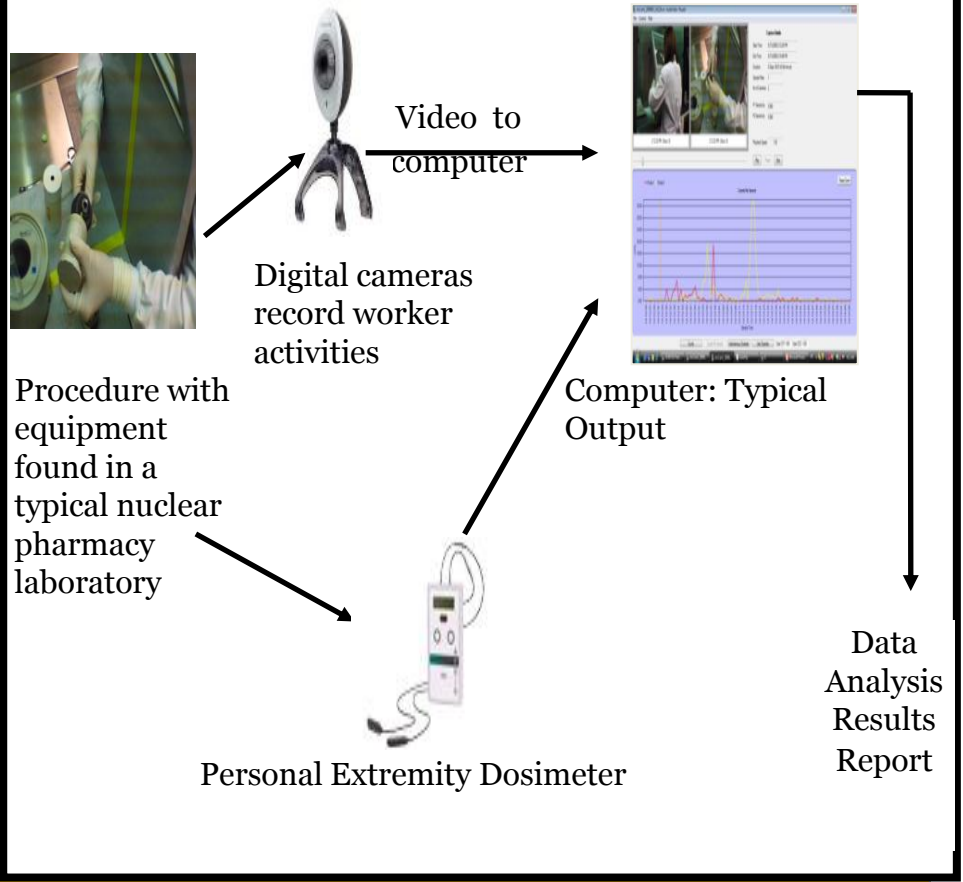

Figure: Flow of data from Personal Extremity Dosimeter and video to computer in Video Exposure Monitoring (VEM)

Project Deliverables

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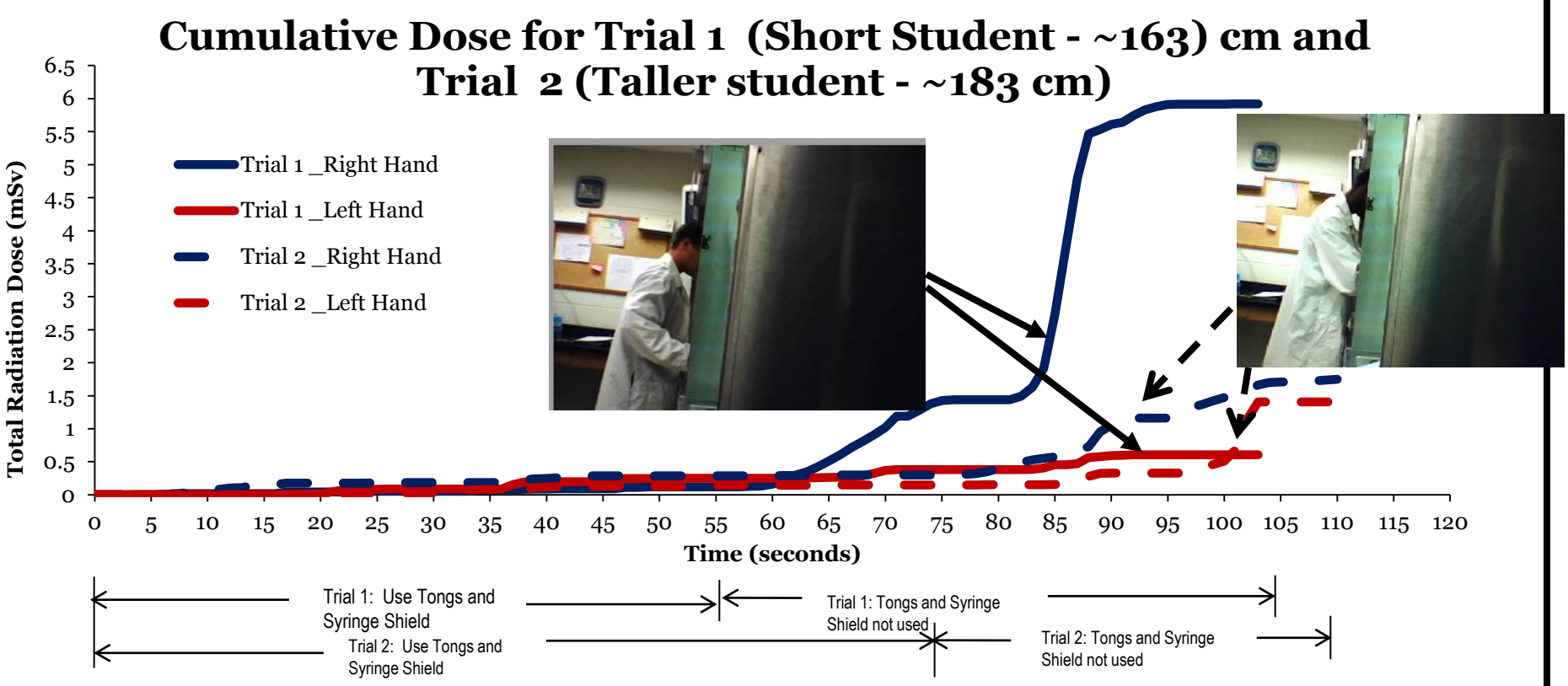
The PtD deliverables of this project are **focused on an adjustable lead shield L-block**



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Compelling Evidence for PtD

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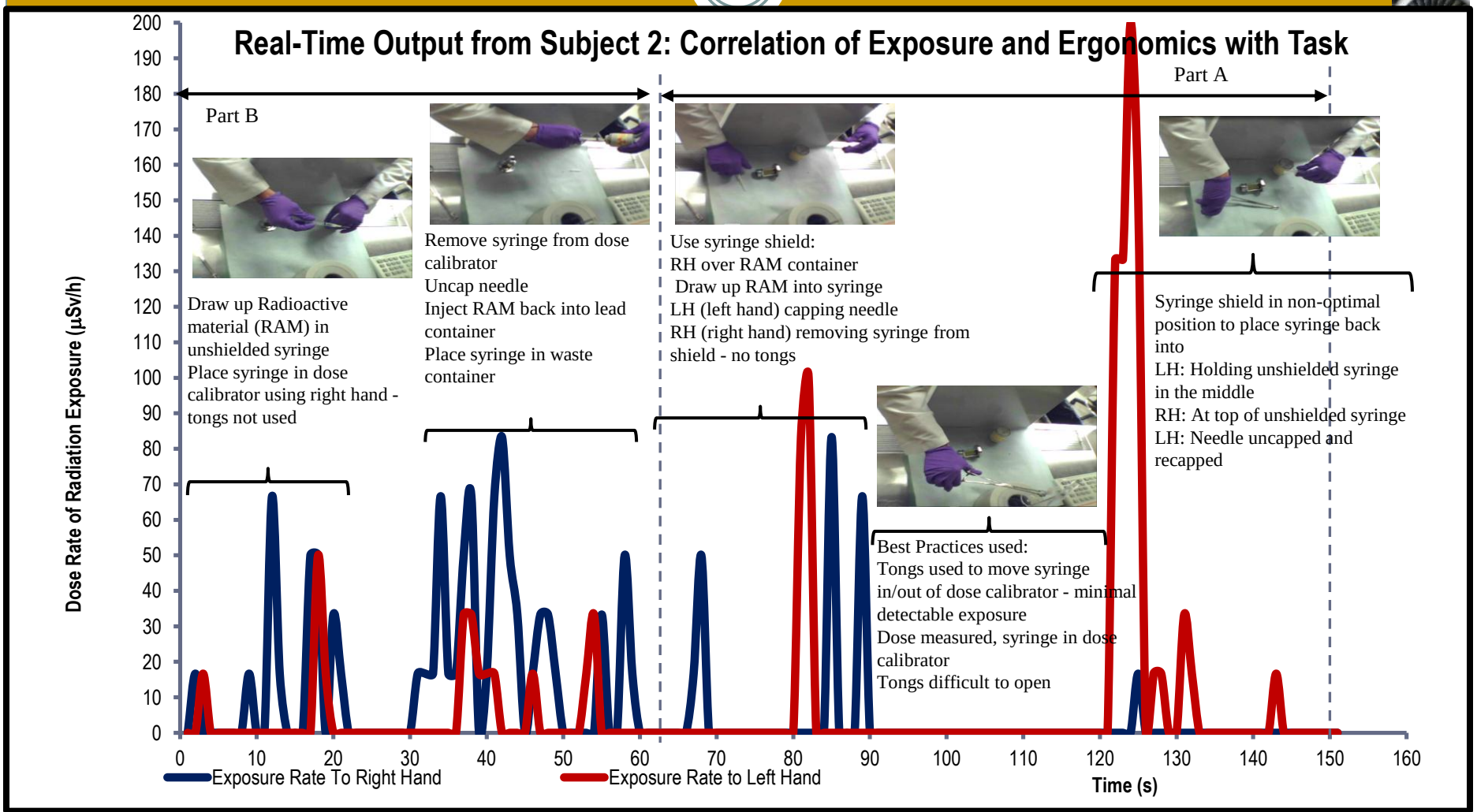

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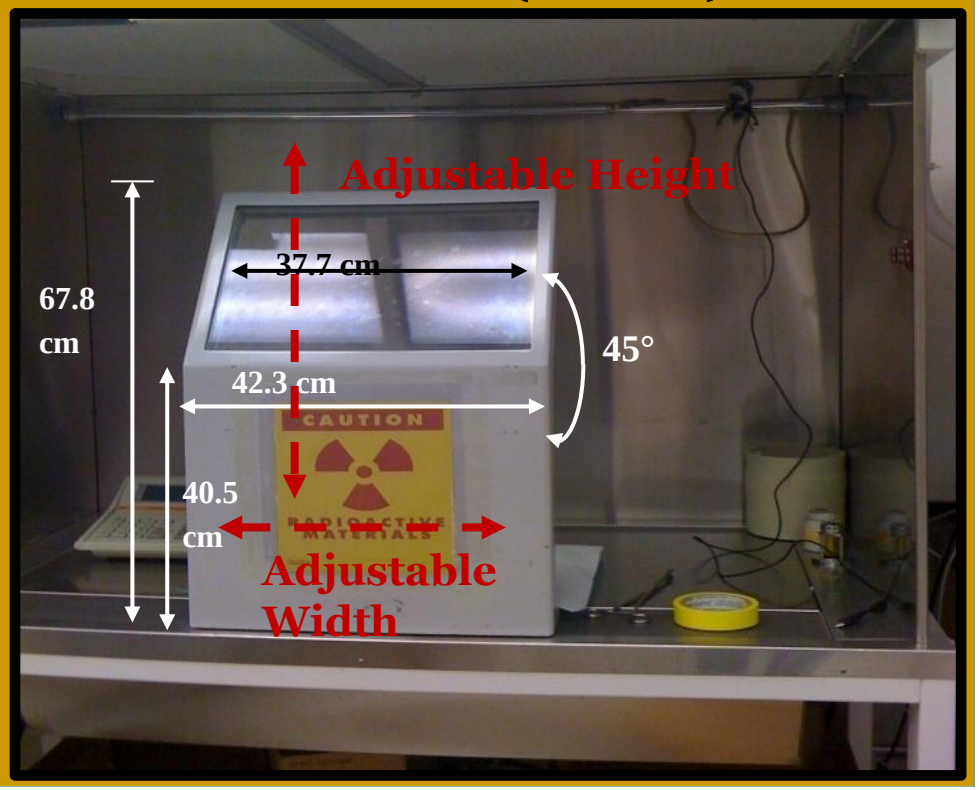
Integration of PtD

PtD was integrated in this project through:

- Video Exposure Monitoring (VEM) with real-time radiation dosimeter and Rapid Upper Limb Assessment (RULA) for musculoskeletal disorders

- Redesign fixed dimensioned L-Block lead shield to be adjustable based on anthropometry:

  - Height: 35.25 - 65.15 cm
  - Width: 32.7 - 42.3 cm



Lessons Learned

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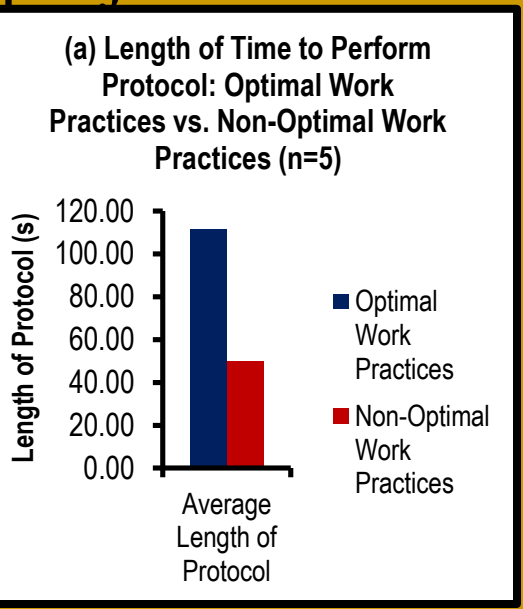
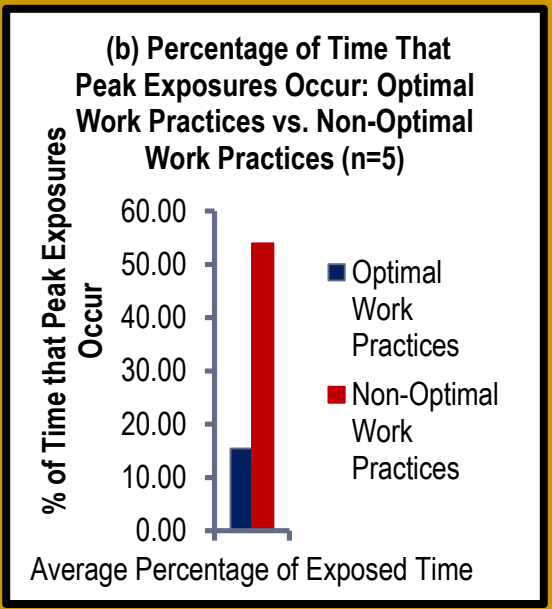
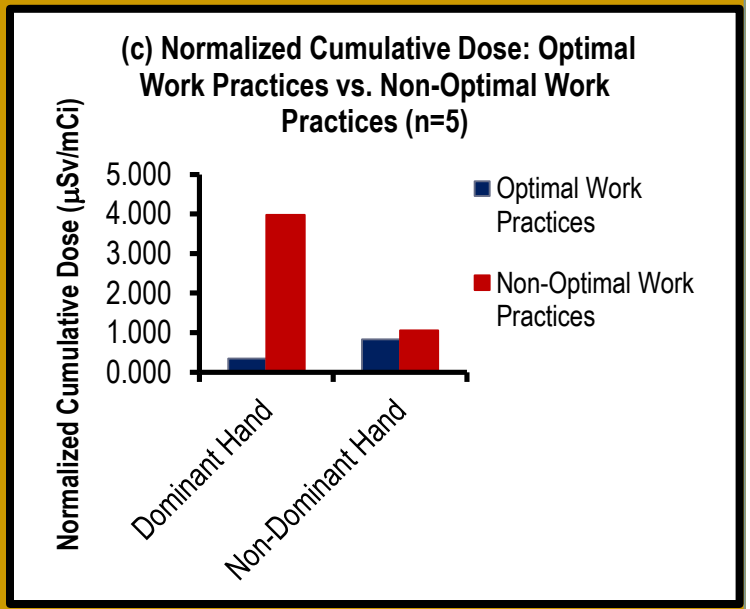
The lessons learned through the implementation of this project were:







⇒ Minimization of radiation exposure is obtained by using optimal work practices even though it takes slightly longer.

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Lessons Learned

The lessons learned through the implementation of this project were:

Optimal Practices to Reduce Radiation Exposure (Part A)							
	RULA Score: Draw up Tc-99m into syringe (n=5 subjects)				RULA Score: Place syringe in/out of Dose Calibrator (n = 5 subjects)		
	Dominant Hand	Non-Dominant Hand	Average		Dominant Hand	Non-Dominant Hand	Average
Average ± Std. Dev.	5.60 ± 0.89	6.40 ± 0.55	6.00 ± 0.71		4.40 ± 1.52	4.40 ± 1.14	4.40 ± 1.29

Non-Optimal Practices that Lead to Higher Radiation Exposures (Part B)							
	RULA Score: Draw up Tc-99m into syringe (n=5 subjects)				RULA Score: Place syringe in/out of Dose Calibrator (n = 5 subjects)		
	Dominant Hand	Non-Dominant Hand	Average		Dominant Hand	Non-Dominant Hand	Average
Average ± Std. Dev.	4.80 ± 1.30	5.20 ± 1.00	5.00 ± 1.27		4.20 ± 1.30	4.00 ± 1.00	4.10 ± 1.14

Next Steps

Suggested next steps of this project and the integration of PtD in your project/class are:

- Investigate relationship between anthropometric variations in individuals and radiation exposure
- Make a prototype of recommended modified L-block
- Test modified L-block in small teaching nuclear pharmacy laboratory
  - Goal - Reduced exposure to radiation.
  - Goal - Less musculoskeletal stress.

Conclusions

The conclusions drawn from this project are:

- PtD has enabled me to focus on the design and usability of the currently designed lead shield L-block and I have concluded that a new adjustable L-Block and optimal practices will reduce radiation exposure and musculoskeletal disorders.

Questions?

Are there questions about this project and the integration of PtD in it?

My question:

Will industry take our design recommendations and fabricate an adjustable L-Block that will benefit the worker to reduce radiation exposure and musculoskeletal disorders?

My answer: Yes, because we have demonstrated a cost effective design that protects all workers from these hazardous physical agents.