



Rehabilitation  
Engineering &  
Applied  
Research

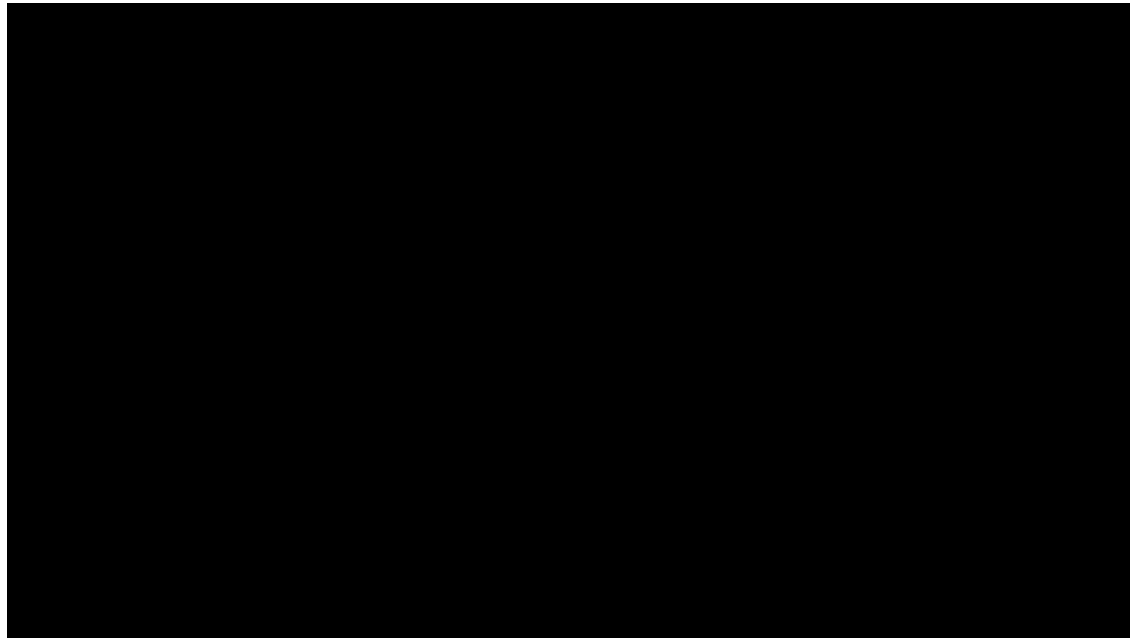
# YOU GOT TO MOVE IT, MOVE IT!

## Pressure Reliefs, Weight Shifts, and Wheelchair Mobility in Individuals with SCI

Sharon Sonenblum, PhD & Stephen Sprigle, PhD, PT

July 13<sup>th</sup>, 2016

# “I Like to Move It, Move It!”

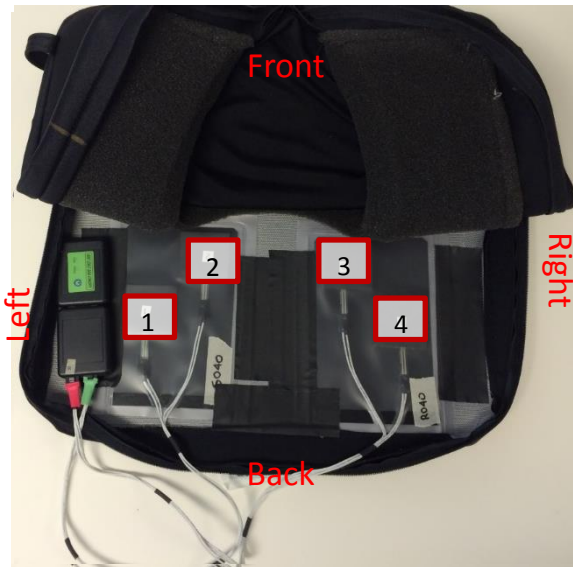


I like to move it move it, Madagascar HD  
All rights reserved to Dreamworks

# Research Questions

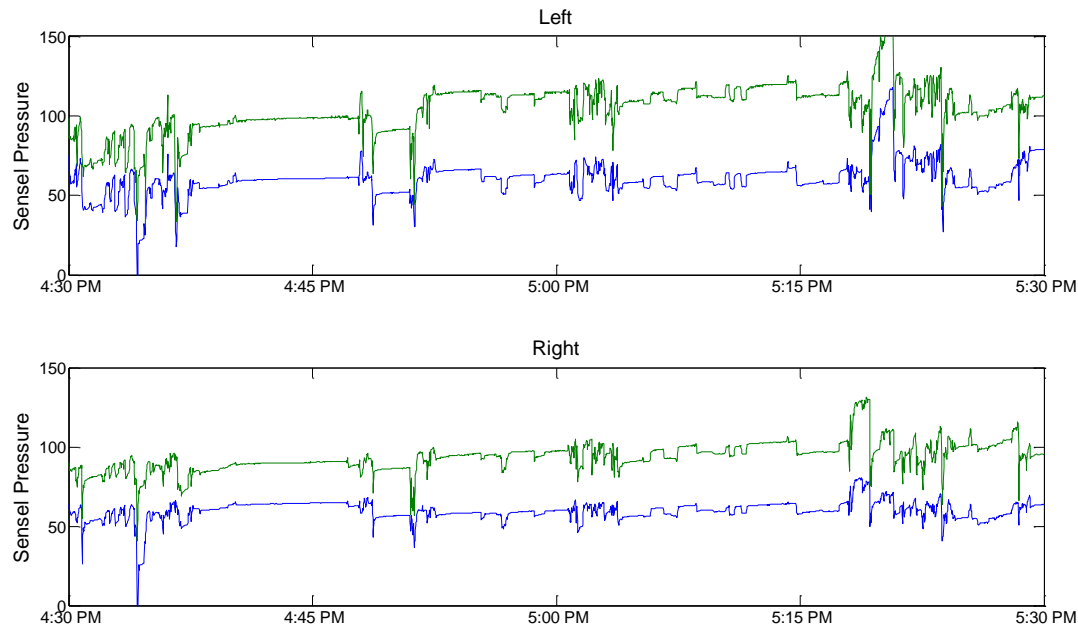
- How do wheelchair users use their wheelchairs during every day life?
- How do wheelchair users move in their wheelchairs during everyday life?
  - New SCI vs. Longer-Term SCI
  - Recurrent pressure injuries (ulcers) versus no history of pressure injuries

# Seat monitor and data logger



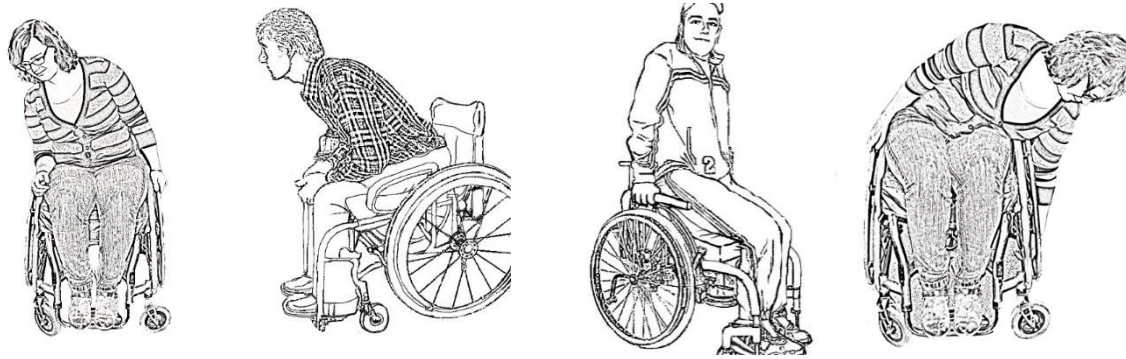
- 4 force-sensing resistors located under wheelchair cushion
- Data-logger captures forces at 1 Hz

# Raw data is a continuous signal of forces that are run through a classifier



# Definitions

- Out of Chair – fully unloaded for > 2 minutes
- Full Pressure Relief (PR) – left and right sides fully unloaded for > 15 seconds and < 2 minutes
- Weight Shift (WS) – either side or both sides are partially unloaded (>30% pressure reduction) for > 15 seconds



# Subject Characteristics

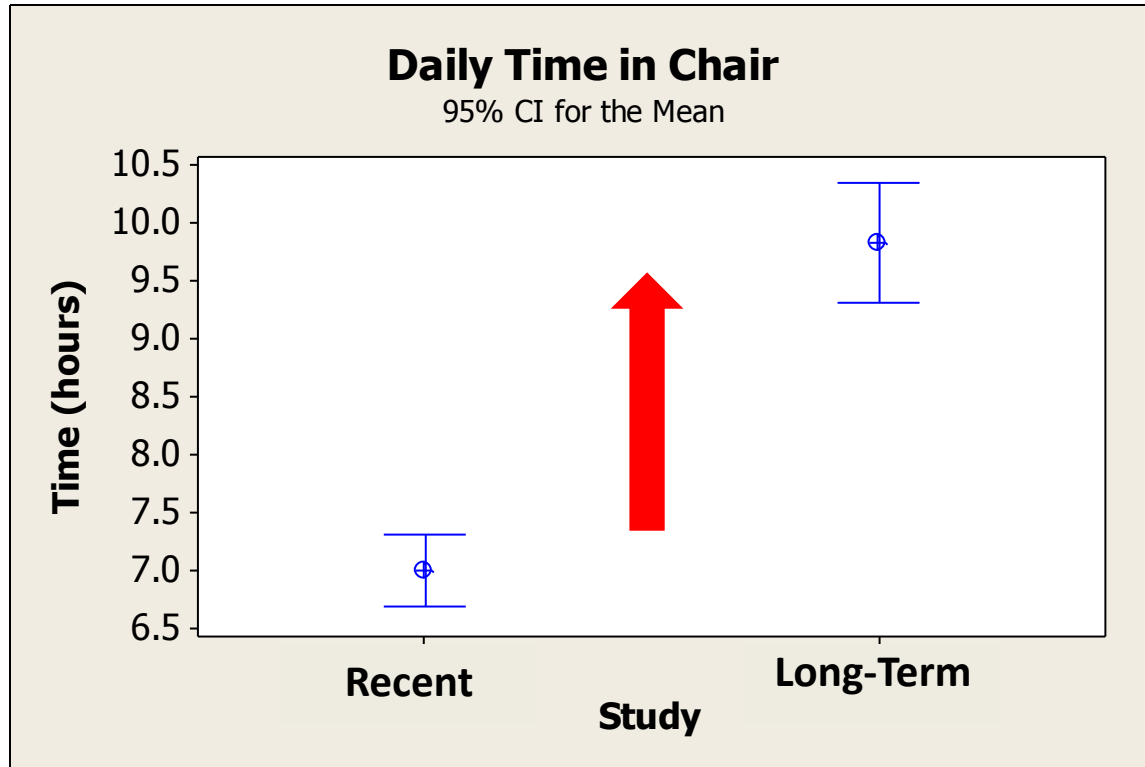
## Recent SCI

- 31 manual wheelchair users
- 359 complete days of data
- Recruited through Shepherd Center and Kessler Foundation
- Characteristics
  - Ages 19-63 (Average 32 yo)
  - 25-215 days post injury (Average 97 days) at start of study
  - 22 men, 9 women
  - LOI split: 8 cervical, 10 upper thoracic, 13 lower thoracic or lumbar

## Long-Term SCI

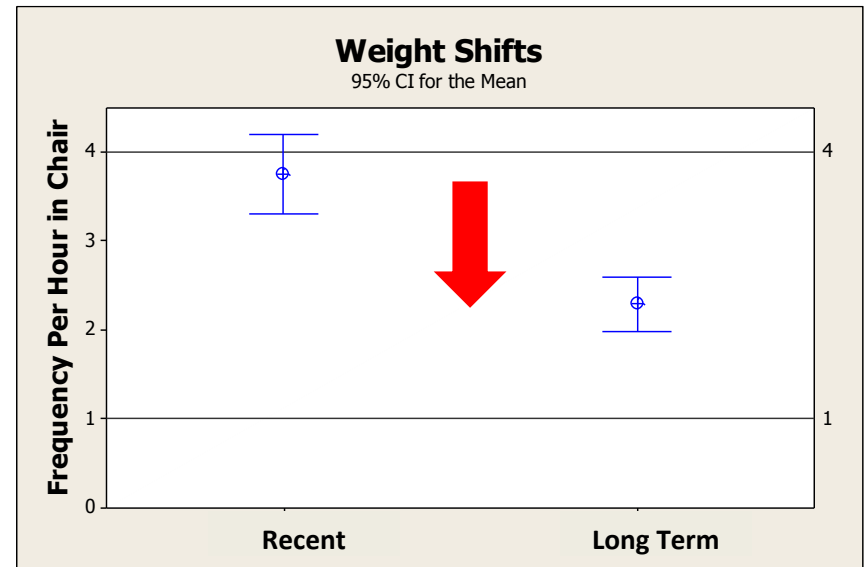
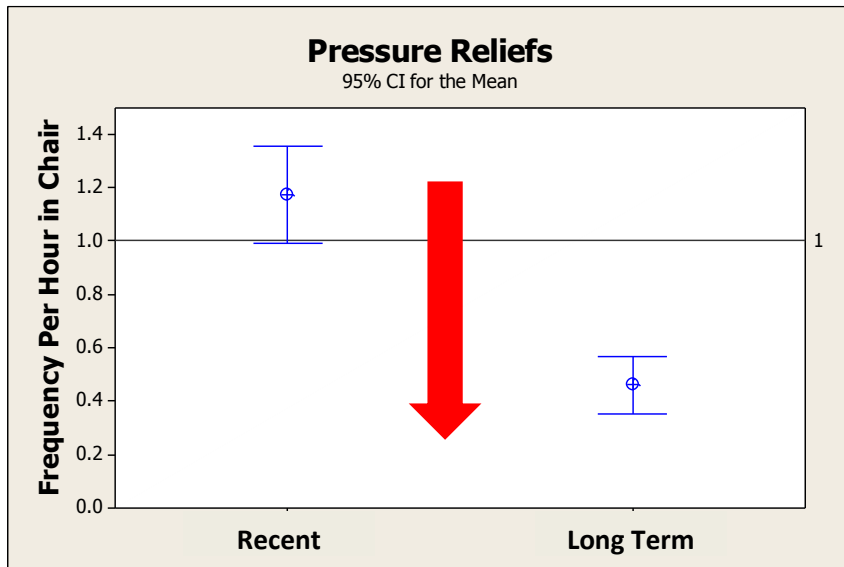
- 29 manual wheelchair users
- 225 complete days of data
- Recruited through Shepherd Center and Duke University / Durham VA
- Characteristics
  - Ages 21-66 (Average 41 yo)
  - 2-33 years post injury (Average 15 years)
  - 23 men, 6 women
  - LOI: mostly lower thoracic or lumbar (18), 7 upper thoracic and 3 cervical
  - 12 had a history of recurrent pressure ulcers

# Time in Chair

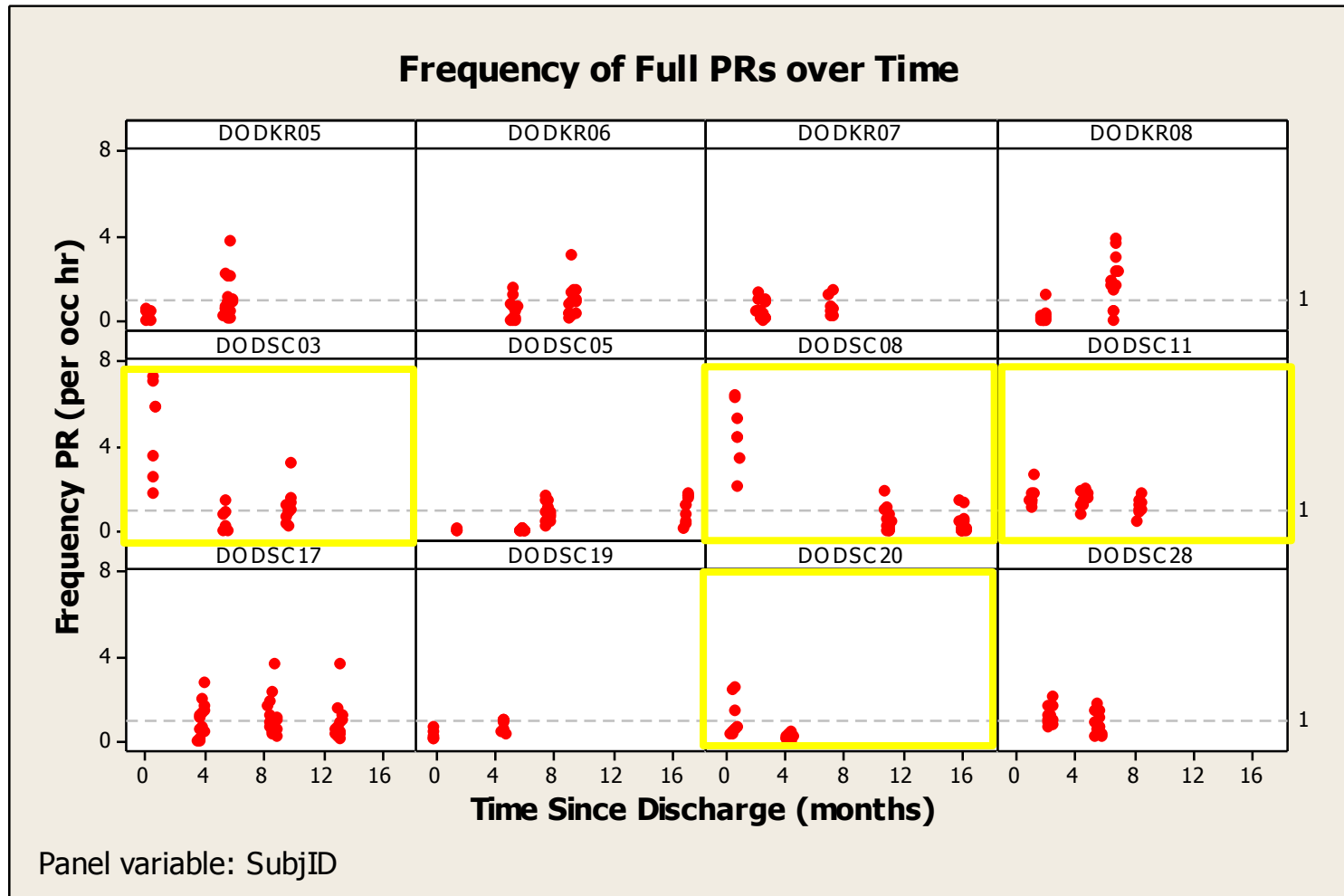




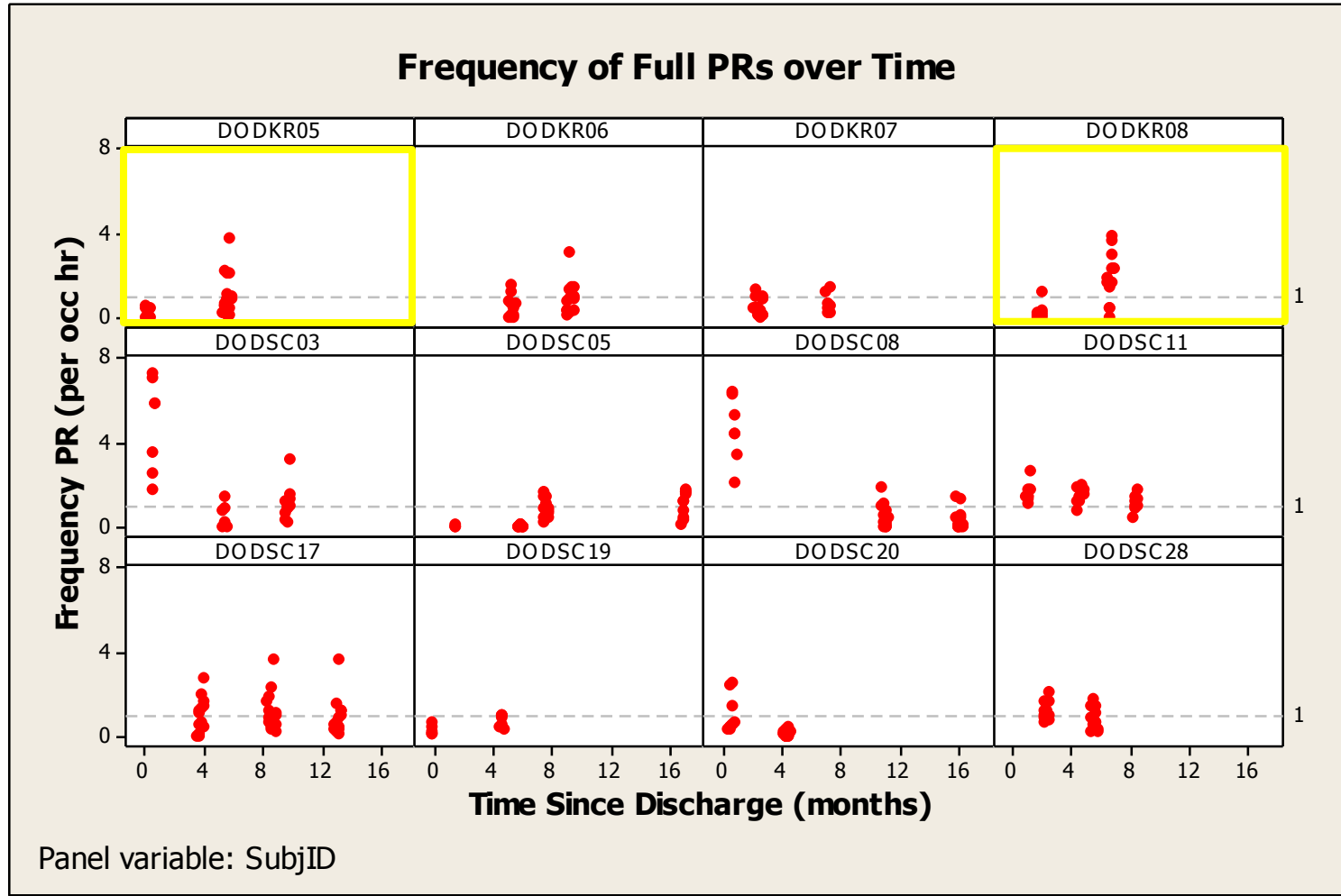
# Pressure Relief and Weight Shift Behavior



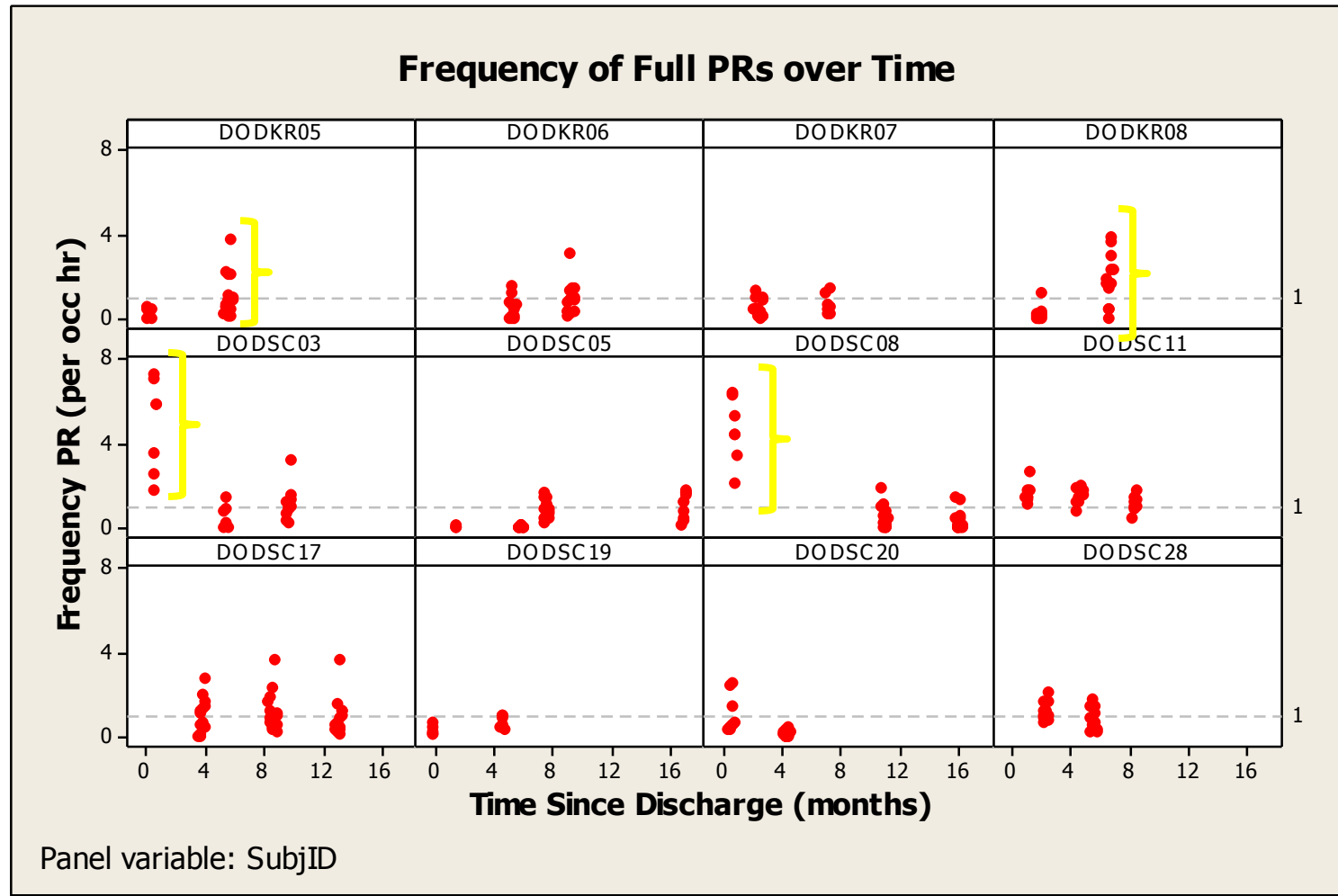
# What is the timeline for change?



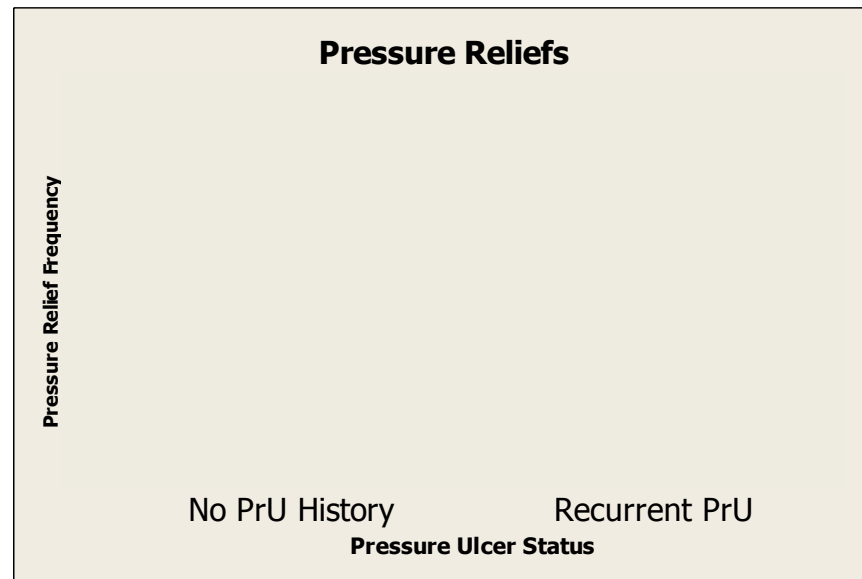
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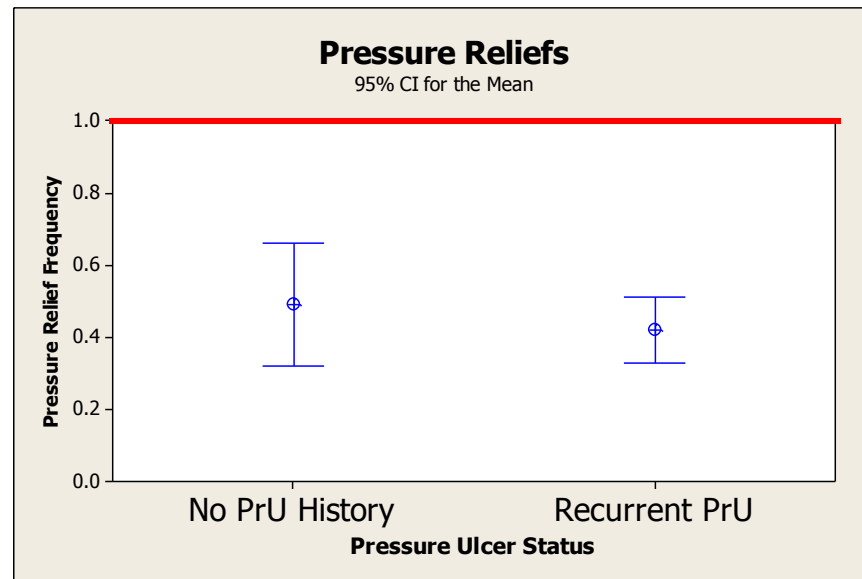
# What is the timeline for change?



# What about Pressure Injuries?

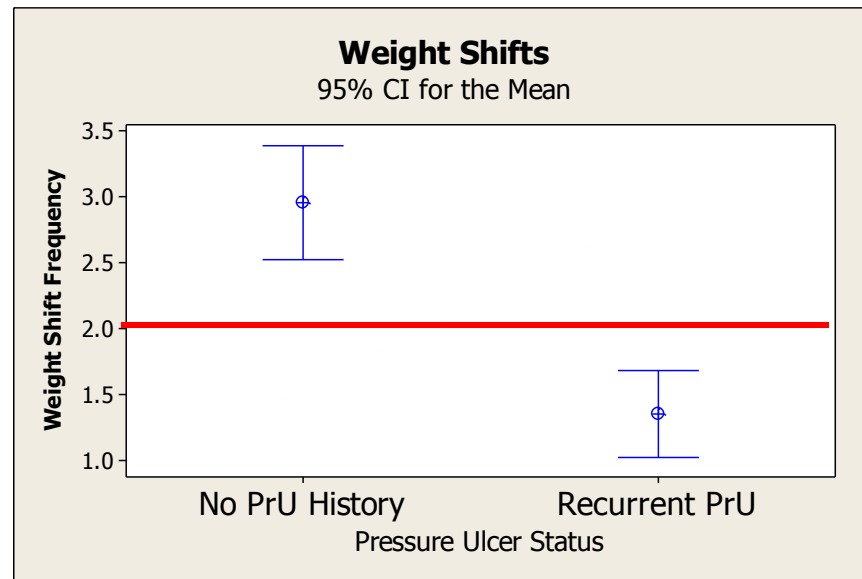


# What about Pressure Injuries?



Nobody does them regularly!

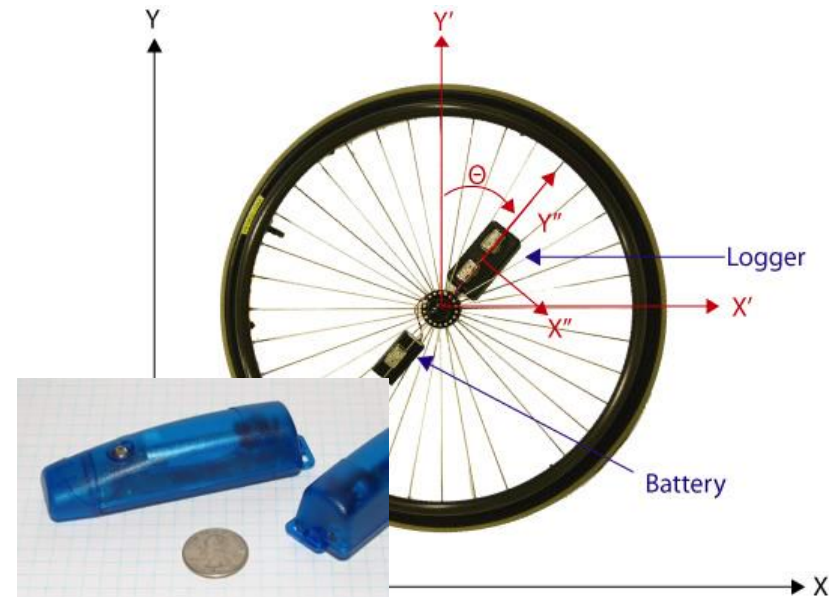
# What about Pressure Injuries?



**Weight shifting behavior IS different!**

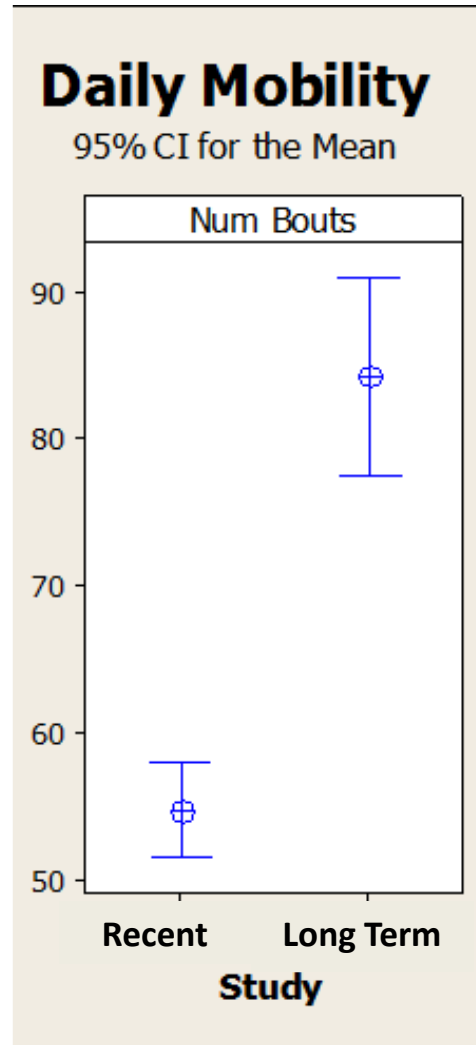
# Wheelchair Propulsion

- Bouts of Mobility – A transition between stationary activities. Minimum speed of 0.12 m/s and duration of 5 seconds.





# Manual Wheelchair Use



# Clinical Implications & Summary

- Behavior changes with time
  - After discharge, time in chair increases and propulsion increases, but protective behaviors decrease.
  - What does this mean about the AT prescribed to them while in inpatient? Does it still fit their needs?
- Wheelchair users do not demonstrate routine
  - All were trained in PRs and to target a frequency
  - We cannot assume dedicated PRs are routine
- Weight shifts are much more common
  - Intermediate forward and side leans qualify
  - In-seat movement can have an impact so
    - Education should address these activities
    - IPM as an education tool, especially because amount of pressure relief for a weight shift might differ by cushion
    - Position people so they can move
- Activity is good
  - put people in a position that they can do stuff
  - Seating systems and training to facilitate transfers
  - encourage activity-
    - leaning and reaching has positive tissue benefits

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# QUESTIONS?