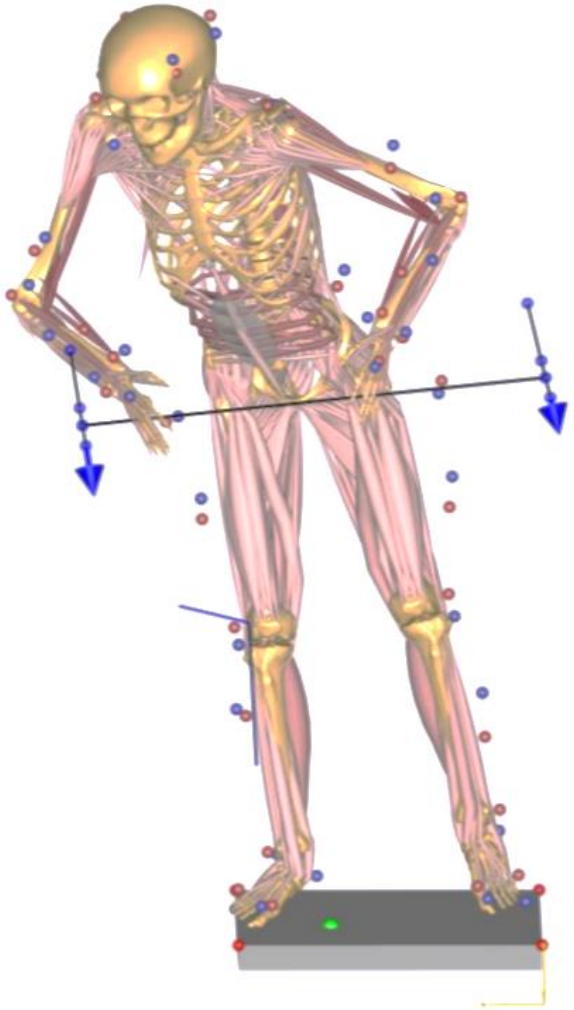
The webcast will begin shortly…

Physical Stresses on Caregivers when Repositioning Patients in Bed

December 10th , 2020



Outline

- General introduction to the AnyBody Modeling System
- Presentation by Jie Zhou
  - *Physical Stresses on Caregivers when Repositioning Patients in Be*
- Question and answer session

Presenter:
Jie Zhou, Ph.D, AEP
Ergonomics researcher in Hillrom

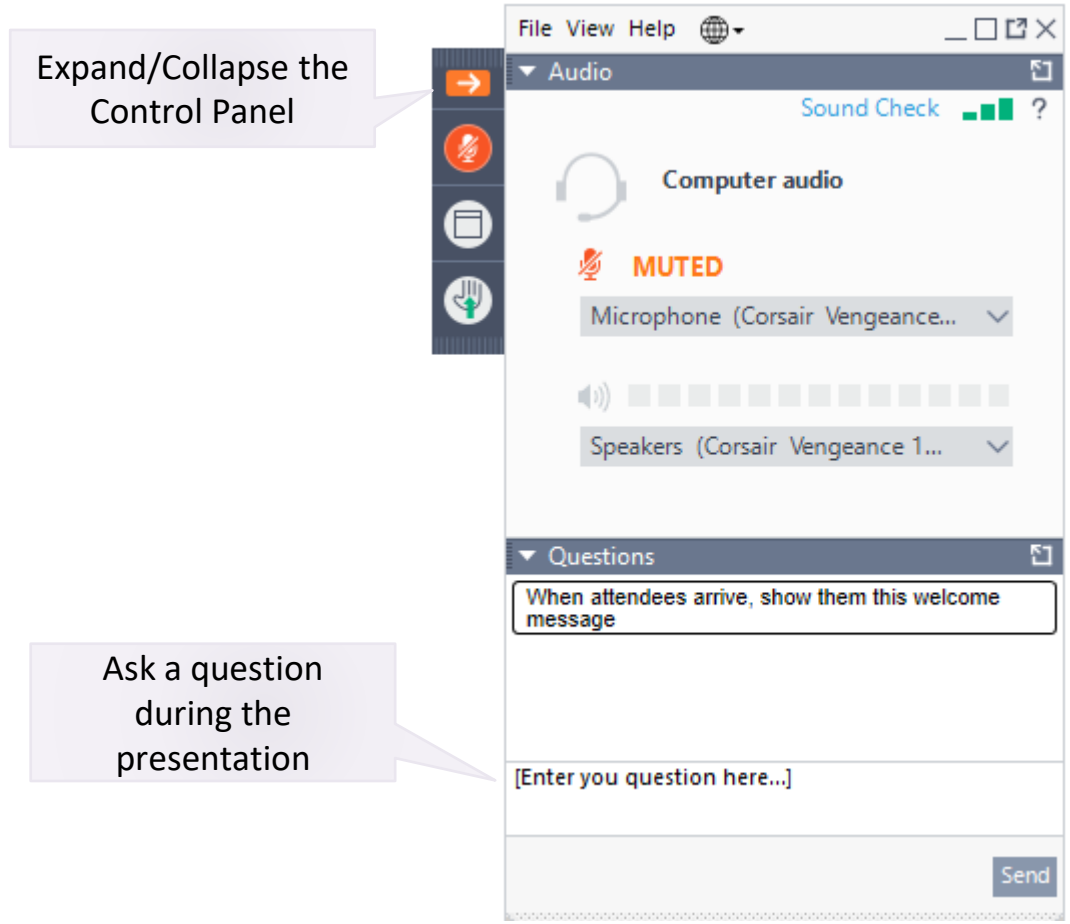
Host:
Kristoffer Iversen
R&D Engineer
AnyBody Technology

Control Panel

The Control Panel appears on the right side of your screen.

Submit questions and comments via the Questions panel.

Questions will be addressed at the end of the presentation. If your question is not addressed, we will do so by email.



Musculoskeletal Simulation

Motion Data

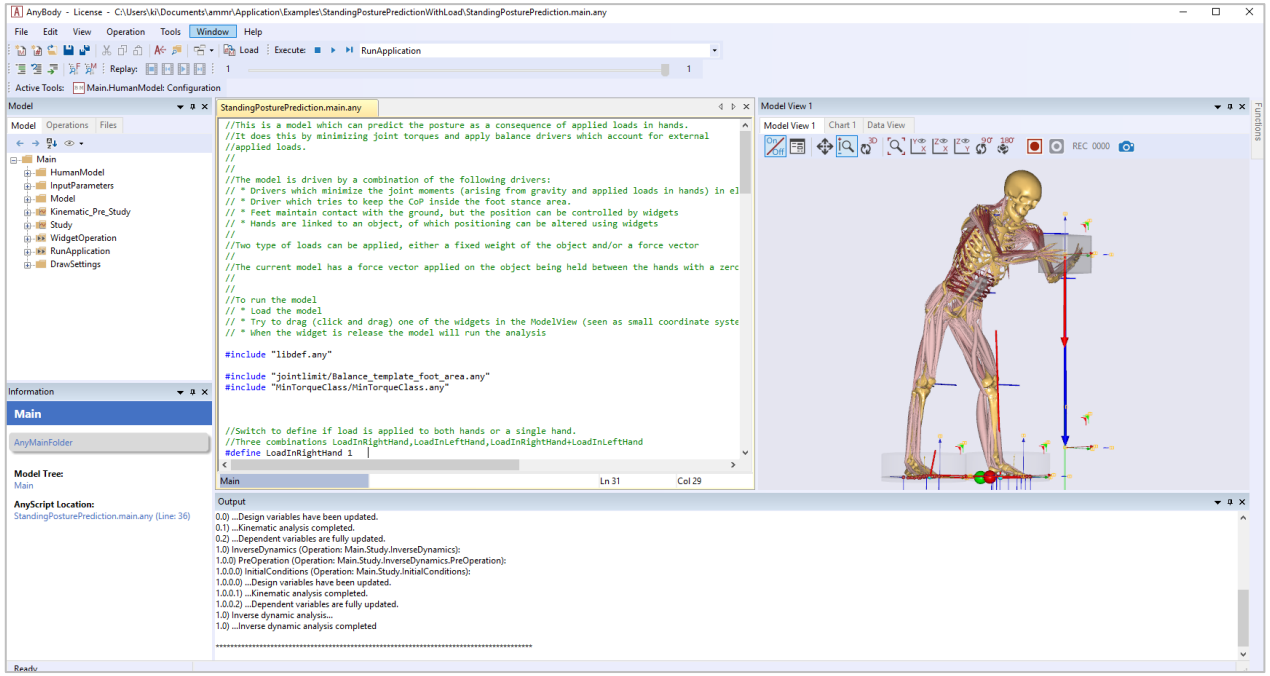
Kinematics and Forces

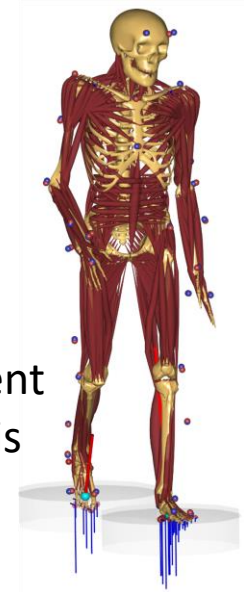
ANYBODY

Modeling System

Body Loads

- Joint moments
- Muscle forces
- Joint reaction forces

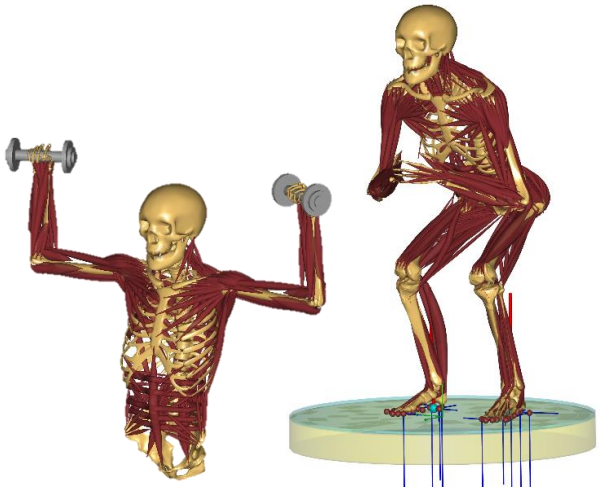




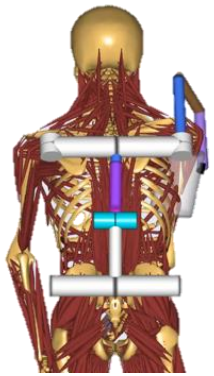
Movement Analysis

Product optimization design

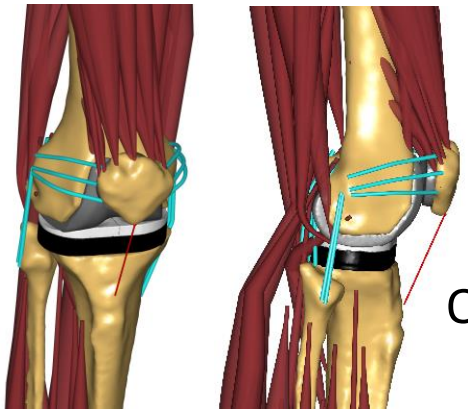
ANYBODY Modeling System



Sports



Assistive Devices



Orthopedics and rehab

AnyBody Modelling System

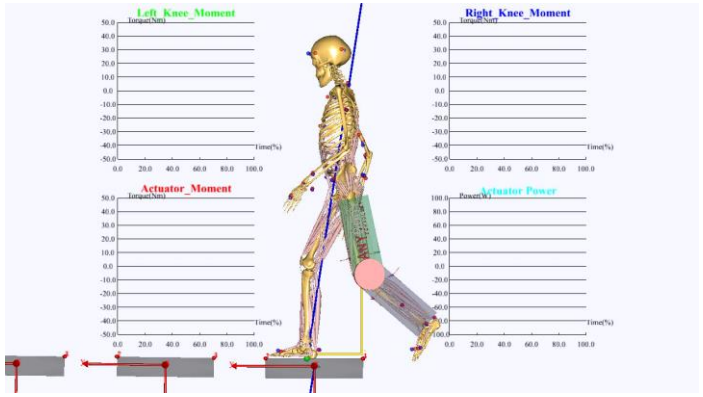
Motion and Forces

Body model

Environment model

Inverse dynamics
Muscle recruitment

Simulation



Internal body loads

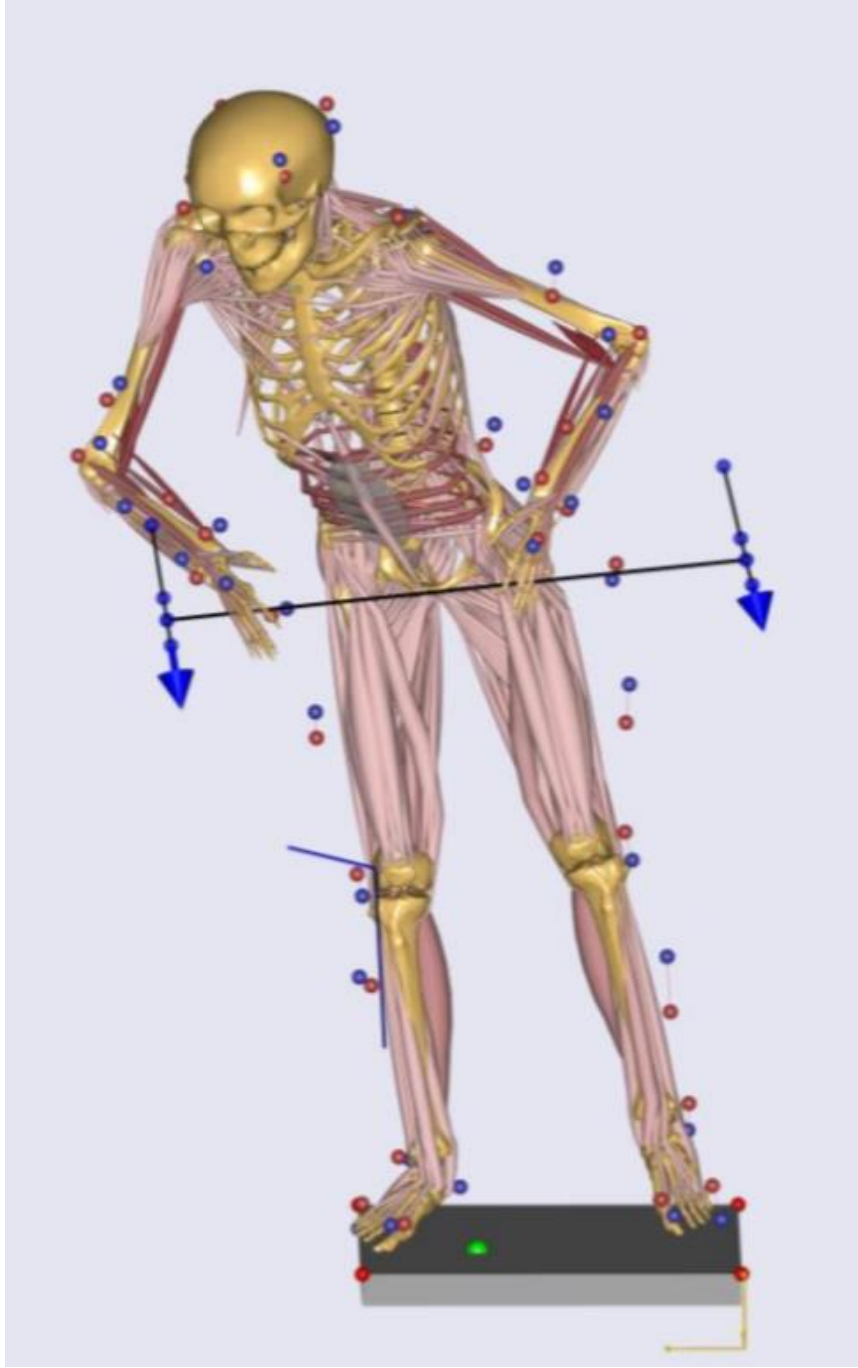
- Muscle forces
- Joint moments

Design Optimization

Post Processing (e.g. Finite element tools)

Physical Stresses on Caregivers when Repositioning Patients in Bed

Presented by Jie Zhou



Physical Stresses on Caregivers when Repositioning Patients in Bed

– JIE ZHOU, PHD, AEP

Hillrom™

INTRODUCTION

- Caregivers are more vulnerable to musculoskeletal disorders (MSDs) than most other occupations [1]
- Repositioning patients in bed is most common patient handling activity[2]
- Manual repositioning is associated with risk of MSDs [3,4]

1. BLS, 2016. Nonfatal occupational injuries and illnesses requiring days away from work, 2015.Bureau of Labor Statistics.

2. Poole Wilson, T., Davis, K. G., Kotowski, S. E., & Daraiseh, N. (2015). Quantification of patient and equipment handling for nurses through direct observation and subjective perceptions. Advances in Nursing, 2015.

3. Marras, W. S., Davis, K. G., Kirking, B. C., & Bertsche, P. K. (1999). A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques. Ergonomics, 42(7), 904-926.

4. Fragala, G. (2011). Facilitating repositioning in bed. AAOHN Journal, 59(2), 63-68.

Hillrom™

- Manual repositioning aids compared to mechanical lifts
  - Cheaper initial investment
  - May be more readily available
  - Perceived to take less time to use

INTRODUCTION

- Most previous studies:
  - Investigated only one type of repositioning aid [5].
  - Tested only a single patient weight [6].
  - Did not perform biomechanical analysis or estimate risk of injury
- The objective: investigate the risk of injury on caregivers when repositioning patients in bed for several combinations of 1) repositioning activity, 2) patient weight and 3) repositioning aid

5. Fray, M., David, D., Hindson, D., Pattison, L. and Metcalfe, D., 2016. Does the use of friction reducing devices actually reduce the exposure to high force lateral transfers?. The Healthcare Systems Ergonomics and Patient Safety Conference (HEPS 2016).

6. Skotte, J., & Fallentin, N. (2008). Low back injury risk during repositioning of patients in bed: The influence of handling technique, patient weight and disability. Ergonomics, 51(7), 1042–1052.

METHODS

- Participants:
  - Caregivers
    - N=10
    - Height: 169.8 cm (7.6 cm), weight: 80.4 kg (16.6 kg)
    - Experience: 7.5 years (SD 3.7 years).
  - Simulated Patients
    - N=3
    - Weight: 50, 77, 141 kg

- Repositioning aids:
  - Air-assisted repositioning devices (AARD)
  - Friction reducing sheets (FRS)
  - Turn and position systems (TAP)
  - Non-stretchable traditional cotton draw sheet (DS)

AARD

FRS

TAP

METHODS

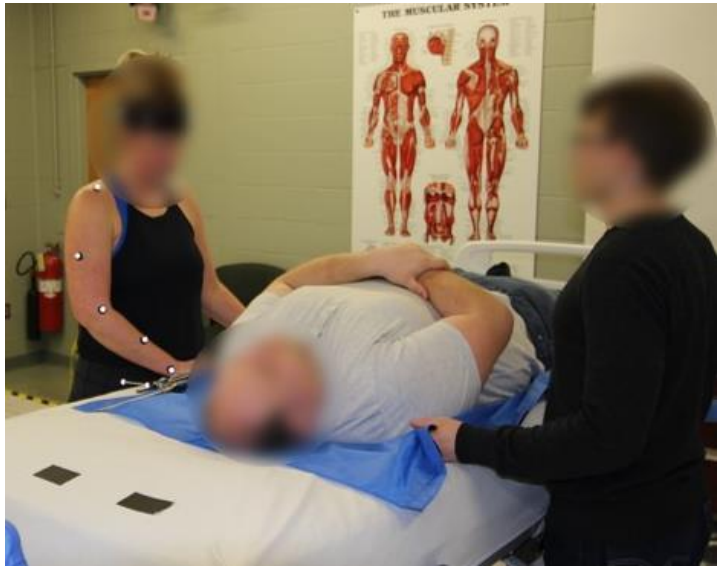
- Equipment
  - Motion capture system
  - Force platform
  - Force gauges
- AnyBody Modeling System® [7, 8]

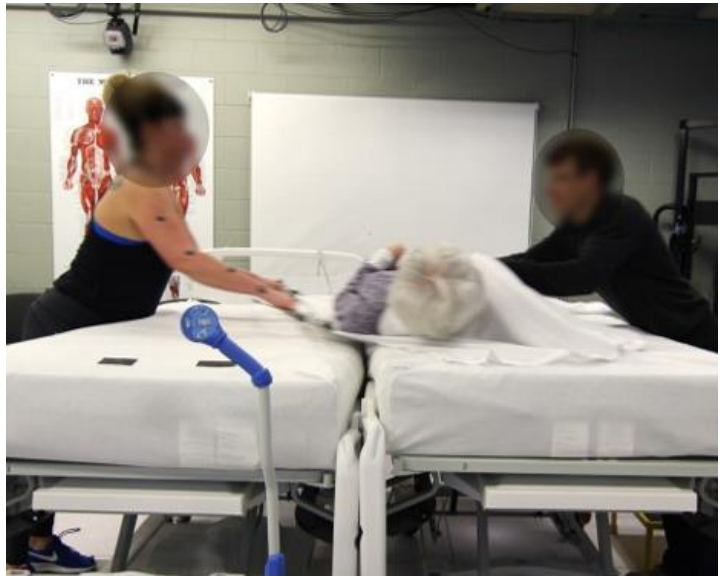
7. Bassani, T., Stucovitz, E., Qian, Z., Briguglio, M., & Galbusera, F. (2017). Validation of the AnyBody full body musculoskeletal model in computing lumbar spine loads at L4L5 level. Journal of Biomechanics, 58, 89-96.

8. Damsgaard, M., Rasmussen, J., Christensen, S. T., Surma, E., & De Zee, M. (2006). Analysis of musculoskeletal systems in the AnyBody Modeling System. Simulation Modelling Practice and Theory, 14(8), 1100-1111.

METHODS

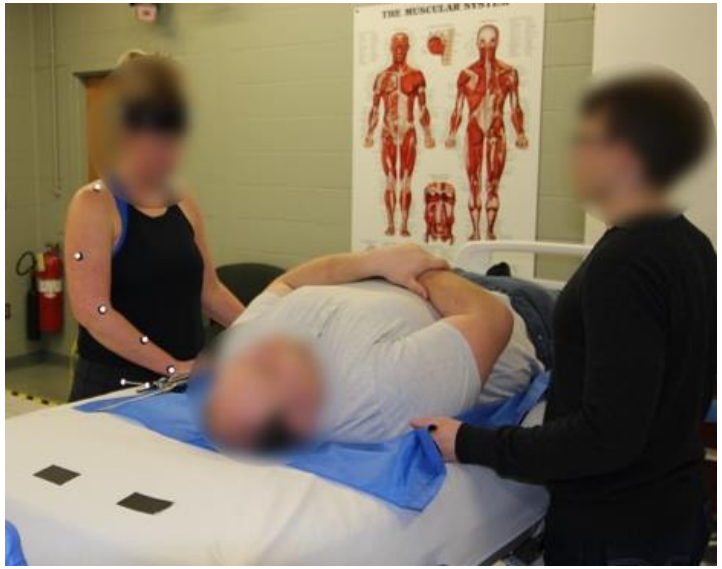
- Repositioning Activities Studied
  - Pull up in Bed
  - Lateral Repositioning
  - Lateral Transfer

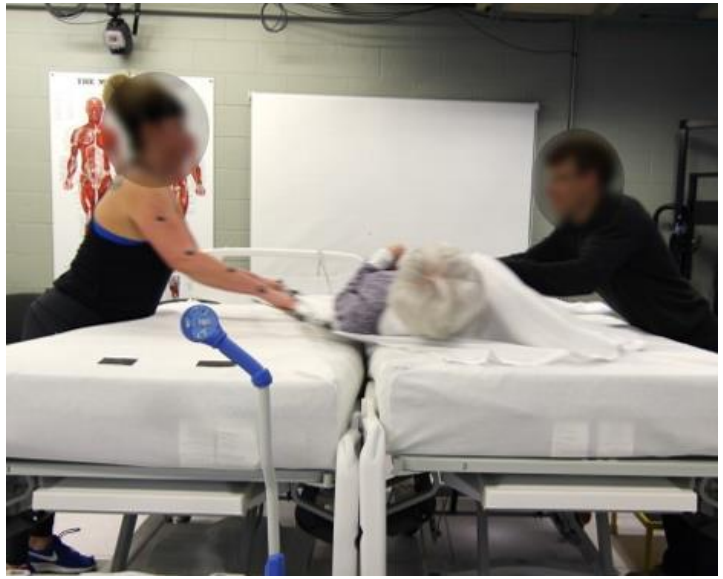




METHODS

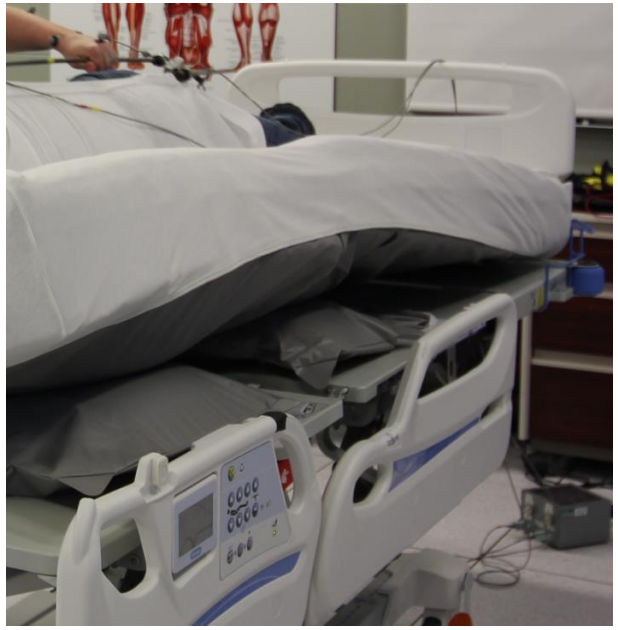
- Procedure
  - Two repetitions, 90 total trials per subject
  - Order of test conditions was partially randomized
  - Bed height was set by the caregiver





METHODS

- Independent variables
  - Repositioning aids
    - DS, TAP, FRS, AARD
  - Patient weight
    - 50, 77, 141 kg
- Dependent variables
  - Peak L5/S1 compression
    - Compared to 3400 N limit [9]
  - Peak pulling force
    - Compared to 245 N limit [10]



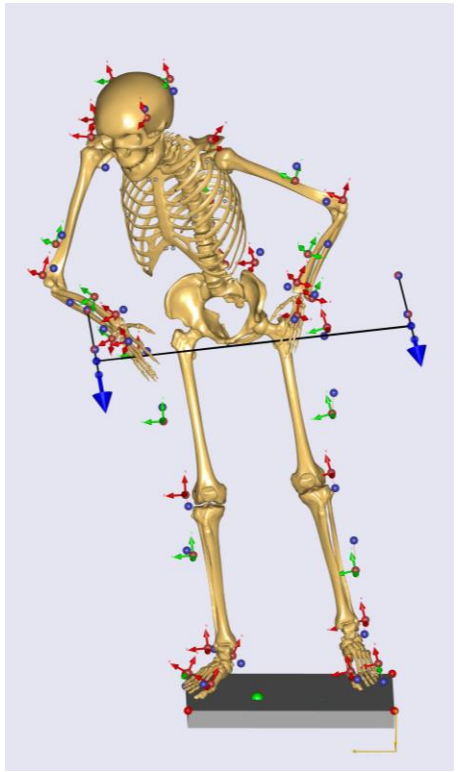
9. Waters, T.R., Putz-Anderson, V., Garg, A. and Fine, L.J., 1993. Revised NIOSH equation for the design and evaluation of manual lifting tasks. Ergonomics, 36(7), pp.749-776.

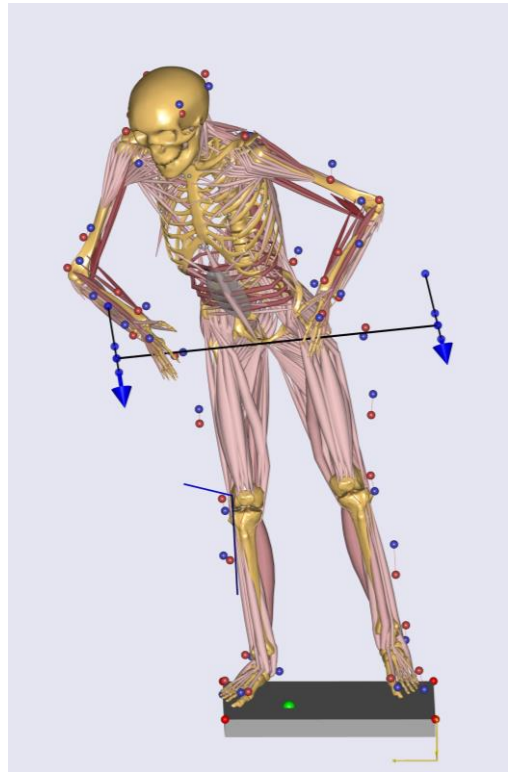
10. Snook, S. H., & Ciriello, V. M. (1991). The design of manual handling tasks: revised tables of maximum acceptable weights and forces. Ergonomics, 34(9), 1197-1213.

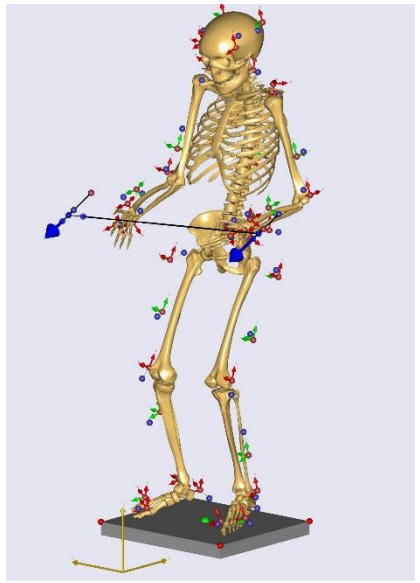
Hillrom™

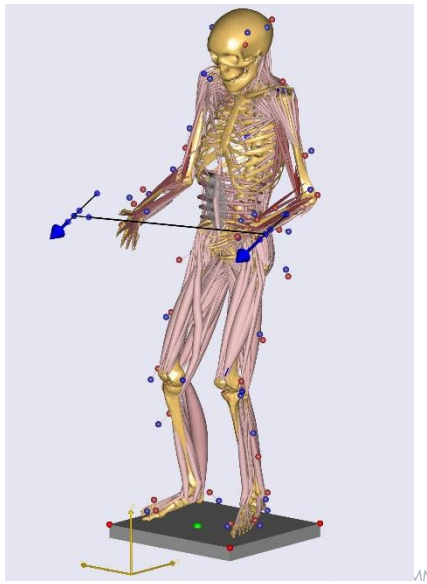
METHODS

- AnyBody Modeling System®
  - Pulling force, ground reaction force, markers coordinates
  - Anthropometry
  - Kinematics
  - Inverse dynamics

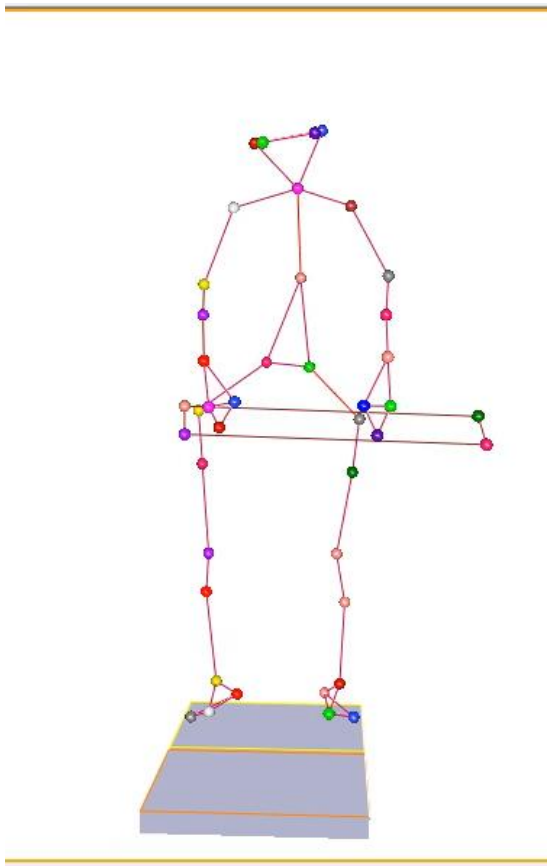


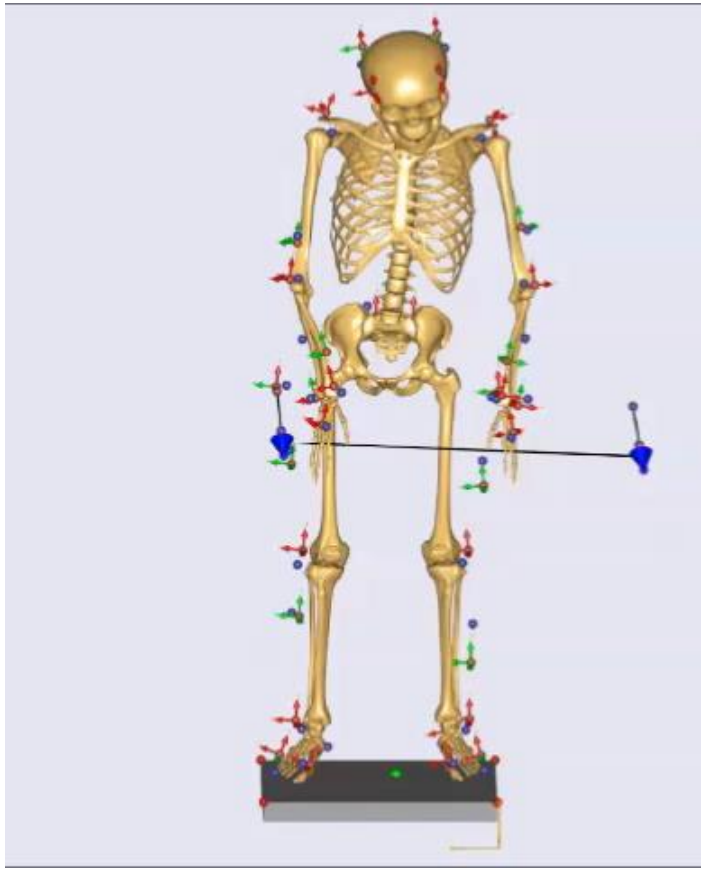


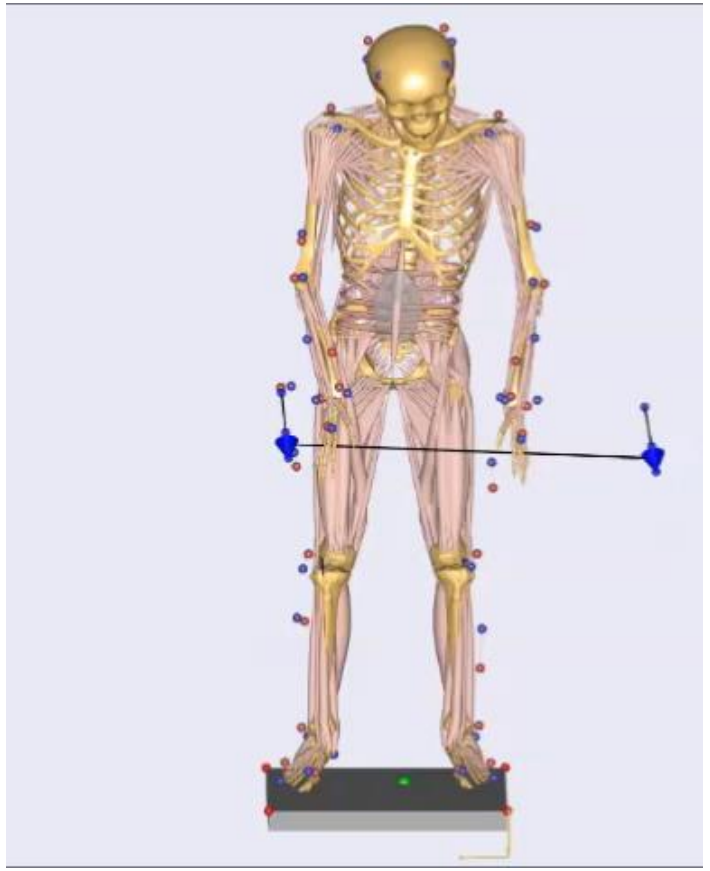




METHODS





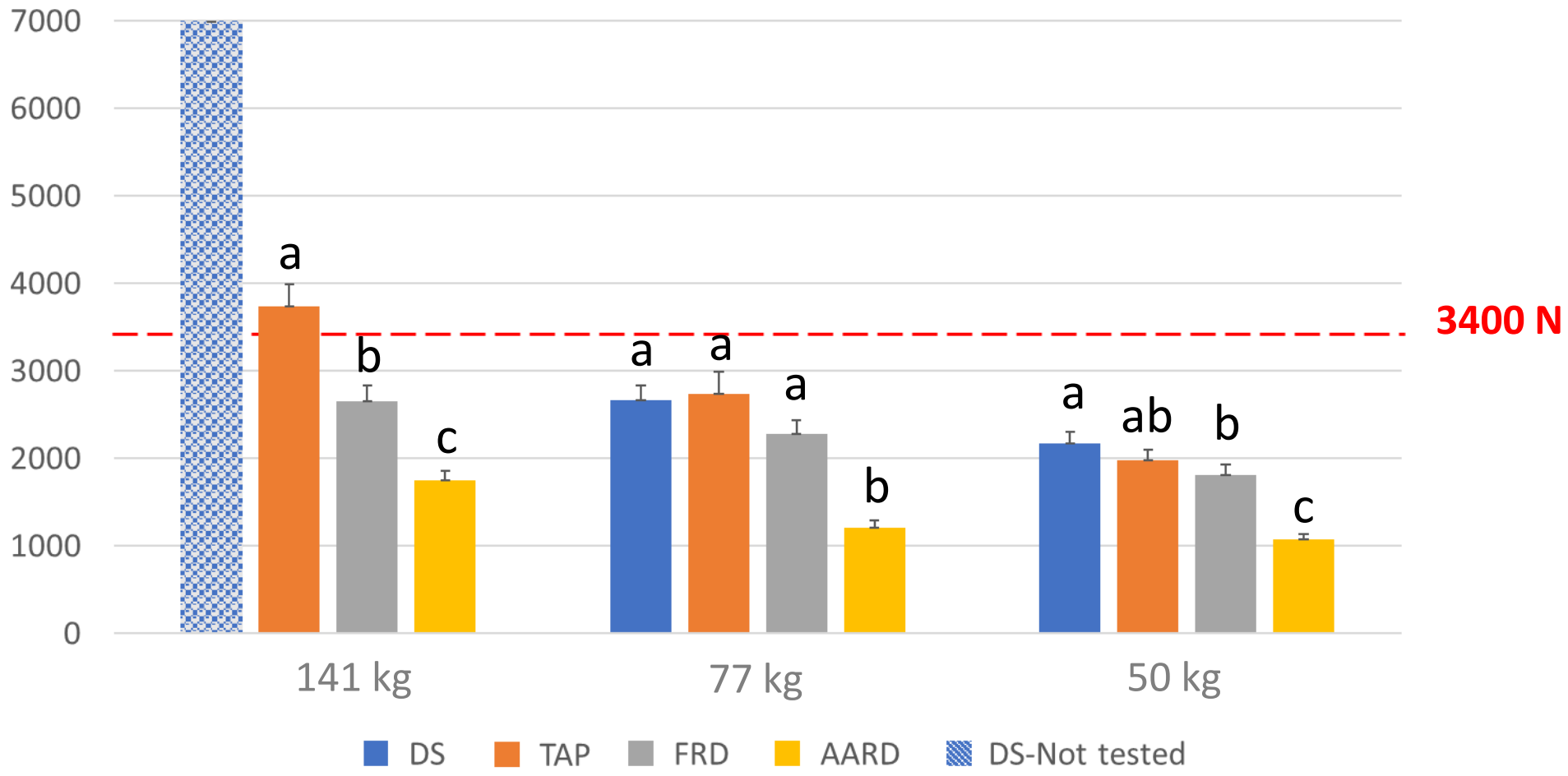


Hillrom™

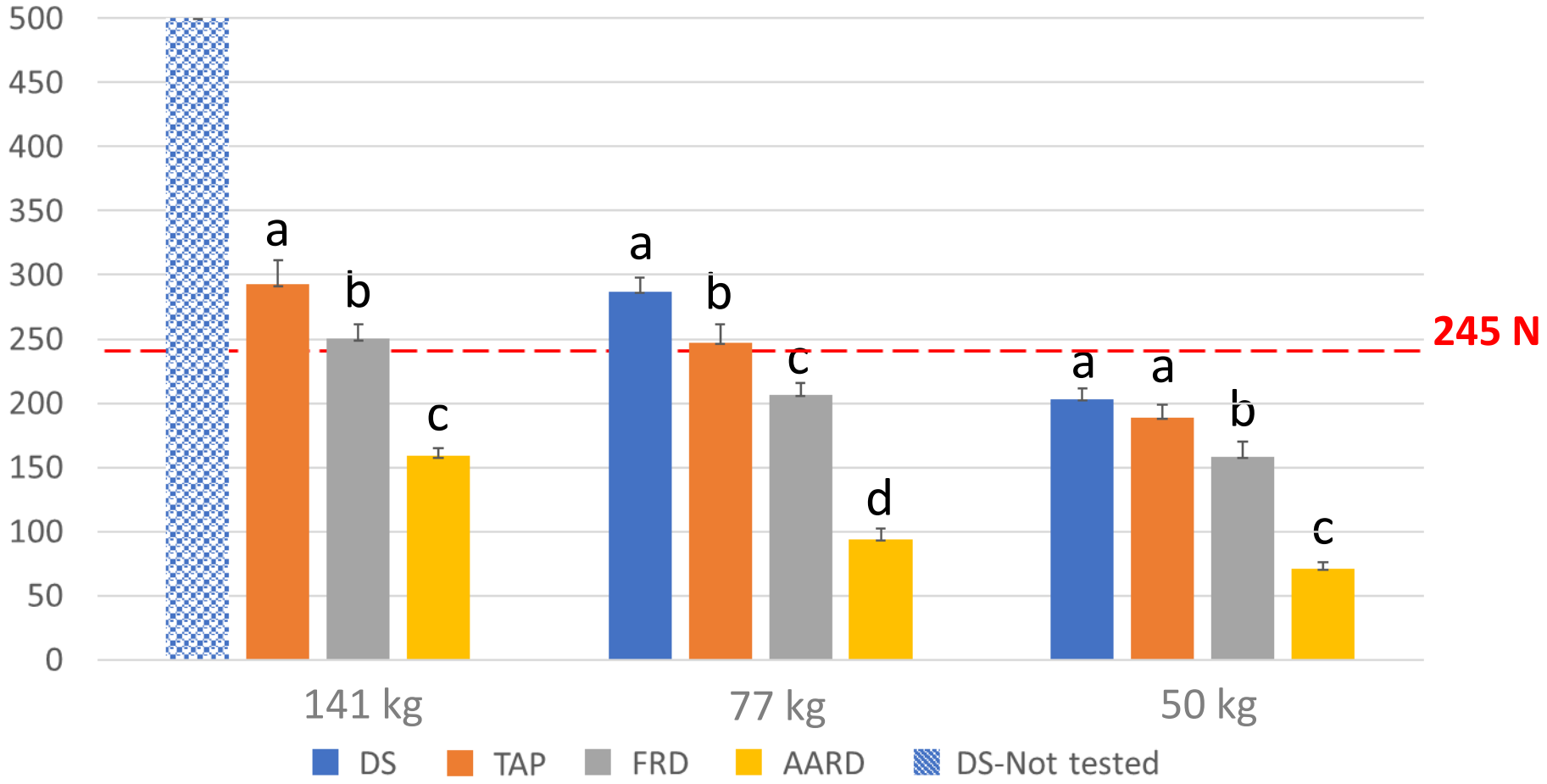
METHODS

- Statistical analysis
  - Repeated measures ANOVA
  - Tukey-Kramer post-hoc tests
  - Participant was set as a random factor
  - Significance criteria $\alpha < 0.05$

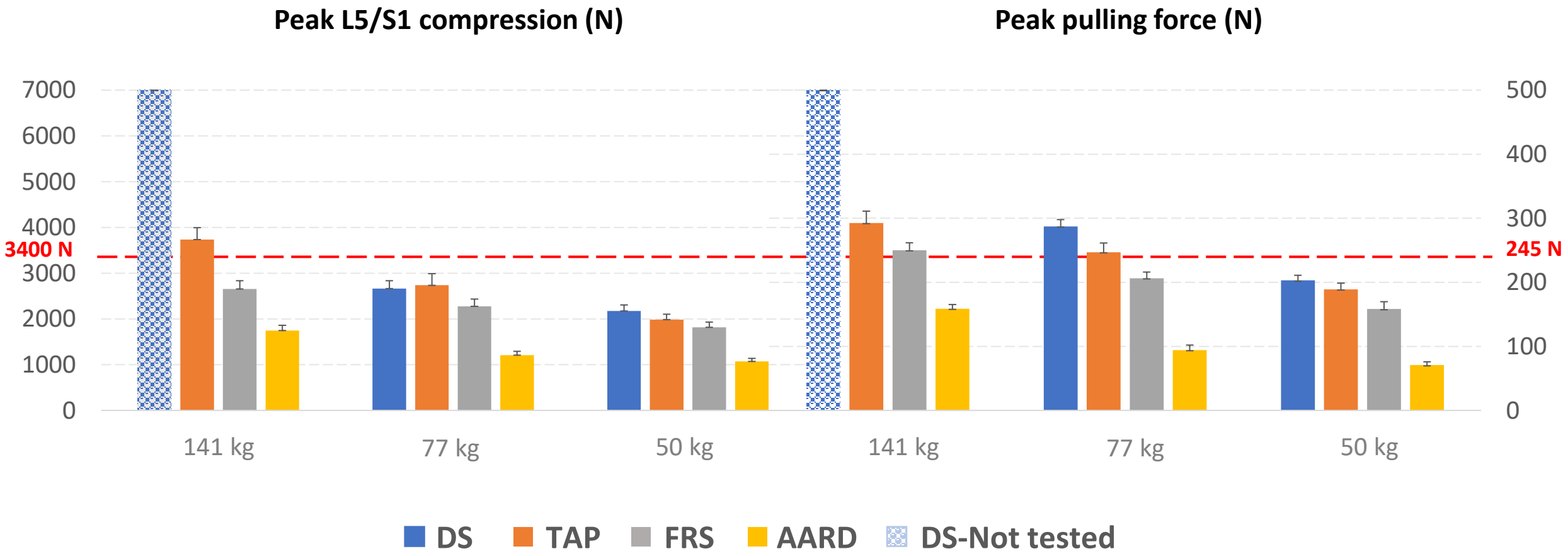
Pull up in bed-Peak L5/S1 compression (N)



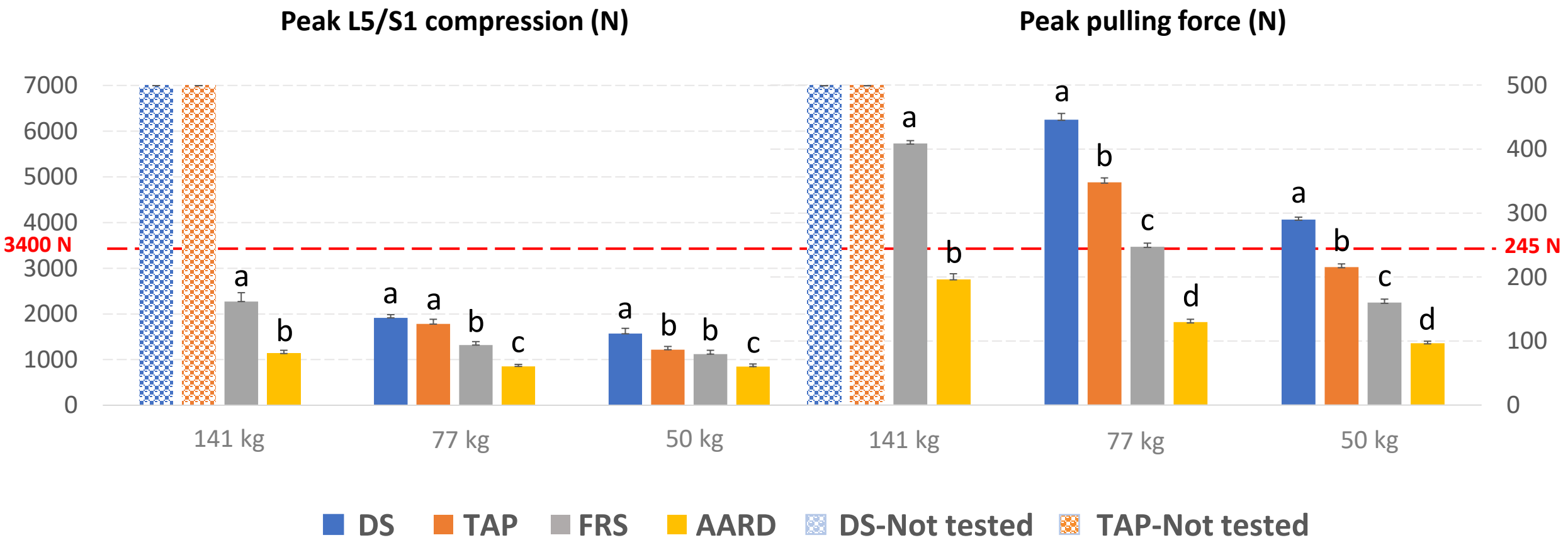
Pull up in bed-Peak pulling force (N)



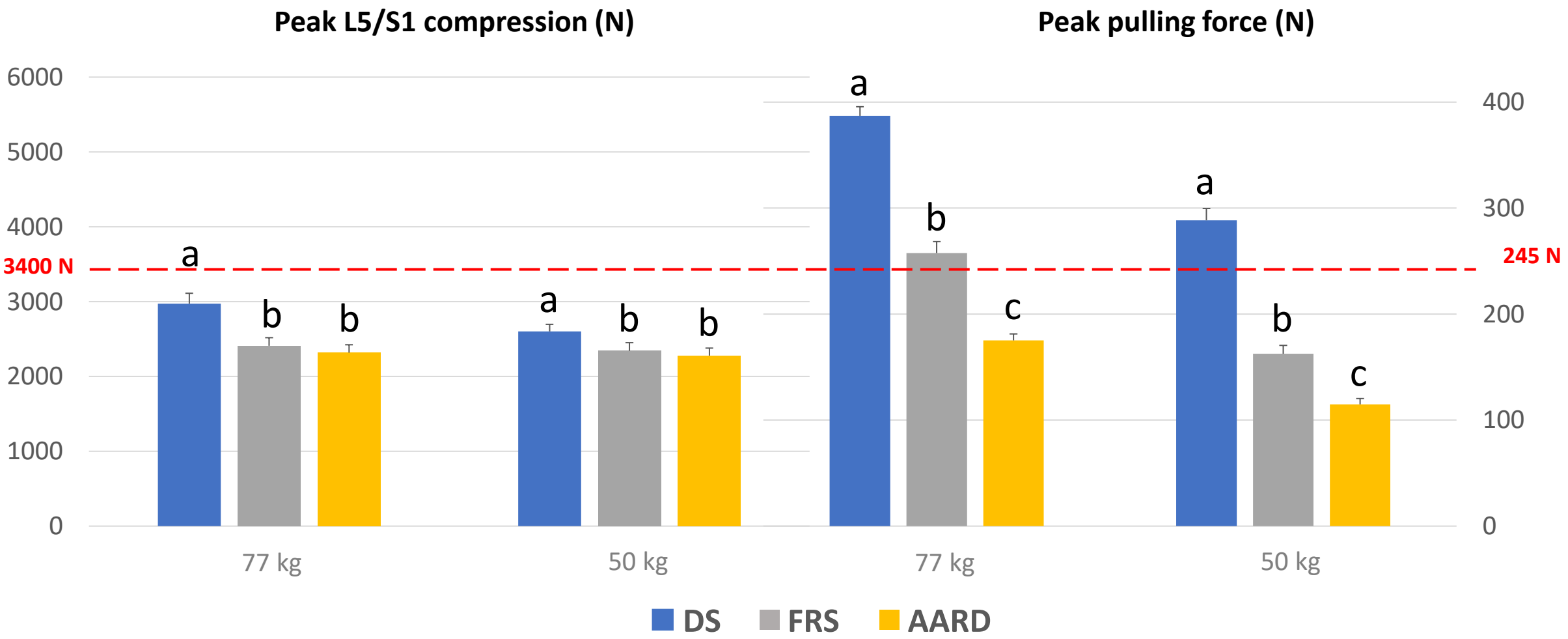
Pull up in bed-Spine Compression vs. Pulling Force



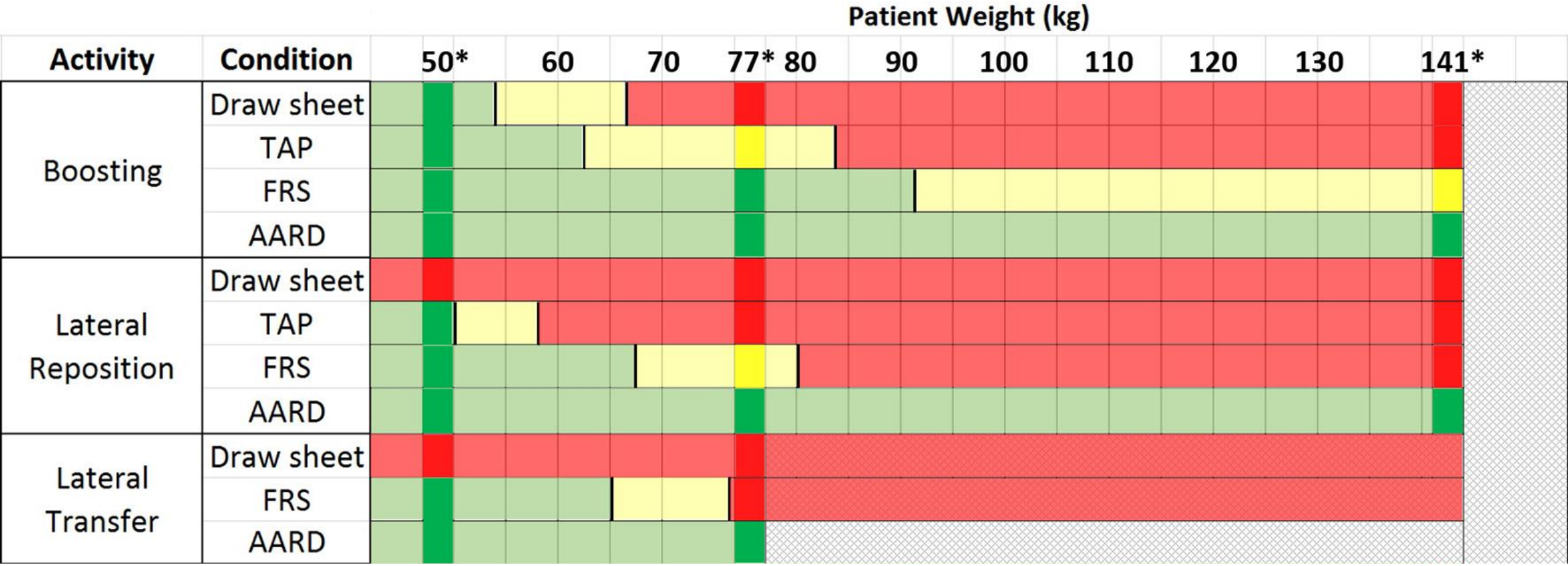
Lateral repositioning-Spine Compression vs. Pulling Force



Lateral Transfer-Spine Compression vs. Pulling Force



Recommendation



DISCUSSION

Implications

- Draw sheet is unacceptable to perform manually for any size patient
- Friction Reducing Sheets is only acceptable for lighter patients
- Only Air Assisted Repositioning Devices (AARD) resulted in forces below the injury thresholds for all tested conditions
- However, AARD needs to be placed and removed before and after use; Inflated, disinfected;
- Mechanical lifts with repositioning sheet remain the lowest risk, repositioning sheet can be left under the patient.

DISCUSSION

AARD compared to mechanical lift

Limitations

- Installing and removing repositioning aids was not evaluated
- Joint forces on other affected regions were not evaluated
- Only one model of each type of repositioning aid was assessed

CONCLUSION

- For patient repositioning, pulling force appears to drive injuries more than spine compression
- Repositioning aids reduce physical stress on caregivers. However, most aids are only appropriate for lighter patients [11]
- Air Assisted Repositioning Devices can be used to safely reposition most patients, but usability concerns may be a barrier for caregivers to use
- A mechanical lift and repositioning sheet are most ideal [12]

11. Lafleur, B., Weaver, T., Tondat, A., Boscart, V., & Laing, A. C. (2018). Manual Patient Transfers–Factors That Influence Decisions and Kinematic Strategies Employed by Nursing Aides. Ergonomics, (just-accepted), 1-12.

12. American Nurses Association, 2013. Safe patient handling and mobility: Interprofessional national standards. Silver Spring, MD: Nursesbooks.org.

Acknowledgement

- Neal Wiggermann, Ph.D., CPE
- Nancy McGann, PT, CSPHP

Thanks, and questions

Reference

1. BLS, 2016. Nonfatal occupational injuries and illnesses requiring days away from work, 2015.Bureau of Labor Statistics.
2. Davis, K.G. and Kotowski, S.E., 2015. Prevalence of musculoskeletal disorders for nurses in hospitals, long-term care facilities, and home health care: a comprehensive review. Human factors, 57(5), pp.754-792.
3. Waters, T. R., Nelson, A., & Proctor, C. (2007). Patient handling tasks with high risk for musculoskeletal disorders in critical care. Critical care nursing clinics of North America, 19(2), 131-143.
4. Fragala, G. (2011). Facilitating repositioning in bed. AAOHN Journal, 59(2), 63-68.
5. Fray, M., David, D., Hindson, D., Pattison, L. and Metcalfe, D., 2016. Does the use of friction reducing devices actually reduce the exposure to high force lateral transfers?. The Healthcare Systems Ergonomics and Patient Safety Conference (HEPS 2016).
6. Skotte, J., & Fallentin, N. (2008). Low back injury risk during repositioning of patients in bed: The influence of handling technique, patient weight and disability. Ergonomics, 51(7), 1042–1052.
7. Bassani, T., Stucovitz, E., Qian, Z., Briguglio, M., & Galbusera, F. (2017). Validation of the AnyBody full body musculoskeletal model in computing lumbar spine loads at L4L5 level. Journal of Biomechanics, 58, 89-96.
8. Damsgaard, M., Rasmussen, J., Christensen, S. T., Surma, E., & De Zee, M. (2006). Analysis of musculoskeletal systems in the AnyBody Modeling System. Simulation Modelling Practice and Theory, 14(8), 1100-1111.
9. Waters, T.R., Putz-Anderson, V., Garg, A. and Fine, L.J., 1993. Revised NIOSH equation for the design and evaluation of manual lifting tasks. Ergonomics, 36(7), pp.749-776.
10. Snook, S. H., & Ciriello, V. M. (1991). The design of manual handling tasks: revised tables of maximum acceptable weights and forces. Ergonomics, 34(9), 1197-1213.
11. Baptiste, A., Boda, S.V., Nelson, A.L., Lloyd, J.D. and Lee III, W.E., 2006. Friction-reducing devices for lateral patient transfers: a clinical evaluation. Aaohn Journal, 54(4), pp.173-180.
12. Theou, O., Soon, Z., Filek, S., Brims, M., Leach-MacLeod, K., Binsted, G. and Jakobi, J., 2011. Changing the sheets: a new system to reduce strain during patient repositioning. Nursing research, 60(5), pp.302-308.

www.anybodytech.com

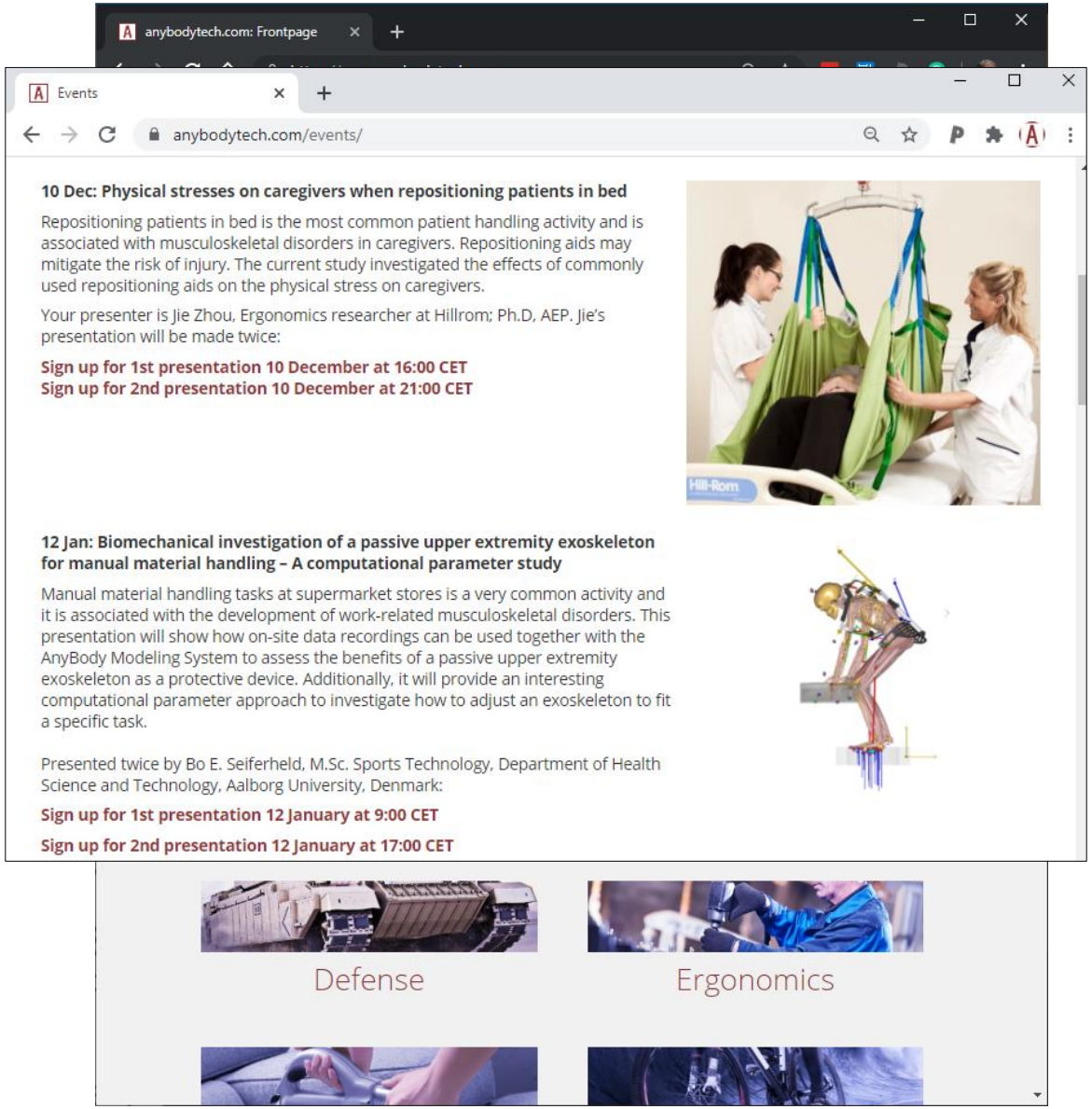
- Events, Dates, Publication list, ...

www.anyscript.org

- Wiki, Blog, Repositories, Forum

Upcoming Webcasts

- January 12th - Biomechanical investigation of a passive upper extremity exoskeleton for manual material handling – A computational parameter study.



Meet us? Send email to sales@anybodytech.com

Want to present? Send email to ki@anybodytech.com

Find us:

Time for questions: