Ergonomics: Have Cal/OSHA regulations been a driver for state-of-the-art assessment and control implementation?

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- I have no personal financial conflicts of interest to disclose.
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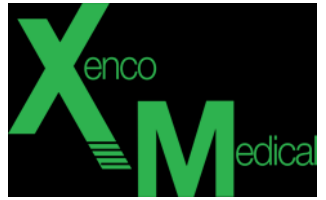
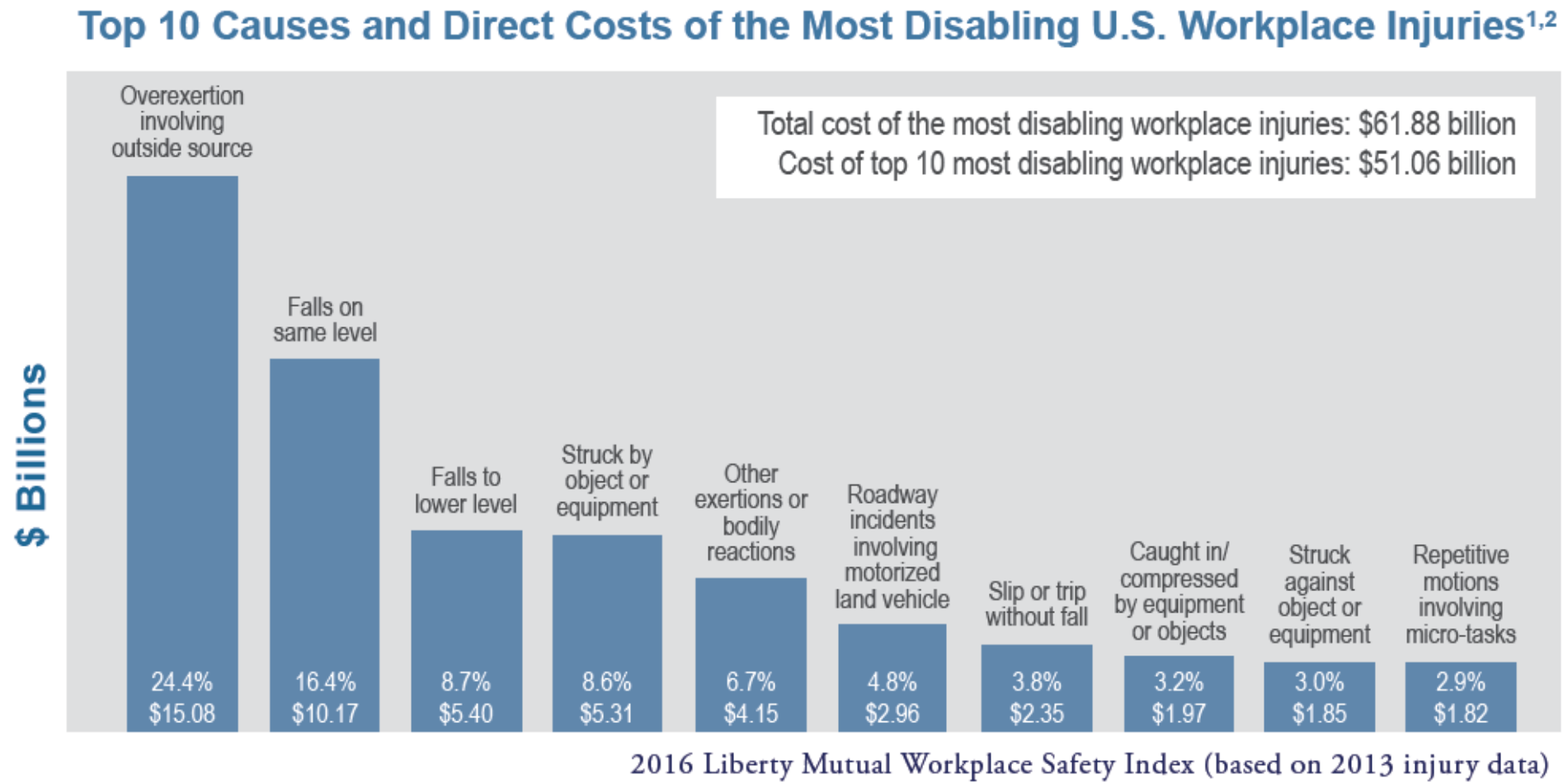


Objectives

- Define ergonomics and why regulations were considered
- Review the history and significance of Ergonomic Regulations in California
- Understand the components of the CalOSHA Ergonomics Standard and its impact
- Explore new industry specific regulations
- Discuss how technology may change how we consider ergonomic regulations in the future

Why Ergonomics?

$60 Billion spent in direct US Workers Compensation costs per year (or ~$1Billion per week)



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What is Ergonomics?

A multi disciplinary science that applies principles based on the physical and psychological capabilities of people to the design or modification of jobs, equipment, products, and workplaces.

The goals of ergonomics are to decrease risk of injuries and illnesses to improve worker performance, to decrease worker discomfort and to improve the quality of work life.

- American Industrial Hygiene Association

How did we get here?

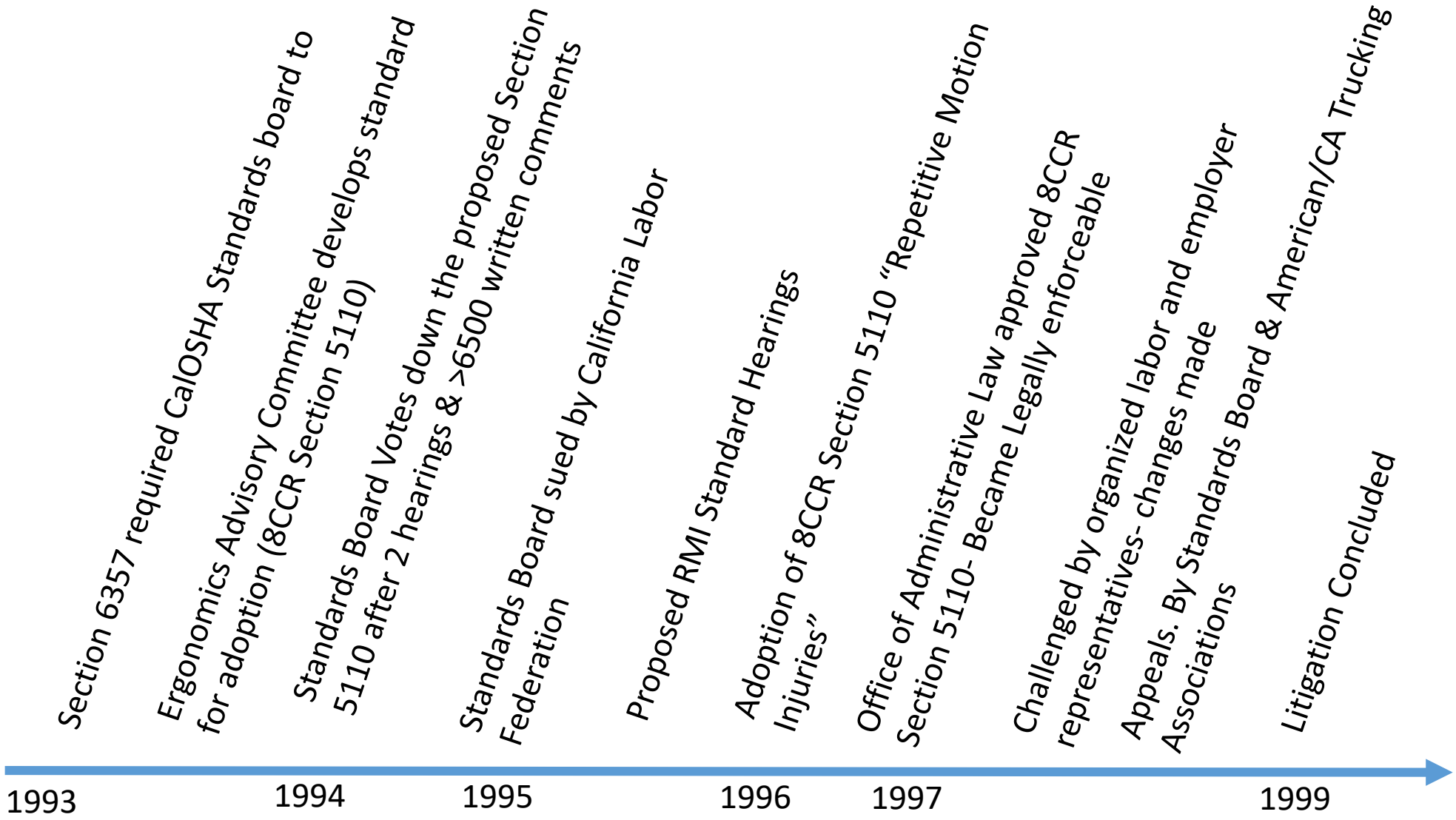
''Cal-OSHA is being taken to court by the trucking associations and the AFL-CIO, so we're kind of stuck between a rock and a hard place,'' said John MacLeod, executive officer of Cal-OSHA, the state agency overseeing workplace safety issues.

California Code of Regulations, Title 8, Section 5110. Repetitive Motion Injuries.

'The inherent problem in promulgating the regulation is that no one can empirically state the cause or cure of a given workplace injury,'' said Ms. Broyles, director of insurance and employee relations at the chamber, in Sacramento.

''But the core issue is that there is a lack of hard scientific data demonstrating the correlation between repetitive motion injury and the workplace job function.''

Ms. Broyles believes that employers have strong incentives to reduce on-the-job injuries, ''so why impose an unnecessary and potentially costly regulation? Employers know full well that workers comp insurance costs will rise if they have a rash of a certain kind of injury.''



History of CCR Title 8 Section 5110, RMI

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ARCHIVE

Washington Proposes Ergonomics Standard

Washington may become the second state in the nation with an ergonomics standard after the Department of Labor and Industries released its proposal Nov. 15.

Todd Nighswonger | Nov 18, 1999

The state of Washington adopted an ergonomics standard in May of 2000.

Alaska & Minnesota all held hearings or assigned Ergonomic Task Forces to address regulation but discontinued efforts.

ARCHIVE

State Plans Make Decisions About Federal Ergonomic Rule

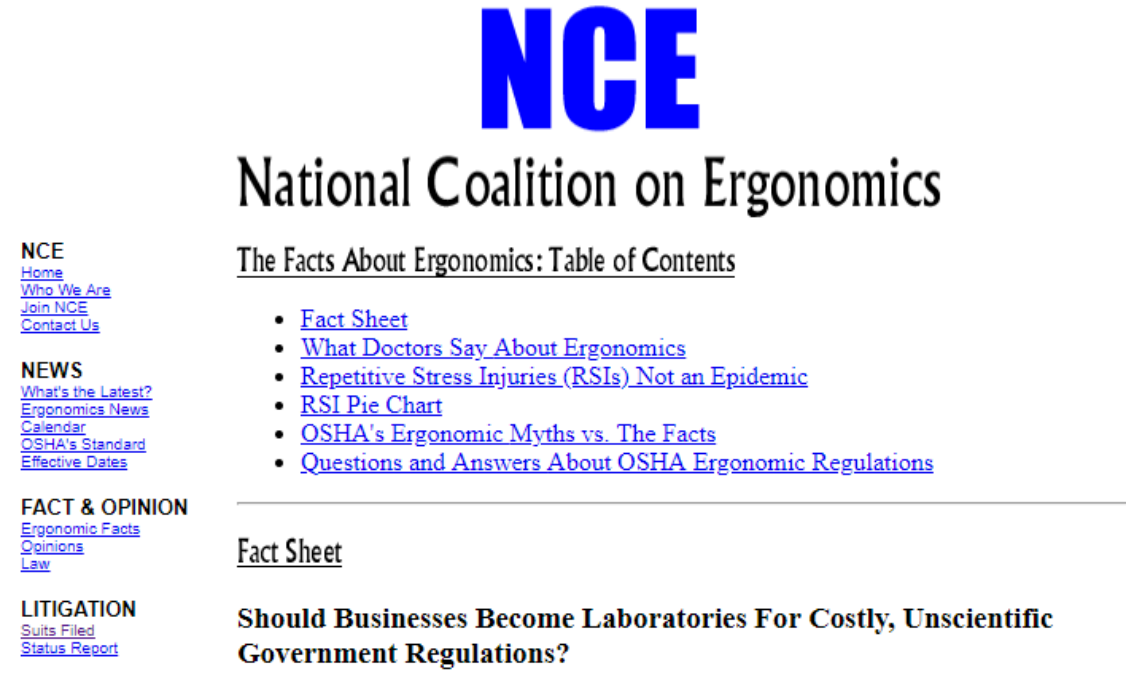
The North Carolina Department of Labor adopted OSHA's ergonomic standard verbatim and the Oregon Occupational Safety and Health Division is reviewing the final rule.

EHS Today Staff | Nov 29, 2000

REPORT Jobs And Labor

OSHA's Ergonomics Rule: A Costly Unfunded Mandate For The States

June 9, 2000 29 min read



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The Facts About Ergonomics: Table of Contents

- Fact Sheet
- What Doctors Say About Ergonomics
- Repetitive Stress Injuries (RSIs) Not an Epidemic
- RSI Pie Chart
- OSHA's Ergonomic Myths vs. The Facts
- Questions and Answers About OSHA Ergonomic Regulations

Fact Sheet

Should Businesses Become Laboratories For Costly, Unscientific Government Regulations?

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Why the debate?

MORE REGULATION

- MSDs are not being adequately addressed
- MSDs are too costly for businesses and the US to bare
- No incentive to protect workers proactively
  - Underreporting
  - Vulnerable workers
- Lack of knowledge/ implementation of best practices

LESS REGULATION

- Too costly for businesses to implement
- Lack of causal evidence
- Exposure & Outcome are difficult to measure
- Difficult for businesses to understand & implement regulation (esp. small businesses)
- Impede job growth
- Increasing WC Rates are enough incentive

Indirect Regulation

Does this mean OSHA will not use the General Duty Clause to cite for ergonomic hazards?

OSHA will use the General Duty Clause to cite employers for ergonomic hazards. Under the OSH Act's General Duty Clause, employers must keep their workplaces free from recognized serious hazards, including ergonomic hazards. This requirement exists whether or not there are voluntary guidelines.

Work Health and Safety Act 2011 and WHS Regulations

Part II Canada Labour Code Part XIX, Hazard Prevention Program

EU Directive 89/391, the OSH 'Framework Directive"

HEALTH

Ergonomics: What's Next for the State of Washington?

Big bucks were spent to repeal Washington's ergonomics standard. Will workers and employers end up paying a high price in terms of injuries and costs?

Sandy Smith | Feb 18, 2004

The state of Washington repealed the ergonomics standard in 2003.

The state of Michigan banned any new ergonomic regulations in 2011.

2011 Senate Bill 20: Ban imposing new business ergonomic regulations

Public Act 10 of 2011

Introduced by Sen. Rick Jones (R) on January 19, 2011

To prohibit the Michigan Occupational Safety and Health Administration (MIOSHA) or other state agencies from imposing rules and regulations regarding workplace "ergonomics." During the Granholm administration, a "workgroup" kept meeting for several years to draft such rules. Official Text and Analysis.


Last One
Standing

Regulation versus Enforcement

California

State's Ergonomics Rules Draw Little Business Opposition

Workplace: Regulations that went into effect in 1998 are weak and seldom enforced, according to safety advocates.

March 08, 2001 | STUART SILVERSTEIN and NANCY CLEELAND | TIMES STAFF WRITERS

Today, more than three years after California became the first state in the nation with an ergonomics standard, business is barely making a peep about the issue. But the reasons provide little comfort to worker safety advocates: The California regulations are widely considered to be weak and, beyond that, they are rarely enforced.

"Having a regulation on the books of some sort, regardless of how weak it is, is motivation for some employers who want to do the right thing," said Maggie Robbins, a health and safety consultant for the California Labor Federation. But, Robbins added, the California standard "is not an effective enforcement tool because it is too difficult for compliance officers to show a violation."

What is in Title 8, Section 5110?

The standard provides that when at least two employees performing identical tasks have been diagnosed by a physician with repetitive motion injuries (RMIs) within 12 consecutive months, the employer must establish a program that shall:

- Evaluate each job, process, or operation of identical activity for exposures which have caused RMIs at the affected work site
- Control or minimize to the extent feasible the exposures that have caused repetitive motion injuries, considering engineering controls and administrative controls
- Provide training to affected employees

Why more regulation?

Title 8 of the California Code of Regulations, section 5120

Safe Patient Handling in California

Fact Sheet for Hospital Workers, June 2016

- Defines work settings, designated workers and patient handling activities
- Describes hospital plans
- Training requirements
- Record keeping requirements

Data source: Bureau of Labor Statistics

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A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques

W. S. MARRAS , K. G. DAVIS , B. C. KIRKING & P. K. BERTSCHE

Transfer task	One-person transfers	Two-person transfers
Probability of 'high' risk group membership		
Lift from bed to wheelchair without an arm	91.4 (17.8)^{D}	81.3 (22.8)^{A}
Lift from wheelchair without an arm to bed	89.5 (21.2)^{DE}	82.3 (22.1)^{A}
Lift from bed to wheelchair	93.8 (12.6)^{D}	78.4 (23.5)^{AB}
Lift from wheelchair to bed	87.3 (22.4)^{DE}	79.4 (24.3)^{A}
Lift from hospital chair to commode chair	95.9 (8.7)^{F}	87.1 (16.7)^{C}
Lift from commode chair to hospital chair	88.8 (24.3)^{DE}	76.9 (23.8)^{B}

Ergonomics, 42:7, 904-926.

Impact of California's safe patient handling legislation on musculoskeletal injury prevention among nurses

Soo-Jeong Lee RN, PhD[1] | Joung Hee Lee RN, PhD[1] | Robert Harrison MD, MPH[2]

2 cross sectional surveys in 2013 & 2016

- Increased knowledge of SPH Policy (87%)
- Increased training on SPH (73%)
- Increased availability of lift equipment (80%)
- Adjusted Prevalence Ratio for WRMSD Symptoms = 0.78 (95%CI: 0.66-0.91)

Am J Ind Med. 2019;62:50–58

Why more regulation?

Title 8 of the California Code of Regulations, Section 3345

California's Housekeepers Ergonomics Standard Takes Effect July 1

The regulation requires employers in the hotel and lodging industry to implement and maintain an effective Musculoskeletal Injury Prevention Program so employees won't be hurt from tasks such as lifting mattresses, pulling linens, pushing heavy carts, and slipping, tripping, or falling while cleaning bathrooms.

Mar 15, 2018

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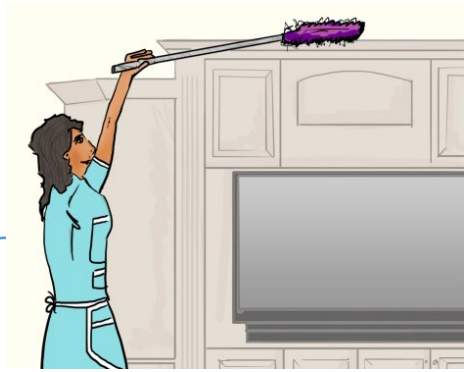
TASKS

Pushing Supply Cart

Making Bed



Dusting

Vacuuming

Cleaning Bathroom

Pictures taken from: https://ergonomics.osu.edu/ergonomics-resources-housekeeping

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Study of Hotel Room Cleaners

- Average of 15.3 rooms/day and 19.4 beds per day
- 84% took pain medication past 4 weeks
- 66% of workers reported skipping lunch or breaks or working longer hours to finish rooms
- Physical workload related to prevalence of severe or very severe pain in dose-response relationship for neck, upper and lower back
- 1 month prevalence of pain by region

	Moderate	Severe/V. Severe
Neck	21%	43%
Upper Back	20%	59%
Lower back	19%	63%

Krause et al, 2005

Study of Hotel Room Cleaners

Study of Hotel Room Cleaners in Las Vegas (Scherzer et al, 2005)

- 35% reported at least 1 injury at current employer
  - 54% reported claim being denied
- 21% reported a workers compensation claim in the past 12 months
  - 35% of claims denied
- 18% had a work-related

injury they did not report

Barriers to Reporting
Work-Related Pain to Supervisor

44% "It thought it would get better"
35% "I did not know I should"
23% "Too many steps to reporting"
13% "We get in trouble if we get hurt"
13% "I was afraid I would get fired"

(Source: Scherzer, AJIM 2005)

Study of Hotel Room Cleaners

Reported Ergonomic Problems (Krause et al 2005)	%
Linen Cart Too Heavy	84
Linen Cart difficult to stock	44
Linen cart needs repair	49
Vacuum cleaner too heavy	62
Vacuum cleaner needs repair	62
Don’t have a squeegee for bathroom	39
Don’t have a mop	32
Have to move furniture	43

Interventions

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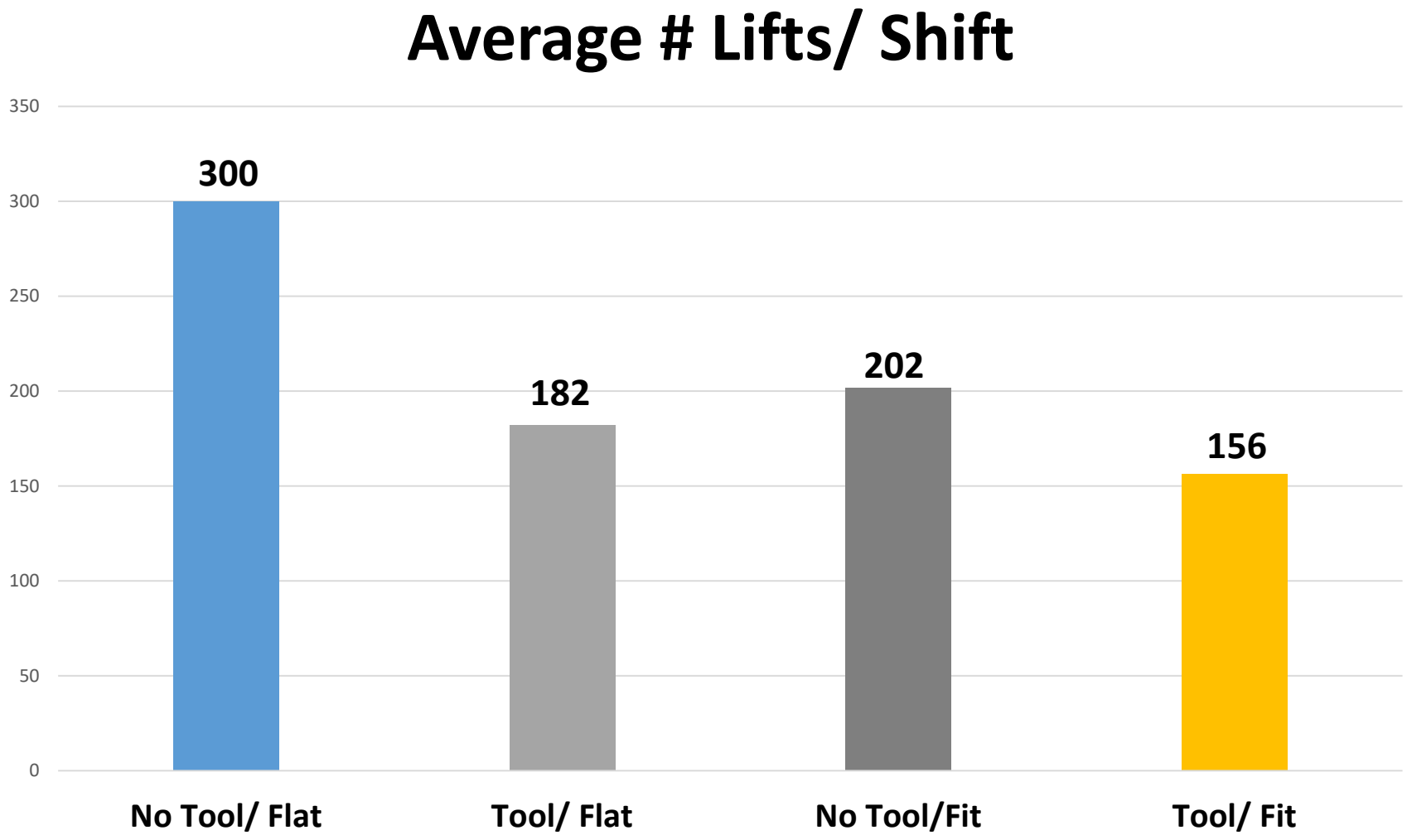
THE UNIVERSITY OF CALIFORNIA 1868

Study of Hotel Room Cleaners

Weight: 9.8kg



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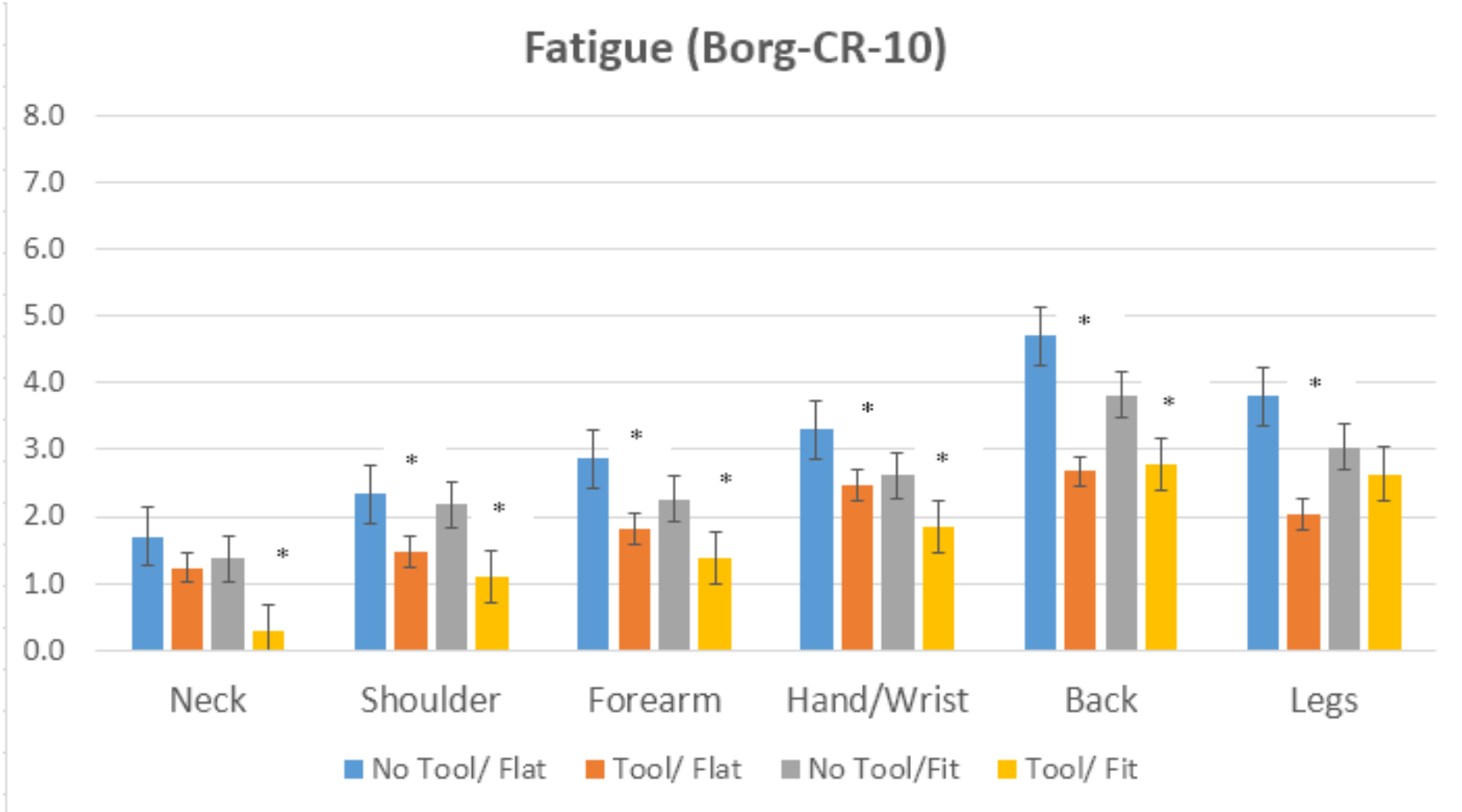
Study of Hotel Room Cleaners



Case Study

New Rooms & Carts vs. to Old Room & Carts

- 50-60% time spent in forward bend
- 70-80% of time in forward reach
- New rooms/carts required more time, particularly for check out rooms

	Example 1	Min.	Example 2	Min.	Example 3	Min.
Check Out Rooms (#)	10	99.6	6	59.7	3	29.9
Stay Over Rooms (#)	2	-7.6	7	-26.7	9	-34.3
Workshift Impact		92.0		33.1		-4.4

Small changes can add a lot of extra work!

Case Study

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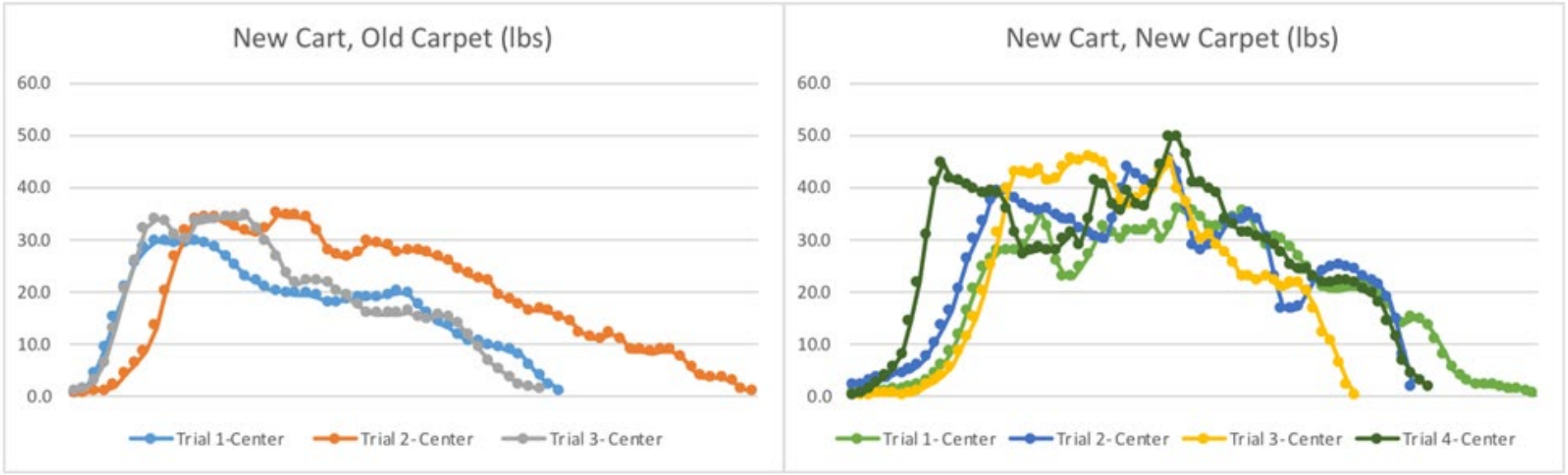
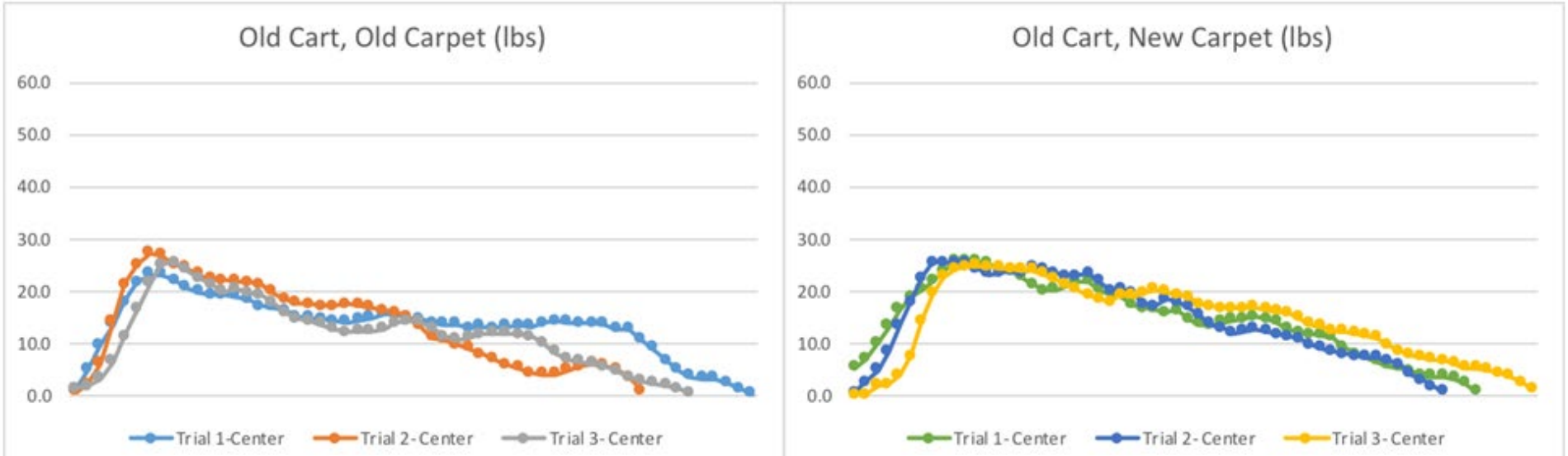
Case Study





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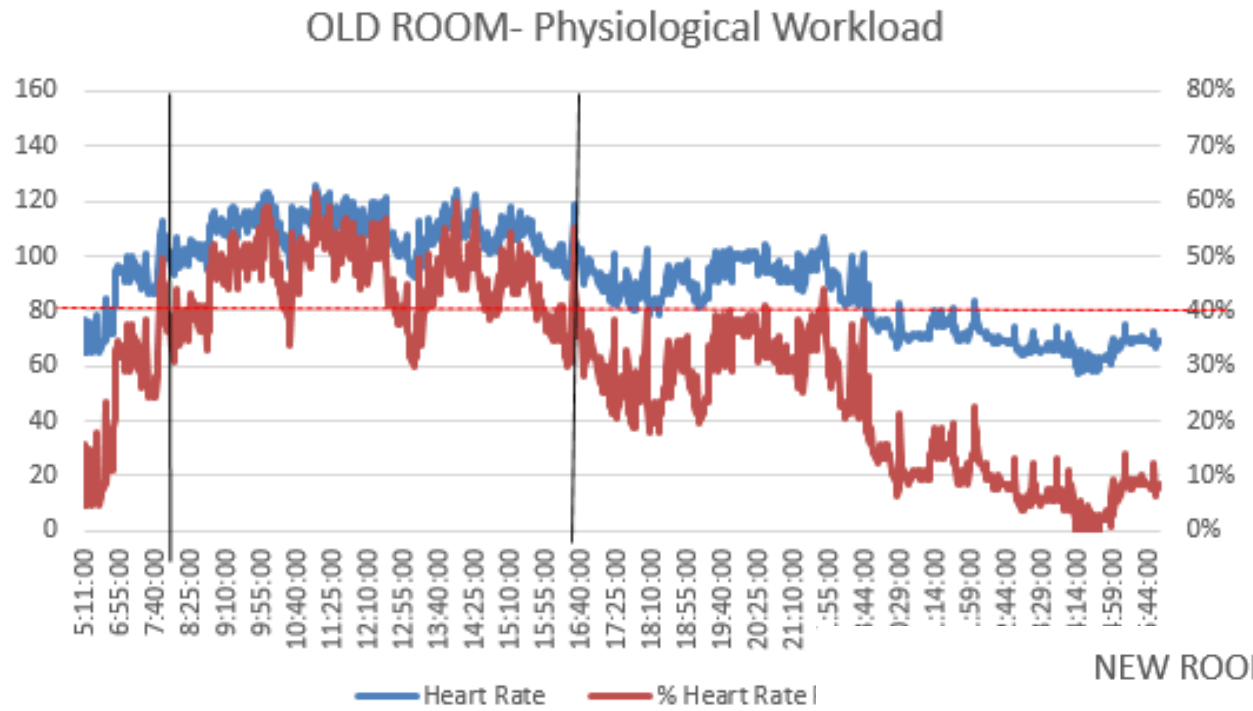

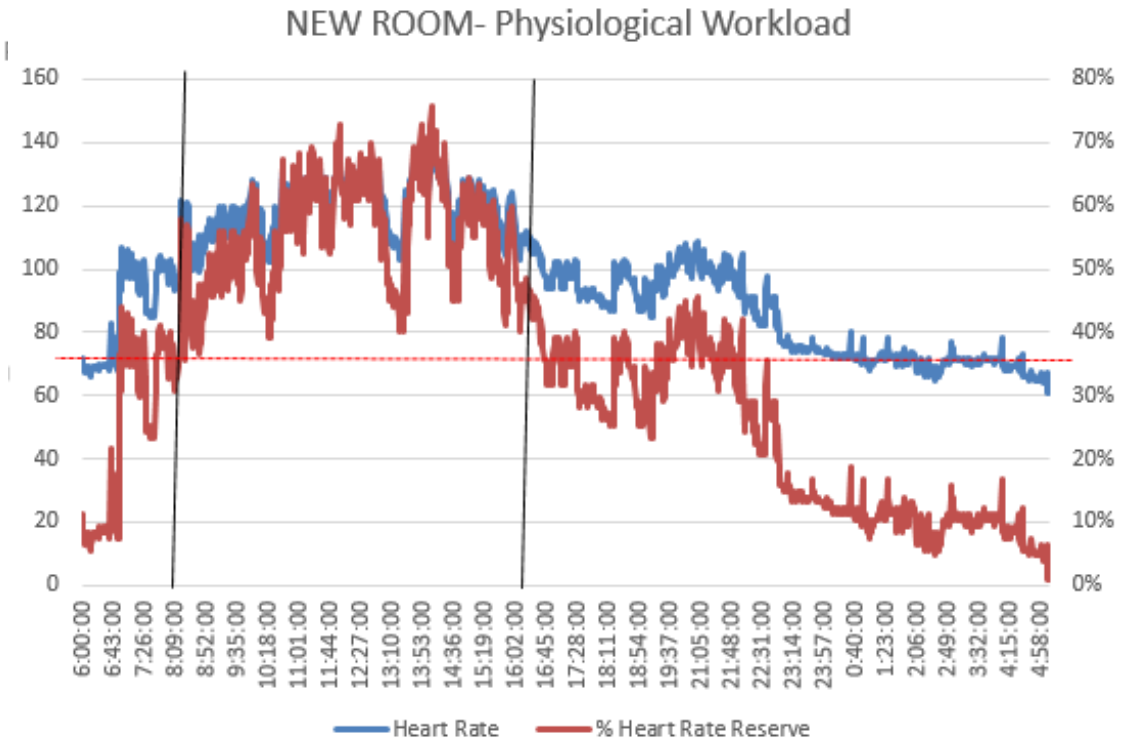

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Case Study

New carts:

- Were ~50% heavier (467lbs vs 314lbs)
- Required 74% increase in peak push force
  - 44.2lbs versus 25.4lbs
- Required a 182% increase in average sustained push force for substantial push distances
  - 35.8lbs versus 12.7lbs for >1600ft/day
- Increased the number of vacuum lifts (18.7lbs) to 28 times/day
  - increased one-handed lift due to linen bag obstruction

New rooms required more time to clean

Use of the new cart and new room required an substantial increase in physiological workload

- The % HRR increased an average of 19%
- Recovery time to leisure heart rate post work shift increased 4-fold (60 minutes).

Hotel Housekeeping Musculoskeletal Injury Prevention Program (MIPP)

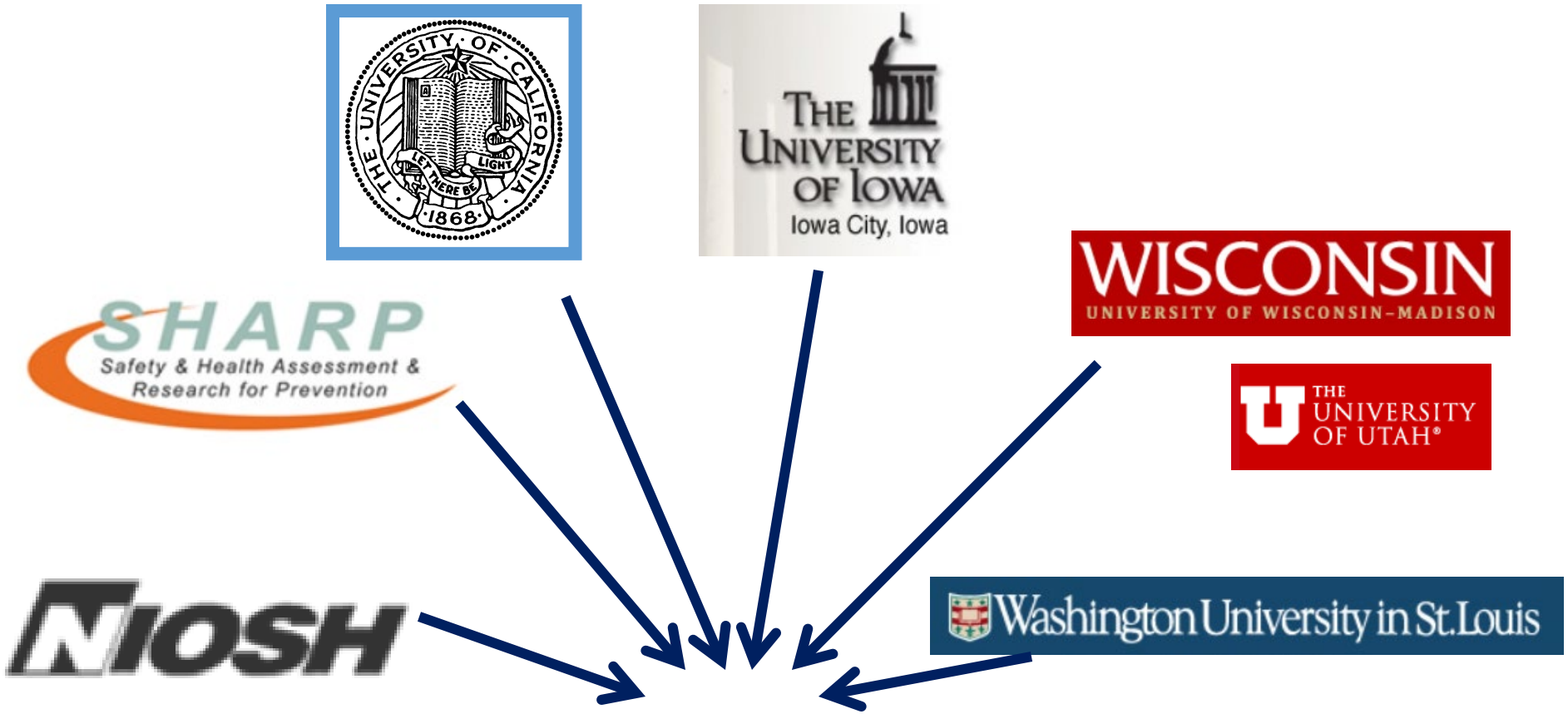
Title 8 of the California Code of Regulations, Section 3345

- Procedures to identify and evaluate housekeeping hazards through work site evaluations that include housekeepers' input
- Procedures to investigate housekeepers' musculoskeletal injuries
- Methods to correct identified hazards
- Training of employees and supervisors on safe practices and controls and a process for early reporting of injuries to the employer

The Future of Ergonomic Regulation

- More evidence from the “Big Ergo” Studies
- Changes in ACGIH TLV for Hand Activity
- Technology will make it easier to make low cost, accurate and reliable assessment of physical exposures
- But the politics….

The Upper Limb Musculoskeletal Disorders Consortium



Pooled Data Set- CTS

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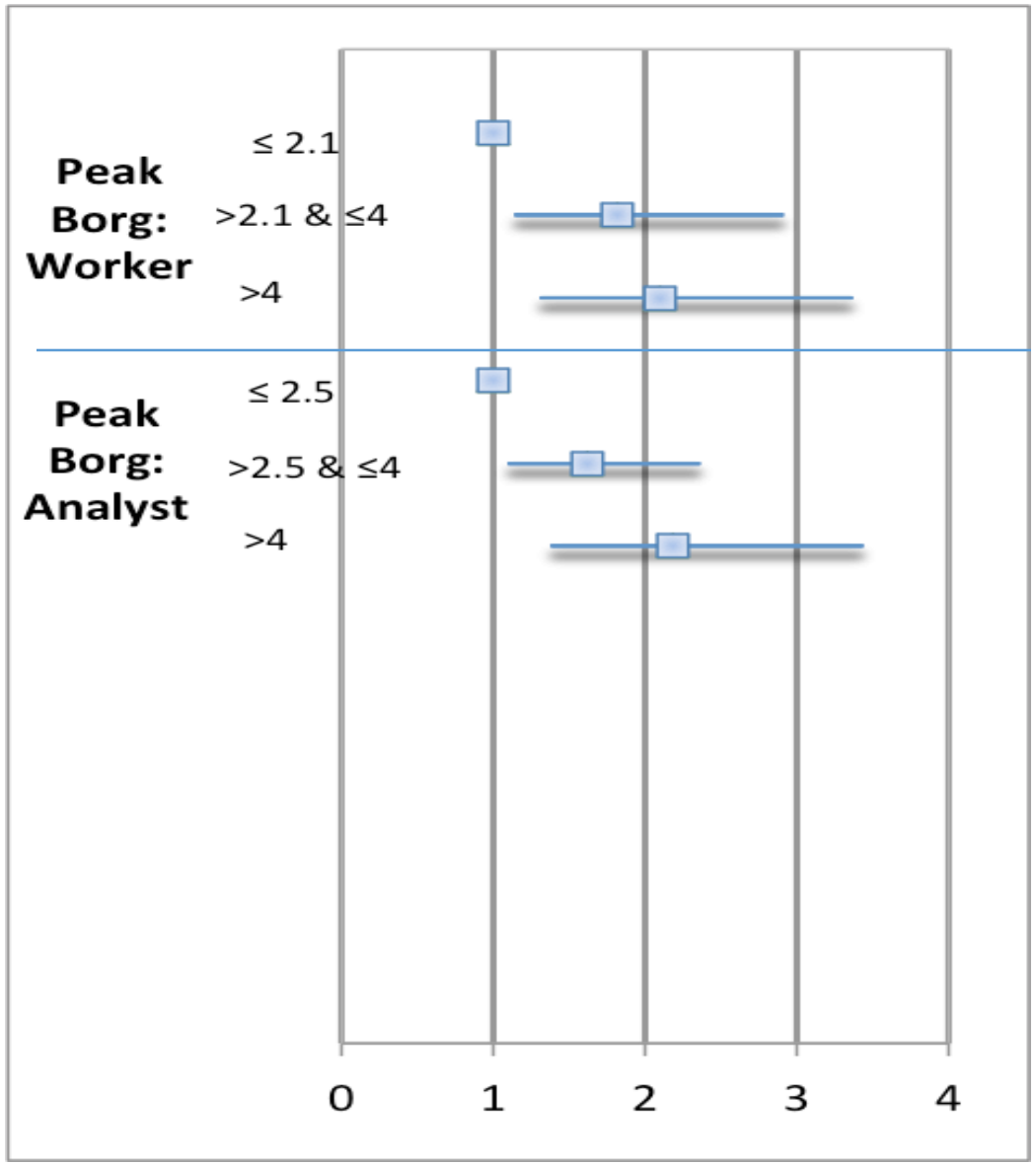
Hazard Ratios for CTS by Peak Hand Force*

[Harris C et al. OEM 2015;72:33-41]



*Adj. for age, gender, BMI, Study site and non-overlapping exposures

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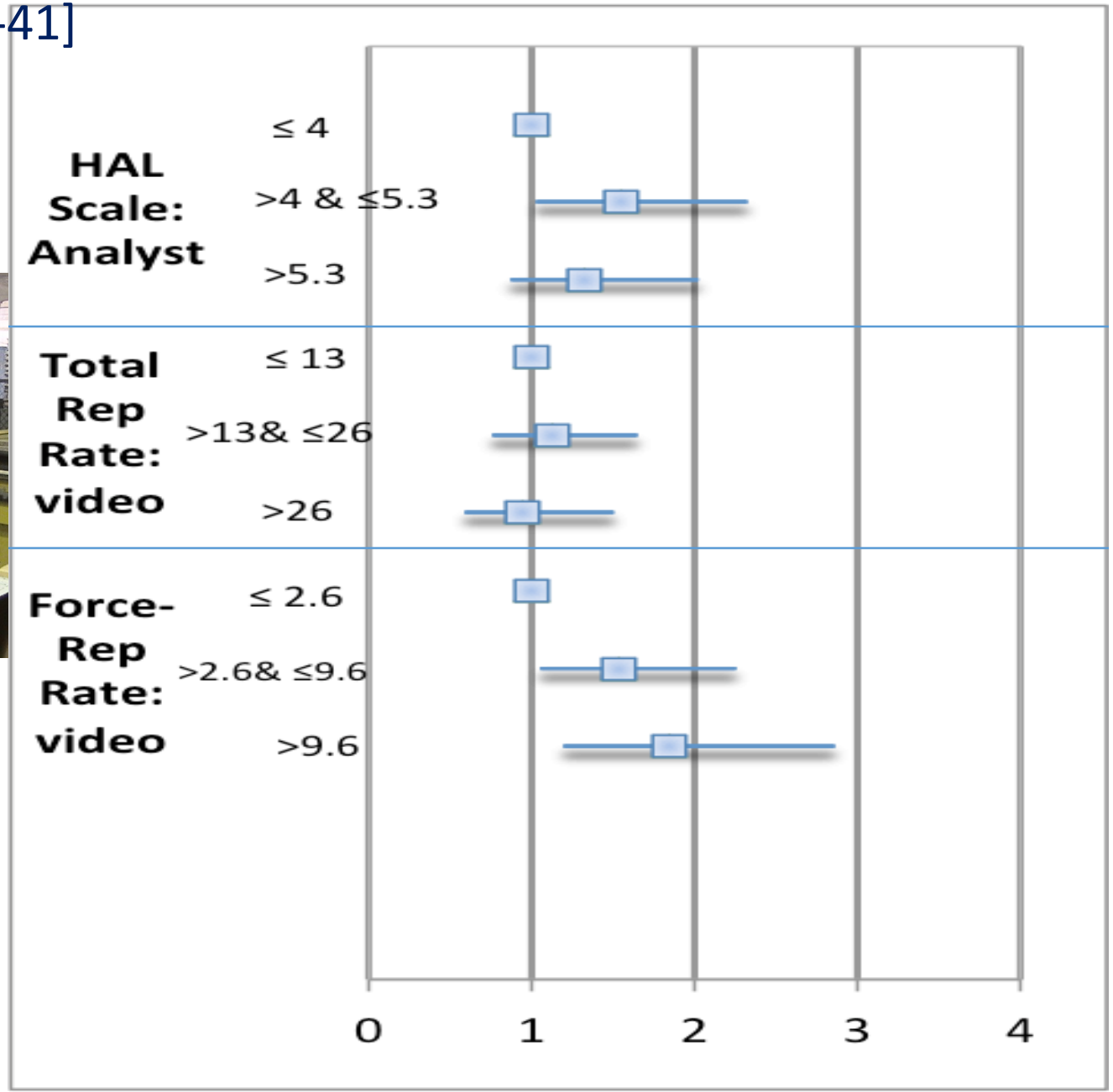
Hazard Ratios for CTS by Repetition*

[Harris C et al. OEM 2015;72:33-41]



*Adj. for age, gender, BMI, Study site and non-overlapping exposures

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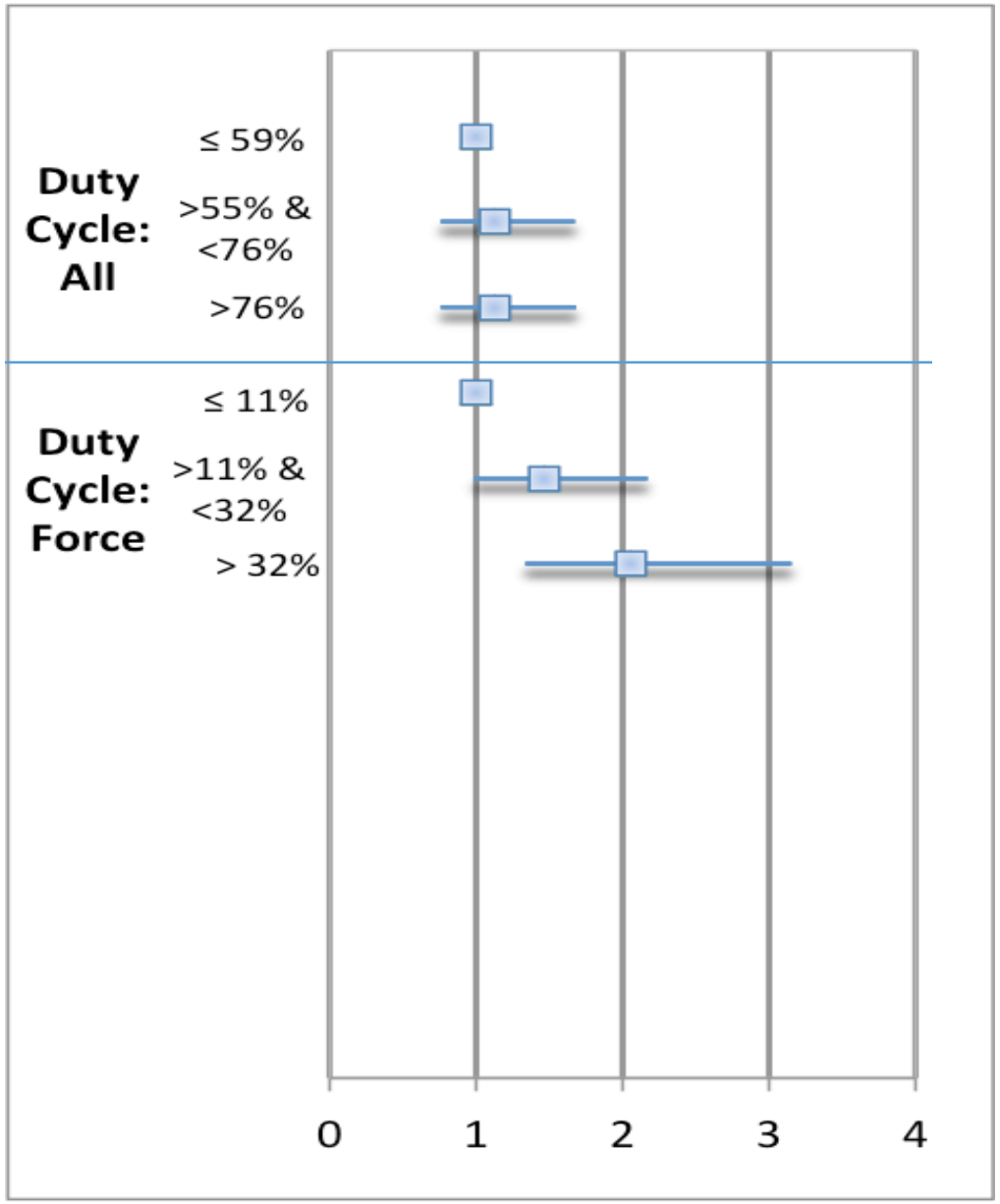
Hazard Ratios for CTS by Duty Cycle*

[Harris C et al. OEM 2015;72:33-41]



*Adj. for age, gender, BMI, Study site and non-overlapping exposures

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Hazard Ratios CTS by ACGIH-TLV HA

[Kapellusch et al. SJWEH 2014;40(6):610-20]

Variable	N=2751	HR*
TLV for HAL* (per unit increase)		1.32 [1.11-1.57]
Action Limit* (≥0.56 & <0.78)		1.73 [1.19-2.50]
Threshold Limit Value* (≥0.78)		1.48 [1.02-2.13]

*adjusted for gender, age, BMI, study site & age x gender

[Bonfiglioli et al. SJWEH 2013;39(2):155-63]

Variable	N= 2299	IRR*
Action Limit* (≥0.56 & <0.78)		1.95 [1.20-3.16]
Threshold Limit Value* (≥0.78)		2.70 [1.48-4.91]

*adjusted for gender, age, BMI, predisposing medical conditions

Summary- Incident CTS

- Biomechanical factors associated with CTS
  - Peak hand force (Borg CR10 ≥ 4)
  - Forceful* hand repetition rate (>3 exertions/min)
  - % time in forceful* hand exertions (> 11%)
- Biomechanical factors not associated with CTS
  - Total hand repetition rate
  - % time any hand exertions
  - Wrist posture
  - Risk increased for those above the Action Limit (0.56) –current cutoff of 0.78 is not sufficient

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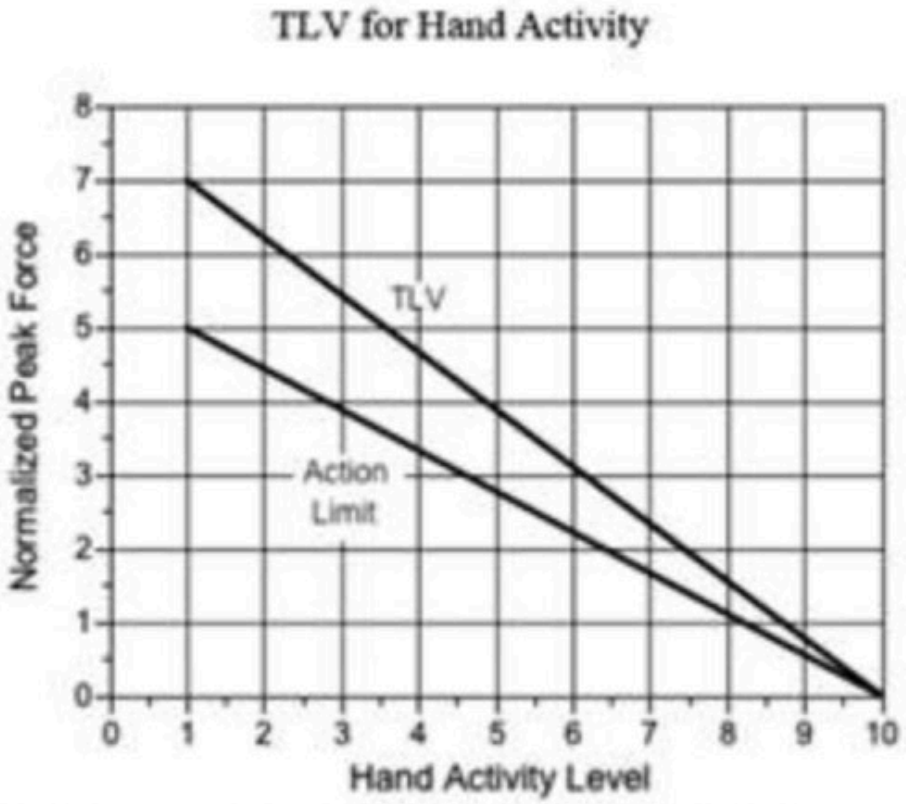
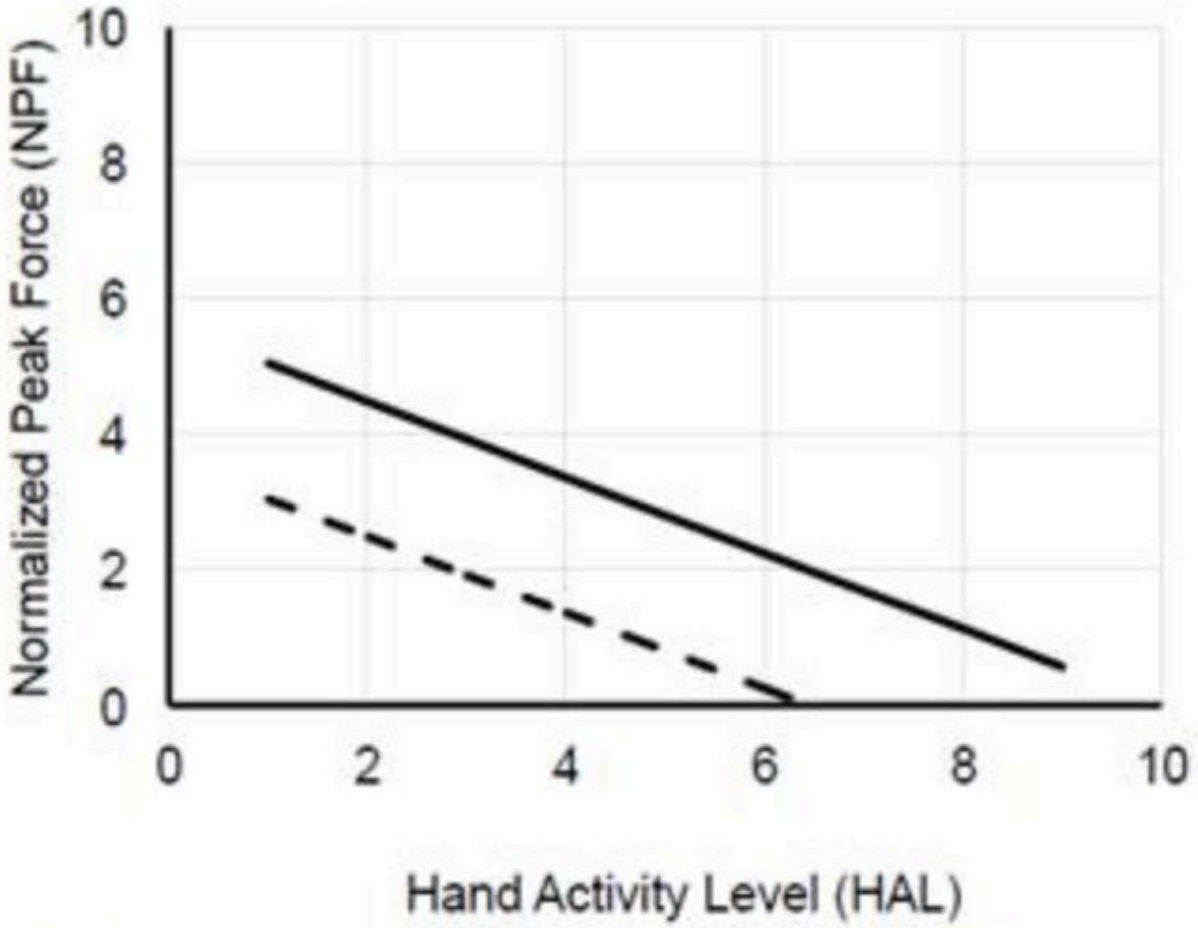
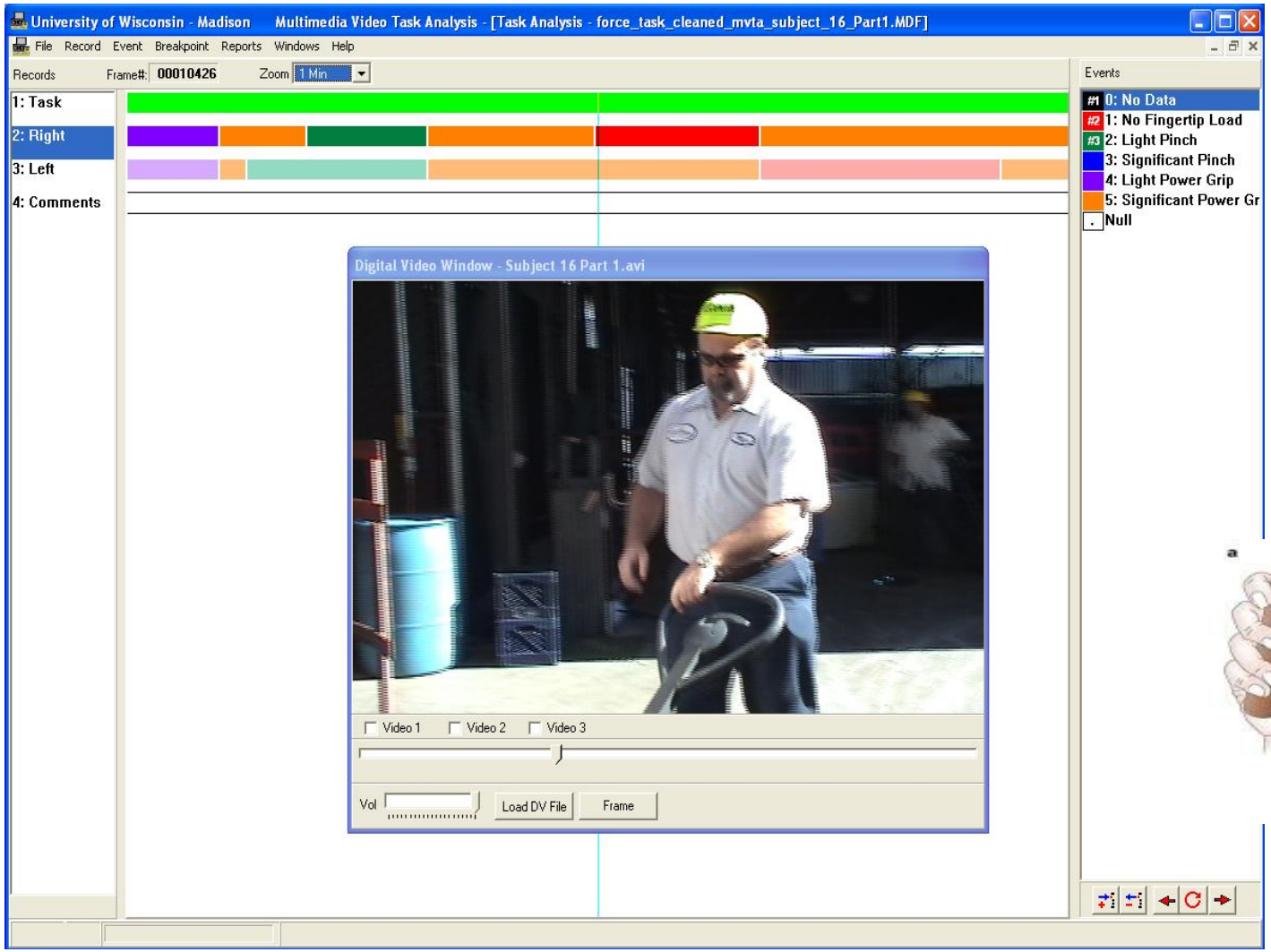
*Forceful = ≥9N pinch force or ≥45N of power grip

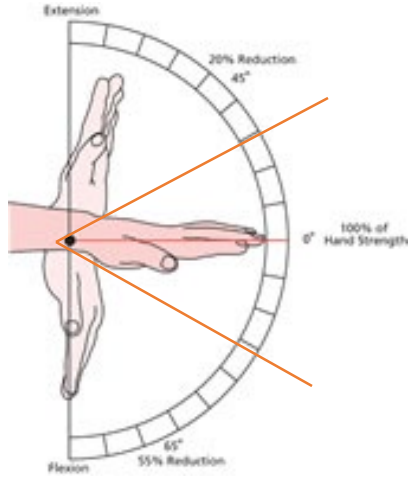
2018 Revised ACGIH TLV for Hand Activity

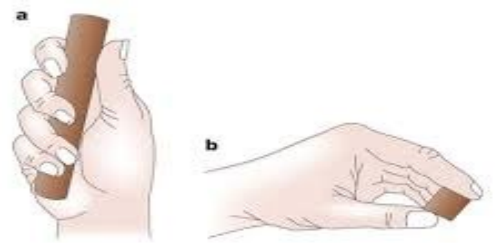




Research to Practice?







$$X_{TWA} = \Sigma [(X_1 * p_1) + (X_2 * p_2) + \ldots (X_{12} * p_{12})]$$

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Our objective is an exposure meter for repetitive motion and other physical exposures

OSHA

NIOSH

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Technological Advances

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Visualizing Repetitive Motion

Greene, et al. Appl. Ergon. (2017)

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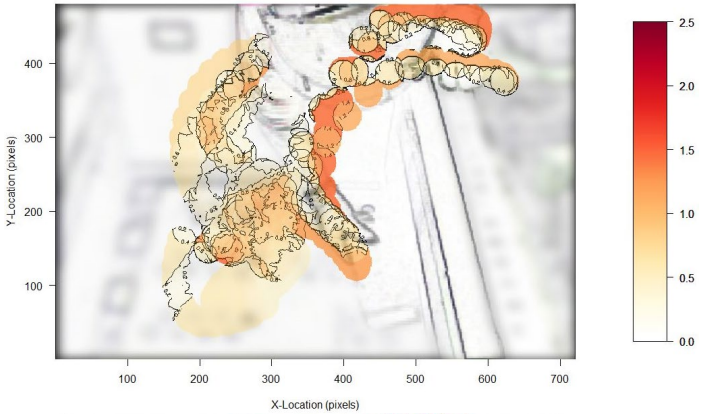
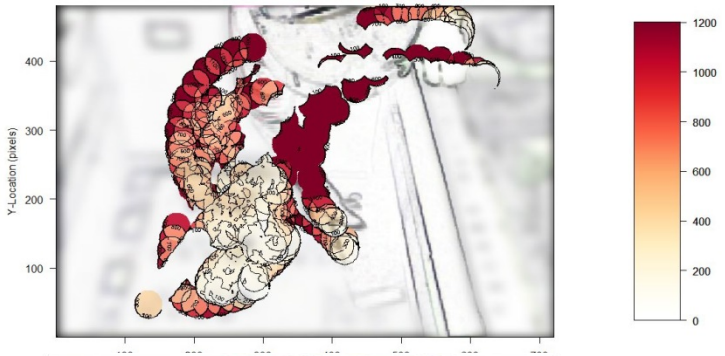
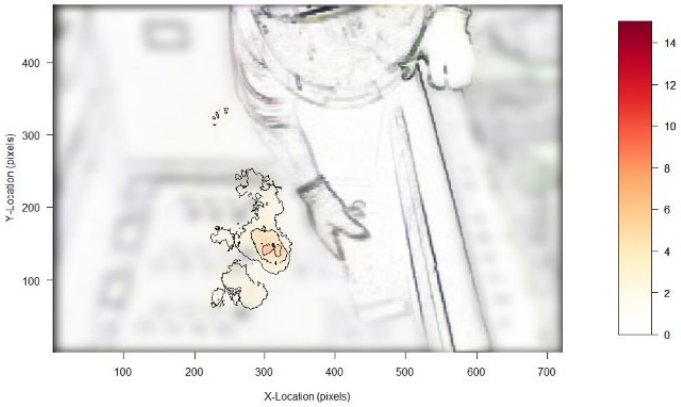
Frequency



Speed



Duty Cycle



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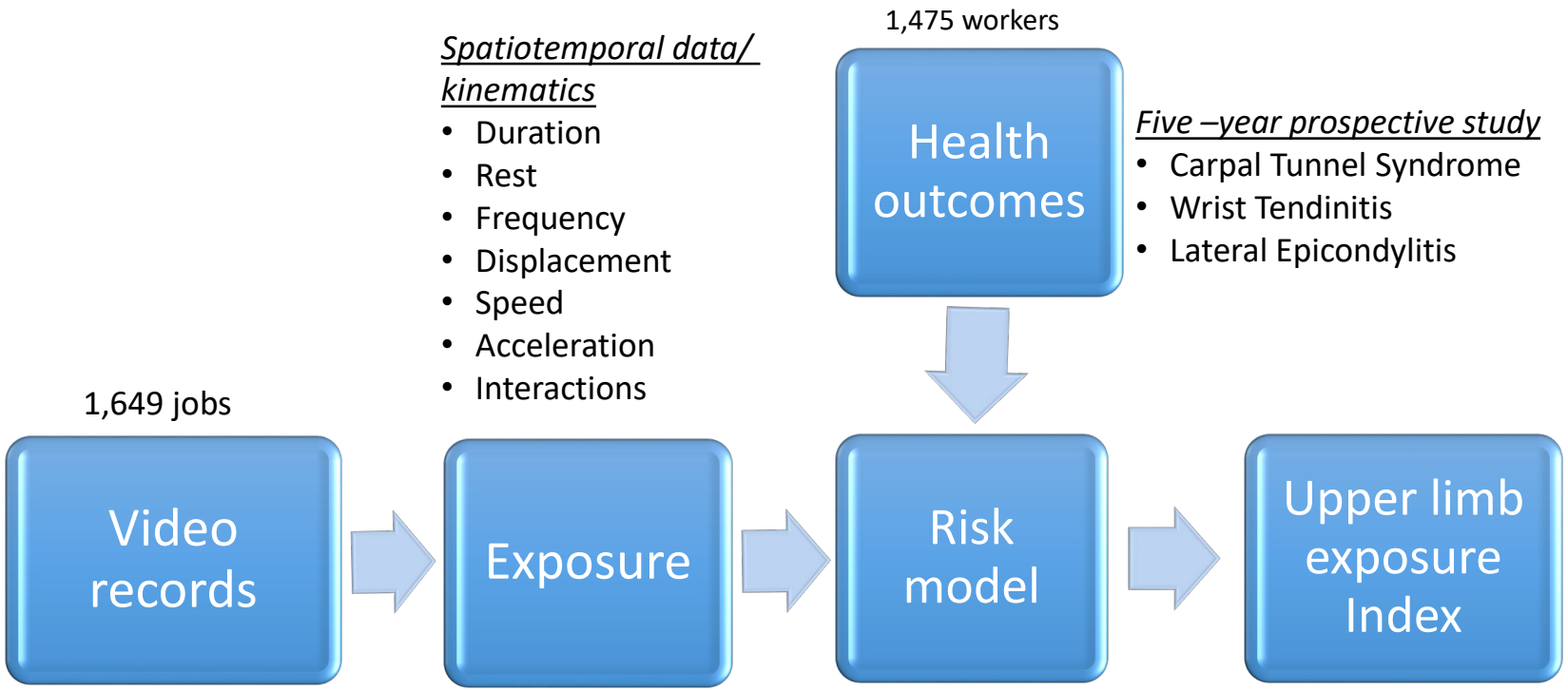
Translating NIOSH upper limb MSD consortium epi data into a computer vision instrument



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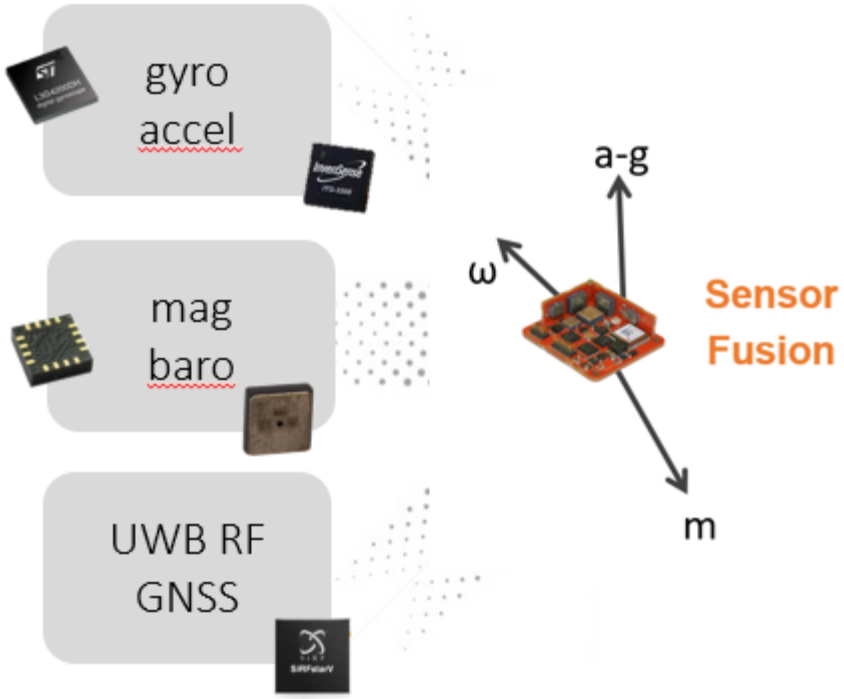
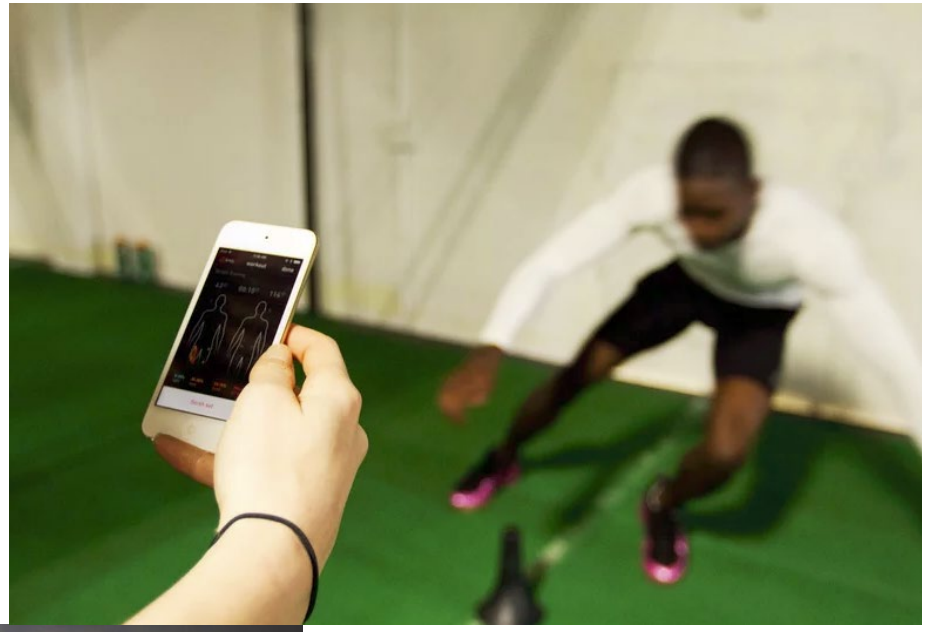
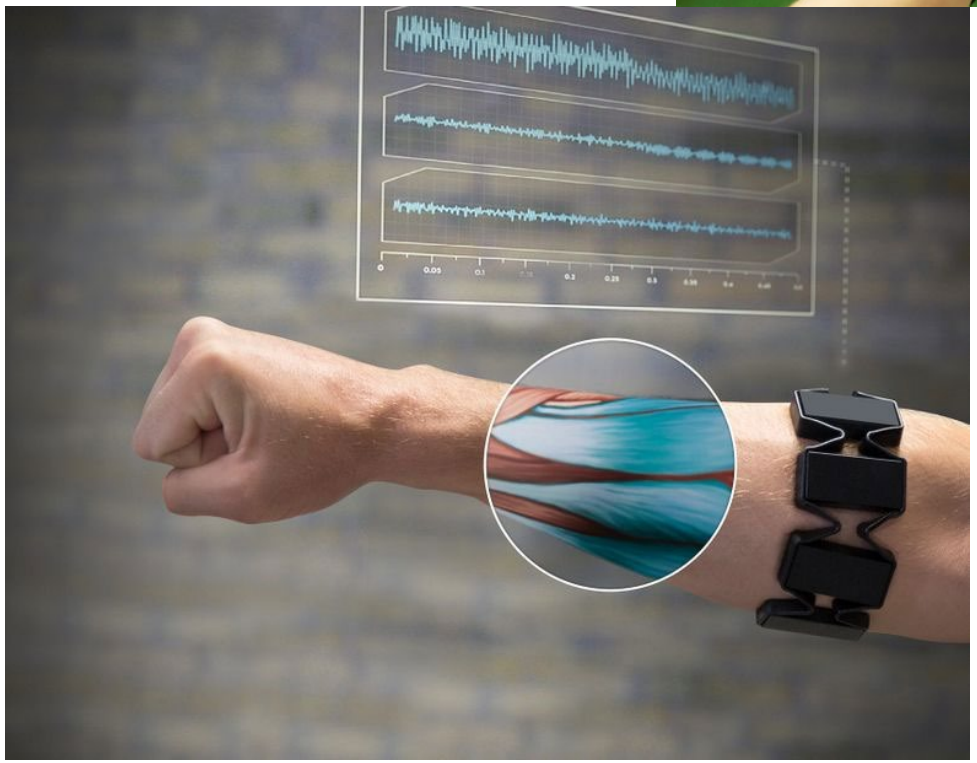
Technological Advances







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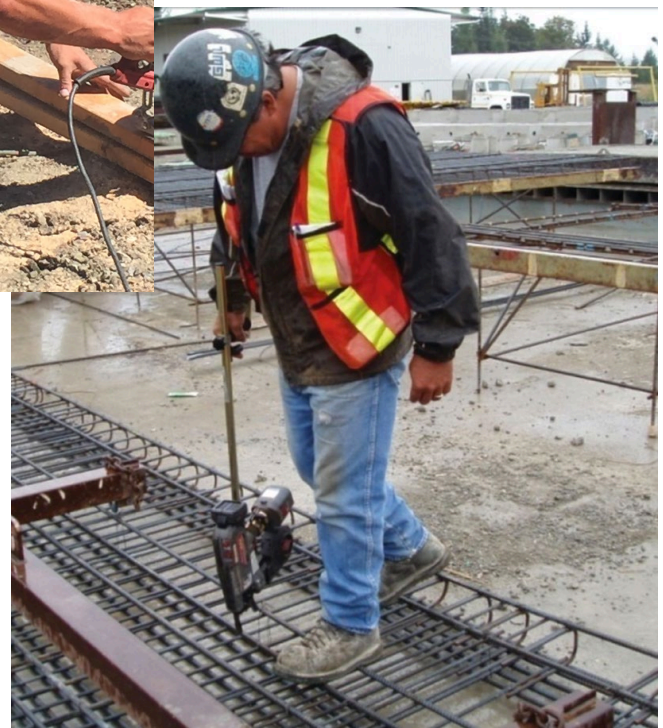
SpineTrack



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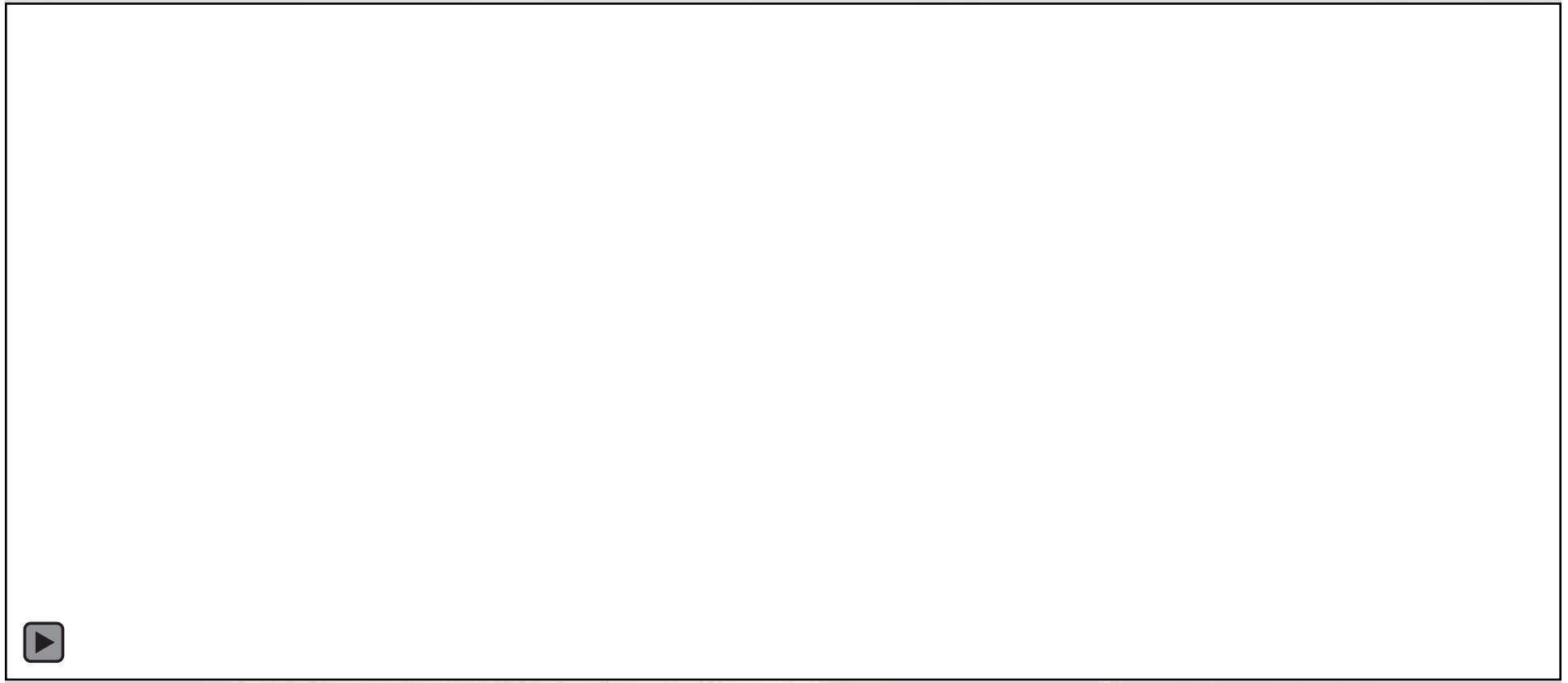
Physical Demands Assessment

Summary Dashboard



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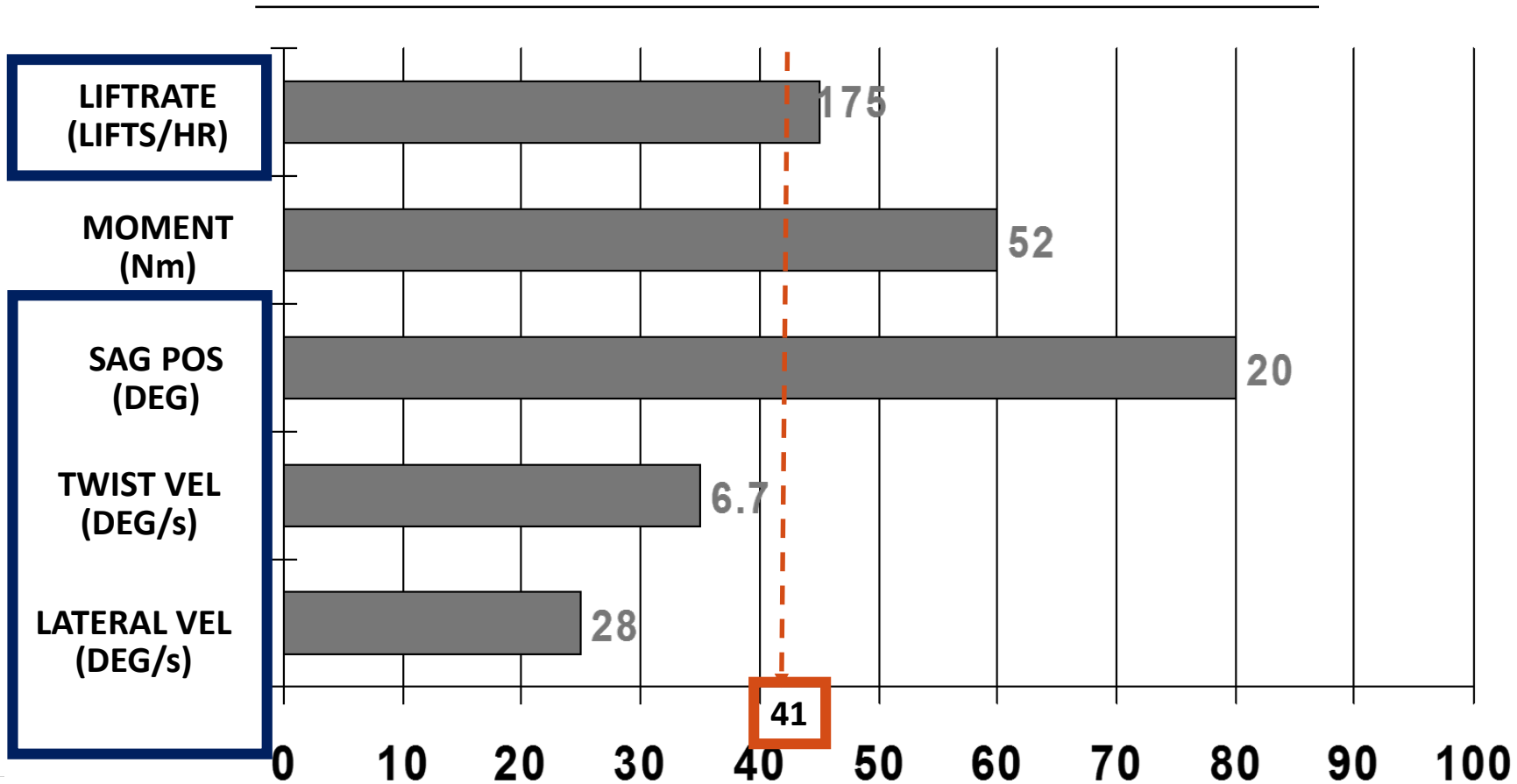
Probability of Lumbar Spine Disorder (RISK MODEL)



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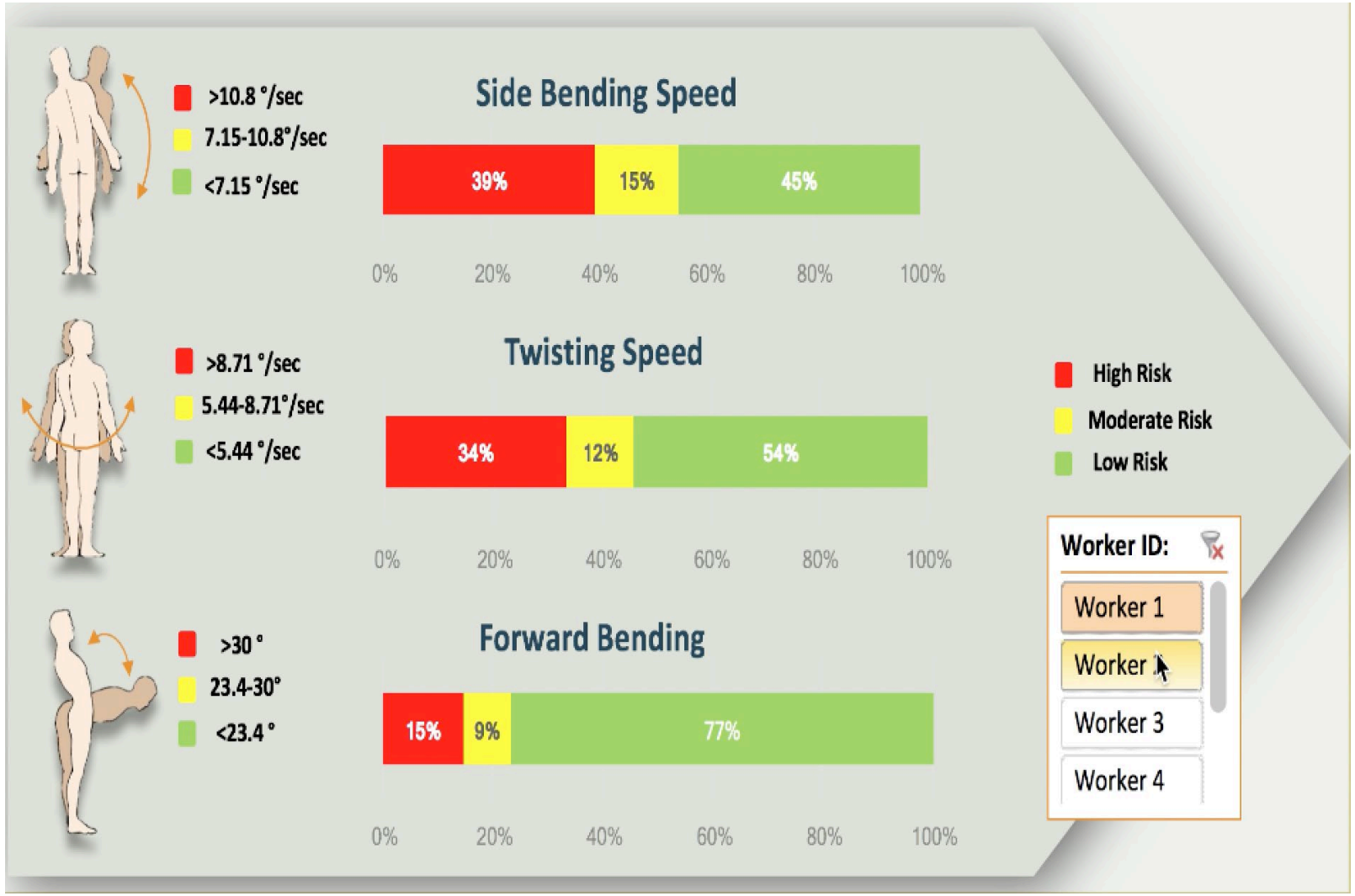
Probability of Lumbar Spine Disorder (RISK MODEL)



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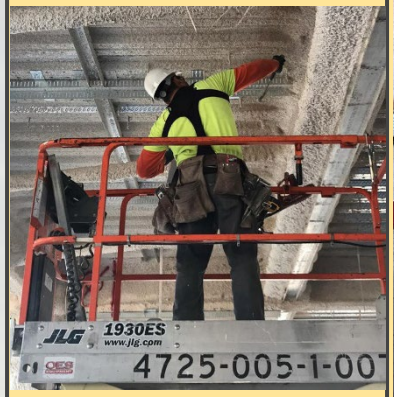
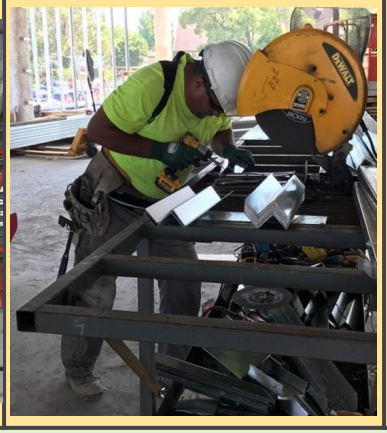
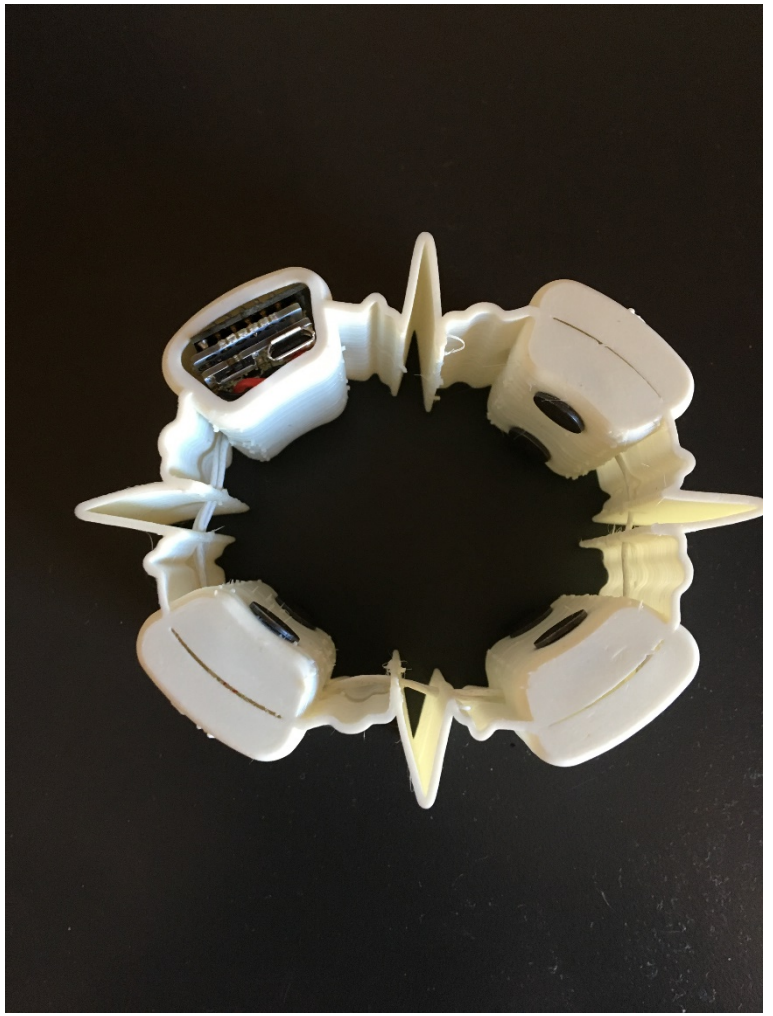
SpineTrack Performance

Worker 1	Worker 2	Worker 3	Worker 4
			
Percent Probability of Belonging to High Risk Group			
24%	21%	32%	40%



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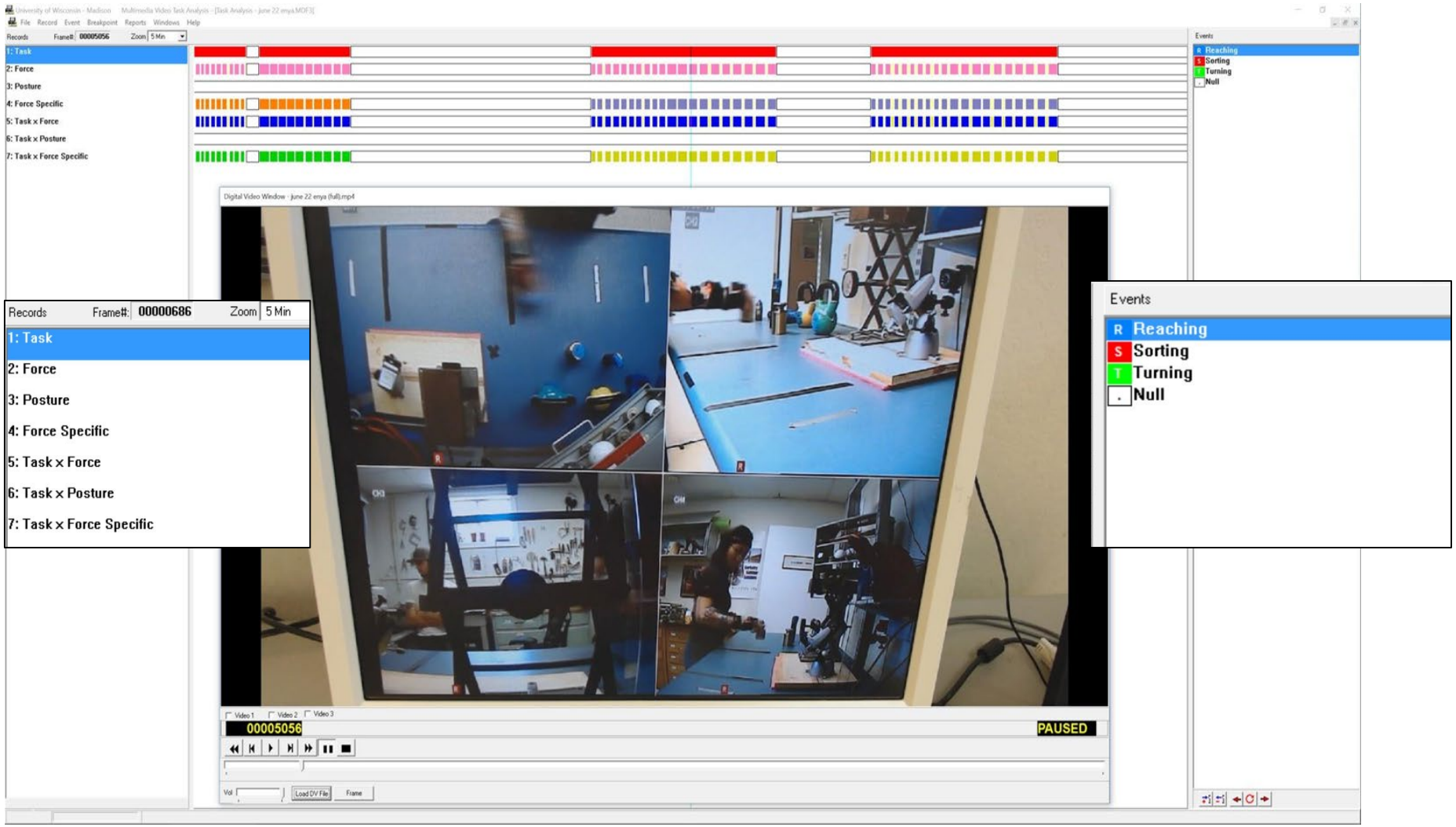
Multimedia Video Task Analysis



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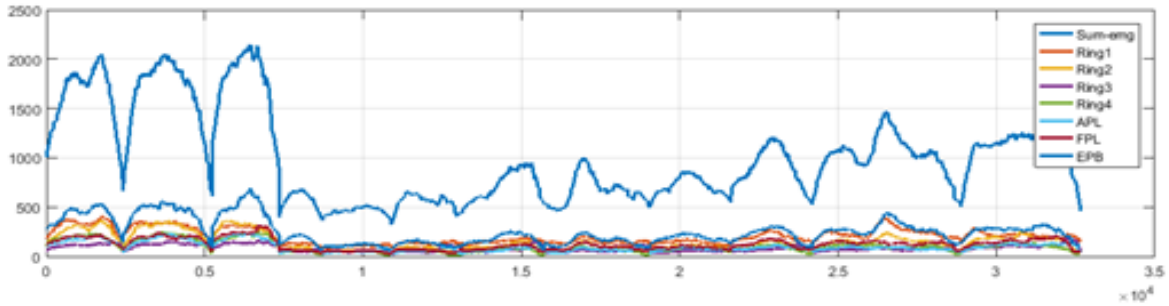
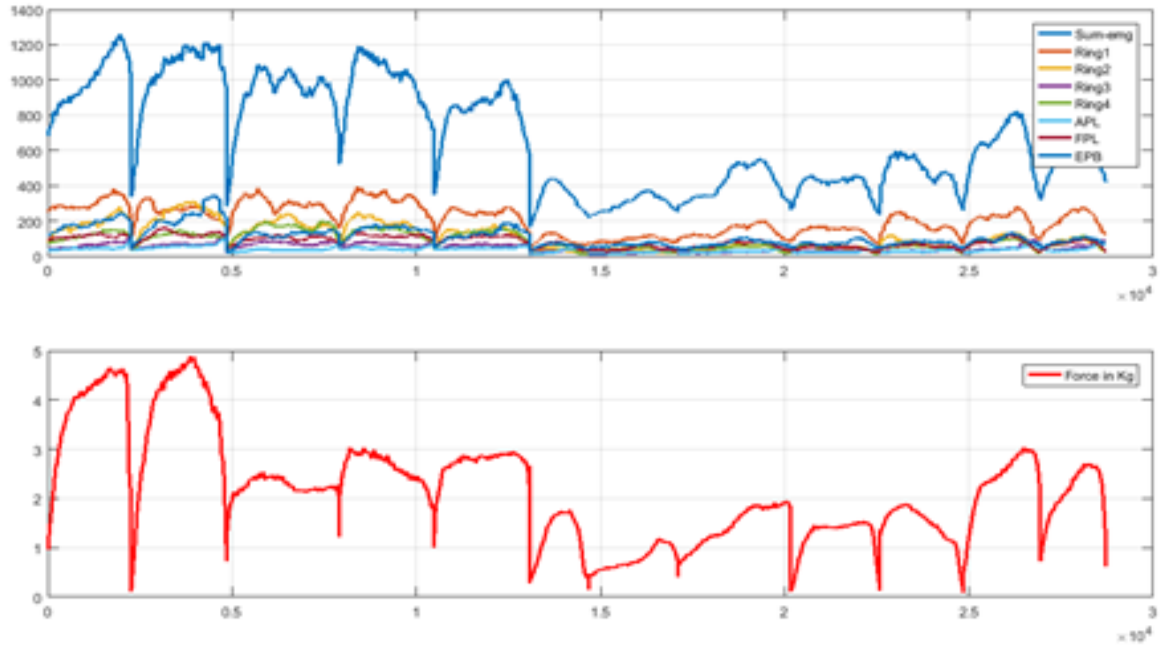
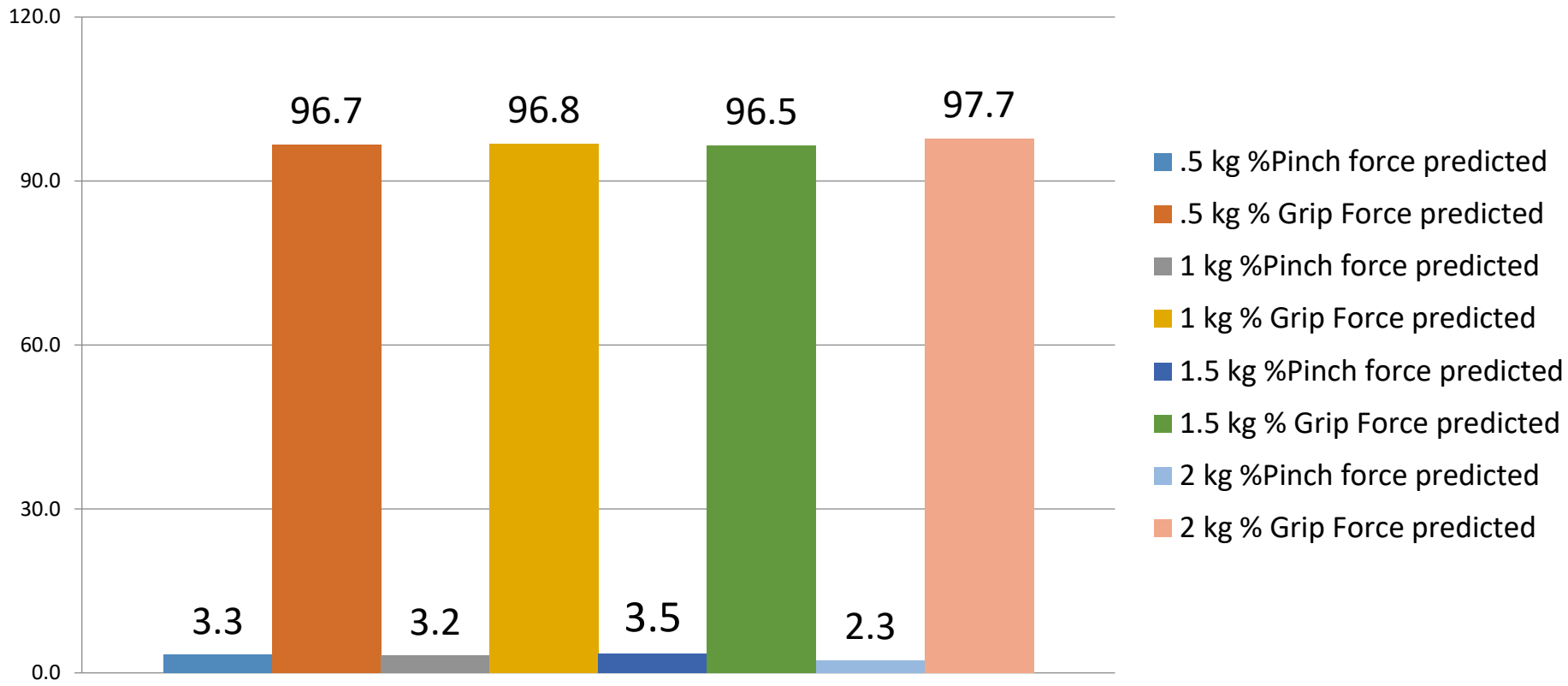
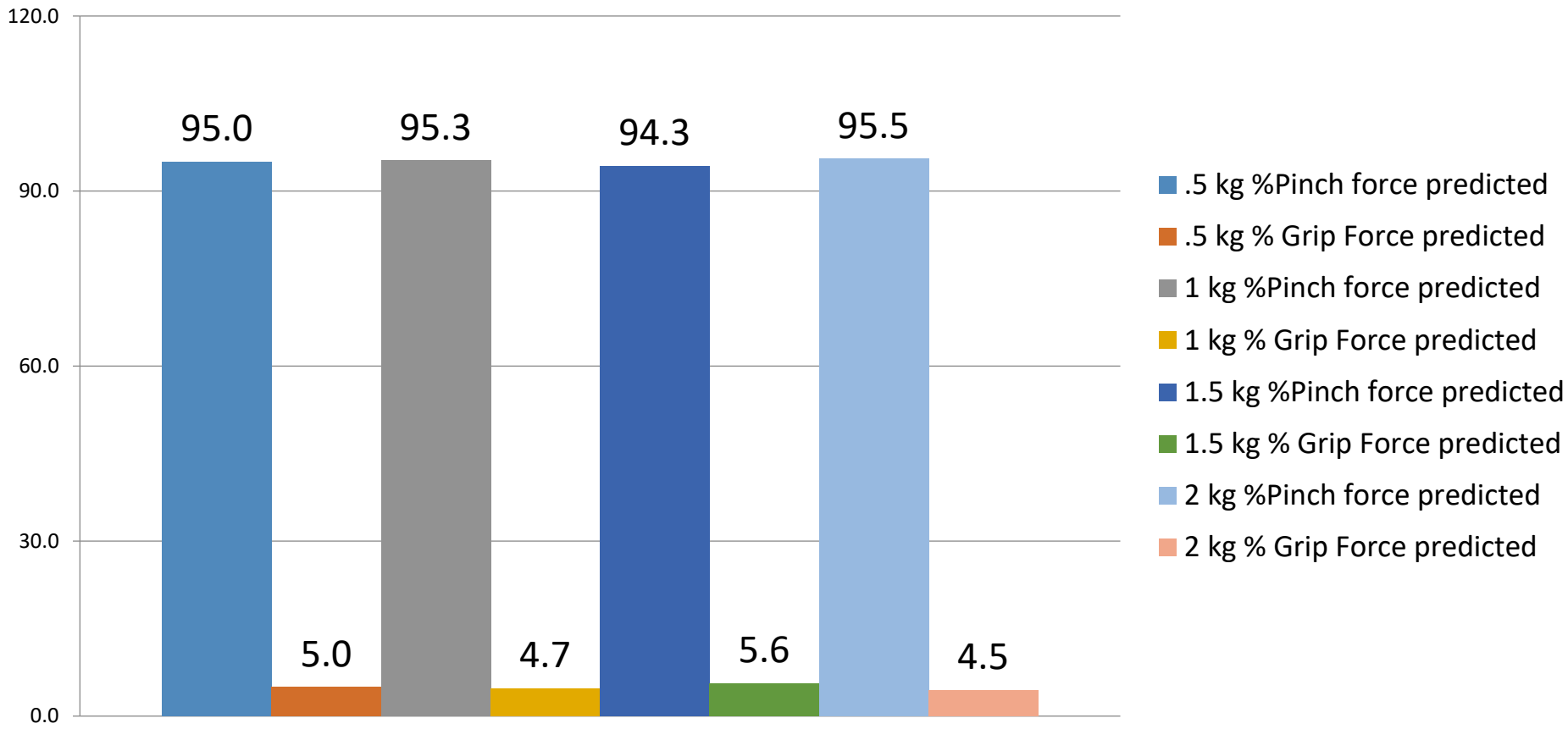

Sum-emg
Ring1
Ring2
Ring3
Ring4
APL
FPL
EPB
Force in Kg

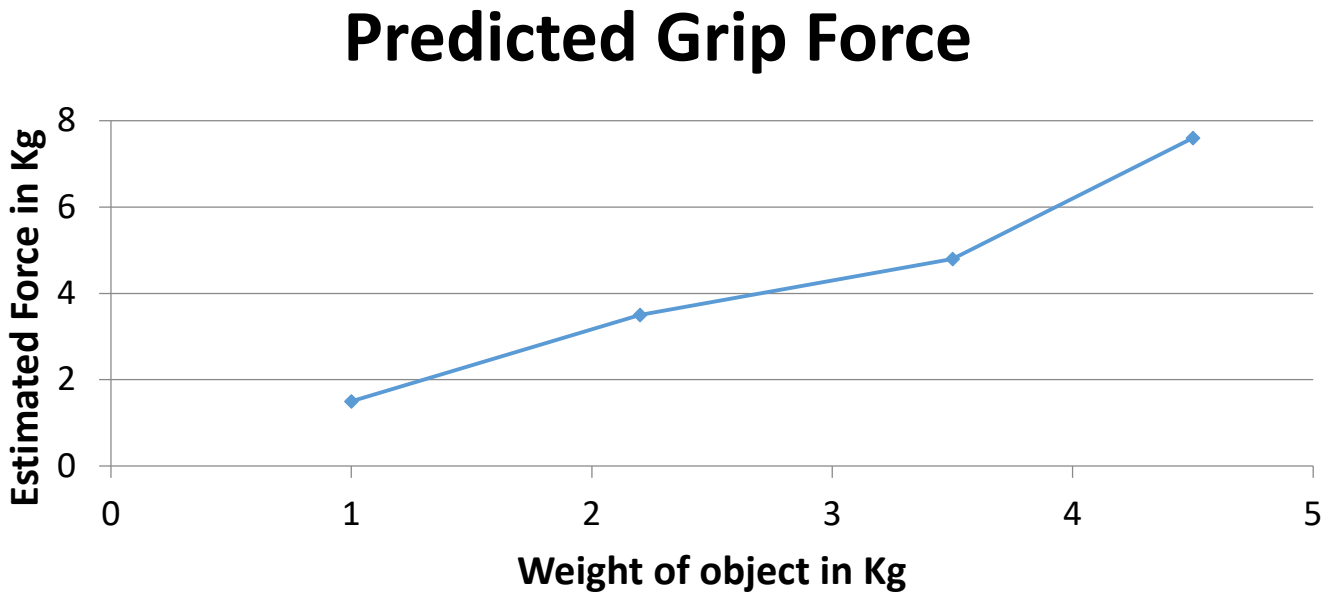

Sum-emg
Ring1
Ring2
Ring3
Ring4
APL
FPL
EPB
Force in Kg

Hand Posture Prediction - Grip

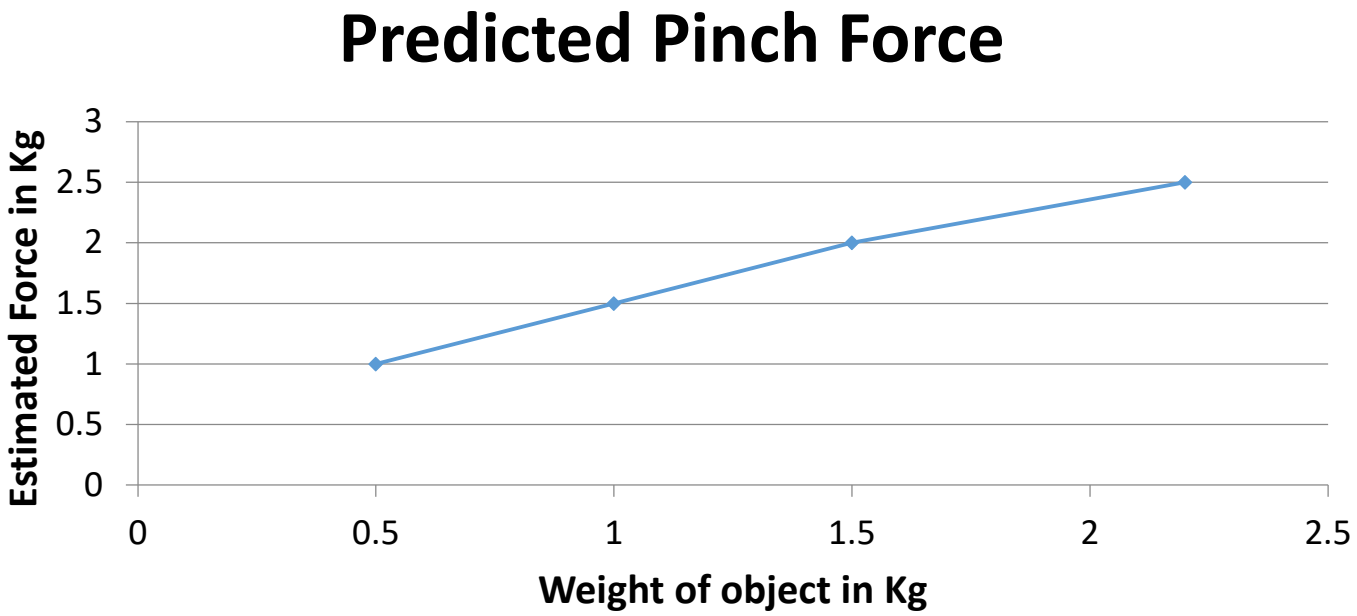


Hand Posture Prediction- Pinch





Predicted pinch and grip force was consistently slightly higher than the object weight lifted



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Hand Posture & Force Estimation

Biomechanical Risk Factor	Risk Threshold	Total Colonoscopy
Left Thumb Force (N=33)		
Mean Thumb Force (N)	>10N*	5.5 (4.4)
Peak (APDF90) Thumb Force	>10N	13.0 (12.3)
% time spent >10N	>11%	16.0 (15.4)
Right Thumb Force (N=36)		
Mean Thumb Force (N)	>10N*	9.1 (6.5)
Peak (APDF90) Thumb Force	>10N	16.7 (9.7)
% time spent >10N	>11%	34.3 (29.6)

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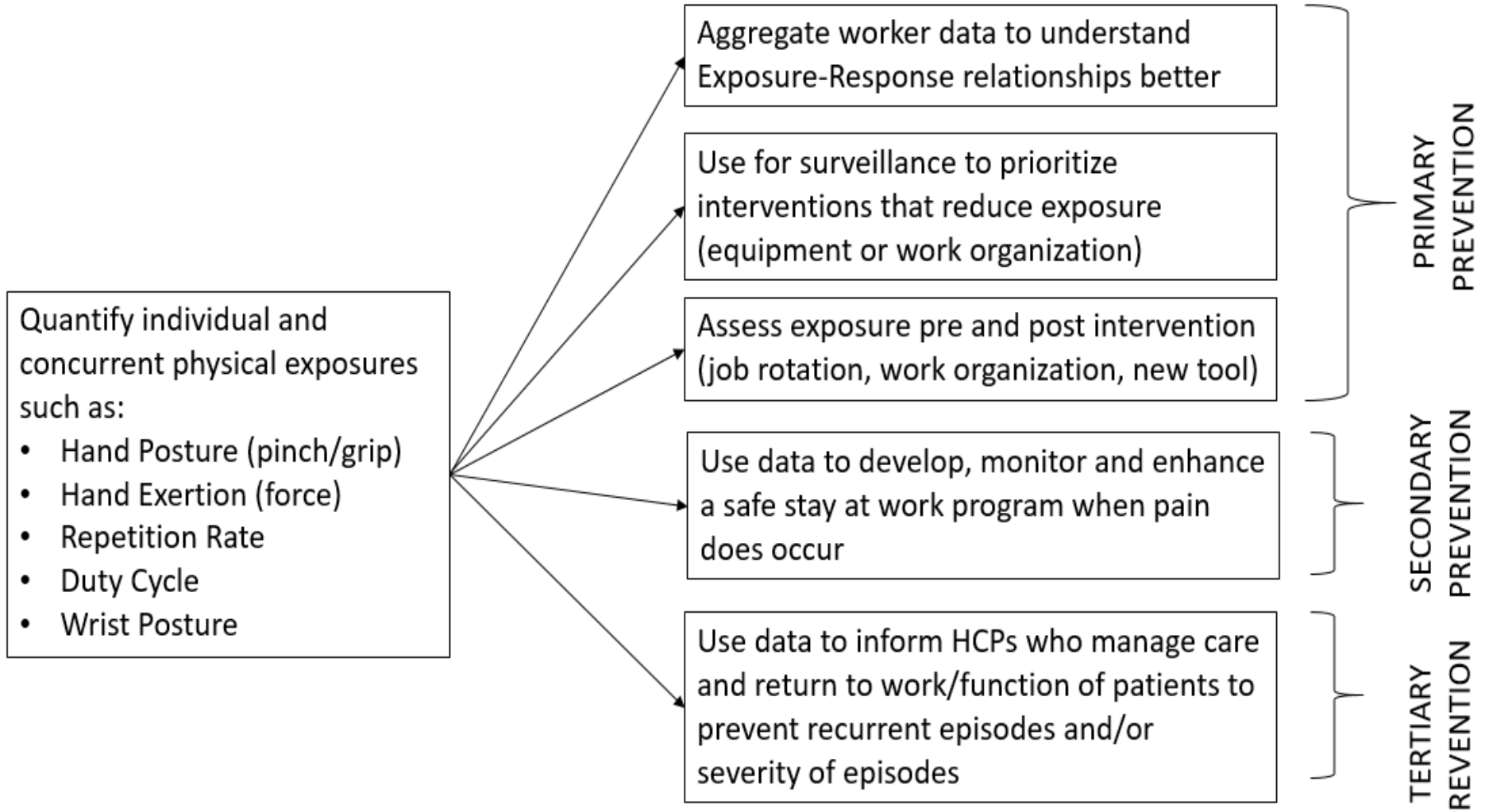
A Different Approach…



Finding Balance

Hiking Artist

Swedish Work Environment Act of 1977

- Refers to work environment
- Emphasis is on education through unions versus citations
- Empowerment of workers "Work should be arranged so that the worker can influence his or her work station
- Law requires the development of union safety representatives (70-90% of white/blue collar workers are unionized)

Collaborative Effort

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Summary

- California's Ergonomic Regulations, though controversial, provide guidance to employers and a safety net for workers.
- In general, ergonomic regulations and the debate surrounding them have promulgated important research and technologies that may help in setting enforceable regulations.
- Balancing the carrot and the stick approach is tricky and will take a collaborative effort from all stakeholders

Thank you!

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