Artificial Intelligence to Reduce Risk of Injury

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National Account Manager

Ergonomic Product Manger

The Road Less Traveled...

- Brett has been an Occupational Therapist for 28 years and has treated in a variety of settings ranging from production & construction to pharma, meat processing and warehouse floors to operating rooms and municipalities.

- As a leader in injury prevention, workers compensation and ergonomics, Brett is sought after for his ability to reduce musculoskeletal injuries by teaming with management, educating employees and methodically achieving desired results
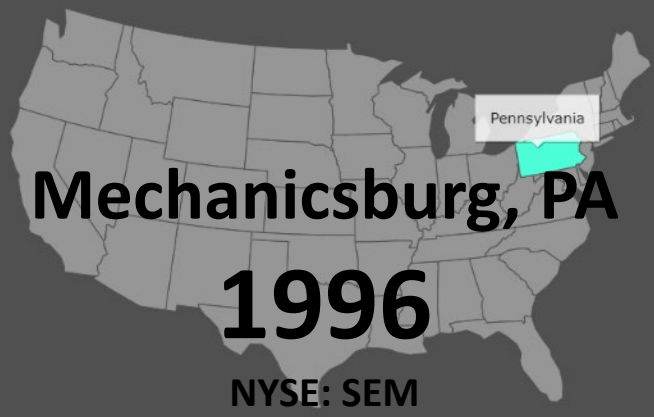
Select Medical Overview

Leading provider of specialized health care in both inpatient and outpatient settings

Mechanicsburg, PA
1996

NYSE: SEM

46,000+ Employees

Four Operating Divisions:

Critical Illness Recovery Hospitals (100 hospitals)

Inpatient Rehabilitation (30 hospitals)

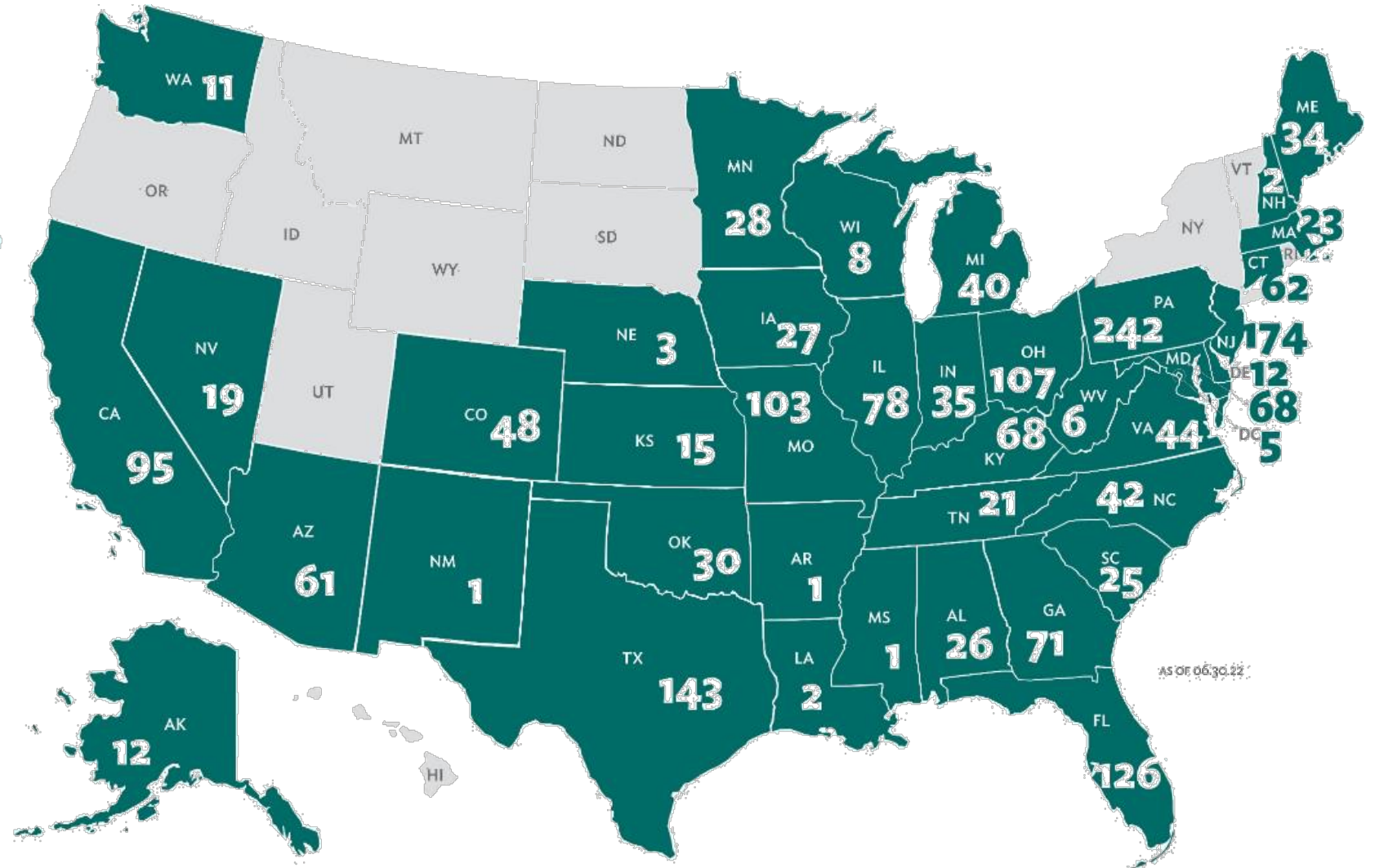**Outpatient Division** (1,900+ outpatient locations)

Occupational Medicine (500+ locations)

Select Medical – Outpatient Division

1,900+ OUTPATIENT PHYSICAL THERAPY CENTERS

(39 States and D.C.)

What Is Artificial Intelligence?

Artificial intelligence (AI) is intelligence demonstrated by machines.
Our Use: A.I. Driven –Sensorless motion-capture risk assessment technology

Ergonomics

"Ergonomics" can be simply defined as the practice of making the work environment safe and productive for the worker. It is aimed at enhancing a healthy relationship between humans and their working environment, ultimately reducing risk, and thereby creating a safer and more productive workplace. The process of ergonomics involves analyzing the worker, studying the tasks required and then designing an environment (processes, products, techniques) that optimizes the safety, health, comfort and performance of the worker (U.S. Department of Labor, 2018).

Work Risk Analysis Overview

- Define Ergonomics
- WorkStrategies a Select Medical Company
- Evaluating the work environment and specific jobs for risk factors
- Many problems are due to faulty worker habits.
- Examples of AI Risk Assessments

WRA Process

Contents

- The Work Risk Analysis includes a formal write up of risks identified including:
- Work Risk and Job Hazard Analyses
- Ergonomic Biomechanical Evaluation and Recommendations
- Strategies for Reduction in Musculoskeletal Hazards
- Corrective Recommendations
- Action Plans

Supplemental Assessments

- **NIOSH** - Lifting Equation
- **RULA** - Rapid Upper Limb Assessment
- **REBA** - Rapid Entire Body Assessment
- LM Strain Index
- AI Video Processing***

WorkRisk Analysis

- Select Medical clinicians are skilled in evaluating the work environment and specific jobs for risk factors that could result in potential musculoskeletal dysfunction.
- The use of AI helps you to better understand the risks by a color coded overlay.

Types of Ergonomics

- **Physical ergonomics:**

Repetitive motion, Vibration, Force, Postures and Environment

- Working postures
- Handling materials
- Repetitive movements
- Work-related musculoskeletal disorders (WMSDs)
- Workplace layout
- Equipment design
- Safety

- **Cognitive ergonomics:**

Mental processes - perception, attention, memory, reasoning

- Skills training
- Mental workload
- Decision-making processes
- Human-technology interaction
- Work stress load
- Social stress load
- Physical training
- Education
- Fatigue

- **Organizational ergonomics:**

Policies, Harmonized systems, taking into consideration the consequences of technology on human relationships, processes and organizations.

- Teamwork
- Communication
- Quality management
- Crew resource management
- Introduction of new work paradigms
- Design of working times/duration
- Work design and flow
- Telework

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Interpretation of the AI Risk Assessment?

As simple as understanding a Stop Light!

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WRA Supplemental Assessments

- It may be beneficial to use a standardized Risk Factor Assessment tool as an adjunct to Work Risk Analysis

- NIOSH Lifting Equation

- **RULA** – Rapid Upper Limb Assessment

- **REBA** - Rapid Entire Body Assessment

- Strain Index

REBA/RULA - Risk Levels

Action level	RULA score	Interpretation
1	1-2	The person is working in the best posture with no risk of injury from their work posture .
2	3-4	The person is working in a posture that could present some risk of injury from their work posture, and this score most likely is the result of one part of the body being in a deviated and awkward position, so this should be investigated and corrected.
3	5-6	The person is working in a poor posture with a risk of injury from their work posture, and the reasons for this need to be investigated and changed in the near future to prevent an injury
4	7+	The person is working in the worst posture with an immediate risk of injury from their work posture, and the reasons for this need to be investigated and changed immediately to prevent an injury

Video Options

Avoiding Consent Concerns

- Block Faces

Avoiding Proprietary Concerns

- No Blur
- Low Blur
- Medium Blur
- Black Background

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Video Requirements

To have a production line or job task be assessed or analyzed for ergonomics and injury prevention, all videos should meet the following standards:

- Short: 15 - 30 seconds (maximum of 60 seconds due to file size)
- Recorded in landscape mode
- Must show 1-3 seconds of a "staging shot" or head to toe view before a "close-up" of the requested activity is observed.

Recording the Video

1. Start by choosing your recording device. We recommend using a GoPro due to the excellent recording quality. However, any modern smartphone or tablet will work (made within the last three years).
2. All videos must be recorded in landscape orientation, ensure your recording device is held in the example to the right →
3. Steady your recording device. It is very important to keep the device still during the video. A small tripod or using a non-movable object to lean against can help.
4. Optionally, you can include audio.
   a. Be conscious of production background noise and ensure the speaker is clear and with enough volume to be easily understood if they are explaining anything.
5. Consider recording a practice video? When you review, pay special attention to what the employee is doing in the video. Is the motion blurry? Is the angle and filming location accurately depicting the problematic movements at hand? Can equipment or tools utilized be seen? Is the audio understood?

Multiple Recordings

1. Capture a second video of the specific body part where issues are occurring (upper body/hands etc.).
2. Provide a second angle of the same activity if possible. From left and right sides or overhead if safe.
3. Position camera with entire person in the screen and progress to zoom in for the specific activity.

Awkward Positions

Sustained Positions

Repetitive Motions

Contact Stresses

Excessive Forces

Exposure to Cold

Vibration
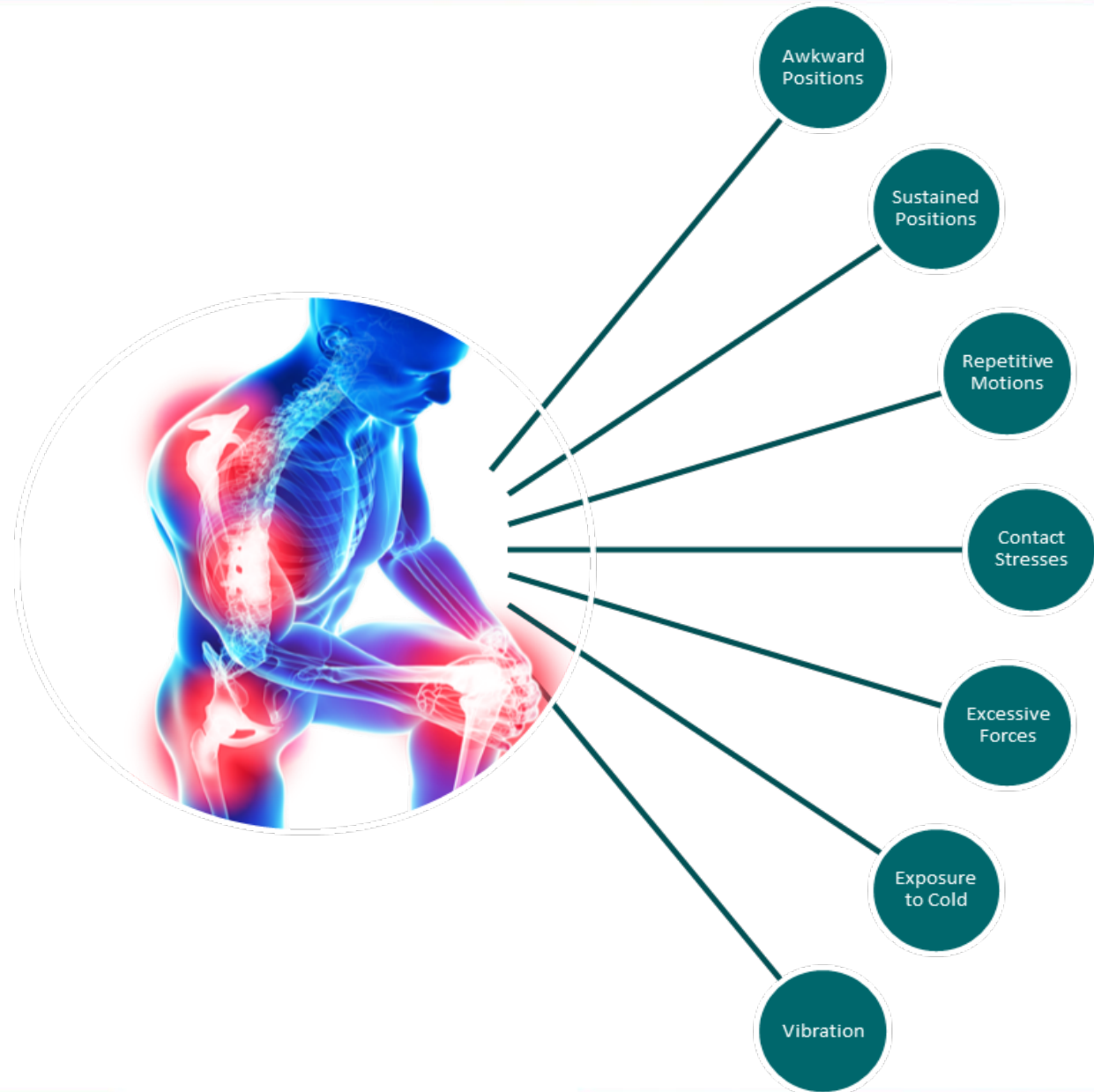
Sustained positions
- Patient care
- Sitting/standing/bending/kneeling/crawling

Extreme environmental conditions
- Heat, Cold, Noise
- Visual impairments — smoke, dust, weather
- Particulate agents — smoke, dust.
- Liquid or gaseous agents

Work station/ Vehicle limitations
- Sitting - posture and design of workspace or vehicle
- Visual display terminals/driving

Forceful exertions
- Lifting/carrying (patients and equipment).
- Forcible entry.
- Maneuvering equipment.
- Hose line operations.
- Hydrant operations.
- Struck by objects.
- Ventilation tactics.

Awkward postures
- Lifting/carrying (patients and equipment).
- Maneuvering equipment (ladders, stair chairs, gurneys, hose lines, tools).
- Wearing PPE and self-contained breathing apparatus (SCBA).
- Crawling, crouching, twisting, bending.
- Ventilation tactics.

Compare Risk at the Joint Level

Right - Original   Left Corrected   Right - Original
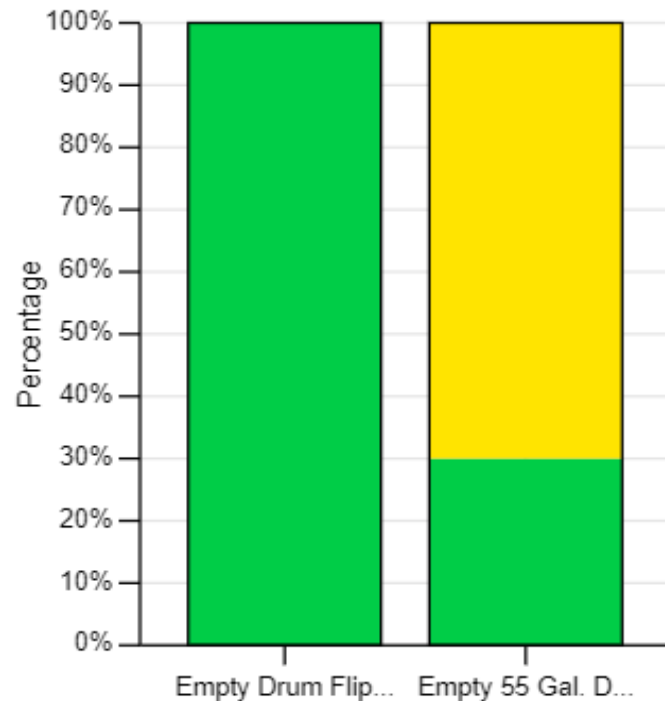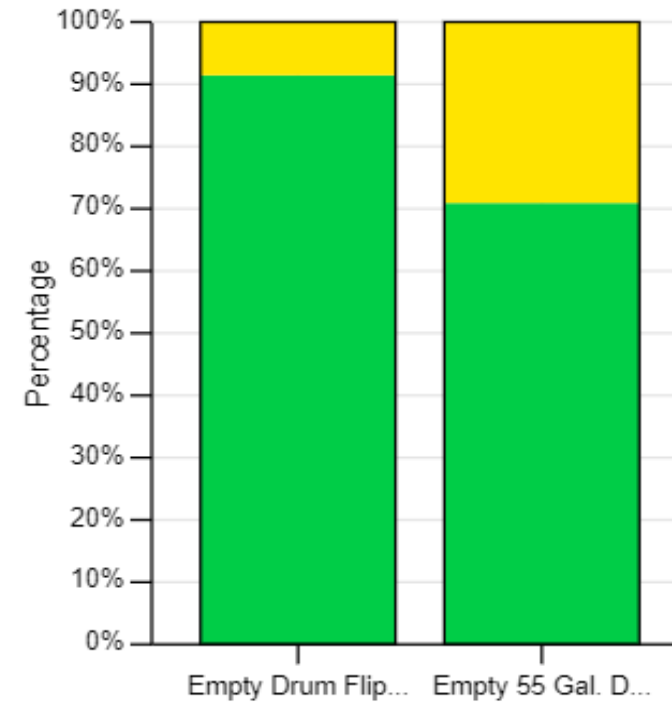
POWER ZONE
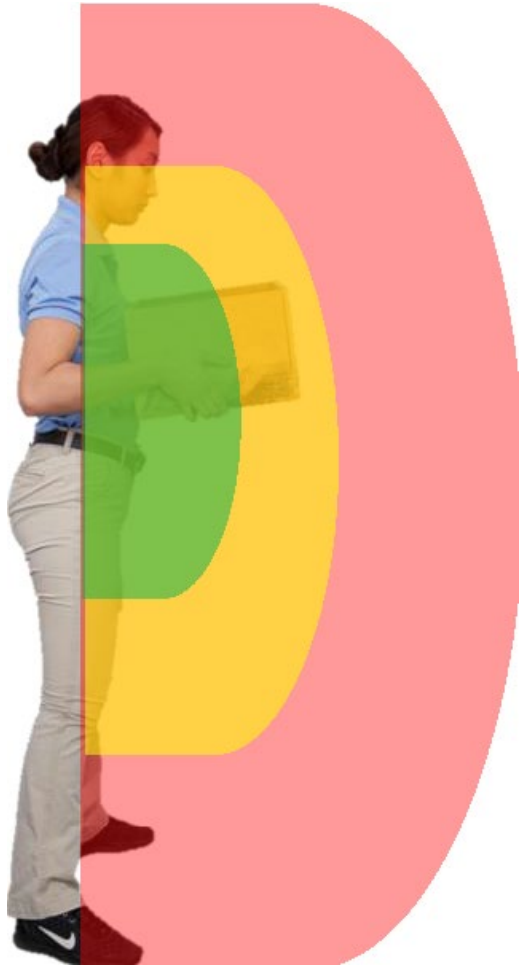
- Position with least amount of stress on body
- Directly in front of body between shoulders and mid-thigh
- Approach items with an "Athletic Stance"

Nursing Staff

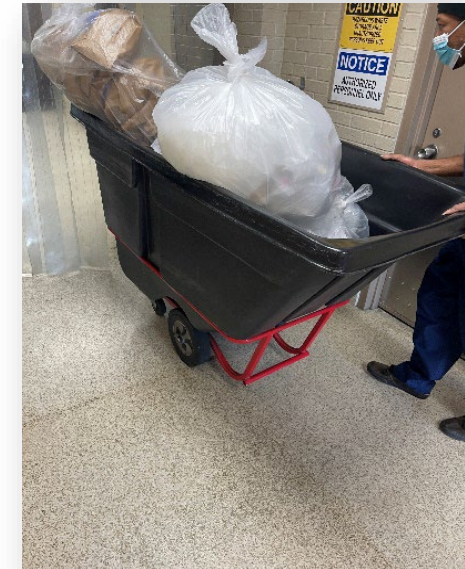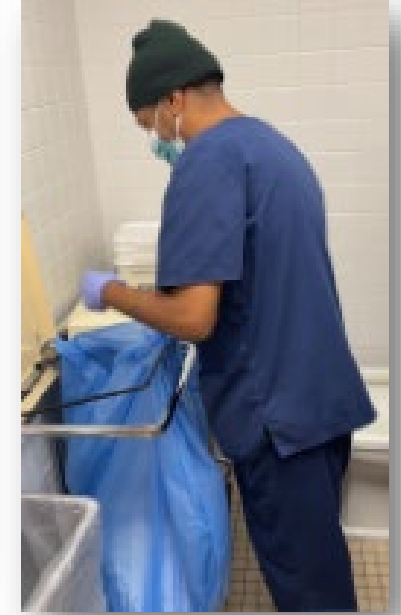## Door Opening Options
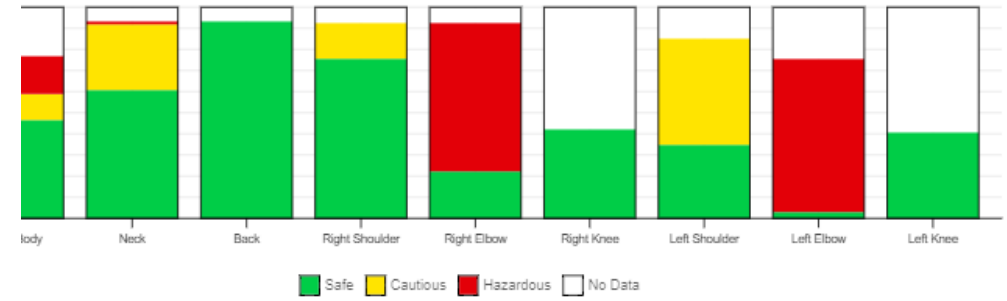
Digital Stimulation & RTC S/S

Front Approach

- 3-4 Rotator Cuff Strain/Sprains annually
- 1 RTC repair
- Complaints of time in crouching
- Kneeling discomfort

EVS Ergonomic Hazards.

The most prevalent causes of sprains, strains and muscular pain encountered by EVS departments:

- **Lifting/carrying:** lifting or carrying bags, laundry, containers, etc.
- **Awkward positions:** Housekeeping job tasks often requires awkward positions. These position increase the risk for injury
- **Sustained positions:** Sustained positions by bending or leaning over a patient to provide care.

- **Repetitive/prolonged activity:** Bending, crouching, pushing, pulling and lifting are most common

Video Analysis by Body Part

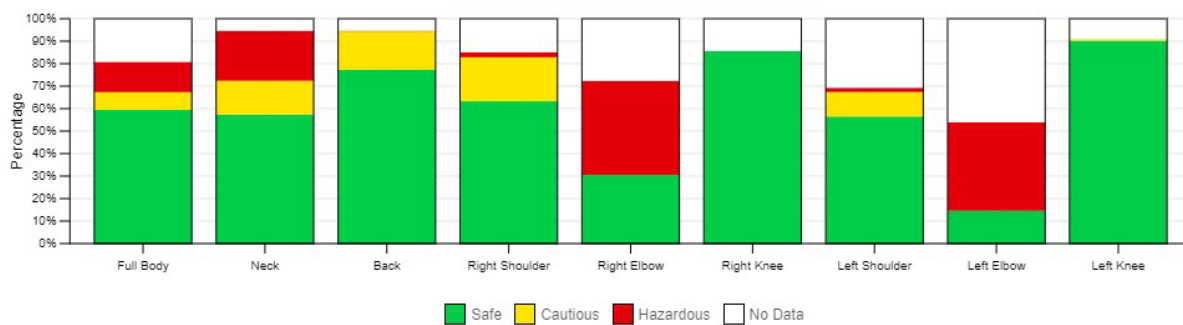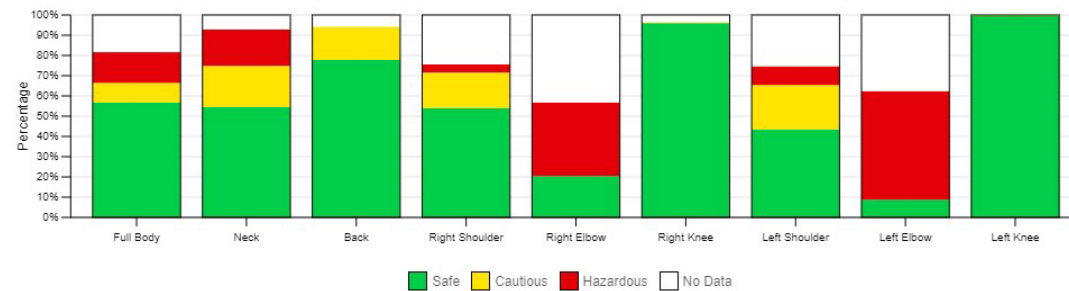Legend: Safe (green), Cautious (yellow), Hazardous (red), No Data (white)
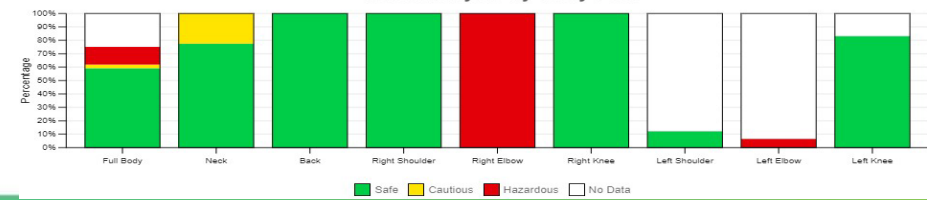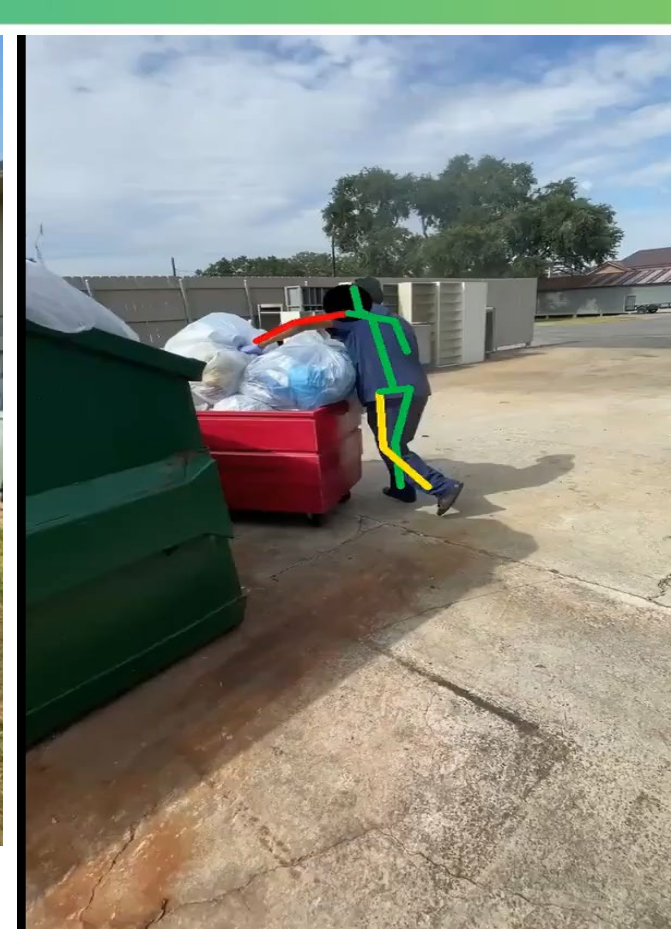
The 2-wheeled cart is easier to manage than the 4-wheeled cart (red).
The 4-wheeled cart requires strength to help with proper steering & rolling of the cart.

Video Analysis by Body Part

(Left chart: Full Body, Neck, Back, Right Shoulder, Right Elbow, Right Knee, Left Shoulder, Left Elbow, Left Knee — Safe, Cautious, Hazardous, No Data)

The AI tells us that the process on the left is much better on the body. The amount of red tells the story…

Video Analysis by Body Part

(Right chart: Full Body, Neck, Back, Right Shoulder, Right Elbow, Right Knee, Left Shoulder, Left Elbow, Left Knee — Safe, Cautious, Hazardous, No Data)

Dietary Task analyzed for ergonomic hazards.

These are the most prevalent causes of sprains, strains and muscular pain encountered by dietary departments:

- **Lifting/carrying:** Lifting or carrying trays, containers, food

- **Awkward positions:** Kitchen/Dietary job tasks often requires awkward positions

- **Sustained positions:** bending or leaning to prep food. Carrying bulk items when transferring to/from stock room

- **Repetitive/prolonged activity:** Bending, crouching, pushing, pulling and lifting are the most prevalent forms of repetitive activities that can lead to injury.
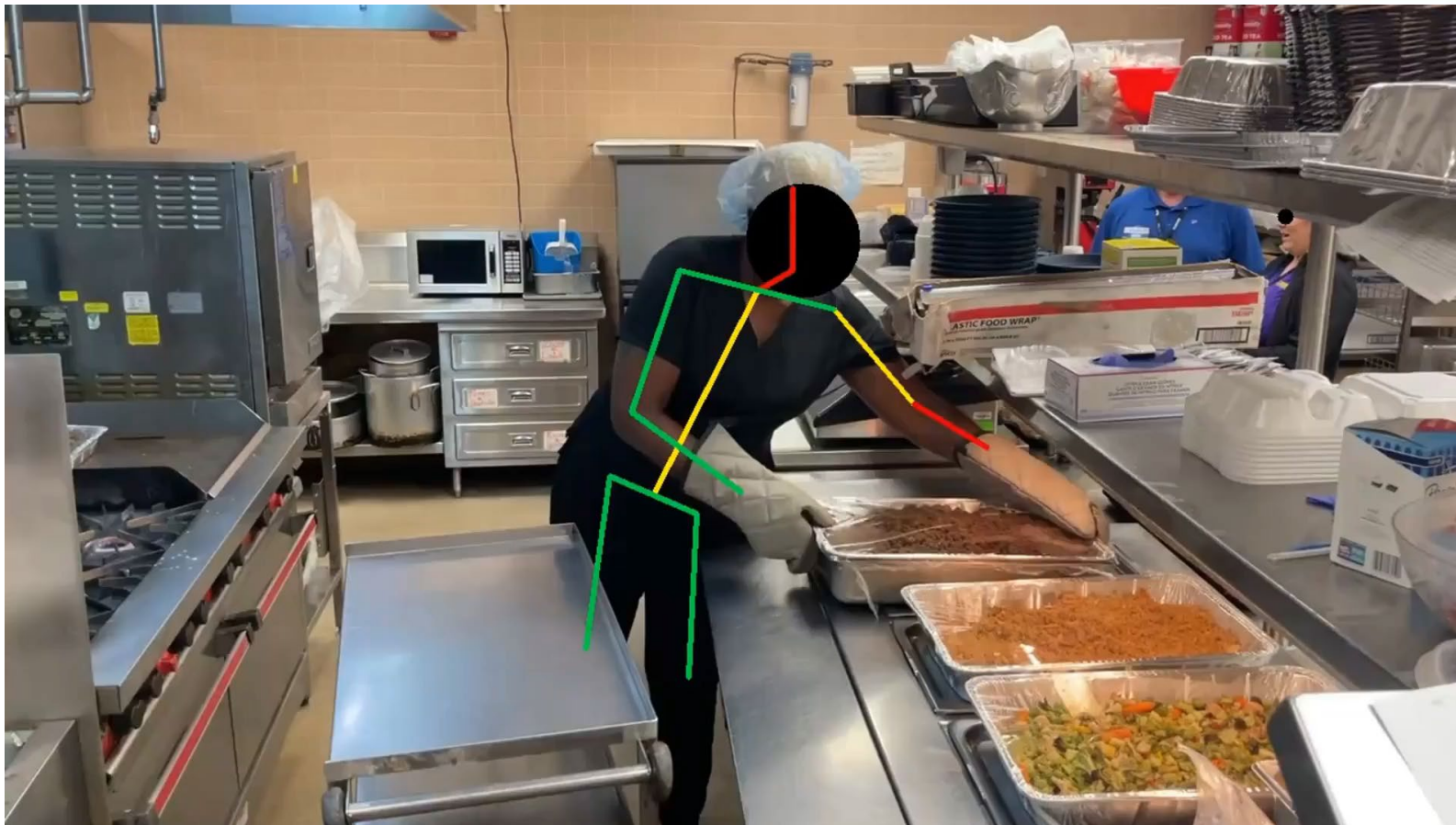
What does the body tell us?

- Improper posture (leaning to the side) puts undue stress on my spine and my arms.
- Lifting requires additional force and strength to properly manage items being moved.
- Prolonged grasping/holding requires additional muscle strength due to the distance that we are carrying items.
- How do we correct?
  - We use what we have available to use….
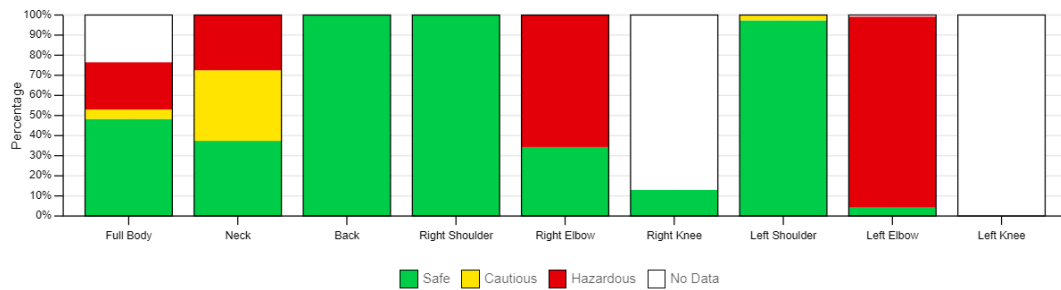 - Cart to countertop to allow for sliding of item
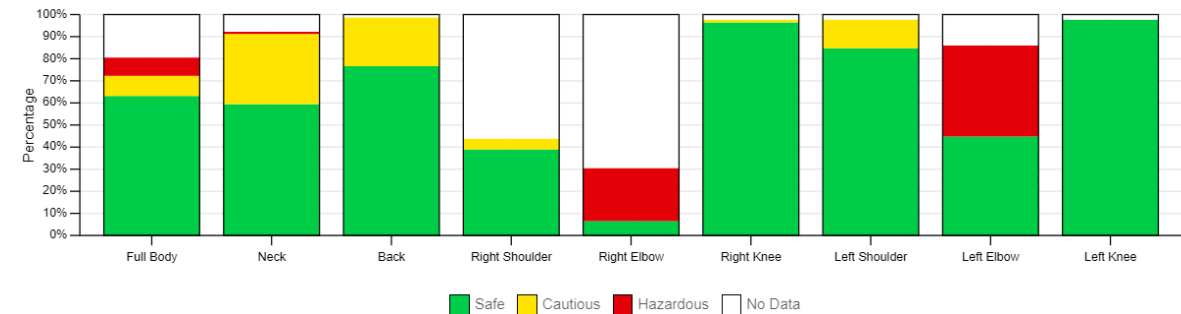
Video Analysis by Body Part

Legend: Safe, Cautious, Hazardous, No Data
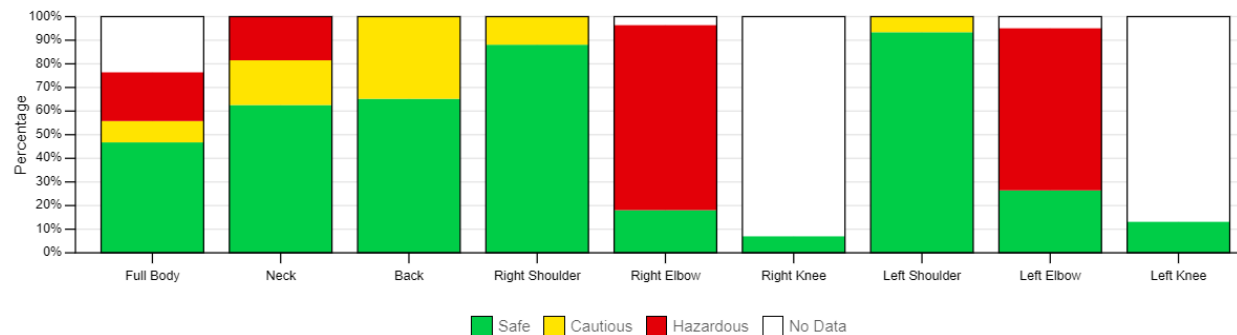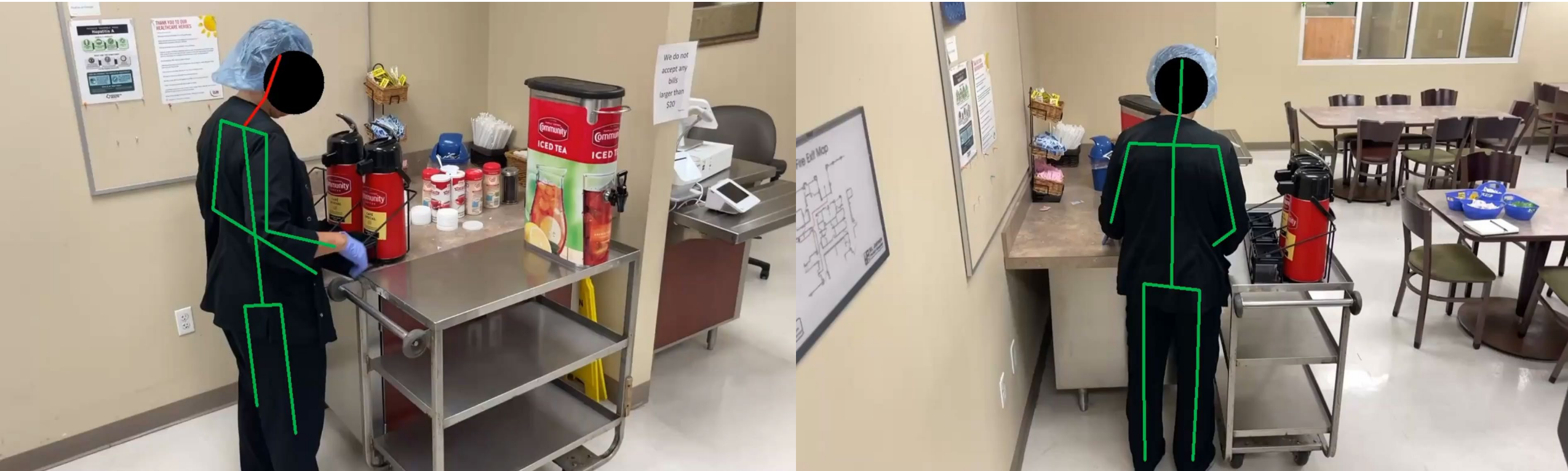
Which process looks best? The AI tells us that the process on the left is much better on the body. The level of red tells the story…

- No lifting – sliding of the pan
- No awkward postures due to KISS method
- No prolonged grasping due to no lifting

Assess the Risk!

No lifting – sliding of the container
No awkward postures due to KISS method (Touching cart to table items is being moved from or placed on.)
No prolonged grasping due to no lifting

Interpretation of the AI Risk Assessment?
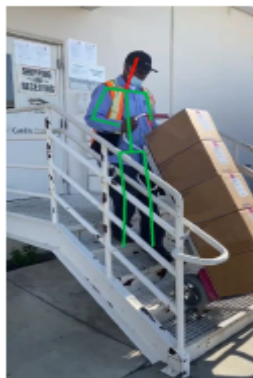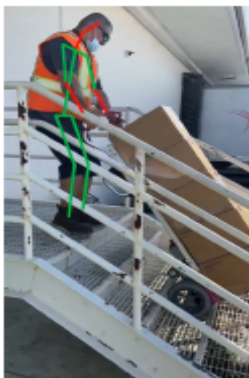
As simple as understanding a Stop Light!

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Reports

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Employer Name: ABC Company

Employer Job Title: Delivery Specialist

Task Description: Accessing and ascending/descending stairs with Lift Kar. Understanding function of Lift Kar when ascending / descending stairs.

Task: Ascending Stairs (Standard Hand Truck)

Assessed posture: Standing

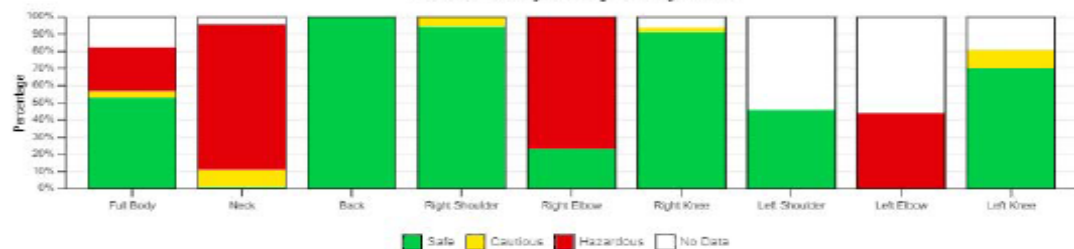**Task:** Ascending Stairs (Lift Kar Assistive device)

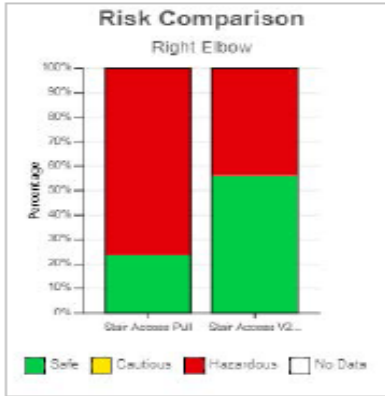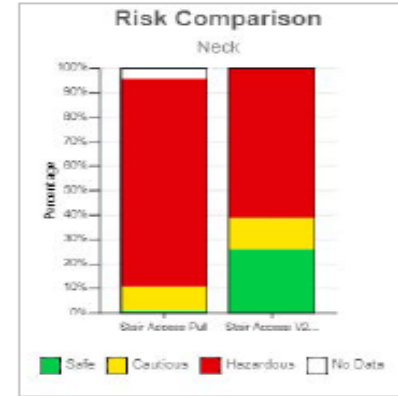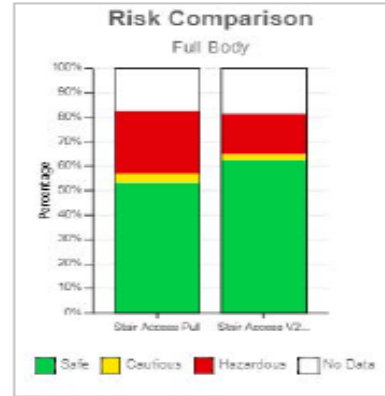**Assessed posture:** Standing

Observations and recommendations:

PSS access stairs and assess stairs visually to confirm structural rigidity while ascending/descending stairs. Utilizes 3 different methods to ascend stairs. Method 1 - climbing stairs with both feet being on stair tread/landing prior to Lift Kar elevating to next stair level. Method 2 - climbing stairs with feet offset on 2 different stair treads/landings prior to Lift Kar elevating to next stair level. Method 3 - Not utilizing Lift Kar lift function and just pulling Lift Kar up the stairs. (Left Picture) PSS doesn't utilize Lift Kar automatic lift function due to various reasons (slow/dead battery). (Right Picture) PSS utilizes full functionality of automation that Lift Kar offers.

Video analysis: Video AI is being utilized to capture difference between three different methods to identify risk levels for each method.

Video Analysis by Body Part

Body parts: Full Body, Neck, Back, Right Shoulder, Right Elbow, Right Knee, Left Shoulder, Left Elbow, Left Knee

Legend: Safe (green), Cautious (yellow), Hazardous (red), No Data (white)

Risk Comparison
Full Body

Risk Comparison
Neck

Risk Comparison
Right Elbow

Legend: ■ Safe ■ Cautious ■ Hazardous □ No Data

Comparison
(Left column = Pre-Training / Right Column = Post-Training:

Left bar graph demonstrates risks associated with minimal use of automation of Lift Kar.
Right bar graph demonstrates risks associated with full automation of Lift Kar.

Task Assessments:

Proper use of Lift Kar allows for associated risks to be minimized by lowering the effort in pulling when ascending or descending stairs.

Best Practices:

1. Always use bilateral hands to handle Lift Kar.
2. Allow for Lift Kar to assist in climbing stairs/curb.
3. Confirm proper battery charged levels, tires at appropriate levels, and full function of Lift Kar are identified prior to use.
4. Confirm understanding of how to properly operate Lift Kar in assess to a curb, ascending stairs, and descending stairs.
5. Allow for Lift Kar to operate - DO NOT RUSH and initiate pulling activity to override automation.
6. If load shifts or Lift Kar starts to fall, ALWAYS let go of the Lift Kar and allow for it to fall. Always protect yourself not the equipment/product!
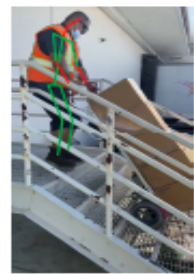
Rapid Entire Body Assessment (REBA)
Scores
A traditional REBA score can now be produced for any aspect of the video.
Color coded for risk level

Score Categorization

1 : negligible risk, no action required
2-3 : low risk, change may be needed
4-7 : medium risk, further investigation, change soon
8-10 : high risk, investigate and implement change
11+ : very high risk, implement change now
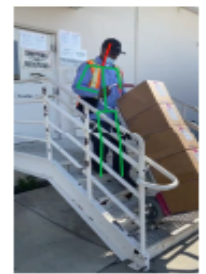
Task: Ascending Stairs (Standard Hand Truck)

REBA ▼

4 - Medium Risk

Task: Ascending Stairs (Lift Kar Assistive device)

REBA ▼

2 - Low Risk

Report Completed by: Brad Little, PTA, CEAS, Reg Manager

Date Completed: 6/25/21

Thank You!!!

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