

Wearable Sensors applied in Injury Prevention

DrillSafe Presentation



Preventure®
POWERED BY BARDAVON



Preventure at Compass Group

A commitment to continuous safety improvement and innovation



Problem: **Persistent manual handling and musculoskeletal injury risk in remote hospitality operations**

- Traditional approaches rely on observation and generic training

Solution: **Objective measurement to pinpoint high-load aspects of tasks and validate what changes actually work**

What is Preventure?

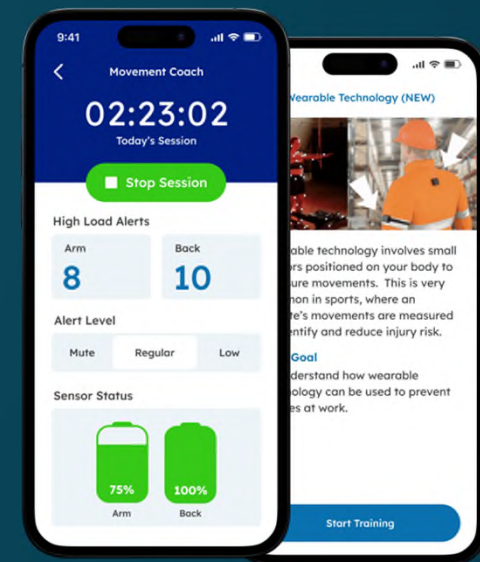
Establish baselines through job task assessments and movement coach sessions



Workers wear sensors for specific task or duration of shift



App/ dashboard provides overview, insights and education content



Promotes positive safety culture and an engaged workforce

What is Preventure?

Preventure wearable sensors are **devices worn on the body** to **measure awkward postures** and **repetitive movements** during a **specific work task** or throughout a **whole shift**.

Given awkward postures and repetitive movements are the two biggest causes of musculoskeletal injury at Compass Group, this is important data to get!

The sensors are typically worn on the back of the collar and around the arm and have a Gyrometer, which measures the position of the body segments (awkward postures) and an Accelerometer which measures the movement of those segments (repetitive movements).

Extreme postures and fast/ repetitive movements are recorded as high loads. The more high loads we experience throughout a task or shift, the more our muscles will fatigue and the more prone to injury we become.

By seeing what aspect of a task causes the load to spike, we can then explore what controls we can implement to equipment, posture or procedures to eliminate or reduce these loads and reduce our team member's risk of injury.

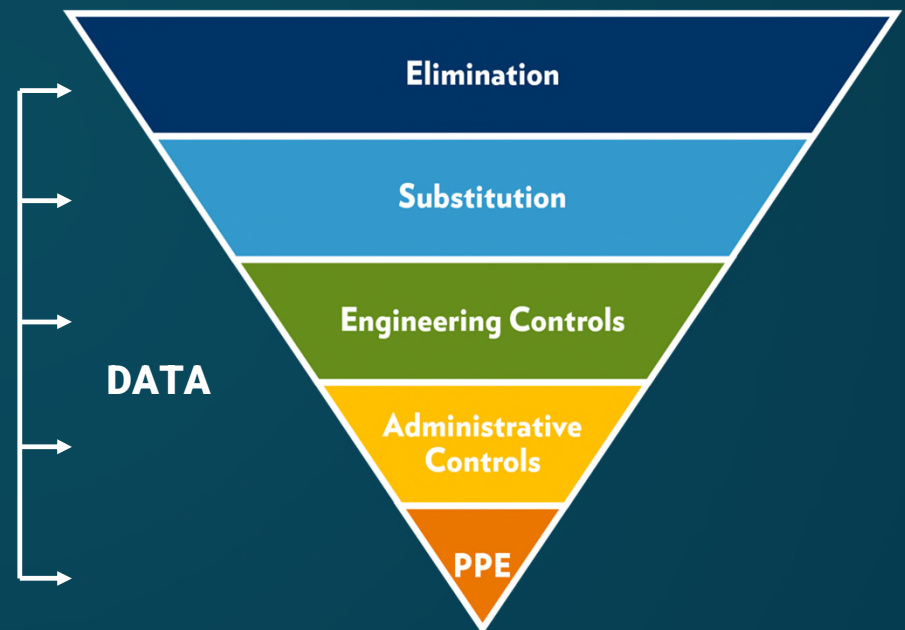
Applications of Preventure

Wearables are a long-term solution, ensuring strategies are based on measured data

- Workplace Redesign & Equipment Selection
- Task Benchmarks & Manual Handling Training
- Real-Time Worker Movement Coaching
- Worker Onboarding & Training
- Return-To-Work & Re-Injury Prevention

These can all be achieved via the two Preventure programs:

- Movement Coach & Task Assessments

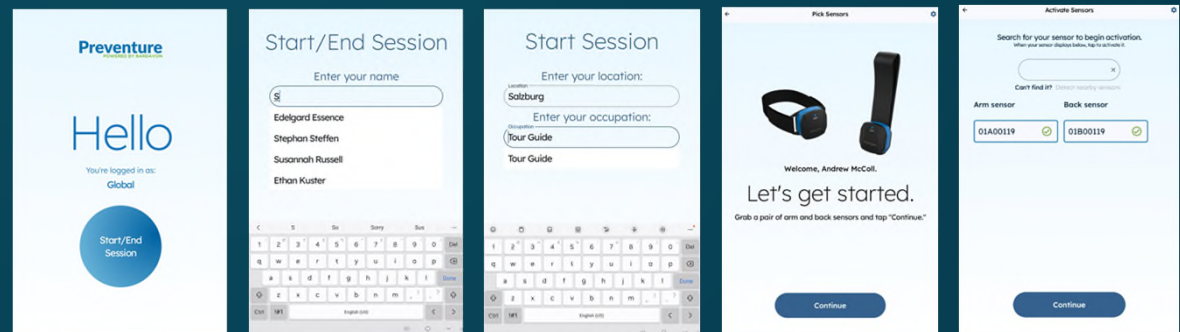


Movement Coach



No GPS or biometric data captured
(developed in partnership with worker unions)

- Workers pair the sensors to a phone **OR** check in via a tablet (provided by Preventure)
- Preventure App downloaded to device (phone or tablet)
- To start a session, workers select name, location and occupation and connect to the sensors (wifi required at start of session)
- Data is stored on the sensors (no wifi required during task assessment or shift)
- Data uploads to the dashboard when the session is ended and returned to the charging station (wifi required for upload)
- Sensors provide real time ***haptic feedback*** (vibration) when detecting 'high load'



Movement Coach

Convenience and ease of use lead to behavior change

What it does

- Real-time feedback on movement + posture
- Turns sensor data into simple coaching cues
- Enables instant self-correction

How we use it

- Live coaching during high-risk tasks
- Onboarding tool for new starters
- Targeted sessions on high-load activities
- Supports supervisor/TLC coaching

Why it matters

- Builds movement awareness + ownership
- Drives immediate behaviour change
- Supports early intervention (pre-injury)
- Validates training with real-world data



Task Assessments

Utilizing data empowers proactive decision-making

Safety Officer will set up worker with sensors and record them using the Preventure app while they perform a specific task (e.g. Bed Making, Shower Cleaning).

For long, repetitive tasks with no definitive end (e.g pot wash) we can record for a set time and ensure this is consistent across the board (3mins/ session)

Workers are engaged with:

- Unobtrusive sensors providing real-time alerts of high load movements
- Analytical task assessments (*comparable to analyzing your golf swing*)
- Real world feedback regarding at-risk movements and improved outcomes
- Involvement in safety culture and understanding of change management



Task Assessment – Demo

Bed Making is one of our most repetitive task with several awkward postures, many of which are unavoidable

Bed Making Demo

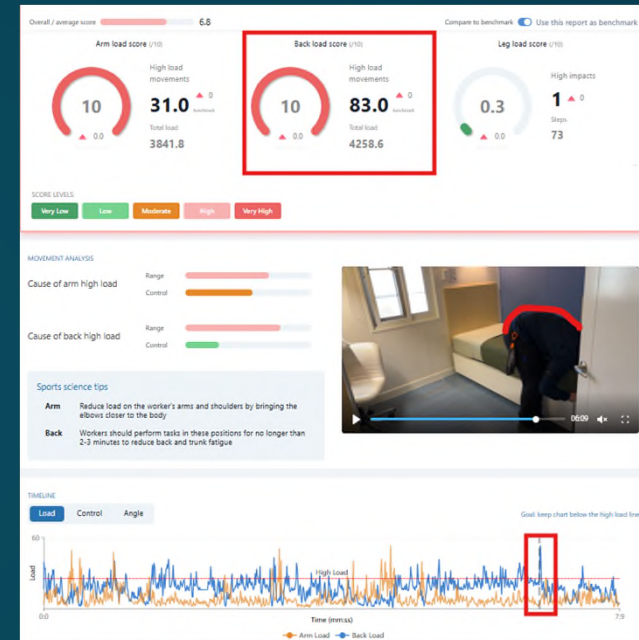
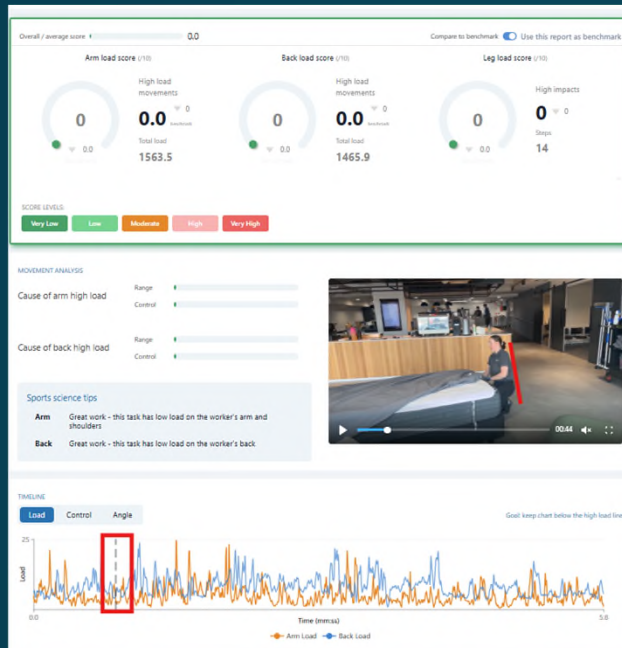
1. Volunteer to make bed their way
2. Record task assessment with Preventure and make note of posture, technique, tools/ chemicals (when applicable) and workspace ergonomics
3. Provide coaching to TM on what controls they could implement to reduce risk of injury (and improve efficiency)
4. Record another task assessment with TM implementing feedback
5. Review data on dashboard to show impact of controls (**ensure Preventure account is logged in on presenter's laptop**):
6. <https://aus.preventure.live/reports/tasks>
7. Share learnings with broader team/ company

Case Studies

Examples of how we've utilized the sensors at Compass Group

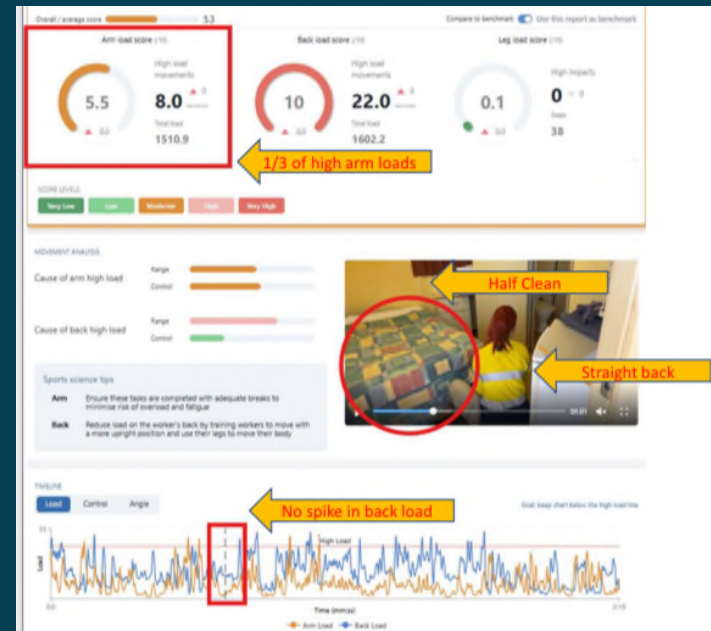
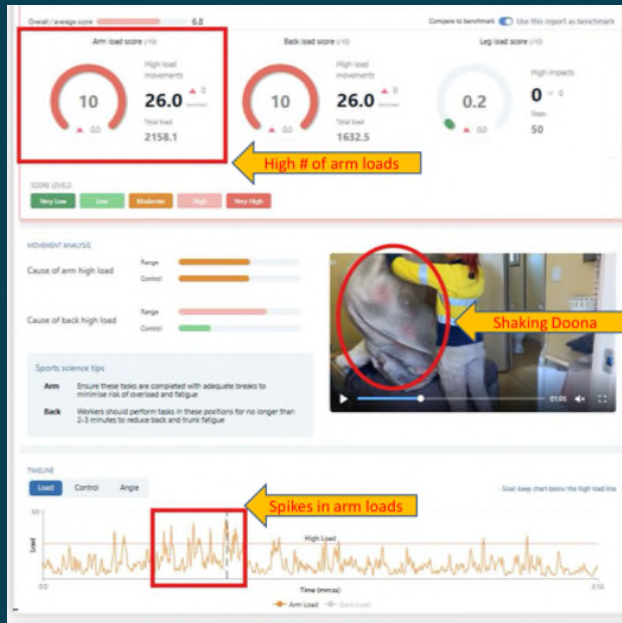


Bed Making Posture & Ergonomics



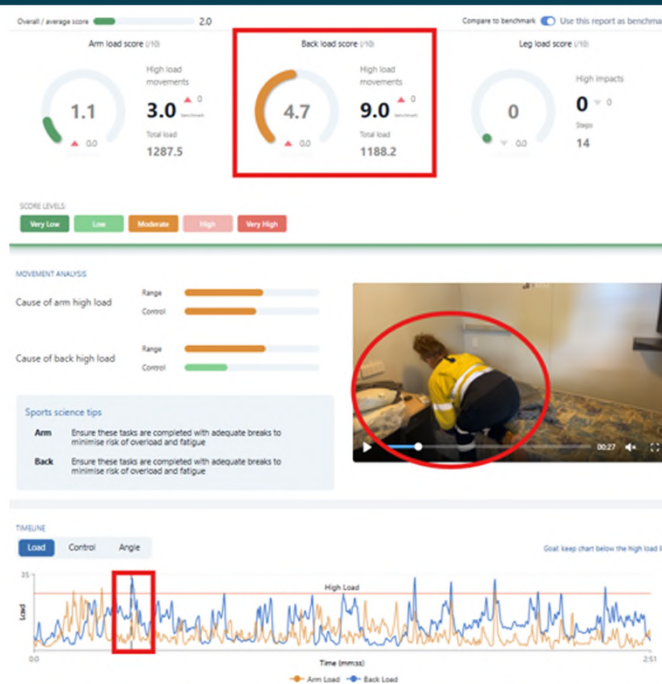
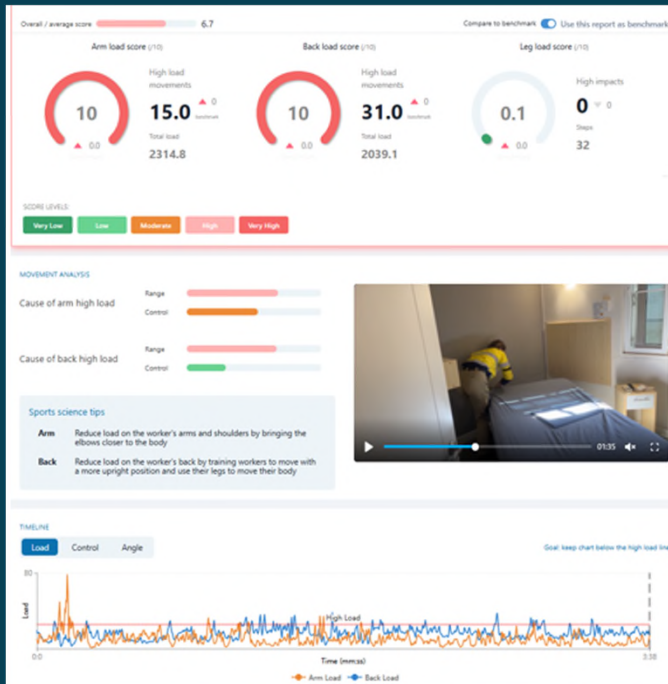
- In the Academy (left) where we have an experienced trainer and plenty of room to navigate the bed, we can perform this task with zero high arm loads and zero high back loads
- As we know – on site we rarely have this much space (right), and furniture like bedside tables or resident belongings force our team members to adopt awkward postures to tuck in linen
- When there is room available, we encourage team members to keep their back as straight as possible to reduce the load on their back
- This can be done by utilising a squatting or kneeling posture
- However, these postures aren't always comfortable for team members, especially those with limited mobility
- Fortunately there are other controls we can implement to reduce the load, such as the linen we use or the way we make the bed

Making a Bed with a Doona (insert lining) vs Comforter (lining included)



- Many sites still make beds with doonas, which put an excessive manual handling strain on our team members, compared to comforters
- We found making a bed with a doona can result in 3x the number of high arm loads
- 26 high arm loads for doona vs 8 for comforters
- That is 650 high arm loads just from making beds/ day (25 rooms/ day) compared to 200 if they all had comforters (or were mid cleans)

Tucking vs Folding Sheets



- Site on the left use doonas and tuck all their linen into the mattress.
- Site on the right use comforters and fold them neatly on top of the bed (see finished product on the far right)
- This reduces the amount of bending team members are performing, resulting in 22 less high back loads.
- That's roughly 550 fewer loads on the back over 25 rooms
- 5x more high arm loads this time for the site that uses doonas instead of comforters

Bed Making Project - Wheatstone

Old Standard



Alternative Method



New Standard



- Gathered data on different bed making techniques and presented results to client.
- Noted a 40% decrease in high back loads when folding comforter on top of bed.
- Objective data showed impact of alternative technique and new bed making standard has now been implemented.

Utilising Movement Coach to Support BBQ Operations at Gorgon Village

Problem: A significant number of injuries are being experienced by TMs involved in BBQ operations

- These are likely due to:
 - Weight and awkwardness of loads being handled
 - Lack of awareness around optimal manual handling techniques and postures for the tasks involved
 - The workplace design/ ergonomics not being fit for purpose
 - The unique nature of the task means we can't implement learnings from other camps
- The preventure data collected provided us with some valuable insights into the physical demands of BBQ operations:
 - Helped us identify what sort of postures and movements are contributing to the muscle fatigue and physical strain our TMs are experiencing

BBQ Chef Occupation Profile

EVENT DATE 19th - 22nd August 2024

SITE NAME Gorgon

BBQ Chef

Profile Strength ● Poor	Reports 12	Average Report Duration 2.3	Workers 2	Normal Shift Hours 8
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Improve profile strength by adding more movement sessions

PHYSICAL DEMAND ANALYSIS

Arm load score
2

HIGH LOAD MOVEMENTS / HOUR
40.59

LOAD / HOUR
23438.29

Back load score
4.9

HIGH LOAD MOVEMENTS / HOUR
110.01

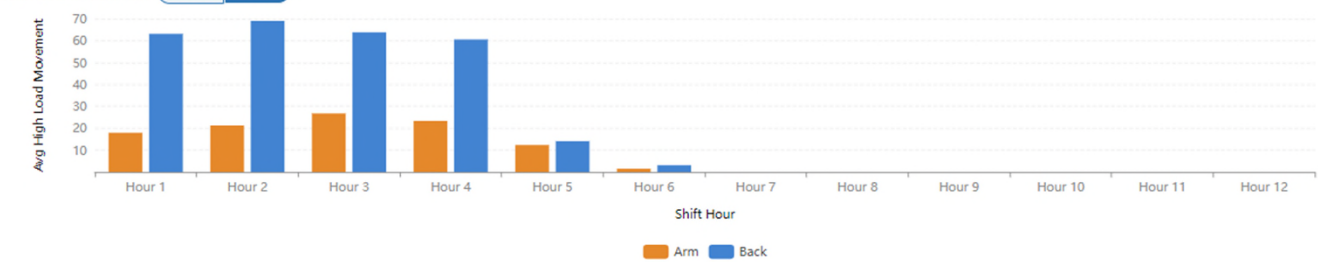
LOAD / HOUR
22093.89

Leg load score
0.8

HIGH IMPACTS / HOUR
0.95

STEPS / HOUR
747.21

HIGH LOAD DISTRIBUTION 12 Hours 24 Hours



Dinner Chef Occupation Profile

EVENT DATE 19th - 22nd August 2024

SITE NAME Gorgon

Dinner Chef

Profile Strength ● Poor	Reports 5	Average Report Duration 4.2	Workers 1	Normal Shift Hours 8
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Improve profile strength by adding more movement sessions

PHYSICAL DEMAND ANALYSIS

Arm load score
1.7

HIGH LOAD MOVEMENTS / HOUR
39.55

LOAD / HOUR
22961.21

Back load score
2.9

HIGH LOAD MOVEMENTS / HOUR
53.55

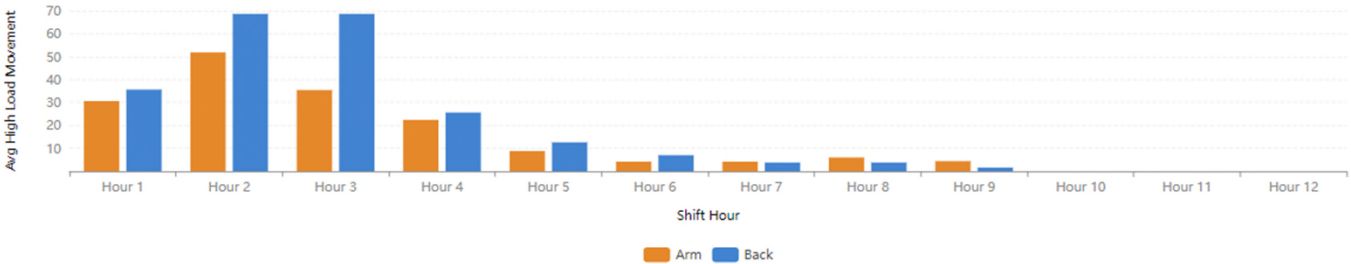
LOAD / HOUR
20212.64

Leg load score
0.4

HIGH IMPACTS / HOUR
0.09

STEPS / HOUR
567.83

HIGH LOAD DISTRIBUTION 12 Hours 24 Hours



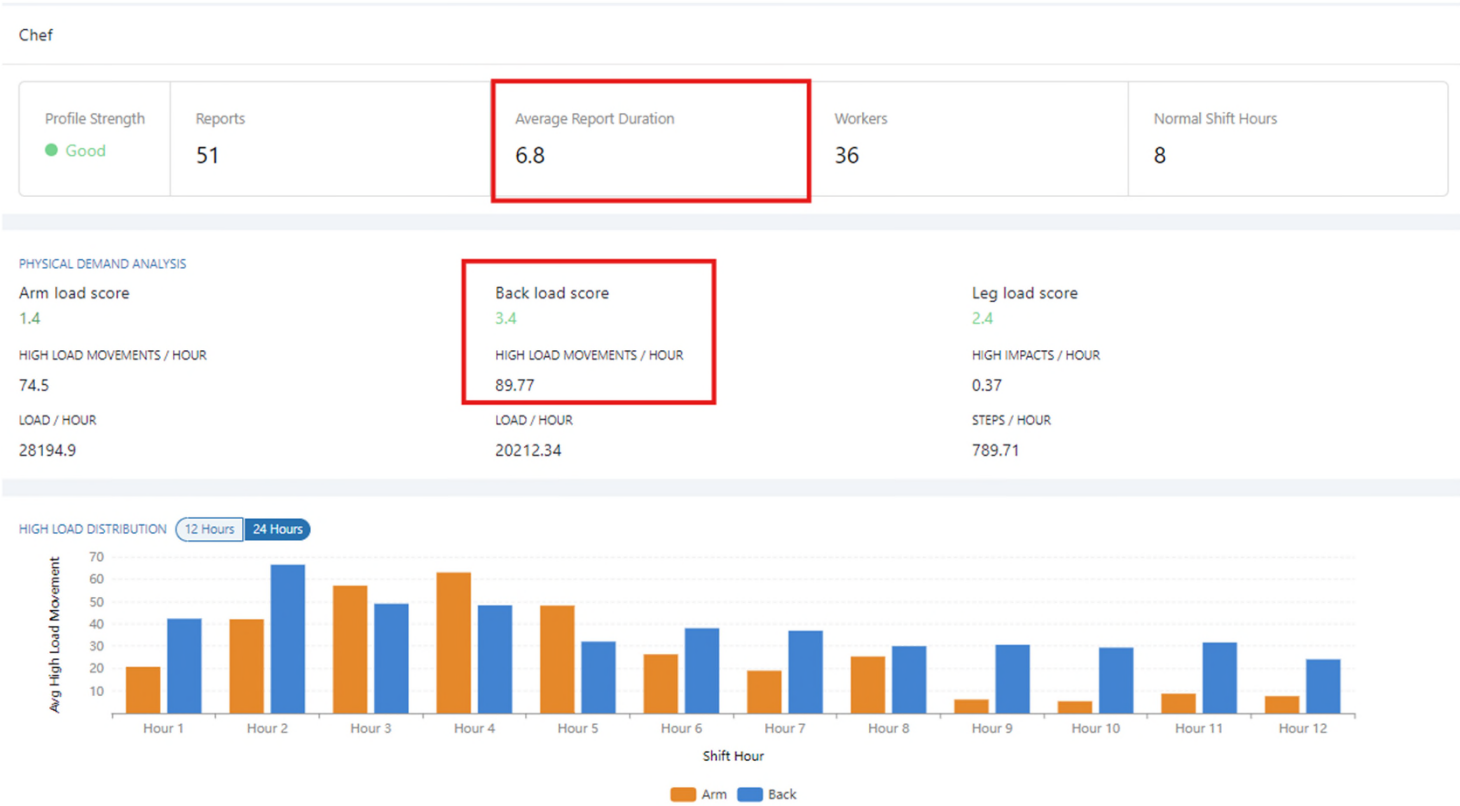
Chef Occupation Profile

EVENT DATE

N/A

SITE NAME

ALL SITES



Overall Load Score Comparison Occupation Profile

EVENT DATE 19th - 22nd August 2024

SITE NAME Gorgon

Overall load scores by occupation

Occupation	Score
TLC	High 6.2
Village Support	Moderate 5.0
Housekeeping	Low 3.6
Tavern	Low 3.4
IPA	Low 3.3
Truck Day/ Operations	Low 3.2
Groundskeeping	Low 3.0
TA	Low 3.0
BBQ Chef	Low 2.9
Utility	Low 2.6
Stores	Low 2.5
Chef	Low 2.4
Mine Site Cleaner	Low 2.4
Manager	Low 2.3
Unassigned	Low 2.2
Laundry	Low 2.2
Cleaners QCH	Low 2.2
Kitchen Utility	Low 2.1
Bar	Low 2.1
Defrost	Very Low 1.9
Laundry Attendant	Very Low 1.8
Dinner Chef	Very Low 1.7

Findings:

- Chef:
 - Average report duration = 6.8hrs
 - Overall back load score = 3.4
 - High load movements/ hr = 89.77
- BBQ Chef:
 - Average report duration = 2.3hrs
 - Overall back load score = 4.9
 - High load movements/ hr = 110.01
- Dinner Chef:
 - Average report duration = 4.2hrs
 - Overall back load score = 2.9
 - High load movements/ hr = 53.55

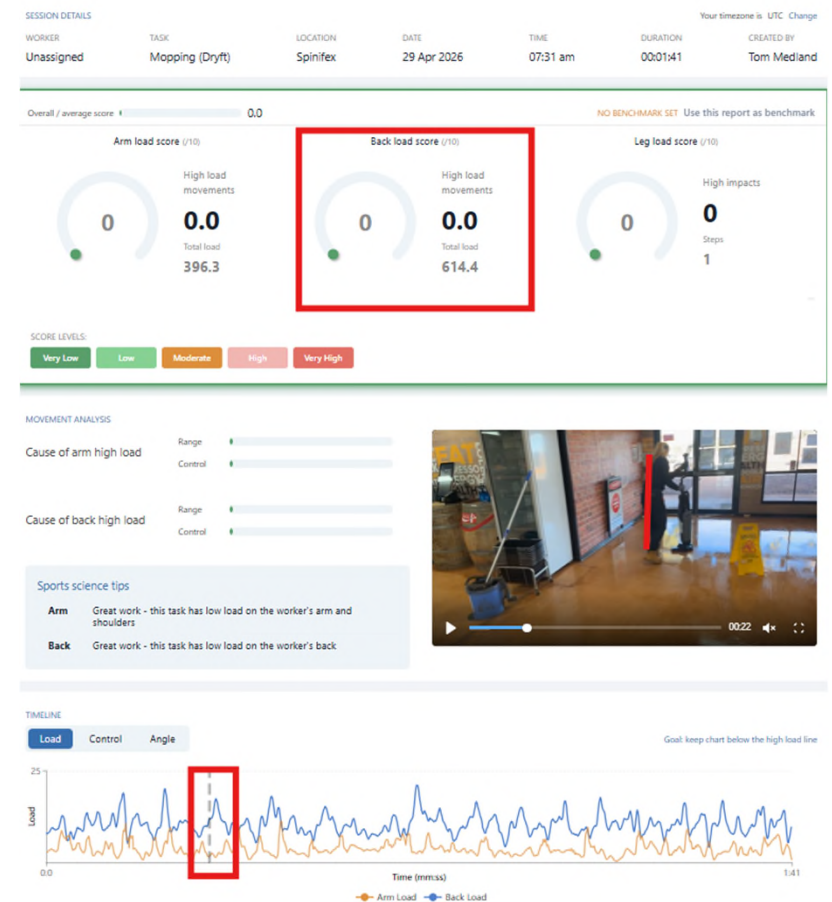
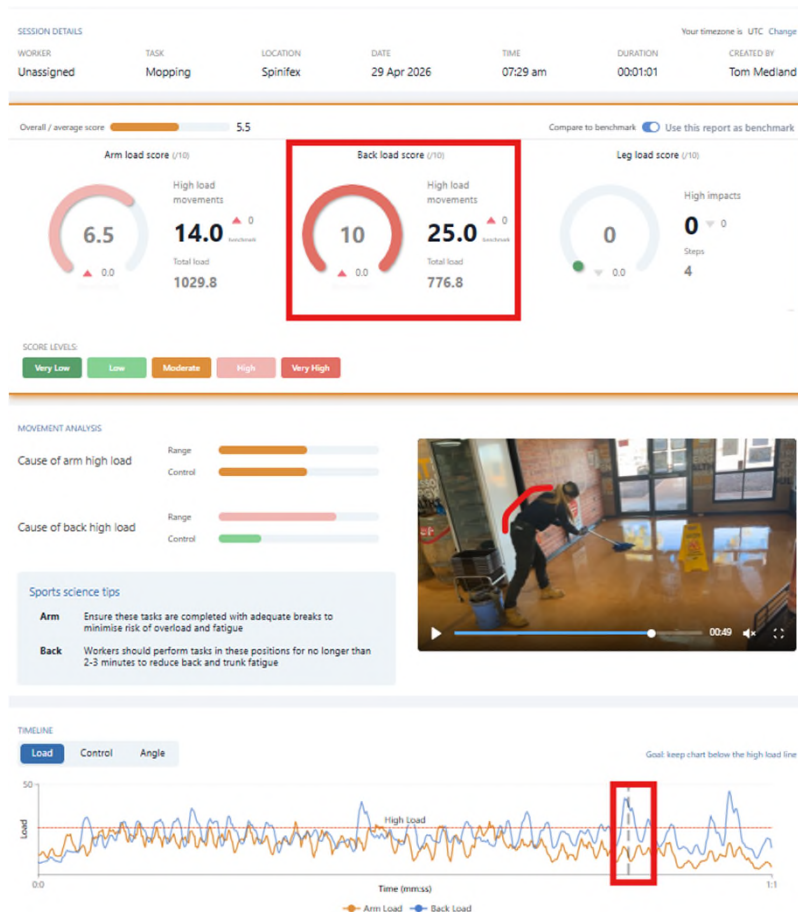
We can deduce that the physical demands on a BBQ chef are significantly higher than other chefs, given that they accumulated a much higher overall load score, in a far shorter period of time

After presenting this data to site we implemented the following controls to reduce risk of injury:

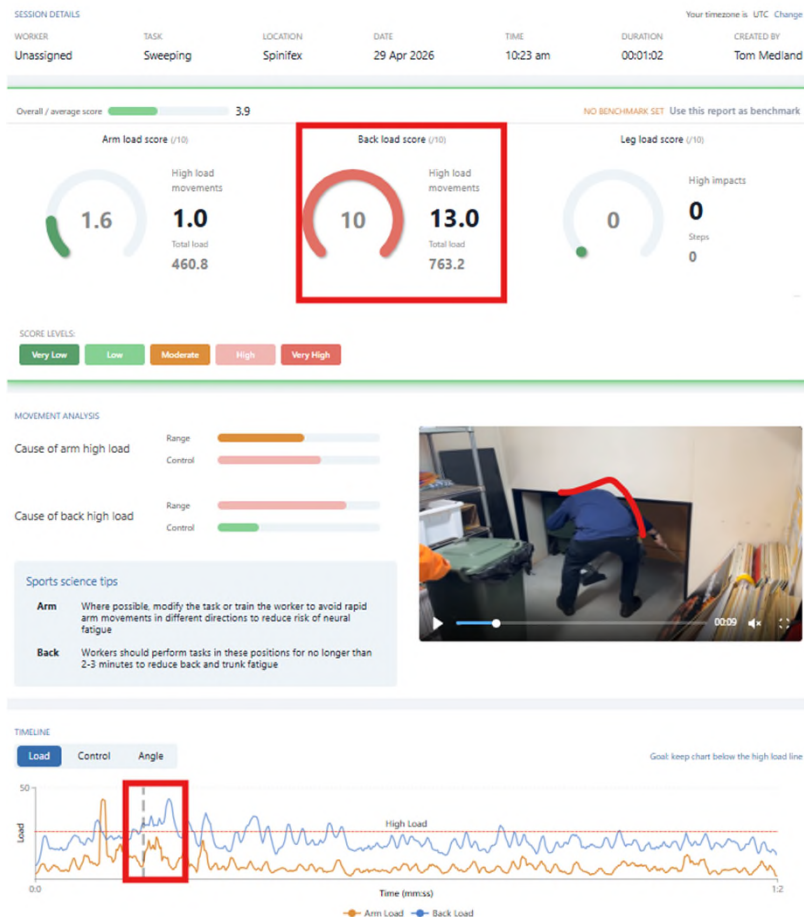
1. Increased frequency of task rotation (every hr instead of every 2hrs)
2. Rotating BBQ shifts - chefs no longer work 2 days on BBQ duty in a row.
3. Procured scissor lift trolley to assist with loading BBQ food van

Mopping with Mop and Bucket

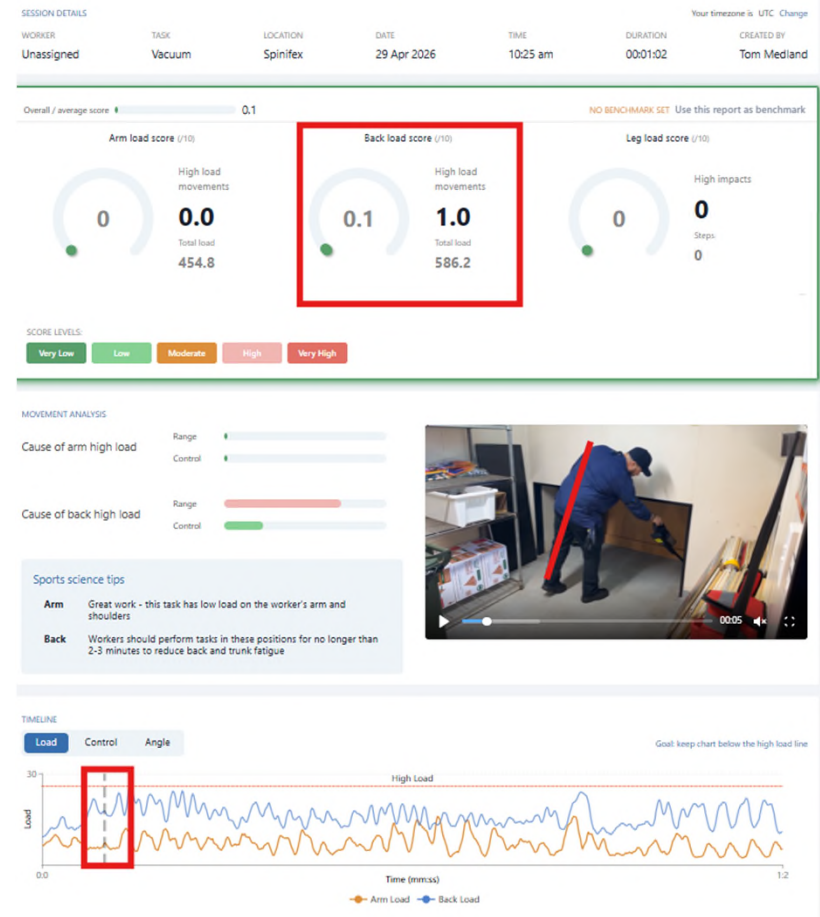
Mopping with Nilfisk Dryft



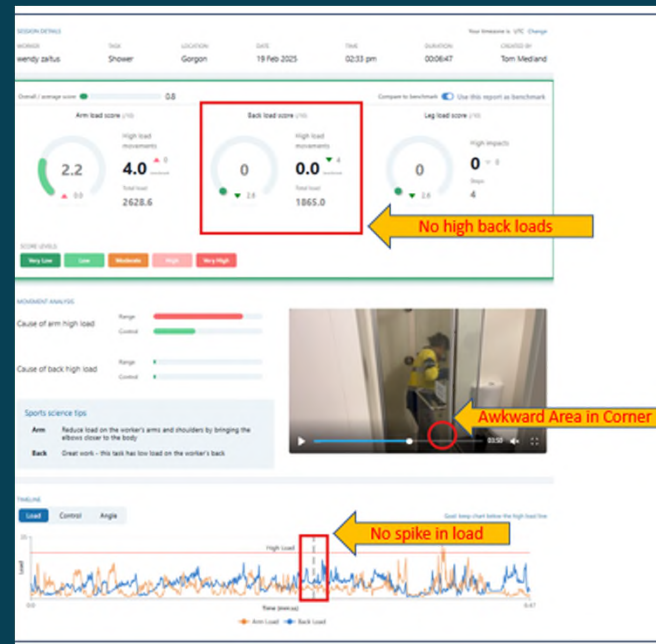
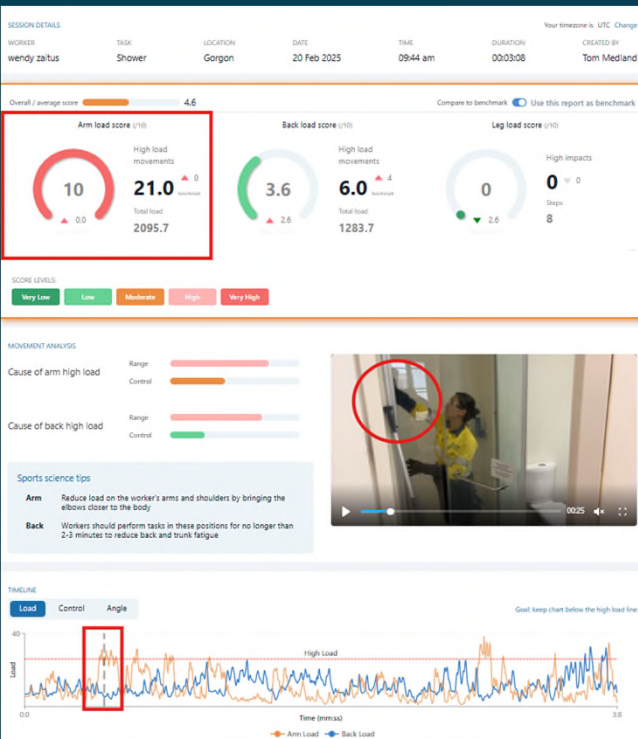
Sweeping with Dustpan & Brush



Vacuuming with VU200



Electric Scrubber Trial - Gorgon



Description:

- Huge reduction in overall load score when electric scrubber is used for most of task (Overall load score 0.8)
- No high back loads accumulated as the TM doesn't have to adopt an awkward posture to clean bottom corners of shower (see screenshot)
- When the shower is wiped with a microfibre by hand to dry at the end of the task, a few loads are experienced because TM is working above shoulder height
- As seen in diagram on bottom left, no high loads were accumulated when electric scrubber was used

Recommendation:

- Explore use of electric scrubbers in shower cleaning for deep cleans to reduce strain that come from repetitive movements, awkward postures and working above shoulder height
- This would allow TMs to focus on cleaning surface level grime from showers and reduce the amount of forceful scrubbing they use on regular cleans

- Gathered data on cleaning shower normally then using an electric scrubber.
- Significant reduction in arm and back loads when utilising tool.
- TM feedback advised that it was awkward to move around shower and took longer to clean.
- We are now trialing a different model that can be broken down and exploring its viability for deep cleans and other tasks.
- Preventure does not measure force so it's crucial we gather subjective feedback to analyse with the objective data from the wearable devices

Comparison by Location – Impact of Mechanised Warewashing



- Sites with the higher loads for pot wash generally only have a traditional pot wash machine (outlined in red)
- Sites with the lowest loads for this task have stronger controls such as a Granulator (Mulla) or a Powersoak Machine



INJURY PREVENTION SOLUTION

QUESTIONS?

How could you utilise Preventure devices/ wearable sensors in your company?

For any questions or queries please email:

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