Is Wearable Tech a Worthy Investment?

Presented by:

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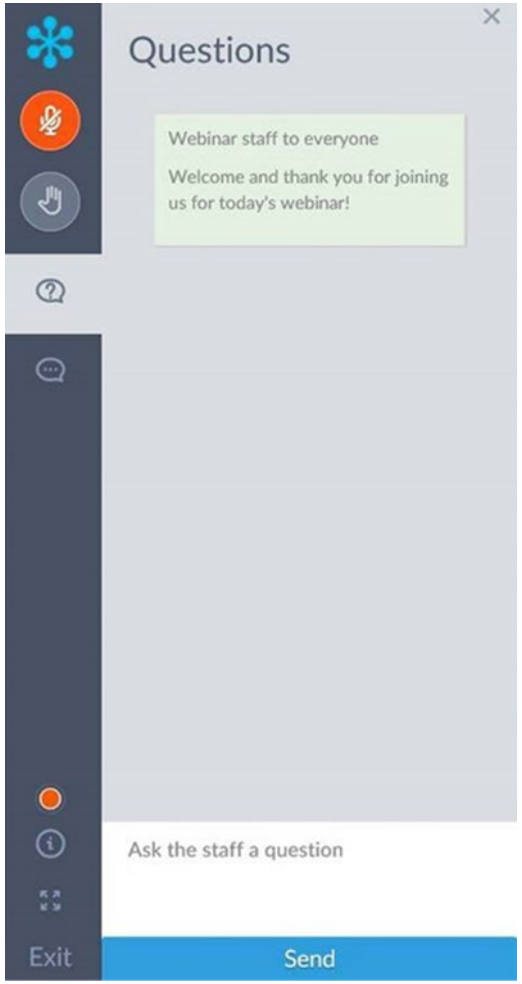
Webinar Housekeeping



You may submit questions and comments via the Questions panel.

Note: Today's presentation is being recorded and will be provided within 48 hours.

Objectives

- History and overview
- Types and examples of wearable technology
- Potential benefits of wearables
- Challenges of implementing wearable technology
- Wearable technology cost and investment
- Artificial intelligence for ergonomics applications
- Research and validation on wearable technology

Wearable Technology Statistics

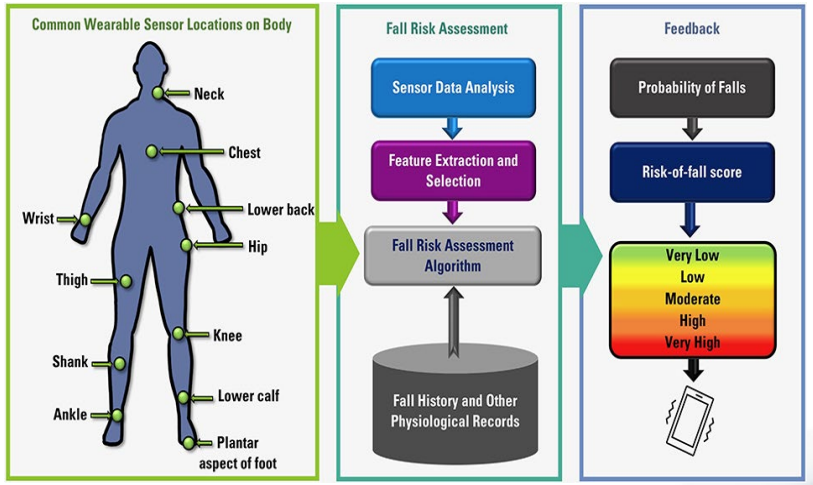
- The wearables market is growing rapidly, presenting users with new ways to engage with technology.
- The global wearable technology market is valued at $61.3 billion in 2022 and is expected to expand at a compound annual growth rate (CAGR) of 14.6% from 2023 to 2030.
- 533.6 million total wearable devices shipped in 2021. This number includes hearables, watches, wristbands, and other wearables.

Types of Wearable Tech

Types of Wearable Technology

IMU (Inertial Measurement Unit) Sensors

- Strong focus on manual material handling
- Haptic feedback (posture-based wearables)
- Machine learning algorithms (data)
- Monitor productivity, safety hazards and wellness
- The three steps:
  - Haptic response to inform users of unsafe movement or activity in real-time
  - Data is sent and stored in the platform (dashboard) to be reviewed by management
  - Coaching, feedback and corrective Actions



Capabilities of Wearables

LUMBAR RISK SCORING

Scoring on lumbar by providing data on bending and twisting, including angle, duration, and count

REPETITIVE MOTION ALERTS

Thresholds are set for an employee or process, and an alert is sent when met

TEMPERATE WARNINGS

Detects either extreme cold or hot conditions & starts a timer for the employee to have a break

FORKLIFT DRIVING

Detects underlying vibration caused by the forklift and calculates duration and driving score

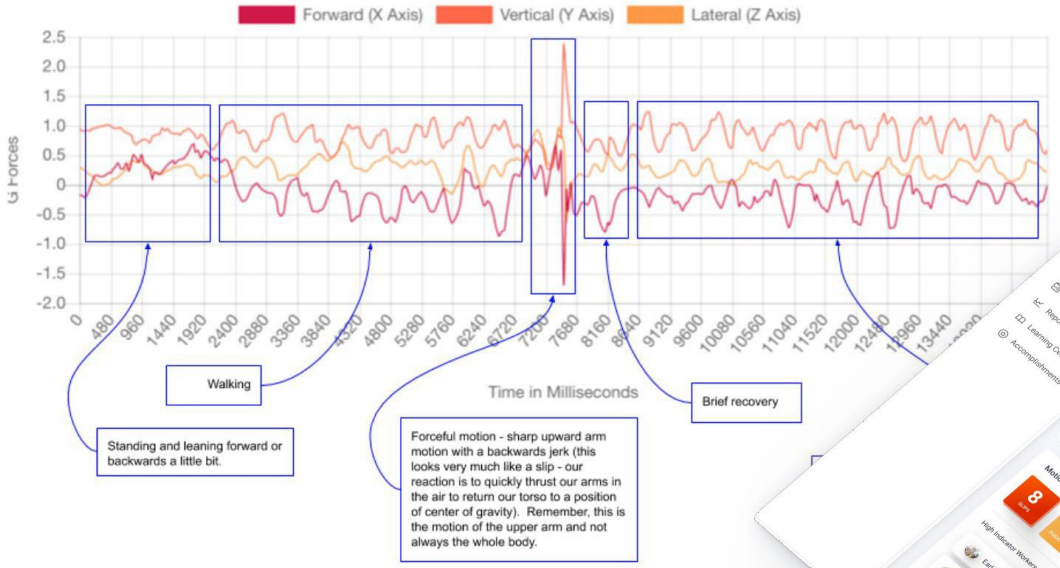
LONE WORKER SAFETY

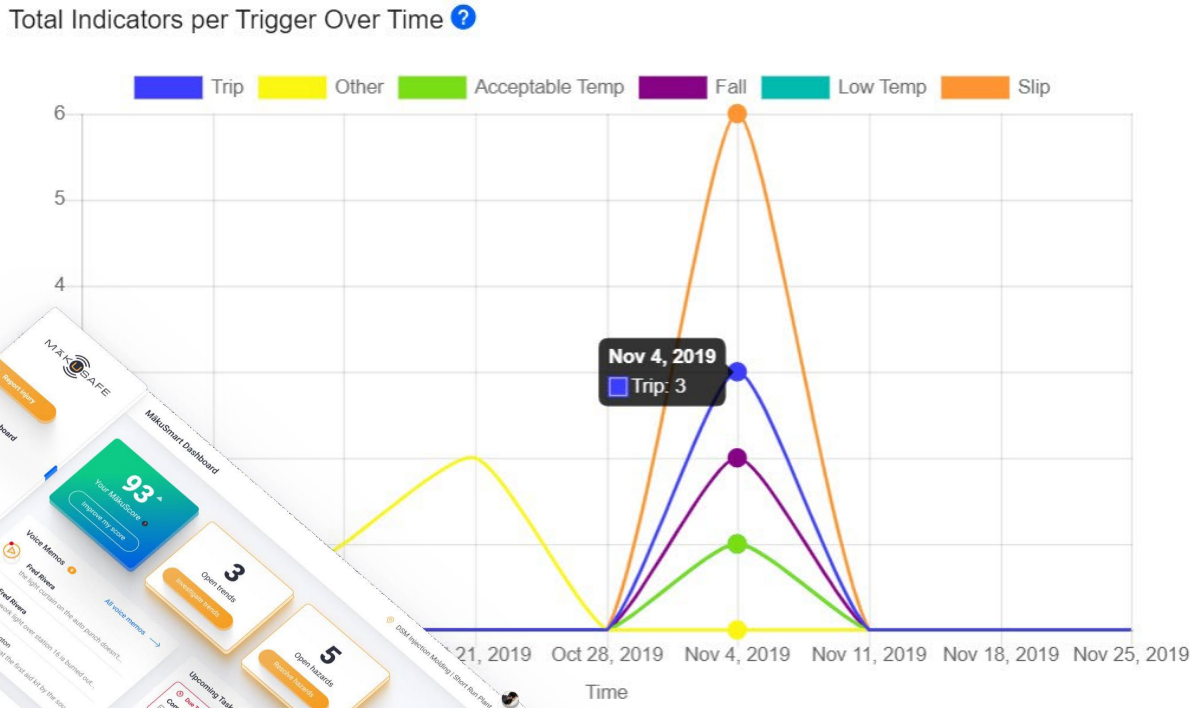
Detects lack of movement and sends a message if two-way button is pressed

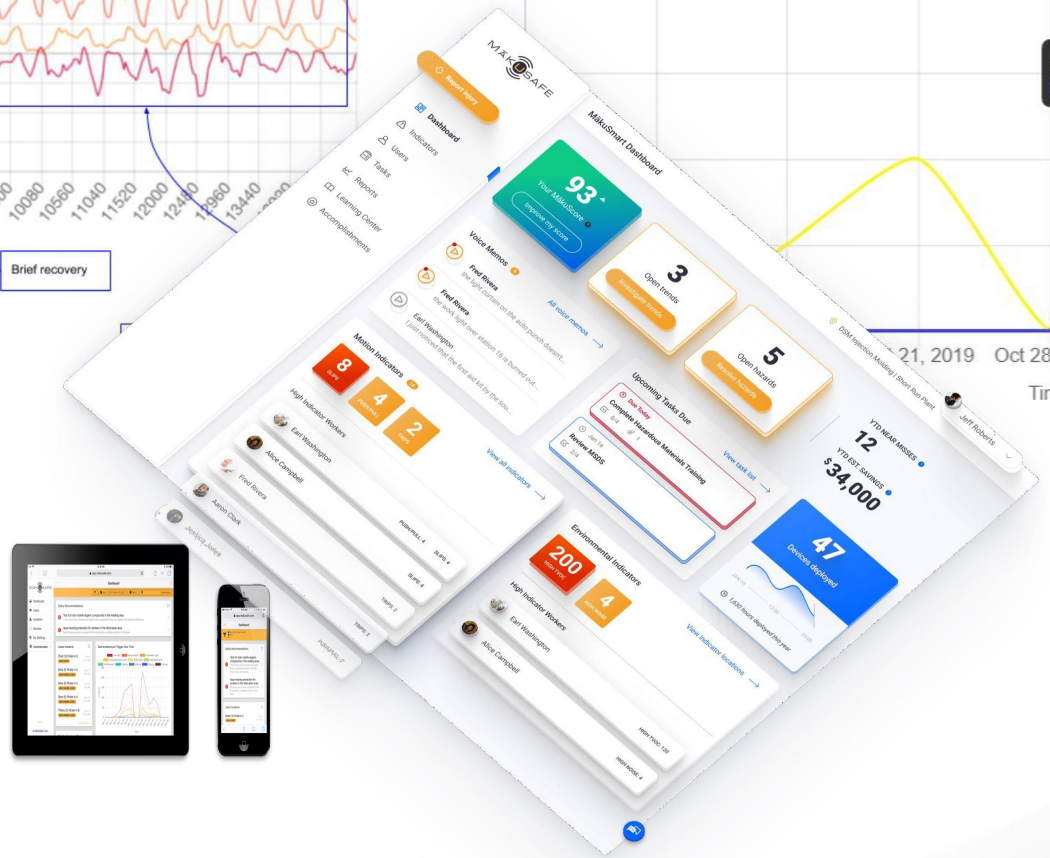
PPE COMPLIANCE

Scanning PPE to determine site wide compliance as well as alert employees when PPE is not worn

Wearables - Data





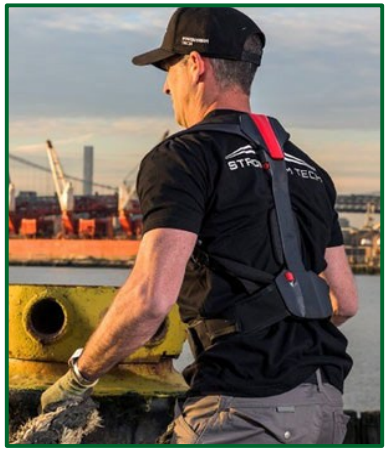


Wearable Technology Vendors (IMU/Physiological Sensors)

Kinetic

Swift Motion

StrongArm Technologies

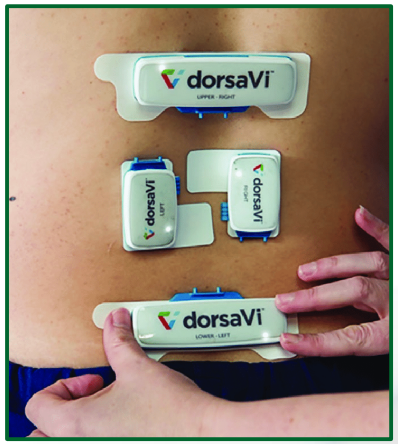


MākuSafe

Modjoul

Smartbelt

dorsaVi



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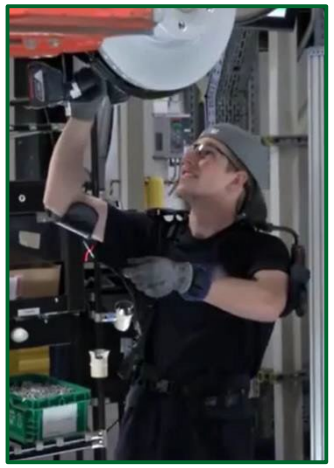
Types of Wearable Technology

Exoskeletons (Exosuits)

- Power (hydraulic) vs. Passive (springs)
- Body part(s) supported: Upper extremities
- Challenges: discomfort/transfers stress

Exoskeletons/Exosuits

- Ekso Bionics
- Equipois
- Sarcos
- Levitate Technologies
- SuitX
- Wyss Institute at Harvard University
- Virginia Tech's partnership with Lowe's



Levitate Technologies

Sarcos

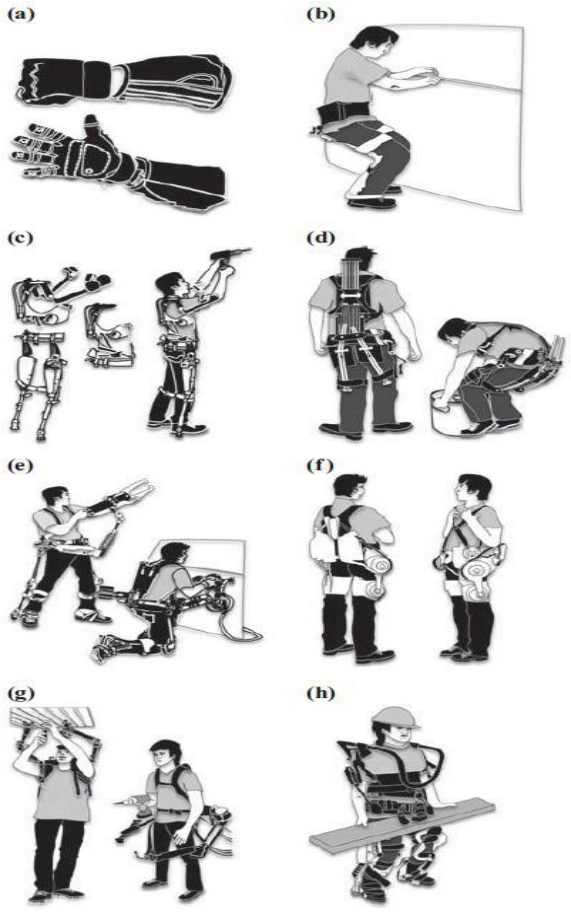
Wyss Institute

Virginia Tech & Lowe's

Ekso Bionics

Study: Use in Improving Manufacturing Performance

- 2019 study by Stephen Fox, Olli Aranko, Juhani Heilala, Päivi Vahala, published in the Journal of Manufacturing Technology Management
- Eight types of wearable products:
  - Glove
  - Wearable chair
  - Modular and whole body
  - Spring (carbon rod) bending assist
  - Transfer to floor
  - Powered
  - Arms and legs
  - Heavy load carry
- Some muscles get reduced activity; others get increased activity
- Overall feedback from workers: Some tasks are easier (helpful to have exosuits/devices), and other tasks are more difficult (not helpful)
- May introduce new sources of cumulative trauma disorder (CTD) and musculoskeletal disorder (MSD) risk



Study: Field Assessment of an Arm-Supported Exoskeleton

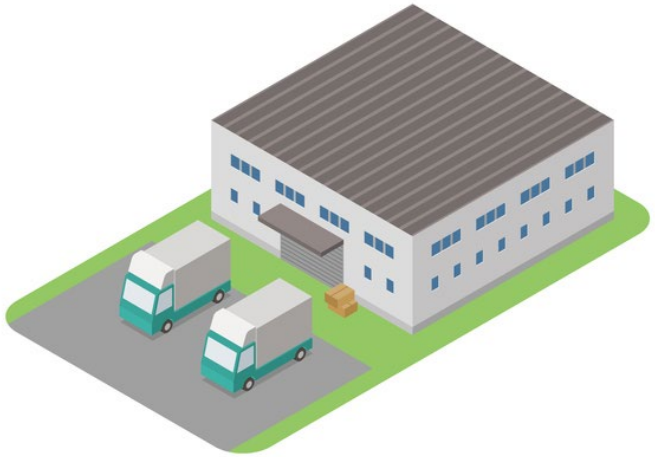
- Maury Nussbaum, Virginia Tech -
  Presented at the 2019 Applied Ergonomics Conference
- EksoVest; 100 in control group; 8 plants; elevated (overhead) assembly line
- Positive feedback from workers
- Barriers at 6 Months:
  - Thermal discomfort (22% reported)
  - Range of motion restrictions (16%)
  - Fit and adjustability (11%)
  - Weight (9%)
- Conclusions:
  - Some benefits (discomfort reduced, increased performance)
  - Some adverse effects (thermal, range of motion, fit)
  - Impacts will take longer than six months

Study: Passive, Upper Extremity Exoskeletal Vest for Tasks Requiring Arm Elevation

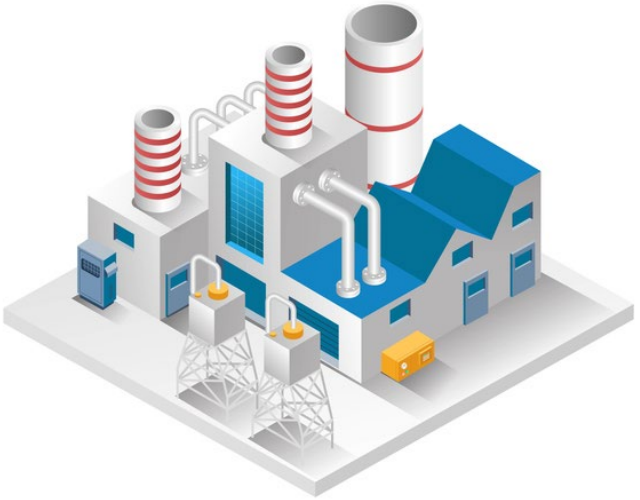
- 27 subjects (14 male, 13 female)
- No participants had any self-reported musculoskeletal injuries in the past 12 months
- Shoulder range of motion – 10% less
- Postural control – reduced
- Slip & trip risk – minimal impact
- Spine loading – reduced by up to 30%

Target Markets

Warehousing and Distribution Centers



Manufacturing



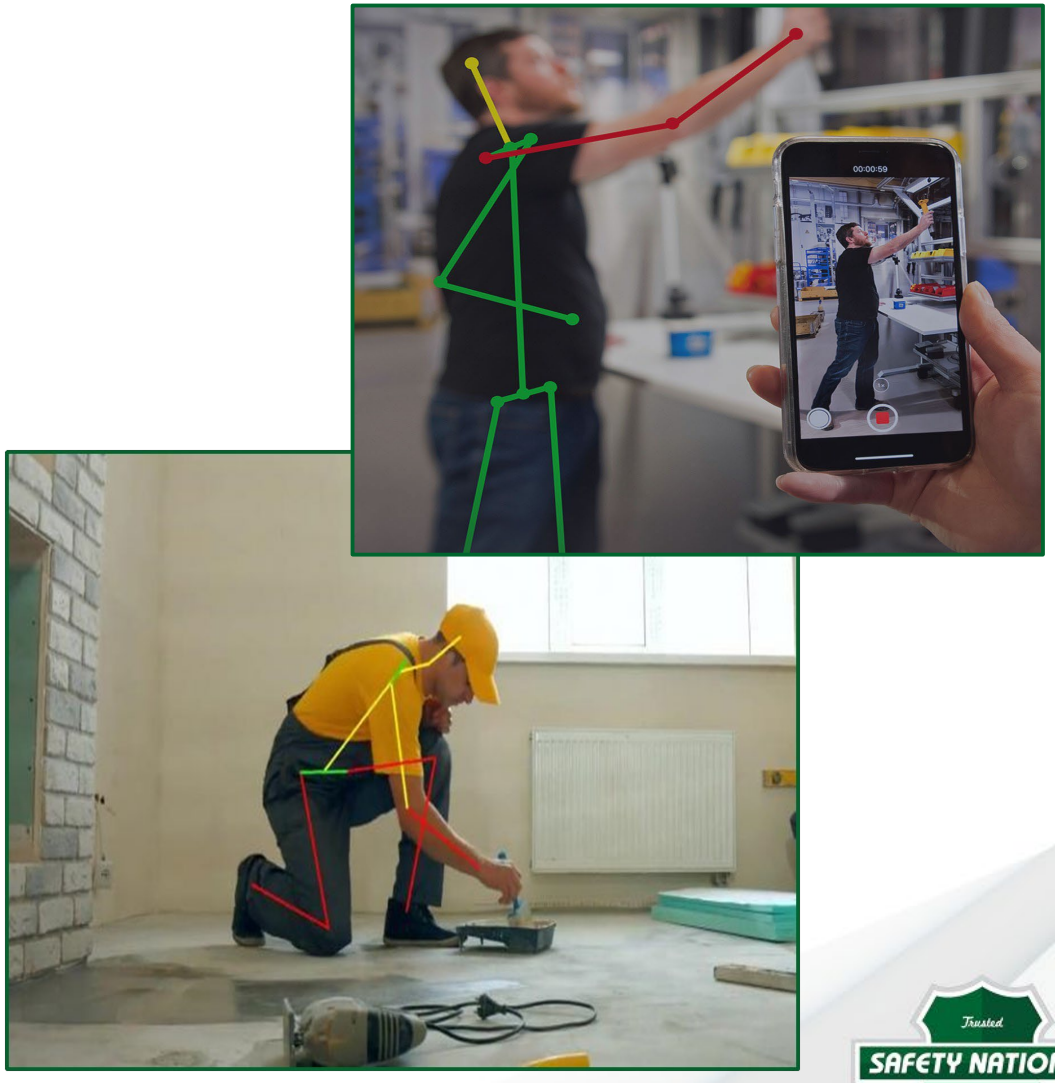
Retail – Back of House

Artificial Intelligence for Ergonomic Applications

Emerging Technology

Artificial Intelligence (Ergo Apps)

- Easy-to-use ergonomic applications
- Manual material handling exposures
- Ergonomic methods/tools
- Alternative and a cost-effective approach
- Beneficial for safety and ergonomic committees
- Highly validated and researched-based methods and tools

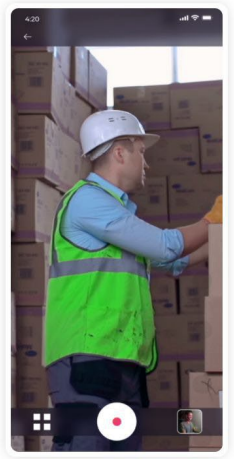


Artificial Intelligence for Ergo Apps

Camera based assessments

No need for wearables, goniometers, or other equipment. Measure and automatically track the safety of employees without stopping production.

- Use your phone's camera in the app
- Upload an existing recording



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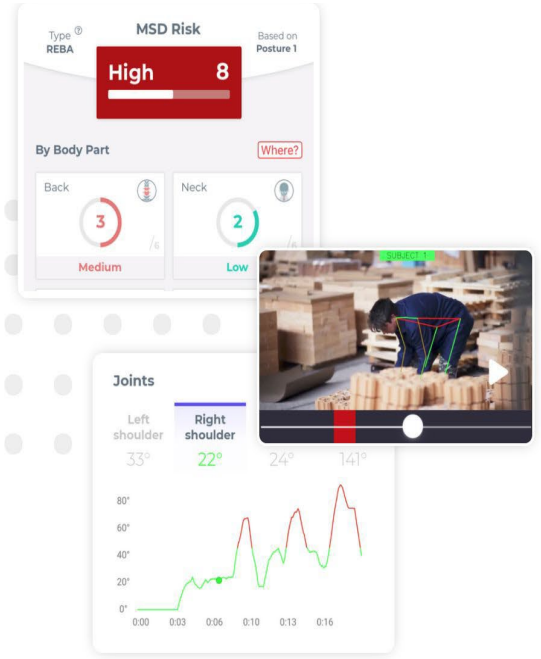

Comprehensive Risk Analysis

Stop filling out long assessment worksheets so you can focus on giving great recommendations.

- Summary of risk using standard medical techniques
- Risky postures highlighted in the video
- Get a risk score for each part of the body
- Joint angles visualized in charts for deeper analysis

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Artificial Intelligence for Ergo Apps

Other Key Features

Centralize and collaborate

Manage videos and assessment results across teams and devices

Analyze

Break assessments by team and job type, compare against company averages

Reports

Generate downloadable pdf reports with summary of risk and potential recommendations

Visualize

Dashboards with interactive charts to dig deeper into the data for custom insights

Wearable Technology Cost & Investment

Wearable Technology Costs

IMU/Physiological Sensors

Minimum Order Requirements

- **Pilot Stage** (~$5K – $10K)
- **Full Rollout** (~up to $50K or higher)

Exoskeletons/Exosuits

Minimum Order Requirements

- **Pilot Stage** (~$10K – $20K for passive exosuits)
- **Full Rollout** (~up to $100K or higher)

Artificial Intelligence (Ergo Apps)

Monthly and Annual Costs

- **Monthly Costs** (~$500 to $800)
- **Annual Costs** (~$6K to $10K)

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Pros and Cons of Wearable Technology

Wearable Technology Benefits

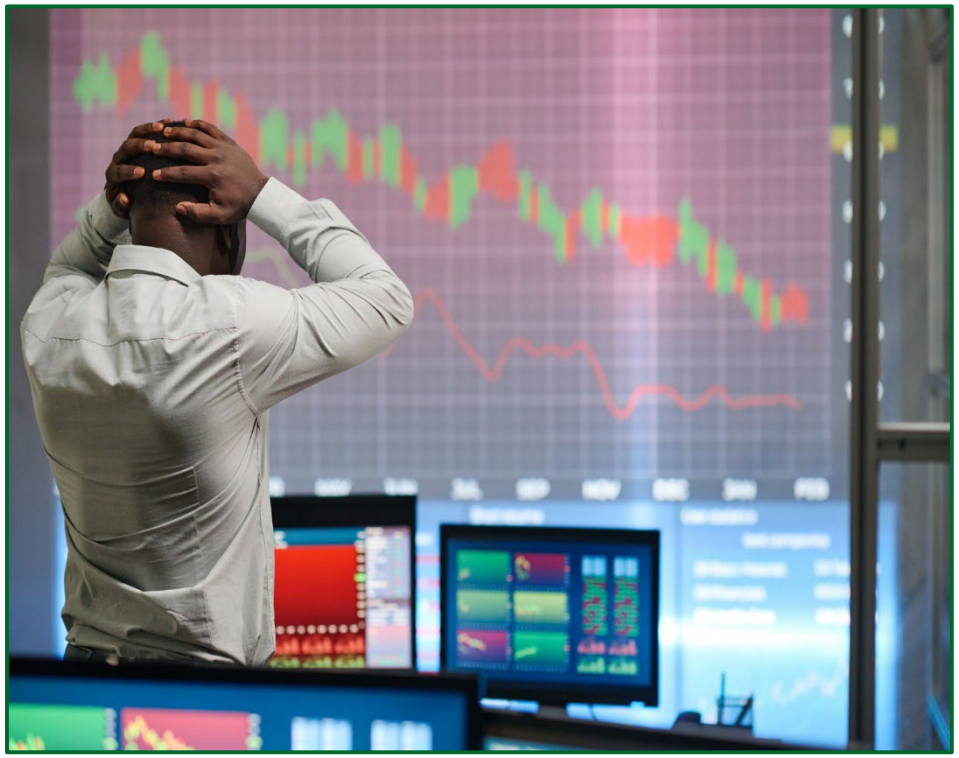
Wearable technology has the potential to:

- Drive rapid data results
- Generate detailed, specific data to help build a business case:
  - Return on investment (ROI)
  - Identifying critical patterns and trends (departments and specific areas)
- Create a promising job risk analysis, evaluation, or assessment
- Enhance employee wellness programs

Wearable Technology Challenges

Wearable technology could lead to:

- Employee distractions
  - Haptic feedback
- Adverse reactions
  - Comfort, range of motion, fit, etc. (adoption)
- Data security and **privacy** breach
- Over-trust or under-trust
  - Technology vs. employee feedback
- A negative safety culture
  - Blaming employees vs. coaching
- Financial and time management commitments



Conclusions on Research Studies

Conclusions on Research Studies

IMU & Physiological Sensors

- Lack of validated research (mostly case studies)
- Small and unrepresentative participant samples
- Testing performed in labs or simulated settings
- More research and validation is needed

Exoskeletons/Exosuits

- Positive results for increased performance, reduced energy expenditure and muscle activity, etc.
- Positive results for overhead (shoulder) work
- Discomfort, balance, and falls are still concerns
- Most transfer stress to another body part
- Unknown impact on whole-body fatigue
- Technology is still evolving
- More research is needed

Final Thoughts….

- Financial and time commitments are needed for long-term success
  - Senior management involvement
- Developing formal written programs
- A strong safety climate is a predictor of success & employee acceptance
- Organizations must understand the pros and cons before making a final decision
- Emerging technology, like ergonomic apps, appear to be more cost-effective
  - Need for an alternative approach

Questions or Comments?

thank you

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