

# I Like The Way You Move!

Movement Health Technology For The Workplace



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# Topics

01

**MSK Disease Scope and Impact**

02

**New Technologies**

03

**Case Studies**



MSK =  
Musculoskeletal



MSD =  
Musculoskeletal Disease

# Musculoskeletal Disease - A Global Issue

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- ~**1.71 billion** people w/MSD worldwide
- MSD is the **leading contributor** to disability worldwide
- **Low back pain** is the single leading cause of disability<sup>1</sup>

# 70 Million Office Visits

- In USA, MSD accounts for nearly **70 million** physician office visits/year
- **MSD drives 130 million total health care encounters** including outpatient, hospital, and emergency room visits



LOST WORKDAYS,  
WAGES  
**UP TO \$600 BILLION A YEAR**

- Institute in Medicine: **\$45-\$54B per year**
- Hinge Health: up to **\$600B per year**

## Medical Billing

Admission Date : August 14, 2016

Discharge date : August 17, 2016

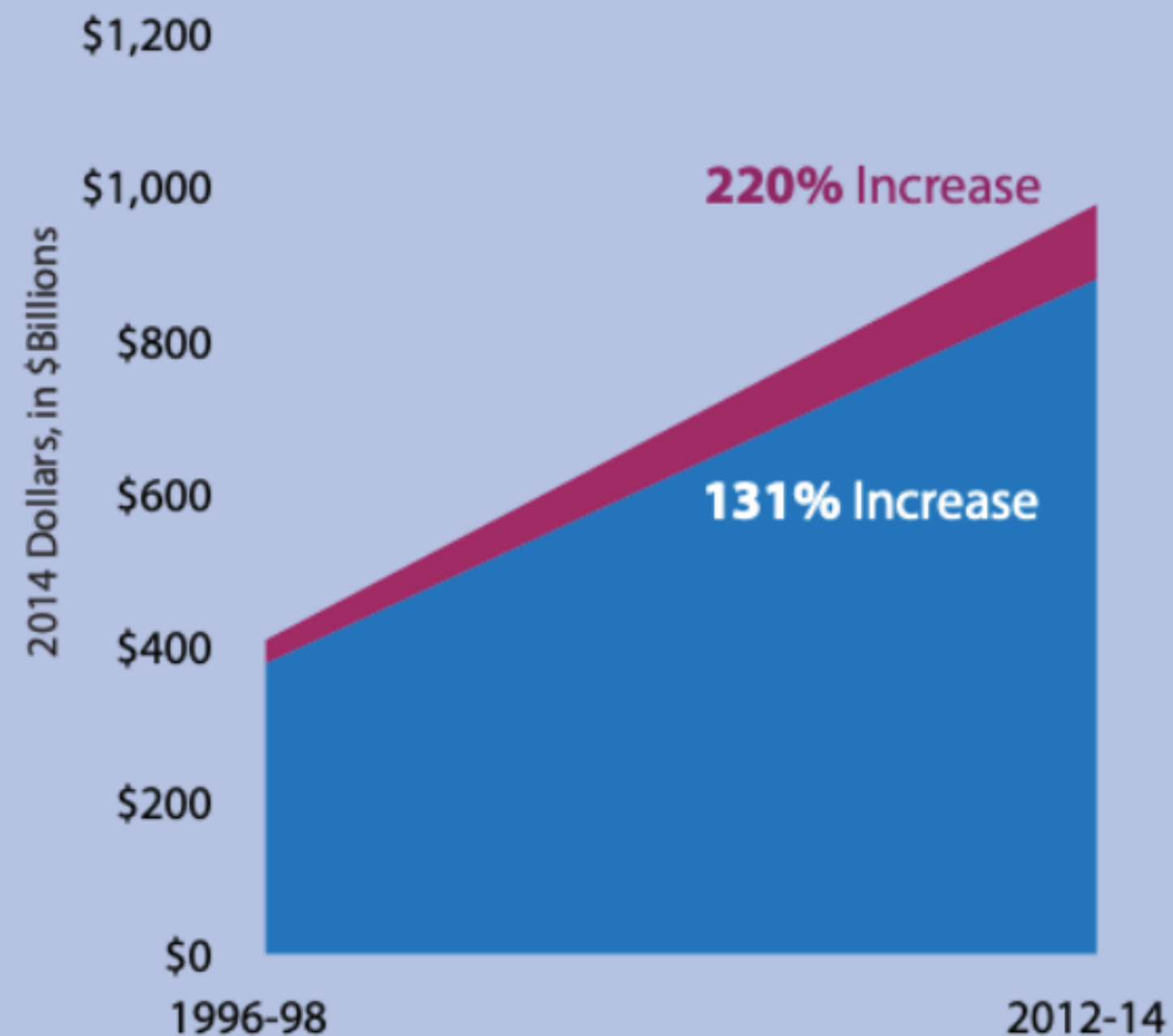
Service Date	Description
8-14-16	Admission charge
8-14-16	Med/Surg Private room
8-14-16	Chest X-Ray
8-14-16	Pharmacy
8-14-16	Chemistry
8-15-16	Med/Surg Private room
8-15-16	LabSurcharge Stat
8-15-16	Chest X-Ray2
8-15-16	Surgery 1 hour
8-15-16	Stapler Skin

# It's Getting Worse

Compared with the 1990s:

- **+131%** Treatment, Medication
- **+220%** Lost Wages
- **In 2014:** >US Defense Spending!

Jumps in TREATMENT COSTS and LOST WAGES because of MUSCULOSKELETAL DISORDERS, 1996-98 – 2012-14 (2014 dollars), in \$Billions



**INDIRECT COSTS**  
(Lost Wages)

**DIRECT COSTS**  
(Treatment, Medication)

# Impact on Work

10

Lost work days per employee per year

264M

Back pain ONLY total annual lost work days

BACK/ANKLE

Younger workers

ROTATOR CUFF

Older workers



# Hardest Hit: Small Business

"In the services sector, 89% of the 3 million firms have less than 20 employees, and these small businesses typically have **limited access to health and safety specialists.**" -CDC

*How can small businesses afford to keep up?*





# Better Professional Education

PROBLEM: **Just 54%** of surveyed medical students thought that their MSK education was adequate.

SOLUTION: "Medical schools in the US must teach **state-of-the-art** knowledge, skills and attitudes regarding the musculoskeletal system and its disorders." -*Bone and Joint Initiative*

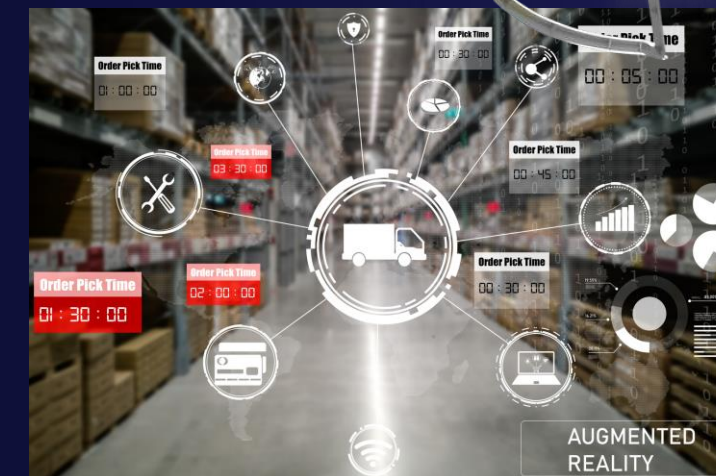
# How can **TECHNOLOGY** help

- **Clinicians**
- **Small Business**
- **Big Business**
- **Workers**



# New Technologies for Improved MSK Health

- Wearable tech
- Safety Apps
- Drones
- LiDAR
- Virtual & Augmented Reality
- Artificial Intelligence



# Not A Great Current "State-of-the-Art"

“Visual estimation and short goniometers **should not be used if an accurate assessment** is required.”

- *Hancock et al 2018*

NEW TECH FOR IMPROVED  
MSK HEALTH



# Costly, Wasteful...Not Helpful

"No association between MRI changes in the lumbar spine and intensity of pain, quality of life, depressive and anxiety symptoms in patients with **low back pain.**"

-Babinska et al 2019



# Wearables Can Measure...

- **Employee's physical activity**, posture, location
- **Workplace conditions** such as movement, light, humidity, temperature, and other conditions



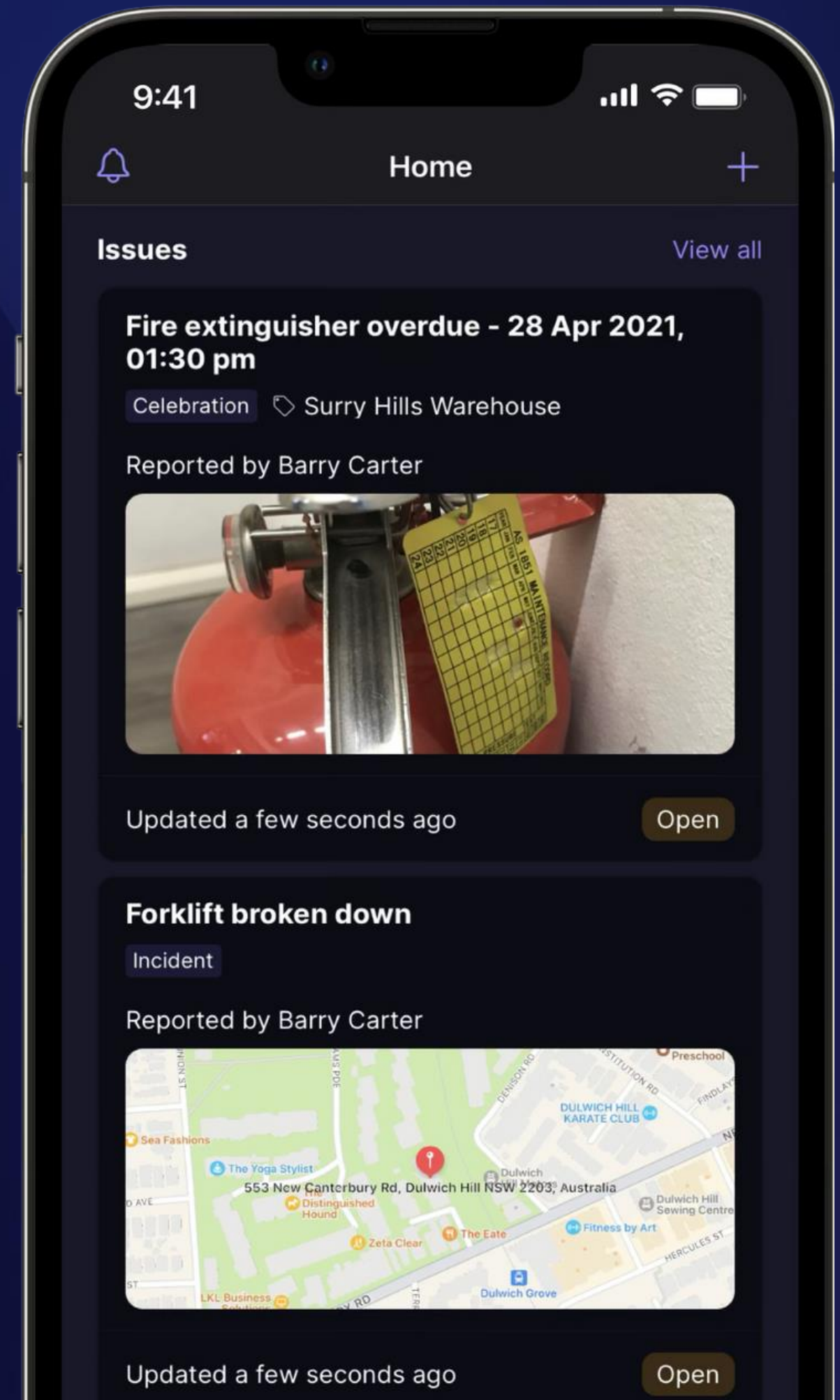
Some wearables can pair with 3rd party data—such as **weather conditions**  $\frac{1}{0}$



# Safety Apps

- Assess, monitor, and improve workplace safety
- Help evaluate **tasks** (ladder safety)
- Identify **hazards** (chemical, noise, etc)
- Maintain regulatory **compliance**
- Many are free  $\frac{1}{0}$

NEW TECH FOR IMPROVED  
MSK HEALTH



# Drones and Robots?

- **Drones inspect & monitor sites** to minimize employees' exposure to falls and other risks
- **Robots can access hazardous, difficult-to-reach locations**—such as tunnels and storage tanks—to limit or eliminate stress on workers' bodies<sup>10</sup>



# Virtual and Augmented

## Reality

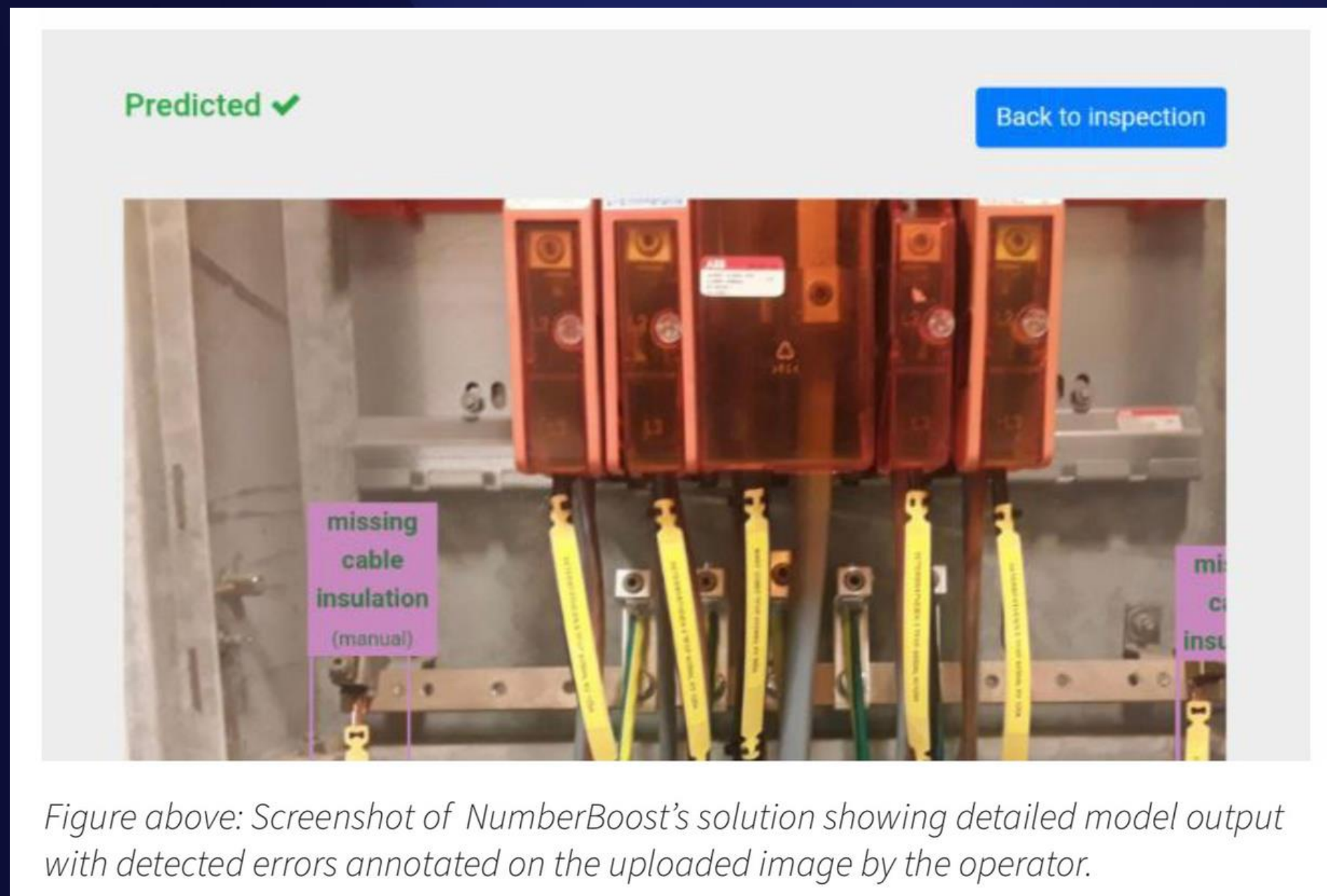
Simulate the task before your worker even starts the job:  $\frac{1}{0}$

- Measure risk in a safe environment
- Reduce & prevent injury

NEW TECH FOR IMPROVED MSK HEALTH

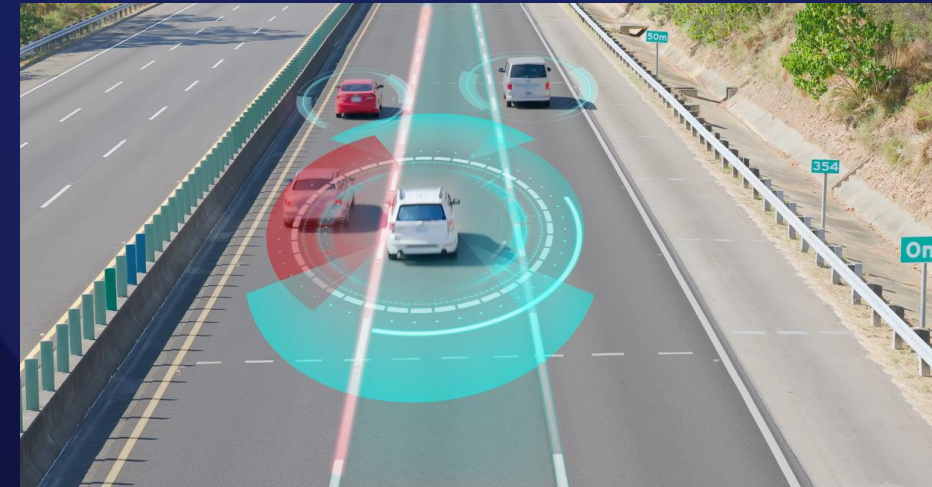
# Artificial Intelligence

Numberboost, a South African start up, uses AI to automatically **detect errors** on photos of electrical cabinets  $\frac{1}{0}$



# LiDAR

- Like RADAR, but with light
- Used in self-driving cars, to map geographies
- Provides a 3D view of entire environment
- **Innovative use: 3D map of human body movement**

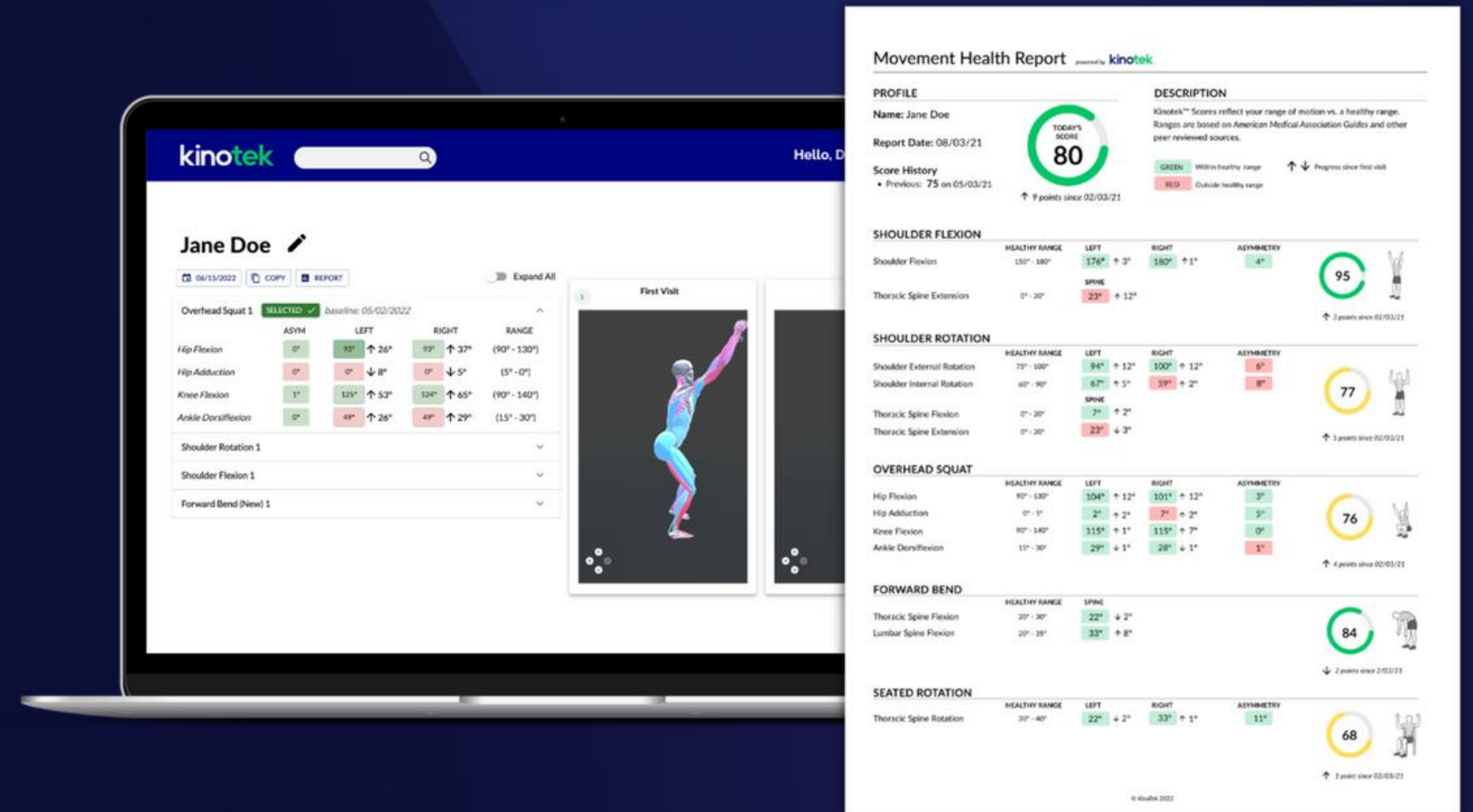


# Maine-Based Startup

Uses AI, ML and LiDAR to map

- Dynamic human movement
- Asymmetries
- Compensations
- Objective, consistent, accurate
- 3D visualizations

Aids in early detection of injury  
Speeds assessments and recovery  
Enable standardization



NEW TECH FOR IMPROVISED MSK HEALTH

# The Case Of Mistaken Pain

The screenshot displays a medical software interface with the following components:

- URL:** k.app/client/118de325-7a24-4869-bb67-9b7337f8c839/
- Buttons:** COPY, REPORT, Expand All (toggle), Selected: 08/20/2021
- Timeline:** line: 07/29/2021
- SPINE Section:**
  - 14° ↓ 1° (20° - 35°)
  - 27° ↓ 1° (20° - 40°)
- Selected Section (baseline: 08/20/2021):**

ASYM	LEFT	RIGHT	RANGE
2°	20°	21°	(90° - 140°)
10°	17°	27°	(90° - 130°)
14°	105°	119°	(150° - 180°)
- 3D Model:** A 3D anatomical model of a human figure with a red overlay on the right side of the torso. A legend on the left lists: Frontal Plane (Movement on the Sagittal Axis), Sagittal Plane (Movement on the Frontal Axis), and Transverse Plane (Movement on the Rotational Axis). Checkboxes for 'Show Asymmetry', 'Shoulder', 'Hip', 'Neck', and 'Spine - Thoracic' are visible.
- Navigation:** A small 3D figure icon and a directional pad (up, down, left, right arrows) are located at the bottom left of the 3D model area.

NEW TECH FOR IMPROVED MSK HEALTH

# The Case Of Mistaken Blame



NEW TECH FOR IMPROVED MSK HEALTH



# Let's See How Technology Can Work on You

NEW TECH FOR IMPROVED MSK HEALTH

Questions?





# References:

1. "Musculoskeletal Health." World Health Organization, World Health Organization, July 2022, <https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions>.
2. "Work-Related Musculoskeletal Disorders & Ergonomics." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 12 Feb. 2020, <https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html>.
3. "IIF News Releases." U.S. Bureau of Labor Statistics, U.S. Bureau of Labor Statistics, Jan. 2022, <https://www.bls.gov/iif/home.htm>.
4. "BMUS: The Burden of Musculoskeletal Diseases in the United States." BMUS: The Burden of Musculoskeletal Diseases in the United States, 2022, <https://www.boneandjointburden.org/>.
5. Kersey, Laura. "Technology at Work - Wearables in Workers Compensation." NCCI Holdings Inc., June 2019, [https://www.ncci.com/Articles/Pages/II\\_Insights\\_Wearables.aspx](https://www.ncci.com/Articles/Pages/II_Insights_Wearables.aspx).
6. "Technology for Workplace Safety." Chubb, 2022, <https://www.chubb.com/us-en/businesses/resources/4-technologies-to-improve-workplace-safety.html>.
7. Lou, Candice & Solms, Sebastiaan. (2015). Game, Settings, Match - The Impact and Future of Wearable Technology in Fitness and Healthcare.
8. Sabesan, Vani. "Musculoskeletal Education in Medical Schools: A Survey of... : Jaaos Global Research & Reviews." Journals.lww.com, 2018.
9. [https://journals.lww.com/jaaosglobal/Fulltext/2018/06000/Musculoskeletal\\_Education\\_in\\_Medical\\_Schools\\_\\_A.1.aspx](https://journals.lww.com/jaaosglobal/Fulltext/2018/06000/Musculoskeletal_Education_in_Medical_Schools__A.1.aspx).
10. S, N. "Safety Technologies." National Safety Council: Explore Safety Technologies, 2022, <https://www.nsc.org/workplace/safety-topics/work-to-zero/safety-technologies>.
11. National Council on Compensation Insurance. Workers Compensation and the Aging Workforce. December 2011. [https://www.ncci.com/Articles/Pages/II\\_2011\\_Aging\\_Workforce\\_Research\\_Brief.pdf](https://www.ncci.com/Articles/Pages/II_2011_Aging_Workforce_Research_Brief.pdf)
12. National Council on Compensation Insurance. March 2021. Latest trends in worker demographics. <https://www.ncci.com/Articles/Pages/Insights-Latest-Trends-Worker-Demographics.aspx#>