

Manager

Expert

Worker





That affects
my
motivation,
stress, and
productivity

40% of all employees have a WMSD

A photograph of three people in a factory setting. On the left, a man with glasses and a beard in a light blue shirt holds a clipboard. In the center, a woman in a white lab coat looks on. On the right, a man in a yellow hard hat and safety glasses works on a machine. Three thought bubbles are overlaid on the image: a blue one above the man on the left, a blue one above the woman, and a teal one above the man in the hard hat.

Based on my
risk
assessment,
there should
be no injury

That affects
my
motivation,
stress, and
productivity

I hope I used
the right
assessment.
These are not
objective and
time consuming

40% of all employees have a WMSSD

A photograph of three people in a factory setting. On the left, a man with glasses and a beard, wearing a light blue shirt, holds a black clipboard. In the center, a woman with brown hair, wearing a white lab coat over a light blue shirt, looks on. On the right, a man wearing a yellow hard hat, safety glasses, and a dark blue long-sleeved shirt is working on a machine. Four thought bubbles are present: a purple one for the man on the left, a blue one for the woman, a blue one for the man on the right, and a teal one for the man on the right. A teal banner is at the bottom.

Total cost of a worker staying home due to a WMSD

350 euros
per day

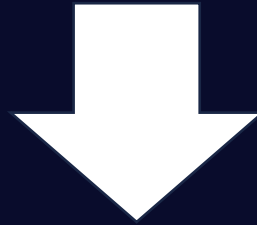
Based on my risk assessment, there should be no injury

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40% of all employees have a WMSD

How and when does a work-related musculoskeletal disorder originate?



Can we use that information to prevent future injuries?

**Advanced
Musculoskeletal
Modeling
Techniques to
Complement
Ergonomic Decision
Making in the
Workplace**

Tuur van der Have

Dr. Tuur van der Have

Human Movement Biomechanics Research Group
KU Leuven



**Advanced
Musculoskeletal
Modeling
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Making in the
Workplace**

A method to quantify
the physical load during
occupational tasks

But why is this important?

Tuur van der Have

How does a work-related musculoskeletal disorder originate?

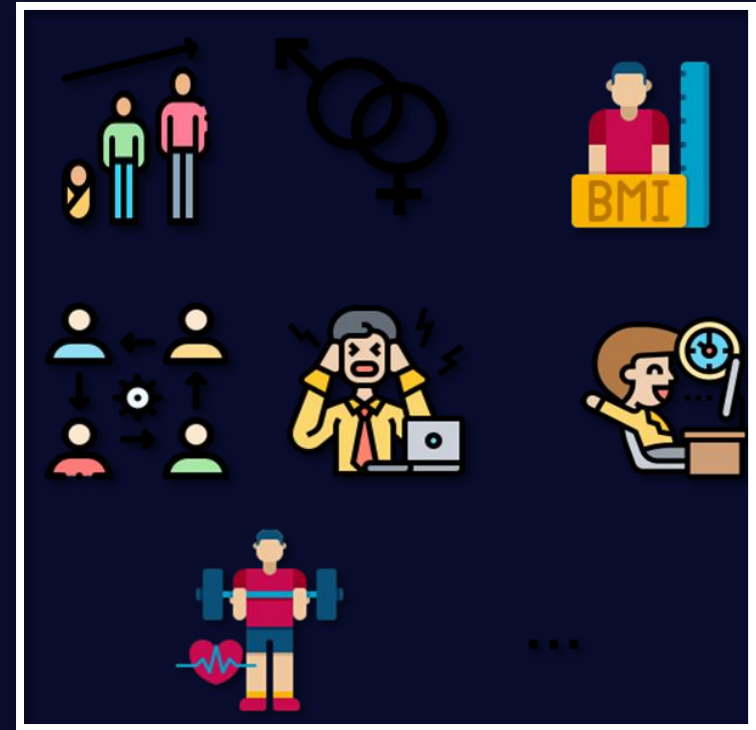
Physical load



Loading capacity

How does a work-related musculoskeletal disorder originate?

Physical load



How does a work-related musculoskeletal disorder originate?

A. Arm en pols

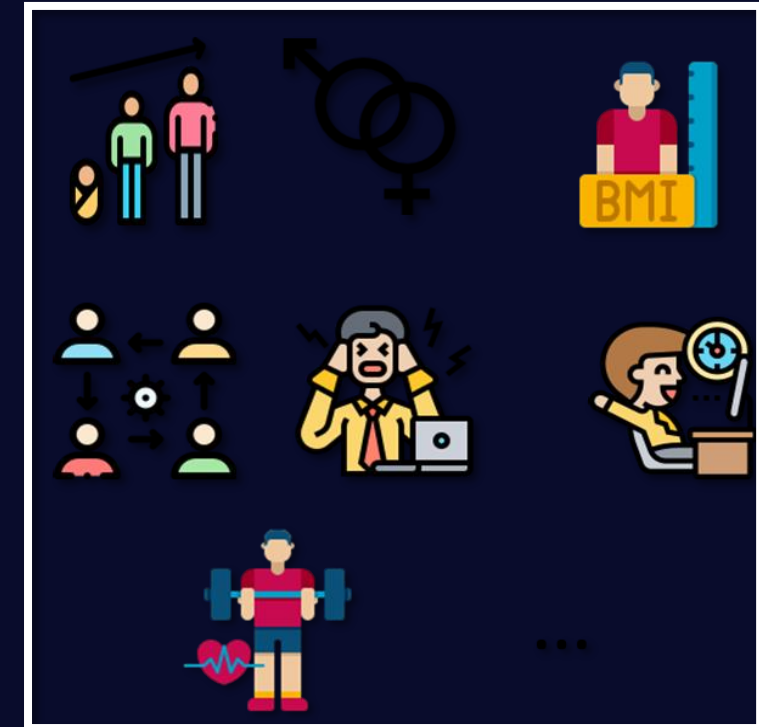
Stap 1: Bovenarm

Aanpassingen:
Opgetrokken schouder:
Abductie (zijwaarts)
Arm ondersteund op

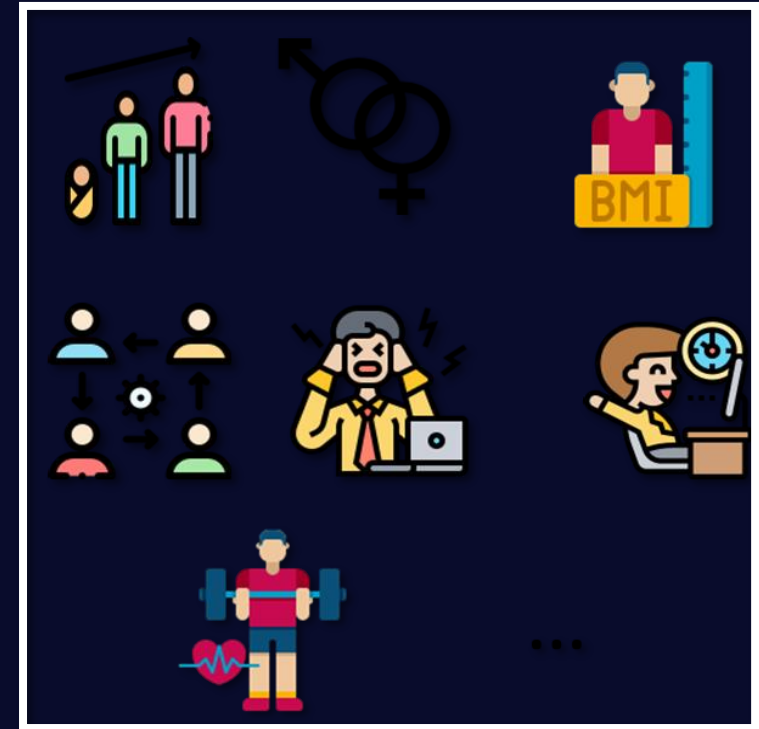
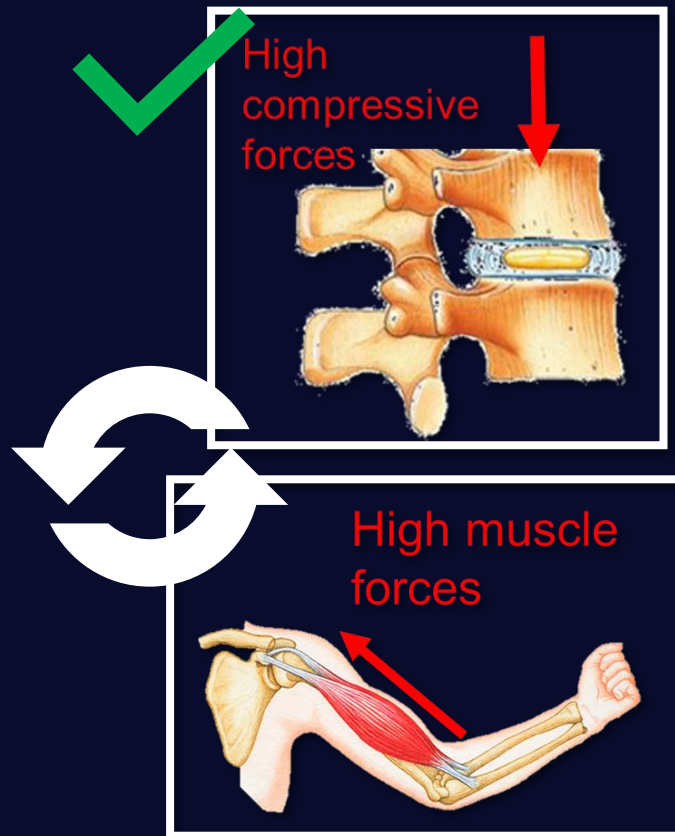
Stap 2: Onderarm

Aanpassingen:
Onderarm werkt over middellijn
Onderarm werkt zijwaarts van

Start/einde	Einde/start	Aantal punten	Start/einde	Einde/start	Aantal punten	Extra punten (max. 6 punten) <i>Alleen relevant indien van toepassing</i>
		0			10 ²⁾	Soms draaien of zijwaarts buigen van romp herkenbaar +1
		3			13 ²⁾	Vaak/voortdurend draaien of zijwaarts buigen van romp herkenbaar +3
		5			15 ²⁾	Zwaartepunt van last of handen <u>soms</u> van lichaam af +1
		7			18 ²⁾	Zwaartepunt van last of handen <u>vaak/voortdurend</u> van lichaam af +3 ²⁾
		9 ²⁾			20 ²⁾	Armen af en toe geheven, handen tussen elleboog- en schouderhoogte +0,5
						Armen vaak/voortdurend geheven, handen tussen elleboog- en schouderhoogte +1
						Handen af en toe boven schouderhoogte +1
						Handen vaak/voortdurend boven schouderhoogte +2 ²⁾
						Aantal punten LH + extra punten = Totaal (max. 6 punten)



How does a work-related musculoskeletal disorder originate?

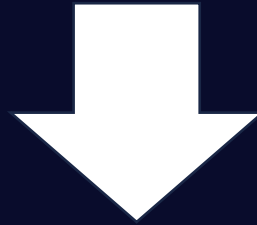


3 main question originate from this figure



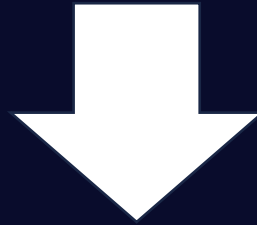
- 1) How do we quantify those forces?
- 2) Do ergonomic principles appropriately manage the internal forces?
- 3) When is there an imbalance?
→ injury

How and when does a work-related musculoskeletal disorder originate?



- 1) How do we quantify those forces?
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- 3) When is there an imbalance?
→ injury

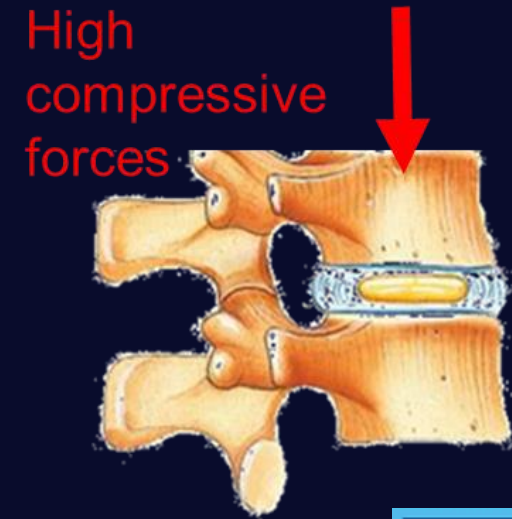
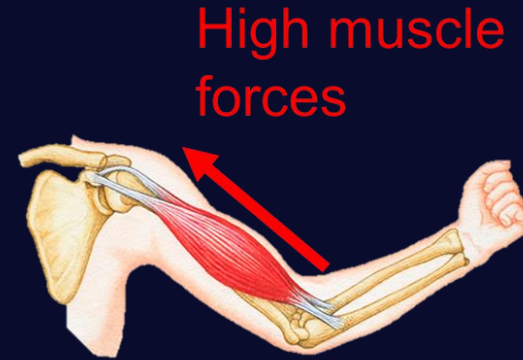
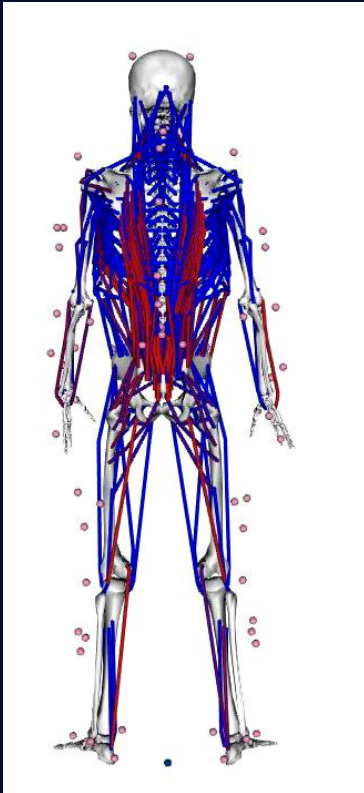
How and when does a work-related musculoskeletal disorder originate?



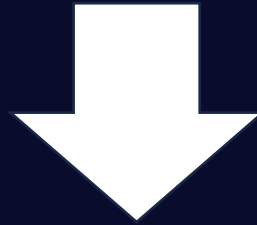
- 1) How do we quantify those forces?
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→ injury

Full-body musculoskeletal models can be used to estimate these risk factors

A mathematical description of the human musculoskeletal system including bones, joints, and muscles



How and when does a work-related musculoskeletal disorder originate?



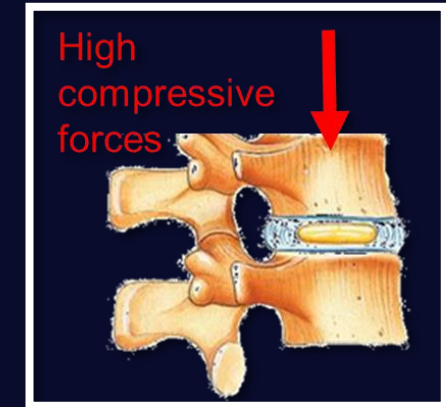
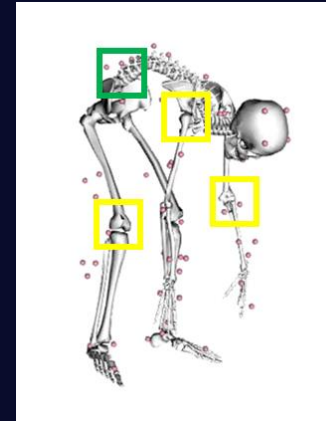
- 1) How do we quantify those forces?
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- 3) When is there an imbalance?
→ injury

Loading topography during occupational tasks

Low lift



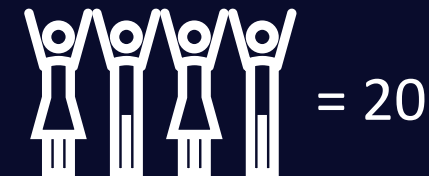
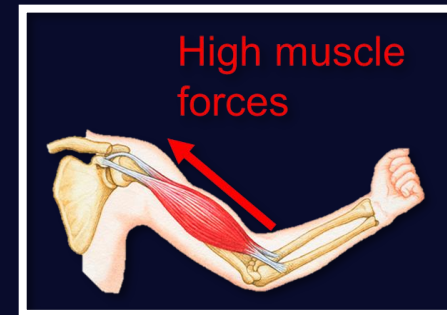
Ergonomic lift



Overhead wiring

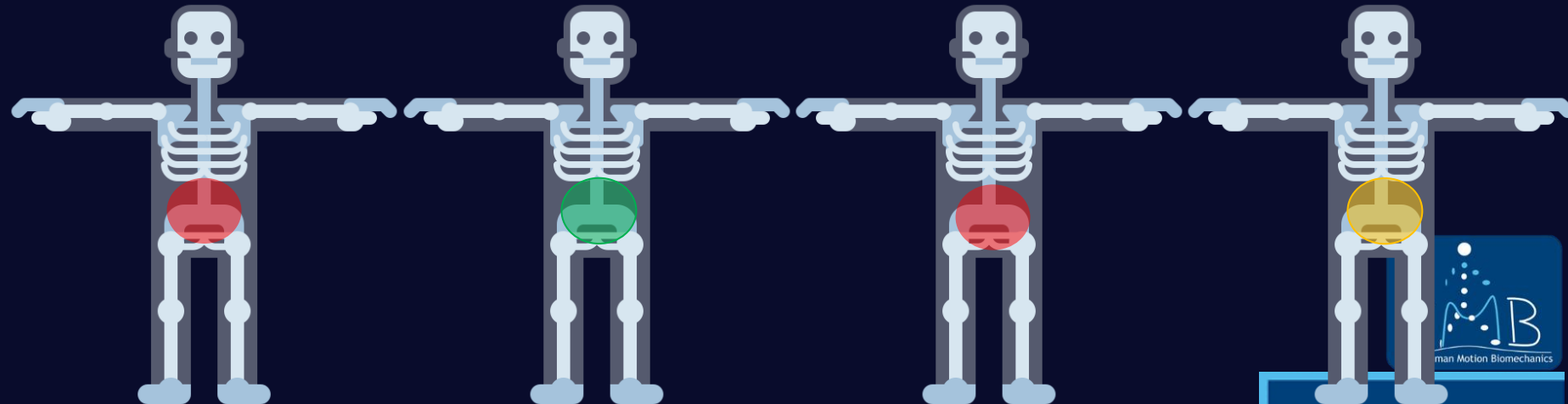


Stoop



Job rotation based on a single joint analyses

Start/finde	Einde/finde	Aantal punten	Start/finde	Einde/finde	Aantal punten	Extra punten (max. 6 punten) Alleen relevant indien van toepassing
		0			10 ¹⁾	Soms draaien of zijwaarts buigen van romp herkenbaar +1
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		9 ¹⁾			20 ¹⁾	Armen af en toe heffen, handen tussen elleboog- en schouderhoogte +0,5
						Armen vaak voortdurend heffen, handen tussen elleboog- en schouderhoogte +1
						Handen af en toe boven schouderhoogte +1
						Handen vaak voortdurend boven schouderhoogte +2 ¹⁾
		Aantal punten LH			extra punten	Totaal



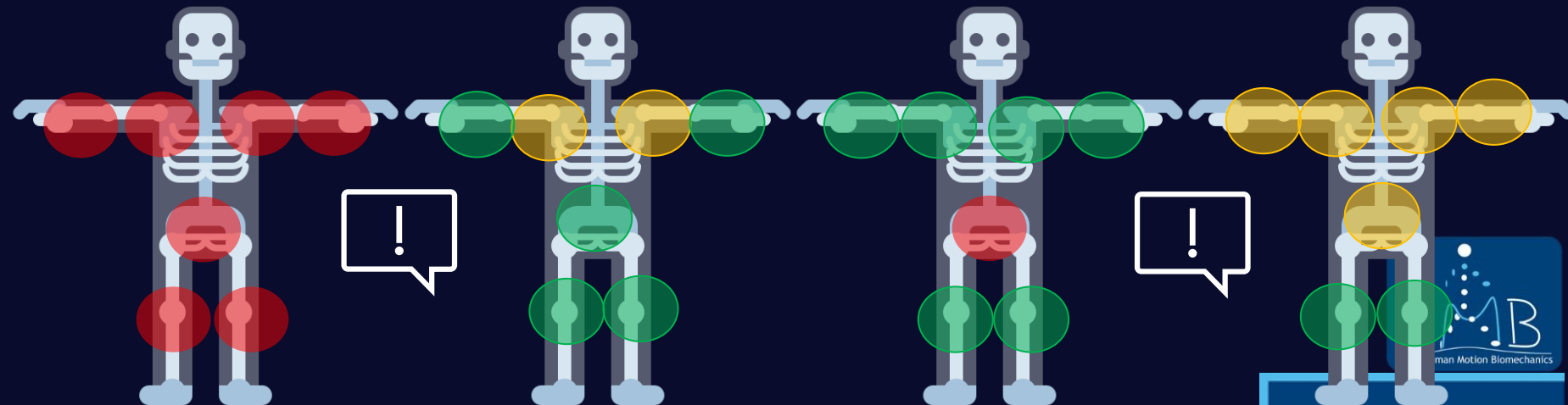
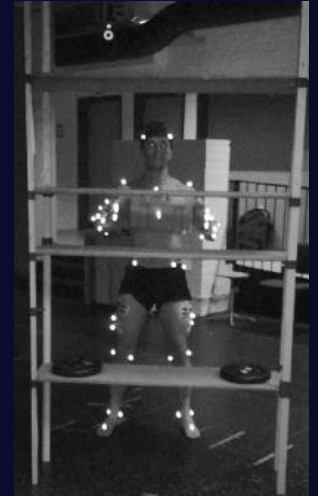
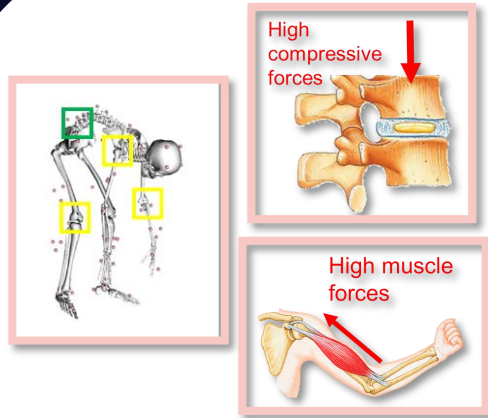
Your
MATE
in ergonomics



man Motion Biomechanics

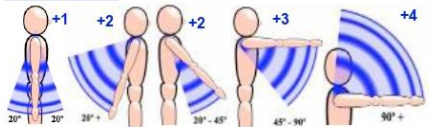
KU LEUVEN

Job rotation based on loading topography



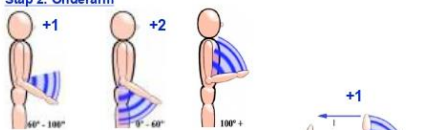
There is a difference!

A. Arm en pols
Stap 1: Bovenarm



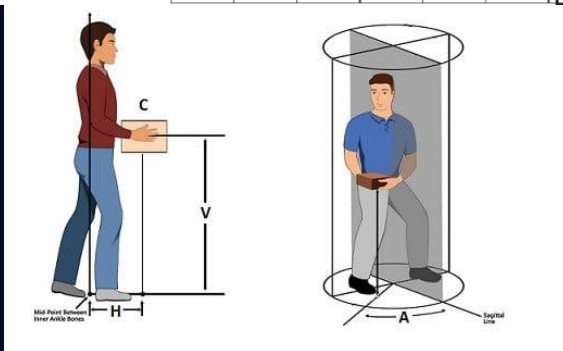
Aanpassingen:
 Opgetrokken schouder: +1
 Abductie (zijwaarts heffen): +1
 Arm ondersteund of persoon leunt: -1

Stap 2: Onderarm

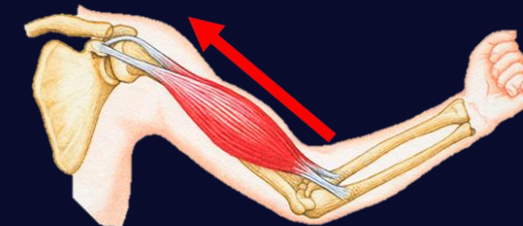


Aanpassingen:
 Onderarm werkt over middellijn: +1
 Onderarm werkt zijwaarts van lichaam: +

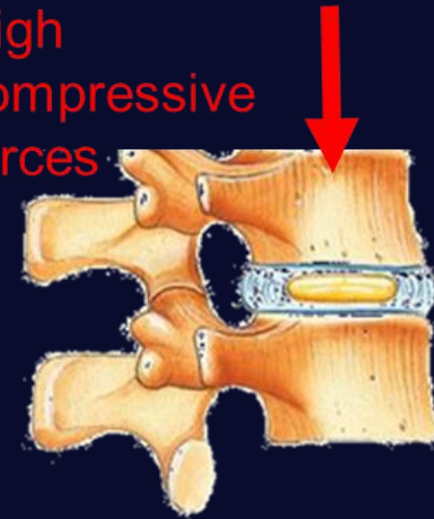
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		9 ²⁾			20 ²⁾							
<table border="1"> <thead> <tr> <th>Aantal punten LH</th> <th>extra punten</th> <th>Totaal</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>						Aantal punten LH	extra punten	Totaal				
Aantal punten LH	extra punten	Totaal										



High muscle forces



High compressive forces



Confirmed by other papers

We know it doesn't work: Why do we still use how to lift training for the prevention of musculoskeletal disorders?

Jodi Oakman ^a, Katrina A. Lambert ^b, Susan Rogerson ^c, Alison Bell ^d

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<https://doi.org/10.1016/j.ergon.2023.103542>

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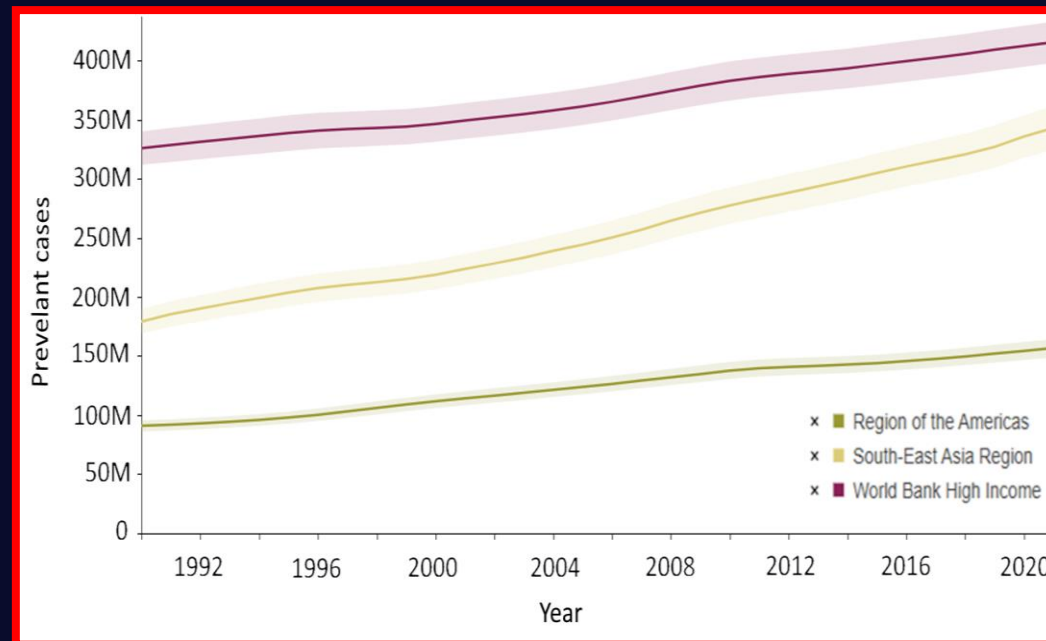
Highlights

- How to lift training remains highly prevalent in MSD prevention.
- Employers continue to use HTLT training in their MSD prevention strategies.
- OHS professional will offer HTLT training if requested despite its ineffectiveness.
- Greater focus needed on ensuring translation of research evidence into practice.

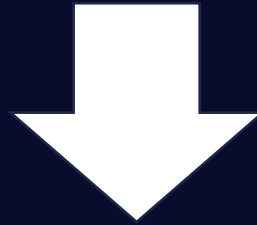
Effect of training and lifting equipment for preventing back pain in lifting and handling: systematic review

BMJ 2008 ; 336 doi: <https://doi.org/10.1136/bmj.39463.418380.BE> (Published 21 February 2008)

Conclusions There is no evidence to support use of advice or training in working techniques with or without lifting equipment for preventing back pain or consequent disability. The findings challenge current widespread practice of advising workers on correct lifting technique.

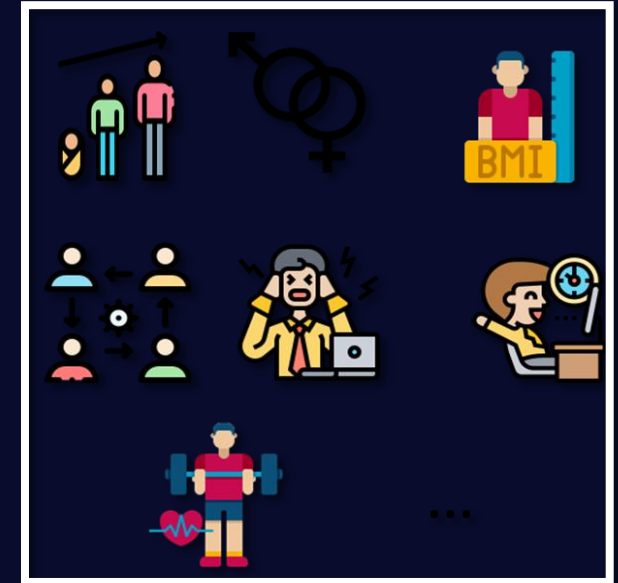
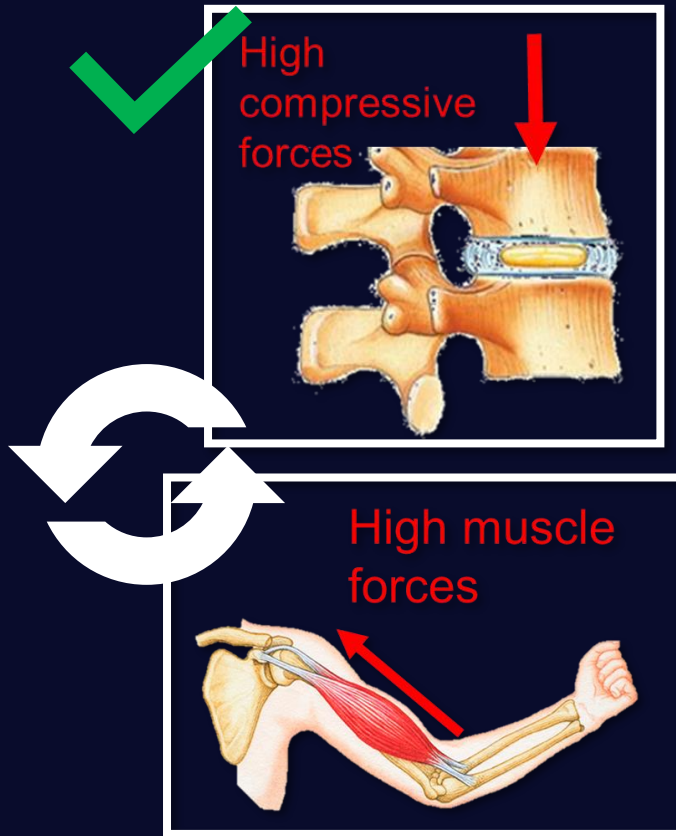


How and when does a work-related musculoskeletal disorder originate?

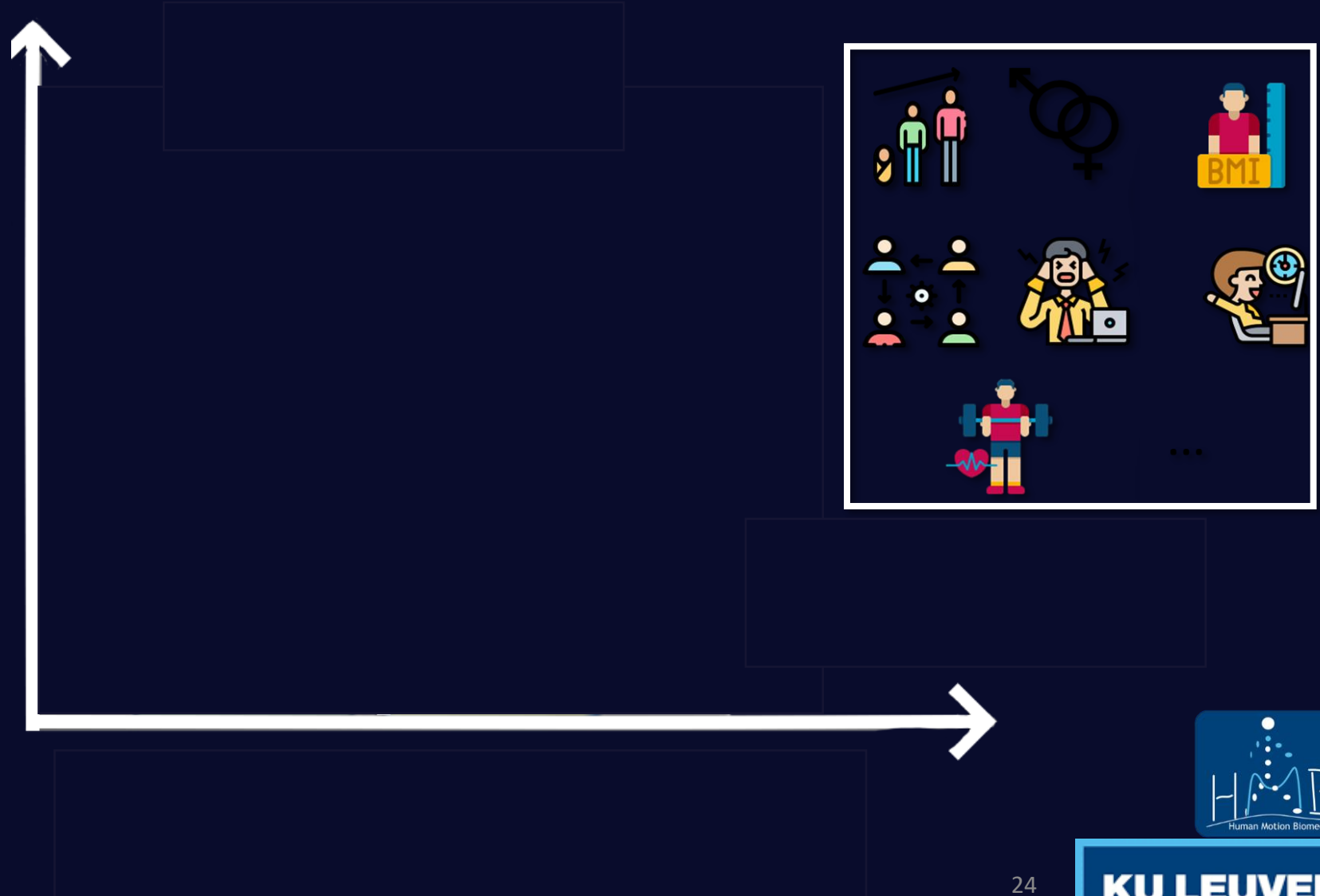
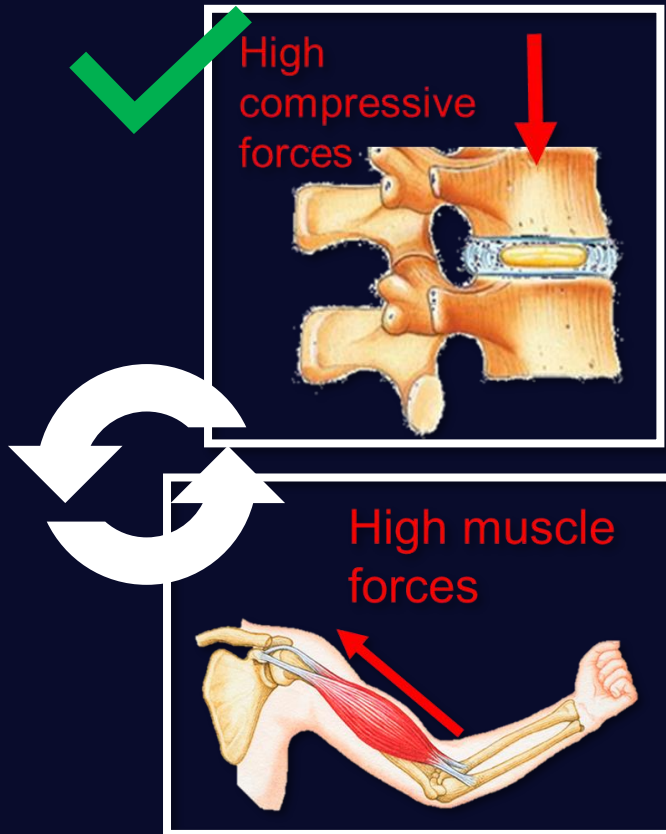


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→ injury

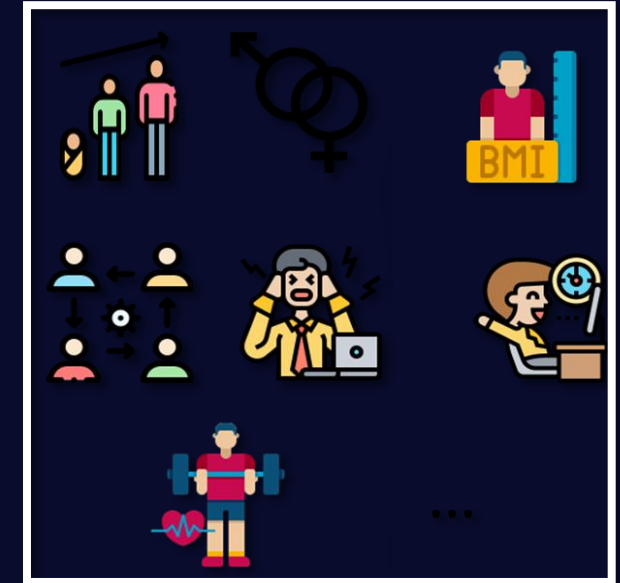
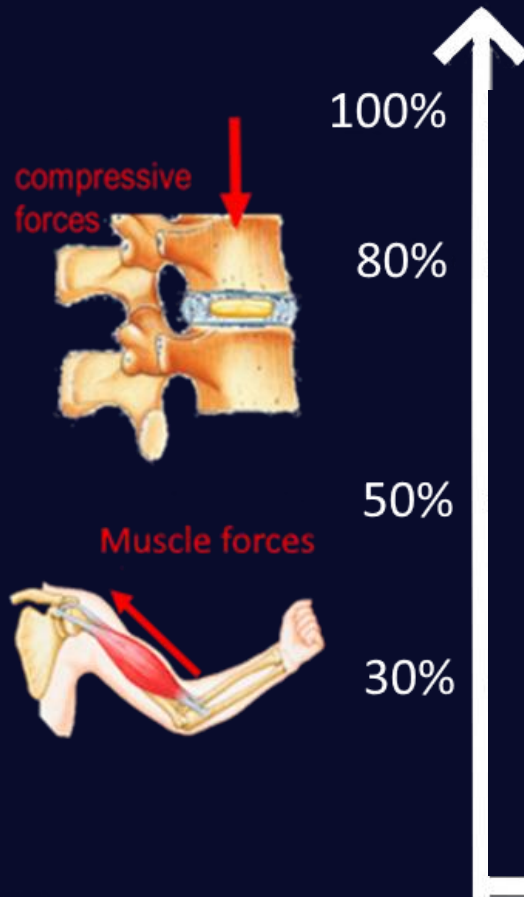
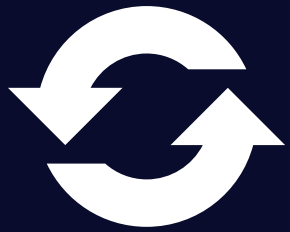
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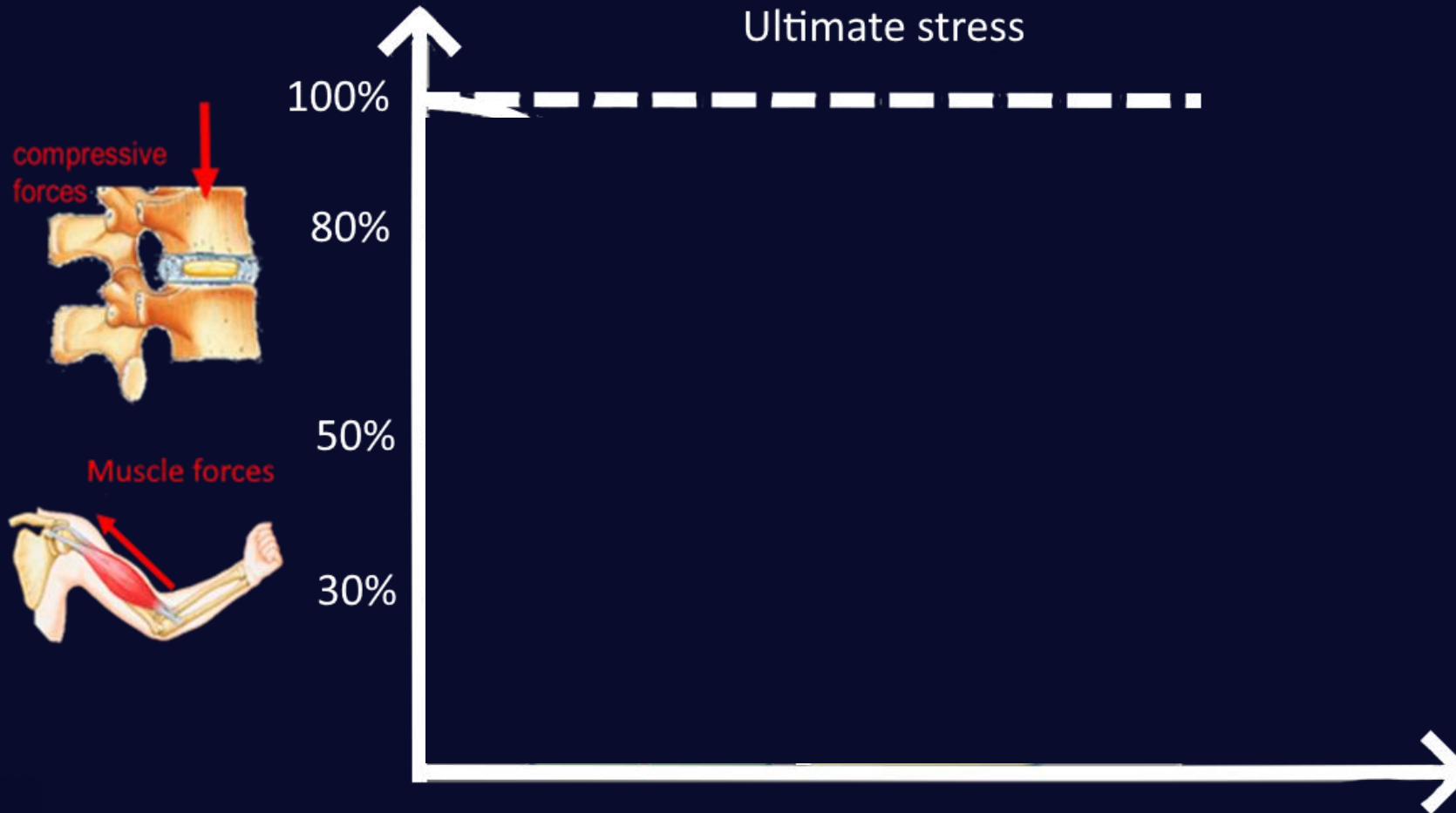
How does a work-related musculoskeletal disorder originate?



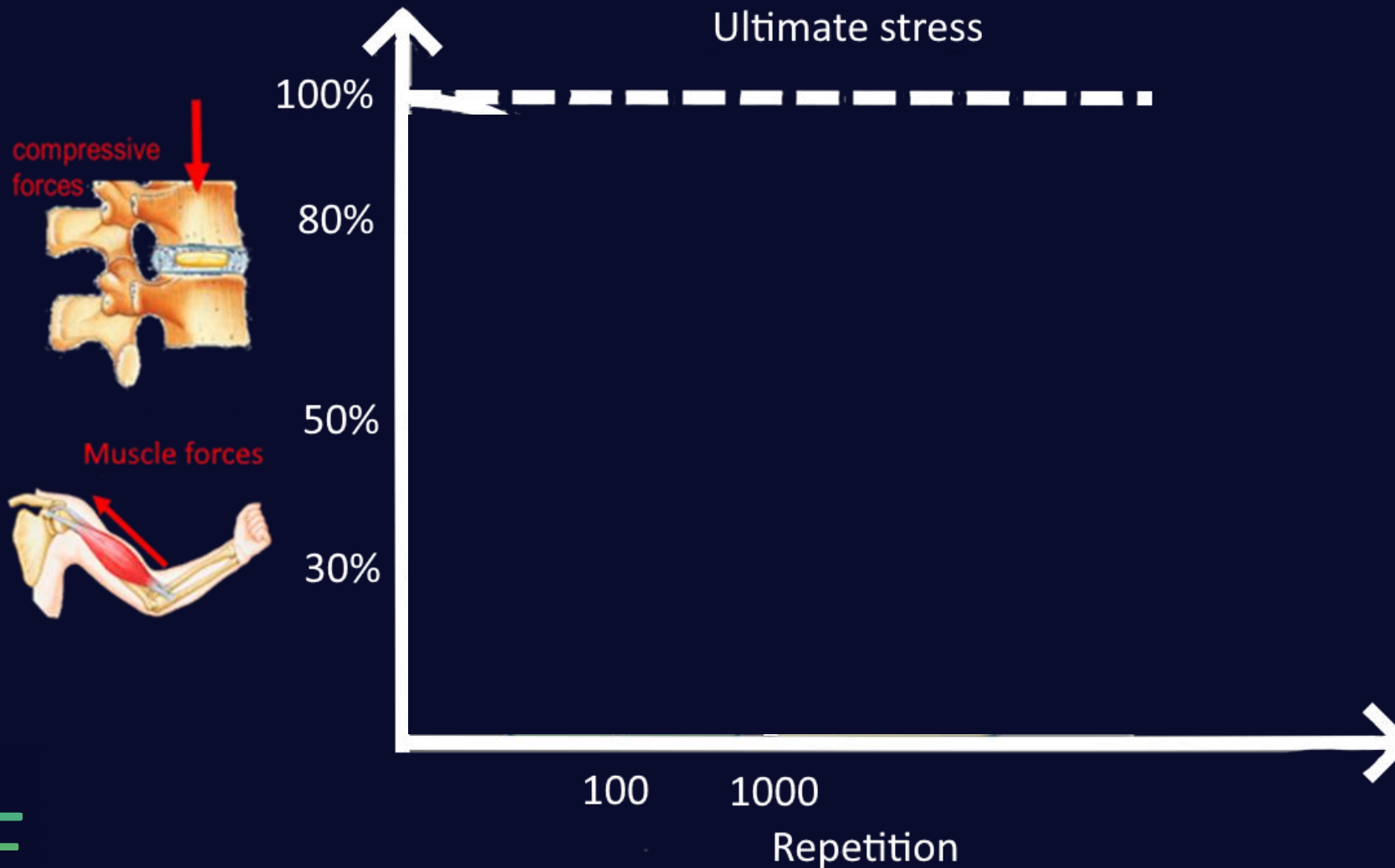
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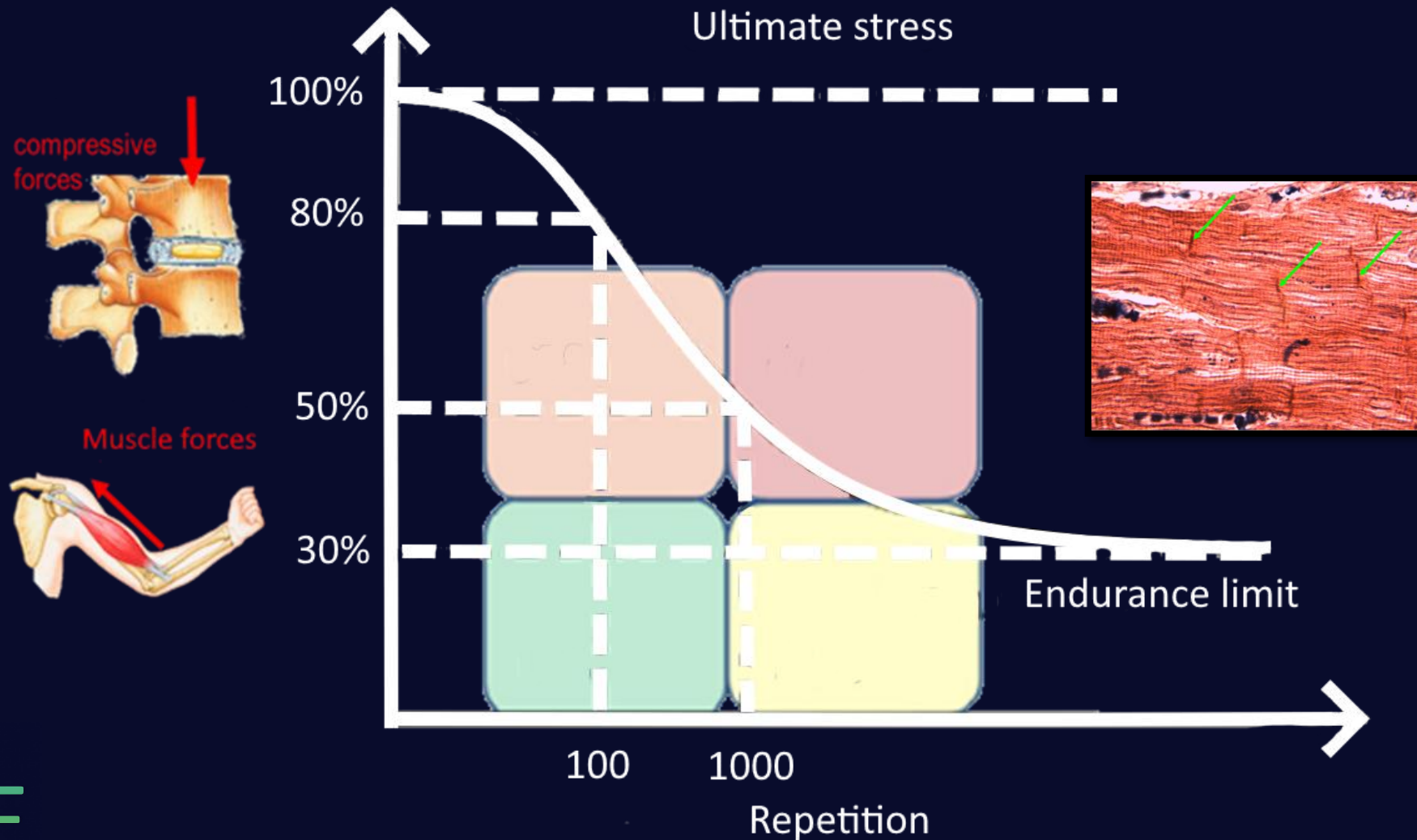
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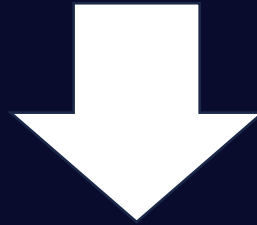
How does a work-related musculoskeletal disorder originate?



How does a work-related musculoskeletal disorder originate?



How and when does a work-related musculoskeletal disorder originate?



Can we use that information to prevent these injuries?

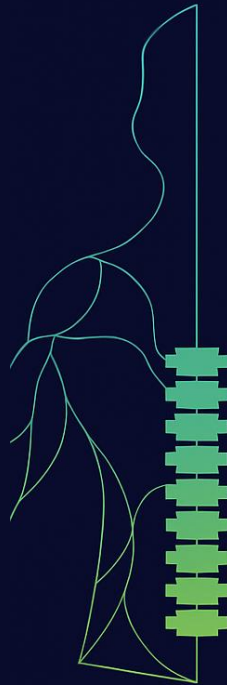
Existing ergonomic risk assessments neglect multiple factors



1. Focus on the spine
 2. Static postures
 3. Worker-specific characteristics
 4. Assistive devices
- + Subjective
 - + Every task, different ergonomic risk assessment

Advanced
Musculoskeletal
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Making in the
Workplace

Tuur van der Have

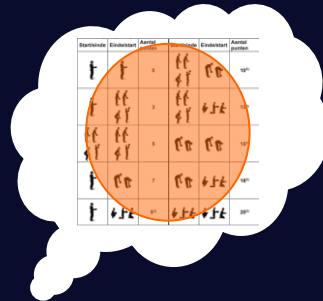
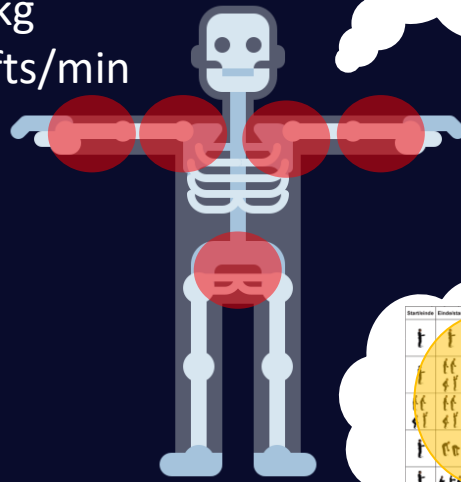


Your
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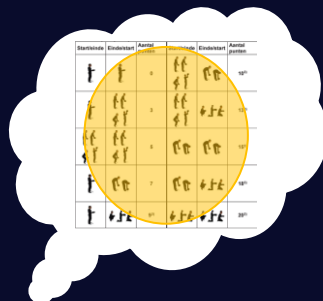
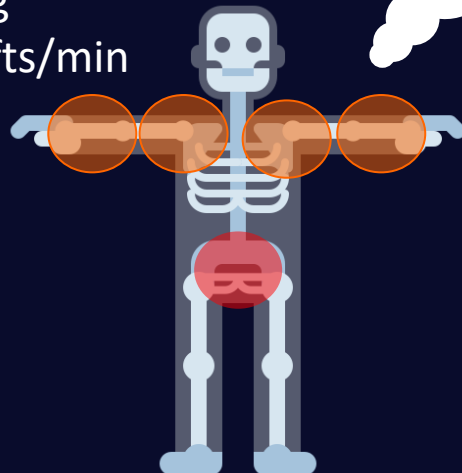
Reducing the weight or the handling frequency?



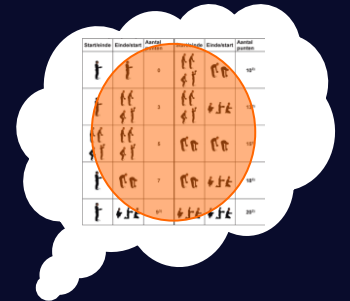
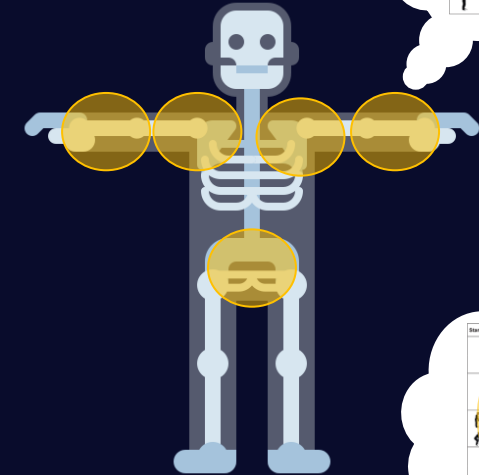
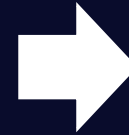
10 kg
3 lifts/min



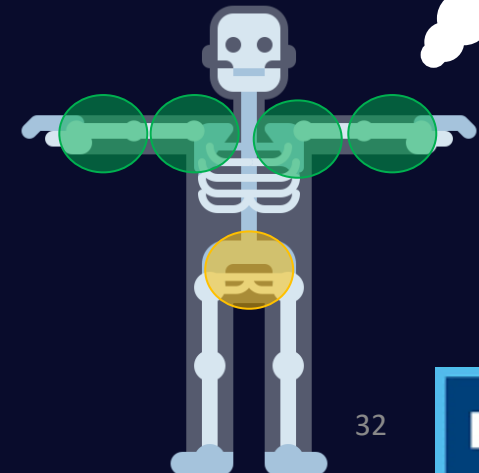
3 kg
3 lifts/min



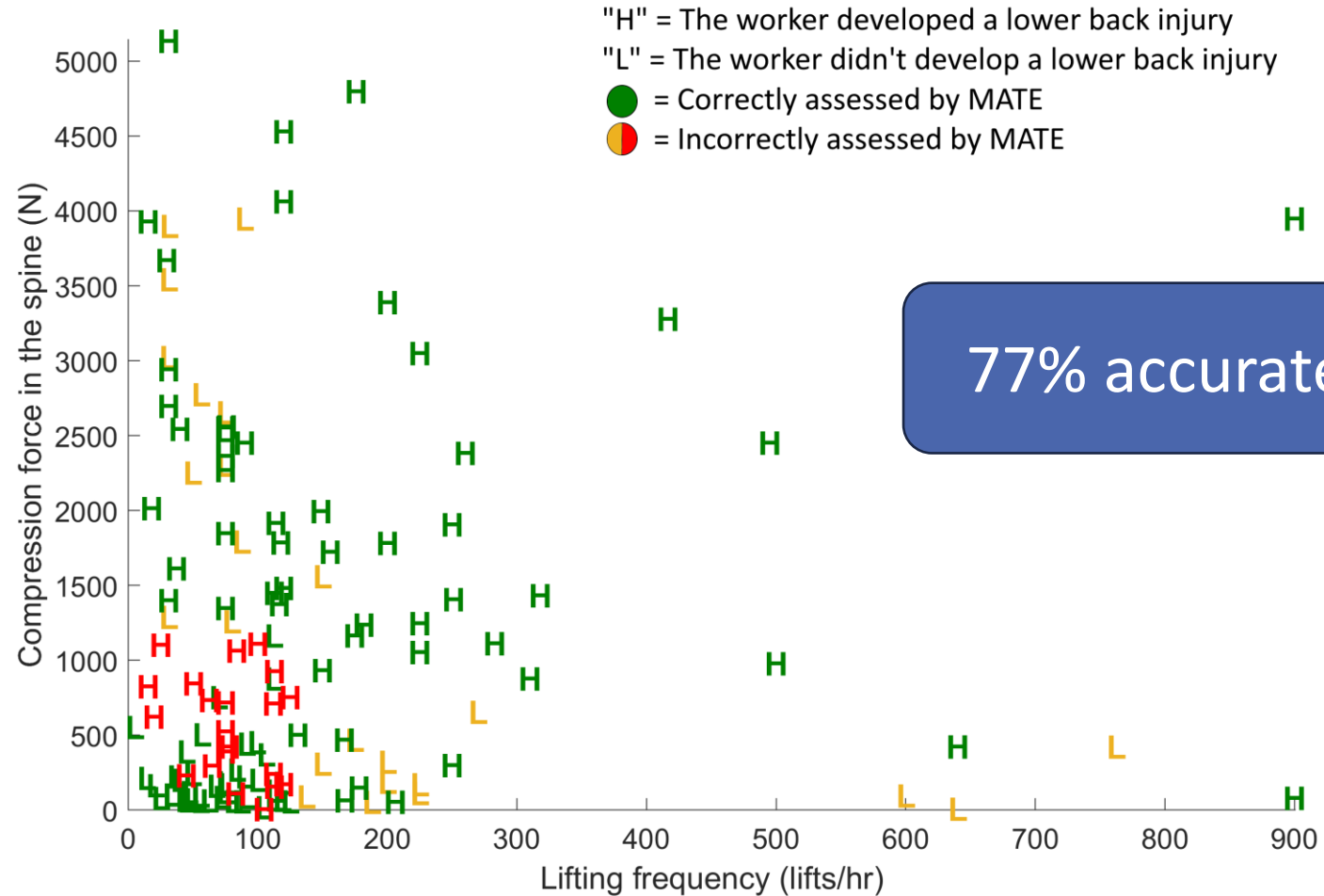
Reduce
lifting
frequency



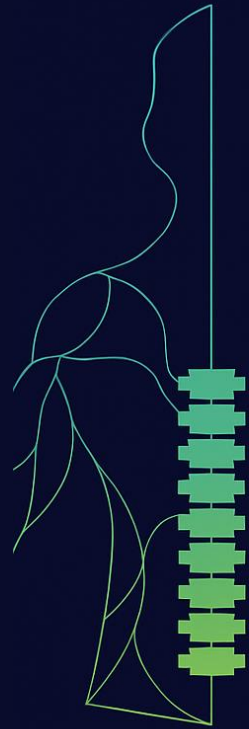
Reduce
lifting
frequency



MATE = evidence-based estimation of overloading

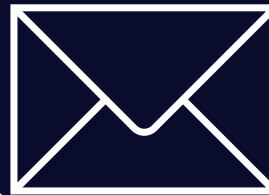


NIOSH = 9% accurate on the same database



Your MATE in ergonomics

IMU measurements



Your MATE Report

Summary of the motion

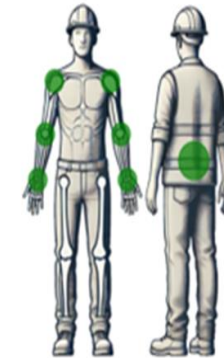
The motion with trialID: [redacted] is evaluated in this report. The report belongs to [redacted] who handled a load of 1 kg and is performed with a lifting frequency of 1 lifts per minute.

Overall loading evaluation



Joint specific loading evaluation

For each joint, the MATE evaluated its loading.



+RULA
+REBA
+KIM



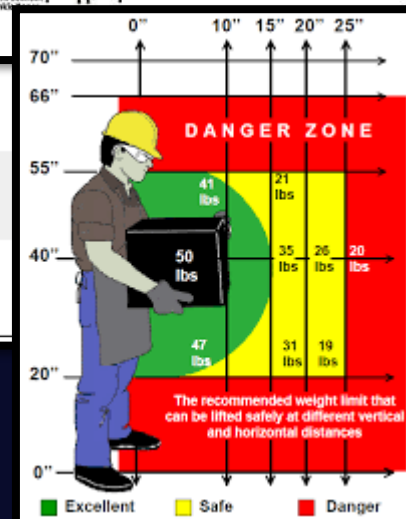
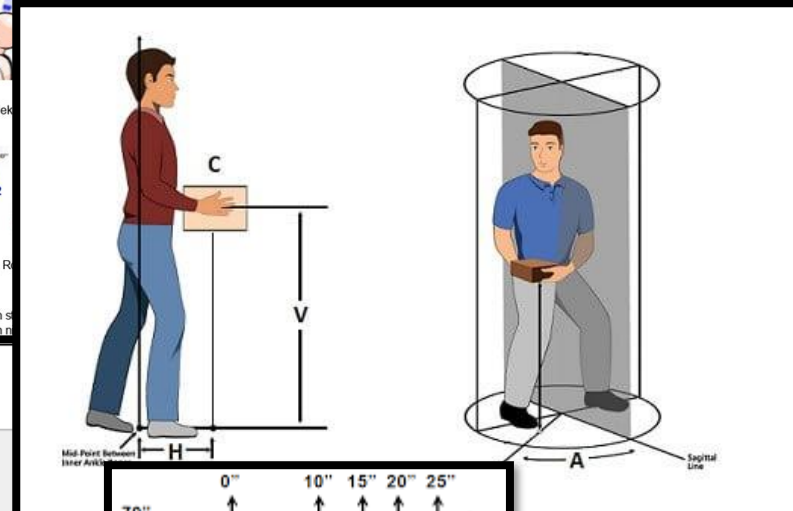
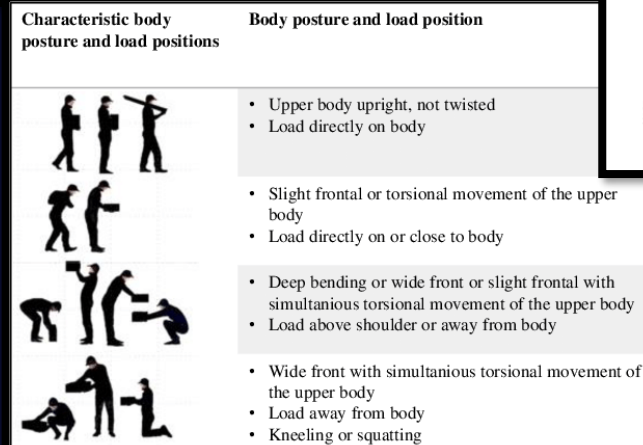
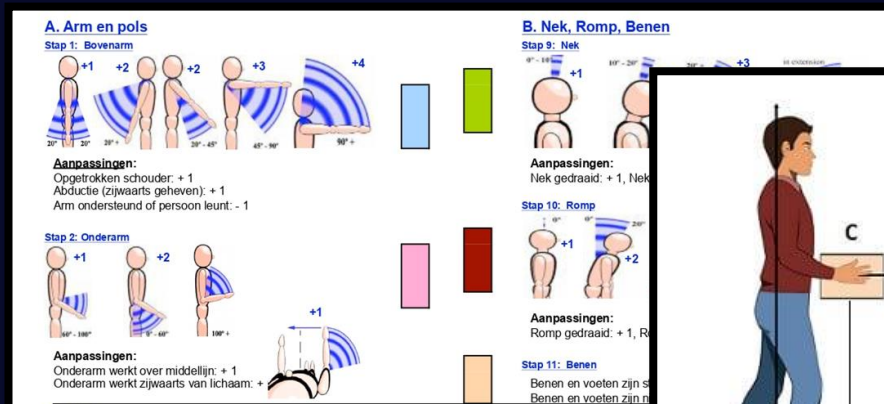
Your
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in ergonomics



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www.mate-ergonomics.be

MATE replaces all risk assessments



Your MATE Report

Summary of the motion

The motion with trialID: [redacted] is evaluated in this report. The report belongs to [redacted] who handled a load of 1 kg and is performed with a lifting frequency of 1 lifts per minute.

Overall loading evaluation

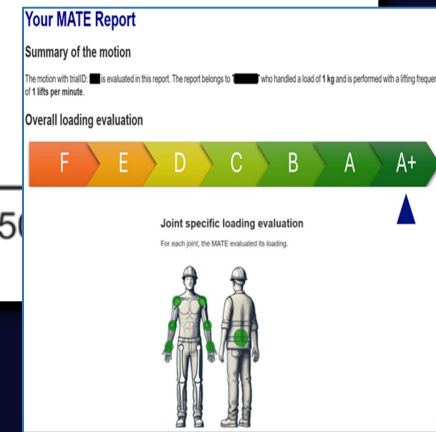
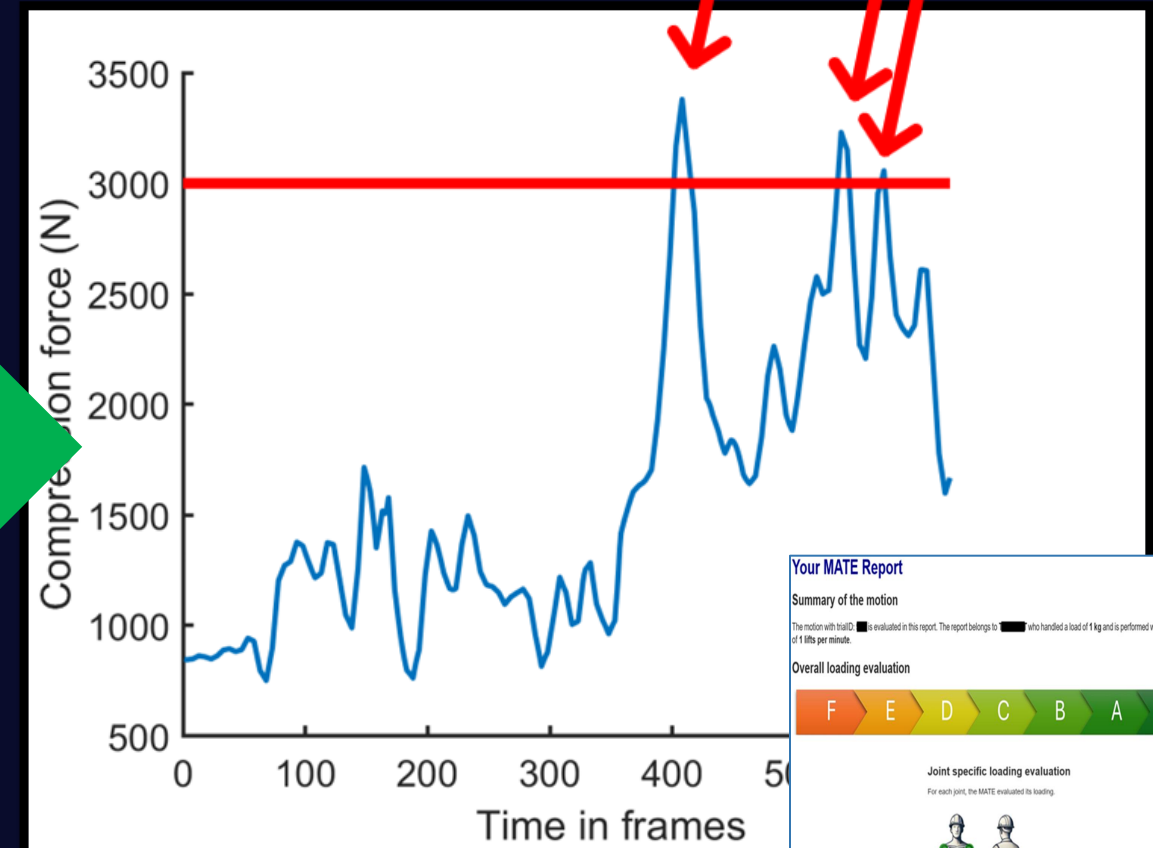
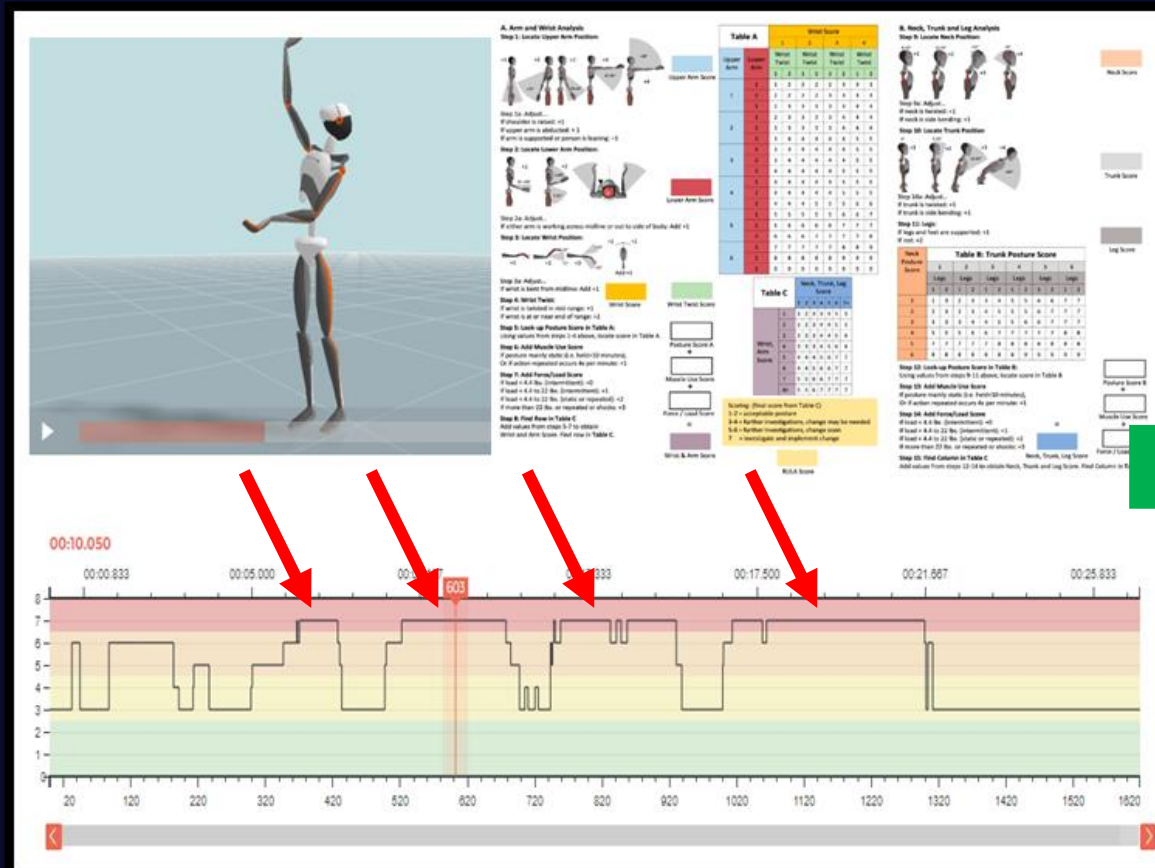


Joint specific loading evaluation

For each joint, the MATE evaluated its loading.



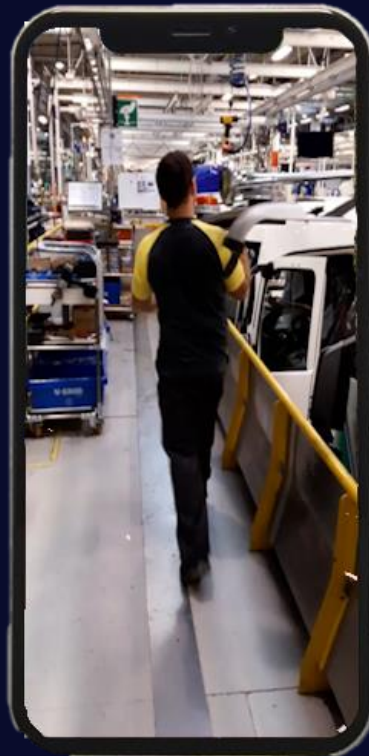
MATE moves away from the traditional risk estimation



Stop using sensors and use video analysis

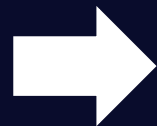
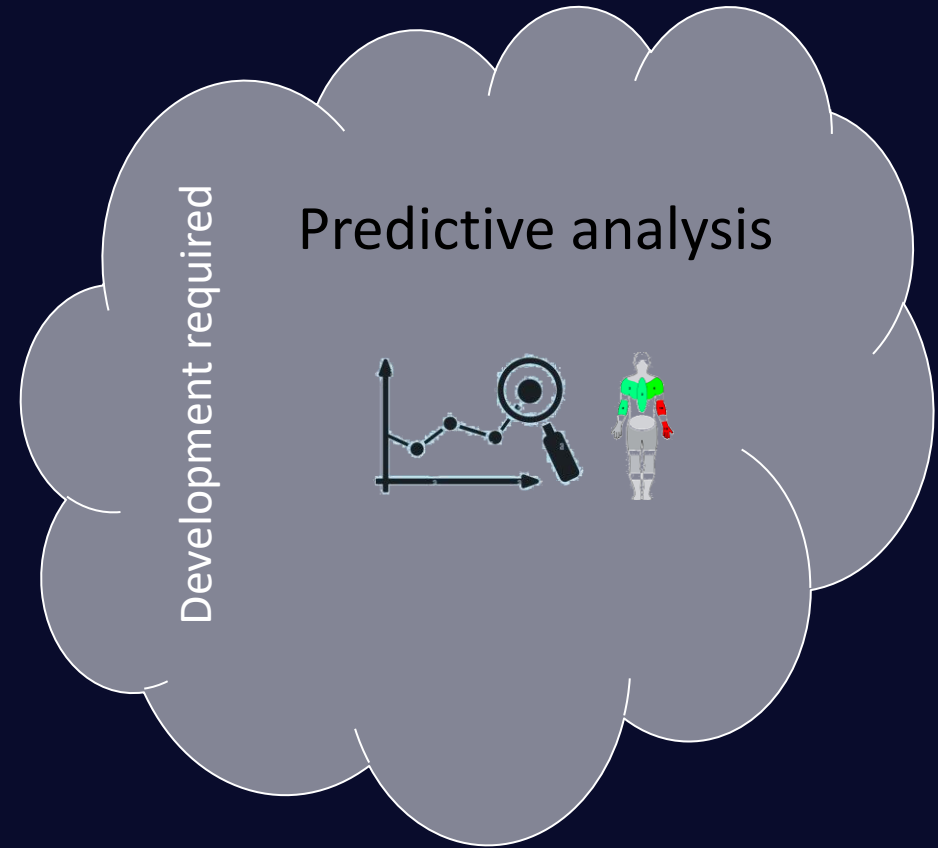
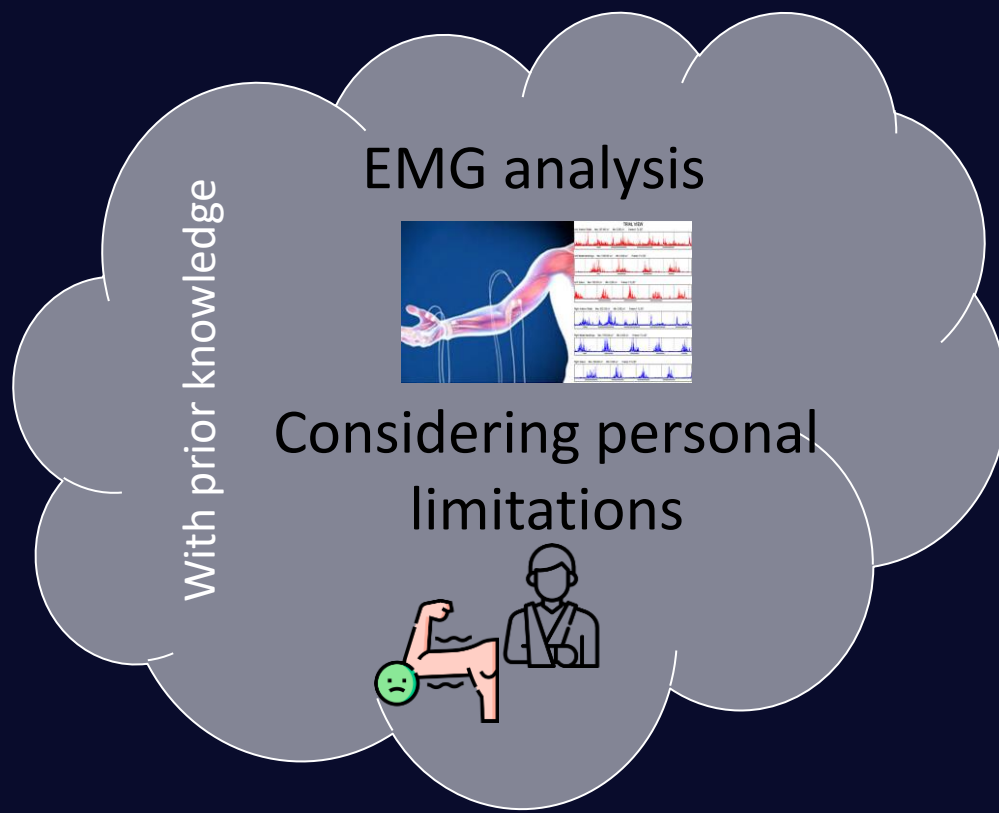


Stanford University



Your
MATE
in ergonomics





To improve the reintegration of workers

Combination is possible



License user

Unlimited use of the tool

Use the latest versions of tool

Customer service

+ additional risk assessments
(RULA, REBA, KIM)



Mini partner

Develop and suggest new features

First access and testing of cutting-edge
additional features

Following development, transferred to
licensed user

→ Pre-order payment

→ Intense help during iterative design

Consultancy projects

Help with measuring IMU data

Assistance in any project where MATE could possibly fit

Precision in Prediction, Prevention in Practice

www.mate-ergonomics.com