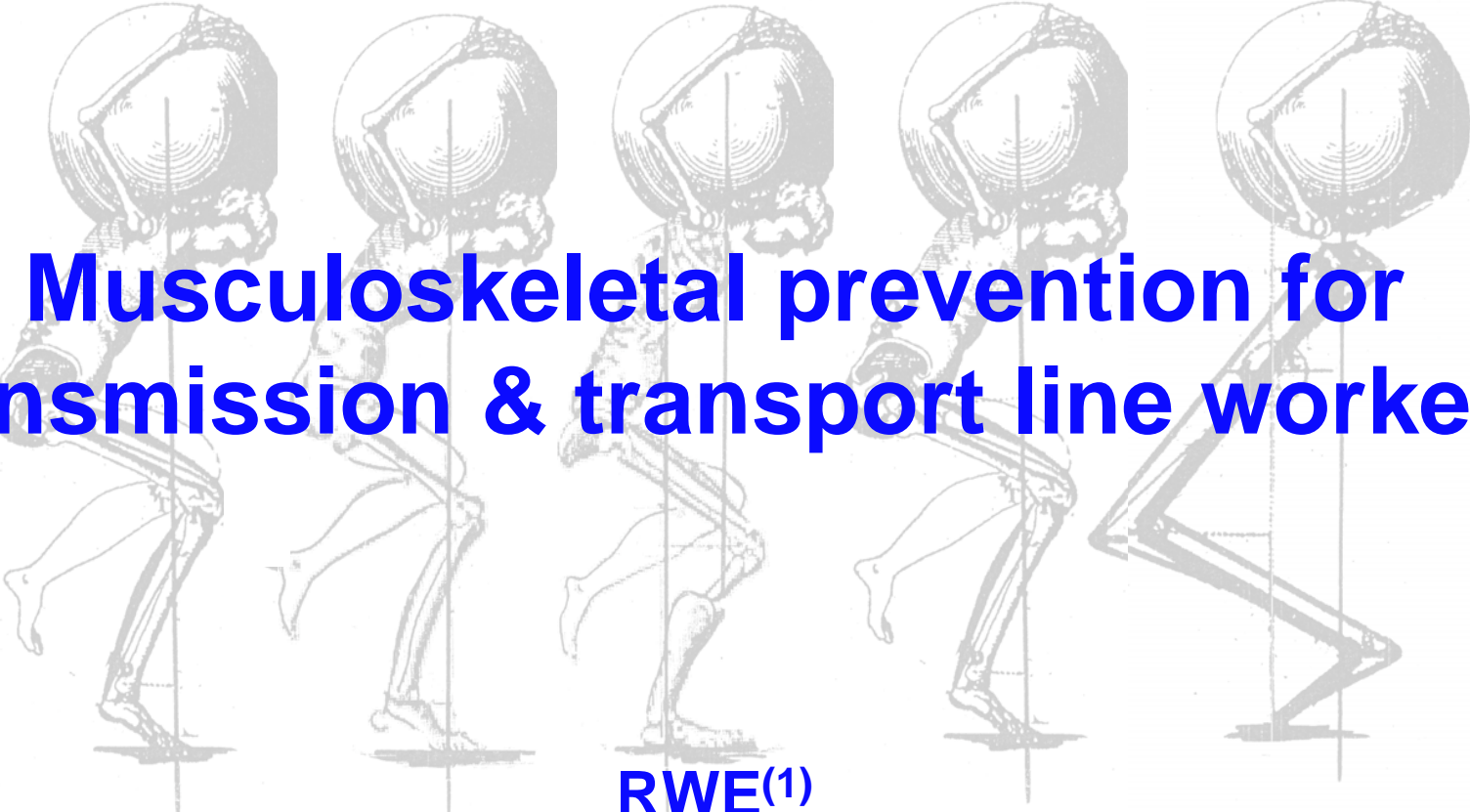


IFH CONFERENCE OCTOBER 13-14, 2005, BERLIN



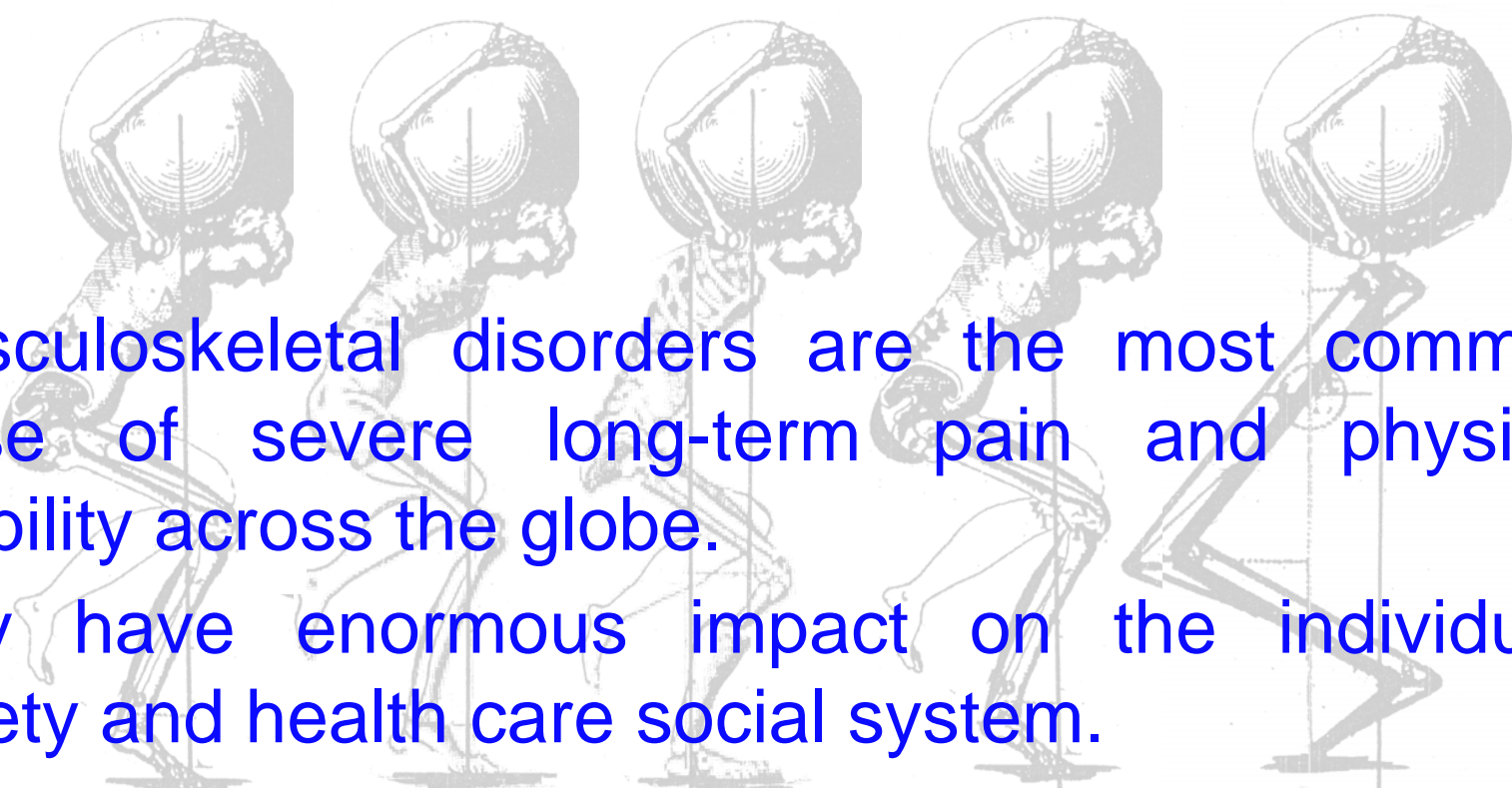
Musculoskeletal prevention for transmission & transport line workers

RWE⁽¹⁾

Institute for Biomechanics and Orthopaedics⁽²⁾

Deutsche Sporthochschule Köln

Prof. B. Tenckhoff ⁽¹⁾, Prof. Dr. H. Krahl & Prof. Dr. G.-P. Brüggemann⁽²⁾



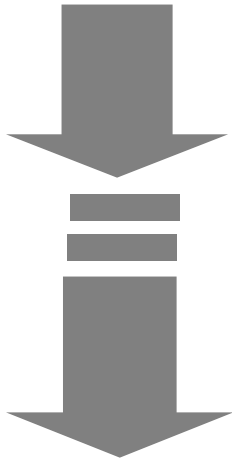
„Musculoskeletal disorders are the most common cause of severe long-term pain and physical disability across the globe.

They have enormous impact on the individual, society and health care social system.

There are effective ways to prevent these conditions, but we must act on them now.”

(Kofi Annan)

Individual musculoskeletal disposition (strength)



**Work place
conditions**



**Physical loading in maintenance and
repair of high transmission and transport systems**

Workplace activities: Mechanical loading of biological structures



**mechanical stress on load
carrying structures**

- Material properties
- Material age
- Material fatigue



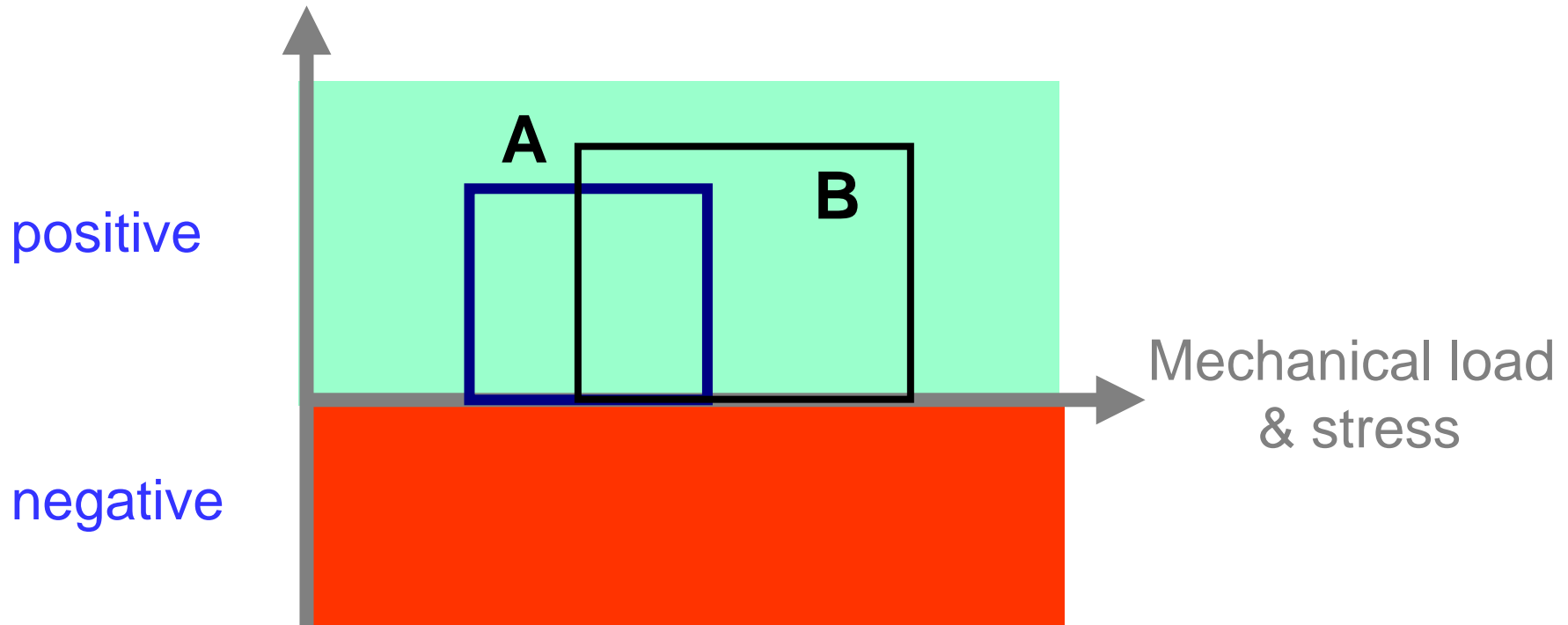
- **adaptation**
- **growth**
- **modulation**



- **injury**
- **damage**



Biological answer



14 years

26 years



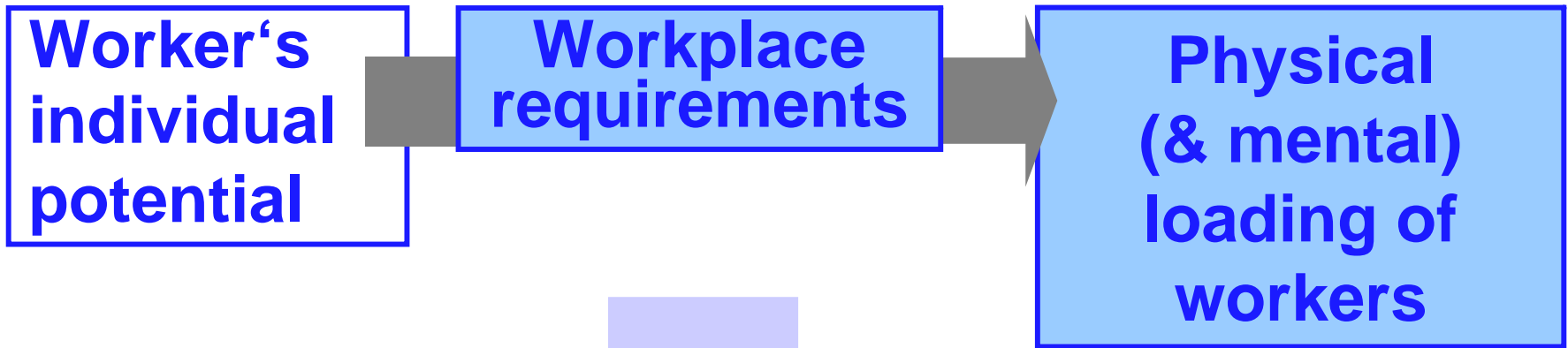
A - Type

14 years

24 years



B - Type



Dysbalance of W's ind. potential and WP requirements:

- changes in the ind. potential (e.g. physical training)
- changes physical loading (e.g. workplace conditions)
- ... or both

• Worker's individual potential

• workplace requirements



General preventive strategies
+ Individualized strategies



well being



Transmission & transport line workers workplace



- risky
- dangerous to fall
- high voltage (>100 000 V)

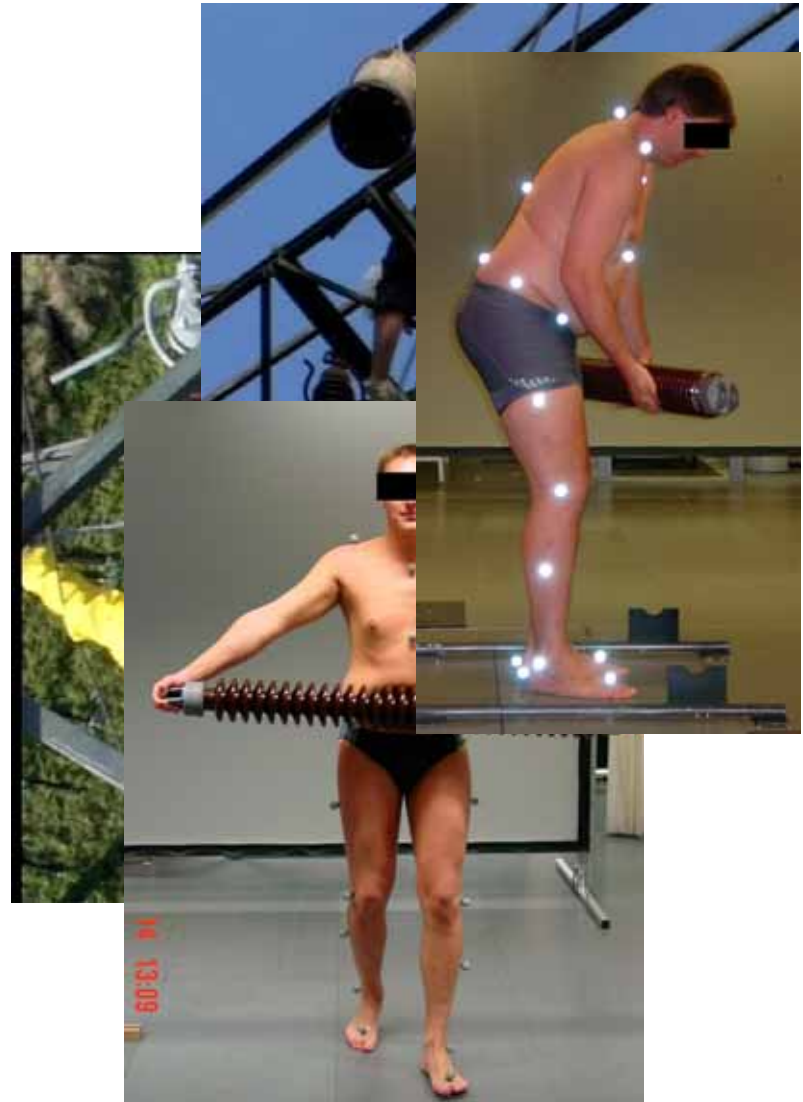
- physical loading
- heavy external loads
- poor body positions
- unproper working positions
- climbing

Estimation of musculoskeletal loading (n=82)

- Analysis of the work place specific activities/loading; assessment of tasks
- ## 2. Biomechanics at work place
- (A) lifting & carrying loads
 - (B) ladder, beam & traverse

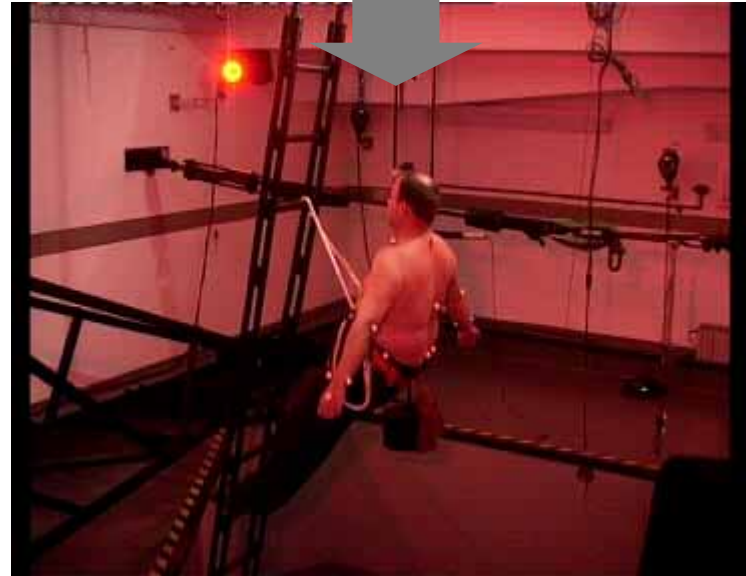
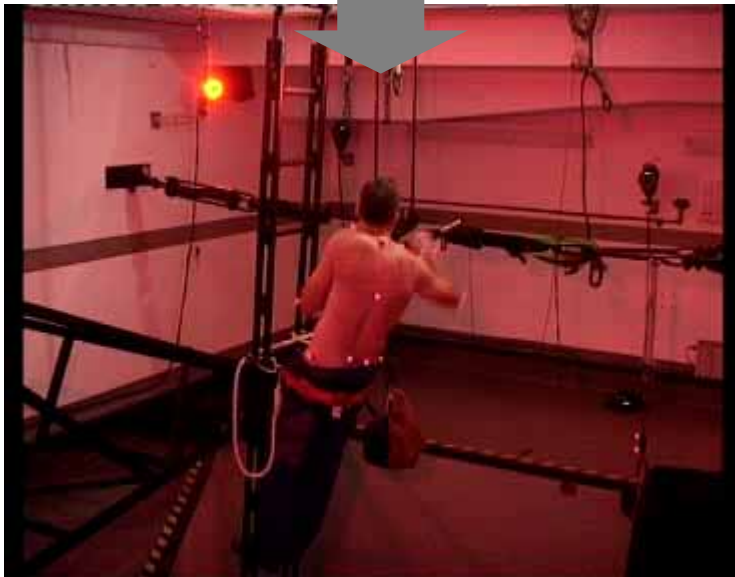
In addition:

- Cardio-pulmonal loading at the work place



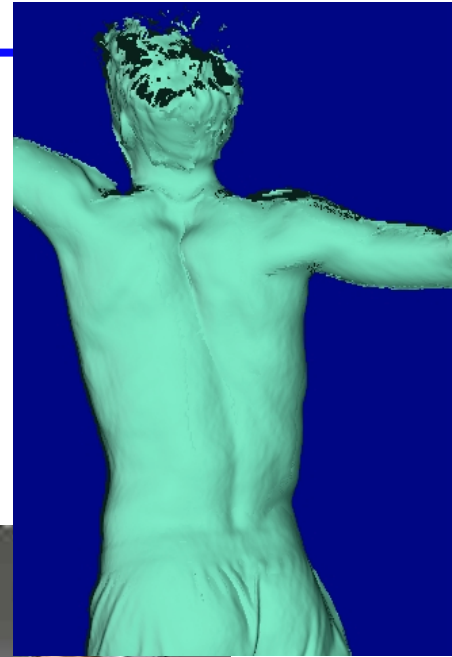
Biomechanics at the workplace

B: ladder, beam & traverse



Estimation of individual potential (n=82)

- **Clinical orthopedic status**
- **Anthropometry & body composition**
- **Muscle strength**
- **Joints' functional capacity**
- **Trunk and spine function**
- **Cardio-pulmonal capacity**



Intervention - Prevention (01 - 11/2004)

Visit at workplace:

Presentation of individual results: *Explanation*

Visits at workplace 2 – k:

Intervention / *Initiation* of preventive workouts, *individualized physical training*

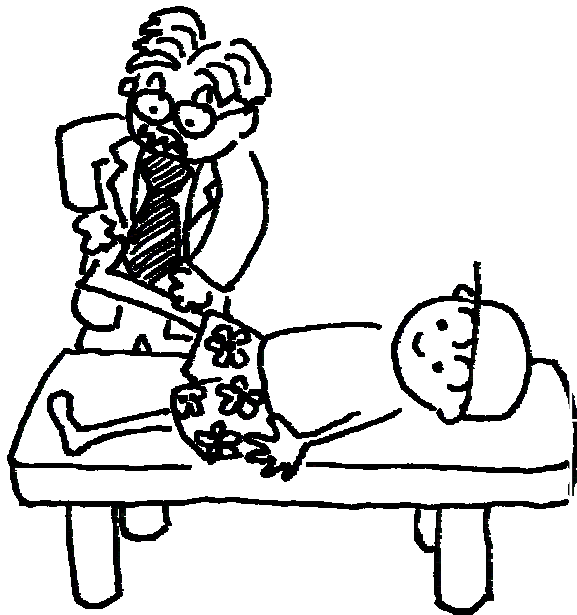
Visits on regular base:

Supervision, consulting



Evaluation (10 months intervention)

Clinical findings / worker

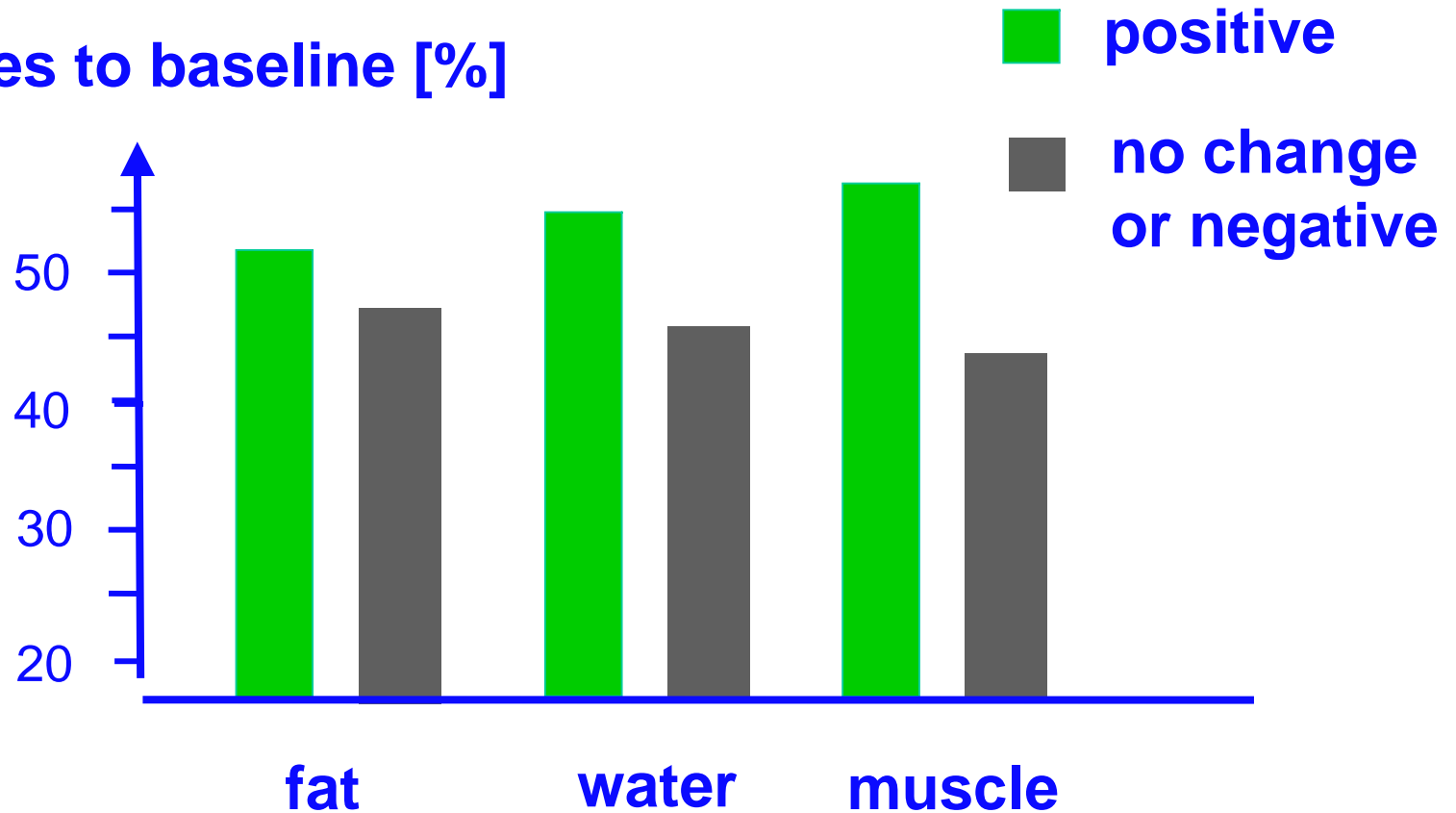


	pre (03)	post (04)	Diff.
hip	2,3	0,8	-1,4
knee	1,8	0,5	-1,3
shoulder	1,9	0,9	-1,1
hand	0,5	0,2	-0,4
elbow	0,2	0,1	-0,1
trunk	1,7	1,7	0,0

Evaluation (10 months intervention)

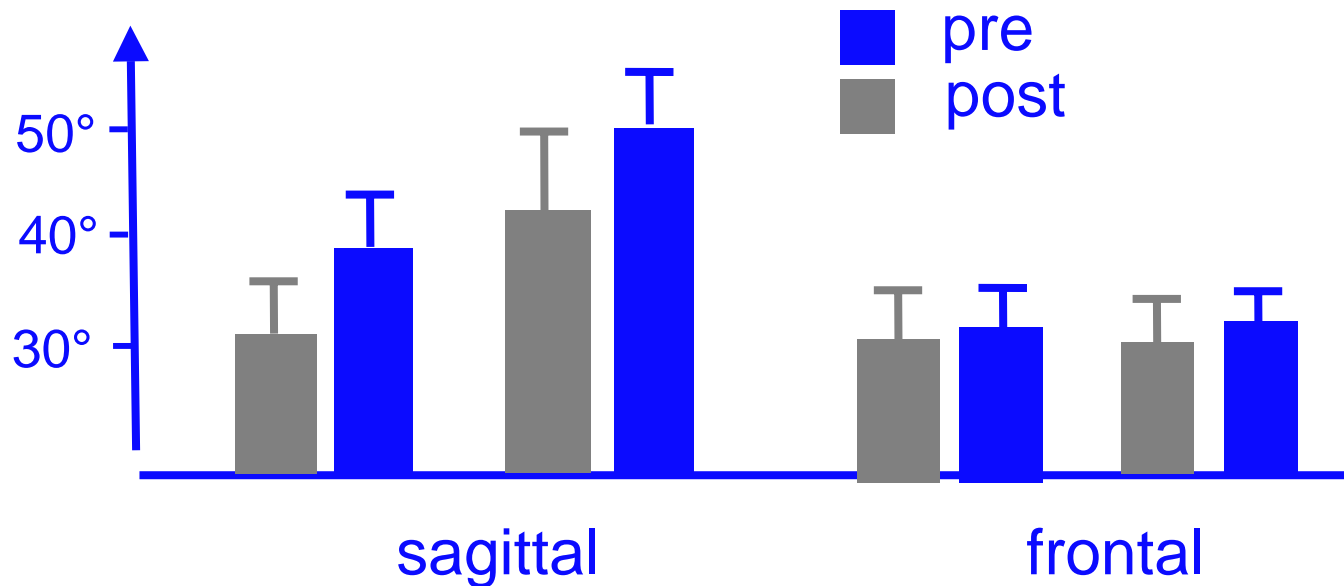
Body composition

Changes to baseline [%]



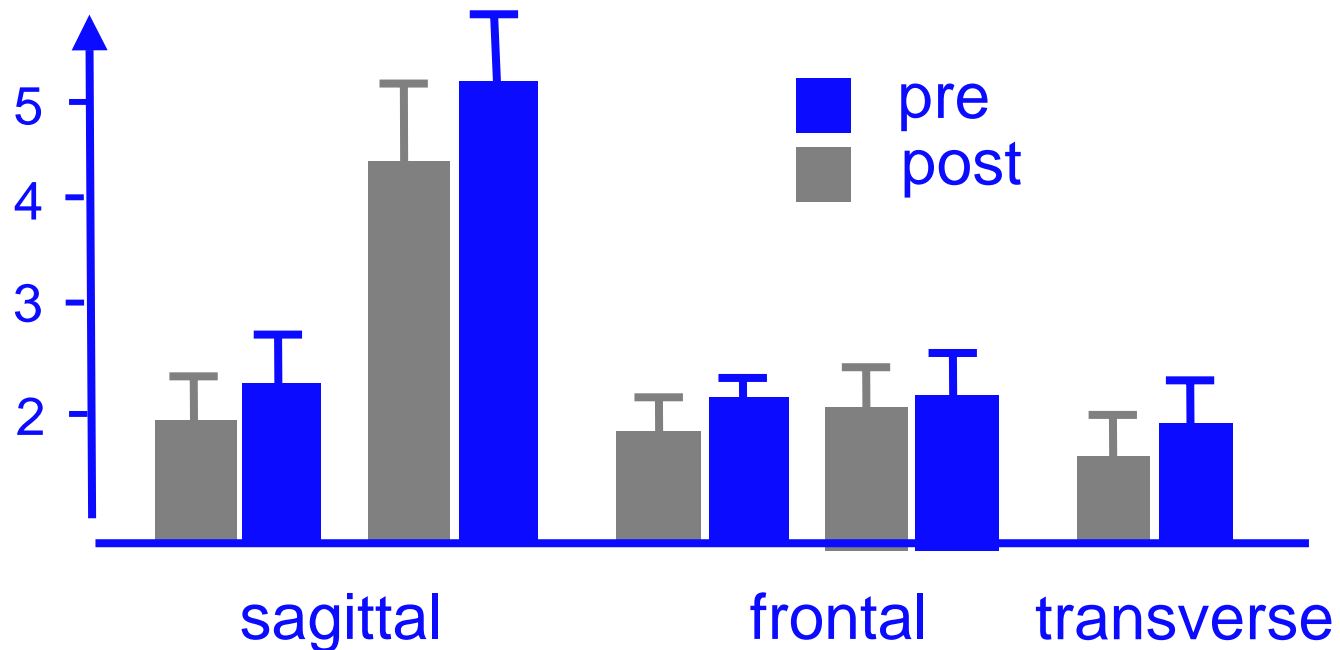
Evaluation (10 months intervention)

Flexibility trunk (spine)



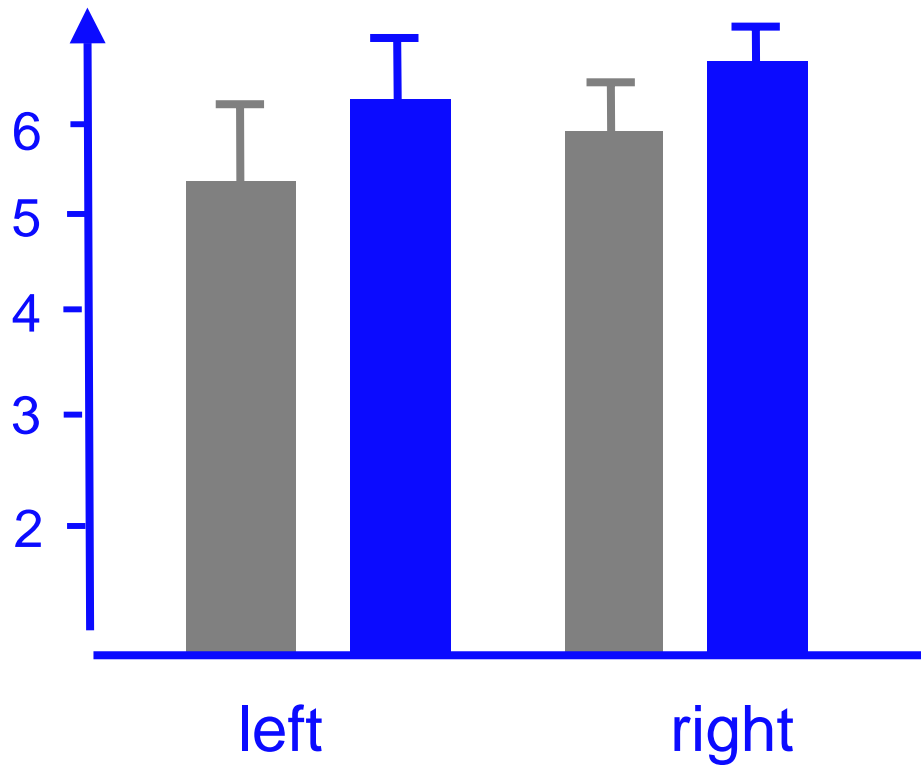
Evaluation (10 months intervention)

Muscle strength trunk [Nm/kg]



Evaluation (10 months intervention)

Grip strength [N/kg]



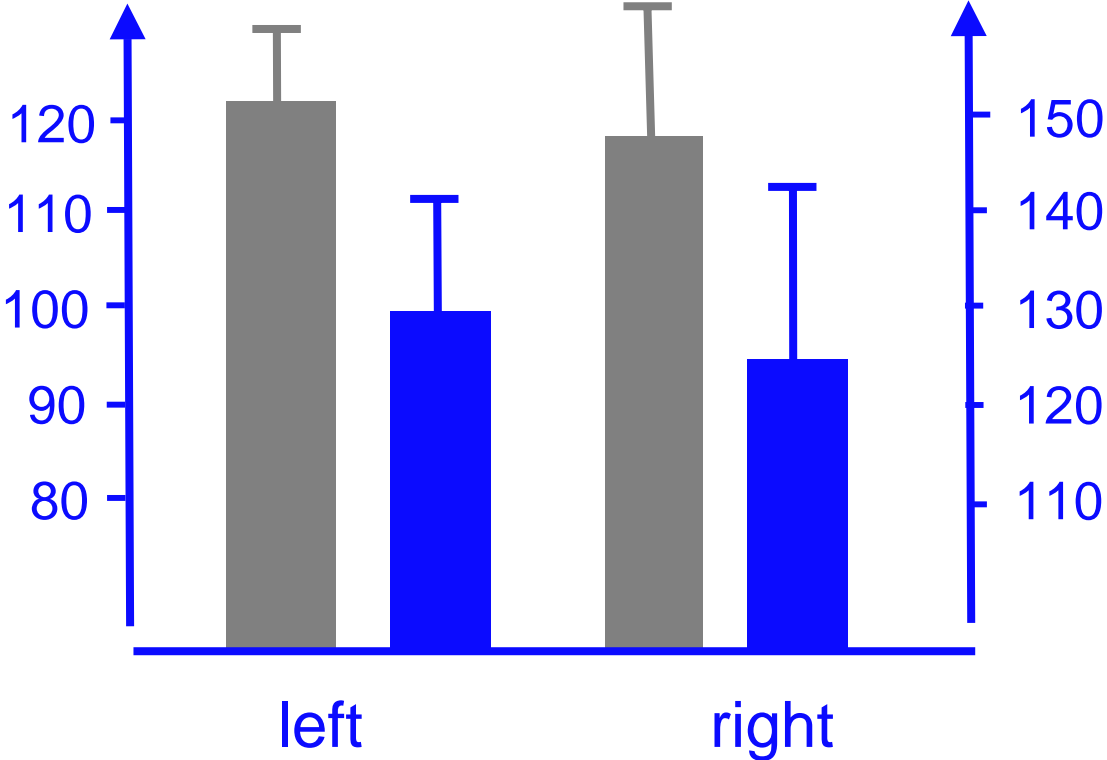
■ pre
■ post

Evaluation (10 months intervention)

„Mast“-Ergometry

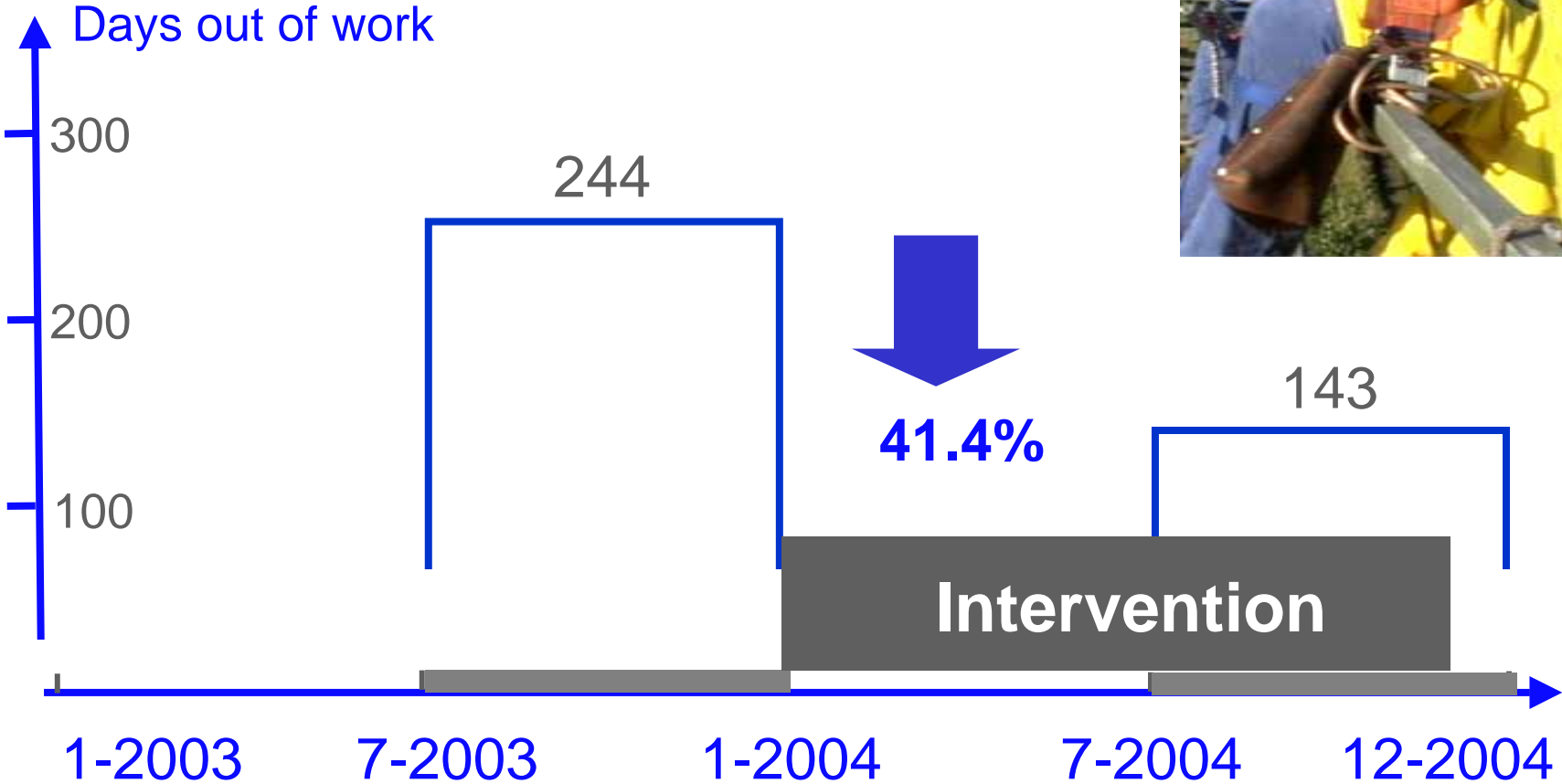
Heart rate [1/min]

VO₂ [ml/kg/min]



pre
post

Evaluation (10 months intervention)





Work place specific requirements and individual capacity:

Some workers showed clear discrepancies

- **Individual findings of individual „risk potential“ enabled the application of preventive (individualized) strategies for intervention**
- **The effectiveness could be evaluated and demonstrated.**
- **A continuous effect and the impact to the well being at the workplace has to be examined.**

Prevention in high voltage engineering

A high-voltage engineer is shown working on a metal structure, possibly a power line tower or transformer, in a forest. The engineer is wearing a grey long-sleeved shirt, blue pants, and a red safety harness. They are also wearing safety glasses and white gloves. The background is filled with trees with yellow and orange autumn leaves. The text "Prevention in high voltage engineering" is overlaid in yellow at the top of the image.

Task specific requirements and individual physical capacity
- First results -