IfADo
Institut für Arbeitsphysiologie an der Universität Dortmund

Risk prevention for healthcare workers by reduction of lumbar load during patient-transfer activities

Andreas THEILMEIER, Claus JORDAN
Alwin LUTTMANN, Matthias JÄGER

Norbert WORTMANN
Stefan KUHN

General aims

- lumbar-load quantification during patient-transfer activities close to reality

- assessment of healthcare worker's load with regard to biomechanical overload of the lumbar spine

- examination of load-reduction potentials of preventive measures like optimized task execution or application of small aids

- 16 endangering patient-transfer activities examined
- 1000 transfers studied regarding action force and posture
- lumbar load for 162 typical transfers computed

Methods

- time-variant and spatial lumbar-load quantification by biomechanical model calculations with **The Dortmunder**

infrared cameras

infrared marker

video cameras

capturing of the posture with opto-electronic system and video recordings

capturing of the forces with different measuring systems like …

measuring-bed, -chair or -tub

upper frame

lower frame

4x three-axial force-sensors between the frames

needs information about

postures

and

applied forces

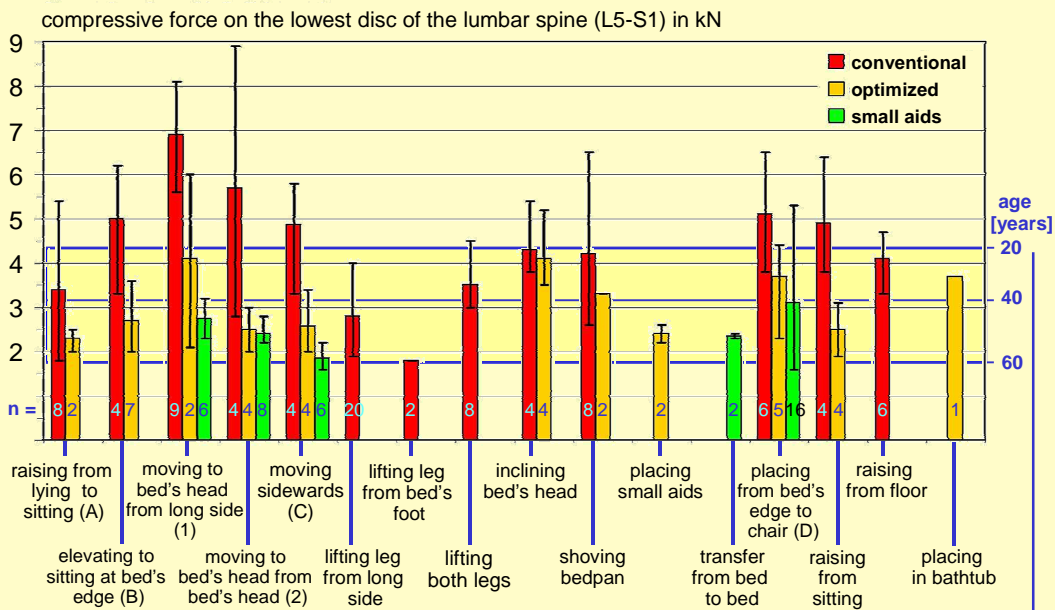**calculates** characteristic values of mechanical lumbar load

Work design

regarding the lumbar load for three different task execution modes

conventional
"commonly used" task execution without consideration of kinaesthetic or other "back-compatible" aspects

optimized
task execution in a presumably less stressful way with consideration to kinaesthetic or "back-compatible" aspects

small aids
task execution with usage of special aids, e.g. to reduce friction or to bridge distances
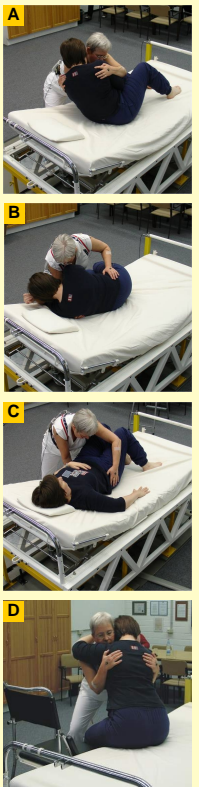
sliding mat

sliding board

Lumbar load during patient-transfer activities

compressive force on the lowest disc of the lumbar spine (L5-S1) in kN

Legend:
- **conventional** (red)
- **optimized** (yellow)
- **small aids** (green)

age [years]: 20, 40, 60

n = 8 2 | 4 7 | 9 2 6 | 4 4 8 | 4 4 6 | 20 | 2 | 8 | 4 4 | 8 2 | 2 | 2 | 6 5 16 | 4 4 | 6 | 1

Activities:
- raising from lying to sitting (A)
- elevating to sitting at bed's edge (B)
- moving to bed's head from long side (1)
- moving to bed's head from bed's head (2)
- moving sidewards (C)
- lifting leg from long side
- lifting leg from bed's foot
- lifting both legs
- inclining bed's head
- shoving bedpan
- placing small aids
- transfer from bed to bed
- placing from bed's edge to chair (D)
- raising from sitting
- raising from floor
- placing in bathtub

examples for a **conventional** execution

A | B | C | D

examples for an **optimized** execution

A | B | C | D

Evaluation of lumbar load

Dortmund Recommendations
age-and-gender specific limits for the maximum compressive force on the the lumbar discs

age	20	30	40	50	≥ 60	years
female	4.4	3.8	3.2	2.5	1.8	kN
male	6.0	5.0	4.1	3.2	2.3	kN

examples for an execution with **small aids**

1 | 2 | C | D

Results – Summary

- intensive lumbar load for many transfer activities
- **conventional:** exceeding of recommended limits
- **optimized:** noteworthy reduction of lumbar load
- **small aids:** in part, the essential reduction of lumbar load

Conclusions – Prevention

- prevention for patient-transfer activities is necessary
- endangering for older healthcare workers is conspicuous
- effectivity of design measures is well-founded
- optimized task execution and usage of small aids are recommended