




12-14 June 2019 • Dresden, Germany

EUROSHNET – European Occupational Safety and Health Network

Guideline for the integration of passive exoskeletons in the workplace

Emmanuelle Turpin-Legendre

 Our job:
making yours safer

www.inrs.fr

Context

Exoskeletons...

Various design and specific assistance

Wearable technologies able to provide a physical assistance to the operator by a limitation of muscular efforts or an enhancement of motor abilities



Occupational exoskeletons are designed to assist specific areas of the body like the upper limbs and the back

Exoskeletons...for companies

Specific applications

These devices are designed to specifically response to a need for physical assistance, depending on the tasks

What kinds of companies?

Companies of various size and sectors are now showing interest:

- Small, medium and large companies
- Automotive, construction, energy, aeronautic, food sector, railway, ...

Objectives for companies

Prevent MSD

Decrease the physical workload

Manual handling tasks



Awkward postures tasks
Arms above the shoulders



Awkward postures tasks
Back



To find out more, French INRS productions (www.inrs.fr/exosquelettes):

ED 6311 – Occupational exoskeletons: impacts on the operators health and safety, state of knowledge

ED 6315 - Acquisition and integration of an exoskeleton in a company. A guide for prevention actors

Preconceived ideas and Vigilant points

10 Preconceived ideas

1 - Exoskeletons...

... in order to prevent MSD?

~~TRUE~~ /WRONG

They can limit the excessive efforts and constraining postures **but don't act on all the factors of MSD:** the repetitiveness of the gestures, the mental stress, the organization of the work, the social climate, ...

2 - Exoskeletons...

... in order to decrease the physical workload?

TRUE /~~WRONG~~

The muscular effort can be locally reduced but what about the cardio-respiratory effort, the postural constraints? **Overall physical effort could be increased**

3 - Exoskeletons...

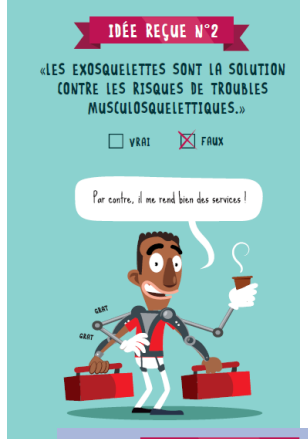
... in order to increase force?

TRUE /~~WRONG~~

Locally they increase the strength of a muscle group , but the operator isn't overall stronger
If there are no fixed points on the ground, what becomes of the external forces like the weight of the device and the objects handled, the reaction forces?

The efforts are entirely supported by the operator, only the forces distribution is modified

And so on

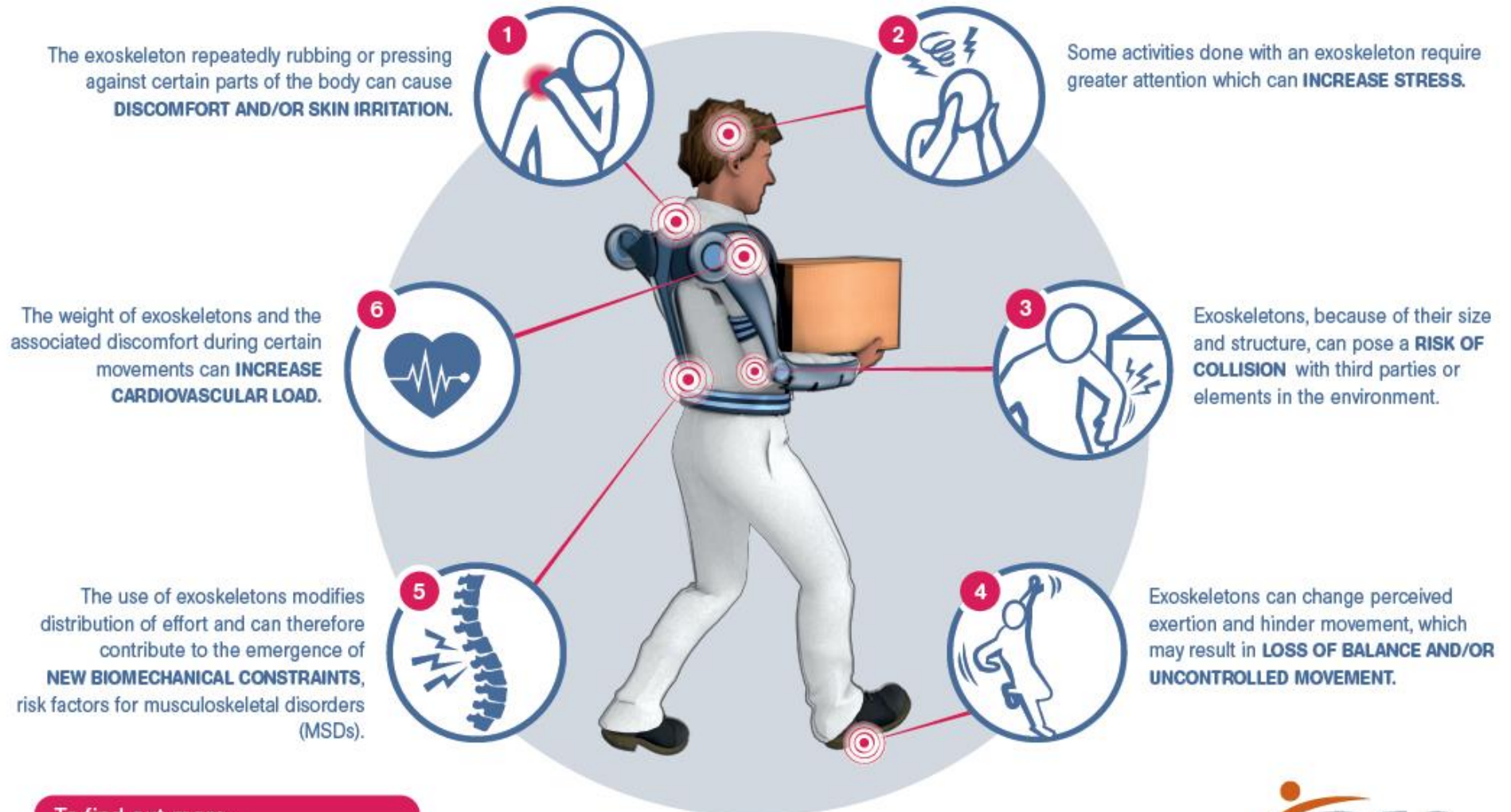


(Theurel et al., 2018)

To find out more
www.inrs.fr/exosquelettes

Exoskeletons at work: 6 critical points

Exoskeletons can relieve strain on operators but... using them is not without risk.



To find out more:
www.inrs.fr/exosquelettes

French Standardization

Emmanuelle Turpin-Legendre



Jean-Jacques ATAIN KOUADIO



French standardization

Guide 2017 – Exoskeletons: Tools and methods for evaluation of human-device interaction (AC Z68-800)

- Participants: designers, integrators, researchers, user companies, ...
- Objectives: to offer tools, methods, supports to discuss the relevance and the feasibility of integrating these new devices



Workshop exchange (Since 2017) – Sharing of practices and knowledge of French exoskeletons manufacturers and users

- Visits in each companies to explain their experiment
- Presentation of a use case or a problem
- Feedbacks on the use of tools and methods are discussed and analyzed

Standard (Since 2017) – Ergonomic recommendations for wearable physical assistance devices like exoskeletons (NF X35-800, in process)

- Objectives: to give ergonomic recommendations on the use of these devices, to identify the effects on the operator, to evaluate the human-device interaction
- Applications: to any company whatever it's size and activities (except medical sector, games, sports and leisure)
to users, designers, suppliers and integrators

Thank you for your
attention



EXO
GROUPE

inrs