



Finnish Institute of  
Occupational Health

# *Well-being through work*



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# Usability of Computer-based Assessment Method of Physical Work Capacity among Firefighters

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# Content

- Background
- Why this kind of project was needed?
- Where are we now?
- Future?
- What else are we studying?



# In Finland

- Firefighters have the same retirement age than other municipal workers in Finland (63-68 years)
- Many firefighters move into early retirement
- The most common reasons were in 2010-2013:
  - musculoskeletal disorders 44 %
  - cardiovascular disorders 13%
  - mental disorders 12 %
- 500-600 work accidents/year

# Background

- The project was one subproject of large project: Operational capacity of regional rescue services and their personnel, 1.9.2007-31.12.2009 (Ministry of the Interior)

Including:

- Good occupational health practice (GOHP)
- Models for early interventions (as a part of GOHP and human resources management)
- Occupational safety and environmental activities, so that the aim is 0 accidents in all tasks, physical exercise and training situations
- Computer based system for the assessment, feedback and follow-up of physical work capacity of rescuers (FireFit)
- Establishment of the OHS activities among part-time and voluntary personnel

- The Finnish Parliament discussed and accepted recommendations of the project in May 2010
- All Chief Executive Officers of rescue service regions committed themselves to take the FireFit method in use in 2010
- The Ministry of the Interior established a working group of different stakeholders for improving well-being of rescue personnel in Finland (2011). The group have been working until the end of 2014.
- Common intent of all stakeholders (trade unions, Insurance Company etc.) to enhance health, safety and work ability of Finnish rescue personnel

# FireFit

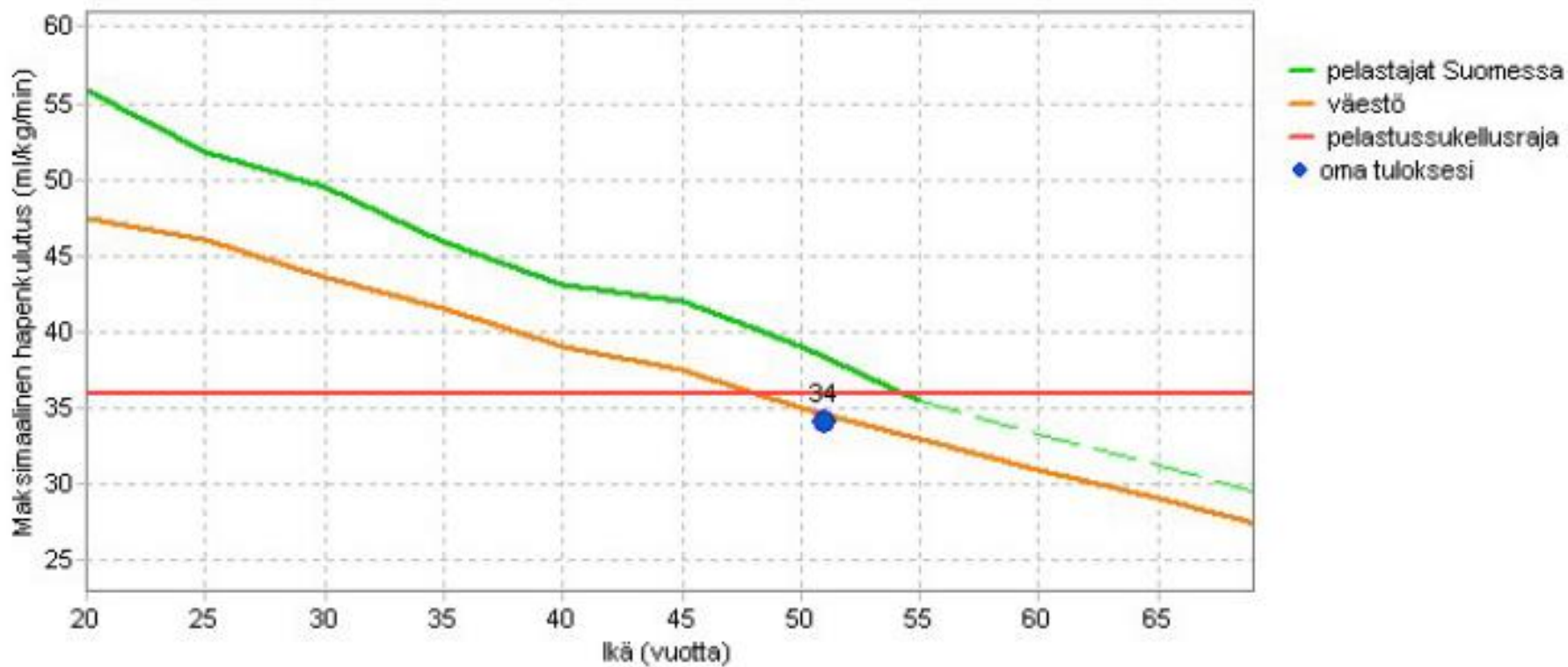
- Is based on the MilFit system used in Finnish Army
- Via online computer guidance:
  - contains all the assessments required in the national guidelines (are changing at the moment!)
  - contains assessment of the health risks in co-operation with OHP
- FireFit is developed by the FIOH, UKK-institute, Aino Health Management (Aino Active Oy), Emergency Services College, Fire Departments (piloting)
- Educational system for the FireFit-testing personnel

# Individual feedback/Group level feedback:

- Physical work capacity in terms of **energetic work load** of rescue tasks
- Physical work capacity in terms of **other rescue workers** in Finland
- Physical work capacity in terms of **average population** of the same sex and age group
- Physical work capacity in terms of **health**
- The **trend** of physical work capacity
  
- **Motivationally** matched exercise instructions and related to body mass
- **Interactive** personalized feedback
- **Aim: safety and healthy work!!**



	1	2	3	4	5
VO2max (l/min)	≤ 2,49	2,5-2,99	3,0-3,99	4,0-4,8	≥4,81
VO2max (ml/kg/min)	≤ 29,99	30,0-35,99	36,0-49,99	50,0-57,99	≥58,0
Benc press 45 kg (rep/60s)	≤9	10-17	18-29	30-44	≥45
Sit-up (rep/60 s)	≤20	21-28	29-40	41-51	≥52
Squatting, 45 kg (rep/60 s)	≤9	10-17	18-26	27-33	≥34
Pull-up (rep)	≤2	3-4	5-9	10-14	≥15
<b>Smoke diving test drill (%Hrmax)</b>	>95%		85-94%		<84%
BMI	≤ 18,99/ ≥ 30		19–19,99/ 28–29,99		20–27,99
Waist girth (men/women, cm)	≥ 100/ ≥ 90		90–99,9/ 80–89,9		≤ 89,9/ ≤ 79,9
FMS	7-9	10-13	14-16	17-18	19-21
Balance test (s)	>26	22-25,99	16.1-21,99	12,51-16	≤12,5



Maksimaalisen hapenkulutuksen (VO2max) viitearvot ja tavoitetasot yksikössä ml/kg/min.

# FireFit-index



*In addition of separate test results there is also comprehensive FireFit index required for different tasks.*



## **Aerobic test:**

Submaximal indirect bicycle ergometer test or spiroergometer test

**Aerobic capacity**  
(1-5) 50 %

## **Muscular tests:**

Sit-up test (rep/1 min)

Bench press, 45 kg (rep/1 min)

Squatting, 45 kg (rep/1 min)

Pull-up (max rep)

**Muscular strength and endurance**  
(1-5) 50%

**Physical work capacity index**  
(1-5)

**Work-related test drill**  
(smoke-diving)

**Body composition**

**Body control, flexibility, balance**

# "Traffic lights"

- Green = Physical work capacity is OK  
73% (394)
- Yellow = VO<sub>2</sub>max and muscular performance OK  
but BMI 28-30  
10% (53)
- Pink = VO<sub>2</sub>max and muscular performance OK  
mutta BMI >30  
7% (41)
- Red = VO<sub>2</sub>max and/or muscular performance  
NOT OK  
10% (55)



# FireFit testing process

Information before employment:

- Direct  $VO_2$ max test  
OR
- Spiroergometer test
- measured HR max and  $VO_2$  max
- information from Emergency Service College
- OR
- the test immediately in the beginning of employment

Educated (FireFit) person for the tests:

- inside rescue service region
- from outside (OHS, private sector)

Fitness tests (annually)

Individual feedback and follow-up of the results

Communication with employer personnel planning

Tool for the follow-up of physical activity

(for example web-based exercise diary)

Updating the exercise instructions

Individual FireFit-exercise instructions

- aerobic capacity
- muscular strength and endurance
- flexibility
- motor control

Communication with OHS preventive measures, early interventions and treatment

# Why this project was needed?

FireFit method is in use in most of the regional rescue services in Finland.

We wanted to find out:

- 1) How the use of the FireFit method was organized?
- 2) Short term effectiveness for enhancing work ability of firefighters by using the method?
- 3) The developmental needs of the method?

One of the main interest was to clarify how the method act as a tool for discussion and cooperation between different stakeholders.

# Methods and subjects

- Web-based questionnaire was sent actors of 16/22 regional rescue services (RRS) and to two industrial plant fire brigade and to their occupational health personnel (OHP) in 2013-2014
- Subjects from 14+1 rescue services agreed to participate in the study
- The response rate was 75 % for the persons of the regional rescue services
- The response rate was 62 % for occupational health personnel
- FireFit method had been in use from 1 to 8 years
- 61 % had completed the basic training course
- Most of them had at least 2 years experience in the use of the system (longer time in RRS)

# How the use of the FireFit method was organized?

- Muscular tests and smoke diving test drill were done mostly in RRS: 55-77 % of the answers
- Body composition measurements were done often by occupational health nurse or physiotherapist (42 %), they also gave comprehensive feedback
- Submaximal ergometer test was done by occupational physiotherapists in 39 % of RRS
- Only about 3 % of tests were done by external service providers
- Almost all RRS have action plan for the persons who do not pass the tests and for recording system for exceptional situations



# Short term effectiveness for enhancing work ability of firefighters by using the method?

- The quality, equality and the use of all tests in professional manner improved
- Most of the respondents (84%) agreed that the FireFit method is good tool for early intervention
- They reported that it has been easier to influence the problems of work ability than before with the help of the system
- As a whole, the comprehensive and work related feedback from the assessments has made discussion easier

# Continue

- The discussion has led to the **real causes** of the problems and to wider health promotion issues
- A total of 88 % of the respondents answered that the **cooperation** between the OHP and the actors of the fire departments have increased (61 % inside RRS)
- The **consultation** of medical doctors and occupational physiotherapists has been more prevalent and early enough especially for persons with musculoskeletal problems
- A total of 77 % of the respondents felt that the **quality and comprehensiveness of physical training** has improved by the individual instructions obtained from the FireFit system

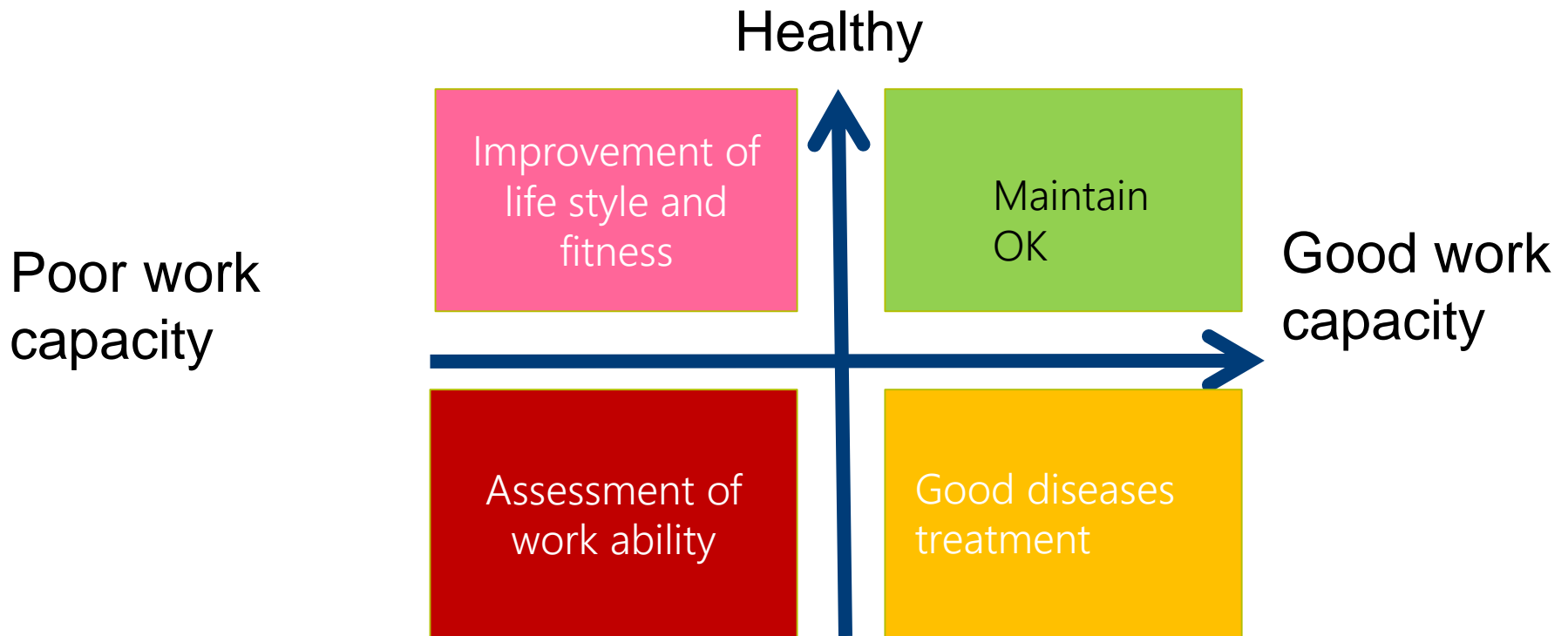
# The developmental needs of the method?

- In all fire departments there should be an **established and well-known** action plan for what to do when a fire fighter fails to pass the tests or if there is an accident during the assessment
- High quality use of the method requires continuous education and training of it's users as well as continuous information
- There should also be more detailed plans concerning the assessments of voluntary firefighters
- In addition of the test of physical work capacity there should also be test of psychological capacity

# Some points

- The connection with the health examinations and with early prevention/health promotion actions and personnel planning should to be discussed continuously
- When the pre-test health risks (by the international recommendations of ACSM,2006) have been evaluated carefully, the test can be done safely in rescue departments
- The aim of the tests is **to motivate rescuers to exercise** so that the physical work capacity remains good enough during the whole working career

# What to do?



For example health check:  
<40 y: every 3-5 year  
40-50 y: every second year  
>50 y: every 1-2 year

# In the future



- Recommendations of **body flexibility/control tests** have recently published (part of them done by OHP in connection with health examinations); **implementation in practice!**

# Functional Movement Screen (FMS) (Cook G. 2001, 2010)

- Good tool for prevention of accidents
- Connected to the risk of accidents, also MSD and WA among firefighters



Deep Squat



Hurdle step



In-line lunge



Shoulder mobility



Active straight  
leg raise



Trunk stability  
push-up



Rotary stability

# What else are we studying?

- *"Can the Skellefteå model reduce firefighters' exposure to chemical agents in operative work?"* project studied a total of six fire stations in Finland. [juha.Laitinen@ttl.fi](mailto:juha.Laitinen@ttl.fi)
- *"Enhancing physical work capacity among rescue workers: the effect of four active recovery methods"*. All the active recovery methods: ingestion of caffeine, active stretching, cool water immersion and contrast water therapy enhanced recovery. [juha.oksa@ttl.fi](mailto:juha.oksa@ttl.fi).



- *“Developing better working time arrangements for rescue workers”*. The main aim of this project is to develop and validate a novel shift schedule for Finnish rescue workers. Results and recommendations will be available in the beginning of 2018.
  - We collect knowledge base of existing shift schedules nationally and internationally
  - Choose one or two novel shift schedules with actors
  - Conduct an intervention study where the effects of shift schedule on stress, recovery, fatigue, work ability and well-being are measured. (We use both objective and subjective methods)

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- *“Co-operation and competence network for promoting occupational health, safety and well-being at work”.*
- Research and development project
- Project will help workplaces proactively carry out occupational health, safety and well-being (OHSW) measures, thus improving the productivity of work.
- The aim of it's one subproject is to develop good practices for promoting work ability and health in order to extend the working careers of those in **physically and psychosocially demanding work**, and to prevent the premature retirement of ageing workers and those with partial work ability. Large EU-project going on until 2018. [sirpa.lusa@ttl.fi](mailto:sirpa.lusa@ttl.fi)

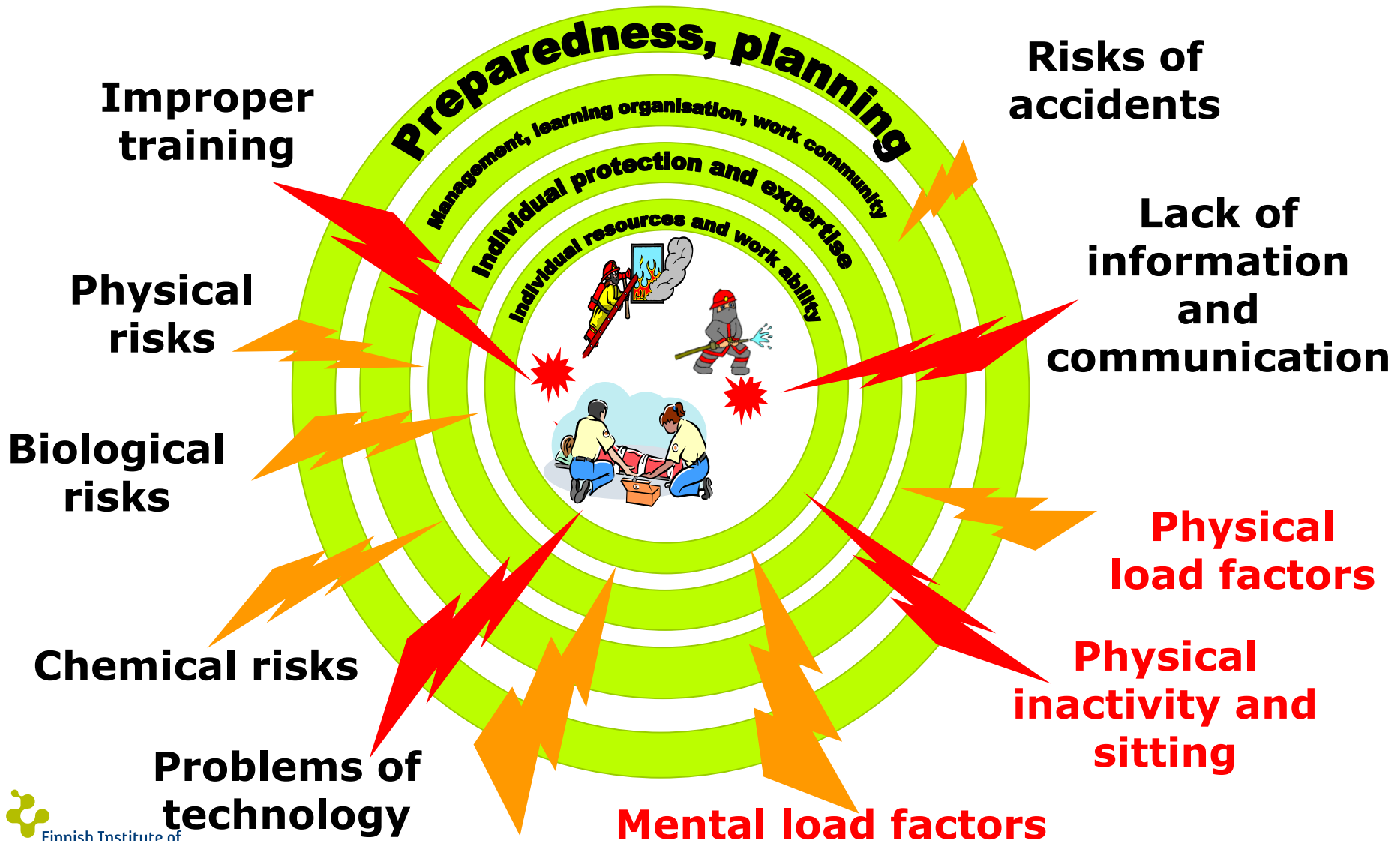
### *The Body and Mind subproject*

# In the future studies:

- We have developed **wearable gaze tracking devices**: allow automatically estimating where a user has directed his/her attention, e.g. if the user has observed certain signs or other visual stimulus. For example, in control rooms, the system could be used to infer how well the operator is doing her job and if she/he has directed her attention to the correct places; has she/he noticed all the message displayed in various screens. Other possibilities utilizing gaze tracking include:
  - estimating user vigilance making it possible to automatically alert of the user is, e.g., too tired or even falling a sleep
  - interaction in AR/VR environments (Augmented/Virtual Reality)
  - training: comparing and visualizing gaze path differences between experts and novices

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# Managing risks in emergency work





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*Thank you!*



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