



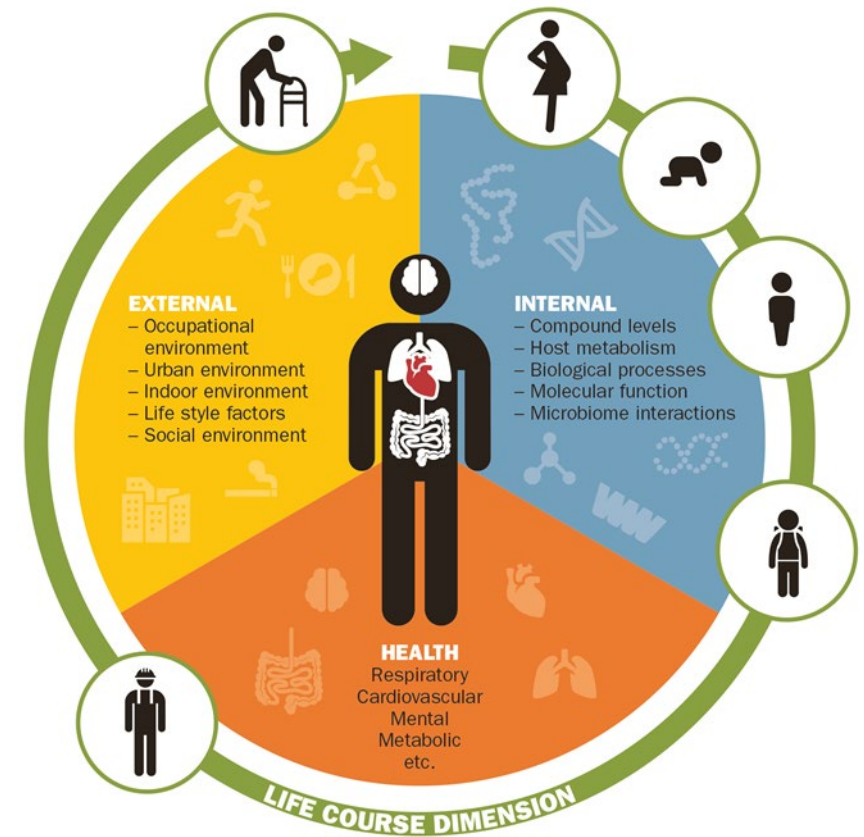
Applying the exposome
concept to working-life
health:

The EU EPHOR project

Anjoeka Pronk, TNO, The Netherlands

The Exposome

- Totality of all exposures
 - From conception until death
- Counterpart of genome
 - Believed to explain 70-80% of disease
- Links external exposures to internal exposures to health/disease



Source: White paper Exposome TNO 2018

Why an exposome approach to working life?



The working life exposome:

All occupational and related non-occupational (i.e. general environment, lifestyle, behavioral and socio-economic) exposure factors

- Occupational disease in EU countries:
 - 5-7% mortality, 2-6% GDP
- Challenges:
 - Single occupational exposure-single disease
 - Vulnerability unknown
 - Biological mechanisms unknown
 - Upcoming challenges:
 - Demographic changes: Ageing workforce, female participation
 - Changing nature of work
- Working life largely neglected in exposome studies

What is EPHOR?

Working Life Exposome

A Fundamental Shift

Single Occupational
Exposure



Single Disease



Interrelating Working
Life Exposures



Health, Biological Changes
and Vulnerability



An EU project (2020-2024) about:

- Applying the exposome concept to working life health
- Providing better insights into:
 - Working life-health relationships
 - Vulnerable life stages and groups
- Laying the groundwork for prevention:
 - Evidence-based
 - Cost- effective

Objective: Working Life Exposome Toolbox



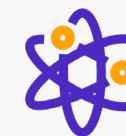
Better and More Complete Knowledge

- Multiple exposures within the working life exposome in relation to non-communicable diseases
- Complex interactions of exposures, internal markers and vulnerability

Innovative Methods for Working Life Exposome

- Collection, storage and interpretation
- Impact assessment

Stakeholders



Scientists



Policy makers



Occupational health practitioners

How: a combined approach

APPROACH

Mega Cohort

Large scale pooling of EU cohorts



Case Studies

Focus on respiratory disease

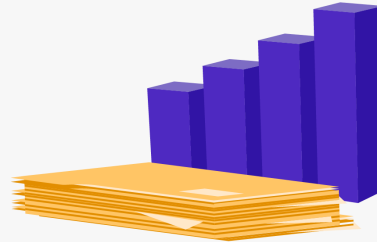
Focus on shift work



EXPOSOME DATA

Existing Data

Cohorts, job exposure matrices, databases



Also New Data

External: individual level, high resolution, many exposures

Internal: biomarkers and omics



EXPOSURE-RESPONSE DATA

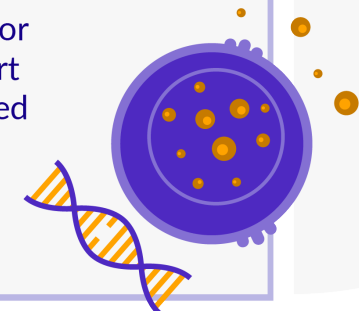
Increased Power

Associations between (interacting) working life risk factors and NCDs, vulnerable life periods or sub groups, e.g. gender, SES



Increased resolution

Biological pathways, markers of exposure or disease, multiple short term exposures related to acute effects



HEALTH AND ECONOMIC IMPACT

Based on working life exposure-response data.

Outcomes & expected impact



INTERMEDIATE OUTCOMES



Research Knowledge Base



Evidence Based and Cost
Effective Policy



Evidence Based and Cost
Effective Practice

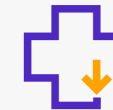


Innovation

IMPACT



Improving Health and
Wellbeing



Reducing the Burden of
Healthcare System



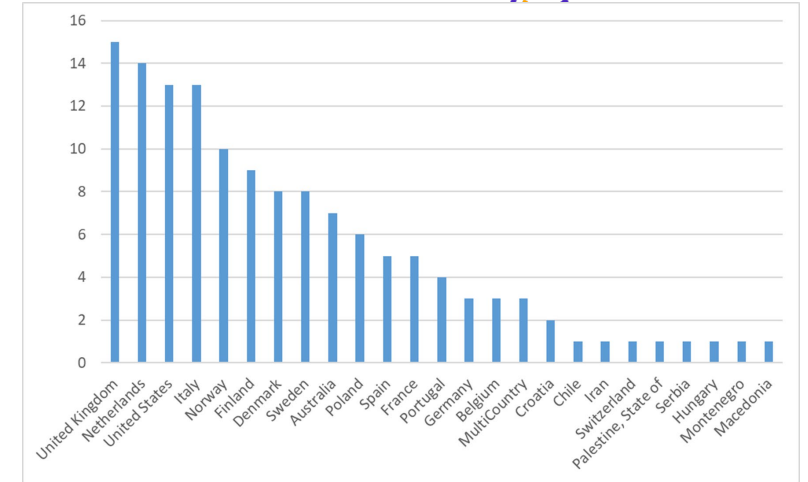
Improving Productivity



Increasing Competitiveness

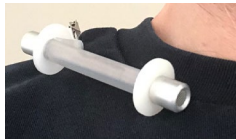
Progress anno mid 2021: Mega cohort

- Inventory of relevant EU cohorts made (>140)
 - Collaboration with EU OmegaNet
 - 13 selected as the initial EPHOR Mega cohort
- 6 working groups
 - defining critical knowledge gaps and research questions on cancer, cardiovascular/metabolic, neurodegenerative, musculoskeletal, mental, and respiratory disease
- Harmonised JEMs for exposure assessment: EuroJEM
 - Existing JEMs for chemical, particle, ergonomic, psychosocial and physical exposures
 - New JEM development for UV light and precarious work
 - Extra: contribution to JEM for SARS-CoV-2 (presented today: K. Oude Hengel)



Progress anno mid 2021: case studies

- Protocols case studies developed and first subjects (will be) included fall 2021:
 - Respiratory case study among 3000/400 subjects in general population
 - Shift work case study among 800 subjects in hospitals and transportation



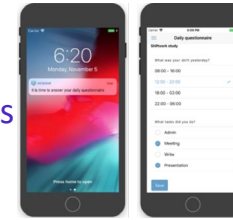
Passive sampling (chemicals)



Sensors (73 x 54 x 20 mm box)
Light
Sound
Finedust (PM1, 2.5, 10)
Particle Count
UVB
Temperature
Relative Humidity



Personal environmental
sampling



Questionnaires

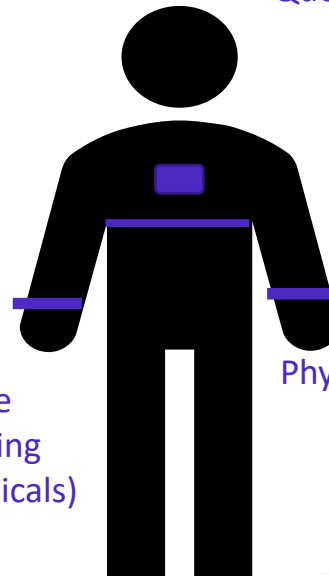
EMA questions regarding:

- Sleep
- Work times
- Commute
- Exercise
- Mood/stress
- Respiratory symptoms, medication, PPE
- Diet/eating schedule, medication, shifts



Heart Rate (WP7)

Heart rate



Physical Activity

Passive
Sampling
(Chemicals)



Activity sensor
Activity
Sleep

Passive Area
Sampling
(Biologicals)



Biological sampling



Exhaled breath
condensate
(15 mins)



Exhaled breath
VOC/ aerosol
(20 mins)



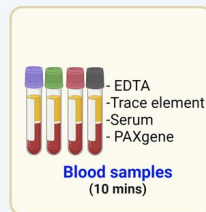
Saliva samples
(5 mins)



Urine samples
(5 mins)



Finger prick
blood samples
(5 mins)



Blood samples
(10 mins)

- EDTA
- Trace element
- Serum
- PAXgene

Progress anno mid 2021: data interpretation



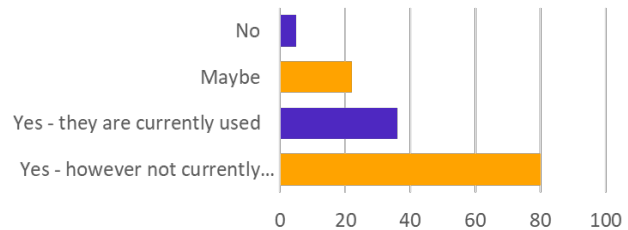
- Data platform for centralized and decentralized analyses
 - Mega cohort mainly via Datashield
- Advanced statistical methods
 - Interactions, timing of exposure, use of data mining
- Health impact assessment
 - Concepts on the use of exposome results in impact assessments
 - Review on working life expectancy as end point for impact assessment

Progress anno mid 2021: stakeholder consultation

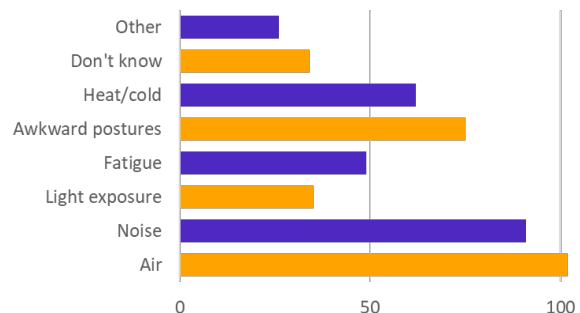


- **Goal:** to gain insights on how sensors can be used in the workplace from an occupational hygiene and occupational safety and health perspective. → for toolbox development (Occ. health pract.)
 - Stakeholders contacted: IOSH, BOHS, SOM, ISES, NVVA (contacts IOM/TNO) & through EPHOR network
 - 228 responses, 134 fully completed responses.
 - 64 participants are interested to be contacted/involved in the future.

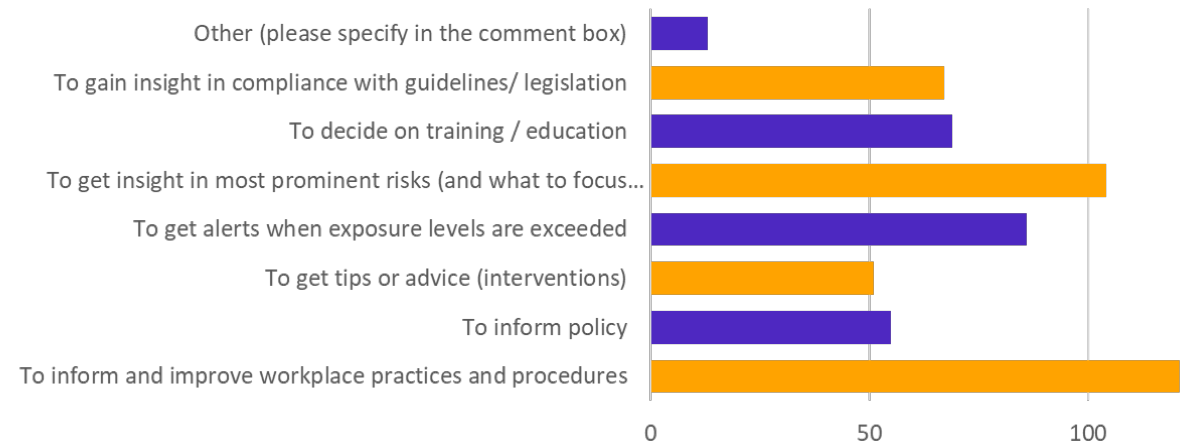
Are you in favour of using wearable tech at the workplace to track OSH risk factors?



Environmental information that your company would be happy for wearable sensors to collect



What is your main interest in the data following any monitoring periods that use wearable sensors in workplaces?



Progress anno 2021: Toolbox

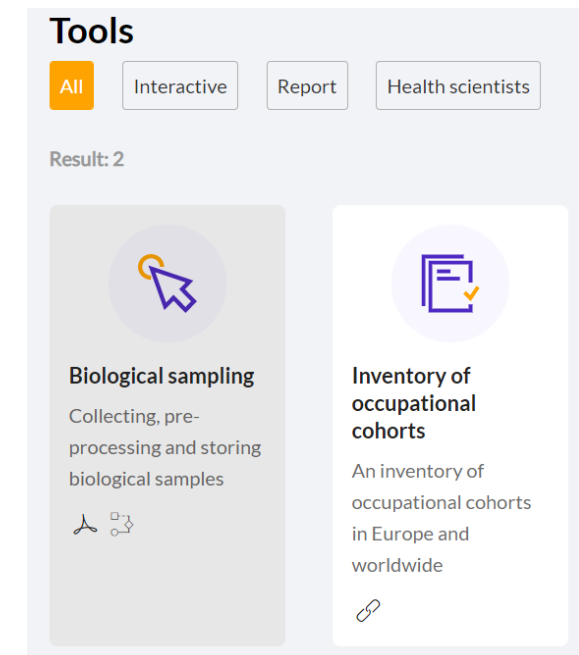


- Toolbox version 0.1 is live:
<https://www.we-expose.eu/>
- Current tools:
 - Inventory of occupational cohorts
 - Biological sampling strategy
- New expected tools coming years:
 - Methods for application of sensors
 - EuroJEM
 - Use of Megacohort
 - Data analyses methods
 - Health impact assessment
- Stakeholders will be involved in the development of tools



Working Life Exposome Toolbox

The WE-EXPOSE (Working Life Exposome for Policy, OSH, and Science) Toolbox provides health scientists, occupational health practitioners, and policy makers with.



Get involved!



- Follow progress and linked activities via linkedin company page:
[Ephor Project EU - on the working life exposome: My Company | LinkedIn](#)
- Contribute as a stakeholder in the stakeholder consultations guiding optimal development of the tools and toolbox:
 - Scientists
 - Occupational health practitioners
 - Policy makers
- Collaborate with relevant cohorts & JEMs

Acknowledgments



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Project coordinator

TNO, NL (Anjoeka Pronk, Astrid Kruizinga, Rob Stierum, Eelco Kuijpers)



Part of the European Human Exposome Network

www.humanexposome.eu

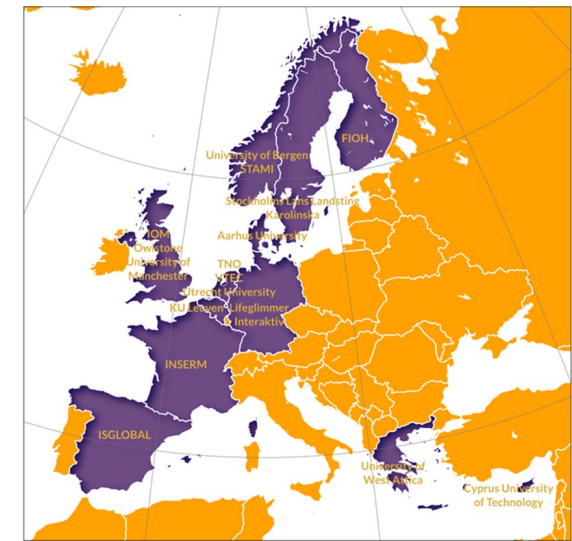


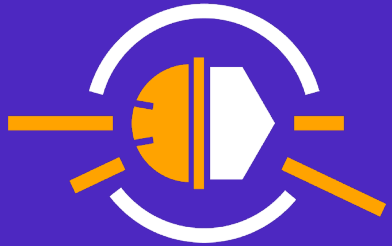
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Lifeglimmer, DE (Lorna Morris);
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Interaktiv GmbH, DE (Jorg Zell);
Cyprus University of Technology, CY (Konstantinos Makris);
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EPHOR

Exposome tools for a healthy working life

THANKS FOR YOUR ATTENTION

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