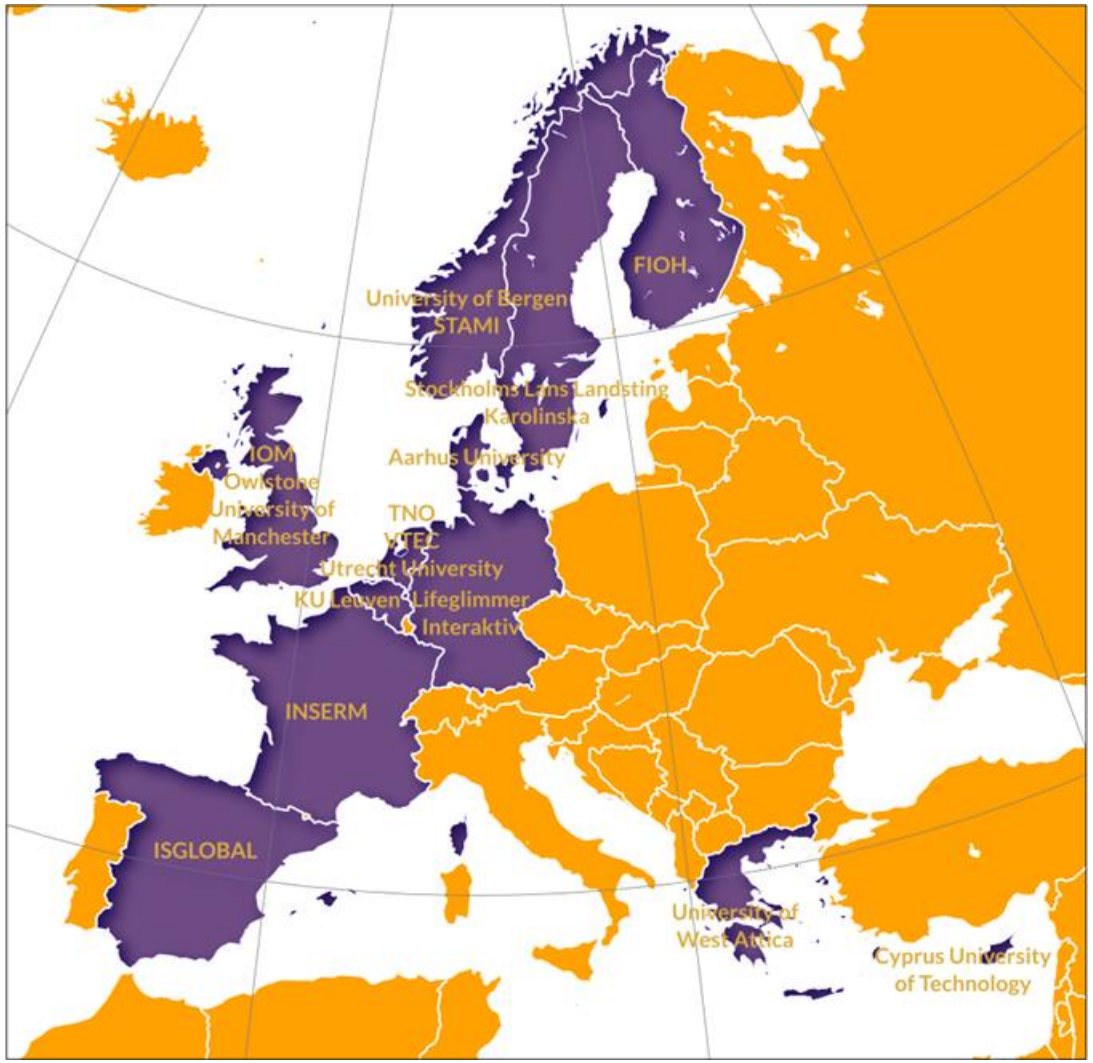
EPHOR
Exposome tools for a healthy working life

Applying the exposome concept to working-life health: The EU EPHOR project

Anjoeka Pronk, TNO, The Netherlands

What is EPHOR?

EPHOR Exposome tools for a healthy working life



- Exposome Project for Health and Occupational Research
- EU Project: 2020-2024 (19 partners)
- Providing better insights into:
  - Working life-health relationships
  - Vulnerable life stages and groups
- Laying the groundwork for prevention:
  - Evidence-based
  - Cost- effective

Definition

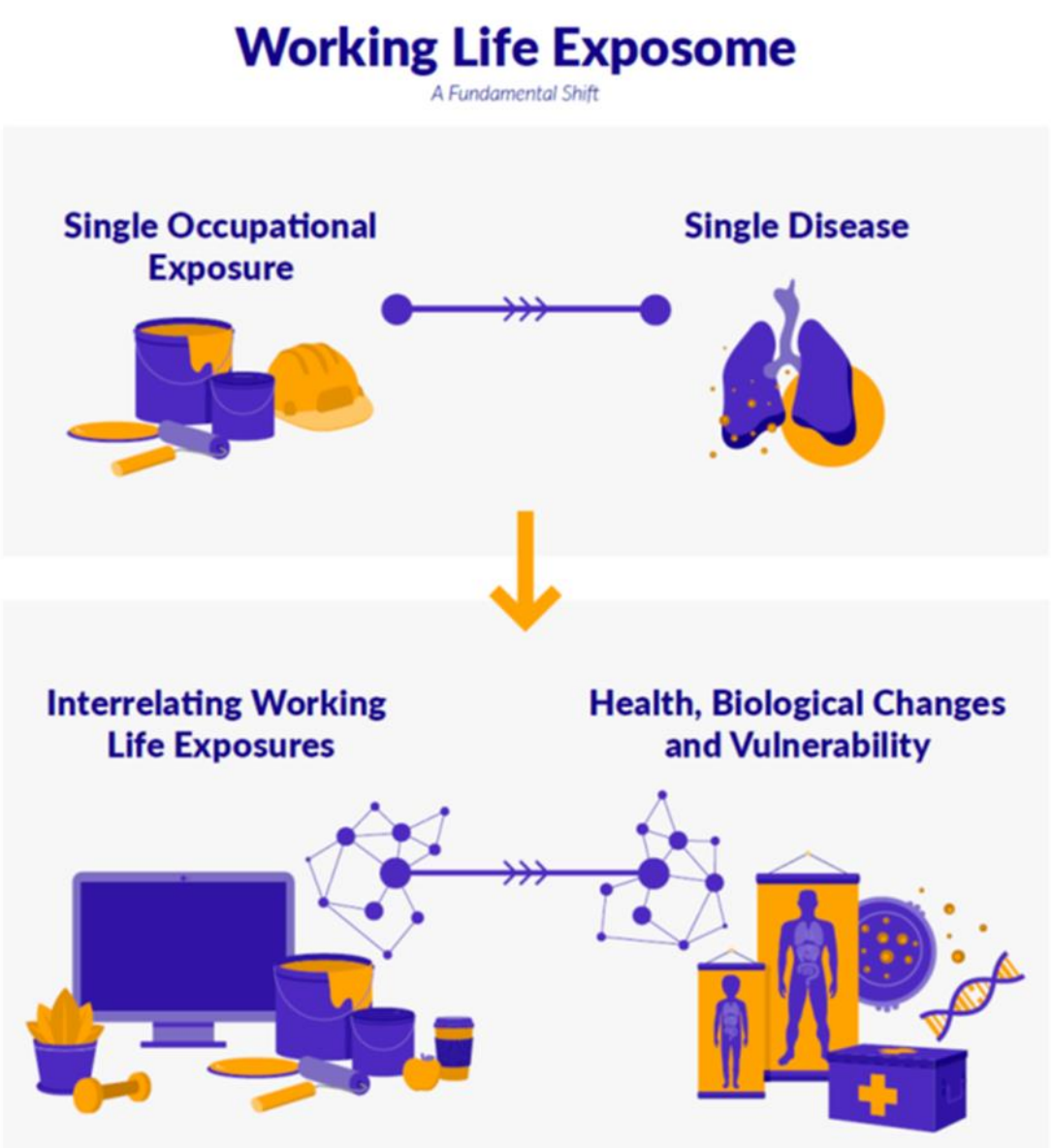
EPHOR Exposome tools for a healthy working life

The working life exposome:

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

Why EPHOR?

EPHOR Exposome tools for a healthy working life



- 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

Objectives

EPHOR Exposome tools for a healthy working life

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

Expected outcomes & impact

EPHOR Exposome tools for a healthy working life

Working Life Exposome Toolbox

Dissemination and Exploitation

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

Approach

EPHOR Exposome tools for a healthy working life

APPROACH

Mega Cohort

Large scale pooling of EU cohorts

Case Studies

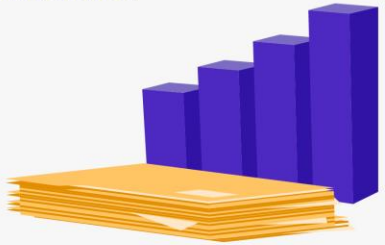
Focus on respiratory disease

Focus on shift work

EXPOSOME DATA

Existing Data

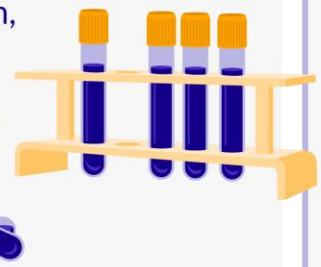
Cohorts, job exposure matrices, databases



Also New Data

External: individual level, high resolution, many exposures

Internal: biomarkers and omics



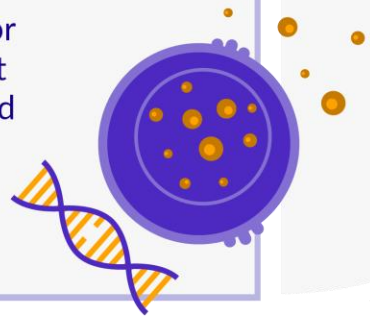
EXPOSURE-RESPONSE DATA

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

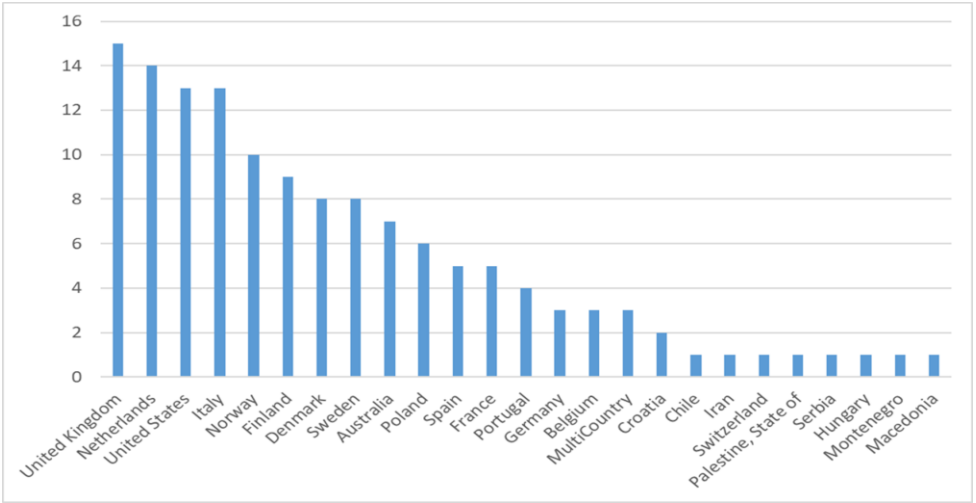
Based on working life exposure-response data.

Progress M22: Mega cohort approach

EPHOR Exposome tools for a healthy working life

- Inventory of relevant EU cohorts made (>140)
  - Collaboration with EU OmegaNet
  - 13 selected as the initial EPHOR Mega cohort

  (more in keynote Michelle Turner)



- Harmonised JEMs for exposure assessment: EuroJEM
  - Existing JEMs for chemical, particle, ergonomic, psychosocial and physical exposures
  - New JEM development:
    - UV light (E2.6)
    - Precarious work
    - Contribution to JEM for SARS-CoV-2 (S10.3)
  - Methods development on use of text mining: S1.5

Progress M22: Mega cohort approach

EPHOR Exposome tools for a healthy working life

- Types of research questions
  - Targeted:
    - Effect of combined exposures, timing of exposure, vulnerable sub groups
  - Agnostic
    - Hierarchical approach: job title, EuroJEM

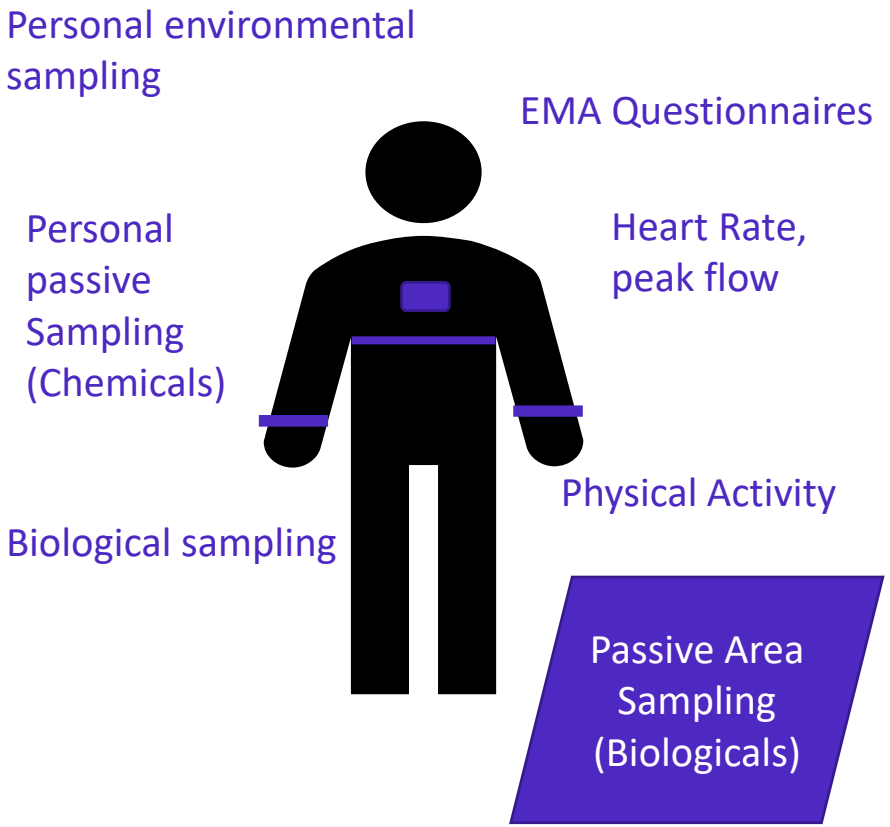
- 6 working groups
  - Critical knowledge gaps → research questions
  - Cancer, cardiovascular/metabolic, neurodegenerative, musculoskeletal, mental, and respiratory disease

- Data analyses methods development (B1.2)

Progress M22: Case studies approach

EPHOR Exposome tools for a healthy working life

- Respiratory:
  - 3000 (long term) / 400 (acute) effects
  - Based within ECRHS & Constances cohorts
  - End points/research priorities:
    - Long term: chronic respiratory effects (prognosis), biomarkers of susceptibility
    - Acute effects: LF, symptoms, effect biomarkers (among asthmatics)
- Shift work (see also S9.4):
  - 1000 subjects in hospitals and transportation
  - End points/research priorities:
    - Cardiovascular health
    - Aging
- Methods development: S1.3 & S1.4



Progress M22: Toolbox

EPHOR Exposome tools for a healthy working life

WEXPOSE

- 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
  - Tutorials
  - Health impact assessment concepts & methods
- Stakeholder involvement

Lessons learned so far

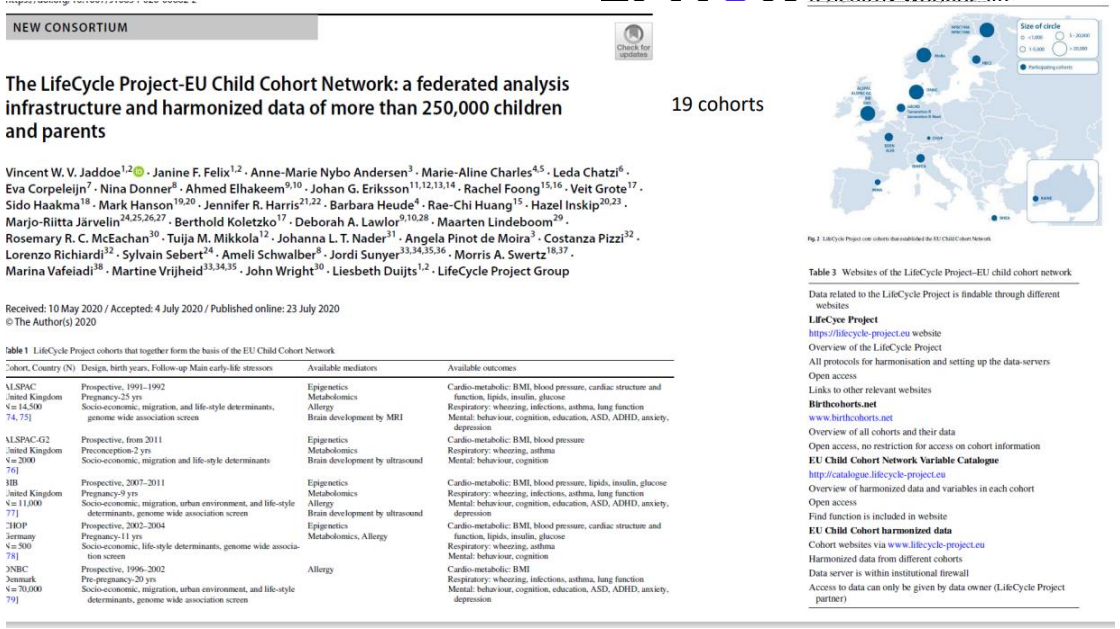
EPHOR Exposome tools for a healthy working life

- 1 Mega-cohort

→ Infrastructure for federated analyses

→ (Protocols for) harmonized data

→Tutorials, methods



NEW CONSORTIUM

The LifeCycle Project-EU Child Cohort Network: a federated analysis infrastructure and harmonized data of more than 250,000 children and parents

19 cohorts

Vincent W. V. Jaddoe[1,2] · Janine F. Felix[1,2] · Anne-Marie Nybo Andersen[3] · Marie-Aline Charles[4,5] · Leda Chatzi[6] · Eva Corpeleijn[7] · Nina Donner[8] · Ahmed Elhakeem[9,10] · Johan G. Eriksson[11,12,13,14] · Rachel Foong[15,16] · Veit Grote[17] · Sido Haakma[18] · Mark Hanson[19,20] · Jennifer R. Harris[21,22] · Barbara Heude[4] · Rae-Chi Huang[15] · Hazel Inskip[20,23] · Marjo-Riitta Järvelin[24,25,26,27] · Berthold Koletzko[17] · Deborah A. Lawlor[9,10,28] · Maarten Lindeboom[29] · Rosemary R. C. McEachan[30] · Tuija M. Mikkola[12] · Johanna L. T. Nader[31] · Angela Pinot de Moira[3] · Costanza Pizzi[32] · Lorenzo Richiardi[32] · Sylvain Sebert[24] · Ameli Schwalber[8] · Jordi Sunyer[33,34,35,36] · Morris A. Swertz[18,37] · Marina Vafeiadi[38] · Martine Vrijheid[33,34,35] · John Wright[30] · Liesbeth Duijts[1,2] · LifeCycle Project Group

Received: 10 May 2020 / Accepted: 4 July 2020 / Published online: 23 July 2020
© The Author(s) 2020

Table 1 LifeCycle Project cohorts that together form the basis of the EU Child Cohort Network

Cohort, Country (N)	Design, birth years, Follow-up	Main early-life stressors	Available mediators	Available outcomes
ALSPAC United Kingdom N = 14,500 74, 75]	Prospective, 1991–1992 Pregnancy-25 yrs	Socio-economic, migration, and life-style determinants, genome wide association screen	Epigenetics Metabolomics Allergy Brain development by MRI	Cardio-metabolic: BMI, blood pressure, cardiac structure and function, lipids, insulin, glucose Respiratory: wheezing, infections, asthma, lung function Mental: behaviour, cognition, education, ASD, ADHD, anxiety, depression
ALSPAC-G2 United Kingdom N = 2000 76]	Prospective, from 2011 Preconception-2 yrs	Socio-economic, migration and life-style determinants	Epigenetics Metabolomics Brain development by ultrasound	Cardio-metabolic: BMI, blood pressure Respiratory: wheezing, asthma Mental: behaviour, cognition
BIB United Kingdom N = 11,000 77]	Prospective, 2007–2011 Pregnancy-9 yrs	Socio-economic, migration, urban environment, and life-style determinants, genome wide association screen	Epigenetics Metabolomics Allergy Brain development by ultrasound	Cardio-metabolic: BMI, blood pressure, lipids, insulin, glucose Respiratory: wheezing, infections, asthma, lung function Mental: behaviour, cognition, education, ASD, ADHD, anxiety, depression
CHOP Germany N = 500 78]	Prospective, 2002–2004 Pregnancy-11 yrs	Socio-economic, life-style determinants, genome wide association screen	Epigenetics Metabolomics, Allergy	Cardio-metabolic: BMI, blood pressure, cardiac structure and function, lipids, insulin, glucose Respiratory: wheezing, asthma Mental: behaviour, cognition
DNBC Denmark N = 70,000 79]	Prospective, 1996–2002 Pre-pregnancy-20 yrs	Socio-economic, migration, urban environment, and life-style determinants, genome wide association screen	Allergy	Cardio-metabolic: BMI Respiratory: wheezing, infections, asthma, lung function Mental: behaviour, cognition, education, ASD, ADHD, anxiety, depression

Table 3 Websites of the LifeCycle Project–EU child cohort network

Data related to the LifeCycle Project is findable through different websites	
LifeCyce Project	
https://lifecycle-project.eu website	
Overview of the LifeCycle Project	
All protocols for harmonisation and setting up the data-servers	
Open access	
Links to other relevant websites	
Birthcohorts.net	
www.birthcohorts.net	
Overview of all cohorts and their data	
Open access, no restriction for access on cohort information	
EU Child Cohort Network Variable Catalogue	
http://catalogue.lifecycle-project.eu	
Overview of harmonized data and variables in each cohort	
Open access	
Find function is included in website	
EU Child Cohort harmonized data	
Cohort websites via www.lifecycle-project.eu	
Harmonized data from different cohorts	
Data server is within institutional firewall	
Access to data can only be given by data owner (LifeCycle Project partner)	

- New data collection
  - Generic exposome protocols vs study specific needs in case studies
  - COVID: DIY and minimally invasive sampling for future use

Acknowlegdments

EPHOR Exposome tools for a healthy working life

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 874703.

TNO innovation for life

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

EHEN

Part of the European Human Exposome Network
www.humanexposome.eu

WP Leads

IOM, UK, WP 1 (Miranda Loh);
Karolinska Institutet, SE, WP 2 (Maria Albin);
Katholieke Universiteit Leuven, BE, WP 3 (Lode Godderis);
Universiteit Utrecht, NL, WP 4 (Roel Vermeulen);
STAMI, NO, WP 5 (Ingrid Sivesind Mehlum);
Aarhus Universitet, DK, WP 6 (Vivi Schlünssen);
ISGLOBAL, ES, WP 7 (Manolis Kogevinas);
University of Manchester, UK, WP 8 (Martie van Tongeren);
TNO, NL, WP 9-12 (Anjoeka Pronk & Astrid Kruizinga);
University of West Attica, GR, WP 13 (Tina Garani-Papadatos).

Other partners

INSERM, FR (Marcel Goldberg);
FIOH, FI (Svetlana Solovieva);
VTEC-Engineering BV, NL (Jan Mink);
Universitetet i Bergen, NO (Cecilie Svanes);
Lifeglimmer, DE (Lorna Morris);
Owlstone Medical Limited, UK (Will Murch);
Interaktiv GmbH, DE (Jorg Zell);
Cyprus University of Technology, CY (Konstantinos Makris);
SLL, SE (Maria Albin).

EPHOR
Exposome tools for a healthy working life

THANKS FOR YOUR ATTENTION

www.ephor-project.eu

Ephor Project EU - on the working life exposome: My Company | LinkedIn