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Welcome

Welcome to the second European Human Exposome Network (EHEN) newsletter.

It is now just over two years since EHEN was established and this year will see our projects reach their half way point. During the course of the last eight months, eight projects have had their profile papers published in Environmental Epidemiology and one project paper is currently under review. This is an important milestone for EHEN.

Since exposome research is not well understood, a big part of EHEN’s job is to help people understand what it is and how it can impact people’s long-term health. In this newsletter, we explain the types of data being used in the projects and describe in simple terms the external and internal exposures being studied. You can also read progress updates from each project and EHEN working group.

We welcome any feedback you may have on this newsletter so please do not hesitate to contact us.

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Did you know that only 4.3% of the entire population has a clean bill of health¹ and that 20% of all deaths in Europe are related to environmental factors²

We want to change that through EHEN's extensive research.

¹The Lancet, 2015
²European Commission, 2020
EHEN’s Reach

Collectively, the EHEN projects are working in 24 countries across Europe and the USA. There are over 100 data sets being used, representing millions of European citizens, many of which already exist but some are being set up specifically for this research. Each data set has a wide range of data variables such as age, height, weight, blood composition, employment, diet and lifestyle factors, medication, cholesterol and many more.

What are the types of data sets?

**Cohorts:** A cohort of people is a group who have something in common. Cohort studies are a type of longitudinal study - an approach that follows research participants over a period of time (often many years).

**Cross-sectional:** Cross-sectional data, or a cross section of a study population, is a type of data collected by observing many subjects (such as individuals, countries, or regions) at one point or period of time.

**Biobanks:** A biobank is a collection of biological samples and health information. Samples of bodily fluid or tissue e.g., blood, are collected for research use to improve understanding of health and disease.

**RCTs:** Randomised controlled trials (RCT) are prospective studies following participants forward in time. RCTs measure the effectiveness of a new intervention or treatment. In RCTs, participants are recruited and randomly assigned to two or more groups. One group (the experimental group) has the intervention being tested, the other (the comparison or control group) has an alternative intervention, a dummy intervention (placebo) or no intervention at all.

Case control study (or retrospective study): These studies compare a group of patients with a disease or outcome of interest (cases) with a group of people who do not have the disease or outcome (controls). In these studies, researchers compare how frequently the exposure to a risk factor is present in each group and from there determine the relationship between the risk factor and the disease.

Health or Occupational registries: A registry is a collection of information about individuals, usually focused around a specific diagnosis or condition. National registries can help government officials, health practitioners, and clinical researchers answer a variety of critical questions and are useful for better planning and regulation of healthcare delivery at a national level. They can help to track trends and are used for health analysis, health statistics, improving the quality of healthcare, research, administration and emergency preparedness.

EHEN also involves a database with data on working life and health on the national level, encompassing information on job life history of the entire working population in a certain time period.

How is the data used?

The EHEN project teams are using this huge collection of data to study a large variety of exposures and their impact on health.

For example, we may look at air pollution exposures and access to green space and their combined effect on blood pressure to understand the risk of heart disease across the life-course.

In addition to the citizen data sets, the EHEN projects also access environmental and exposure data including, for example, earth observation data, atmospheric variables and air pollution related data.
Exposures Being Studied

EHEN researchers are studying the environmental exposures an individual has over a lifetime (external exposome) and how our bodies respond to these exposures (internal exposome). Many of the ‘internal’ or biological studies are referred to as ‘omics’ sciences. Omics refers to the fact that researchers are trying to study all of something. For example, metabolomics is the science that studies all chemical processes involving metabolites (small molecules). Below we explain in more detail some of those exposures.

Epigenomics: The study of all of the epigenetic changes in a cell. In other words understanding how our behaviours and environment can cause changes to the way genes are switched on and off without changing the DNA structure or sequence (the exact order of the four building blocks, or bases, that make up DNA).

Transcriptomics: The study of all RNA (ribonucleic acid) molecules in a cell. An RNA molecule is a long, single-stranded chain of cells that process protein. Within a cell, RNA is copied from pieces of DNA and contains information to make proteins and perform other important functions. Transcriptomics is used to understand more about how genes are turned on and off. This is also called gene expression.

DNA Methylation is an epigenetic modification or biological process by which methyl groups (three hydrogen atoms bonded to a carbon atom) are added to the DNA molecule to modify gene expression.

miRNA are small RNA molecules that control gene expression. Molecules of microRNA are found in cells and in the bloodstream.

External exposures

Internal exposures

Microbiome and Metagenomics
Food and Drink
Chemicals
Medicines
Work
Metals

Green and Blue Environment
Built Environment
Air
Noise
Social

Social: Personal circumstances including for example, education, family, occupation, income, housing, etc.

Green/Blue Environment: Green space such as parks, woodland, gardens etc. and/or outdoor space which features water e.g., lakes, rivers, the sea etc.

Built Environment: Refers to the human-made environment in which people live, work and play on a day to day basis. Includes homes, buildings, streets, pavements, open spaces, transportation options and more.

Proteomics
Immunome
Metabolomics

Telomere length
Epigenomics
DNA Methylation
miRNA
Gene expression

Proteomics
Immunome
Metabolomics

Transcriptomics
Gene expression

Metabolomics: Study of small molecules, commonly known as metabolites, within cells, biofluids, tissues or organisms. Metabolites are made when the body breaks down food, drugs, chemicals or its own tissue. Collectively, these small molecules and their interactions within the body are known as the metabolome.
EHEN Toolbox

It is recognised across EHEN that it will be important to build an inventory of tools developed in all projects. Examples of tools are data catalogues, protocols for future studies, analytical tools etc. This tool inventory or “virtual toolbox” will be available on the EHEN website. Work is ongoing to develop suitable functionality to allow users to search through all the tools, using an easy-to-use classification system. Links to the location of each tool, as well as a brief explanation of its use, will be included.

Watch this space as we will provide relevant updates on the progress of the tools being developed in each future newsletter.

Latest News

Measuring Air Quality in Basel and Barcelona with Google Air View Cars

For two years a Google Street View car, fitted with advanced air quality measuring equipment by Utrecht University, drove around the streets of Copenhagen and Amsterdam, to build a hyper-local, block-by-block map of air quality.

The maps resulted from this, including measurements of nitrogen dioxide (NO2), black carbon, and ultrafine particles, can now be studied by citizens. But more importantly, it will give scientists the opportunity to investigate what the health effects are and whether there is a need for regulation.

In 2021, the Google Air View cars were adopted by Utrecht University, to get them up and running in other cities and integrate them into the EXPANSE project. In the Autumn of 2021, the car arrived in Basel, where it drove around for several months under the guidance of Kees de Hoogh (SwissTPH) and his team. From December to March the car measured the air quality in Barcelona, under supervision of ISGlobal’s Cathryn Tonne and her team.

Curious to see what this looks like? Have a look at the video made by Spanish media.

Latest from the Working Groups

Communication and Dissemination (C&D)

The C&D Working Group leads EHEN’s communication and dissemination activities and plays a key role in ensuring maximum impact. The group meets every 2-3 months. The last six months has been spent developing tools to support this goal. This includes preparing slides with key EHEN messages, creation of this newsletter, development of a communications calendar, collating information about each project to enable broader understanding of what is being studied and the key expected outputs, producing an inventory of planned tools, and ongoing work around key EHEN stakeholders.

Metadata

The Metadata Working Group met recently to continue to synergise activity related to the data used within the EHEN projects. The ultimate aim is to harmonise the (meta) data across projects where possible and applicable, in particular, harmonisation of the data variables within the data sets to enable researchers to interrogate and make use of more data when undertaking their research. Within the four subgroups progress includes:

- The omics data variables to be harmonised have been identified and summarised in a data model proposal. The HEAP project, is already implementing a similar data model which can be a “proof-of-concept” for the EHEN omics data model.
- Harmonisation protocols have now been agreed for key medical and clinical variables in the data sets used by ATHLETE and LongITools. EPHOR is currently starting this process.
- The chemical subgroup reviewed chemical exposure related variables and drafted a proposal of ontology of chemicals and biomarkers.
- A new Metadata Catalogue has also been developed for LongITools and ATHLETE with an aspiration to add more EHEN projects to it.

Law and Ethics

The Law and Ethics Working Group focuses on specific issues such as cross-border sharing of human tissues and consents, along with larger themes including how exposome research can contribute to individual wellbeing, health and social equity. This group continues to meet regularly to progress this area of work.
In addition to the organisation of its annual consortium meeting in January, the ATHLETE project has launched several new resources:

- A flyer and video in 10 languages, illustrating how the ATHLETE project can improve understanding of how environmental pollutants affect health.
- Follow our latest scientific findings, including our publication in eLife on a new method that allows assessment of diet quality and metabolic health of children from urine samples.
- Rewatch a webinar organised by the CHE EDC Strategies Partnership, on how per- and polyfluoroalkyl substances (PFAS) affect child cardiometabolic health and inflammatory markers.

The EPHOR consortium has reached various milestones:

- The EPHOR toolbox is online (Working Life Exposome Toolbox - We Expose). At the moment there are two tools included. This will expand during the coming year.
- The field studies around respiratory diseases and effect of night shift work has started with the inclusion of the participants.
- There is a consortium meeting in Leuven in which we plan to interact with stakeholders.

If you want to keep up to date with the EPHOR project, please follow us on LinkedIn.

The annual Equal-Life consortium meeting was held on 8th-10th March 2022 in Slovenia (hybrid). The mock-up of the Equal-Life tool was canvassed. Other key outputs include:

- Literature reviews and conceptual frameworks on the pathways between exposome and mental health/child development. Working groups are refining the research questions emerging from the literature and following dialogue and consultation with experts and stakeholders.
- Biomarker analysis on plasma of children with high and low mental health risk is almost done.
- GIS data sets were tested to calculate the built and natural environment indicators prioritised in an exposome list.

The EXIMIOUS consortium has started its first sampling campaigns and activity has begun in the three cohort categories: a) occupational cohorts, b) disease cohorts, and c) general population cohorts. Partners from different work packages are collaborating closely to combine the exposure assessment with biological measurements.

In February 2022, EXIMIOUS organised their second symposium “immune-mediated diseases: an interplay between environment and genetics”. More than 70 participants joined this event. Did you miss it? Worry not, you can watch the full recording on the EXIMIOUS YouTube channel. If you’d like to be notified about the Spring/Summer symposium, including more exposome research highlights and insights, subscribe here.

The EXPANSE consortium is an active community of over 120 members. Key outputs in the last six months are:

- Development of a new mobile phone application to engage study participants in exposome research.
- Delivery of a set of geospatial surfaces describing the various dimensions of the urban exposome.
- Development of methodologies for exposome assessment and statistical inference.
- Establishment of active working groups on epidemiological analyses of exposome and cardiovascular disease, lung health, administrative cohorts and omics data.

HEDIMED has built a solid basis for successful research, impact and comms. It will soon issue its first newsletter and contact central stakeholders in the spring. The latest key research outputs are:

- Transfer of samples from clinical cohorts and trials to omics-performing labs and start of the analyses (e.g. proteomics, volatilomics).
- Setup of project’s internal data analysis platform.
- Start of the analyses of environmental factors relating to immune-mediated diseases using satellite data.
- Construction of system dynamics model for the modelling the effects of preventive interventions against different immune-mediated diseases.
The HEAP informatics platform will provide a complete workflow for obtaining actionable knowledge from exposome research data. Resources for researchers are now available, including a video overview of the HEAP platform. In 2022, it is being tested with data from consumer receipts, wearable sensors, biological samples, national registries and population-based cohorts.

Events and resources planned for later this year are:

- A public talks programme on “The role of exposome research in addressing major societal challenges”.
- A series of video tutorials for researchers, with tips on ensuring their data is FAIR.

For further news, subscribe to the newsletter.

**LongITools**

The LongITools consortium now has over 110 active members. A new group for early career researchers has been set up to enable networking and more sustainable collaboration between our teams. Key outputs in this period are:

- An online, searchable catalogue detailing information about data sets and harmonised variables available, the common data model and institutions involved. Its public launch is in May.
- A database recording the major policies, laws and regulations related to the external exposome (e.g., pension rules, state benefits, healthcare system reforms) in the countries where our data sets are.
- Two policy forums, on air pollution (September 21) and obesity (March 22).

**REMEDIA**

The REMEDIA consortium has worked on gaining access to six cohorts together with the collection of environmental data both through in-situ and modelled data. The methodological aspects of the case-control studies to be performed for internal exposome analysis have been finalised, and exposome-phenotype associations statistical and machine learning analyses are due to start soon.

Sensors dedicated to developing an environmental toolbox as well as a biomarker sensor have been designed and tested. Test campaigns have been conducted to simulate at the laboratory targeted representative atmospheres. A “Pan European multicriteria risk assessment analysis” has started.

The consortium held its annual meeting on 14th-15th March 2022 in Patras, Greece, in person!

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**Upcoming Events**

**EHEN Scientific Meeting, Barcelona**

24th-25th May 2022

The EHEN projects will be meeting in Barcelona or online on 24th and 25th May 2022. We are hoping for a collaborative meeting with much knowledge sharing. Each project and working group will give an update on progress and there will be a number of presentations focused on sharing scientific developments. This will be the first opportunity to meet in person since the launch of EHEN in Brussels in February 2020.

**Exposome-NL Conference, Utrecht**

20th May 2022

The first Exposome-NL conference will take place in Utrecht, the Netherlands on 20th May 2022, where you can hear the latest insights and future perspectives in the field of exposome research. Experts will cover topics such as the microbiome, metabolomics, sensoring, geospatial modelling, data science, ethics, the social exposome, global health, and exposome and policy. The deadline for submission of abstracts for the poster session is 15th April 2022. More information [here](#).

**Paula Rantakallio Symposium, Oulu**

15th-17th June 2022

The next Paula Rantakallio Symposium will be held in Oulu, Finland as a hybrid event. It will focus on recent discoveries and methodological advances in life-course epidemiology and longitudinal analyses in a wide array of chronic health conditions e.g., obesity, depression, cardiovascular diseases, and dementia.

Early bird registration and abstract submission is open until the 22nd April 2022. For the preliminary programme please visit the [website](#).
Project Profile Papers

ATHLETE

EPHOR
Applying the exposome concept to working life health. The EU EPHOR project. Environmental Epidemiology, April 2022 6(2):e185. doi: 10.1097/EE9.000000000000185

Equal-Life

EXIMIOUS

EXPANSE
Developing the building blocks to elucidate the impact of the urban exposome on cardiometabolic-pulmonary disease. The EU EXPANSE project. Environmental Epidemiology, August 2021, 5(4):e162. doi: 10.1097/EE9.000000000000162

HEAP

LongITools

REMEDIA

The HEDIMED profile paper is still under review.

What is a profile or overview paper?
A profile or overview paper describes the scientific concepts, methodologies, goals, expected outcomes, and the strengths and challenges of the research project.
It is important because it puts an initial stake in the ground for the research and can be cited in future publications.

For more information visit the website:
https://www.humanexposome.eu/

And for details of upcoming exposome-related events visit:
https://www.humanexposome.eu/events/

This newsletter only reflects the author’s view and the European Commission is not responsible for any use that may be made of the information it contains.

All projects which are part of the European Human Exposome Network received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreements No: 874583 (ATHLETE), 874703 (EPHOR), 874724 (EQUAL-LIFE), 874707 (EXIMIOUS), 874627 (EXPANSE), 874662 (HEAP), 874864 (HEDIMED), 874739 (LONGITools) and 874753 (REMEDIA).