



European Educational Programme in Epidemiology

35th RESIDENTIAL SUMMER COURSE

FLORENCE, ITALY

Specialized Courses 10 – 14 JULY 2023



European Educational Programme in Epidemiology

Specialized Courses:

“GIS (Geographic Information Systems) in Epidemiology”

Danielle Vienneau & Kees de Hoogh

10 – 13 July 2023

“Computational Epidemiology”

Claus Thorn Ekstrøm & Mikkel Andersen

10 – 13 July 2023

“Genetic and Epigenetic Epidemiology”

David Evans, Gibran Hemani, Matthew Suderman, Paul Yousefi

10 – 14 July 2023

“Modern time series methods for public health and epidemiology”

Antonio Gasparrini, Ana Maria Vicedo-Cabrera & Francesco Sera

10 – 14 July 2023

“Perinatal and Early Life Epidemiology”

Anne-Marie Nybo Andersen, David Taylor-Robinson, Katrine Strandberg-Larsen

10 – 14 July 2023

WELCOME DRINKS:

10 July, 18:30 – 19:30

GIS (Geographic Information Systems) in Epidemiology

10 – 13 July 2023

Danielle Vienneau and Kees de Hoogh

Program Monday 10 July 2023

08:30 – 09:00 **Software clinic** (optional, only if you need help)

09:00 – 10:30 **Course Introduction**

Quick start to GIS

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Exercise 1** Exploring ArcGIS10 and mapping

13:00 – 14:00 **Lunch**

14:30 – 15:30 **Exercise 2** Spatial analysis and interpolation

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Exercise 2** Spatial analysis and interpolation

17.30 – 18.00 **Wrap up day 1**

Program Tuesday 11 July 2023

09:00 – 10:30 **Exercise 3** Working with raster data

10:30 – 11:00 **Coffee Break**

11:00 – 13:00 **Exercise 3** Working with raster data

13:00 – 14:00 **Lunch**

14:30 – 15:30 **Lecture 1**

GIS in Epidemiology – Danielle Vienneau

Exercise 4 Projections and geocoding

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Exercise 4** Projections and geocoding

17:30 – 18:00 **Wrap up day 2**

Program **Wednesday 12 July 2023**

09:00 – 10:30 **Exercise 5** Route Analysis

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Exercise 5** Route Analysis

13:00 – 14:00 **Lunch**

14:30 – 15:30 **Lecture 2**

Exposure assessment using GIS – Kees de Hoogh

Exercise 6 Health Risk Assessment - Italy

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Exercise 6** Health Risk Assessment - Italy

17:30 – 18:00 **Wrap up day 3**

Program Thursday 13 July 2023

09:00 – 10:30 **Exercise 7** Exploring and mapping QGIS

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Exercise 8** Spatial analysis and interpolation QGIS

13:00 – 14:00 **Lunch**

14:30 – 15:30 **Lecture 3**

Mapping and Communication - Danielle Vienneau

Exercise 9 Advanced Topics / “choose your own adventure”

15:30 – 16:00 **Coffee point available**

16:00 – 17:00 **Exercise 9** Advanced Topics / “choose your own adventure”

Computational Epidemiology

10 – 13 July 2023

Claus Thorn Ekstrøm, Mikkel Andersen

Program Monday 10 July 2023

Topic: Computational tools for large scale epidemiological analysis

09:00 – 10:30

Sessions 1

Introduction to the course: schedule, content, material, and R

Lecture: The computational toolbox: overfitting, loss functions, data splitting, cross-validation, non-parametric and parametric bootstrap

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Practical

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Penalized regression, lasso, variable selection

Practical

15:30 – 16:00

Coffee Break

16:00 – 17:30

Sessions 4

Lecture: Ridge regression and elastic net, de-lassoing

Practical

Program Tuesday 11 July 2023

Topic: Non-parametric prediction using random forests

09:00 – 10:30

Sessions 1

Lecture: Decision trees and random forests

Practical

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Nearest neighbor smoothing, combining predictions into ensemble learners

Practical

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Prediction errors and random forest tuning

Practical

15:30 – 16:00

Coffee Break

16:00 – 17:30

Sessions 4

Lecture: Variable importance

Practical

Program Wednesday 12 July 2023

Topic: Neural networks and deep learning

09:00 – 10:30

Sessions 1

Lecture: Supervised vs unsupervised learning. Logistic regression as a machine learning method

Practical

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Neural network architecture and flexibility

Practical

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Deep learning, neural networks

Practical

15:30 – 16:00

Coffee Break

16:00 – 17:30

Sessions 4

Lecture: Pitfalls, AI, deep learning vs traditional statistical models.

Practical: Prediction competition

Program Thursday 13 July 2023

Topic: Data-driven causal structure learning

09:00 – 10:30

Sessions 1

Lecture: DAGs and causal inference. Causal discovery / structure learning. Causality and machine learning

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Invariant prediction accuracy from causal models

Practical

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: The PC algorithm for causal discovery

Practical

15:30 – 16:00

Coffee Break

16:00 – 17:30

Sessions 4

Lecture: The temporal PC algorithm for including exogeneous temporal information in causal discovery

Practical

Genetic and Epigenetic Epidemiology

10 – 14 July 2023

David Evans, Gibran Hemani, Matthew Suderman & Paul Yousefi

Program Monday 10 July 2023

08:00 – 09:00 **Optional refresher session on R**
- **R Practical session:** Basics of R; Using packages; Simple plotting
(Practical) – Gibran Hemani

09:00 – 10:30 **Session 1**
- **Course Outline / Introduction**
(Lecture) – David Evans

- **Genetics Theory:** Molecular and biological basis of inheritance;
Hardy-Weinberg; Biometrical Genetics; Complex traits and Diseases;
Linkage disequilibrium; Haplotypes and tagging
(Lecture) – David Evans

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Session 2**
- **Introduction to genetic data:** Genetic data formats; PLINK software;
Quality control in GWAS
(Practical) - Gibran Hemani

13:00 – 14:00 **Lunch**

14:00 – 15:30 **Session 3**
- **Genetic Association Studies and GWAS:** GWAS studies of
quantitative and dichotomous traits
(Lecture + Practical) – David Evans

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Session 4**
- **Population stratification:** Using genetic data to uncover and control
for underlying population structure; Mixed models in GWAS
(Lecture + Practical) – David Evans

Program Tuesday 11 July 2023

09:00 – 10:30

Session 1

- **Imputation:** Imputation of genetic data in GWAS
(Lecture + Practical) – Gibran Hemani

10:30 – 11:00

Coffee Break

11:00 – 12:30

Session 2

- **Meta-analysis:** EasyQC; GWAS Meta-analysis; MTAG
(Lecture + Practical) – Gibran Hemani

13:00 – 14:00

Lunch

14:00 – 15:30

Session 3

- **Follow up of findings:** Interpretation of genome-wide significant associations and follow up of findings
(Lecture + Practical) – Gibran Hemani

15:30 – 16:00

Coffee point available

16:00 – 17:30

Session 4

- **Polygenic approaches:** Polygenic scores; SNP heritability; Genetic correlation; G-REML and GCTA; LD Score regression
(Lecture + Practical) – David Evans

Program Wednesday 12 July 2023

09:00 – 10:30 **Session 1**
- Introduction to Mendelian randomization: Mendelian randomization studies
(Lecture) – Gibran Hemani

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Session 2**
- Introduction to Epigenetic epidemiology: Gene regulation, cell differentiation, different epigenetic mechanisms, why epidemiologists might be interested in epigenetics
(Lecture) – Matthew Suderman

13:00 – 14:00 **Lunch**

14:00 – 15:30 **Session 3**
- Epigenome wide association studies: Theory, examples from the literature, data prep, practical in R
(Lecture + Practical) – Matthew Suderman

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Session 4**
- Beyond EWAS: EWAS functional interpretation, DMRs, meta-analysis, data integration, mQTLs, practical in R

(Lecture + Practical) – Matthew Suderman

Program Thursday 13 July 2023

09:00 – 10:30 **Session 1**
- Clinical epigenetics: Examples from the literature, study design, translational applications, practical in R

(Lecture + Practical) – Matthew Suderman and Paul Yousefi

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Session 2**
- Epigenetic predictors: Predictive vs. explanatory modelling, resampling methods, performance metrics, practical in R

(Lecture + Practical) – Paul Yousefi

13:00 – 14:00 **Lunch**

14:00 – 15:30 **Session 3**
- Causal inference in Epigenetics: Theory and examples from the literature, e.g. negative control designs, 2 step MR, MR or negative control

(Lecture) – Paul Yousefi

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 **Session 4**
- Mendelian randomization and Epigenetic Studies: 2 step MR practical in R

(Practical) – Matthew Suderman

Program Friday 14 July 2023

09:00 – 10:30

Session 1

-Power and Type 1 error in Genetic Epidemiology: Statistical Power; Significance; Type I error; Mini-practical involving Purcell's Genetic Power Calculator and Mendelian Randomization power calculator

(Lecture + Practical) – David Evans

10:30 – 11:00

Coffee Break

11:00 – 12:30

Session 2

-Current topics in Genetic and Epigenetic Epidemiology (L) (DE, GH, RR, GS): Tutors present 30mins on a current research topic of theirs

(Lecture) – David Evans, Gibran Hemani, Matthew Suderman, Paul Yousefi

Modern time series methods for public health and epidemiology

10 – 14 July 2023

Antonio Gasparrini, Francesco Sera, Ana Maria Vicedo-Cabrera

Program Monday 10 July 2023

Topic: Time series in epidemiology and public health

09:00 – 10:30

Sessions 1

Introduction to the course: schedule, content, material, and R

Lecture: Intro to time series data and analysis

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Time series analysis in environmental epidemiology

Demo: An analysis of short-term effects of air pollution in London

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Interrupted time series (ITS) design

Demo: Effect of the indoor smoking ban on cardiovascular events

15:30 – 16:00

Coffee point available

16:00 – 17:30

Sessions 4

Real-data practical

Program Tuesday 11 July 2023

Topic: Modelling complex temporal relationships

09:00 – 10:30

Sessions 1

Lecture: Distributed lag models (DLMs)

Demo: Investigating lagged effects of air pollution

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Distributed lag non-linear models (DLNMs)

Demo: Investigating risk associations of temperature

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Extensions of DLMs and DLNMs

Demo: DLMs/DLNMs in cancer epidemiology using cohort data

Demo: An application of DLMs/DLNMs pharmaco-epidemiology

15:30 – 16:00

Coffee point available

16:00 – 17:30

Sessions 4

Real-data practical

Program Wednesday 12 July 2023

Topic: Novel time series designs and data methods

09:00 – 10:30

Sessions 1

Lecture: The case time series (CTS) design

Demo: CTS analysis of electronic health records of clinical data

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Data resources for time series analysis

Demo: Application of the CTS design in smartphone studies

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Complex linkage and GIS methods for time series data

Demo: Small-area analysis with the CTS design

15:30 – 16:00

Coffee point available

16:00 – 17:30

Sessions 4

Real-data practical

Program Thursday 13 July 2023

Topic: Health impact assessments with time series data

09:00 – 10:30

Sessions 1

Lecture: Health impacts of events or interventions

Demo: An analysis of excess mortality during the COVID-19 pandemic

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Excess risk measures for time-varying exposures

Demo: Computing attributable risks of environmental exposures

13:00 – 14:00

Lunch

14:00 – 15:30

Sessions 3

Lecture: Health impact projections under climate change scenarios

Demo: Projections of temperature-related mortality in London

15:30 – 16:00

Coffee point available

16:00 – 17:30

Sessions 4

Real-data practical

Program Friday 14 July 2023

Topic: Multi-location time series studies

09:00 – 10:30

Sessions 1

Lecture: Two-stage designs in environmental research

Demo: Mortality risks of heat across regions of England and Wales

10:30 – 11:00

Coffee Break

11:00 – 12:30

Sessions 2

Lecture: Multi-location ITS studies

Demo: Nationwide analysis of a smoking ban and cardiovascular risk

Final Q&A

Perinatal and early life epidemiology

10 – 14 July 2023

Anne-Marie Nybo Andersen, David-Taylor Robinson, Katrine Strandberg-Larsen

Program Monday 10 July 2023

08:30 – 10:30	Introduction to the course: Why is early life important for public health. DOHaD concept Presentation of faculty and participants
10:30 – 11:00	Coffee Break
11:00 – 13:00	<u>Data sources</u> in Early Life epidemiology
13:00 – 14:30	Lunch
14:30 – 15:30	Discussion of a paper
15:30 – 16:00	Coffee point available
16:00 – 17:30	To study <u>fertility</u>

Program Tuesday 11 July 2023

08:30 – 10:30 To study fetal growth and gestational duration as an outcome

10:30 – 11:00 **Coffee Break**

11:00 – 13:00 To study fetal and infant mortality

13:00 – 14:30 **Lunch**

14:30 – 15:30 Infections and reproduction, maternal infections and child health

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 Presentation by course participants

Program Wednesday 12 July 2023

08:30 – 10:30 Social determinants of perinatal and early life health

10:30 – 11:00 **Coffee Break**

11:00 – 13:00 Methodological challenges when studying lifestyle exposures and perinatal health

13:00 – 14:30 **Lunch**

14:30 – 15:30 Discussion of a paper

15:30 – 16:00 **Coffee point available**

16:00 – 17:30 Presentation by course participants

Program Thursday 13 July 2023

08:30 – 10:30	To study <u>congenital anomalies</u> <i>Incl. issues around medication in pregnancy</i>
10:30 – 11:00	Coffee Break
11:00 – 13:00	To study <u>health consequences of perinatal characteristics</u> : fetal growth, birthweight and gestational age
13:00 – 14:30	Lunch
14:30 – 15:30	Discussion of a paper
15:30 – 16:00	Coffee point available
16:00 – 17:30	<u>Birth cohort studies</u> : opportunities and limitations

Program Friday 14 July 2023

08:30 – 10:30

Life course studies:

Childhood adversities and later health consequences *ACEs* as *concept*

10:30 – 11:00

Coffee Break

11:00 – 13:00

Screening in pregnancy, polygenic risk scores, ethical issues around early life epidemiology

13:00 – 14:30

Lunch

14:30 – 15:30

End of course

Evaluation of course



European Educational Programme in Epidemiology

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