



# **European Educational Programme in Epidemiology**

**32<sup>nd</sup> RESIDENTIAL SUMMER COURSE  
FLORENCE, ITALY  
Specialized Courses 8 – 12 JULY 2019**



# European Educational Programme in Epidemiology

## Specialized Courses:

### **“GIS (Geographic Information Systems) in Epidemiology”**

*Danielle Vienneau & Kees de Hoogh*

8 – 11 July 2019

### **“Geo-spatial methods for global health applications”**

*Annibale Biggeri & Emanuele Giorgi & Corrado Lagazio*

8 – 11 July 2019

### **“Genetic and Epigenetic Epidemiology”**

*David Evans & Gibran Hemani & Gemma Sharp & Rebecca Richmond*

8 – 12 July 2019

## **WELCOME DRINKS:**

8 July, 18:30 – 19:30

**“GIS (Geographic Information Systems) in Epidemiology”**

8 – 11 July 2019

***Danielle Vienneau and Kees de Hoogh***

**Program Monday 8 July 2019**

---

08:30 – 10:30 Optional Software clinic (1hr)  
**Class starts 9:30!**  
Course intro (30min) – Kees de Hoogh  
**Quick start to GIS**  
Intro and Demo (30min) – Danielle Vienneau

---

10:30 – 11:00 **Coffee Break**

---

11:00 – 13:00 **Quick start to GIS continued**  
Exercise 1 (2hr)

---

13:00 – 14:00 **Lunch**

---

14:30 – 15:30 **Lecture 1**  
GIS in Epidemiology (1h) – Danielle Vienneau

---

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

---

16:00 – 18:00 **Spatial relationships and analysis**  
Intro (15min) – Kees de Hoogh  
Exercise 2 (1h45min)

---

**Program**      **Tuesday 9 July 2019**

---

08:30 – 10:30      **Working with raster data**  
Intro (15min) – Kees de Hoogh  
Exercise 3 (1h45min)

---

10:30 – 11:00      **Coffee Break**

---

11:00 – 13:00      **Projections and geocoding**  
Intro (15min) – Danielle Vienneau  
Exercise 4 (1h45min)

---

13:00 – 14:00      **Lunch**

---

14:30 – 15:30      **Lecture 2**  
Exposure assessment using GIS (1h) – Kees de Hoogh

---

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

---

16:00 – 18:00      **Wrap-up and discussion**  
(finish exercises, overview day 1&2)

---

**Program**      **Wednesday 10 July 2019**

---

08:30 – 10:30      **Decision making with Route Analysis**  
Intro (15min) – Kees de Hoogh  
Exercise 5 (1h45min)

---

10:30 – 11:00      **Coffee Break**

---

11:00 – 13:00      **Risk assessment**  
Intro (15min) – Danielle Vienneau  
Exercise 6 (1h45min)

---

13:00 – 14:00      **Lunch**

---

14:30 – 15:30      **Lecture 3**  
Mapping and Communication (1h) – Kees de Hoogh & Danielle  
Vienneau

---

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

---

16:00 – 18:00      **Quick Start to Open course GIS**  
Intro (15min) – Kees de Hoogh  
Exercise 7 (1h45min)

---

**Program Thursday 11 July 2019**

---

08:30 – 10:30 **Open source GIS part 2**  
Intro (15min) – Kees de Hoogh  
Exercise 8 (1h45min)

---

10:30 – 11:00 **Coffee Break**

---

11:00 – 13:00 **Self-study / GIS-help desk (2h)**  
Option to work on own project data or additional prepared exercises  
(Spatial Pattern Analysis, ModelBuilder)

---

13:00 – 14:00 **Lunch**

---

14:30 – 15:30 **Self-study / GIS-help desk (1h)**  
(share experiences in own projects)

---

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

---

16:00 – 17:00 **Wrap-up and discussion (1h)**  
(share experiences in own projects)

---

**“Geo-spatial methods for global health applications”**

8 – 11 July 2019

**Annibale Biggeri & Emanuele Giorgi & Corrado Lagazio**

**Lessons begin at 9:00 and at 14:30**

**Monday 8<sup>th</sup> July**

- Spatial areal data
- Historical review of Disease Atlases
- Principles of Disease Mapping

**Tuesday 9<sup>th</sup> July**

- Bayesian approaches to Disease Mapping
- Using Posterior Quantities
- Bayesian Ranking

**Wednesday 10<sup>th</sup> July**

- The class of geostatistical problems.
- Exploring spatial correlation in the data: the variogram.
- The linear geostatistical model.
- Geostatistical prediction.

**Thursday 11<sup>th</sup> July**

- The binomial geostatistical model.
- Monte Carlo maximum likelihood.
- Prevalence mapping.

**Coffee breaks: 10:30 – 11:00 and 15:30 -16:00**

## **“Genetic and Epigenetic Epidemiology”**

8 – 12 July 2019

**David Evans & Gibran Hemani & Gemma Sharp & Rebecca Richmond**

Genetic epidemiology refers to the study of the role of genetic factors in determining health and disease in families and in populations. Genetic epidemiological studies have made substantial contributions to understanding the aetiology of complex traits and diseases, and hold great promise for personalised healthcare in the future. This course provides an introduction to the design, analysis and interpretation of genetic and epigenetic epidemiological studies of disease, with a focus on genome-wide and epigenome-wide association studies (GWAS and EWAS). Topics that will be covered include design and analysis of GWAS, imputation, meta-analysis, bioinformatic follow-up, whole genome and polygenic approaches including G-REML and LD score regression, epigenetics, EWAS, and Mendelian randomization (MR). As well as lectures, participants will gain practical experience in analysing genetic and epigenetic datasets. We will use the R statistical software package for the majority of analyses and participants will get plenty of hands on training in this package. By the end of the course participants should have a good working knowledge of concepts in genetic and epigenetic epidemiology, and will be able to perform analyses of genetic and epigenetic datasets

**NB.** This course assumes some familiarity with the R programming language. Students should be familiar with R or should get up to speed by doing the online swirl basic R modules *before* they attend the course (<https://swirlstats.com/>). There will be an optional refresher session on Monday morning at 8am for students who are inexperienced with R.



**Program Monday 8 July 2019**

---

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 9 July 2019**

---

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 10 July 2019**

---

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) – Gemma Sharp, Rebecca Richmond

---

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  
(Practical) – Rebecca Richmond, Gemma Sharp

---

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

---

16:00 – 17:30      **Session 4**  
- **Epigenetics as a mediator:** Examples from the literature, study design  
  
(Lecture) – Gemma Sharp, Rebecca Richmond

---

**Program Thursday 11 July 2019**

---

09:00 – 10:30 **Session 1**  
**-Epigenetics as a predictor:** Examples from the literature, study design, epigenetic age, practical in R  
  
(Practical) – Rebecca Richmond, Gemma Sharp

---

10:30 – 11:00 **Coffee Break**

---

11:00 – 12:30 **Session 2**  
**- Beyond EWAS:** EWAS functional interpretation, DMRs, meta-analysis, data integration, mQTLs  
  
(Lecture) – Gemma Sharp, Rebecca Richmond

---

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 practical in R  
  
(Practical) – Rebecca Richmond, Gemma Sharp

---

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) – Rebecca Richmond, Gemma Sharp

---

**Program**      **Friday 12 July 2019**

---

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, Rebecca Richmond, Gemma Sharp

---



# **European Educational Programme in Epidemiology**

**FACULTY MEMBERS**

## Faculty Members

### **Annibale Biggeri**

Università di Firenze  
Unità Operativa di Biostatistica – ISPO  
Padiglione Alberto Mario Fiori  
Via delle Oblate, 2  
50141 Firenze  
Italy  
E-mail: [abiggeri@ds.unifi.it](mailto:abiggeri@ds.unifi.it)

### **David M Evans**

University of Queensland  
Brisbane St Lucia, QLD 4072  
Australia  
E-mail: [d.evans1@uq.edu.au](mailto:d.evans1@uq.edu.au)

### **Emanuele Giorgi**

Lancaster Medical School  
Faculty of Health and Medicine  
Furness College, Room B73  
Lancaster University  
Lancaster LA1 4YG  
United Kingdom  
E-mail: [e.giorgi@lancaster.ac.uk](mailto:e.giorgi@lancaster.ac.uk)

### **Gibran Hemani**

University of Bristol  
Senate House  
Tyndall Avenue  
Bristol, BS8 1TH  
United Kingdom  
E-mail: [g.hemani@bristol.ac.uk](mailto:g.hemani@bristol.ac.uk)

### **Kees de Hoogh**

Swiss Tropical and Public Health Institute  
Socinstrasse 57  
4002 Basel  
Switzerland  
E-mail: [c.dehoogh@swisstph.ch](mailto:c.dehoogh@swisstph.ch)

### **Corrado Lagazio**

Dept. of Economics  
University of Genova  
Via Vivaldi 5  
16126 Genova  
Italy  
E-mail: [corrado.lagazio@unige.it](mailto:corrado.lagazio@unige.it)

### **Gemma Sharp**

University of Bristol  
Oakfield House  
Oakfield Grove  
Bristol  
United Kingdom  
E-mail: [gemma.sharp@bristol.ac.uk](mailto:gemma.sharp@bristol.ac.uk)

### **Rebecca Richmond**

University of Bristol  
Oakfield House  
Oakfield Grove  
Clifton BS8 2BN  
United Kingdom  
E-mail: [rebecca.richmond@bristol.ac.uk](mailto:rebecca.richmond@bristol.ac.uk)

### **Danielle Vienneau**

Swiss Tropical and Public Health Institute  
Socinstrasse 57  
4002 Basel  
Switzerland  
E-mail: [danielle.vienneau@swisstph.ch](mailto:danielle.vienneau@swisstph.ch)

### **Neil Pearce**

**(Director of the course)**  
Dept. of Medical Statistics  
London School of Hygiene &  
Tropical Medicine  
Keppel Street  
London WC1E 7HT  
United Kingdom  
E-mail: [Neil.Pearce@lshtm.ac.uk](mailto:Neil.Pearce@lshtm.ac.uk)

### **Lorenzo Richiardi**

**(Director of the course)**  
Unit of Cancer Epidemiology  
Dept. of Medical Sciences, University of  
Turin  
Via Santena 7, 10126 Turin  
Italy  
E-mail: [lorenzo.richiardi@unito.it](mailto:lorenzo.richiardi@unito.it)

### **Rodolfo Saracci**

**(Founder Director of the course)**  
Istituto di Fisiologia Clinica del CNR  
Via Trieste 29  
56100 Pisa  
Italy  
E-mail: [saracci@hotmail.com](mailto:saracci@hotmail.com)

### **Secretariat**

#### **Mar Ferrer**

Barcelona Institute for Global Health  
ISGlobal  
Campus Mar  
Doctor Aiguader 88  
08003 Barcelona  
Spain  
E-mail: [eepe@eepe.org](mailto:eepe@eepe.org)