



European Educational Programme in Epidemiology

**32nd 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

8 – 11 July 2019

“Genetic and Epigenetic Epidemiology”

David Evans & Gibran Hemani

8 – 12 July 2019

“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 – 14:30 **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 – 14:30 **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 – 14:30 **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 – 14:30 **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

Monday 8th July

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

Tuesday 9th July

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

Wednesday 10th July

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

Thursday 11th July

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

“Genetic and Epigenetic Epidemiology”

8 – 12 July 2019

David Evans & Gibran Hemani

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 11 June 2018

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

12:30 – 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 12 June 2018**

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

12:30 – 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 13 June 2018**

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

12:30 – 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 14 June 2018

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

12:30 – 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 15 June 2018**

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

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