European Educational Programme in Epidemiology

33rd RESIDENTIAL SUMMER COURSE

FLORENCE, ITALY

Specialized Courses 6 – 10 JULY 2020

European Educational Programme in Epidemiology

Specialized Courses:

“GIS (Geographic Information Systems) in Epidemology”
Danielle Vienneau & Kees de Hoogh
6 – 9 July 2020

“Geo-spatial methods for global health applications with focus on Disease Clustering”
Annibale Biggeri & Toshiro Tango
6 – 9 July 2020

“Genetic and Epigenetic Epidemiology”
David Evans, Gibran Hemani, Gemma Sharp & Rebecca Richmond
6 – 10 July 2020

“Modern mediaton analysis”
Bianca De Stavola & Johan Steen
6 – 9 July 2020

“Modern time series methods for public health and epidemiology”
Antonio Gasparrini, Francesco Sera & Ana Maria Vicedo-Cabrera
6 – 9 July 2020

WELCOME DRINKS:
6 July, 18:30 – 19:30

"GIS (Geographic Information Systems) in Epidemology"
6 – 9 July 2020
Danielle Vienneau and Kees de Hoogh

Program	Monday 6 July 2020
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 7 July 2020
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 8 July 2020

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 9 July 2020
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 with focus on disease clustering"

6 – 9 July 2020

Annibale Biggeri & Toshiro Tango

Lessons begin at 9:00 and at 14:30

Monday 6th July

- Introduction to Spatial Statistics
- Principles of Bayesian Statistics
- Disease Mapping

Tuesday 7th July

- Bayesian approaches to Disease Mapping
- The class of geostatistical problems
- Geostatistical prediction

Wednesday 8th July

- Introduction to "clustering" and "clusters"
- General tests for temporal/spatial clustering
- Focused tests for spatial clustering

Thursday 9th July

- Spatial scan statistics for detecting hot spots (clusters)
- SaTScan and FleXScan
- FleXScan with a restricted likelihood ratio
- Space-time scan statistics for a time-periodic geographical disease surveillance

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

"Genetic and Epigenetic Epidemiology"
6 – 10 July 2020
David Evans, Gibran Hemani, Gemma Sharp & Rebecca Richmond

Program	**Monday 6 July 2020**
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 7 July 2020**
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 8 July 2020
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 9 July 2020
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** **- Beyong 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 10 July 2020
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

Program	Monday 6 July 2020
08:30 – 10:30	Optional Software clinic: setting up R and Stata (1hr) **Class starts 9:30!** **Lecture 1** Course overview and traditional mediation analysis - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 2** Introduction to counterfactual thinking – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Pen & paper practical**

Program	Tuesday 7 July 2020
09:00 – 10:30	**Lecture 3** Identification and estimation of total causal effects - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 4** Introduction to causal diagrams – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Pen & paper and computer practical**

Program Wednesday 8 July 2020

09:00 – 10:30	**Lecture 5** Counterfactual-based mediation analysis in 'simple' settings: estimands and identification - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Paper & pen and computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 6** Counterfactual-based mediation analysis in 'simple' settings: estimation – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Computer practical**

Program	Thursday 8 July 2020
09:00 – 10:30	**Lecture 5** Counterfactual-based mediation analysis in 'complex' settings: multiple mediators - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Pen & paper and computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 6** Counterfactual-based mediation analysis in 'complex' settings: time-varying mediators and time-to-event outcomes – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Pen & paper and computer practical**
17:30 – 18:30	**Course overview -** Bianca De Stavola and Johan Steen

"Modern mediation analysis"
6 – 9 July 2020
Bianca De Stavola & Johan Steen

Program	Monday 6 July 2020
08:30 – 10:30	Optional Software clinic: setting up R and Stata (1hr) **Class starts 9:30!** **Lecture 1** Course overview and traditional mediation analysis - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 2** Introduction to counterfactual thinking – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Pen & paper practical**

Program	Tuesday 7 July 2020
09:00 – 10:30	**Lecture 3** Identification and estimation of total causal effects - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 4** Introduction to causal diagrams – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Pen & paper and computer practical**

Program Wednesday 8 July 2020

09:00 – 10:30	**Lecture 5** Counterfactual-based mediation analysis in 'simple' settings: estimands and identification - Bianca De Stavola
10:30 – 11:00	**Coffee Break**
11:00 – 13:00	**Paper & pen and computer practical**
13:00 – 14:00	**Lunch**
14:30 – 15:30	**Lecture 6** Counterfactual-based mediation analysis in 'simple' settings: estimation – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 18:30	**Computer practical**

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14:30 – 15:30	**Lecture 6** Counterfactual-based mediation analysis in 'complex' settings: time-varying mediators and time-to-event outcomes – Johan Steen
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Pen & paper and computer practical**
17:30 – 18:30	**Course overview -** Bianca De Stavola and Johan Steen

"Modern time series methods for public health and epidemiology"

6 – 9 July 2020

Antonio Gasparrini, Francesco Sera & Ana Maria Vicedo-Cabrera

Program	**Monday 6 July 2020**
08:30 – 09:30	**(Optional) refresher session on R** Basics of R; Intro to R studio (Practical)
	Session 1
09:30 – 09:45	**General introduction to the course**
09:45 - 10:30	**Lecture: Introduction to time series analysis – the basics of the design**
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	**Session 2** **Practical: Time series analysis in environmental epidemiology**
13:00 – 14:00	**Lunch**
14:00 – 15:30	**Session 3** **Lecture: Interrupted time series (ITS) design**
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Session 4** **Practical: ITS for public health evaluation**

Program	Tuesday 7 July 2020
09:00 – 10:30	**Session 1** **Lecture: Flexible modelling of time – Distributed lag linear and non-linear models (DLMs and DLNMs)**
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	**Session 2** **Practical: DLMs and DLNMs in time series analysis**
13:00 – 14:00	**Lunch**
14:00 – 15:30	**Session 3** **Lecture: Extensions of DLMs and DLNMs**
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Session 4** **Practical: Extending DLMs and DLNMs – an application in cancer epidemiology**

Program	Wednesday 8 July 2020
09:00 – 10:30	**Session 1** **Lecture: Modern two-stage designs**
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	**Session 2** **Practical: Application of two-stage designs in multi-location studies**
13:00 – 14:00	**Lunch**
14:00 – 15:30	**Session 3** **Lecture: Health impact projections under climate change scenarios**
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Session 4** **Practical: Projecting health impacts under climate change – an application**

Program	Thursday 9 July 2020
09:00 – 10:30	**Session 1** **Lecture: Case-time series (CTS) – a novel epidemiological design**
10:30 – 11:00	**Coffee Break**
11:00 – 12:30	**Session 2** **Practical: CTS in small-area analysis – examples in environmental epidemiology**
13:00 – 14:00	**Lunch**
14:00 – 15:30	**Session 3** **Practical: CTS in individual-level analysis – examples in pharmaco and clinical epidemiology**
15:30 – 16:00	**Coffee point available**
16:00 – 17:30	**Session 4** **Final remarks**

European Educational Programme in Epidemiology

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