MODULE SPECIFICATION

Academic Year (student cohort covered by specification)	2023-24			
Module Code	3135			
Module Title	Spatial Epidemiology in Public Health			
Module Organiser(s)	Dr Rachel Pullan & Hope Simon			
Faculty	Infectious & Tropical Diseases			
FHEQ Level	Level 7			
Credit Value	**CATS**	15	**ECTS**	7.5
HECoS Code	100265:101317:100379 (1:1:1)			
Term of Delivery	Term 2			
Mode of Delivery	For 2023-24 this module will be delivered by predominantly face-to-face teaching modes. Where specific teaching methods (lectures, seminars, discussion groups) are noted in this module specification these will be delivered by predominantly face-to-face sessions. There will be a combination of live and interactive activities (synchronous learning) as well as recorded or self-directed study (asynchronous learning).			
Mode of Study	Full-time			
Language of Study	English			
Pre-Requisites	This is a quantitative module with a lot of practical computer-based sessions. A willingness to carry out quantitative data analysis is essential and good basic computing skills are needed. Statistical teaching is performed in R for this module. Although students are not expected to have prior knowledge of R, some familiarity is highly advisable. For this reason, students are encouraged to take some of the introductory R courses LSHTM offers throughout Terms 1 and 2. Although not essential, students are recommended to have taken both Extended Epidemiology and Statistical Methods in Epidemiology.			
Accreditation by Professional Statutory and Regulatory Body	None			

Module Cap (Indicative number of students)	30 (numbers may be capped due to limitations in facilities or staffing)
Target Audience	This module is intended for students interested in the application of spatial epidemiology methods to improve control of infectious diseases. The module focuses (but not exclusively) on environmentally driven and poverty-associated infectious diseases. Students join from multiple disciplines, including data science, epidemiology and public health.
Module Description	Spatial epidemiology includes description and analysis of geographic variation in health outcomes with respect to multiple contextual factors (including environmental, demographic, socio-economic and behavioural). This very practical course provides an overview of how to approach spatial problems in epidemiology, with a specific focus on public health applications. The course is structured sequentially to move from sourcing spatial health and covariate data, to visualisation and spatial exploration, quantifying spatial patterns, and finally to methods for spatial prediction. Broadly, the course focuses on: • assessing and visualising data through the use of a geographical information system (GIS); • sourcing important spatial health and covariate data, including population and remote sensed data; • quantifying spatial patterns using a range of exploratory statistical approaches; • introducing approaches to modelling spatial data (ie predicting health outcomes in space). Spatial epidemiology is a very rapidly advancing field, pushing our abilities to map, monitor and model health outcomes at increasingly fine spatial resolution. Although we do introduce these new advances, the course primarily focuses on fundamental principles.

	Nb The first two days of this module mirrors the stand-alone GIS training provided by LSHTM. If your interests primarily concern visualising data using a GIS, you may find that the stand-alone training is sufficient for your needs.
Duration	5 weeks at 2.5 days per week
Timetabling slot	Slot D1.
Last Revised (e.g. year changes approved)	June 2023

Programme(s) This module is linked to the following programme(s) *(Lead programme first)*	**Status** *(Compulsory/Recommended Option)*
MSc Control of Infectious Diseases	Recommended Option
MSc Epidemiology	Recommended Option
MSc Public Health for Development	Recommended Option

Module Aim and Intended Learning Outcomes

Overall aim of the module

The overall module aim is to:

- introduce students to methods for analysing and predicting spatial patterns of infectious diseases, and to develop a critical appreciation of their application to disease control.

Module Intended Learning Outcomes

Upon successful completion of the module a student will be able to:

1. Collect and organise spatial data on disease and its ecological determinants (e.g. climate, land-use and poverty) using appropriate tools, including Global Positioning Systems, Geographic Information Systems platforms (qGIS) and R statistical software;
2. Apply basic statistical techniques to analyse the spatial patterns of infection and disease;
3. Appreciate the relative merits of alternative spatial statistical approaches for exploring and predicting spatial distributions of infection and disease;
4. Demonstrate an understanding of how the output of these analyses can be integrated into a rational disease control programme and be able to relate your knowledge to published/peer-reviewed studies.

Indicative Syllabus

Session Content
The module is expected to cover the following topics: • Collection and organisation of spatial data using Global Positioning Systems, Geographic Information Systems, and Remote Sensing; • Exploring spatial patterns of infection and disease, using a range of spatial analytical methods in R; • Spatial prediction of infection and disease, using alternative statistical modelling approaches; • Critical review of spatial epidemiological literature; • Integration of spatial data collection and analysis into rational disease control programmes.

Teaching and Learning

Notional Learning Hours		
Type of Learning Time	**Number of Hours**	**Expressed as Percentage (%)**
Contact time (including through remote platforms)	**50**	**33.3**
Directed self-study	**20**	**13.3**
Self-directed learning	**30**	**20**
Assessment, review and revision	**50**	**33.3**
Total	**150**	**100**

Student contact time refers to the tutor-mediated time allocated to teaching, provision of guidance and feedback to students. This time includes activities that take place in face-to-face contexts such as lectures, seminars, demonstrations, tutorials, supervised laboratory workshops, practical classes, project supervision as well as where tutors are available for one-to-one discussions and interaction by email.

The division of notional learning hours listed above is indicative and is designed to inform students as to the relative split between interactive and self-directed study.

Teaching and Learning Strategy
This module is predominately computer-based. The computer packages used will include qGIS and R. The module assumes no prior experience in these packages but students must be comfortable learning new programs. Data analysed will be drawn from research projects by staff in the Faculty of Infectious & Tropical Diseases. There will also be lectures and seminars, including case studies by external speakers, and small group work.

Assessment

Assessment Strategy
The assessment for this module has been designed to measure student learning against the module intended learning outcomes (ILOs) as listed above. Formative assessment methods may be used to measure students' progress. The grade for summative assessment(s) only will go towards the overall award GPA. The assessment for this module will be online. Students will be provided with an epidemiological dataset and asked to analyse these data using appropriate spatial analytical approaches covered in the module. This assessment is written up as a report (word limit: 2,000 words).

Summative assessment			
Assessment Type *(delete as appropriate)*	**Assessment Length (i.e. Word Count, Length of presentation in minutes)**	**Weighting** (%)	**Intended Module Learning Outcomes Tested**
Coursework	**2000 words**	**100**	**1,2,3,4**

Resitting assessment
Resits will accord with the LSHTM's Resits Policy The task will be the same as the original assessment

Resources

Indicative reading list *(if applicable)*

Text book:

PRINT ITEM Pfeiffer, DU, Robinson, TP, Stevenson, M, et al. Spatial analysis in epidemiology. Oxford: Oxford University Press; 2008. *This text book forms an excellent introduction and reference throughout the course.*

Key readings:

PDF Kraemer, MUG, Hay, SI, Pigott, DM, et al. Progress and challenges in infectious disease cartography. Trends in Parasitology. 2016;32(1):19-29.

PDF Hay, SI, Battle, KE, Pigott, DM, et al. Global mapping of infectious disease. Philosophical Transactions of the Royal Society B: Biological Sciences. 2016;368(1614).

Manda S, Haushona N, Bergquist R. A Scoping Review of Spatial Analysis Approaches Using Health Survey Data in Sub-Saharan Africa. Int J Environ Res Public Health. 2020; 17(9):3070

Eberth JM, Kramer MR, Delmelle EM, Kirby RS. What is the place for space in epidemiology? Ann Epidemiol. 202;64:41-46

Lee EC, Asher JM, Goldlust S, Kraemer JD, Lawson AB, Bansal S. Mind the Scales: Harnessing Spatial Big Data for Infectious Disease Surveillance and Inference. J Infect Dis. 2016; 214(suppl_4):S409-S413.

Tatem A. Innovation to impact in spatial epidemiology. BMC Medicine. 2018. 16:209

PDF Rogers, DJ, Randolph, SE. Studying the global distribution of infectious diseases using GIS and RS. Nature Reviews Microbiology. 2003;1(3):231-7.

PDF Pullan, RL, Sturrock, HJ, Soares Magalhães, RJ, et al. Spatial parasite ecology and epidemiology: a review of methods and applications. Parasitology. 2012;139(14):1870-87.

PDF Clements, AC, Reid, HL, Kelly, GC, et al. Further shrinking the malaria gap: how can geospatial science help to achieve malaria elimination?. Lancet Infectious Diseases. 2013;13(8):709-18.

PDF Magalhães, RJ, Clements, AC, Patil, AP, et al. The applications of model-based geostatistics in helminth epidemiology and control. Advances in Parasitology. 2011;74:267-96.

PDF Dalrymple, U, Mappin, B, Gething, PW. Malaria mapping: understanding the global endemicity of falciparum and vivax malaria. BMC Medicine. 2015;13(140).

PDF Elith, J, Leathwick, JR. Species distribution models: ecological explanation and prediction across space and time. Annual Review of Ecology, Evolution, and Systematics. 2009;40:677-97.

PDF Fritz, CE, Schuurman, N, Robertson, C, et al. A scoping review of spatial cluster analysis techniques for point-event data. Geospatial Health. 2013;7(2):183-98.

Other resources

Guidance note: Please list the other study resources for the module.

Teaching for Disabilities and Learning Differences

The module-specific site on Moodle provides students with access to lecture notes and copies of the slides used during the lecture prior to the lecture (in pdf format). All lectures are recorded and made available on Moodle as quickly as possible. All materials posted up on Moodle areas, including computer-based sessions, have been made accessible where possible.

The LSHTM Moodle has been made accessible to the widest possible audience, using a VLE that allows for up to 300% zoom, permits navigation via keyboard and use of speech recognition software, and that allows listening through a screen reader. All students have access to “SensusAccess” software which allows conversion of files into alternative formats.

For students who require learning or assessment adjustments and support this can be arranged through the Student Support Services – details and how to request support can be found on the LSHTM Disability Support pages.