MODULE SPECIFICATION

Academic Year (student cohort covered by specification)	2020-21
Module Code	3135
Module Title	Spatial Epidemiology in Public Health
Module Organiser(s)	Dr Rachel Pullan
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 2020-21 this module is delivered online. Teaching will comprise 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	A willingness to carry out quantitative data analysis is required and good basic computing skills are essential. Working knowledge of STATA is an advantage but is not essential, as 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 the LSHTM offers throughout Terms 1 and 2.
Accreditation by Professional Statutory and Regulatory Body	None
Module Cap (Maximum number of students)	35 (numbers may be capped due to limitations in facilities or staffing)
Target Audience	This module is intended for students interested in the epidemiology and control of infectious diseases. The module focuses (but not exclusively) on infectious diseases in developing countries.
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 clusters, 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); • quantifying spatial patterns and clusters 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 however, 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)	October 2020

Programme(s) This module is linked to the following programme(s)	**Status**
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 (ESRI-ArcGIS Desktop) 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; 5. Critically read and assess relevant literature.

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; • 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 a rational disease control programme.

Teaching and Learning

Notional Learning Hours

Type of Learning Time	Number of Hours	Expressed as Percentage (%)
Contact time (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. Student contact time also includes tutor-mediated activities that take place in online environments, which may be synchronous (using real-time digital tools such as Zoom or Blackboard Collaborate Ultra) or asynchronous (using digital tools such as tutor-moderated discussion forums or blogs often delivered through the School's virtual learning environment, Moodle).

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

Teaching and Learning Strategy
This module is predominately computer-based. The computer packages used will include ArcGIS and R, as well as spatial analysis packages including GeoDa and SatScan. 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 online 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. The assessment consists of two sections. 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 short report. Students will also critically review a spatial epidemiology manuscript.

Summative Assessment

Assessment Type	Assessment Length (i.e. Word Count, Length of presentation in minutes)	Weighting (%)	Intended Module Learning Outcomes Tested
Short Report	1500 words	70	1,2,3,4
Critical Review	750 words	30	3,4,5

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

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).

PDF Murray, KA, Preston, N, Allen, T, et al. Global biogeography of human infectious diseases. PNAS. 2015;112(41) 12746-12751.

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 Brooker, S, Hay, SI, Bundy, DA. Tools from ecology: useful for evaluating infection risk models?. Trends in Parasitology. 2000;18(2):70-4.

PDF Brooker, S, Michael, E. The potential of geographical information systems and remote sensing in the epidemiology and control of human helminth infections. Advances in Parasitology. 2000;47:245-88.

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.

Teaching for Disabilities and Learning Differences

The module-specific site on Moodle gives students access to lecture notes and copies of the slides used during the lecture. Where appropriate, lectures are recorded and made available on Moodle. All materials posted on Moodle, including computer-based sessions, have been made accessible where possible.

LSHTM Moodle is accessible to the widest possible audience, regardless of specific needs or disabilities. More detail can be found in the Moodle Accessibility Statement which can also be found within the footer of the Moodle pages. All students have access to "SensusAccess" software which allows conversion of files into alternative formats.

Student Support Services can arrange learning or assessment adjustments for students where needed. Details and how to request support can be found on the LSHTM Disability Support pages.