Course Handbook

Short Course on Modern Tools for NTD Control Programmes

Kenya Medical Research Institute
Nairobi, Kenya
May 2013

Welcome remarks

We wish to extend you a warm welcome to Nairobi for a short course on modern tools for neglected tropical diseases (NTDs).

Recent years have seen remarkable progress in the control of NTDs, with increased availability of funding and the establishment of national NTD control programmes. As countries develop their programmes, data on the geographical distribution of NTDs are required to target treatment to areas of greatest need and to estimate drug and resource requirements. In addition, as interventions are scaled up, national governments and donors require clear information on the progress in control efforts.

Our goal this week is to provide you training in available epidemiology and mapping tools designed to assist in the design, implementation and evaluation of targeted and cost-effective NTD control activities. A particular emphasis of the course is on the mapping of NTDs.

Prepare yourself to be challenged and work hard.

With your new skills we hope you will be able to present, analyse and use information on the geographical distribution of NTDs in your own country.

We are pleased to have participants from some many different countries, so please take time to meet old friends and make new contacts. This is an opportunity to share experiences, problems and solutions. We hope your participation on the course will also foster local, national, regional and global partnerships for NTD control.

We look forward to working with you this week.

Professor Simon Brooker, London School of Hygiene & Tropical Medicine

Professor Moses Bockarie, Centre for Neglected Tropical Diseases, Liverpool School of Tropical Medicine

Dr Sammy Njenga, Eastern and Southern Africa Centre of International Parasite Control, Kenya Medical Research Institute

Table of Contents

May 2013

Schedule

Sunday   Welcome
12 May

16:00 – 18:30 Registration and software installation
Silver Springs Hotel

19:00 – 21:00 Welcome reception
Silver Springs Hotel

Monday   Key Concepts in NTD Mapping
13 May

9:00 – 10:00 Lecture: **Epidemiology and Control of NTDs**

Instructor	Prof. Simon Brooker
Aims	To describe the epidemiology and transmission dynamics of neglected tropical diseases (NTDs) and to identify the role of epidemiology in mapping and designing control strategies
Summary	This lecture provides an overview of the epidemiology, transmission dynamics and control of NTDs:

- The study of epidemiology
- Disease burden of NTDs
- Transmission dynamics of NTDs
- Epidemiological measures
- Age patterns of infection and other heterogeneities
- Main control strategies
- Epidemiological basis for mapping of NTDs

Key readings

Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, Hotez PJ (2006). Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *Lancet* 367, 1521-1532.

Gryseels B, Polman K, Clerinx J & Kestens L (2006). Human schistosomiasis. *Lancet* 368(9541), 1106-1118.

Mabey DC, Solomon AW & Foster A (2003). Trachoma. *Lancet* 362(9379), 223-239.

Taylor MJ, Hoerauf A & Bockarie M (2010). Lymphatic filariasis and onchocerciasis. *Lancet* 376(9747), 1175-1185.

10:30 - 11:00 Official opening ceremony

    Guest of honour   Dr. Solomon Mpoke, KEMRI Director

11:30 -12:30 Lecture: Current Tools for NTD Diagnostics

    Instructor   Dr. Sammy Njenga

    Aims   To introduce the various methods available to diagnose different neglected tropical diseases (NTDs)

    Summary   This lecture provides an overview of the different diagnostic methods for NTDs, including currently used methods and those in develop:

- Parasitological methods
- Antigen detection
- Tools for diagnosis in vectors and intermediate hosts
- Future diagnostic methods

    Key readings

McCarthy JS, Lustigman S, Yang GJ, Barakat RM, García HH, Sripa B, Willingham AL, Prichard RK & Basáñez MG (2012) A research agenda for helminth diseases of humans: diagnostics for control and elimination programmes. *PLoS Neglected Tropical Diseases* 6, e1601.

Solomon AW, Engels D, Bailey RL, Blake IM, Brooker S, Chen J-X, Chen J-H, Churcher TS, Drakeley CJ, Edwards T, Fenwick A, French M, Gabrielli AF, Grassly NC, Harding-Esch EM, Holland MJ, Koukounari A, Lammie PJ, Leslie J, Mabey D, Rhajaoui M, Secor WE, Stothard JR, Wei H, Willingham AL, Zhou X-N & Peeling RW (2012) A diagnostics platform for the integrated mapping, monitoring and surveillance of neglected tropical diseases: rationale and target product profiles. *PLoS Neglected Tropical Diseases* 6, e1746.

12:30 – 13:30 Lunch

13:30 – 17:00 Practical: Introduction to GIS using QuantumGIS

    Instructor   Dr. Jorge Cano Ortega

    Aims   This first practical aims to familiarize the trainees with the Quantum GIS (QGIS) interface and GIS features by exploring the elements in the menu bar, using the main tools to display geographical data, managing the layer attributes and eventually creating thematic maps.

Summary   In this practical, you will learn the following skills:

- Organizing and manipulating data layers
- Using symbology
- Understanding map projections
- Map production

Tuesday 14 May   Data Management for Mapping

9:30 – 10:30   Lecture: **Principles of surveys and mapping**

Instructor   Jenny Smith

Aims   To introduce participants to the main principles of surveys and mapping. The lecture will provide an overview of key elements of survey design, data collection and visualisation of survey data for planning control. The importance of ensuring the quality of data during all stages of survey planning and implementation is emphasised, in order to generate reliable maps and policy recommendations.

Summary   This lecture provides an overview of the principles of survey design and visualisation of spatial data:

- Key elements of survey design
- Sampling methodologies
- Minimising error
- Data collection and processing
- Smartphone data collection
- Techniques for visualising data

Key readings

Aanensen DM, Huntley DM, Feil EJ, al-Own F, Spratt BG (2009) EpiCollect: Linking Smartphones to Web Applications for Epidemiology, Ecology and Community Data Collection. PLoS ONE 4(9): e6968.

Baker MC, Mathieu E, Fleming FM, Deming M, King JD, Garba A, Bockarie M, Kabore A, Sankara DP, Molyneux DH (2010) Mapping, monitoring, and surveillance of neglected tropical diseases: towards a policy framework. Lancet 375: 231-38

Coggon D, Rose G, Barker DJP (1997) Epidemiology for the uninitiated, fourth edition. Chapter 4: Measurement error and bias & Chapter 5: Planning and Conducting a Survey. BMJ Publishing Group. Open access: http://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated

May 2013

Sturrock HJW, Gething PW, Clements ACA, Brooker S (2010) Optimal survey designs for targeting chemotherapy against soil-transmitted helminths: effect of spatial heterogeneity and cost-efficiency of sampling. Am J Trop Med Hyg. 2010 June; 82(6): 1079–1087.

Swinscow TDV () Statistics at Square One, ninth edition. Chapter 3: Populations and Samples. BMJ Publishing Group.

11:00 – 12:30 Practical: **Introduction to GPS and smart phone data collection**

Instructor	Dr. Jorge Cano Ortega
Aims	The aim of this practical is to provide guidance for using a standard recreational global positioning system (GPS) receiver to collect data on the geographical position of survey locations, for example villages, schools or households sampled in an epidemiological survey.
Summary	In this practical, you will learn the following skills:

- Setting up your GPS receiver to standardize data collection.
- Marking waypoints (set of coordinates that identify a particular location).
- Altering waypoint properties; selecting attributes, editing attribute properties and deleting a single waypoint or list of waypoints.
- Improving location accuracy.
- Downloading waypoints from a GPS receiver to a computer, using Quantum GIS.
- Saving waypoints as a shapefile and a data table, using Quantum GIS.

12:30 – 13:30 Lunch

13:30 – 17:00 Practical: **Managing special data sets**

Instructor	Jenny Smith
Aims	A key step in most epidemiological analyses is to visualise the spatial patterns of infection and/or disease. This allows for an appreciation of any spatial trends that might be present, identification of obvious errors, and generation of hypotheses about factors that may influence the observed patterns. Visualisation is also important for communicating the findings to the target audience using, for example, maps of a disease distribution.
	Here we will visualise data from a soil-transmitted helminth baseline survey in Kenya to explore the spatial distribution in the prevalence

of infection, and produce a map to support monitoring and evaluation of the national school-based deworming programme.

Summary   In this practical, you will learn the following skills:

- Converting Excel spreadsheets in compatible formats for QGIS (.csv files).
- Data management including importing and joining tables, spatial joins and summarising attribute data.
- Using symbology to visualize quantitative data as point maps and choropleth maps.
- Map production

Wednesday 15May

NTD Mapping

9:30 – 10:30   Lecture: **Ensuring data quality and standardization**

Instructor   Dr. Birgit Nikolay

Aims   The aim of the lecture is to raise awareness of issues in data management that can strongly impact the quality of data and to introduce methods to reduce data errors. Furthermore, participants will learn main data management concepts for mapping data.

Summary   A good quality of data is fundamental for valid conclusions from the analysis of survey data. This lecture is divided into three parts:

- An overview on the different types of survey data and the levels of information collection.
- A description of the main sources of data errors and ways to prevent or detect these. The process of questionnaire design, data entry, and data cleaning is discussed in detail, providing basic guidelines to ensure a standardised and controlled processing of data. Three types of data checks for data entry and data cleaning are introduced, namely structural checks (e.g. format), plausibility of data (possible range of values) and logical checks (inconsistencies of data). Furthermore, the process of mapping data validation is explained.
- A description of how individual-level data can be transformed into group level data that can be displayed on the maps, and how multiple datasets can be merged.

Key readings

Gray DJ, Forsyth SJ, Li RS, McManus DP, Li Y, Chen H, Zheng F, Williams GM (2009). An innovative database for epidemiological field studies of neglected tropical diseases. PLoS Negl Trop Dis. 2009 May 26;3(5):e413.

Ali M, Park JK, von Seidlein L, Acosta CJ, Deen JL, Clemens JD (2006). Organizational aspects and implementation of data systems in large-scale epidemiological studies in less developed countries. BMC Pub Health 6: 86.

11:00 – 12:30 Practical: **Data management for mapping**

Instructor   Dr. Birgit Nikolay

Aims   The practical aims to make participants familiar with the practicalities of the main data cleaning and data management steps that were introduced during the preceding lecture.

Summary   This practical is complementary to the preceding lecture. It will be conducted using Microsoft Excel and Quantum GIS software; however, the introduced concepts also apply when cleaning data with other statistical software.

- Participants will be provided with a survey dataset from a school based soil-transmitted helminth and schistosomiasis survey in Kenya. They will apply the most important steps of data cleaning that were introduced during the lecture.
- The trainees will perform the three types of checks: structural, plausibility, and logical.
- Additional verification steps to validate mapping data – the coordinates of locations – are introduced.
- Participants will learn how to collapse individual-level data to group-level data (e.g. by school location) and merge data from different datasets based on common characteristics (e.g. school identifiers).

Key readings

Van den Broeck J, Cunningham SA, Eeckels R, Herbst K (2005). Data Cleaning: Detecting, diagnosing and Editing Data Abnormalities. PloS Med. 2, 10, e267.

Rahm E, Do HH(2000). Data Cleaning: Problems and Current Approaches. Bulletin of the IEEE Computer Society Technical Commitee on Data Engineering. 23, 4, 3-14.

12:30 – 13:30 Lunch

15:30 – 17:00 Practical: **Analysing special data sets**

Instructor	Michelle Stanton
Aims	This third practical aims to familiarize you with some of the basic query and analysis tools in QGIS used to extract information based on attribute data and spatial relationships.
Summary	In this practical, you will learn to:

- Search data using the tools available in the attribute table.
- Search data using the cursor.
- Select data by means of the Query Builder.
- Select data using the Spatial Queries plugin.
- Manage geoprocessing tools applicable to vector layers, including union, intersect and buffer.
- Create new spatial data from existing data.
- Manage data in the attribute table, including removing and adding new fields.

Thursday   Spatial Tools for NTD Control
16 May

9:30 – 10:30   Lecture: **Sources of GIS data**

Instructor	Prof. Simon Brooker
Aims	To appreciate the wealth of data freely available online.
Summary	During this lecture you will learn about the sources of:

- Administrative boundary layers
- Demographic estimates and gridded population data
- Socioeconomic survey data
- Climactic and Environmental data

11:00 – 12:30 Practical: **Processing GIS data**

Instructor	Dr. Jorge Cano Ortega
Aims	This practical aims to show the trainees how to access different sources of useful spatial data and provide the key steps to make these data suitable for being used within a QGIS framework.
Summary	In this practical, you will learn to:

- Download new spatial data from different sources: geographical and environmental data.

- Manage pre-processed spatial data within a QGIS framework.
- Merging raster files.
- Extract data by mask.
- Extract data by points.
- Update our epidemiological data tables with environmental and geographical information extracted for subsequent analysis.

12:30 – 13:30 Lunch

13:30 – 17:00 Practical: **Using maps for NTD control**

Instructor	Prof. Simon Brooker
Aims	This final practical aims to integrate the different methods covered throughout the course and to apply them to a "real life" example in using maps in NTD control.
Summary	You will employ your newly acquired skills to develop maps of the distribution of soil-transmitted helminths and schistosomiasis in Liberia and to manipulate spatial data to derive information useful for the planning of NTD control.

Key readings

Baker MC, Mathieu E, Fleming FM, Deming M, King JD, Garba A, Koroma JB, Bockarie M, Kabore A, Sankara DP, Molyneux DH (2010). Mapping, monitoring, and surveillance of neglected tropical diseases: towards a policy framework.*Lancet* 375, 231-238.

Brooker S, Hotez PJ, Bundy DA (2010). The global atlas of helminth infection: mapping the way forward in neglected tropical disease control. *PLoS Neglected Tropical Diseases* 4, e779.

Brooker S, Kabatereine NB, Smith JL, Mupfasoni D, Mwanje MT, Ndayishimiye O, Lwambo NJ, Mbotha D, Karanja P, Mwandawiro C, Muchiri E, Clements AC, Bundy DA, Snow RW (2009). An updated atlas of human helminth infections: the example of East Africa. *International Journal of Health Geographics* 8, 42.

Hürlimann E, Schur N, Boutsika K, Stensgaard AS, Laserna de Himpsl M, Ziegelbauer K, Laizer N, Camenzind L, Di Pasquale A, Ekpo UF, Simoonga C, Mushinge G, Saarnak CF, Utzinger J, Kristensen TK & Vounatsou P (2011) Toward an open-access global database for mapping, control, and surveillance of neglected tropical diseases. *PLoS Neglected Tropical Diseases* 5, e1404.

Friday 17May   **Mapping for your NTD Programme**

9:30 – 12:30   **Mapping for your country control programme**

Instructor	All
Aims	This final practical aims to integrate the various skills you have learnt throughout the course and apply them to map information on NTDs from your national control programme.
Summary	You will make use of the various skills learnt during the course and decide upon the appropriateness of different methods to fulfil your desired mapping and analysis goals.

12:30 – 13:30 Lunch

13:30 – 14:00   **Feedback session**

14:00 – 14:30   **Closing talk**

Instructors

Simon Brooker, DPhil

Simon is Professor of Epidemiology at the London School of Hygiene & Tropical Medicine and a Wellcome Trust senior research fellow. He is currently based in Nairobi at the Kenya Medical Research Institute where he coordinates a programme of research on the epidemiology, surveillance and control of neglected tropical diseases (NTDs) and malaria.

Simon has a long-standing interest in the mapping and spatial modelling of NTDs. and established the Global Atlas of Helminth Infection in 1998

Jorge Cano Ortega, PhD

Jorge is a Research Fellow currently working on a GAHI project modelling the spatial distribution of lymphatic filariasis in Africa. He is also collaborating with the Centre for Neglected Tropical Diseases at the Liverpool School of Tropical Medicine, providing GIS support to African countries implementing NTD control. Jorge has broad experience in using GIS for environmental modelling and has conducted epidemiological and entomological surveys related to vector-borne diseases in Equatorial Guinea and Mozambique.

Jorge's PhD focused on the spatial distribution of tsetse fly populations and risk modelling of sleeping sickness transmission in Equatorial Guinea.

Birgit Nikolay, Dr. Rer.Nat

Birgit is a Research Assistant at the London School of Hygiene & Tropical Medicine. As part of her work, she updates the STH/schistosomiasis component of GAHI and performs mapping gap analysis for programme managers and funders. Birgit also supports national programme implementers, currently in Kenya and Nigeria, in the development and evaluation of deworming programs by providing statistical and geo-statistical expertise. She is involved in cost-effectiveness analysis of surveillance systems. Previously, Birgit worked in arbovirus research at the Institut Pasteur de Dakar in Senegal.

She received a doctoral degree in molecular biology from the University of Vienna and a master's degree in control of infectious diseases at LSHTM.

Dr. Sammy Njenga

Njenga is a Principal Research Scientist in KEMRI and the acting Director of the Eastern and Southern Africa Centre of International Parasite Control (ESACIPAC). His research interests are in the area of neglected tropical diseases including, lymphatic filariasis, schistosomiasis, and soil-transmitted helminthiasis. He holds a PhD from the Liverpool School of Tropical Medicine in the UK.

Jenny Smith, MsC

Jennifer is a Research Fellow and PhD student at the **London School of Hygiene & Tropical Medicine**. Jennifer is primarily working with the **International Trachoma Initiative** on the **Global Atlas of Trachoma** and on identifying optimal approaches to trachoma mapping. Jennifer is also coordinating with GAHI to ensure compatibility between mapping initiatives.

Dr. Michelle Stanton

Michelle is a postdoctoral researcher at the Centre for Neglected Tropical Diseases in the Liverpool School of Tropical Medicine. She supports and co-ordinates operational research activities relating to the control and elimination of lymphatic filariasis and other neglected tropical diseases.

Acknowledgements

May 2013