

Hannah E. Clapham

Mathematical Epidemiologist
OUCRU, University of Oxford
hannah.e.clapham@gmail.com
www.hannahclapham.com

Research synopsis

I combine data with quantitative methods, such as statistical and mathematical models, to gain insight into biological processes, particularly those relevant to dengue transmission and immunity. A focus has been combining insights gained from different data sources, from the individual to the population level, and from different places, to increase our understanding of dengue epidemiology.

Research

Mathematical Epidemiologist

Oxford University, based in: Oxford University Clinical Research Unit (OUCRU), Vietnam, April 2016- present

I work on modelling the epidemiology of dengue and other viral infections in Vietnam. I am supervising a small team and manage the day-to-day running of the modelling group at OUCRU.

Projects on which I am the lead researcher:

- Sero-epidemiology of dengue, chikungunya, zika and other arboviral infections

Other projects:

- Understanding infant immune response in those born to mothers infected with dengue during pregnancy
- Analysis and modelling of dengue surveillance case data from across Vietnam
- Costing analysis of possible screening strategies for the implementation of Dengvaxia
- Combining virus titres and mosquito data to understand infectivity of the different serotypes

Post-Doctoral Fellow

Department of Epidemiology, Johns Hopkins School of Public Health, Baltimore, Nov' 2013 – April 2016

In collaboration with MOPH and AFRIMS in Thailand and Dr Derek Cummings. I worked on projects aiming to increase understanding of dynamics and epidemiology of dengue transmission in multiple settings, particularly Thailand. I undertook frequent visits to Thailand to maintain collaboration and move projects forward.

Projects under this grant on which I was the lead researcher:

- Using TSIR models to further understand dengue transmission
- Analysis of serotype-specific dengue surveillance data from Bangkok
- Analysis of the trends in infant cases of dengue in this surveillance data
- Analysis and modelling of dengue PRNT titres over time during and after infection
- Asymptomatic proportion review and pooled analysis (in collaboration with Michael Johansson at CDC, Puerto Rico)

Collaborator Visit and Training: Organized successful visit and training of Thai MOPH collaborators to JHSPH, Baltimore.

Other projects:

- JE transmission cycles in Bangladesh, in collaboration with Emily Gurley (ICDDR, b) and Juliet Pulliam (University of Florida).
- Motes and contact networks: I lead training in Thailand on using motes for collecting data on contact networks.
- Dengue phylogenetic analysis.
- MERS outbreak analysis: as part of the MERS-CoV Scenario Modeling Working Group we undertook real time analysis and modelling work in collaboration with the Saudi MOPH.

Other previous research:

Research Associate DIDE, Imperial College May 2013-Nov' 2013

Working with Neil Ferguson, I continued work from my PhD on dengue infection dynamics (see below for details). This included spending time at OUCRU, Vietnam.

PhD "Modelling Dengue Infection Dynamics and the Impact of Control Measures"

Department of Infectious Disease Epidemiology, Imperial College London 2009-2013
Funded by MRC.

Supervisors: Neil Ferguson and Christl Donnelly, in collaboration with Cameron Simmons (OUCRU Vietnam). Examiners: Derek Cummings (JHSPH) and Azra Ghani (Imperial College)

I developed the first within host models of dengue infection fit to data. Using Bayesian methods, these models were combined with sequential virus and antibody titres from clinical dengue cases. Firstly, this work provided mechanistic evidence for antibody dependent enhancement in explaining the observed differences in primary and secondary virus dynamics. Secondly, we highlighted the importance of considering infection dynamics when thinking about the action and timing of administration of a dengue antiviral. Thirdly, we showed that the virus and antibody data was consistent with antibody playing a role in controlling dengue infection. I presented this work at ASTMH and at the WHO.

This model, combined with mosquito membrane feeding data, provided a more detailed representation of human infectivity to mosquitoes over time during infection and by serotype, which has been included in a novel transmission model of dengue. This model

was used to evaluate the impact on dengue transmission of mosquitoes infected with different strains of wolbachia, which provide different amounts of transmission blocking.

Singapore Placement: I was funded for a summer research placement at NUS (Alex Cook), Tan Tok Seng Hospital (Mark Chen) and A*STAR (Martin Hibberd), in Singapore. Additionally visited public health bodies in Singapore to understand dengue fever transmission there, its impact on the population and the implementation of public health measures.

MSc Modern Epidemiology Imperial College London 2008- 2009

Funded by MRC.

Dissertation work undertaken in Bangalore, India

Working with local health centres, I collated malaria case data and combined with a transmission model of malaria.

BA Mathematics, 2.1. Hertford College, University of Oxford 2004- 2007

Awards, conferences and meetings

Charlotte Silverman award for service to the community and public health: \$4000

Awarded annually by the Department of Epidemiology, JHSPH.

Gordon Research Seminar and Conference: funding awarded to attend

SISMID, University of Washington, 2014– course fees paid and stipend

Research placement in Singapore, funded by Imperial College scheme.

Santa Fe Institute workshop on Next Generation Surveillance for the Next Pandemic: funded attendee

NIMBioS Investigative Workshop: Modelling Dengue Fever: Knoxville, Tennessee 2012, selected and partially funded attendee.

WHO/VMI Workshop on Dengue Modelling, Geneva, August 2010

Other roles

Reviewer: PLoS NTDs, PLoS Computational Biology, PLoS One, Journal of Mathematical Biology, Journal of the Royal Society Interface, Nature Scientific Reports, Emerging Infectious Diseases, Journal of Evolutionary Biology, American Journal of Tropical Medicine and Hygiene, Scientific Reports, Journal of Infection and Public Health, American Journal of Epidemiology

Press: Quoted in Atlantic article July 8th 2016 about a dengue forecasting system in Pakistan (<http://www.theatlantic.com/science/archive/2016/07/how-a-phone-hotline-helped-control-dengue-outbreaks/490472/>)

Session Co-Chair: ASMTH Dengue Immunology Sessions in 2011, 2012 and Dengue Epidemiology Session in 2015

Teaching:

Lecturer: Summer School of Computational Biology (CBID) Asia Course, Epidemic Forecasting Module, Hanoi, September 2016

Demonstrator: Imperial College

BSc Biology (3rd year Epidemiology module 2010)

MSc Modern Epidemiology (2009-2011), modules on Mathematical Modelling of Infectious Diseases

Modelling Short Course for Public Health Professionals (2010-2012), modules on Mathematical Modelling of Infectious Diseases

Founding Departmental Coordinator of EpiPDA (Epidemiology Postdoctoral Association), Department of Epidemiology, JHSPH, 2015-2016

Group Meeting Organizer, JHSPH ID Dynamics Group, 2015-2016

Departmental Student PhD Representative School of Public Health, Imperial College (2010- 2011)

Secretary, Mathematics Student-Faculty Committee, Oxford University Mathematics Department, 2006-2007

Member of ASTMH (2014- present)

Middle East Sales Coordinator, Macmillan Education (2007-2008)

I liaised with our distributors, customers and representatives across the region to coordinate delivery of large orders of books and maintain effective working relationships. I attended the annual sales conference in Cairo in 2008.

Publications

Cauchemez, S., Nouvellet, P., Cori, A., Jombart, T., Garske, T., **Clapham, H.**, Moore, S., Mills, H.L., Salje, H., Collins, C., Rodriguez-Barraquer, I., Riley, S., Truelove, S., Algarni, H., Alhakeem, R., AlHarbi, K., Turkistani, T., Aguas, R.J., Cummings, D.A.T., Van Kerkhove, M.D., Donnelly, C.A., Lessler, J., Fraser, C., Al-Barrak, A., Ferguson, N.M. [Unravelling the drivers of MERS-CoV transmission](#) (Proc Natl Acad Sci U S A. 2016 Aug 9;113(32):9081-6. doi: 10.1073/pnas.1519235113.)

Clapham, H.E., Than Ha Quyen, Duong Thi Hue Kien, Simmons, C.P. & Ferguson, N.M. [Modelling Virus and Antibody Dynamics during Dengue Virus Infection Suggests a Role for Antibody in Virus Clearance](#) (PLoS Comput Biol. 2016 May 23;12(5):e1004951. doi: 10.1371/journal.pcbi.1004951.)

Reich, N.G., Lauer, S., Sakrejda, K., Iamsirithaworn, S., Hinjoy, S., Sugantho, P., Suthachana, S., **Clapham, H.E.**, Salje, H., Cummings D.A.T., Lessler, J. [Challenges in real-time prediction of infectious disease: a case study of dengue in Thailand](#) (PLoS Negl Trop Dis. 2016 Jun 15;10(6):e0004761. doi: 10.1371/journal.pntd.0004761.)

Nisalak, A. *, **Clapham, H.E.** *, Kalayanaroj, S, Klungthong, C., Butsaya Thaisomboonsuk, B., Fernandez, S., Reiser, J., Srikiatkachorn, A., Macareo, L.R., Lessler, J.T., Cummings, D.A.T, Yoon. I. [Forty years of dengue surveillance at a tertiary pediatric hospital in](#)

[Bangkok, Thailand, 1973 to 2012](#) (Am J Trop Med Hyg. 2016 Jun 1; 94(6):1342-7. doi: 10.4269/ajtmh.15-0337.)

Alera, M.T., Srikiatkachorn, A., Velasco, J.M., Tac-An, I.A., Lago, C.B., **Clapham, H.E.**, Fernandez, S., Levy, J.W., Thaisomboonsuk, B., Klungthong, C., Macareo, L.R., Nisalak, A., Hermann, L., Villa, D., & Yoon, I. [Incidence of dengue virus infection in adults and children in a prospective longitudinal cohort in the Philippines](#) (PLoS Negl Trop Dis. 2016 Feb 4;10(2):e0004337. doi: 10.1371/journal.pntd.0004337.)

Lessler J, Salje H, Van Kerkhove MD, Ferguson NM, Cauchemez S, Rodriguez-Barraquer I, Hakeem R, Jombart T, Aguas R, Al-Barrak A, Cummings DA. [MERS-CoV Scenario and Modeling Working Group, Estimating the Severity and Subclinical Burden of Middle East Respiratory Syndrome Coronavirus Infection in the Kingdom of Saudi Arabia](#) (Am J Epidemiol. 2016 Apr 1;183(7):657-63. doi: 10.1093/aje/kwv452.)

Clapham, H.E., Nisalak, A., Kalayanarooj, S., Thaisomboonsuk, B., Klungthong, C., Fernandez, S., Srikiatkachorn, A., Macareo, L.R., Lessler, J.T., Reiser, J., Cummings, D.A.T., Yoon, I. [Epidemiology of Infant Dengue Cases Illuminates Serotype-Specificity in the Interaction between Immunity and Disease, and Changes in Transmission Dynamics](#) (PLoS Negl Trop Dis. 2015 Dec 11;9(12):e0004262. doi: 10.1371/journal.pntd.0004262.)

Althouse, B.M., Scarpino, S.V., Ancel Meyers, L., Ayers, J.W., Bargsten, M., Baumbach, J., Brownstein, J.S., Castro, L., **Clapham, H.**, Cummings, D.A.T., Del Valle, S., Eubank, S., Fairchild, G., Finelli, L., Generous, N., George, D., Harper, D.R., Hébert-Dufresne, L., Johansson, M.A., Konty, K., Lipsitch, M., Milinovich, G., D Miller, J.D., O Nsoesie, E., Olson, D.R., Paul, M., Polgreen, P.M., Priedhorsky, R., Read, J.M., Rodríguez-Barraquer, I., Smith, D.J., Stefansen, C., Swerdlow, D.L., Thompson, D., Vespignani, A., Wesolowski, A. [Enhancing disease surveillance with novel data streams: challenges and opportunities](#) (EPJ Data Science 2015 4:17. doi: 10.1140/epjds/s13688-015-0054-0)

Clapham, H.E., Rodriguez-Barraquer, I., Azman, A.S., Althouse, B.M., Salje, H., Kalayanarooj, S., Gibbons, R.V., Jarman, R.G., Nisalak, A., Thaisomboonsuk, B., Nimmannitya, S., Yoon, I., Alan Rothman, A. & Cummings, D.A.T. [Dengue Virus \(DENV\) Neutralizing Antibody Kinetics in Children After Symptomatic Primary and Postprimary DENV Infection](#) (J Infect Dis. 2016 May 1;213(9):1428-35. doi: 10.1093/infdis/jiv759.)

Ferguson NM, Hue Kien DT, **Clapham H**, Aguas R, Trung VT, Bich Chau TN, Popovici J, Ryan PA, O'Neill SL, McGraw EA, Long VT, Dui le T, Nguyen HL, Vinh Chau NV, Wills B & Simmons CP. [Modeling the impact on virus transmission of Wolbachia-mediated blocking of dengue virus infection of Aedes aegypti](#) (Sci Transl Med. 2015 Mar 18;7(279):279ra37. doi: 10.1126/scitranslmed.3010370.)

Lessler J, Rodriguez-Barraquer I, Cummings DA, Garske T, Van Kerkhove M, Mills H, Truelove S, Hakeem R, Albarrak A, Ferguson NM; **MERS-CoV Scenario Modeling Working Group**, [Estimating Potential Incidence of MERS-CoV Associated with Hajj Pilgrims to Saudi Arabia, 2014](#) (PLoS Curr. 2014 Nov 24;6. pii:

ecurrents.outbreaks.c5c9c9abd636164a9b6fd4dbda974369. doi:
10.1371/currents.outbreaks.c5c9c9abd636164a9b6fd4dbda974369.)

Clapham, H.E., Tricou, V., Nguyen Van Vinh Chau, Simmons, C.P. & Ferguson, N.M.
[Within host viral dynamics of dengue serotype 1 infection](#) (J R Soc Interface. 2014 Jul
6;11(96). pii: 20140094. doi: 10.1098/rsif.2014.0094.)

Conference Presentations

Epidemics 5, 2015, Clearwater

Evidence for transmission enhancement in incidence patterns of dengue in Thailand

ASTMH conference 2015, Philadelphia

Trends in cases of dengue in infants: insights into serotype differences in disease in
naive and non-naive individuals and population transmission dynamics

ASTMH conference 2012, Atlanta

Considering the Role of Antibody in Dengue Virus Clearance: Data Analysis and
Modelling

ASTMH conference 2011, Philadelphia

Modelling Dengue Pathogenesis, Considering Differences Between Primary and
Secondary Infection.

Poster presentations:

Gordon Research Conference and Seminar on Tropical Infectious Diseases, 2014

Galveston

ASTMH conference 2014, New Orleans

Epidemics 3 2011, Boston

References

Professor Neil Ferguson, Department of Infectious Disease Epidemiology, Director MRC
Centre for Outbreak Analysis and Modelling, neil.ferguson@imperial.ac.uk

Professor Derek Cummings, Department of Biology, University of Florida, datc@ufl.edu

Associate Professor Maciej Boni, Department of Biology, Penn State University,
mfb9@psu.edu