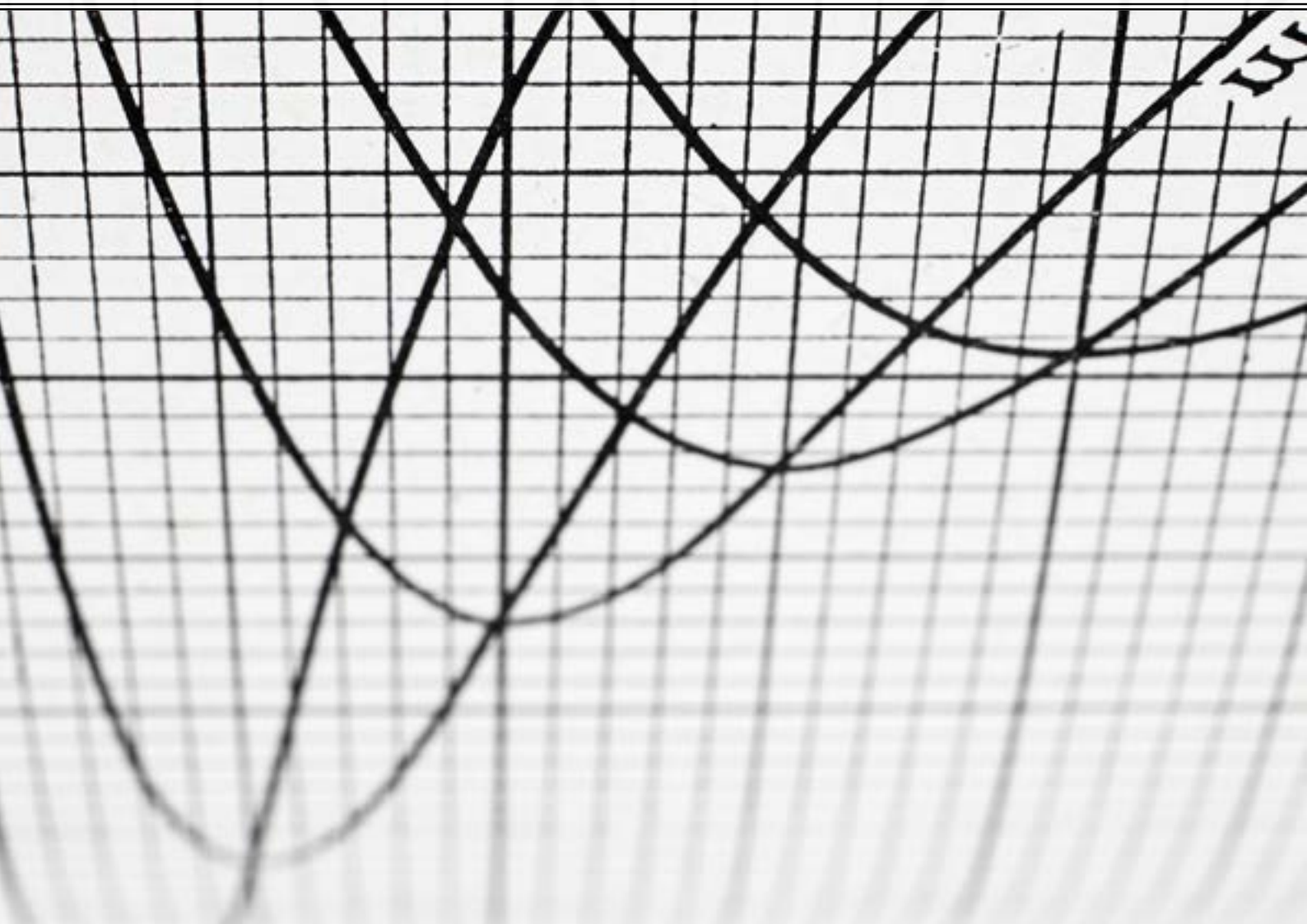




Calculus & Contagion

An Epidemy Project Workshop
June 16TH to June 17TH 2022



ABOUT THIS WORKSHOP

Models have guided the Covid-19 pandemic response with unprecedented authority. The workshop seeks to push beyond this very recent horizon to show that the success story of infectious disease modelling is deeply interwoven with the history of science and medicine. Contributors discuss the ascent of modelling within epidemiological reasoning to evaluate its impact on theories, methods and policies in medicine and public health. The workshop's aim is to expand the historical geography of infectious disease modelling and to extend our understanding of the mobility of modelling between epidemiology and economics, sociology and the information sciences.

REGISTRATION

Registration to the workshop is through Eventbrite:

<https://contagion-and-calculus.eventbrite.co.uk>

The workshop

The workshop will be held in person in Edinburgh. There is very limited set of places available for in-person participation for guests but the event will be live streamed on Zoom.

Privacy

Details gathered as part of the registration process will be handled by the event organisers for purposes of planning and communicating, as well as reporting to our funder. We will not share your details with third parties.

Organised by TER at University of Edinburgh

Lukas Engelmann

ERC Grant # 947872

THE EPIDEMY

Web: <http://theepidemy.net>

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THE UNIVERSITY
of EDINBURGH

📅 **THURSDAY, 16 JUNE 2022**

🕒 **9.00 - 9.15: Welcome**

🕒 **9.15 - 11.15: PANEL 1, Modelling Disciplines**

☕ **11:15 - 11:30: Coffee Break**

🕒 **11.30 - 12.45: Keynote & Discussion**

🍴 **12.45 - 14.00: Lunch Break**

🕒 **14.00 - 15.20: Panel 2, Modelling Science**

☕ **15.20 - 15.40: Coffee break**

🕒 **15.40 - 17.00: PANEL 3, Modelling Inputs**

🕒 **17.00 - 19.30: Break**

🍴 **19.30: Workshop Dinner**

📅 **FRIDAY, 17 JUNE 2022**

🕒 **9.30 - 11.00: PANEL 4, Modelling Boundaries**

☕ **11.00 - 11.30: Coffee Break**

🕒 **11.30 - 12.30: PANEL 4, Modelling Boundaries (cont.)**

🕒 **12.30 - 13.00: Commentary, discussion and outlook**

🍴 **13.00: Lunch & Goodbye**

📅 THURSDAY, 16 JUNE 2022

🕒 9.00 - 9.15: Welcome

Lukas Engelmann, University of Edinburgh.

PANEL 1, MODELLING DISCIPLINES

Contributions to this panel focus on the mobility of models between sciences, into epidemiology or out of epidemiology. Papers emphasise the transfers of knowledge and ways of thinking embodied in and through models in transit.

🕒 9.15 - 9.35

Modeling Disease for One and All: Putting Cause and Effect Back into the Story

Christopher J Phillips, Carnegie Mellon University

Abstract

The substantial interpretive gap in our understanding of epidemic modeling between the 1920s and 1980s is certainly methodological and technical, but it is also disciplinary: epidemiology in this period was transformed from a largely descriptive discipline to one centered on inferring causality. One way we can understand the shift is by charting the rise of biostatistics, a closely-associated discipline that matured in precisely that period. Mid-century biostatisticians were often trained in demography, sociology, and economics, and were explicitly looking to make causal accounts of disease and health through novel applications of statistical theory. This is a sprawling story, but two specific transitions help trace the outlines: first, biostatisticians used surveys and surveillance techniques essential to epidemic modeling in order to design new quasi-experiments and retrospective studies that enabled them to look across populations and measure the role certain factors may have had in causing (or preventing) the disease. Second, preventive medicine researchers in the 1970s used existing surveillance modeling, including both incidence rates and recorded frequencies of transitions between disease “states,” to build stochastic models of the progression of disease. These simulation models were then used to estimate the effects of introducing screening regimes, particularly for cancer. Epidemiologists’ tools became essential for both clinical and preventive medicine by the 1970s. This remains a heavily Anglo-American story, but by shifting the disciplinary perspective, we see how the tools of epidemic modeling moved from a realm of knowledge-making that could only be applied to populations to one relevant for individual decision-making.

Keywords: Biostatistics, Etiology, Chronic Disease, Preventive Medicine, Clinical Medicine

🕒 9.35 - 10.05

Malthus and modelling, demography and disease: on the long and tangled history of demographic and epidemiological modelling

John Nott, University of Edinburgh

Abstract

The nature and structure of a given population is a fundamental part of epidemiological modelling; average age or population density are amongst the indices regularly included in the statistical analysis of disease incidence and spread. Likewise, disease is a fundamental element of demographic modelling, its idiosyncrasies usually smoothed out into gross and infant mortality rates, or in terms of infertility. Indeed, demography and epidemiology share a common intellectual lineage, one which is centuries old. Although today commonly assumed to have distinct scientific remits, this paper argues that epidemiological and demographic modelling have remained both intellectually and infrastructurally interdependent, products of a long and tangled history. This survey paper traces the relationship between demography and epidemiology back to the late eighteenth century, and that most divisive of figures, Thomas Robert Malthus. The originator of perhaps the most perseverant models in social science, Malthus' principle of population takes that whenever population increases too quickly or beyond the bounds of the environment, the 'positive checks' of war, famine and epidemic disease would curtail population growth. As with many subsequent demographers, Malthus maintained a holistic understanding of disease, drawn from the English medical tradition—from the likes of Thomas Sydenham and John Graunt—as well as from contemporary analyses of epidemics which had ravaged indigenous populations in the New World. Although Malthusianism bore limited relevance to the parallel development of epidemiology and bacteriology during the nineteenth century, once epidemics 'became complex' after World War I, population dynamics became expressly relevant to epidemiological theory. With bacteriologists struggling to explain pandemic influenza and a number of other confounding epidemics, variables such as overcrowding and population size relative to food supply suddenly became relevant to the spread of infectious disease. As the influence of biometricians grew, so did the relevance of Malthusian principles. This, the 'economisation' of epidemiology, has underlined the subsequent history of the field. Throughout the twentieth century, epidemiological complexity was built on demographic indices, as well as population-level infrastructures of counting and calculation.

Keywords: Demography, epidemiology, data, metrics

🕒 10.05 - 10.25

Ronald Ross and Hilda Hudson. A collaboration on the theory of epidemics.

June Barrow-Green, Open University

Abstract

In 1916 Ronald Ross published the first of three papers on the mathematical study of epidemiology or, as he called it, 'pathometry'. The second and third of these papers appeared the following year co-authored with the mathematician Hilda Hudson. At the time Hudson, who had ranked equivalent to the 7th wrangler in the 1903 Cambridge Mathematical Tripos, was well known for her work on Cremona Transformations (which culminated in 1927 with an acclaimed book on the subject). So how and why did Hudson, a geometer, end up

collaborating with Ross on the theory of epidemics? And what role did she play? In my talk I shall discuss the nature and extent of their collaboration, as well as the genesis, content, and influence of their work, setting it into the broader context of Ross's mathematical aspirations.

Keywords: pathometry, mathematics, Hilda Hudson, Ronald Ross, collaboration

🕒 **10:25 - 10:45**

Modelling Social Contagion

Lukas Engelmann, University of Edinburgh

Abstract

The first mathematical modellers of epidemic phenomena have often advanced their formal approaches into general theories, applicable, so they hoped, to everything that spreads in human societies. Ideas as much as rumours, products as much as technologies, politics as well as fashions, spread – so they argued - like an infectious disease. This paper seeks to read these theoretical explorations against the background of similar, sociological, attempts to make sense of contagion as a non-material form of organisation in and of societies. Here, I contrast the mathematical approach of Ronald Ross, parasitologist and 1902 Nobel laureate for his discovery of the vector of malaria with the work of Gabriel Tarde, who wrote roughly at the same time the “Laws of Imitation” to establish an infinitesimal and relational sociology. Both conceptualisations of social contagion share a strong focus on affect, both share a rejection of structural explanations, and both embrace quantification as an instrument to theorize rather than to describe. Both also consider the domain of scientific knowledge and epidemics of ideas and information as particularly important domains to exemplify their theories and formulas. The paper offers an initial sketch of a sort of parallel history, showing how the concept of social contagion is itself subject to multiple translations and transfers across disciplinary boundaries and fields of knowledge in the early 20th century.

Keywords: social contagion, epidemiology, Ronald Goss, Gabriel Tarde

☕ **11.15 - 11.30: Coffee Break**

🕒 **11.30 - 12.45: Keynote and Discussion**

Where did modelling come from and why does this matter?

Andrew J. Mendelsohn, Queen Mary University of London

🍴 **12.45 - 14.00: Lunch Break**

PANEL 2, MODELLING SCIENCE

This panel considers how models have historically led to the substantiation of a research field, an epidemic or of a crisis. The papers discuss how models contribute to making and to stabilizing epidemiology as a science, as models offer objects, methods and practices of research.

🕒 14.00 - 14.20

Beeting Disease: Modeling and Nationalizing Sugar Beet in Britain, 1930-1948

Mark Liang, University of Cambridge

Abstract

Throughout the interwar period and WW2, fields of sugar beet were negotiated into the agricultural landscape of East Anglia and scientific production within Cambridgeshire. Ideas of national self-sufficiency and economic control underscored such changes. At the same time, the crop's associated diseases, the less desirable imports from the Continent (such as Virus Yellow, Phoma betae, and Beet Eelworm), were not construed in the same way. Epidemic modeling was the principal method that scientific authorities used to usher in this transformation, as British scientists came to create models that constructed sugar beet illnesses as foreign, submissible, and dangerous. Disease control relied on nationalist ideas to frame which parts of beet culture were desirable and which parts could threaten domestic agriculture, drawing lines, sometimes arbitrarily, between "clean" and "dirty," "sick" and "healthy," "native" and "foreign." Using the Dillon Weston notes of beet disease held at the Whipple Museum, University of Cambridge, we observe these models materializing shifts away from largely naturalist concerns, such as soil nutrition or climate adaptability, to constructions of spatial and temporal infection. These 20th century examples of horticultural modeling reflect burgeoning ideas of transmissibility, hygiene, and cleanliness within scientific networks and public health, especially with relation to how the state worked to identify and lay claims upon diseases it found significant and/or threatening. Discoveries in this period predicate the history of epidemiological forecasting, both non-human and human, that occur from 1950 onwards, and they furthermore link agricultural history with its "middle past" underlying contemporary ideas around contagions.

Keywords: Agriculture, World War Two, Biological Control, Invasive Species, Plant Culture

🕒 14.20 - 14.40

A social-statistical investigation of racialized disease and dying in early Victorian Canada

Elsbeth Heaman, McGill University

Rawson W. Rawson, secretary of the Statistical Society of London and founding editor of its journal from 1837-42, stood at the intersection of social medicine, statistics, and colonialism. The son of a prominent clinician, he was in London slums scrutinizing poverty, crime, and education before Kay-Shuttleworth; he formulated ambitious social epistemologies for statistics to challenge conservatives like William Whewell; and he straddled fights between social medicine and austerity, A.P. Alison and Edwin Chadwick. Suddenly posted to Canada ("What can I do for Science in Canada?" he asked Charles Babbage), Rawson wrote that social logic into the "Bagot Report" on "Indian" policy of 1844. Rawson had to decide whether Indigenous people were

statistically normal and “countable” like other people. If they were dying, were the causes of deaths bio-medical or socio-cultural? What, precisely, was spreading or not-spreading amongst people whom John Stuart Mill described, in an essay on civilization, as the antithesis of collective agency? A Queteletian like Rawson must see a paradox in the theory that Indigenous people shared only death when death itself was a “social disease.” Rawson had to think about the ways supposedly “constitutional” diseases individualized or socialized people. He attacked the declensionist arguments of Francis Bond Head who was energetically defending poor-law austerity in Britain and Indigenous dispossession in Canada as justice meted out to “enemies” of male virility and state austerity. Rawson collated hundreds of pages of data to counter economic logic with a new reading of social agency, albeit one that settler colonialism soon colonized.

Keywords: Statistics Poverty Decline Race Colonialism

🕒 14.40 - 15.00

Anticipating the impact of invasive plant pests and pathogens, 1989-2007

Erinn Campbell, University of Cambridge

Throughout the 1990s and early 2000s, plant protection experts sought to devise ‘scientific’ standards for predicting the consequences of agricultural plant pest invasion. These standards would support pest risk assessments used by agricultural government agencies to inform rational, justifiable phytosanitary regulations, thus (in theory) protecting domestic plant health while facilitating international agricultural trade. This paper draws from the meeting notes of multinational plant protection conferences to trace the debate over determining the ‘potential’ impact of invasive pests and pathogens. Pest consequence forecasting proved to be a technically complex and politically contentious topic, and there was considerable controversy over the range of consequences that should be addressed in standard pest risk modelling. Despite the relatively unsophisticated state of measurement and modelling methodologies, international standards for pest risk assessment ultimately endorsed a broad, interdisciplinary approach to consequence forecasting. These standards expanded the scope of consequence forecasting from immediate, material effects on plant health to include downstream effects on a nation’s economic, social, and environmental ‘health’. This broadening of scope was achieved by articulating all of these effects as ‘economic impacts’; economic framings made diverse forms of potential ‘disease’ comparable for scientific pest risk assessment.

Keywords: risk, pest forecasting, economic impact analysis, plant health

🕒 15.00 - 15.20: Discussion

☕ 15.20 - 15.40: Coffee Break

PANEL 3: MODELLING INPUTS

Considering what data is included and what is ignored, papers in this panel focus on the types of data and the data practices which have contributed to the development of epidemiological modelling.

🕒 15.40 - 16.00

Big Data and sense - Ebola Virus Disease and Covid-19

Daniel B. Cohen, Harro Maat, Susannah Harding Mayhew, Esther Yei Mokuwa & Paul Richards, Njala University, Sierra Leone

Massively increased computational power in recent decades has greatly expanded the scope of numerical analysis to predict epidemic outcomes. This type of modelling has been successfully applied to influenza, and (somewhat more controversially) to Covid-19. Ebola Virus Disease is a somewhat different, and therefore a useful comparative case. The virus was first identified in central Africa in 1976, followed by more than 25 small outbreaks, all contained locally, up until 2012. Then in 2013, the first Ebola epidemic began in Guinea, in Upper West Africa, quickly spreading to Liberia and Sierra Leone. Some early modelled projections proved very inaccurate (1.4 million deaths within 6 months). The West African epidemic (2014-15) eventually infected c. 30,000 people, causing somewhere between 10-15,000 deaths. The paper explores why initial numerical projections were so wrong, and what lessons can be drawn from this failure. Better projections were made when it was realised that Ebola is a “family disease”. It spreads through contact with body fluids, and thus only infects those involved in the most intimate forms of care for the sick. Recognition of this intimate (and often family-based) risk required micro sociological analysis, the results of which were initially resisted. The paper then looks backwards and finds that an antinomy between Big Data and micro sociology is to be found in the very origins of scientific epidemiology. To make successful use of London Bills of Mortality in his book of 1662 John Graunt had to consider the “Searchers” who collected the data. Graunt describes these as “antient Matrons, sworn to their Office”, and perhaps equivalent to Traditional Birth Attendants found in parts of West Africa today. He considers the possibility that these women may have been “ignorant, and perhaps careless” but judges their reports “might be sufficient in [his] case” because they were based on “sense” (in this instance, observation of the corpse). Our paper concludes with a discussion of observation in epidemiology, and wonders whether (like Ebola) the Covid-19 pandemic might have been more readily controlled if sense had better supported number-crunching.

Keywords: Epidemiology, ethnography, citizen science

🕒 16.00 - 16.20

An “Epidemiology without numbers”? Quantitative methods and the institutionalization of Brazilian Epidemiology (1970 – 2000)

Luiz Alves, Oswaldo Cruz Foundation

The institutionalization of Epidemiology in Brazil reached its turning point in the 1970s when epidemiologists differentiated their discipline from the other in Public Health or Preventive Medicine. A feature of the rising

“Brazilian Epidemiology” was an intense critique of the role played by quantitative methods in epidemiologists’ work and a claim for a closer dialogue with social sciences. Involved in the creation of a new health system and the struggle for the return of democracy in Brazil, leading epidemiologists based their ideas mainly on Marxist theory and the Latin American Social Medicine movement, which put quantitative methods in question. In 1989, Naomar de Almeida Filho, a very important epidemiologist in the country, published “Epidemiology without numbers” a book that summarized these critiques and made the case for social epidemiology. Despite a common claim that “Brazilian Epidemiology is a social epidemiology”, quantitative methods have been played a central role in the institutionalization of Epidemiology in Brazil, especially in the study of infectious diseases and epidemics. The presentation will discuss the tension between the critique of quantitative methods and the training and work of epidemiologists in public health services from the early 1970s to the 2000s. I suggest that modeling and other quantitative methods received great attention in Brazilian Epidemiology due to a historical agenda on health statistics and a perception of epidemiology as a mathematical method for the health field.

Keywords: Epidemiology; quantitative methods; Brazil; social epidemiology; health statistics.

🕒 16.20 - 16.40

On Means and Models of Mosquito Dissection: Global Health in the Twilight of the Detinova Technique

Ann Kelly, King’s College London

The MacDonald-Ross model of malaria transmission sought to quantify the pathogenic exchange between mosquito vectors and human populations. It was the model’s promise that a significant decline in the adult population of mosquitoes would be sufficient to permanently interrupt transmission that launched the Global Malaria Eradication Program (GMEP) in the mid-1950s. The limitations of that theory and their role in the failures of the GMEP have been canonized as received global health wisdom. This paper resets the model’s public health unravelling in Africa, through the lens of the development of an entomological method—the Detinova Technique. The technique offered a way to determine the exact physiological age of the female mosquito and in so doing provide critical insight into the ecological dynamics of disease transmission ignored by the MacDonald Ross model. Yet the degree of manual dexterity implied by the technique limited its diffusion and continued obscurity within the malaria field. Transforming the mosquito ovariole into a unit of public health action hinges upon a distinct conjugation of malaria surveillance and control—one characteristic of the Soviet campaign but obviated by the epidemiological calculus driving efforts in the West. The dynamic tension evidence between technical precision and programmatic action, scalable assumptions and highly skilled practice, serves a prompt to consider some of the methodological parameters of knowability and doability in relation to global health, and the particular models of disease ecology upon which those topologies of intervention depend. Ultimately our story unfolds over the body of the mosquito, the struggles to render it epidemiologically legible and its singular capacity to elude the most sophisticated forms of quantitative and anatomical analysis.

🕒 **16.40 - 17.00**

Making a health emergency visible: defining, counting and modeling the Zika epidemic in Brazil

Jonatan Sacramento, University of Campinas

An epidemic is considered a health emergency, and demands and mobilizes a series of responses that vary less by the severity of the situation and more by the socio-technical arrangements in which they are found. In turn, the health classification produces administrative meanings about the processes of care and about the intelligibility of the disease itself, which allows us to manage devices, rationalize policies and plan health care. One way to manage these epidemic processes is to define and calculate the number of cases of a given disease and its consequences, modeling its behavior. This sanitary, bureaucratic and scientific rationality not only produces the epidemic reality, but also produces processes of social differentiation. In this sense, my objective is to think about the process of visualization of the Zika epidemic from the construction of statistical data around the cases of Zika virus and microcephaly in Brazil, a process that went through the definition of the case idea and the construction of a specific device of epidemiological surveillance. This surveillance practice shaped the hypothesis of a causal relationship between the virus and the birth defects recorded in the Northeast region of Brazil, the epicenter of the Zika virus epidemic between 2015 and 2016. By analyzing the scientific production on Zika and the construction of this surveillance device for microcephaly cases, my objective is to analyze the processes of building consensus in public health through the processes of counting and modeling the Zika virus epidemic.

Keywords: Zika virus; Microcephaly; Epidemiological surveillance; Visualization

🕒 **17.00 - 19.30: Break**

🍴 **19.30: Workshop Dinner**

FRIDAY, 17 JUNE 2022

PANEL 4, MODELLING BOUNDARIES

This panel finally demonstrates how, where and under what circumstances models failed to deliver what they promised and how that has led to significant transformations in the history of epidemiology.

🕒 **9.30 - 9.50**

‘Precursors and Trailers’: Modeling Endemicity and Infectivity in early Twentieth Century Britain

Jacob Steere-Williams, College of Charleston

Abstract

The late nineteenth century disciplinary toolkit of epidemiology in Britain was dependent on field-based practices of outbreak investigation, often of infectious disease. In the first three decades of the twentieth century, however, Anglo-American epidemiologists began to incorporate new statistical modelling to explain the prospective patterns of disease incidence. The backdrop for this transition was in part demographic—with the decline of many, but not all of the major infectious diseases of the Victorians; in part institutional—with attempts to professionalize epidemiology as an academic discipline in addition to a state-sponsored activity; and in part epistemological—with new findings in the ecology and evolution of microorganisms, and in the rhetorically-persuasive power of biostatistics. And while epidemiological modelling became a central way that epidemiologists justified the importance of their discipline, field-based outbreak investigation did not disappear by the 1930s. This paper explores the intersections between outbreak investigation and modelling from the 1890s to the 1930s by examining how endemic diseases—centrally summer diarrhea in this paper—were conceptualized and studied by British epidemiologists. At the center of this paper is the uneasy way in which epidemiological modelers such as John Brownlee attempted to reimagine the Victorian understanding of summer diarrhea using new mathematical techniques alongside the everyday practices of field epidemiologists such as William Pickles.

🕒 **9.50 - 10.10**

The interaction of models and policy for pandemic control

Liza Hadley, University of Cambridge

The COVID-19 pandemic has seen a hugely expanded involvement of epidemic modelling in political decision-making. In this talk, we identify and discuss seven broad challenges on the interaction of models and policy for pandemic control. This work arose from the ‘Infectious Dynamics of Pandemics’ program at the Isaac Newton Institute, and features in an Epidemics special issue on ‘Future Pandemics’. Pandemics pose major difficulties at the interface of policy and modelling. They require surveillance, planning, and preparation on a time-scale longer than standard political horizons, coupled with a readiness to act quickly. Outbreaks do not respect political boundaries, so combatting them is most successful when there is a high degree of international cooperation. However, political, social, and environmental differences may mean that the most

effective forms of action vary considerably between countries, making it difficult to define best practice. Early intervention can save large numbers of lives, but the earlier the response the less certain the situation; and since the best outcome is quick suppression, politicians risk being criticised for major expenditure and disruption when ‘nothing happened’. This talk discusses the current challenges of epidemic modelling for decision-making. We start by considering the problems of long-term preparedness and international cooperation. Next, decisions on policy need to weigh up the different effects of a pandemic on society, especially on health and on the economy. We consider the integration of modellers into decision-making and explore the inclusion of economic and social science expertise. Communication (among scientists, with decision-makers, and with the public) is our third major topic. We then conclude discussions with a look at the main technical challenges for developing models that address key policy questions, and finish by presenting a collection of recommendations and suggestions for future outbreak response.

🕒 10.10 - 10.30

Resisting Models: Representing Cancer in Sub-Saharan Africa

Thandeka Cochrane, Jenn Fraser, King’s College London

In Africa, disease modelling has been used to track the transmissibility and dynamics of a variety of conditions. From malaria and yellow fever to AIDS and Ebola, models have been used to understand epidemics and mitigate their spread. However, mathematical models are not applied to all diseases in a uniform way. Cancer, a disease that is presently thought to have reached “epidemic-status” across the African continent, is notoriously difficult to model. The elusive and multicausal nature of carcinogenesis makes developing models for the disease highly difficult and expensive, requiring large amounts of data and sophisticated health information systems that are not always available. How, then, has information about Africa’s cancer epidemic been generated? How do we model diseases that resist modelling? This presentation traces the history of how cancer in sub-Saharan Africa has been represented by researchers from the mid-twentieth century to the present day. Drawing on archival and ethnographic data, we explore the predictions and assumptions that health professionals have generated about African cancer patterns. Through examining how researchers used tools like anatomical models, maps, and algorithms to model disease-types such as Burkitt’s lymphoma, liver cancer, cervical cancer, and Kaposi’s Sarcoma, we consider how these representations reflect and resist reality—functioning as powerful mnemonic devices that not only project ideas about cancer, but also international agendas, socio-political realities, and affective states. In addition to contributing to discussions of how epidemiological modelling has taken shape beyond the Anglo-American realm, this presentation showcases how complex and creative ways of rendering African cancer patterns statistically intelligible has made some expectations for (and realities of) the disease highly visible, while minimizing and obfuscating others.

Keywords: Cancer, Wax Models, Maps, Africa

🕒 10.30 - 11.00

Mediating between different worlds: Modelling in Indian Tuberculosis policy

Armaan Mullick Alkazi, University of Edinburgh

Intervention based epidemiological modelling has gone from a footnote in Indian TB policy to the most important arbiter of resources, time and priorities. I chart this transformation in TB policy through two movements. First a close reading of policy documents from the past twenty years analyzing the relationship TB policy has to modelling. I pay special attention to how and why this specific form of impact based epidemiological modelling have gained prominence in India and the evolving interactions between rapidly circulating global models and their articulation in national policy. Second an analytical history of the constituent parts of impact modelling; the biomedicalization of TB, the rise of calculative measures and grammars and the failure of the recent international DOTS program. Following the recent turn in anthropology (Bear et al. 2015), I look to push beyond seeing modelling a way of generating or exceeding the real. Instead I frame it as a way of mediating between different ethical projects. Modelling as a technology of the imagination plays a key role in holding the assemblage of the national tuberculosis program together. Technologies of the imagination allow for the syncing of diverse timescapes and ethical projects, international development goals and India's claims to modernity. In this process they enable the movement of resources, especially of capital and expertise between different actors and allow for a sense of purpose, direction and claiming of the moral good.

Keywords: Tuberculosis, Epidemiology, Temporal Rythms, Inequality

☕ 11.00 - 11.30: Coffee Break

🕒 11.30 - 11.50

Obstacles in Epidemiological Modelling: An Historical Epistemology Study

Mathieu Corteel, Harvard University

By following the official statements and daily figures during the Covid-19 crisis, every citizen has become familiar with epidemiological modelling. Every day, we subjectively evaluate the probability of contamination according to the density of infected people present on our territory: the epidemiological rationality of the SIR model is now mixed with our common sense. As a consequence, epidemiological discourses have profoundly modified our way of living in society. Our behaviour is now governed by the statistical representation of the virus. Indeed, the norms of distancing and social interaction are derived from epidemiological modelling. But are not our statistical projections partly fiction? If epidemiological tools are useful for making political and social choices, should we not also communicate about their limits? Given the great uncertainty surrounding the evolution of the pandemic, we wish to highlight the obstacles inherent in our epidemiological models. By mobilizing historical epistemology, we want to trace, in the style of Bachelard (Bachelard 1938), the obstacles that limit the claims of modelling to the positivity of natural sciences. To do so, this article proposes an epistemological study of the SIR model through its own history, from the "Pathometry" of Ronald Ross (Ross & Hudson 1916, 1917) to the "Theory of Malaria Eradication" of George Macdonald (Macdonald, 1956). By combining the analysis of the formal aspects of this scientific tool

with its historical applications, our objective is to clarify the promises and limitations of epidemiological modelling.

Keywords: Historical epistemology, SIR model, Bachelard, Epidemiology, Malaria, Covid-19

🕒 11.50 - 12.30

From hysterical contagion to latent variable analysis in contested illness definition

Emma Broder, Harvard University

In this paper I examine several 20th century instances of how ambiguous disease outbreaks were labeled either organic or psychological. These evaluations are notable for privileging models of contagion over empirical data. First, in the 1940s and 50s, outbreaks of “epidemic neuromyasthenia” in the US and Iceland were deemed somatic—of an unknown pathogenic origin—by excluding a psychological diagnosis, because “there are no waves of hysterical paralysis” in the words of EIS director Donald Henderson. An explanation based on epidemic trends rather than diagnostic criteria is notable in this era of clinical epidemiology, as the EIS and other powerful public health institutions attempted to bring the two fields into alignment. Next, I turn to strikingly similar diseases in the 1980s and 90s and prominent psychogenic theories of their cause, which used analytic models to make claims that could transcend clinical facts about the nature and cause of these illnesses. That is, analytic approaches to disease definition were now seen to confirm a psychogenic origin of conditions like fibromyalgia, irritable bowel syndrome, and chronic fatigue syndrome under the category of “functional somatic syndromes.” I argue that for conditions which have long been known for their idiosyncratic variation between patients, epidemiologists and psychiatrists turned away from empirical (and clinical) modes of thought, which were bound to produce equivocal and ambivalent data on conditions seemingly on the border of psychiatry and internal medicine, and turned instead to analytic methods in an attempt to reveal deeper truths about the diseases.

🕒 12.30 - 13.00: Commentary, discussion and outlook

Gladys Kostyrka, University of Edinburgh

🍴 13.00: Lunch & Goodbye

BIOGRAPHIES

Christopher J Phillips, Carnegie Mellon University **he/him**

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Christopher J. Phillips is Associate Professor of History at Carnegie Mellon University, where his principle research interests are in the spread of mathematical methods into new domains. His books include *The New Math: A Political History and Scouting* and *Scoring: How We Know What We Know About Baseball*. He is currently finishing a monograph entitled *Number Doctors: The Emergence of Biostatistics and the Reformation of Modern Medicine*. He received his Ph.D. in History of Science from Harvard University.

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John's background lies in the medical and economic history of contemporary Africa, with complementary interests in medical anthropology, STS, demography and epidemiology. John was trained at the University of Leeds, where his PhD focussed the history of nutrition and nutritional medicine in West Africa. Before coming to Edinburgh, he was engaged as a postdoctoral researcher on *Making Clinical Sense* (www.makingclinicalsense.com), a historical-ethnographic study of the technologies used medical education, based at Maastricht University.

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June Barrow-Green is Professor of History of Mathematics at the Open University. Her research focuses on the history of 19th–20th century western mathematics, with a special interest in the history of the gender gap in mathematics. Recent work includes a study on the role of British mathematicians during WW1. Her current research concerns the development of dynamical systems post-Poincaré, and the historical representation of women in mathematics.

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Lukas Engelmann is a Chancellor's Fellow and Senior Lecturer in the History and Sociology of Biomedicine at the University of Edinburgh. His research is concerned with the history of epidemiological reasoning in the

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My dissertation examines the 20th century history of contested illnesses and how patient experience and medical/scientific knowledge differently construct bodies and objects of knowledge. Linking similar conditions which share a nonspecific symptomatology and contested etiology, I investigate the material, cultural, and political dimensions of illnesses which challenge clinical and epidemiological classification.

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Philosopher and historian of the biological and medical sciences, her research first focused on viruses, controversies about their nature, the definition and origin of life (PhD dissertation, IHPST, Paris 1 University). As a post-doctorate scholar at the School of Social and Political Science (Edinburgh University), she investigates the various forms and challenges of transdisciplinarity in epidemiology throughout the 20th and 21st centuries, taking as a starting point the integration of anthropological approaches in the responses to Ebola epidemics from the 1970s until today.
