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Q1 What is yaws and how can your research support the eradication and elimination of this neglected tropical disease? How have you collaborated with Michael Marks, Associate Professor at London School of Hygiene and Tropical Medicine, UK, to achieve this goal?

Yaws is a bacterial infection primarily seen in children, causing lesions in the skin and sometimes in the bones. It is one of a handful of diseases currently targeted by the World Health Organization (WHO) for eradication by 2030. This is an ambitious goal, especially as there are only two diseases that have ever been officially eradicated: smallpox and rinderpest. My work with Michael Marks aims to support disease eradication efforts by using mathematical modelling to infer missing information from the data and predict the effect of different potential intervention policies.

Q2 Why does the WHO recommend mass drug administration (MDA) as a strategy to control or eliminate many neglected tropical diseases?

MDA is an intervention policy for treatable diseases like yaws. The idea is to repeatedly give out drugs to the total population, including those with no symptoms or sign of infection. While it is not possible to reach absolutely everyone in one round of MDA, if each round has reasonable coverage and we miss different people in different rounds, then most people should eventually be treated. When the prevalence of disease is reduced, there are fewer infectious individuals and so fewer new infections. In this way we hope to gradually reduce the prevalence of disease and eventually eliminate the disease in the population.

Q3 Please explain why it is important to measure and model the effects of systemic non-adherence to MDA campaigns. Going forward, what implications may this have for the design of subsequent MDA programmes?

The success of an MDA campaign rests on reaching the majority of the population. If we instead systematically miss a significant group, they might provide a reservoir of infection, allowing disease resurgence after we stop the intervention. When some people are more likely to miss successive rounds of treatment, we call this systematic non-adherence. Significant work has been done for specific treatment campaigns to identify the causes of systematic non-adherence, and ways of reaching groups that are not receiving treatment. Our work instead aims to find ways of measuring the extent of the problem and estimating the effects of it on disease elimination. In particular, if we don't take systematic non-adherence into account then we may overestimate the effect of an intervention and stop too early, leading to disease

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resurgence. The modelling framework is quite broad and can be applied to various infections that are targeted with MDA. It can also be used to investigate other sorts of interventions that can have systematic effects over many rounds, such as repeated community testing or multiple vaccine doses.

Q4 Could you tell us about your involvement in the UK's response to the COVID-19 pandemic? Were any of your reports considered by the Scientific Advisory Group for Emergencies (SAGE) to support the government response to COVID-19?

During the COVID-19 pandemic, I was a member of Scientific Pandemic Influenza Group on Modelling, Operational sub-group (SPI-M-O), the modelling subgroup of SAGE, supporting the UK government response. We had regular meetings, weekly during the main part of the pandemic and reducing to fortnightly in 'quieter' times. For each meeting there was a set of commissions, i.e., questions that were asked of the modellers with research to be completed and presented at the meeting (often only a few days after the commission came in). I was co-author on more than 60 documents sent to SPI-M-O, of which more than 20 went on to be considered directly by SAGE. Other documents and contributions at meetings were incorporated into consensus statements written by the SPI-M-O secretariat to be sent to SAGE. The whole SPI-M-O process was a bit like an extremely rapid peer review, in which leading experts in the field presented their response to commissions asked and others critiqued, asked for clarifications, and suggested improvements. For me, it was like a masterclass in a huge range of techniques and skills, not least how to present scientific insights in a clear and accessible way while communicating the limitations and uncertainties involved.

Q5 Could you discuss the key projects you have undertaken to date as a member of the Joint UNIversities Pandemic and Epidemiological Research (JUNIPER) Consortium?

In Autumn 2020, I was part of a group of SPI-M-O members from eight universities who formed the JUNIPER modelling consortium,[1] originally focused on collaborating on the COVID-19 response. Initially, the majority of our work was concentrated on responding to the direct commissions coming from SPI-M-O, but one of the advantages of forming a larger consortium was the ability to start planning ahead a little. In 2021, after the rapid expansion of the Alpha variant, and in response to the circulation of other variants of concern around the world, I led some work considering the potential for future waves of COVID-19 caused by variants of concern. The initial work, which was sent to SPI-M-O, included scoping of the international situation at the time and modelling of the potential impact of a novel (to the UK) variant on the UK pandemic. This work was later extended significantly to consider different putative variant characteristics, a more complex model including hospitalisations, and a consideration of the potential effect of border controls.

Q6 The WHO recently launched its 2021–2030 neglected tropical disease (NTD) roadmap. How are you able to support the WHO in targeting control efforts at this set of diseases?

The WHO launched the new NTD goals for 2030 and the roadmap towards them following intensive consultation with the global community, including managers of national NTD programmes, stakeholders in NTDs, and input from disease experts and modellers. I attended two meetings between the WHO and NTD disease modellers, facilitated by the NTD modelling consortium. The first was in 2019, consulting on the proposed goals, and the second more recently in 2022, discussing the design of strategies to meet the goals, and ways to measure and certify elimination. These consultations varied for the different NTDs, reflecting their varying degrees of progress towards elimination.

Q7 Have you been involved in investigating the 2022 mpox (formerly monkeypox) outbreak in England? How can infectious disease modelling groups inform and facilitate the implementation of public health strategies to prevent the transmission of mpox virus in human populations?

The JUNIPER modelling consortium has been modelling mpox in the UK, and I have been involved in some of these discussions, both internally and with the UK Health Security Agency (UKHSA). UKHSA work with JUNIPER and other groups, which formed part of the UKHSA Investigation into Monkeypox Outbreak in England: Technical Briefing 8.[2] This modelling aimed to investigate questions regarding the expected future of the mpox outbreak in the UK, including the expected size of the overall outbreak, time until the outbreak is over, and effects of vaccination. These analyses support policy decisions on public health strategies like vaccinations, and whether further interventions are required.

Q8 How important will the One Health approach be in controlling and preventing future pandemics?

The One Health approach recognises that human health is intrinsically linked to animal health and the environment. We can use this approach to identify places where infections with pandemic potential may emerge, and work together to reduce risk and respond to global health threats like COVID-19. It is essential to integrate these approaches with a focus on global equity, but also recognising the factors that lead to higher risk activities taking place. Sadly, both COVID-19 and mpox vaccinations have been very unequally distributed between the different countries and continents, highlighting persistent and ongoing global inequalities.

Q9 What are the potential impacts of climate change on emerging vector-borne infectious diseases in the UK and Europe?

The changing climate alters the regions of the world that can support different species. For vector-borne diseases, this also brings the potential for new regions to support disease transmission. Perhaps the most well-known example is that rising temperatures in Europe may render parts of Europe habitable to malarial mosquitoes. However, climate change has already begun to have an impact on vector-borne diseases in Europe, with increases in the number and geographical extent of infections with West Nile virus. The potential for infections expanding into new geographical regions presents difficulties for populations and health systems that are unused to identifying and treating these conditions.

Q10 What has been your most significant achievement during the course of 2022?

As has typically been the case since the COVID-19 pandemic began, this year has been a whirlwind of very different types of work, from the intensive short deadlines of government scientific advice,

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to university teaching in various forms, to much more long-term academic research. Throughout, it has been essential to form strong and supportive collaborations and work effectively together, and it is these teams that I am most proud of. Working together with other modellers (who might in normal academic life be somewhat in competition) in the JUNIPER consortium and in SPI-M-O has been a pleasure and a privilege, and I am proud of what we achieved together.

References

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