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Are we conducting science and/or impacting on the world?

Alex Welte - staff researcher at SACEMA.

From June to August 2017, we at SACEMA have had a period of heightened activity to promote capacity development amongst our Masters and Doctoral students. We have found ourselves asking, again and again, a set of related questions of fundamental importance to the kind of 'Epidemiological Modelling' that we are a 'Centre of Excellence' in. These questions revolve around the challenges of mapping mathematical models onto the real world: What mechanisms are we claiming to have knowledge of, or at least working hypothesis about? What data do we have that can help us fine tune ('calibrate', in insider speak) these models into quantitative correspondence to the real world? What 'predictions' can models be asked to make by way of 'validation'? And so on.

Missing so far from this list of questions: What are we hoping to learn, and in support of which hoped-for impact into better health? That is indeed a tough one. It can be hard enough to be sure about what 'policy options' are seriously on the table, what is driving the decision making, what data is available to be explored through descriptive and 'mechanistic/predictive' analysis. However, that is still relatively straightforward compared to executing valid science while meaningfully improving a highly political decision making process.

Perhaps there is a necessary gap between our aspirations and our actual impact, and maybe we must to some extent choose whether science or policy discourse is our primary activity. I personally lean strongly toward the science, hoping to keep an eye on whether it is at least in principle potentially useful, and preferably not completely neglecting to make the relevant discursive connection to facilitate impact. Perhaps we cannot simultaneously be competent scientists and also revolutionise how healthy the world is, how large systems of infrastructure and policy are designed and nurtured. So, do we modellers just follow our noses (or mind ruts), or are there some broad guidelines for where we can meaningfully apply our efforts?

To my not unbiased eye, the main contributions in this edition of the Quarterly give us a good indication of the kinds of questions that warrant modelling, and with which non-modellers can also better engage if they are willing to at least frame their thinking explicitly in model-like terms.

Whether we are wondering how to eradicate rabies, which persists in complex networks of feral and domesticated animals about which we have different kinds of data and over which we have very different levels of control. Or whether we are wondering what the emerging issues in HIV care are now that some sort of face value clinical stability is in principle, and increasingly pragmatically, relatively easy to attain for most patients. We will face some similar limitations to descriptive analysis, and eventually be forced to think about how things might plausibly play out over time.

Jonathan Dushoff, in reviewing rabies modelling, shows the way 'dynamical' thinking has shown how inter-related small regions are, and credibly made the case that vaccination of domestic animals could eradicate rabies in large regions. This view of existing data, filtered/transformed to take into account the passage of time, makes it possible to think beyond shallow concepts like a one-year budget cycle or a politically palatable set of targets for performance evaluation.

As we see in Cari van Schalkwyk's report on the international AIDS conference, there are lots of long-term questions about future prevention strategies, models of long-term care, emerging complications and long-term disease interactions. How can we possibly wrap our minds around questions like which of these challenges warrant changes in the basic model of healthcare provision, which merely warrant an adjustment of investment, and which are likely to be self-resolving, or justify merely closer scrutiny rather than immediate action?

There is surely no recipe for turning complicated societal issues into equations to be solved, and the answers circulated as supposed truths to naïve politicians and citizens. Nevertheless, while bearing in mind the limitations of looking even into hypothetical futures, it seems that there is often a clear distinction between interpreting data through the lens of 'where do we stand', and the lens of 'where are-we / might-we-be heading'. As most of the important questions in public health inevitably justify considering both views, there is usually some use for a level of 'dynamical' (i.e. modeller) thinking, and it should not be the sole responsibility of modelling technicians to drive this kind of thinking and discourse.

On a quite different kind of dynamical time and size scale, Zoë Gill gives us a view into one of the more intriguing aspects of aging, namely limits on cell replication and the specialisation that this produces in a complex emergent way. Some cells are released from primitive 'progenitor' tissue reserves, live out their lives, and harmlessly die at a typical range of times (like red blood cells released from bone marrow). Others, crucially immune system cells like white blood cells, go through a more complex process of formation/release into circulation, after which they are expected to experience potentially many rounds of cell division, and potentially to have their progeny remain extant in significant quantities for the life of the individual. The latter dynamic is a key component of immunological memory. Zoë gives us a tour of stable and emerging knowledge about the limits of replication to which functional cells can be subjected, and why this is important to understand such things as the limits of immune system longevity.

The article by Gary Murphy and Eduard Grebe appears superficially to have little to do with epidemiological or biological modelling, focusing as it does on tests for 'recent HIV infection'. However, an important theme in the work SACEMA has been doing to support a set of related assay development/benchmarking processes has been the use of the appropriate combination of dynamical and statistical thinking in planning and executing analysis of data, and interpreting results and optimising biomarkers available on a given platform. Building appropriate models, it seems, is ever close to the heart of the action.

As ever, we hope this edition of the Quarterly nourishes, rather than ages, our readers minds.

Alex Welte *- staff researcher at SACEMA. Areas of interest: population dynamics, disease surveillance, and applied mathematics generally.*
alexwelte@sun.ac.za