mod4PH Podcast Episode 2
Guest: Dr Rachael Milwid, Public Health Agency of Canada

Introduction

Welcome to the Mod4PH research highlights. This is a public health podcast produced by the National Collaborating Centre for Infectious Diseases. My name is Wendy Xie, and I am NCCID's modelling knowledge translation project manager.

Today will be one of several episodes for this Mod4PH series, where we showcase mathematical modelling research for public health.

In this episode, we will be speaking to Dr Rachael Milwid.

After completing her postdoctoral fellowship at McGill University, Rachael joined the Public Health Agency of Canada in August 2021. Since then, she has used her mathematical modelling skill set in the development and analysis of disease transmission models of COVID-19 importation into Canada, mpox transmission, and other exciting projects.

Today, Rachael spoke with us about her experiences and considerations as a math modelling researcher during the COVID-19 pandemic.

Interview

Wendy - Hello everyone who's listening in, hello Rachael, and thank you so much for joining us for this episode.

Rachael – Hi Wendy, thank you so much for having me. It's really great to be here today.

Wendy – Thank you so much. For our first question I would like to ask, how do you think the public health perspective of infectious disease modelling changed during the COVID-19 pandemic? And how did this affect your experiences as a math modelling researcher?

Rachael - So, I think that the pandemic played a significant role in increasing the public health awareness of epidemiology in general, but more specifically math modelling. During the pandemic we were using techniques and developing techniques at the same time as the public was really learning about these techniques. And so for that reason, amongst other reasons, it was really important to be transparent both about the modelling process and the assumptions used, but also about the modelling results, and how to interpret those results, given the assumptions and the methods that we implemented. And on top of the public perception, the models were often used to inform situational awareness within governments, and that aspect grew a ton during the pandemic, and so, from my perspective, it was really nice to be able to showcase the utility of modelling, and it was also nice to be able to put my skill set to use in a very applied and needed setting.

Wendy – So, if a reader who has no previous experience with infectious disease modelling is trying to interpret the results of a modelling paper, what advice would you give to help them critically assess the quality of the study?

Rachael – Okay, so I think that there's really a bunch of things that you need to take into account. So, the first aspect that comes to mind is really to focus on the model assumptions and see, do they make sense in the respective context? So, for example, you should see are the parameters that are used in the model - are those relevant to the population at hand? You could ask questions such as - the simplifying assumptions and the methods that are used to develop the model - do those make sense? And how would those impact the results of the model?

So second, I would really recommend comparing the methods and comparing the results to results and methods and other papers. So yes, this does mean a lot of reading, but I think it's important because number one you can say are the results consistent across studies? And if so, what can we take from that? But more importantly, if there's a discrepancy in the results, I would say, well, why do we see that discrepancy? Is it a question of methodology? Is it a question about the data that was used? Maybe it was that data wasn't representative or relevant. And it's really important to know what's causing that discrepancy. Or maybe there's just something that we're missing, like some piece of biological knowledge that needs to be added into the model.

So finally, I would really look at the publishing information for that paper. I would try to answer questions such as is the article published in a reputable journal. And then, I would see, is the article peer reviewed. And peer review is really important, because it gives other experts a chance to critically appraise and evaluate the methods that are employed within the article, as well as to try and see - do the results make sense? So I think peer review is really important. But finally, I would see - do the methods and the data justify the conclusions? So, for example, is the sample size or the data that's being used, is that large enough and relevant for the conclusions that are being drawn about a particular population? And maybe it's not. Maybe you can't really generalize the results, or maybe the results are only relevant to specific populations.

Wendy - So there were a lot of different math models of COVID-19 that were published throughout the pandemic and continue to be published. How have models of COVID-19 improved in terms of their ability to help inform policy decisions, and what allows for these continued improvements?

Rachael - That's an excellent question, and I think that the main improvement has been our knowledge base. So, as the pandemic progressed, we learned more and more about both the epidemiology of COVID-19, as well as the transmission dynamics. And so, we were able to take that knowledge base and refine our models to make them more relevant and more realistic and representative of COVID-19.

On top of that, it's really important to remember that the model is really only as good as the data and assumptions that go in to inform it. And so, as the pandemic progressed, we were able to collect more data, which is important because we could use it to a) inform the model, but b) we could use it for model validation. And model validation is critical. So model validation is when you check to see, do your model results represent what we're seeing in reality and if they're not representing what we're seeing in reality, then you say, well, why is that? What am I missing in the model process and in the model structure that I'm not getting the right results? And so, we can then go back and refine the models and to make them make more sense, and better represent our respective population.

Finally, through our modelling experiences, I think that policy makers came to appreciate the value of modelling. And that was used to better help them inform situational awareness as well as evidence-based decisions. And so, as the pandemic progressed, we used modelling more and more, but it didn't stop with the COVID-19 pandemic. We then used modelling for other outbreaks, so for example, the mpox outbreak. We're currently developing models for avian influenza, and you know, even random outbreaks that could happen that we don't know about yet, but we want to be prepared. And so, as the utility of modelling became more evident, I think that the use and the requirement for models has become greater, and we're using models, you know, every day to try and be prepared for whatever is next.

Wendy - And that's actually a great segue into our next question. So we've learned a lot from our experiences with math modelling during the pandemic. What do you think is important for us to remember going forward when we want to apply modelling research for public health in the future.

Rachael - So I think that probably the main thing to remember is that modelling is an excellent tool, but that the results should be used as a guideline. And I say this for multiple reasons. So first the

models are really good at predicting trends. But there's limitations to keep in mind. So, for example, the model is only as good as the data that's used to inform the model. So, to make a relevant model, you need good quality data, by which I mean, you need lots of population specific or general epidemiological specific data to inform the model.

On the on top of that we cannot predict individual behaviour. I don't know if person X is going to go to a party or not which would increase their chances of acquiring some disease. And so, because we can't predict that, we really need to use the model results to determine trends that could happen in various scenarios, but also, we can use these different scenarios to get a range of outcomes. And that range of outcomes is important, because it allows policymakers to know a best and a worst case scenario and use that to inform whatever they're using the models for, so policy or situational awareness.

I think that the really great thing about models is that they are really ethical and efficient way of testing a whole bunch of different scenarios, such as intervention strategies. So, for example, we could use a model to really quickly see the impact of different vaccination uptake rates, or to study the impact of school closures and workplace closures on the pandemic. And by doing this analysis in advance of implementing the actual interventions, we can see - will it be efficacious? Is it going to make a difference? Is it worthwhile doing it? Or we can answer questions such as what is the required uptake rate that we need to prevent an outbreak or to prevent the worst-case scenario. I think models really are powerful tools for pandemic preparedness, and just to maximize the resources that we have to best deal with whatever life throws at us.

Wendy - And that's all we have time for today. Thank you so much for your insights Rachael, and we hope to speak to you again!

Rachael – Thank you Wendy, it was really great chatting with you, and it was a very interesting conversation. Have a great day!

Conclusion

This concludes our conversation with Dr Rachael Milwid from the Public Health Agency of Canada. If you have any further questions or would like any math modelling researchers and their work featured on this podcast series, please write to us at nccid@umanitoba.ca.

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