Professor Emma McBryde's research on infectious diseases has had a significant impact across the globe, thanks to a combination of medicine and mathematics.

When Professor Emma McBryde returned to Australia from a research trip to Papua New Guinea, she brought news no one was expecting: that the country had the highest tuberculosis rates in the world.

"What I found when I got there was that every hospital bed was taken up by a person with tuberculosis," Prof McBryde said. "It was absolutely the most substantial burden on the hospital system. I saw children dying of tuberculosis. I saw people with drug-resistant tuberculosis having all sorts of side effects from their treatment. It was really eye-opening."

AusAid (now DFAT) sent her to the country's Western Province in 2012 to investigate concerns TB could spread to Australian territory in the nearby Torres Strait, with a treaty allowing free movement between parts of the two countries.

While she found the potential for this was low, Prof McBryde reported back to the Australian and Papua New Guinean governments just how widespread TB was in PNG, eventually triggering an emergency response.

And it wasn't just her medical background that helped her reach this conclusion and make recommendations on how to best address the disease – it was also maths.

A trained medical doctor and infectious diseases specialist, Prof McBryde completed her PhD in applied mathematics and biostatistics.

She now uses mathematical modelling to predict the spread of infectious diseases and determine the most effective and economical methods of tackling them.

"It's essentially trying to reconstruct epidemics of different infectious diseases, with or without interventions, trying to work out what interventions would be the best ones under the circumstances," Prof McBryde said.

Part of James Cook University's Australian Institute of Tropical Health and Medicine since 2015, her research in modelling infectious diseases of global significance –including influenza, SARS and tuberculosis – has shaped policy and on-the-ground responses across the globe.

"What we do will impact on such broad and important policies that work on such large scales," she said.

Prof McBryde likens her research to working with a patient with an interesting but elusive diagnosis. "You have to really engage your brain in what could it be, but with modelling you have more time to think about it and you can be a bit more creative," she said. "It's not just a matter of finding a solution, you

create a model and say, ‘if this is true, what are the consequences? If we possibly did such-and-such, how could that help?’ So you engage your creative brain as well.”
And the outcomes of her modelling have been life-changing for people all over the world.

Prof McBryde said tuberculosis, the number one infectious disease killer globally, is one of the most fascinating and neglected conditions, and using modelling she’s helped to develop national TB programs in PNG, the Philippines, Fiji and Bulgaria.

“What drives me is trying to challenge orthodox beliefs, and in tuberculosis there are a lot of old-timers saying ‘this is how you do it because this is how you do it’, and I really like challenging that,” she said.

Prof McBryde has also been involved in projects modelling other infectious diseases and in 2009 when Australia was hit with pandemic influenza she was able to complete research on the disease in time to inform the Northern Hemisphere before their winter.

Her current work includes researching the co-epidemic of diabetes and TB in PNG, and examining possible causes – including an enzyme in many Papua New Guineans – for high levels of drug-resistance.

She is also part of a team developing a pandemic mapping tool available on the internet where users can choose a disease, a model, put in parameters and run a simulation to see what might happen over the world.

Despite her distinguished career, Prof McBryde said there was still much more to come in the world of infectious diseases and mathematical modelling.

“I still think my greatest achievements are well and truly ahead of me rather than behind me,” she said.