Validating a Risk Prediction Model

From my perspective as a medical statistician who works in risk prediction modelling, not prognostic modelling research, before we can get a model, such as CanRisk, into clinical practice to guide decision making, there are a series of steps that need to be undertaken. We start with model development, which is essentially the process of applying mathematical and statistical algorithms that underpin models such as CanRisk.

Once we have that model, it's then a case of making sure that the model is well validated, and by that, what we mean is that it makes accurate predictions. And then we want to check that it makes a positive clinical impact in the sense of it improves health outcomes if we were to use the model, and so validating the prediction model.

This is essentially trying to answer the question: does the risk model accurately estimate risk in patients that it hasn't seen? And if we pass the relevant information about that patient into models such as CanRisk, it will provide a prediction for them. And so validation is all about testing whether that predicted risk accurately reflects what might happen to them in the future.

Well, let's imagine that we start with a situation where we recruit a collection of women who don't have breast or ovarian cancer baseline into our study. We pass all of their information into the CanRisk tool and out pops an estimate of their risk of developing breast or ovarian cancer within the next period of time. At that point, we then observe which of those women experience the outcome and which don't. Once we've done that and we've completed the follow up of the study, the validation exercise is then essentially comparing the predicted risks from step two to the observed outcomes that were observed during follow-up.

What we have available to us is a range of statistical methods and techniques that allow us to quantify different aspects of the prediction model in terms of how accurate those predictions are. Accuracy in a statistical sense.

I guess what's fundamentally important is also the clinical impact of the risk model if we were to use it. So impact assessment studies, as they’re called, are trying to answer the questions of does the use of this risk model positively change clinical outcomes? Does it improve patient care?