So far, we have used what is known as internal validation to test our model.

This means that we took the data from one set of patients and split them into a training set and a testing set.

While this confirms that our model is good at making predictions for patients in the Framingham Heart Study population, it's unclear if the model generalizes to other populations.

The Framingham cohort of patients were white, middle class adults.

To be sure that the model extends to other types of patients, we need to test on other populations.

This is known as external validation.

There have been many studies to test the Framingham model from the influential 1998 paper on diverse courts.

This table shows a sample of studies that tested the model on populations with different races.

The researchers for each study collected the same risk factors used in the original study, predicted CHD using the Framingham Heart Study model, and then analyzed how accurate the model was for that population.

For some populations, the Framingham model was accurate.

For the ARIC study that tested the model with black men, this figure shows a bar graph of how the Framingham predictions compare with the actual results.

The gray bars are the predictions.

And the black bars are the actual outcomes.

The patients are sorted on the x-axis by predicted risk and on the y-axis by the percentage of patients in each group who actually developed CHD.

For the most part, the predictions are accurate.

There's one group for which the model under-predicted the risk and one group for which the model over-predicted the risk.

But for other populations, the Framingham model was not as accurate.

For the HHS study with Japanese-American men, the Framingham model systematically over-predicts a risk of CHD.

The model can be recalibrated for this population by scaling down the predictions.

This changes the predicted risk but not the order of the predictions.

The high risk patients still have higher predictions than the lower risk patients.

This allows the model to have more accurate risk estimates for populations not included in the original group of patients.

For models that will be used on different populations than the one used to create the model, external validation is critical.