

# Can we predict who is going to die after a stroke?

## What is the problem?

A stroke is caused by a lack of oxygen to the brain, resulting in the sudden death of brain cells. It is the third most common cause of death in the UK. The lives of many patients after a stroke are also affected by disability. Worldwide, stroke is the second leading cause of death and third leading cause of disability.

Clinical scores are tools which are used to identify patients who are at a high and low risk of certain outcomes. Many stroke scores have been created, although none of them have been widely accepted in clinical practice. To date there is no stroke score that can predict the likelihood of death of patients within 10 years after suffering from a stroke.

## What am I interested in?

I wanted to develop a simple and accurate score to predict which patients will die within 10-years after a stroke. I wanted to use predictors that do not require any specialised investigations and are available in many clinical areas.

## What did I do?

I conducted a search of papers published on previous research into strokes and, after analysing the findings, I selected 10-year mortality (death) predictors, which were:

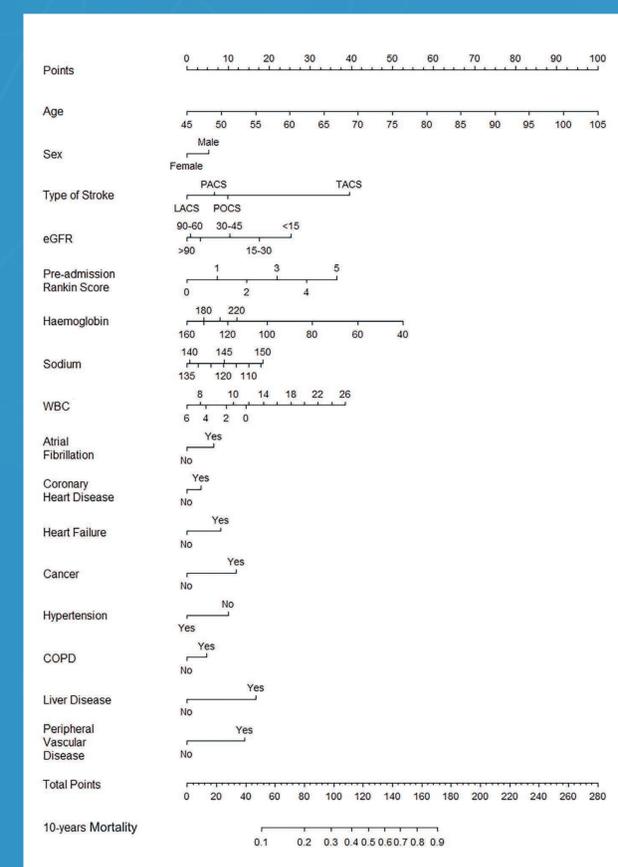
- age
- sex
- type of stroke
- estimated glomerular filtration rate (eGFR) (a test to check how well the kidneys are working)
- Rankin Score (a measure of disability) of the patient before admission to hospital
- haemoglobin levels (a measure of the capacity of the patient's blood to provide oxygen to brain tissues)
- sodium levels (commonly disturbed in situations needing immediate medical attention and is an important predictor of adverse outcomes after stroke)
- white blood cell levels (to check for abnormalities in the immune system,

which is the system which protects us from infections)

- other diseases or conditions the patient was suffering from (namely, atrial fibrillation (irregular heart beat), coronary heart disease, heart failure, cancer, hypertension (high blood pressure), chronic obstructive pulmonary disease (COPD – a lung disease), liver disease and peripheral vascular disease).

All blood results included were based on values when the patient was admitted to hospital.

Using data from a population of thousands of patients who had suffered a stroke and statistical analysis, I created a nomogram (see Figure 1), which is a tool for calculating probabilities for predictive models using a visual representation. I assessed the ability of the nomogram to predict death by repeatedly using subsets of patients from the original patient population.



**Figure 1** The nomogram aids the prediction of the likelihood of an individual dying within 10-years after suffering a stroke. The number of points assigned to the value of each variable for that patient is determined and each variable's value is located on the variable axis. The corresponding points for that variable are noted from the 'Points' axis, at the top of the nomogram, at the equivalent position along the axis to the position of the variable. The total of all these scores is calculated and, using the 'Total Points' axis at the bottom of the nomogram, the predicted mortality, at the equivalent position along the axis to the Total Point's position, can be determined. LACS – Lacunar Syndrome, PACS – Partial Anterior Circulation Stroke, POCs – Posterior Circulation Syndrome and TACS – Total Anterior Circulation Stroke (front part of the brain stroke) are different types of stroke. eGFR – estimated Glomerular Filtration Rate, WBC – white blood count, COPD – chronic obstructive pulmonary disease.

## What did I find?

I found that patients with strokes that affect all of the front part of the brain were almost 3 times more likely to die within 10 years after their stroke. Those with eGFR below 15 were almost twice as likely to die after stroke compared to those with eGFR over 60. Out of all the other conditions which the patients suffered that I analysed, liver disease had the strongest effect on stroke mortality, increasing the risk of death by over 50%. In our model, hypertension was found to have a protective effect.

## What does this mean?

The nomogram I have developed is an easy tool to use to help visualise the magnitude of the effect of the predictors I chose on the likelihood of patients who have suffered a stroke dying within 10 years and could be used by doctors to help them and their patients in making decisions about their treatment. While the score was validated on samples resampled from the original population, in order to assess whether it will be a useful tool for widespread use across different populations of stroke sufferers, it will need to be validated on different populations.

## Who am I?

I am a third year medical student at the University of Aberdeen. My main field of interest is neurology (disorders of the nervous system) and I am hoping to specialise and contribute to research in this specialty in the future. I am also hoping to spend a year between the third and the fourth year of medical studies studying either Neuroscience or Psychology.