New algorithm uses disease history to predict intensive care patients' chances of survival

27 May 2019

Credit: CC0 Public Domain

Researchers from the University of Copenhagen and Rigshospitalet have used data on more than 230,000 intensive care patients to develop a new algorithm. Among other things, it uses disease history from the past 23 years to predict patients' chances of survival in intensive care units.

Every year, tens of thousands of patients are admitted to intensive care units throughout Denmark. Determining which treatment is best for the individual patient is a great challenge. To make this decision, doctors and nurses use various methods to try to predict the patient's chances of survival and mortality. However, the existing methods can be significantly improved.

Therefore, researchers from the Faculty of Health and Medical Sciences at the University of Copenhagen and Rigshospitalet have developed a new algorithm which much more accurately predicts an intensive care patient's chances of surviving. Their research has been published in the scientific journal *Lancet Digital Health.*

"We have used Danish health data in a new way, using an algorithm to analyze file data from the individual patient's disease history. The Danish National Patient Registry contains data on the disease history of millions of Danes, and in principle the algorithm is able to draw on the history of the individual citizen of benefit to the individual patient in connection with treatment," says Professor Søren Brunak from the Novo Nordisk Foundation Center for Protein Research.

Analysing 23 Years of Disease History

Developing the algorithm, the researchers used data on more than 230,000 patients admitted to intensive care units in Denmark in the period 2004-2016. In the study the algorithm analyzed the individual patient's disease history, covering as much as 23 years.

At the same time, they included in their calculations measurements and tests made during the first 24 hours of the admission in question. The result was a significantly more accurate prediction of the patient's mortality risk than offered by existing methods.

"Excessive treatment is a serious risk among terminally ill patients treated in Danish intensive care units. Doctors and nurses have lacked a support tool capable of instructing them on who will benefit from intensive care. With these results we have come a significant step closer to testing such tools and directly improving treatment of the sickest patients," says Professor Anders Perner from the Department of Clinical Medicine and the Department of Intensive Care, Rigshospitalet.

Significant with Regard to Death and Survival

The algorithm made three predictions: the risk of the patient dying in hospital (which could be any number of days following admission), within 30 days of admission and within 90 days of admission.

For example, the researchers could tell that up to 10-year-old diagnoses affected predictions, and that young age lowered the risk of dying, even when other values were critical, while old age increased mortality risk. The algorithm is not just a useful tool in everyday practice in intensive care units throughout the country. It can also tell us which factors are significant when it comes to a person's death or survival.

"We "train" the algorithm to remember which previous diagnoses have had the greatest effect on the patient's chances of survival. No matter whether they are one, five or 10 years old. This is possible when we also have data from the actual admission, such as heart rate or answers to blood tests. By analysing the method, we are able to understand the importance it attaches to the various parameters with regard to death and survival," says Søren Brunak.

The researchers behind the study hope to be able to use the algorithm in clinical tests within a couple of years. At the same time, the next step is to try to further develop the algorithm, making it capable of making predictions by the hour.

More information: Annelaura B Nielsen et al, Survival prediction in intensive-care units based on aggregation of long-term disease history and acute physiology: a retrospective study of the Danish National Patient Registry and electronic patient records, *The Lancet Digital Health* (2019). DOI: 10.1016/S2589-7500(19)30024-X