Ibeas, Jose; Macias Toro, Edwar Hernando; Rubiella, Carol; [et al.]. «Renal failure and mortality : from evidence to artificial intelligence, change of paradigm?». Nephrology Dialysis Transplantation, Vol. 34, Issue Supplement$_1(June2019), art.gfz103.SP689.DOI10.1093/ndt/gfz103.SP689$

RENAL FAILURE AND MORTALITY: FROM EVIDENCE TO ARTIFICIAL INTELLIGENCE, CHANGE OF PARADIGM?

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INTRODUCTION: The mortality of the patient with renal insufficiency is high and especially in dialysis. There are many risk factors involved, although mainly those related to cardiovascular risk, which in turn are closely linked to those related to uremia, mutually reinforcing.
The approach to identifying these factors is difficult, and those recommended by Guides or predictive models have not been validated in the renal patient. Mortality risk models implicitly assume that each risk factor is linearly related to events, simplifying what are really complex relationships that would include a huge number of factors, with non-linear relationships. Approaches that incorporate multiple elements that identify real relationships are needed. Machine-learning can be an alternative. Based on computational methods that detect complex and non-linear interactions between variables identify latent variables, unlikely to observe directly.
The aim is to evaluate if machine-learning algorithms based on neural networks can establish a predictive model of mortality in the patient on hemodialysis.

METHODS: Design: Retrospective analysis of a historical cohort of 250 patients on hemodialysis in a single centre, from November 2008 to February 2018. Inclusion criteria: > 18 y.o. and death in the period described.
Methodology:
1. Preprocessing the data to be used after collecting the historical information for several years.
2. Exploration of variables, training models with samples of different time windows to predict mortality at different time ranges.
3. Variables selection by two methods: a) By an expert; b) By Recursive feature elimination (RFE), with random forest (RF) as a learning model. In a second phase, train a model using artificial neural networks (ANN) to compare the two methods.
4. Optimise neural network performance by considering all the variables and architecture consisted of two layers with 50 and 25 neurons, respectively.
5. Creation of time windows for mortality prediction by models with the training of ANNs of two hidden layers with 300 and 100 neurons. Samples randomisation and separation with a ratio of 70-30% for training and testing, using 5-fold for cross- validation.
Variables: a) Age, sex, time in dialysis, date of death; b) Diagnosis of comorbidity by ICD-9; c) All variables of all hemodialysis sessions; d) All the analytical variables of the entire follow-up time.

RESULTS: Age: 73.3 6 11.09 years, 64.8% men and 35.2% women, time in HD: 2.4 6 1.9 years. The best mortality prediction was the one who collected information for six months and predicted mortality to 18, with a ROC area of 0.982, an accuracy of 0.982, sensitivity of 0.971, specificity of 0.935, positive predictive value of 0.949 and negative predictive value of 0.962.

CONCLUSIONS: The methodology of machine learning demonstrates a training and validity with excellent capacity of recognition and prediction of the event of death.
The method of machine learning may involve a change in the approach of algorithms for the establishment of risk factors for mortality in the renal patient.