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P273 -Predicting change in dry weight of a Hemodialysis patient over the coming month using Xgboost Machine Learning algorithm

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Introduction:
Everyday many renal clinicians have to make a clinical estimation of dry weights in their hemodialysis (HD) patients. The objective of this study was to develop a machine learning algorithm which could be used as a mobile app alongside the conventional clinical estimation to aid the renal physicians.

Methods:
This was a prospective cohort study which was carried out from July 2018 to December 2018, at a tertiary care hospital in Islamabad, Pakistan. All the consenting patients (by non-probability convenience sampling) were included, who had received HD for at least 3 months and who didn't have any disability to communicate. A total of 78 patients were enrolled. An MBBS qualified physician administered a proforma to the patients at the start of a one-month observational period that recorded predictors like age, sex, income, cause of renal failure, HD duration, HD regimen, quality of life score using WHO QOL BREF, dietary compliance, medicinal compliance and electrolytes etc. Dry weight as an outcome was estimated clinically by the in-charge renal consultant at the start and end of this observational period. Statistical analysis included descriptive stats and building of four machine learning algorithmic models namely linear regression, gradient boost, random forest and Xgboost. We used R statistical software version 3.5.2 for the above analysis.

Results:
The study population included 53% (42/78) males and a median age of 58 years. The mean duration on HD was 41 months while only 28% (22/78) patients had a HD regime of three times per week. Dietary compliance was observed by 83% (65/78) patients while 69% (54/78) patients observed medication compliance.
We divided the data into training and testing sets and used predictors as above for estimating the change in dry weight over the coming one month. We built four models from the training data set which included Linear regression (R2=0.24, RMSE=9.71), Gradient Boost model (R2=0.24, RMSE=1.72), Random forest (R2=0.31, RMSE=1.58) and Xgboost (R2=0.39, RMSE=1.52). The best performing model by a long distance was Xgboost which was able to explain about 39% variance in the dependent variable. We then developed a mobile app based on this model which takes in the predictors from last month and can give a general estimation of dry weight change expected currently in a given patient. There are plans to increase the sample size to further improve the accuracy of this model and to perform a cost-benefit analysis in terms of work-hours saved per week down the line.

Conclusion:
We were able to develop a predictive model using Xgboost machine learning algorithm which could estimate a change in dry weight in a given HD patient one month from now with a fairly good accuracy. This model was then implemented in the form of a mobile / web app which can be used by clinicians around the world to get a better estimate of dry weight changes in their HD patients. Future plans are to increase the sample size to further improve the accuracy.