Artificial neural networks for prediction final height in children with growth hormone deficiency

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Objective

We used 4 binary and 7 continuous predictors available at the time of diagnosis and start of therapy and developed multiple linear regression (MLR) models and artificial neural networks (ANN)

Design and method:

The sample included 121 patients of Endocrinology Research Center who were under observation in 1978-2016 and reached the final height. All patients were treated by rhGH at least for 3 years.
The input variables obtained at therapy onset include 4 binary and 7 continuous.
FH SDS was calculated using Auxology software.
Statistica software v.13 (StatSoft, Inc., USA) was used for statistical analysis and ANN development.
Different topologies were tested including linear and Bayesian networks, radial basis functions and 3- and 4-layer perceptrons. RMSE and explained variance R^2 (%) were the main characteristics of models' quality

Results:

MLR models had poor quality. The best ANN predicting FH has RMSE 4.41 cm and explains 75.9% of variance, and 11 predictors are used. The best ANN for predicting FH SDS explains 42.4% of variance and has RMSE 0.601 SDS, and 11 predictors are used. It seems promising to increase the sample and improve the ANN models.

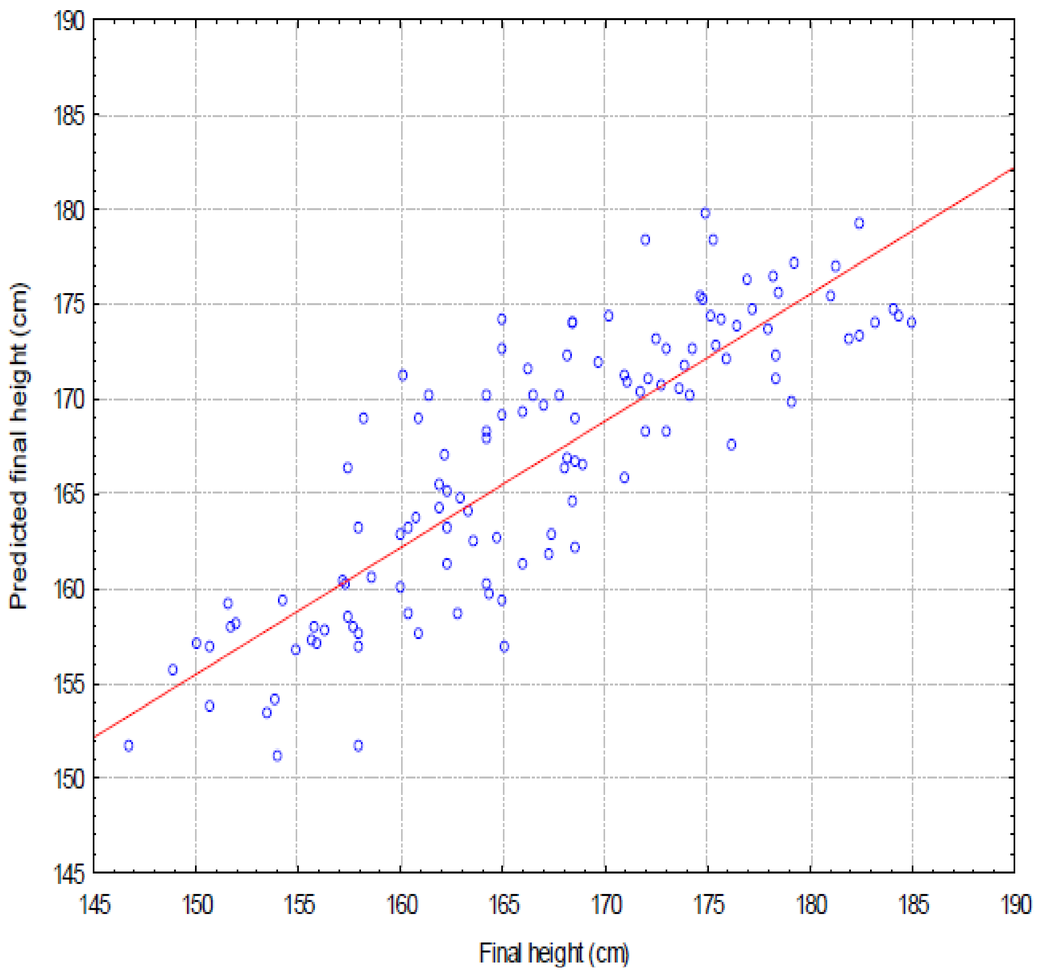

Fig. 1. Scatterplot of target and predicted final height (n=121).

Conclusion:

ANN demonstrated to be the efficient approach to mathematical modeling for clinical purposes. The ability to predict the individual effectiveness of growth hormone replacement therapy is of great importance. The models provide personalized approach to treatment of patients with GH-deficiency. ANN allows making dose of rhGH and regimen of injection individually adjusted and contribute to improved overall outcomes. ANN can also be useful for evaluating effectiveness of the therapy in patient subgroups and for demonstrating factors determining FH.