

**A Multilayer Perceptron Neural Network Model to Classify Hypertension in
Adolescents Using Anthropometric Measurements: A Cross-Sectional Study in
Sarawak, Malaysia**

ABSTRACT

This study outlines and developed a multilayer perceptron (MLP) neural network model for adolescent hypertension classification focusing on the use of simple anthropometric and sociodemographic data collected from a cross-sectional research study in Sarawak, Malaysia. Among the 2,461 data collected, 741 were hypertensive (30.1%) and 1720 were normal (69.9%). During the data gathering process, eleven anthropometric measurements and sociodemographic data were collected. The variable selection procedure in the methodology proposed selected five parameters: weight, weight-to-height ratio (WHtR), age, sex, and ethnicity, as the input of the network model. The developed MLP model with a single hidden layer of 50 hidden neurons managed to achieve a sensitivity of 0.41, specificity of 0.91, precision of 0.65, F-score of 0.50, accuracy of 0.76, and Area Under the Receiver Operating Characteristic (ROC) Curve (AUC) of 0.75 using the imbalanced data set. Analyzing the performance metrics obtained from the training, validation and testing data sets show that the developed network model is well-generalized. Using Bayes' Theorem, an adolescent classified as hypertensive using this created model has a 66.2% likelihood of having hypertension in the Sarawak adolescent population, which has a hypertension prevalence of 30.1%. When the prevalence of hypertension in the Sarawak population was increased to 50%, the developed model could predict an adolescent having hypertension with an 82.0% chance, whereas when the prevalence of hypertension was reduced to 10%, the developed model could only predict true positive hypertension with a 33.6% chance. With the sensitivity of the model increasing to 65% and 90% while retaining a specificity of 91%, the true positivity of an adolescent being hypertension would be 75.7% and 81.2%, respectively, according to Bayes' Theorem. The findings show that simple anthropometric measurements paired with sociodemographic data are feasible to be used to classify hypertension in adolescents using the developed MLP model in Sarawak adolescent population with modest hypertension prevalence. However, a model with higher sensitivity and specificity is required for better positive hypertension predictive value when the prevalence is low. We conclude that the developed classification model could serve as a quick and easy preliminary warning tool for screening high-risk adolescents of developing hypertension.