THE KOREAN SOCIETY OF NEPHROLOGY
APCN & KSN 2024
June 13(Thu) - 16(Sun), 2024 Coex, Seoul, Korea
Promoting Sustainable Kidney Health: The Asia-Pacific and Beyond

Abstract Submission No.: A-0577

Refined Machine Learning Approach for Early Identification of High-Risk Chronic Kidney Disease in Type 2 Diabetes Mellitus Patients: Simplified Screening Tool Version

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Objectives : Chronic Kidney Disease (CKD) is a significant complication in Type 2 Diabetes Mellitus (T2DM), particularly challenging to diagnose early in resource-limited settings. This study aims to develop a Machine Learning (ML)-based tool to identify high-risk CKD in T2DM patients, focusing on simplicity and feasibility for use in both urban and rural healthcare environments.
Methods : We analyzed data from 3,471 T2DM patients (25,082 visits) at a university hospital in Bangkok, Thailand, between 2005 and 2014. Key features included age, gender, BMI, blood pressure, fasting blood sugar, and HbA1c levels. Patients were divided into training and testing datasets. Three tree-based ML algorithms—Decision Tree, Random Forest, and Extreme Gradient Boosting (XGBoost)—were employed, with model performance evaluated using ten-fold cross-validation and metrics like AUROC, precision, recall, and F1 score.
Results : The XGBoost model incorporating HbA1c (HbA1c-XGBckd) demonstrated the highest efficacy (AUROC 0.824), marginally surpassing the Random Forest model. Adjusting the ML cut-point to 0.3 optimized sensitivity and NPV for CKD screening. Key predictors of CKD included age, HbA1c, and blood pressure. The duration of T2DM did not significantly affect CKD risk in the models, possibly due to effective diabetes management in the patient cohort.
Conclusions : The HbA1c-XGBckd and non-HbA1c-XGBckd models are potent, user-friendly tools for early CKD detection in T2DM patients. Their adaptability makes them suitable for diverse healthcare settings, promising significant clinical and public health benefits, especially in resource-constrained environments.

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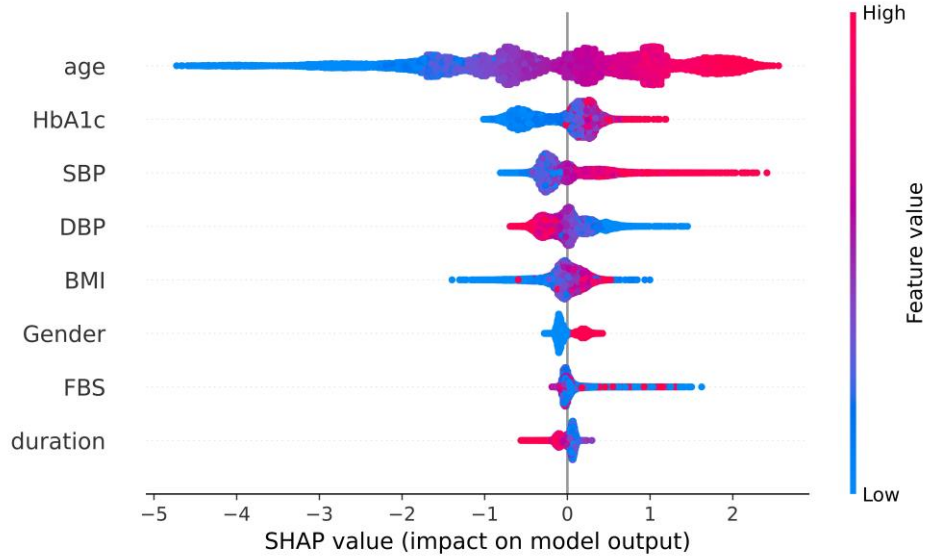

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