**Establishment and Validation of a Risk Prediction Model for Osteoporosis in Patients with Type 2 Diabetes Based on Machine Learning**

**Background & Aim:** This study aims to establish a machine learning-based risk prediction model to assess the risk of osteoporosis in patients with type 2 diabetes receiving treatment at the Chongqing Public Health Medical Center. By identifying key risk factors, this model provides a scientific basis for clinicians to implement early intervention and personalized treatment.

**Methods:** This study collected clinical data from 300 patients with type 2 diabetes, including demographic information, laboratory test results, and bone density measurements. The random forest algorithm was chosen to construct the risk prediction model due to its advantages in handling high-dimensional data and feature selection. Model performance was assessed using five-fold cross-validation and the area under the ROC curve (AUC) to identify the best predictive factors.

**Results:** The constructed model exhibited excellent performance in distinguishing between high-risk and low-risk patients, with an AUC of 0.89, sensitivity of 82%, and specificity of 85%. Key risk factors included age, BMI, HbA1c, and bone density.

Conclusion: The random forest-based risk prediction model effectively identifies the risk of osteoporosis in patients with type 2 diabetes, demonstrating significant potential for clinical application. The establishment of this model provides a scientific basis for early screening and personalized treatment, warranting further validation in larger sample sizes in the future.