# **Exploring Health-Related Quality of Life in Individuals with Diabetes:** Insights from Machine Learning Algorithms

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# Introduction

The presence of complications, coexisting comorbidities, and the chronic nature of diabetes often lead to a decline in health-related quality of life (HRQoL).

## Objective

To explore factors associated with HRQoL among individuals with diabetes and assess potential enhancement in predictive accuracy by using machine learning (ML) algorithms.

## Methods

- Study Design: Cross-sectional
- Data source: 2018-2021 Medical Expenditure Panel Survey (MEPS) Full-Year Consolidated files
- Study population: Individuals aged  $\geq$  18 years with self-reported diabetes were included. Individuals without reported VR-12 scores were excluded.
- Features: Age, health status including comorbidities (coronary heart disease, angina, heart attack, other heart disease, stroke, cancer, joint pain, arthritis, asthma), diabetes-related factors (diabetes-related complications, diabetes treatments, diabetes care information channel, confidence in diabetes care), and social determinants of health (SDoH) (race and ethnicity, marital status, health insurance coverage, education, and socioeconomic status)
- Study outcome:
- HRQoL, measured through the Veteran's RAND 12-item (VR-12) physical component summary scores (PCS) and mental component summary scores (MCS).
- Individuals were categorized into groups based on the top 25th percentile for PCS and the top 25th percentile for MCS, separately.

# Model Building and Performance:

- The dataset was split into 70% for model development and 30% for validation
- Logistic regression and ML models, including k-nearest neighbors (KNN), support vector machine (SVM), extreme gradient boosting (XGB), and random forest (RF), were compared using receiver operating characteristic (ROC) curve visualization and area under the ROC curve (AUC).

#### Results

Among 22,819,516 adults with self-reported diabetes, 49% of them were female. 75% of individuals were white followed by 15% black. 16% of the individuals were Hispanic.

# Table 1. Cohort characteristics

Sex
Male
Female
Age group
18-24 years old
25-44 years old
45-64 years old
65+ years old
Race
White
Black
American Indian/Alaska Native
Asian
Multiple/mixed race
Unknown
Hispanic
English speaking
Not well
Well
Unknown
Region
Northeast
Midwest
South
West
Currently married
Education
Less than GED
High school diploma / GED
Bachelor degree
Higher Education
Unknown
Socioeconomic status
Poor
Near poor
Low
Middle
High
Insurance
Any private
Public only
Uninsured

N = 22,819,516 <sup>1</sup>
11,577,321 (51%)
11,242,195 (49%)
264,739 (1.2%)
2,393,768 (10%)
9,110,157 (40%)
11,050,853 (48%)
17,069,829 (75%)
3,398,275 (15%)
293,191 (1.3%)
1,353,538 (6.0%)
704,682 (3.1%)
154,839 (0.7%)
3,574,564 (16%)
1,443,929 (6.3%)
18,415,407 (81%)
2,960,179 (13%)
3,479,351 (15%)
5,070,168 (22%)
9,637,401 (42%)
4,632,596 (20%)
12,132,009 (53%)
3,338,681 (15%)
11,114,539 (49%)
3,510,193 (15%)
2,114,515 (9.3%)
2,741,587 (12%)
3,375,263 (15%)
1,305,937 (5.7%)
3,438,910 (15%)
6,469,025 (28%)
8,230,380 (36%)
12,309,538 (54%)
9,777,260 (43%)
732,718 (3.2%)

(AUC=0.784).

(AUC=0.652).

# Figure1. ROC curves across different model



#### **Strengths and Limitations**

The strengths of the study include a nationally representative survey, a comprehensive list of features and accurate predictions. It is essential to consider limitations such as the cross-sectional study design and the utilization of self-reported data when interpreting the findings.

The study demonstrated that ML algorithms yielded only slight enhancements in predicting HRQoL in diabetes in MEPS compared to traditional logistic regression, with RF and XGB proving to be the most effective algorithms to assess PCS and MCS, respectively.

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# **Results (Cont.)**

When assessing PCS, RF (AUC=0.792) performed the best, followed by logistic regression (AUC=0.786) and XGB

When assessing MCS, XGB (AUC=0.677) performed the best, followed by RF (AUC=0.674) and logistic regression

#### Conclusion

#### **Contact Information**