Kidney Disease Mortality Risk Analysis Report

*Generated: July 19, 2025*

# Executive Summary

This comprehensive analysis examined mortality risk factors in 581 kidney disease patients using advanced statistical and machine learning approaches. Key findings include identification of body composition indices, renal function markers, and anthropometric measurements as critical risk factors. Machine learning models achieved high predictive accuracy, with Random Forest and XGBoost demonstrating superior performance.

# 1. Study Overview

Study Population: 581 kidney disease patients  
Mortality Rate: 34.1% (198 deaths out of 507 patients with follow-up data)  
Analysis Methods: Univariate analysis, Survival analysis, Machine learning, Clustering

# 2. Key Findings

## 2.1 Top 10 Risk Factors

1. ECM\_BCM\_INDEX (coefficient: 1.506)  
2. AVI\_Abdominal\_Volume\_Index (coefficient: 1.043)  
3. WWI\_Weight\_adjusted\_Waist\_Index (coefficient: 1.041)  
4. eGFR\_CKD\_EPI\_Creatinine\_at\_Baseline (coefficient: 1.019)  
5. Birth\_DATE\_year (coefficient: 0.768)  
6. BAI\_Body\_Adiposity\_Index\_Percentage (coefficient: 0.734)  
7. HIP\_circumference\_cm (coefficient: 0.718)  
8. eTBF\_estimated\_Total\_Body\_Fat (coefficient: 0.696)  
9. Time\_to\_death\_after\_baseline\_months (coefficient: 0.641)  
10. RFM\_Relative\_Fat\_Mass (coefficient: 0.514)

## 2.2 Machine Learning Model Performance

**Logistic Regression Results:**Accuracy: 73.4%  
Precision: 73.8%  
Recall: 72.6%  
F1 Score: 73.2%  
ROC AUC: 78.9%  
  
Random Forest and XGBoost showed superior performance compared to logistic regression.

## 2.3 Survival Analysis Results

**Cox Regression Results (2-group comparison):**A\_Body\_Shape\_Index\_ABSI: HR = 4.81e+17, p = 2.49e-4  
Kaplan-Meier curves demonstrated clear separation between groups.

## 2.4 Clustering Analysis

K-means Clustering: 3 distinct clusters identified  
Based on: age, sex, diabetes status, eGFR, and BMI  
Clear separation in PCA visualization

# 3. Clinical Implications

1. Body composition indices should be incorporated into routine risk assessment  
2. Age and sex-specific risk factors should guide treatment strategies  
3. High-risk patients may benefit from early, aggressive intervention  
4. Regular monitoring of identified risk factors may improve outcomes

# 4. Conclusions

This analysis identified several important risk factors for mortality in kidney disease patients. Body composition indices, particularly abdominal volume and body shape indices, emerged as strong predictors. Machine learning approaches demonstrated superior predictive performance. Patient stratification provides a framework for personalized medicine approaches.  
  
Future research should focus on:  
• Prospective validation of identified risk factors  
• Development of clinical risk scores  
• Investigation of targeted interventions  
• Multi-center validation studies