# Model Evaluation Results

## Overall Results

Precision Accuracy Recall F1 Score AUC  
Logistic Regression 0.206897 0.632292 0.590909 0.306483 0.662522  
Kernel SVM 0.226891 0.727083 0.409091 0.291892 0.636931  
Decision Tree 0.209945 0.753125 0.287879 0.242812 0.557587  
Random Forest 0.278481 0.826042 0.166667 0.208531 0.649841  
Naïve Bayes 0.219298 0.662500 0.568182 0.316456 0.668917  
XGBoost 0.294118 0.840625 0.113636 0.163934 0.648185  
NGBoost 0.215385 0.746875 0.318182 0.256881 0.628939  
LightGBM 0.320000 0.843750 0.121212 0.175824 0.657792  
CatBoost 0.239130 0.837500 0.083333 0.123596 0.643665

## Best Model

The best model is Naïve Bayes with the following metrics:

Precision: 0.2193

Accuracy: 0.6625

Recall: 0.5682

F1 Score: 0.3165

AUC: 0.6689

## Top 12 Features

Left Knee WOMAC Total Score, Right Knee WOMAC Total Score, Education, Age, Analgesic use, SF-12: physical summary scale, SBP, CES-D Score, Either knee, used medication for pain, aching or stiffness, past 12 months, SF-12: mental summary scale, V00PASE, BMI

## Process Details

Dataset Path: D:\Papers\2024 research authorship\MLM for EL-Gebalay\OA\New\Updated\_OA\_Simple\_Dataset.xlsx

Target Column: Joint Replacement

Categorical Features:

Numerical Features: Age, SBP, DBP, Height, WEIGHT, BMI, Above weight cut-off for age/gender group, Employment, Education, Marital Status, Limits or avoids activities due to pain, aching or stiffness, SF-12: physical summary scale, SF-12: mental summary scale, Left Knee WOMAC Total Score, Right Knee WOMAC Total Score, Either knee, ever injured so badly difficult to walk for at least one week, Either knee, used medication for pain, aching or stiffness, past 12 months, Ever had heart attack, Ever treated for heart failure, Had operation to unclog or bypass arteries in legs, Had stroke, cerebrovascular accident, blood clot or bleeding in brain, or transient ischemic attack (TIA), Have asthma, Have emphysema, chronic bronchitis, or COPD, Have stomach ulcers or peptic ulcer disease, Have diabetes, Ever had problem with kidneys, poor kidney function, Have rheumatoid arthritis, Used SAMe (S-adenosylmethionine) for joint pain or arthritis more than half the days of the month, past 30 days, Used MSM (methylsulfonylmethane) for joint pain or arthritis more than half the days of the month, past 30 days, Used glucosamine for joint pain or arthritis, past 6 months, Used parathyroid hormone or PTH (includes Forteo, or teriparatide, given by injection) to treat osteoporosis, past 6 months, Taken bisphosphonate medication (includes alendronate, risedronate...) to treat osteoporosis or Paget's disease, past 5 years, CES-D Score, Analgesic use, Repeated chair stands: trial 1, Repeated chair stands: trial 2, 20-meter walk: trial 1, 20-meter walk: trial 2, V00PASE

Feature Importances:

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| Feature | Importance |
| Left Knee WOMAC Total Score | 0.0805 |
| Right Knee WOMAC Total Score | 0.0742 |
| Education | 0.0620 |
| Age | 0.0617 |
| Analgesic use | 0.0594 |
| SF-12: physical summary scale | 0.0543 |
| SBP | 0.0504 |
| CES-D Score | 0.0497 |
| Either knee, used medication for pain, aching or stiffness, past 12 months | 0.0489 |
| SF-12: mental summary scale | 0.0457 |
| V00PASE | 0.0437 |
| BMI | 0.0432 |
| Height | 0.0426 |
| WEIGHT | 0.0419 |
| DBP | 0.0415 |
| Used glucosamine for joint pain or arthritis, past 6 months | 0.0338 |
| Marital Status | 0.0334 |
| Employment | 0.0311 |
| Limits or avoids activities due to pain, aching or stiffness | 0.0293 |
| Either knee, ever injured so badly difficult to walk for at least one week | 0.0186 |
| Above weight cut-off for age/gender group | 0.0103 |
| Have diabetes | 0.0081 |
| Taken bisphosphonate medication (includes alendronate, risedronate...) to treat osteoporosis or Paget's disease, past 5 years | 0.0074 |
| Used MSM (methylsulfonylmethane) for joint pain or arthritis more than half the days of the month, past 30 days | 0.0056 |
| Have asthma | 0.0052 |
| Had stroke, cerebrovascular accident, blood clot or bleeding in brain, or transient ischemic attack (TIA) | 0.0021 |
| Ever treated for heart failure | 0.0019 |
| Have emphysema, chronic bronchitis, or COPD | 0.0018 |
| Ever had heart attack | 0.0017 |
| Repeated chair stands: trial 1 | 0.0017 |
| Have stomach ulcers or peptic ulcer disease | 0.0017 |
| Have rheumatoid arthritis | 0.0016 |
| Repeated chair stands: trial 2 | 0.0014 |
| Ever had problem with kidneys, poor kidney function | 0.0012 |
| Used SAMe (S-adenosylmethionine) for joint pain or arthritis more than half the days of the month, past 30 days | 0.0008 |
| Had operation to unclog or bypass arteries in legs | 0.0007 |
| 20-meter walk: trial 1 | 0.0004 |
| Used parathyroid hormone or PTH (includes Forteo, or teriparatide, given by injection) to treat osteoporosis, past 6 months | 0.0003 |
| 20-meter walk: trial 2 | 0.0001 |