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An Artificial Intelligence-based Approach in Total Knee Arthroplasty

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Faculty Disclosure Information

- Nothing to disclosure

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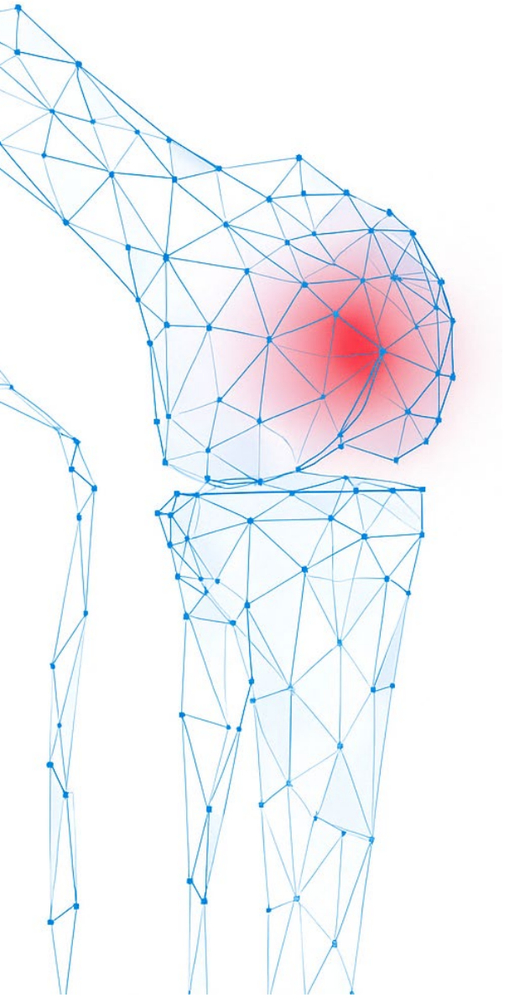
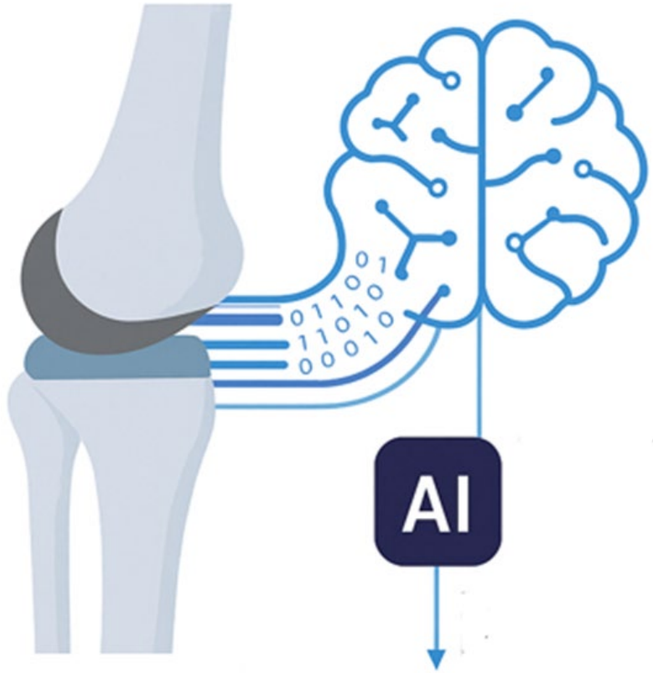
Background



The application of **Artificial Intelligence** and **Machine Learning** tools in total knee arthroplasty emerges with the potential to improve patient-centered decision-making and outcome prediction in orthopedics, as ML algorithms can generate patient-specific risk models.

Background



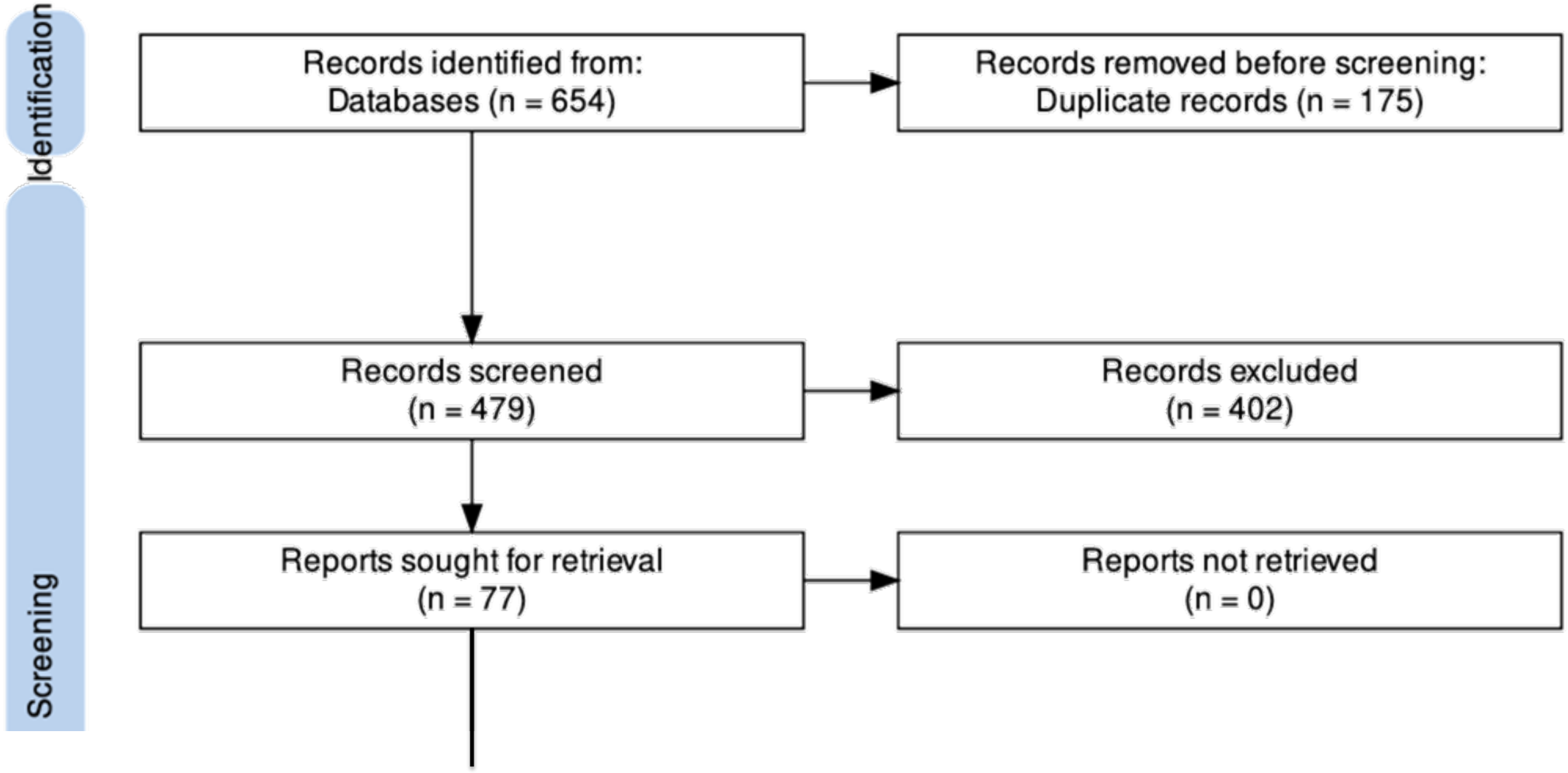
The application of AI/ML in KA has been **useful** for:

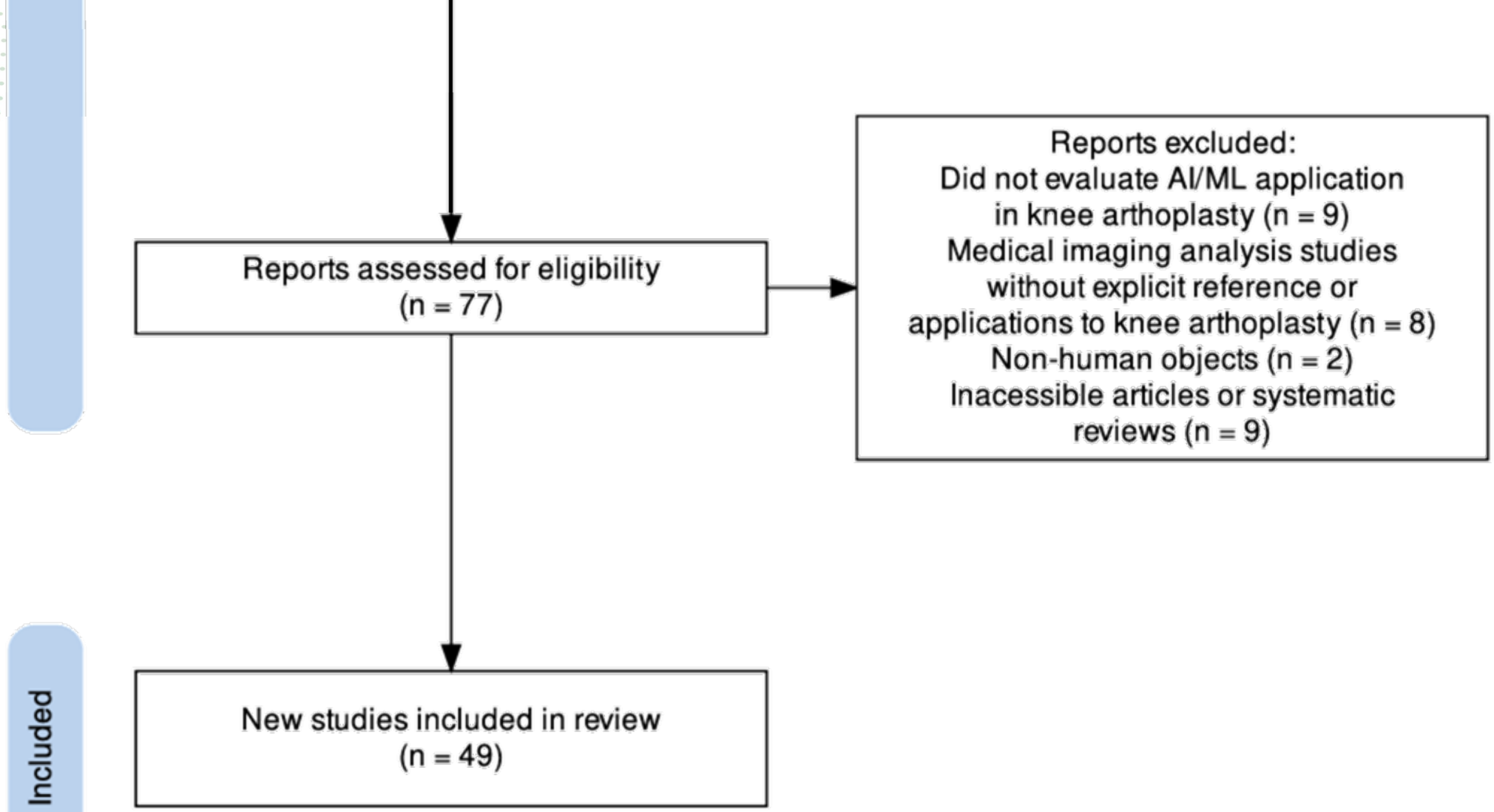
- predicting implant size
- reconstructing data
- assisting with component positioning and alignment
- enhances surgical precision
- selecting the right drugs
- help predict clinical and management parameters
- more patient specific approach to medicine
- generating patient-specific risk models

Aim

To evaluate the potential of the application of AI/ML models in the prediction of TKA outcomes and the identification of populations at risk.

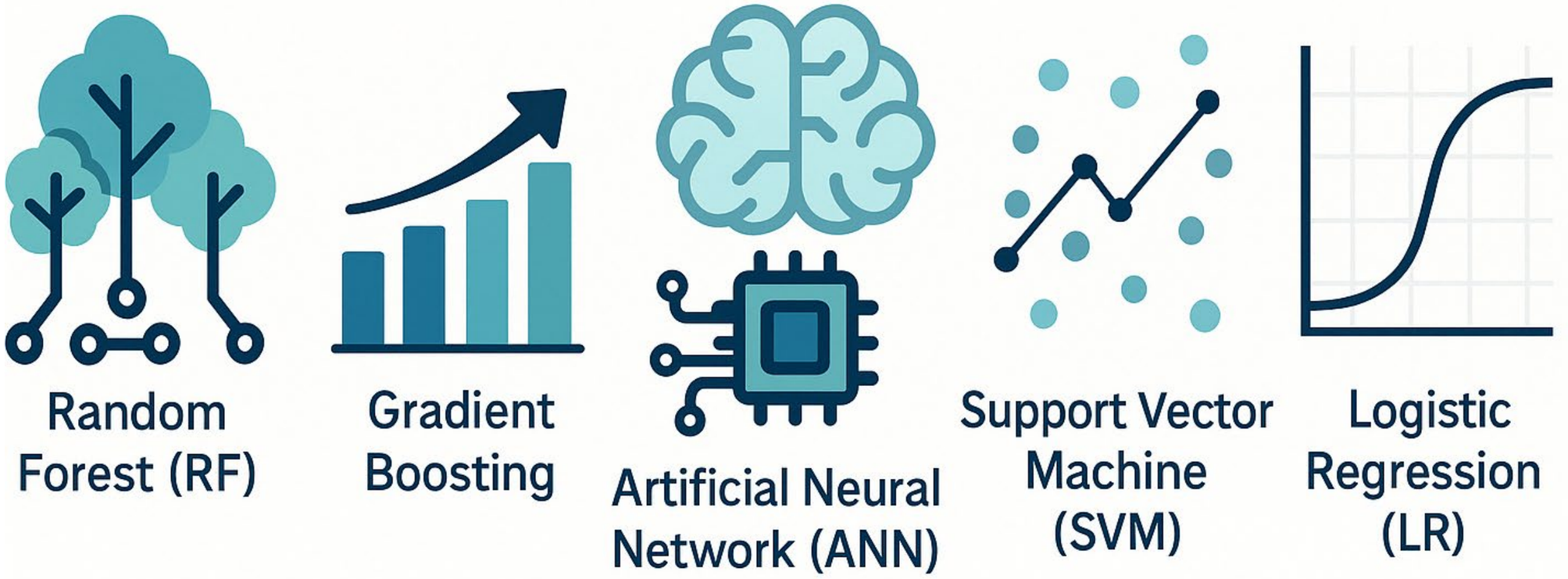
Materials and methods




Reports assessed for eligibility
(n = 77)
Reports excluded:
Did not evaluate AI/ML application
in knee arthoplasty (n = 9)
Medical imaging analysis studies
without explicit reference or
applications to knee arthoplasty (n = 8)
Non-human objects (n = 2)
Inacessible articles or systematic
reviews (n = 9)
Included
New studies included in review
(n = 49)

Results

Most Common AI/ML Models Used



Results

Output variables

Output	Best AUC	Best AI/ML Models
Length of Hospital Stay (LOS)	0.832	ANN
Complications	0.849	SHC
Blood transfusion	0.871	GBM
Inpatient cost	0.828	ANN
Cost Prediction	0.813	DenseNet
Future Clinical Intervention	0.90	MLP, CNN
Clinical outcomes	0.88	LR, DNN
Patient Satisfaction	0.857	GBM
MCIDs, KOOS, PROs	0.89	LASSO, GBM
Surgical technique/outcomes	0.89	RF
Technical outcomes / biomechanical properties	1.0	DCNN

Discussion

AI/ML Models Hold Potential in TKA for:

💰 Inpatient Cost Prediction

🛠️ Surgical Workflow Optimization

🧠 Improved Decision Accuracy

AI- and ML-based models enable more accurate predictions, faster data processing, and improved recognition of clinical patterns.

These tools help reduce clinician bias and support risk-based, patient-specific care planning.

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