

AI-Predicted Versus Clinician-Selected Treatment Decisions for Caries Management in Primary Dentition

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Objective:

- Develop and evaluate artificial intelligence (AI) model to predict clinician-selected treatment for pediatric dental caries

Methods:

- Retrospective study using data from outpatient encounters at Nationwide Children's Hospital from 2023-2025
- Primary teeth with first instance of treated caries in children 2-12 years old
- XGBoost AI model trained to use predictor variables to assign teeth a treatment decision
 - Predictors: demographics, SDoH, COI, medical history, dental history, tooth-level
 - Decisions: preventative, direct restoration, full coverage restoration, pulp therapy, extraction
- Primary outcome: assess inter-rater reliability between AI and clinician
 - Secondary outcome: Observe patterns of predictor variables on AI treatment decision
- Cohen's Kappa and balanced accuracy

Results:

- 29,639 teeth across 8,403 children
- 64% accuracy (95% CI: 62.5-64.5%, p<0.001)
- Cohen's Kappa: 0.46 (moderate agreement)
- Class-specific balanced accuracy
 - Strong: preventative (80%), extraction (76%)
 - Moderate: full coverage restoration (66%)
 - Weak: direct restoration, pulp therapy (50%)

Discussion:

- AI can predict treatment decisions with moderate accuracy and shows promise for decision support.

AI models can capture complex clinical decision patterns and may support pediatric dental treatment planning.

Clinical severity variables dominate decisions over behavioral, developmental, and societal factors.

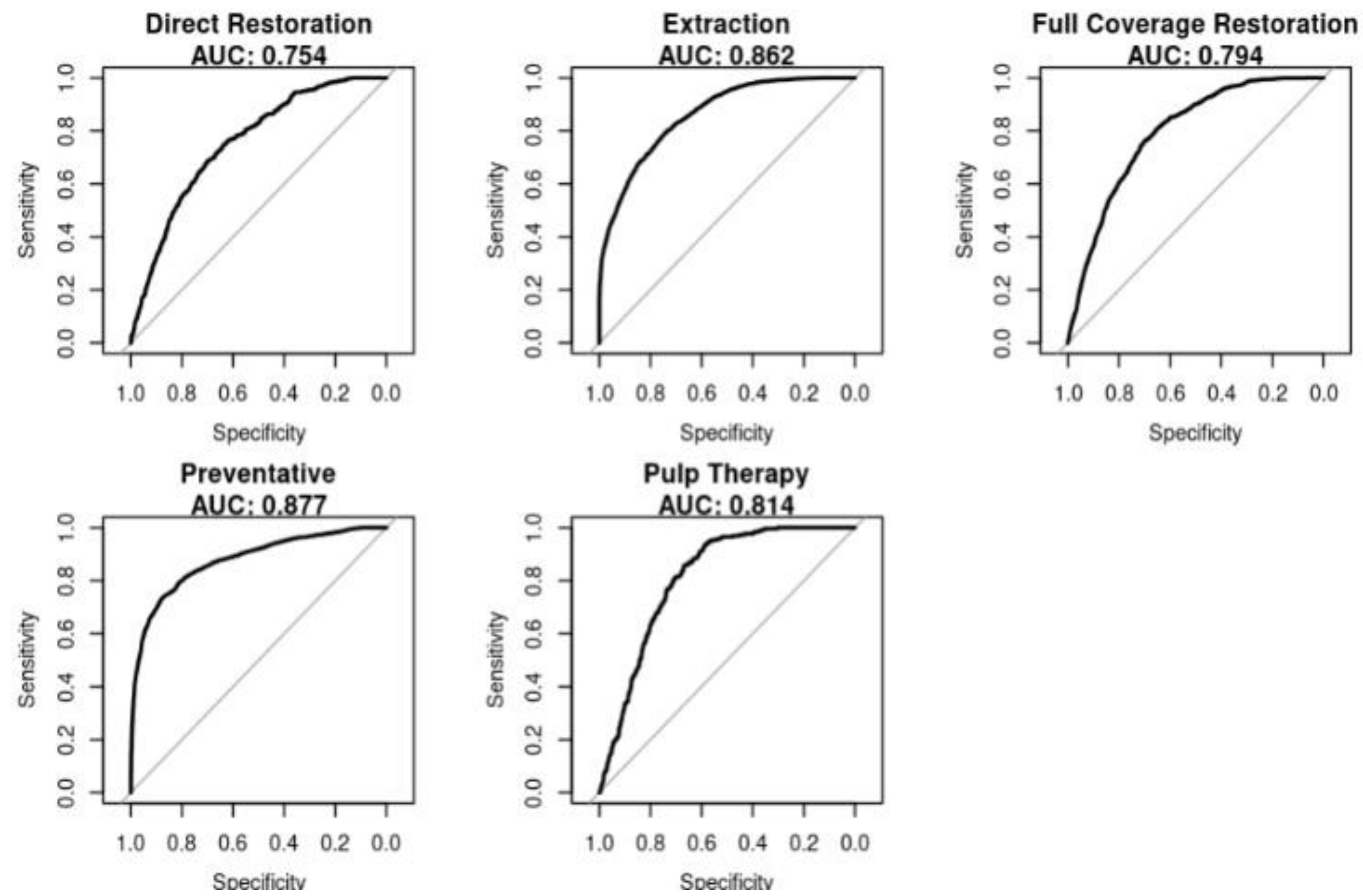


Figure 1. One-vs-rest ROC curves showing good discrimination (AUC 0.754-0.877)

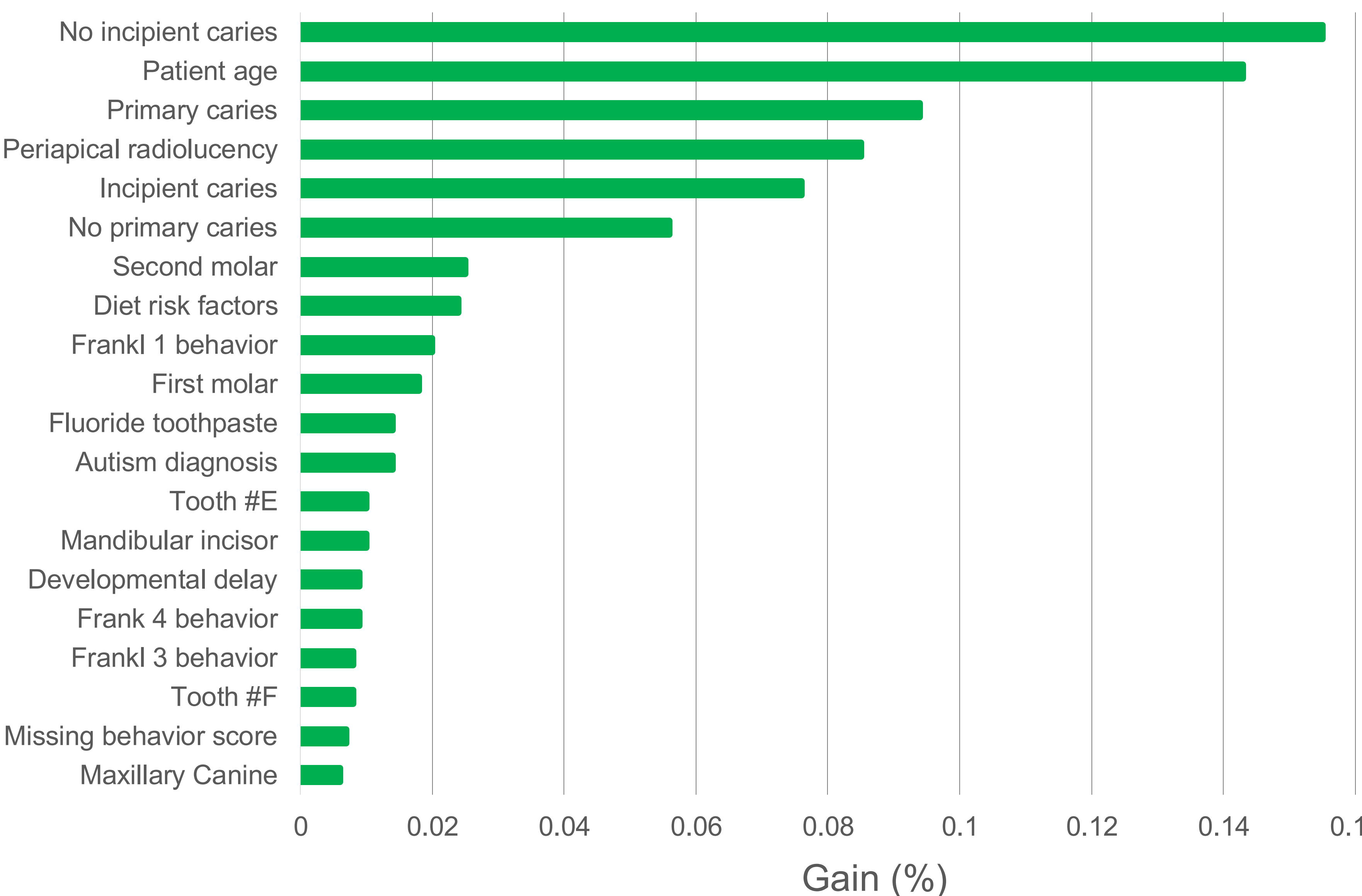


Figure 2. Histogram showing top 20 most important predictor variables ranked by relative contribution to improving model performance across all class trees.

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