

# PA-477. Validation of a Rule-Based Algorithm for Line-of-Therapy Assignment in Multiple Myeloma Using Simulated Data

## BACKGROUND

Advances in myeloma treatment have led to increasingly complex therapeutic sequences, often spanning multiple lines of therapy (LOTs). Labeling LOTs is essential for accurately tracking a patient's treatment history, guiding clinical decisions, ensuring eligibility for trials, and supporting reimbursement. Real-world data (RWD) enables the study of outcomes across these trajectories, but ambiguity in LOT transition criteria leads to variation in how electronic health records (EHRs) represent treatment history. This limits consistency in analyses. To address this challenge, **we developed HEAL-MM, an algorithm vetted by MM specialists that converts EHR data into standardized LOTs and treatment phases.** It segments therapies based on drug additions, treatment gaps, and procedural anchors (e.g., transplant, CAR-T), and assigns phase labels (e.g., induction, maintenance, bridging, consolidation) using clinical rules. **We report results from initial testing to validate each decision path and rule implementation.**

## METHODOLOGY

We identified unique logic paths in the algorithm and independently validated each through 100,000 randomized synthetic simulations. Each simulated case had 1–20 random treatment events, with 0–3 transplants, 0–2 CAR-T procedures, and myeloma-specific medications. **These were all probabilistically weighted, randomly allocated, and spaced apart based on RWD frequencies observed in HealthTree.** HEAL-MM processed each sequence chronologically, applying LOT transition rules and assigning treatment phases. Precision was calculated based on the pass/fail status of the unique logic paths using the defined criteria (e.g., new LOT triggers, phase labeling, and structural output integrity). All tests were executed in Node.js v22.15.0 using Vitest for reproducibility and logic verification.

## ACKNOWLEDGEMENT

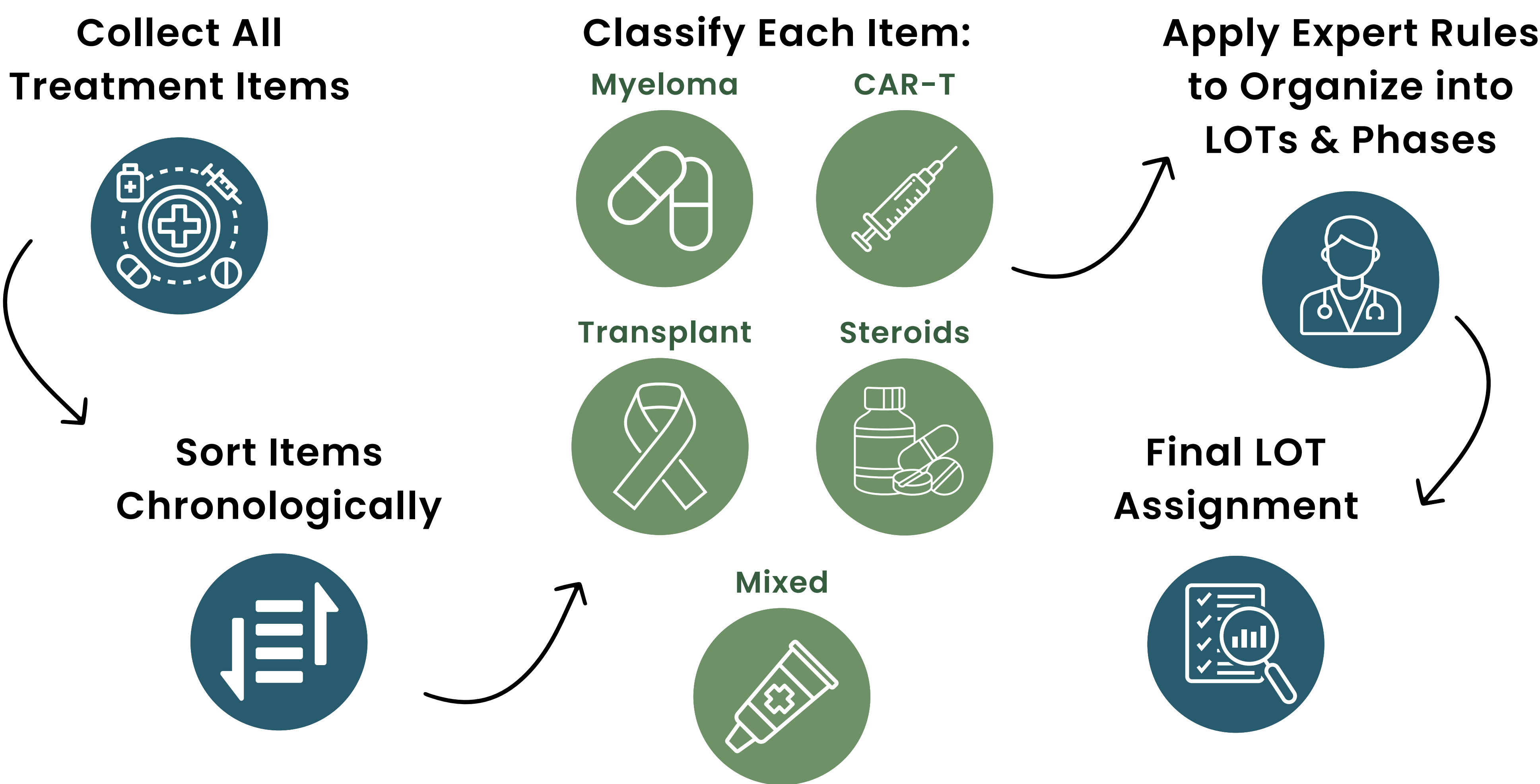
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## RESULTS

### Lines of Therapy (LOT) Algorithm Flow



**HEAL-MM processed all 2.6 million simulated patients without runtime errors or logic failures. The algorithm achieved a 100% precision rate on 26 unique logic paths. No unintended LOT transitions or misclassified phases were observed.**

## CONCLUSION

**HEAL-MM is the first algorithm to convert structured treatment data from standard EHR systems into clinically meaningful LOTs and phases.** It demonstrated its ability to assign lines of therapy (LOTs) and treatment phases while adhering to expert-defined clinical rules. These promising results demonstrate its potential for integration into RWD pipelines, as it lets us identify treatment cohorts in real time on living databases, and compare outcomes across centers with confidence. While the present validation was limited to synthetic simulations, work is ongoing to evaluate the concordance of HEAL-MM with real-world LOTs. **This represents an innovative approach in MM, and sets a template for similar advances in other hematologic diseases.**

