Using Machine Learning to prepare CPCD data for RIW regression

36th PCSI Conference, Slovenia

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May 30th, 2024

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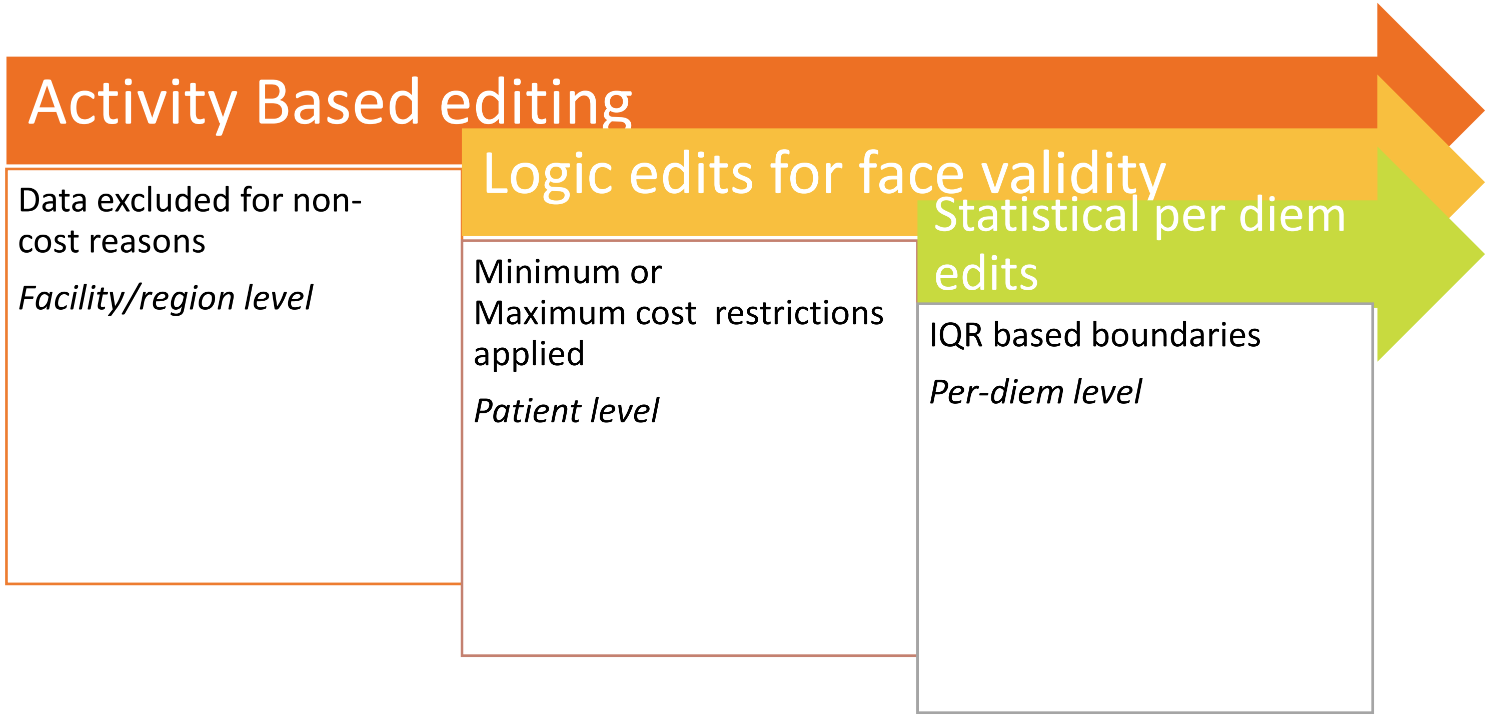
Outline

- Background: from cost to RIW production
- Issues and concerns
- New ML approach
- Outcome evaluation
- Next steps

Background: before RIW production starts…



Activity Based editing

Data excluded for non-cost reasons

Facility/region level

Logic edits for face validity

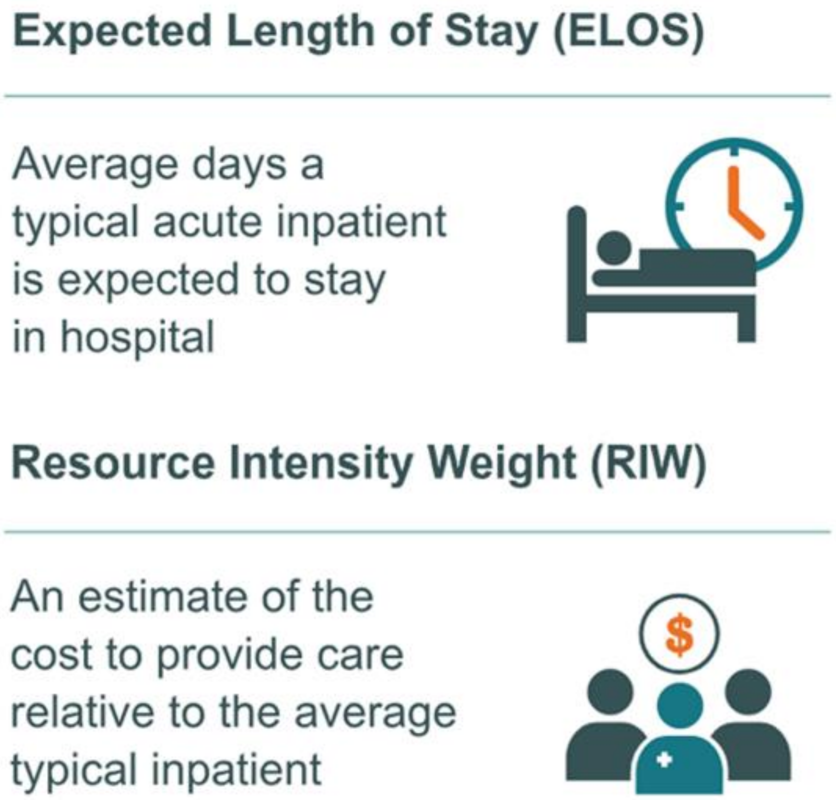
Minimum or Maximum cost restrictions applied

Patient level

Statistical per diem edits

IQR based boundaries

Per-diem level



Expected Length of Stay (ELOS)

Average days a typical acute inpatient is expected to stay in hospital

Resource Intensity Weight (RIW)

An estimate of the cost to provide care relative to the average typical inpatient

Current methodology: Issues and concerns

Activity data based

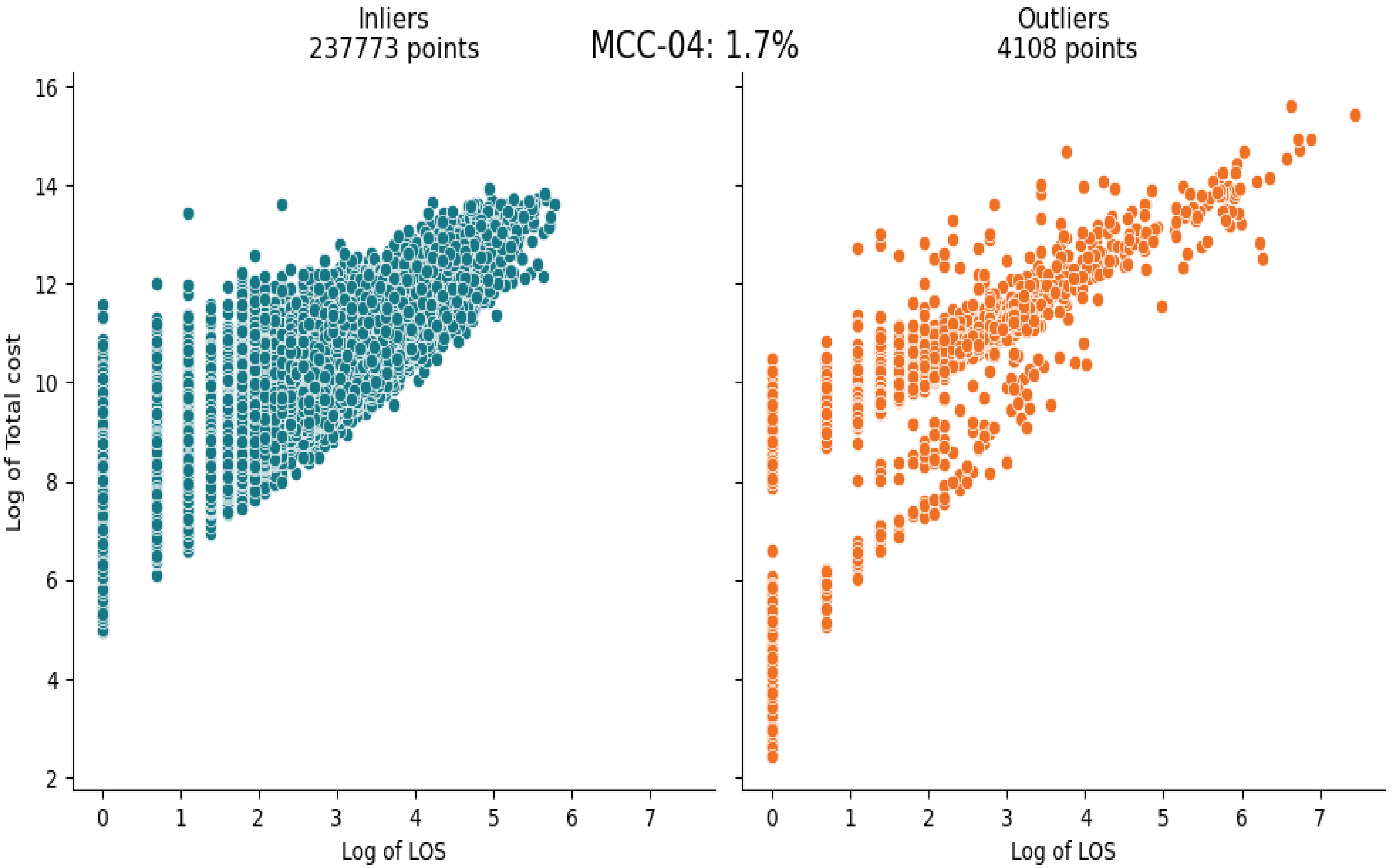
Logic edits for face validity

- Arbitrary high/low boundaries were set up based on historical findings
- Traditional methods are time-consuming

Statistical per diem edits

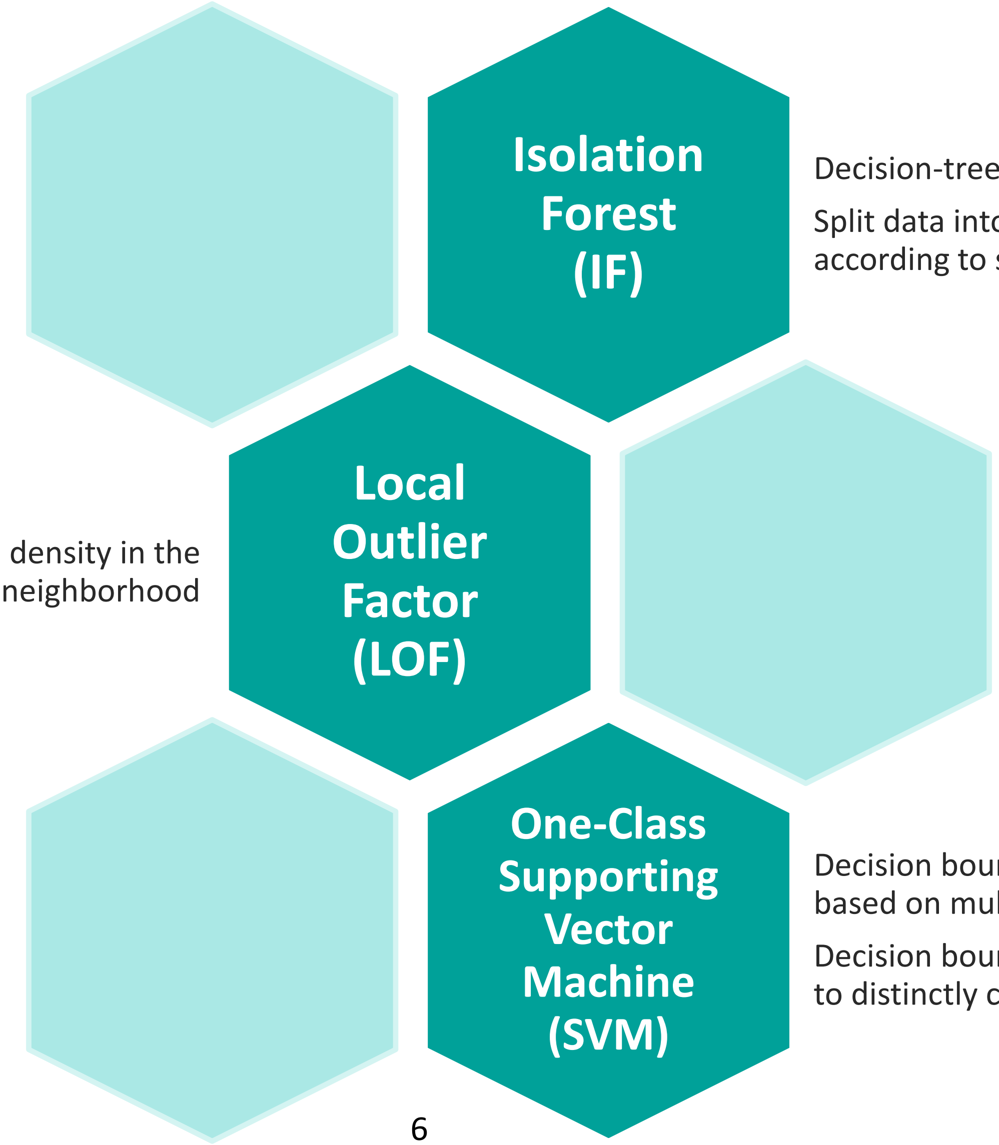
- Correlation between LOS and total cost
- Statistical distributions vary across groups
- High volume of outliers
- High impact to low volume CMGs

CMG+ Inliers and outliers in current approach



- Inliers and outliers have similar distribution patterns
- All cases at the higher end of cost and LOS distributions are excluded

Explore unsupervised ML approaches



Isolation Forest (IF)

Decision-tree-based algorithm

Split data into sub-samples according to some features

Local Outlier Factor (LOF)

Focus on the density in the neighborhood

One-Class Supporting Vector Machine (SVM)

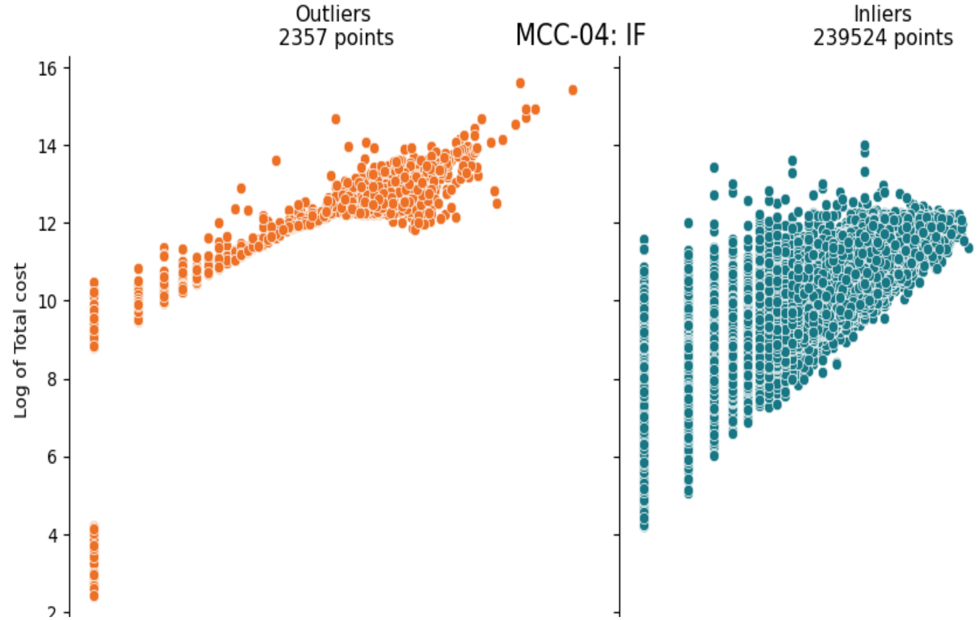
Decision boundaries are set up based on multiple dimensions

Decision boundaries are used to distinctly classify data points

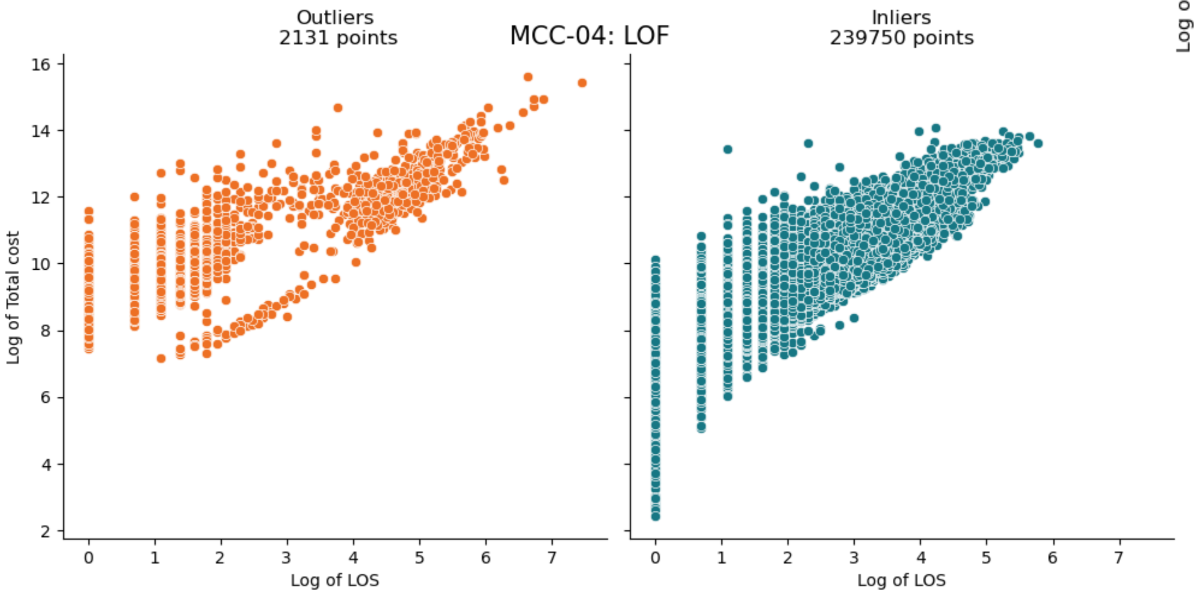
CMG+ costs cleaning: Model specifications

- **Analysis performed at the MCC level instead of CMG**
  - Outliers rate set to 1% and 2%
- **3 set of features tested**
  - Model 1: LOG total cost
  - Model 2: LOG total cost + LOG acute LOS
  - Model 3: LOG Total cost, LOG acute LOS + cost per diem
- **Final features selected**
  - Model 3 and outlier rate of 1%

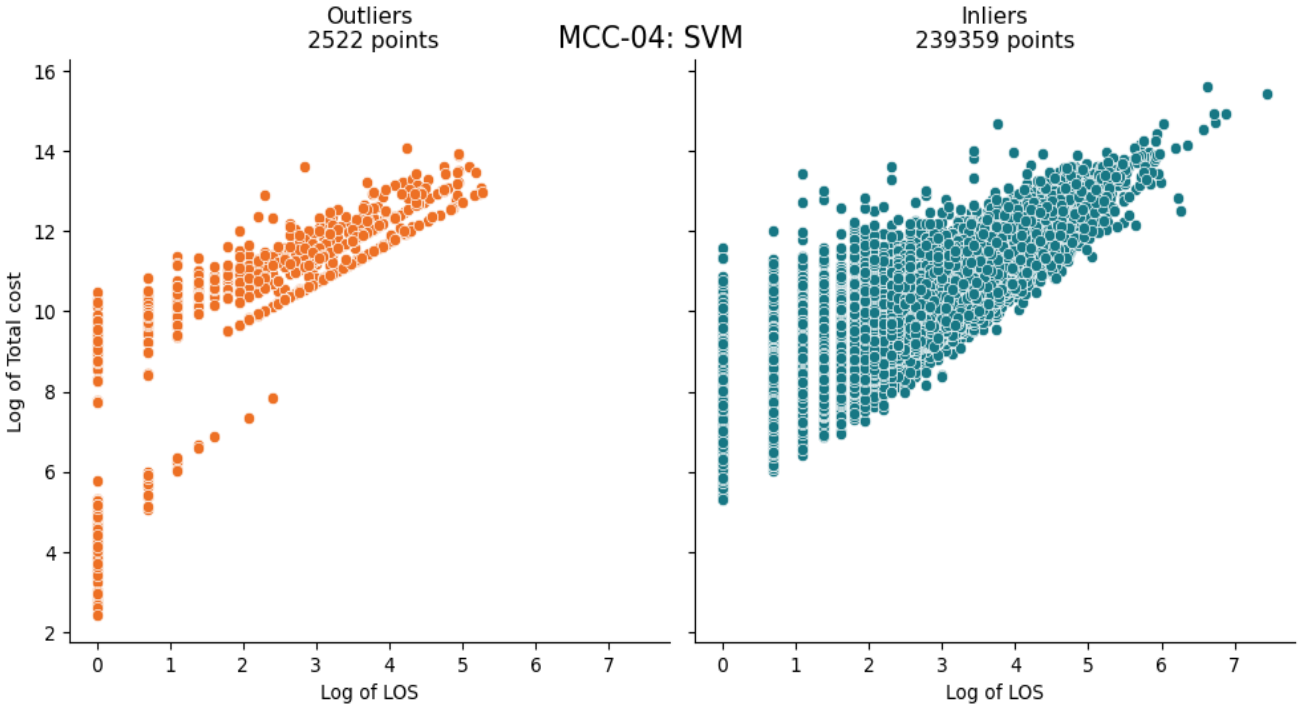
Preliminary findings – comparing 3 methods



MCC-04: IF



MCC-04: LOF



MCC-04: SVM

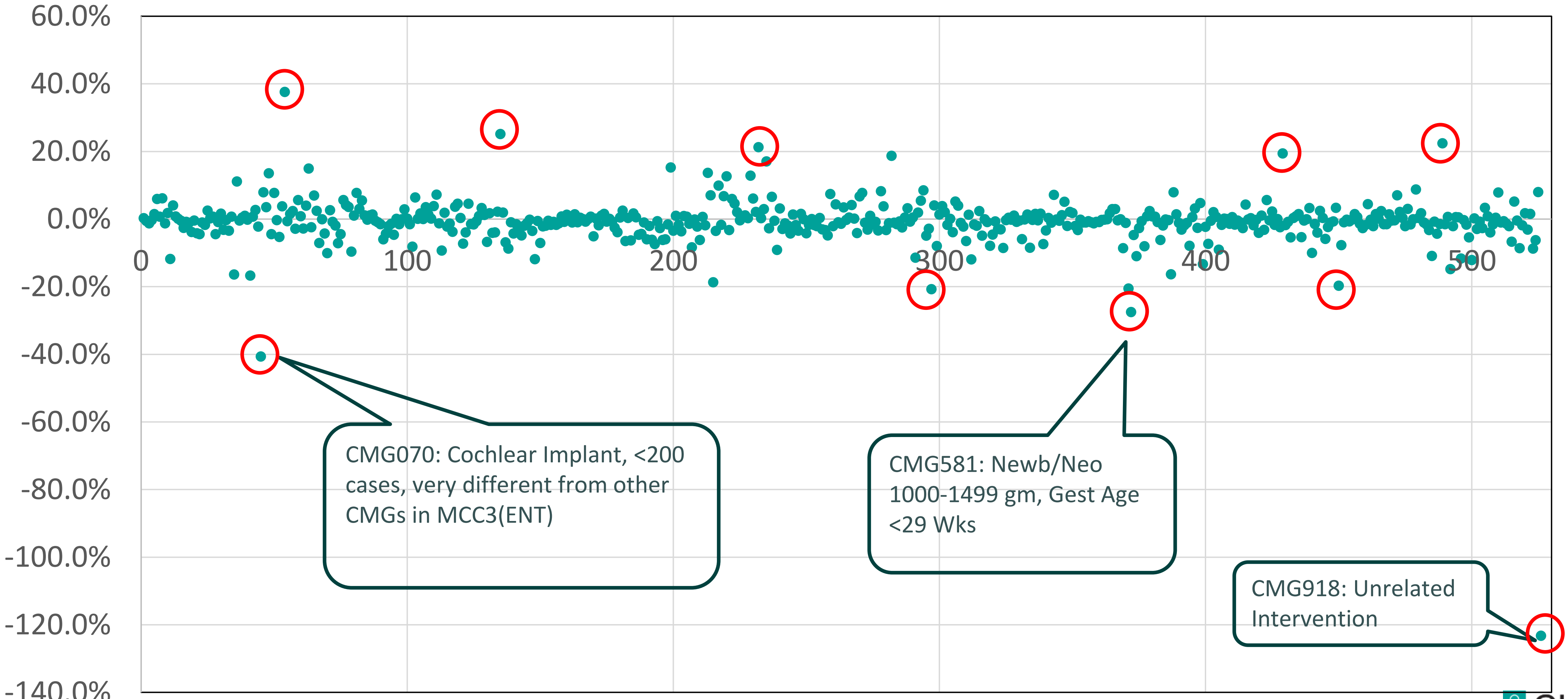
MCC 04: Respiratory

Impact on CPCD data used for RIW

- **0.36 % fewer cases identified as outliers**
- **By MCC, approximately 20-40% of outlier cases overlap**
- ***64% of outliers had 1 day stay in 2022 product, almost 73% have 1 day stay in new ML approach***

Data Set	**Volume**	**Actual Mean**	**Predicted Mean**	**Bias**	**MAE**	**R-Square**
2022 Production	2,107,864	9,218.57	9,233.03	-14.46	3,216	81.5%
MCC Only	2,114,406	9,216.81	9,222.53	-5.72	3,257	80.3%

Change in GOF by CMG



CMG070: Cochlear Implant, <200 cases, very different from other CMGs in MCC3(ENT)

CMG581: Newb/Neo 1000-1499 gm, Gest Age <29 Wks

CMG918: Unrelated Intervention

What we see on the journey…

CONTINUOUS LEARNING

EFFICIENCY & FLEXIBILITIES

OPPORTUNITIES

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