

Identifying Process-Centric Teams Using a Community Detection Framework



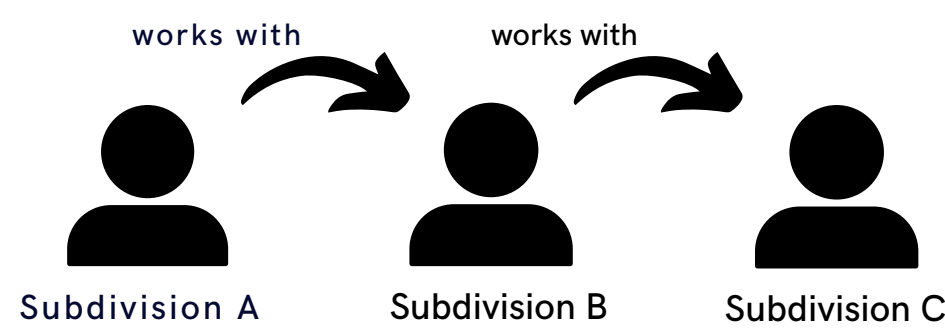
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Project Context

Process-Centric Teams work together on specific tasks and members can be from different parts of the organization - **this makes them hard to detect!**

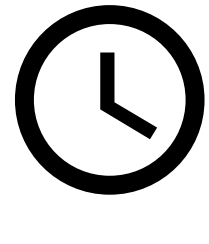


Can we establish a framework for identifying process-centric teams?

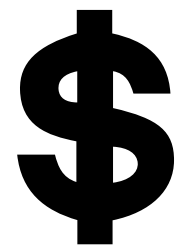
- Use case: **The Rebalancer Project**



Investigations are conducted when **deviations** from manufacturing protocols occur



The more **overloaded** an investigator, the **longer** it takes for them to finish an investigation



Late investigations are **costly** as they can hold up production

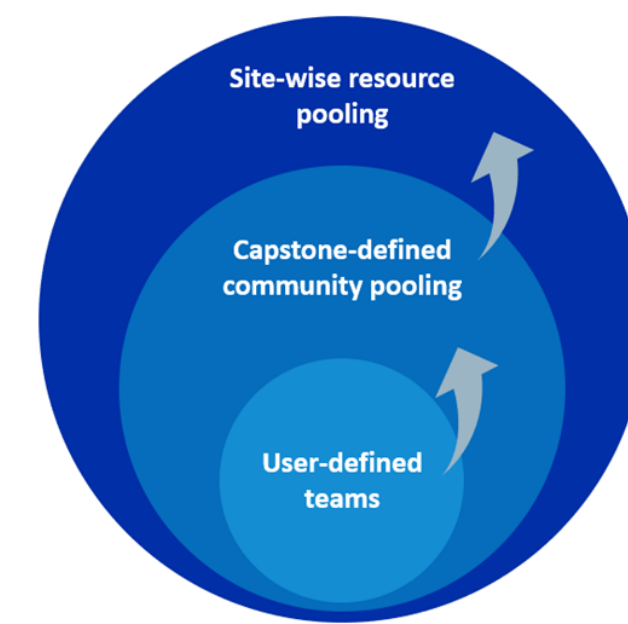


The Rebalancer project is a tool for **recommending** people to investigations based on **workload & org chart position**

Project Scope

- Increase the **number** and **size** of team recommendations

Resource Pooling in Rebalancer



Site-wise resource pooling:
Make recommendations based solely on who has extra capacity (regardless of team or operation)

Capstone-defined pooling:
Based on capstone-defined communities of Process-Centric Teams (PCTs)

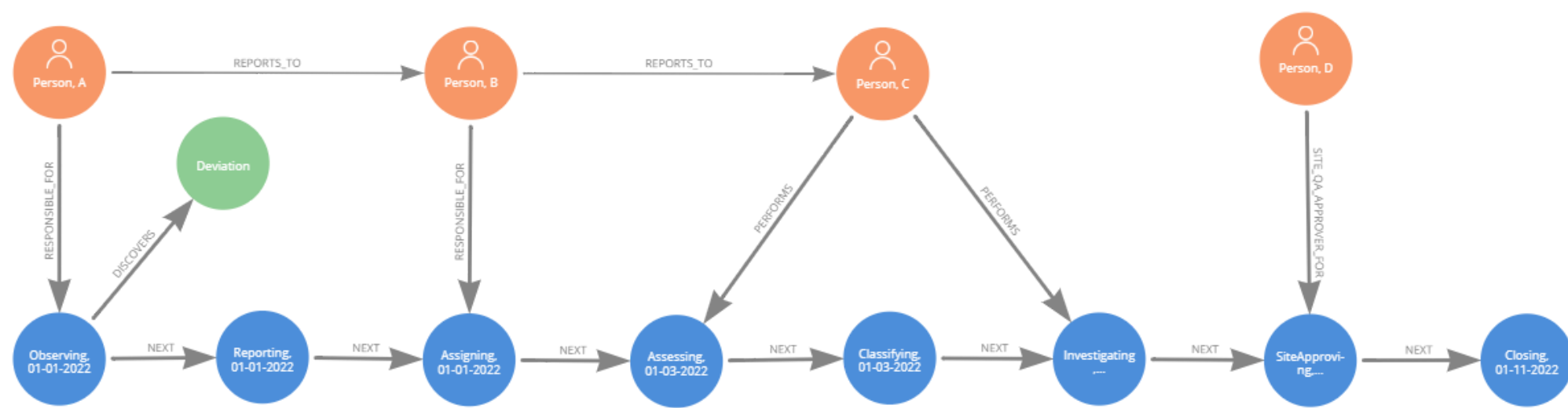
User-defined teams:
Groups of team members defined by users when first onboarded onto the Rebalancer application

- Recommend teams with **stronger working relationships** than the current user-defined teams
- Make **recommendations** for overloaded investigators based on new team recommendations

Data

23.5K investigations across 17 sites from January 2020 - July 2022

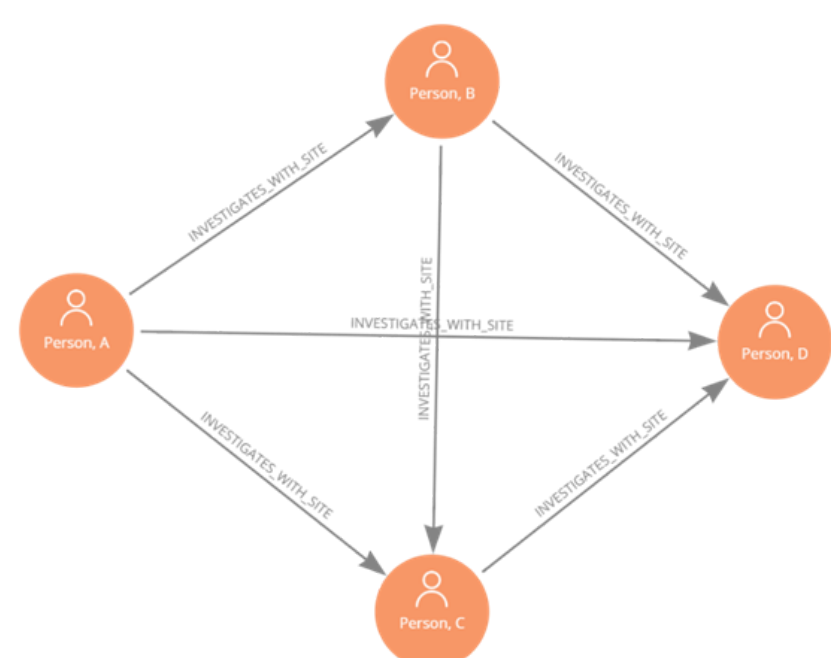
Hypothetical Investigation



Network Design

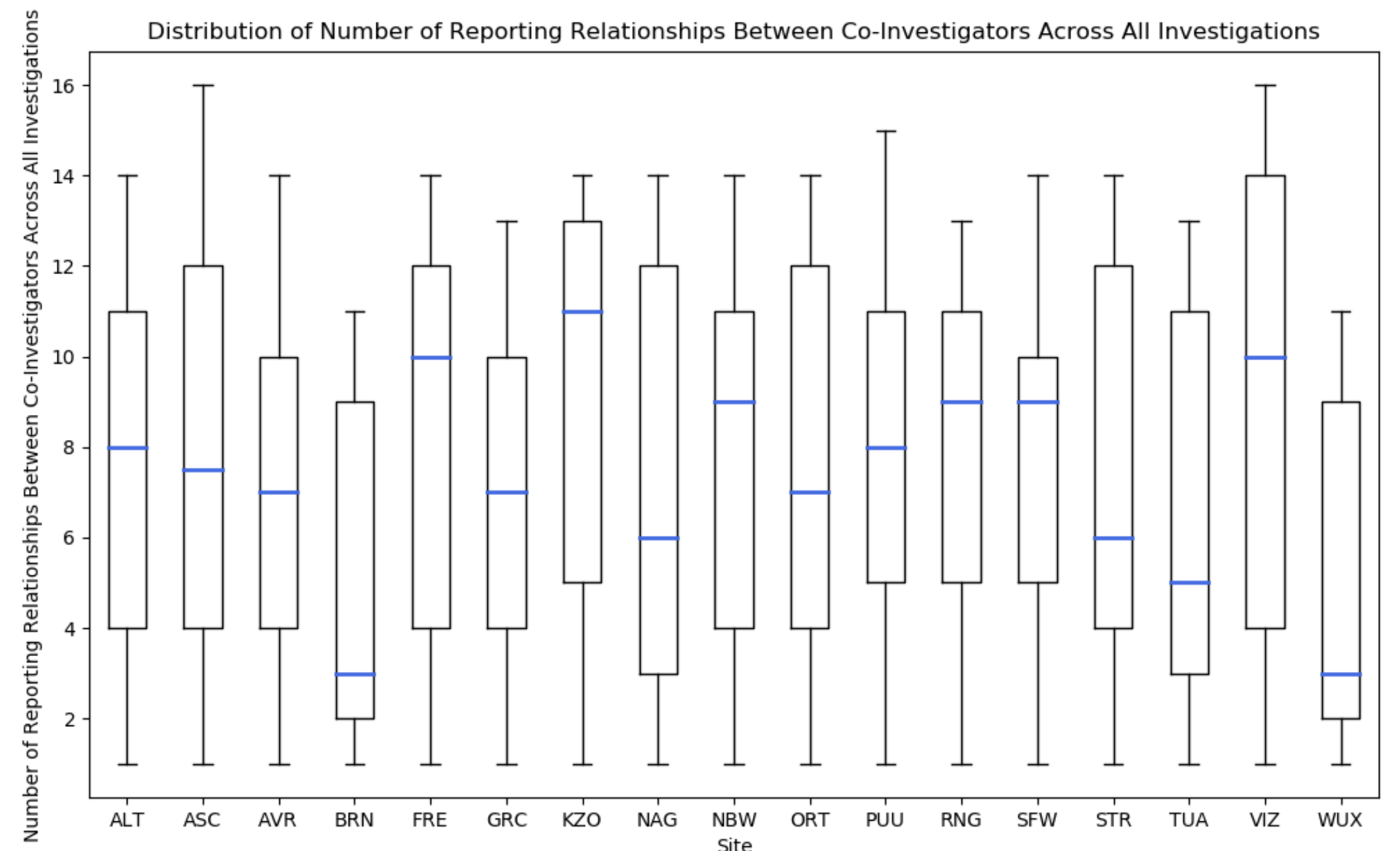
"INVESTIGATES_WITH" Relationships:

- Undirected
- Weighted by number of investigations



Exploratory Analysis

Do people who work together on investigations have close reporting relationships?



Median number of reporting relationships between co-investigators ranges from 3-11

Reporting relationships **do not** necessarily correspond to who works together on investigations

Analytical Methods

Community Detection: Louvain Algorithm

Modularity Score

$$Q = \frac{1}{2m} \sum_{i,j} \left(A_{ij} - \frac{k_i k_j}{2m} \right) \delta(c_i, c_j)$$

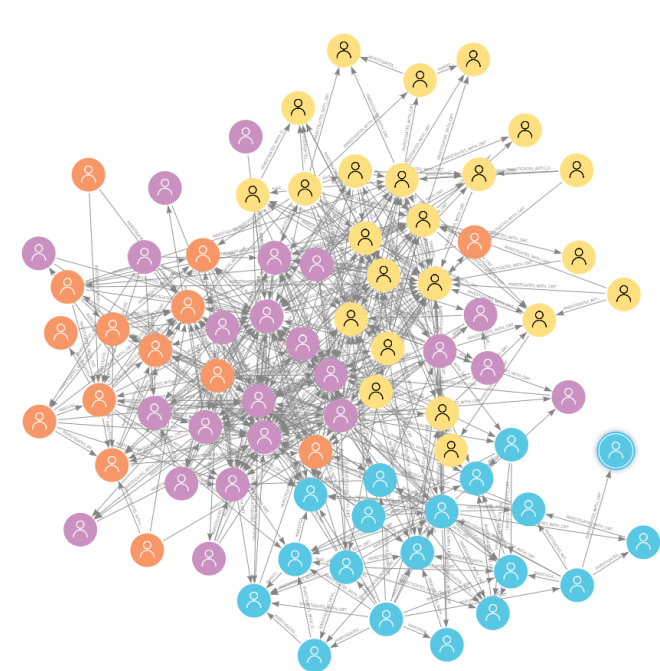
A_{ij} = weight of edge between nodes i and j

$k_i = \sum_j A_{ij}$ = sum of weights of edges attached to node i

c_i = community to which node i is assigned

$$\delta(c_i, c_j) = \begin{cases} 1 & \text{if } c_i = c_j \\ 0 & \text{otherwise} \end{cases}$$

$$m = \frac{1}{2} \sum_{i,j} A_{ij}$$



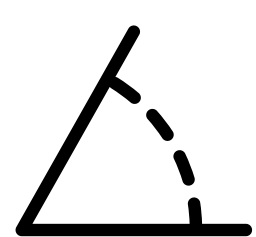
Modularity scores range from [-1,1], 1 being ideal

Recommending Investigators

- Limit candidates to investigator's Louvain community
- Calculate cosine similarity with each candidate having the same Rebalancer role based on number of each type of process worked on
- Calculate cosine similarity between investigator's community & other communities based on investigation qualities
- Repeat step 2 from most similar community to least

Cosine Similarity

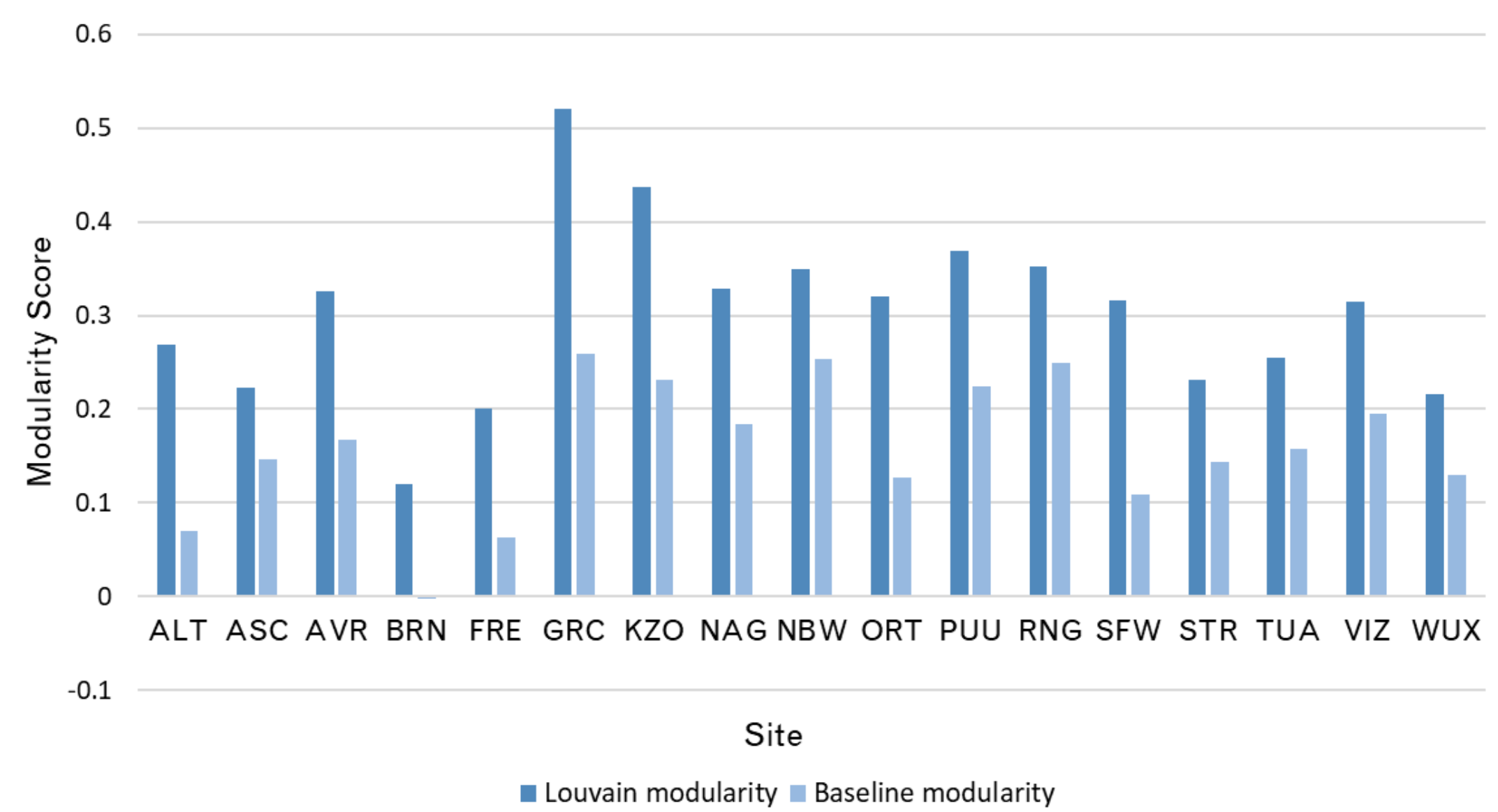
$$\text{Cos}(A, B) = \text{Cos}(\theta) = \frac{A \cdot B}{(\|A\| \|B\|)}$$



Cosine similarity scores range from [0,1], 1 being ideal

Results & Validation

Comparing Modularity Scores: Louvain vs. Baseline



User-defined communities baseline assumption: assign person to **area** where most investigations occur

Takeaway:

For all 17 sites, Louvain communities demonstrated **higher modularity scores** when compared to the baseline communities

Business Impact

of Team Recommendations Increased from 8 - 87

Average Team Size Increased from 10 - 33

Next Steps

- Validate recommendation findings by sharing results with Pfizer investigators
- Extend community detection framework to other process-centric teams