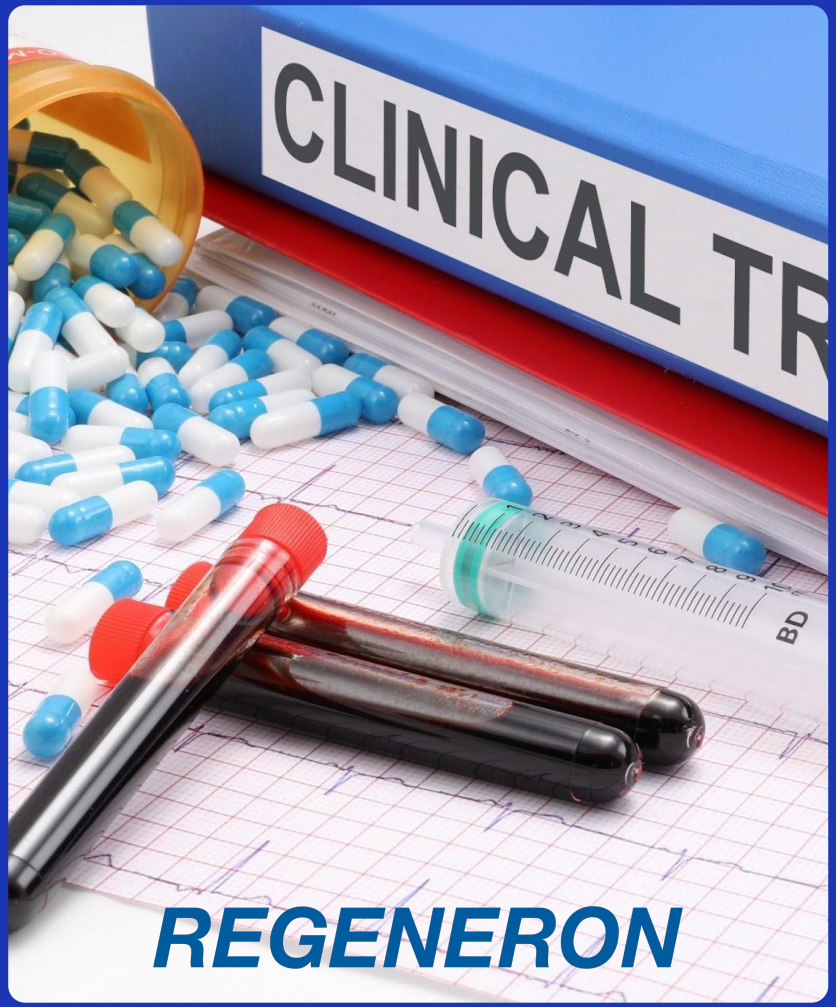
COLUMBIA UNIVERSITY

IEOR E4524

Collected Exhibits from Analytics in Practice teams 2025

Alpha, Bravo and Charlie Teams collaborating with Regeneron

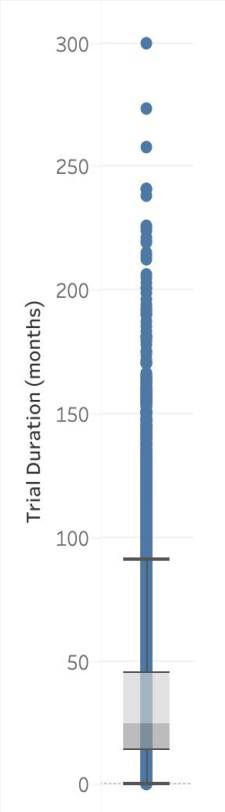


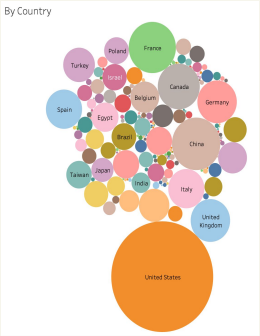
BRAVO TEAM

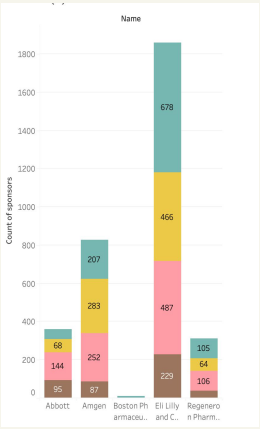
Visualize ClinicalTrials.gov data to benchmark endpoint complexity

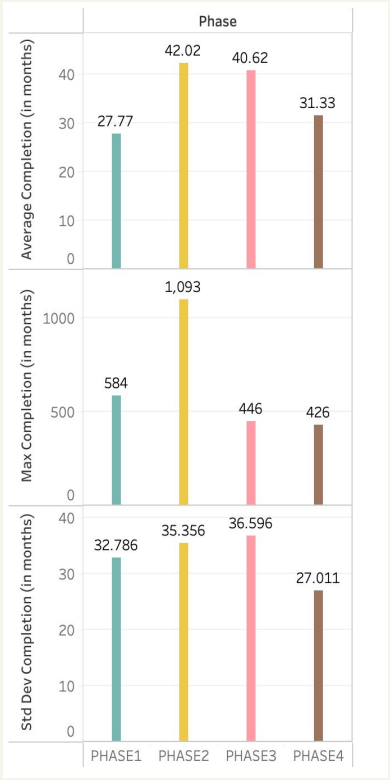
- We created an interactive visualization tool (using data commonly available from ClinicalTrials.gov or derivable from those types of sources) to analyze and benchmark endpoint complexity across clinical trials.
  - The filtering systems allow for a more focused and detailed visualization to further explore connections and insights
- We transitioned from Tableau (free version), to Apache Superset, to Preset.io.

Initial Tableau Visualizations (free version)









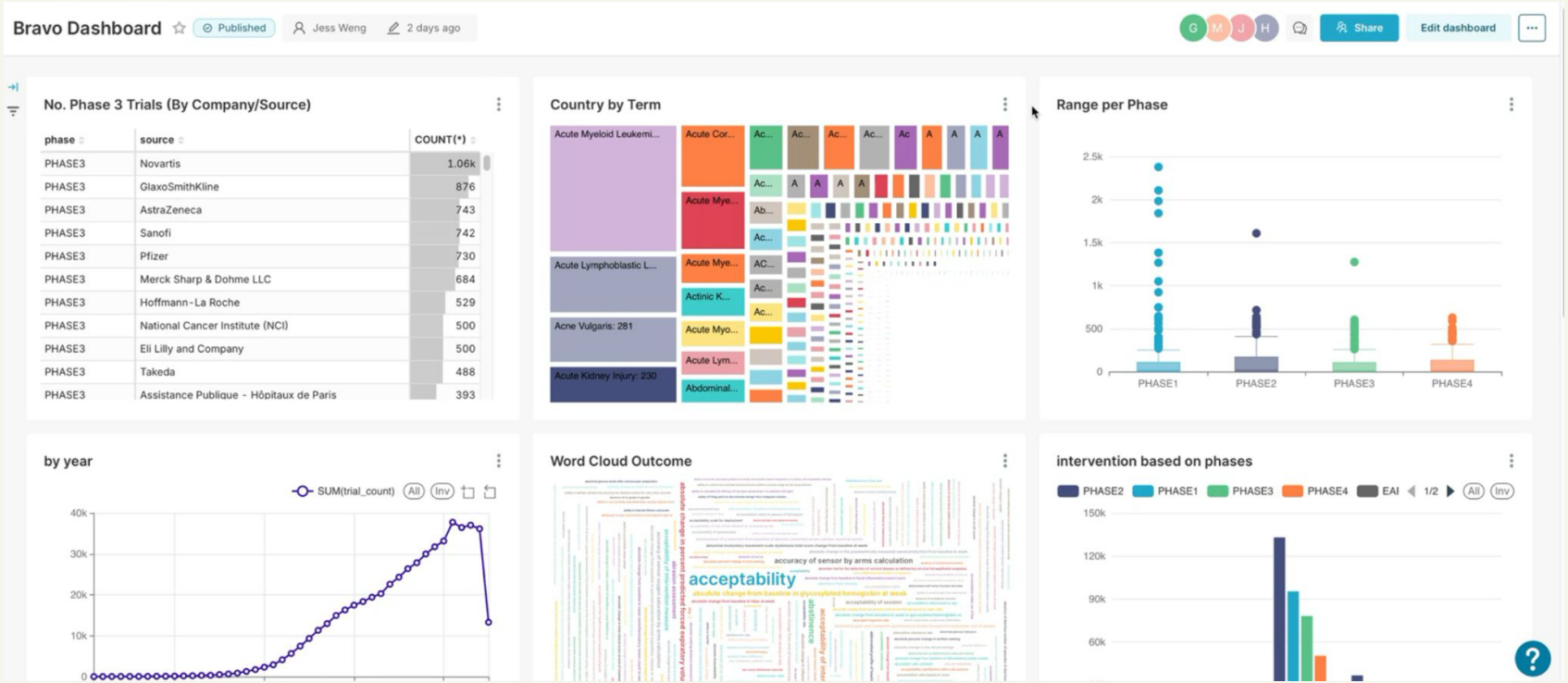
Filters and modifications:

- Industry sponsored trials
- Phase 3
- Excluded null values from secondary outcomes, start dates, completion dates
- Converted start and completion dates (from string to date format)
- Created a calculated field to calculate trial duration in months.

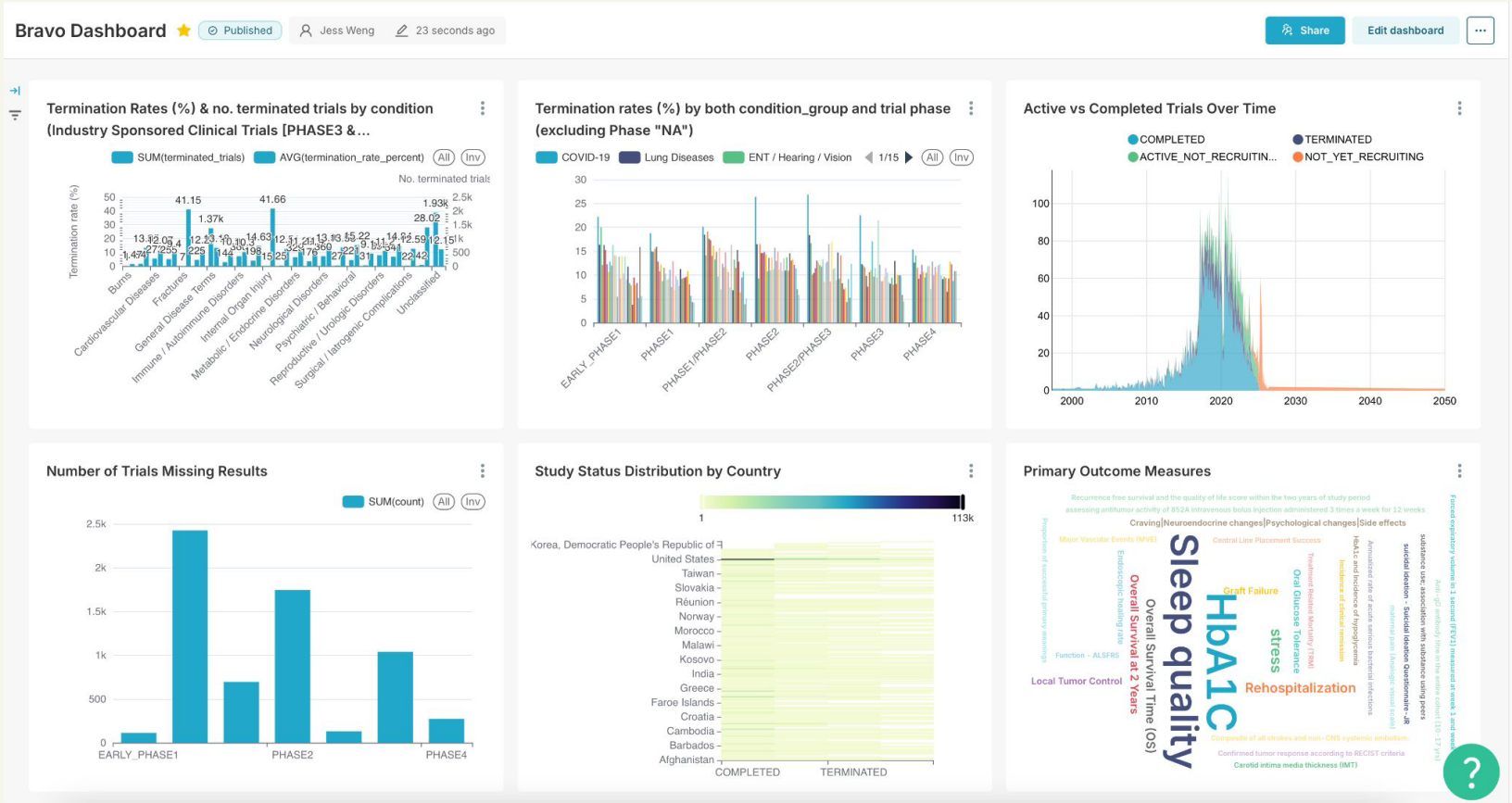
Initial Apache Superset Visualizations

- With the free version of Tableau, we struggled with integrating MeSH data with clinical trial data (without an API).
- So we pivoted away from Tableau (free version) to Apache Superset to utilize other features.
  - This solved our API issues.
- However, we still could not collaborate together on this platform and had issues with connecting to the AACT database.
  - Thus, we pivoted away to Preset/back to Tableau (free version)

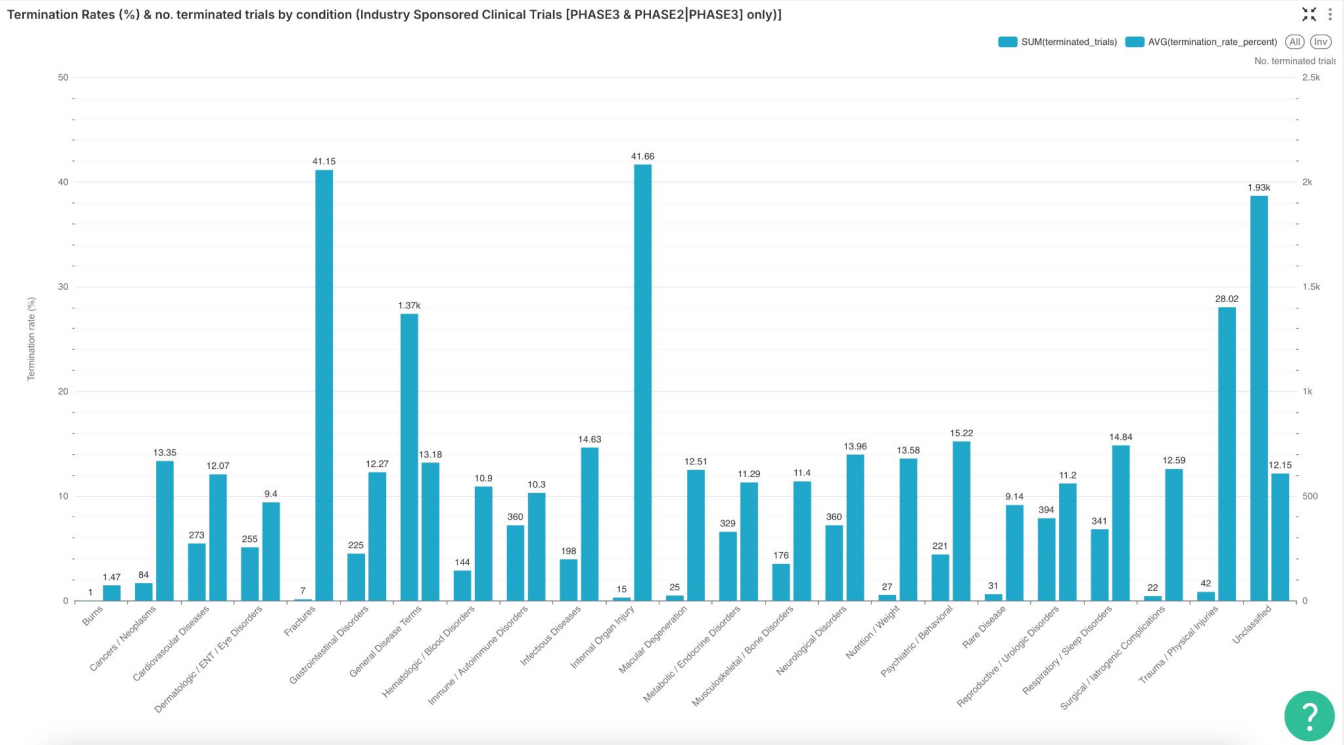
Initial Preset Visualizations



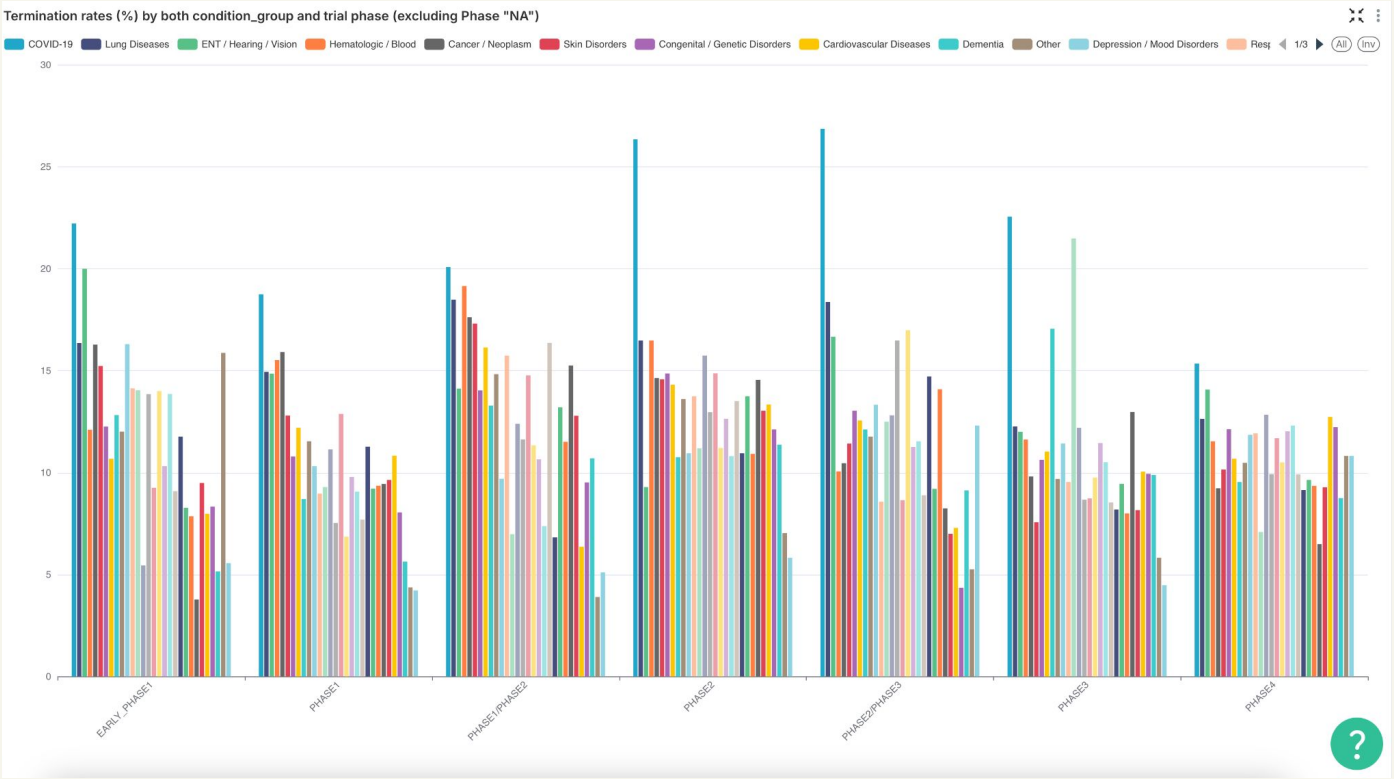
Final Preset Visualizations: Dashboard #1 (No Filters)



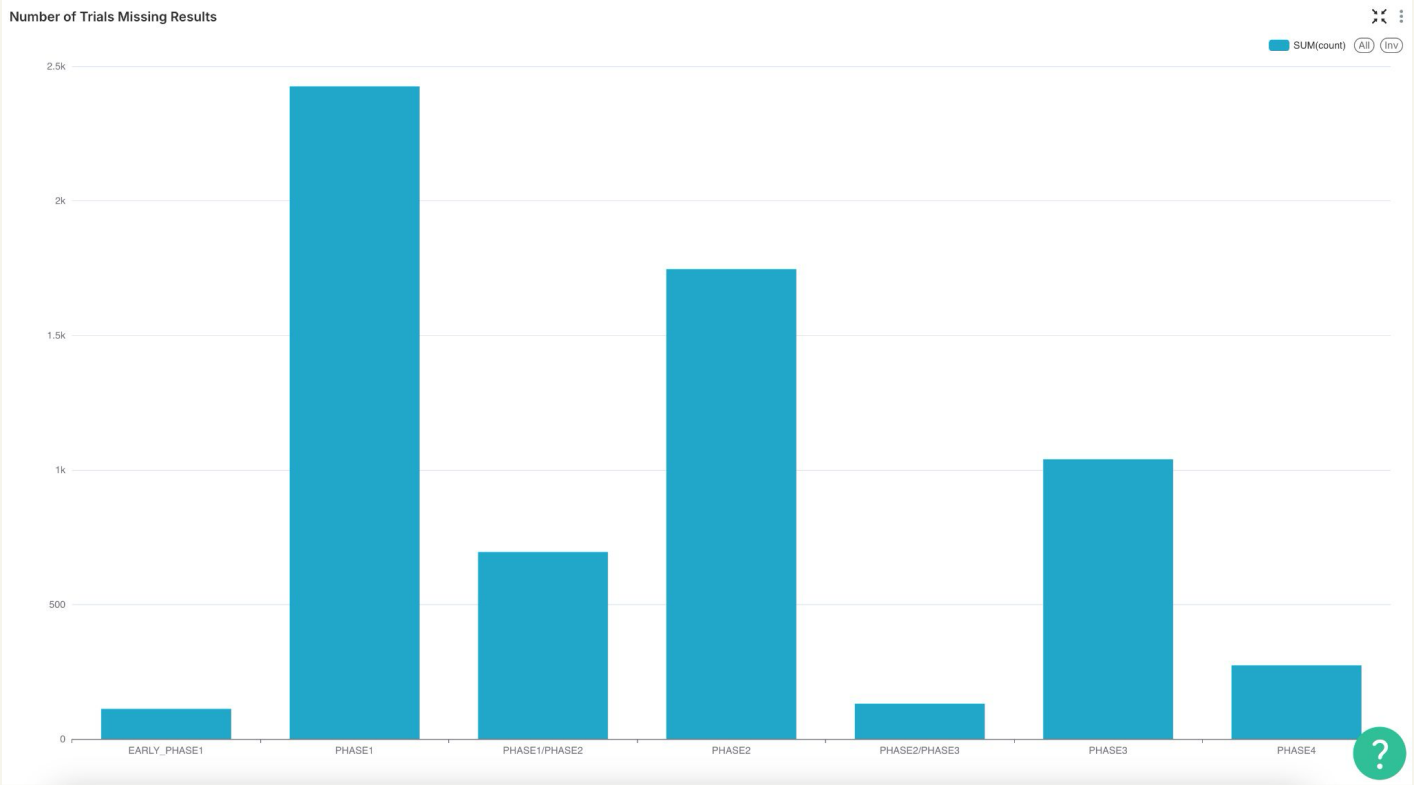
This chart shows termination rates and the number of terminated trials by condition for industry-sponsored Phase 2|3 and Phase 3 clinical trials, which is important for identifying high-risk therapeutic areas and improving future trial strategies.



This chart shows termination rates by condition group and clinical trial phase (excluding Phase "NA"), revealing how risks vary across disease areas and stages to guide better resource allocation and trial planning.

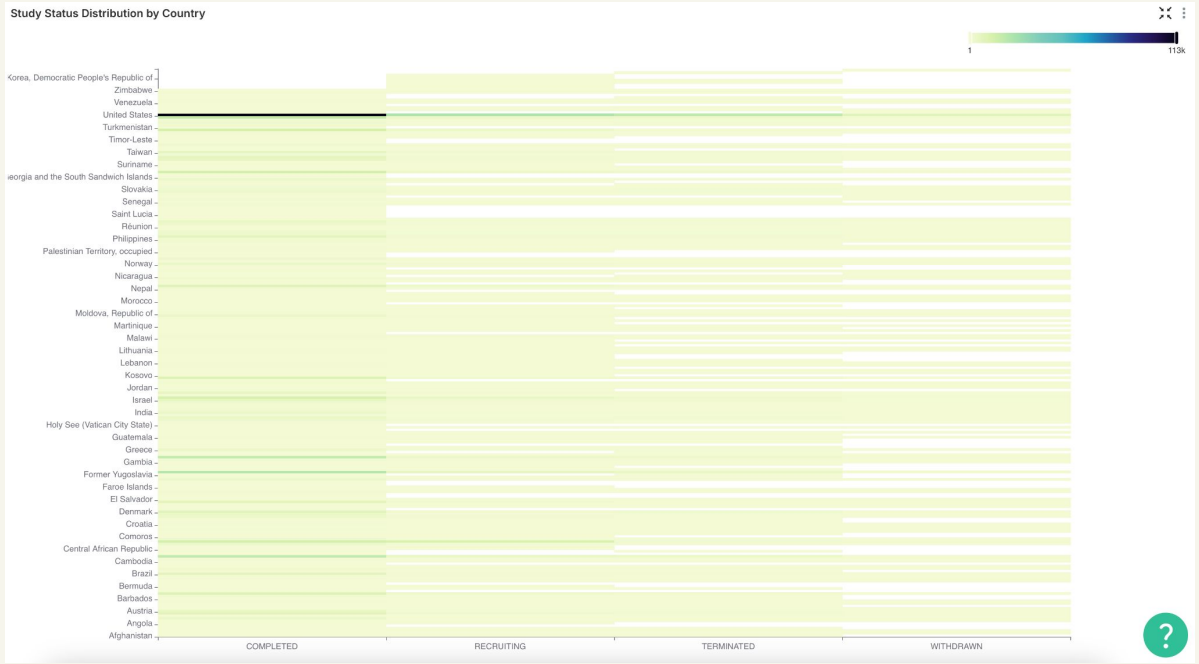


This bar chart displays the number of clinical trials missing results by trial phase, highlighting gaps in reported outcomes that can affect transparency and data availability.



This heat map shows the distribution of study statuses across different countries and trial phases, helping to identify geographic and phase-related trends in trial progress.

Note: ClinicalTrials.gov is the result of a federal law requiring that clinical trials be registered (so this database contains a disproportionate amount of data specifically pertaining to U.S. research); other countries have their own databases.



This word cloud visualizes the most common primary outcome measures across trials, offering a quick overview of frequently studied endpoints.

User Story Dashboard #1

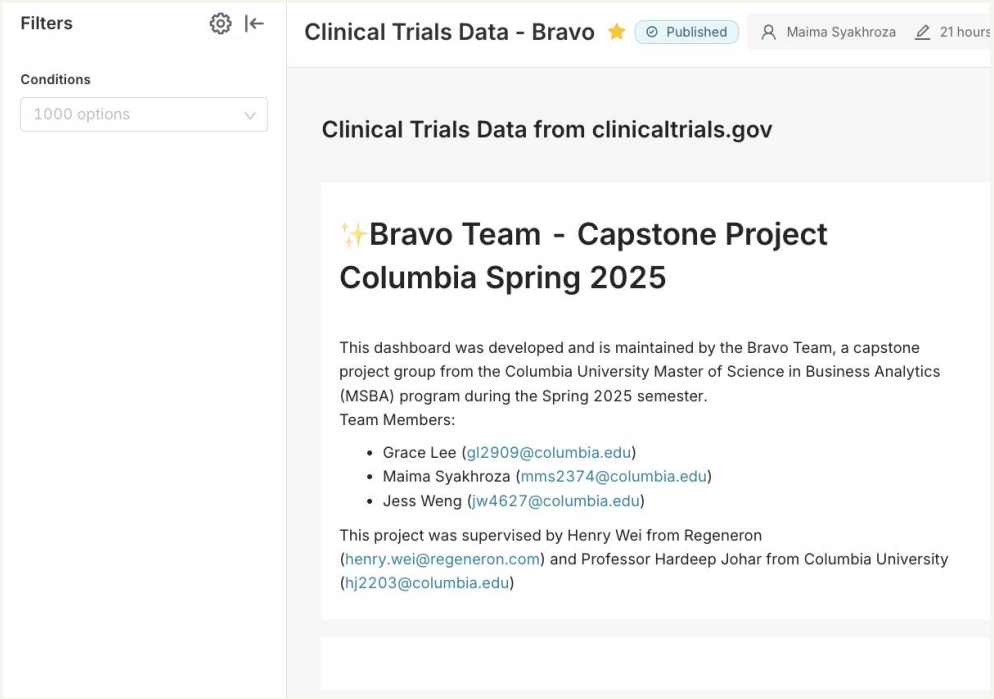
User Story #1

Who: Public Health Researcher
What: Want a dashboard that shows trends in active and completed trials across different conditions.
Why: To evaluate areas of higher trial failure and adjust regulatory planning based on phase-specific risks.

User Story #2

Who: Regulatory Affairs Specialist
What: Want a dashboard that displays termination rates by clinical trial phase and condition.
Why: To ensure compliance and assess the risk factors involved in ongoing trials.

Final Preset Visualizations: Dashboard #2 (With Filters)



The dashboard for Clinical Trials can be filtered based on conditions (obesity, AIDS, PHA, etc.) It will automatically run the graph based on the filters.

If needed, filters can expanded to other areas such as Phase, Year Started, etc.

Based on the filter, there are currently :

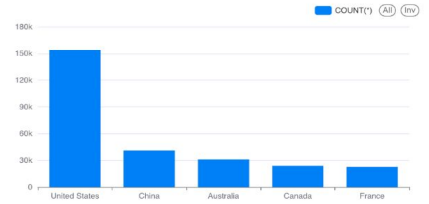
active includes: recruiting, non-recruiting but active, available

Total Active Clinical Trial

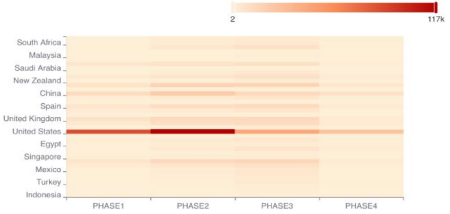
547k

Current Active Clinical Trial

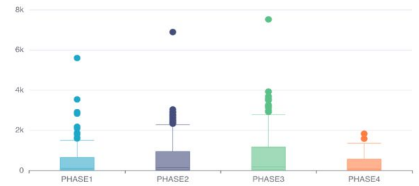
Top 5 Countries with Active Clinical Trials



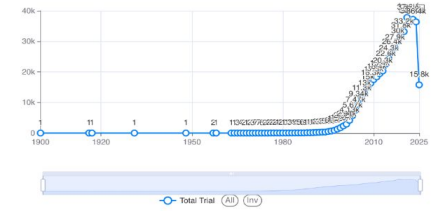
Countries by Phase



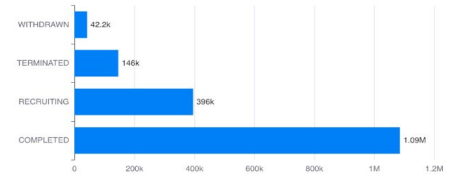
Range per Phase



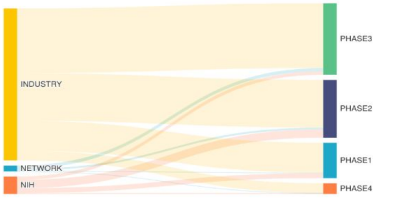
Clinical Trials by Year



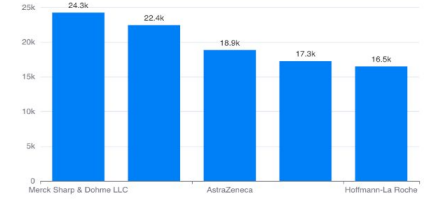
Clinical Trials Status



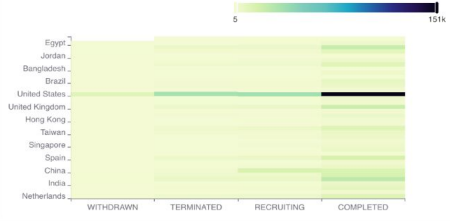
Sponsor Relationship to Phase



Top 5 BioTech Companies Sponsor

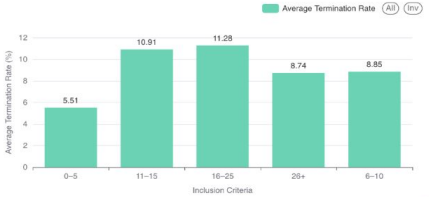


Country with Clinical Trials Status



Empty column

Average Termination Rate Based on Criteria



The dashboard shows the total current active clinical trials, top 5 countries with the most active clinical trials, countries per phase, time for each phase, research momentum, completed vs terminated trials, sponsors per phase, top 5 sponsors, country per status, and the termination rate per inclusion criteria.

User Story Dashboard #2

User Story #1

Who: Clinical Researcher / Sponsor Organization
What: Want a dashboard that shows clinical trial activity for a specific disease
Why: To strategically plan where and how to launch a successful clinical trial

User Story #2

Who: Biotech Investor
What: Want a dashboard that shows clinical trial landscape
Why: To identify high-growth markets, leading players, and areas with high research momentum to inform investment decisions

Limitations of the Data

1. ClinicalTrials.gov contains a disproportionate amount of data specifically pertaining to U.S. research, so we might need to combine other countries' databases for a more complete picture.
2. Unable to get the top countries with a heat map graph. We are able to do it only by filtering manually.
3. Missing financial insights in the clinical trial data.
    a. Unable to estimate cost per phase or funding amounts due to a lack of cost data
    b. This would disproportionately impact smaller companies with less resources
4. Missing country-level regulatory or timelines. Unable to get the risk score for each country.
5. No visibility into what protocols succeeded or failed. We are able to get the numbers of inclusion criteria, but can't really compare what makes it terminated.
6. Unable to see the emerging biotech startups, was able to do only the top sponsors.
7. Dashboard can't be shared publicly by link. To share publicly only do it through pdf which makes it not interactive.
8. Termination reasons are vague and often categorized under "other" to conceal other agendas.

Limitations of Preset

Complex Data Relationships

- Complicated joins across the many relationships and tables
  - Ex: AACT is composed of 51 tables that provide information related to clinical trials.

Real-Time Monitoring Challenges

- Not ideal for instant event tracking
  - Preset can auto refresh with like a timer, but it’s not event driven (no live feed, no automatic alerts without refreshing).

Statistical Analysis

- Only basic aggregations and summaries
- Advanced calculations must be pre-processed
  - Ex: These calculations must be done through SQL Lab.
- Preset does not support dynamic per-bar sorting of stacked segments (often have to hard code results to make visualizations more intuitive)

Replication of Dashboard

- Specific permissions/passwords are needed to access the database, reducing replicability for others (even if they have access to our code)

Next Steps

Gather User Feedback

- Collect feedback on usability, clarity, and missing insights

Optimize for Performance

- Identify and fix slow-loading charts

Enhancements and Future Features

- Training and Documentations
  - Quick guides: “How to use this dashboard” and “FAQs”
- Scaling the dashboard
  - Plan how to add new diseases, geographies, or trial types