Pharma SUG SDE Japan 2023

Innovative Approaches for
Clinical Trial Data Analysis and RWD Analysis :
SAS® Health Clinical Acceleration
SAS® Health Cohort Builder

SAS Institute Japan
Toshiaki Habu・ William Kuan

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS® Life Science Analytics Framework（LSAF）
SAS® Health Clinical Acceleration（HCA）

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

History of SDD/LSAF/HCA

Previous Solution

SAS ®
Drug Development
(2005～2014)

SAS execution environment for regulatory requirements
- SAS9 based
- Java-based
- On-premise provision (Cloud provision in the latter half)
- Programming
- Comply with regulatory requirements (Part 11, etc.)
- Workspace functionality

Current Solution

SAS ® Life Science Analytics Framework (2015～)

Managed Cloud Service
- SAS9 based
- HTML5
- Provided in Cloud
- Workflow Function
- Enhanced Macro API

SAS® Health Clinical Acceleration（2023～）

Move to Viya-based from SAS9-based
- Engine modernization (based on Viya)
- Modularization of functions: further expansion planned

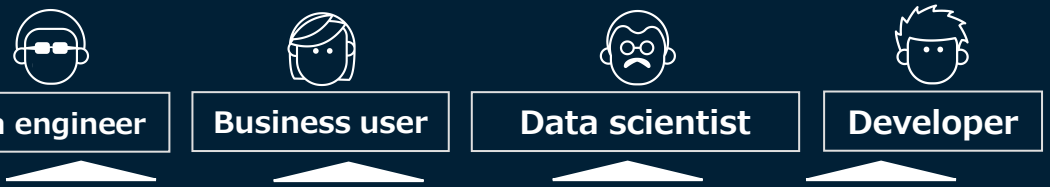
For about 18 years since SDD launch, it has been used by many companies, including global pharmaceutical companies, as a repository and SAS execution environment that complies with FDA CFR 21 Part 11 and other regulatory requirements.

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Ref

SAS Viya

Provides the entire suite of functions and software necessary to promote data utilization on a single platform



Data engineer | Business user | Data scientist | Developer

Stream
Cloud-DB
Hadoop
RDB

Data Source

Data management | **Analytics** | **Visualization**

Search & Insight

Aggregation, Filtering, Statistical analysis, Machine/deep learning, Forecasting, Optimization, Natural language processing

Data preparation

Access・Data cataloging and data processing・Cleansing

Placement and application

Model management・Automation・Monitoring

In-memory analysis engine | **Integrated Repository** | **parallel-distributed processing**

Automation, security, governance, metadata management, workflow

Cloud aws ／ on-premise OPENSHIFT

User Interface / API

sas
python
R
Java
Lua
REST API

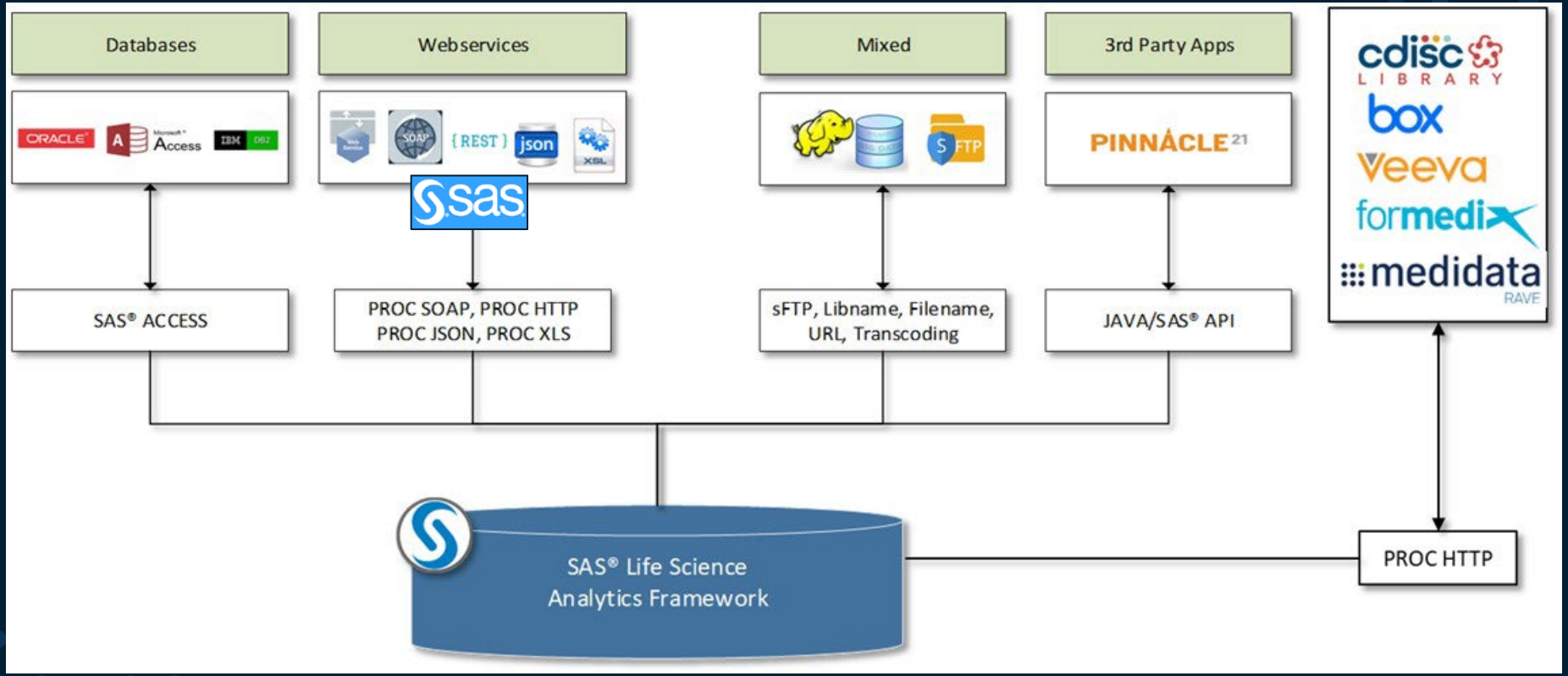
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

sas

SAS® Life Science Analytics Framework (LSAF) Overview

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

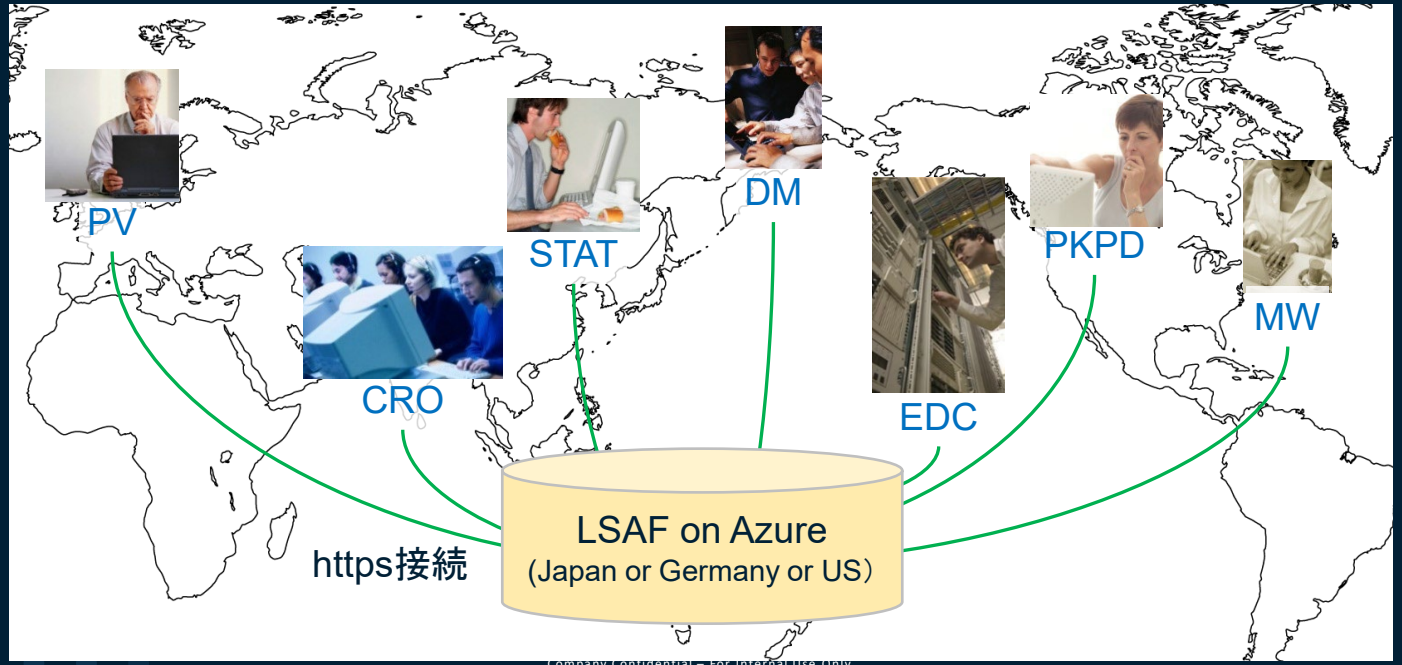
Flexible Integration Capabilities



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Support collaborations within the organization and with external partners

Each user can connect to the LSAF server managed by SAS via https from a browser to develop and run programs and exchange SAS data sets and other files with other personnel, regions, and departments.



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Overview of LSAF (1/2)

LSAF is a solution that provides repository functions for clinical data and data standards, as well as program development and execution functions such as statistical analysis, in a secure cloud format for life science companies.

- **Server maintained and managed by SAS. Available via web browser (https)**
  - **Provided as a cloud service, reducing companies' burden on system construction, maintenance, and validation.**
  - Web-based, so it can be used without concern for the PC environment of each user.

- **Provides a clinical data repository (CDR) and statistical computing environment.**
  - No restrictions on supported file formats, including SAS data sets, programs, and other SAS-related files, as well as CSV, Word, Excel, PDF, and other formats.
  - Groups and roles (combinations of permission and privileges required for each role, such as programmer, medical writer, etc.) can be freely defined, and security can be efficiently configured in terms of access and privileges.
  - Provides a personal area (development area) and a shared area (production area) that can be used for SAS program development and production execution.

Key Point!!

- **Provides regulatory compliance capabilities**
  - Audit trails, implementation of version control, and traceability functions enable efficient electronic recording/electronic signature and GxP compliance.
  - FDA 21 CFR Part 11 compliant

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Overview of LSAF (2/2)

- **Easy integration with other applications.**
  - Extensive experience with EDC integration such as Medidata Rave and InForm, and Pinnacle 21 Enterprise/Community for the purpose of improving operational efficiency and security through automation.
  - Easy deployment of machine learning, RWD, etc. by leveraging SAS Viya, Python and R, etc.

- **Workflow Functions**
  - Workflow functionality improves operational efficiency and visualizes progress.
  - Comply with industry standards (Business Process Model and Notation 2.0) for workflow design enables user-centered operations.

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS® Health Clinical Acceleration

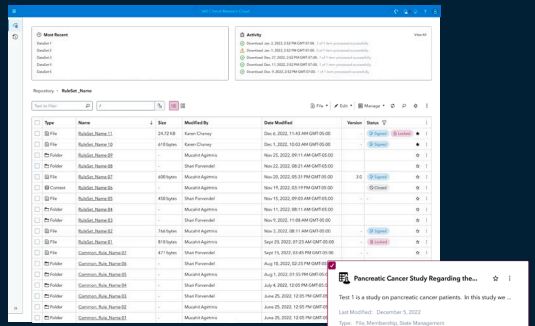
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS® Health Clinical Acceleration at a Glance

Overview

SAS® Health Clinical Acceleration (HCA) provides a modular, open, cloud-native content repository for managing, analyzing, reporting, and reviewing clinical research information. It is the successor to LSAF on Viya.

SAS HCA improves the way people work in a qualified environment and enables life science organizations to maintain data integrity, make informed business decisions, effectively assess the safety and efficacy of research compounds, collaborate across trials, phases, therapeutic areas, and ultimately streamline the drug development process and accelerate their submissions to the FDA.



Platform: Viya 4

Value Propositions:

- Faster Clinical Analysis and Submission – Improved UX
- Regulated Clinical Trial Operations – Single Source of Truth
- Viya Enabled Programming, Analytics & Automation
- Open Integration – Bring your own tool

Personas: Head of IT, Head of Biostats, Study Lead, Biostatistician, Administrator, Programmer, Content Manager, Auditor/Regulator, IT Administrator

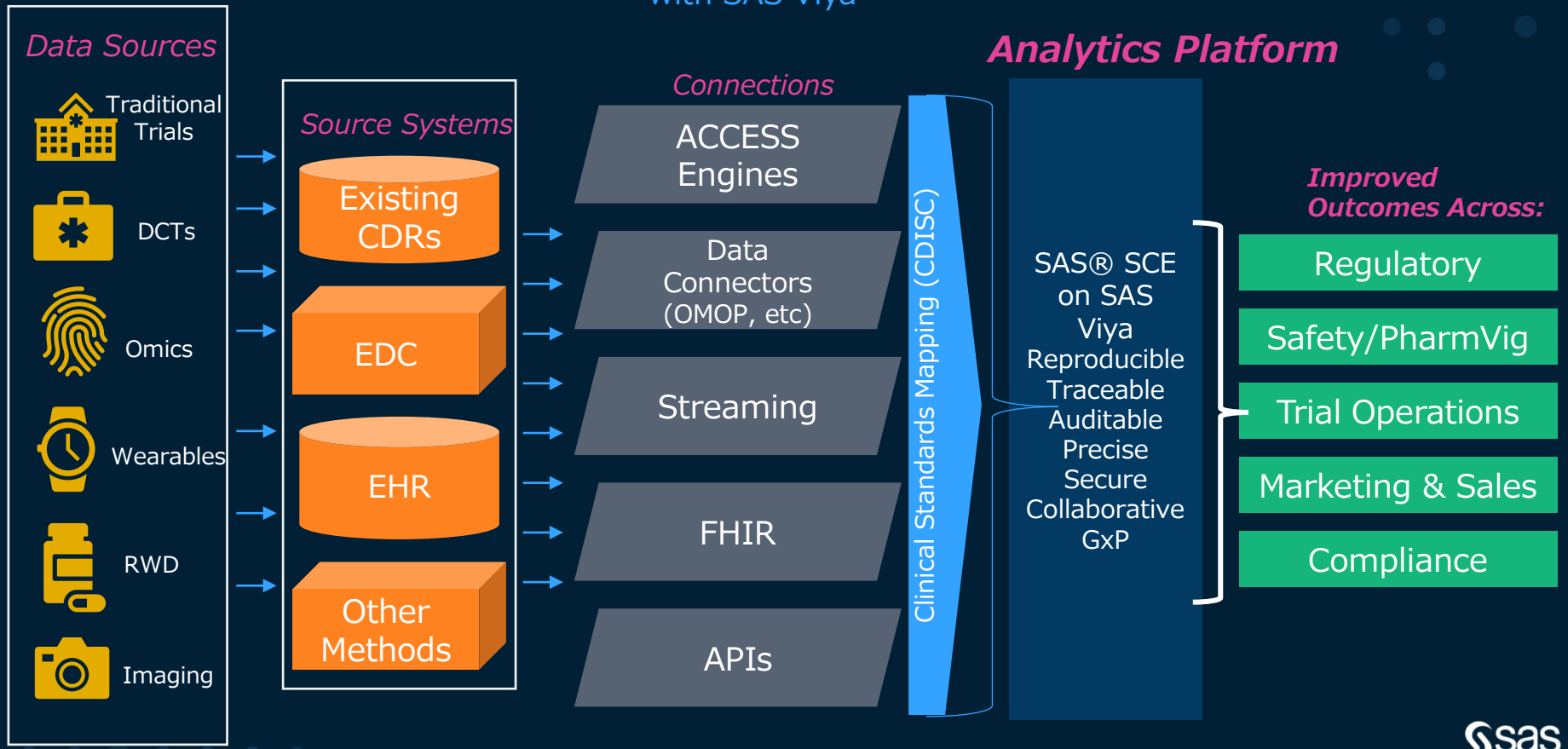
Upcoming Features in MVP:

- Repository
  - Groups & Permissions
  - Roles & Privileges
  - Version Control
  - Electronic Signatures
  - Recycle Bin
  - Search
- Ownership Administration
- Audit History
- Action Status

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

The Future of Efficient, Data-Driven Clinical Trials

with SAS Viya



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS® Health Cohort Builder

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Challenges in dealing with Real World Data

The amount of data to be processed is so large that SAS frozen (or appears to be frozen). In addition, the data wrangling and data cleansing steps took up my whole day.

There are concerns about the ability of our analytics platform on handling yearly increasing data volumes and data sources.

Data extraction is not feasible without skilled specialists.

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Challenges in dealing with Real World Data

SAS Viya technology accelerates data processing

Highly scalable analytics platform and easy to add additional computing nodes (processing servers), etc.

This system has a common data model and can handle data from any data source via GUI

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

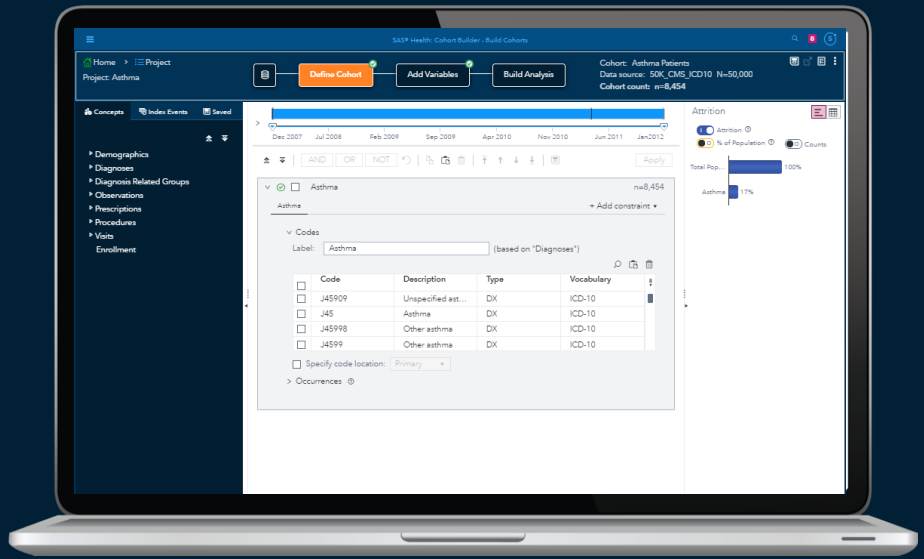
SAS® Health

Reimagining health analytics in the cloud.

Cohort Builder

Easily and confidently build patient subsets within a unified analytics platform

- Interactive, drag-and-drop capability to support complex cohort queries with temporal relationships – no coding required



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

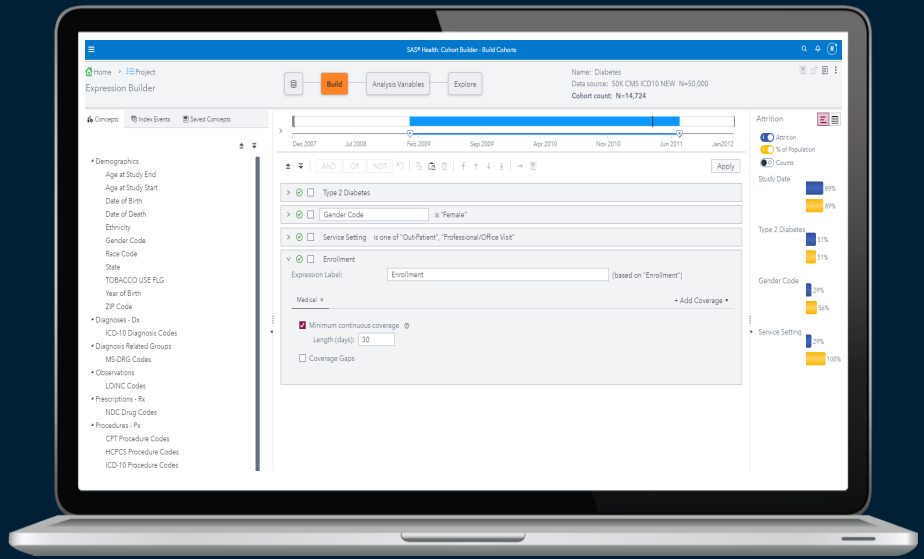
SAS® Health

Reimagining health analytics in the cloud.

Cohort Builder

Easily and confidently build patient subsets within a unified analytics platform

- Interactive, drag-and-drop capability to support complex cohort queries with temporal relationships – no coding required
- Explore cohort characteristics and the effect of inclusion / exclusion criteria on patient populations



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

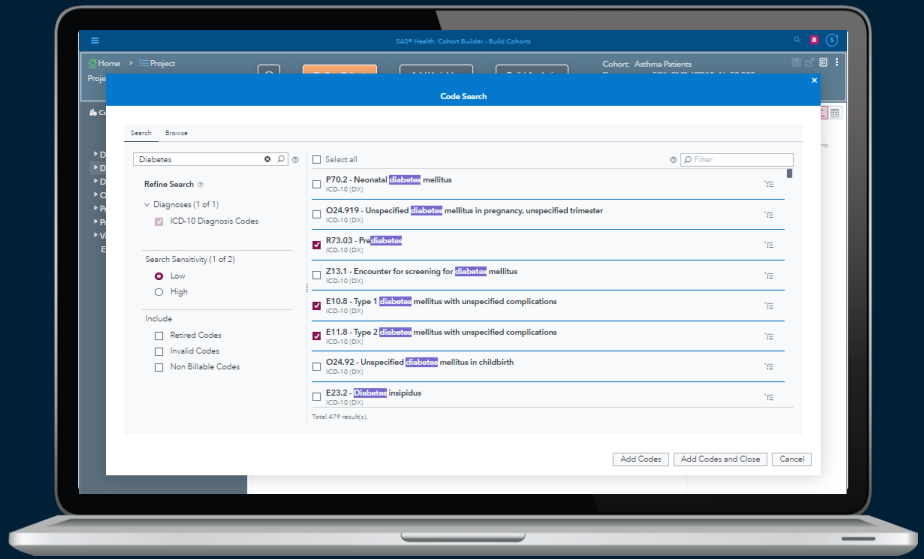
SAS® Health

Reimagining health analytics in the cloud.

Cohort Builder

Easily and confidently build patient subsets within a unified analytics platform

- Interactive, drag-and-drop capability to support complex cohort queries with temporal relationships – no coding required
- Explore cohort characteristics and the effect of inclusion / exclusion criteria on patient populations
- Utilize health care ontologies for selecting code sets to include within cohort criteria



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

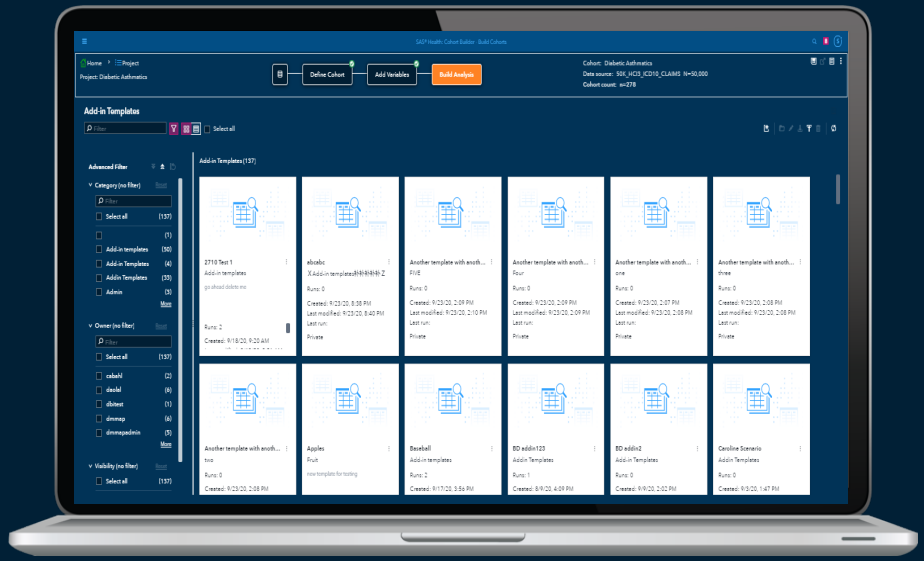
SAS® Health

Reimagining health analytics in the cloud.

Cohort Builder

Easily and confidently build patient subsets within a unified analytics platform

- Interactive, drag-and-drop capability to support complex cohort queries with temporal relationships – no coding required
- Explore cohort characteristics and the effect of inclusion / exclusion criteria on patient populations
- Utilize health care ontologies for selecting code sets to include within cohort criteria
- Leverage and extend your own analytic assets



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

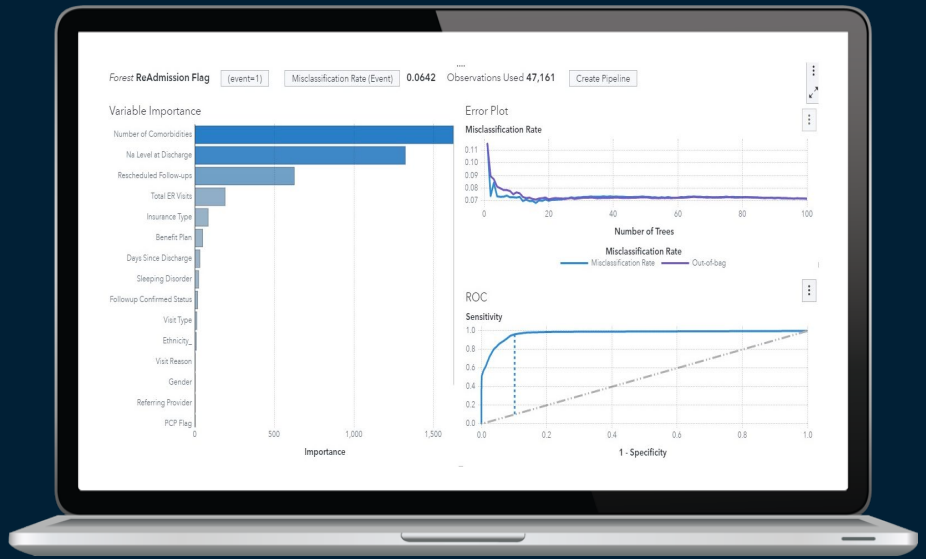
SAS® Health

Reimagining health analytics in the cloud.

Cohort Builder

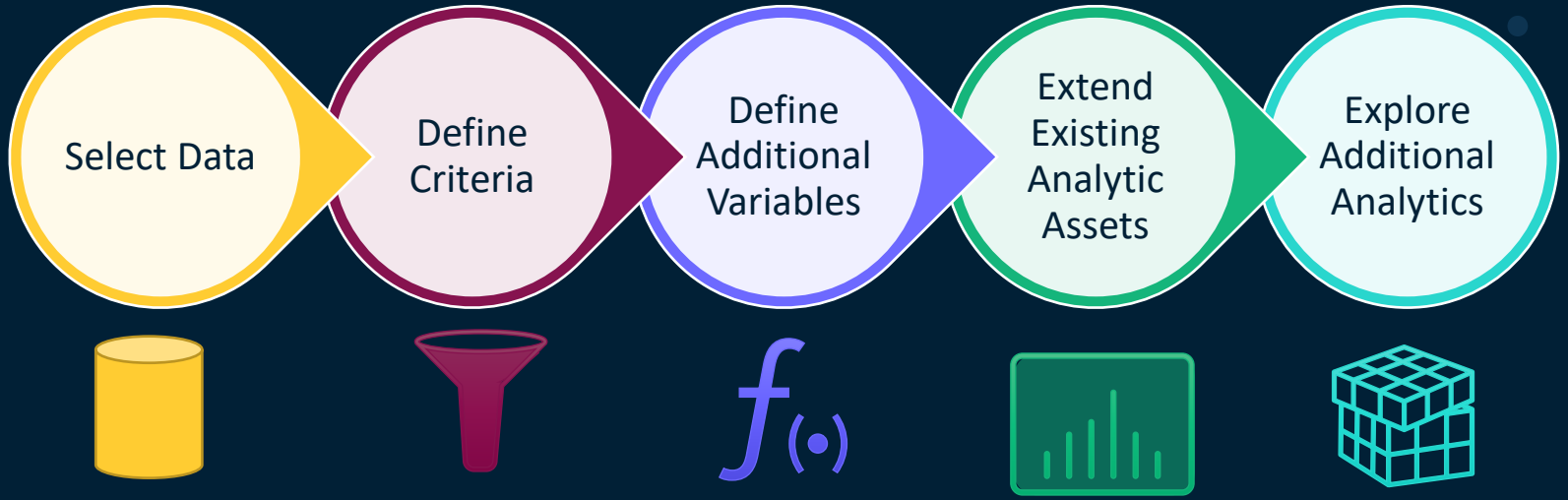
Easily and confidently build patient subsets within a unified analytics platform

- Interactive, drag-and-drop capability to support complex cohort queries with temporal relationships – no coding required
- Explore cohort characteristics and the effect of inclusion / exclusion criteria on patient populations
- Utilize health care ontologies for selecting code sets to include within cohort criteria
- Leverage and extend your own analytic assets
- Gain fast, easy access to advanced health analytics and visualizations



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Overview of Process



- Map
  form
- Data
  valid

- No coding re
- Complex crite
- Share/reuse

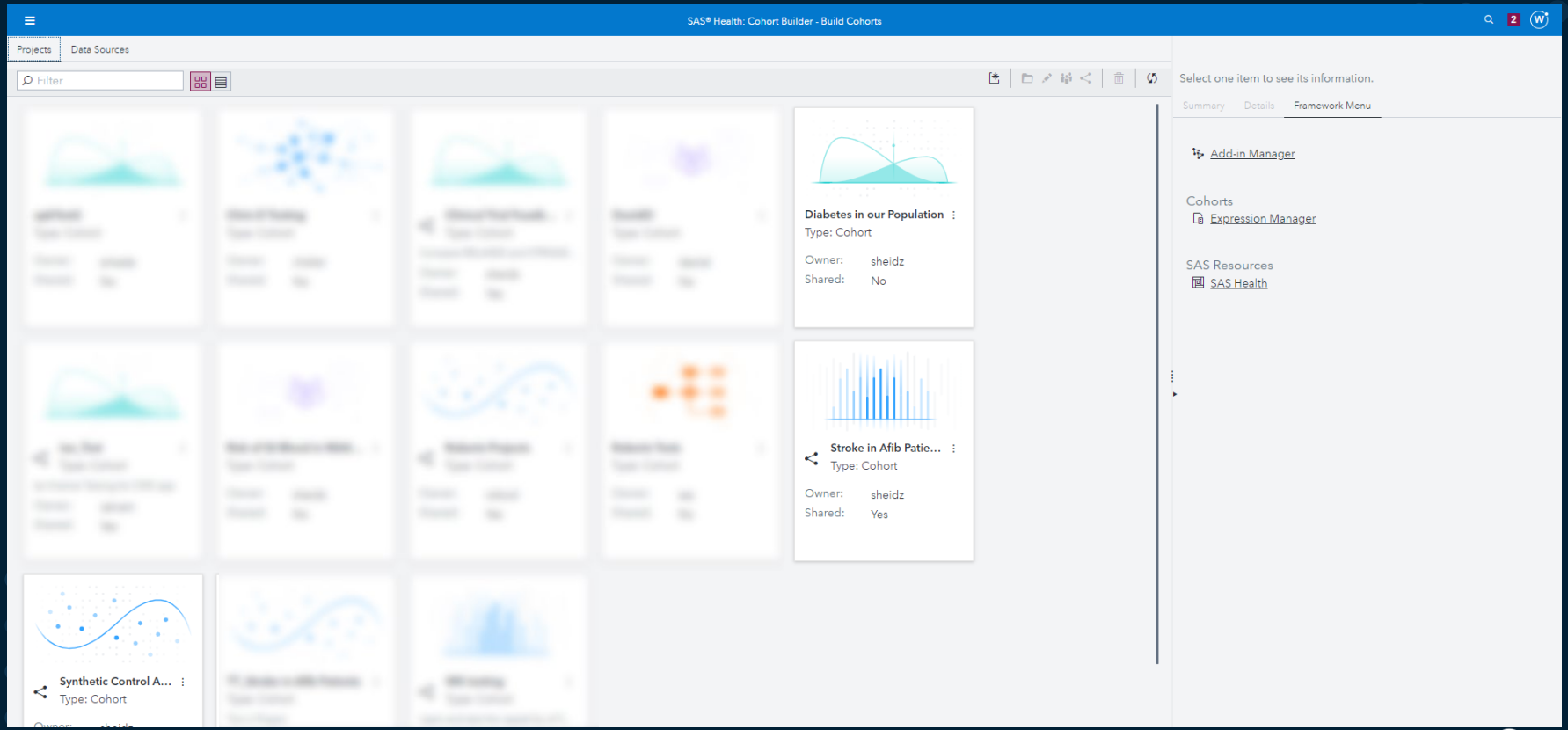
- Predefined
  scores, etc
- Define and

- No co
- Trans
- SAS p

- Visual tools for exploration, analytics and AI/ML
- Coding interfaces for SAS and open source

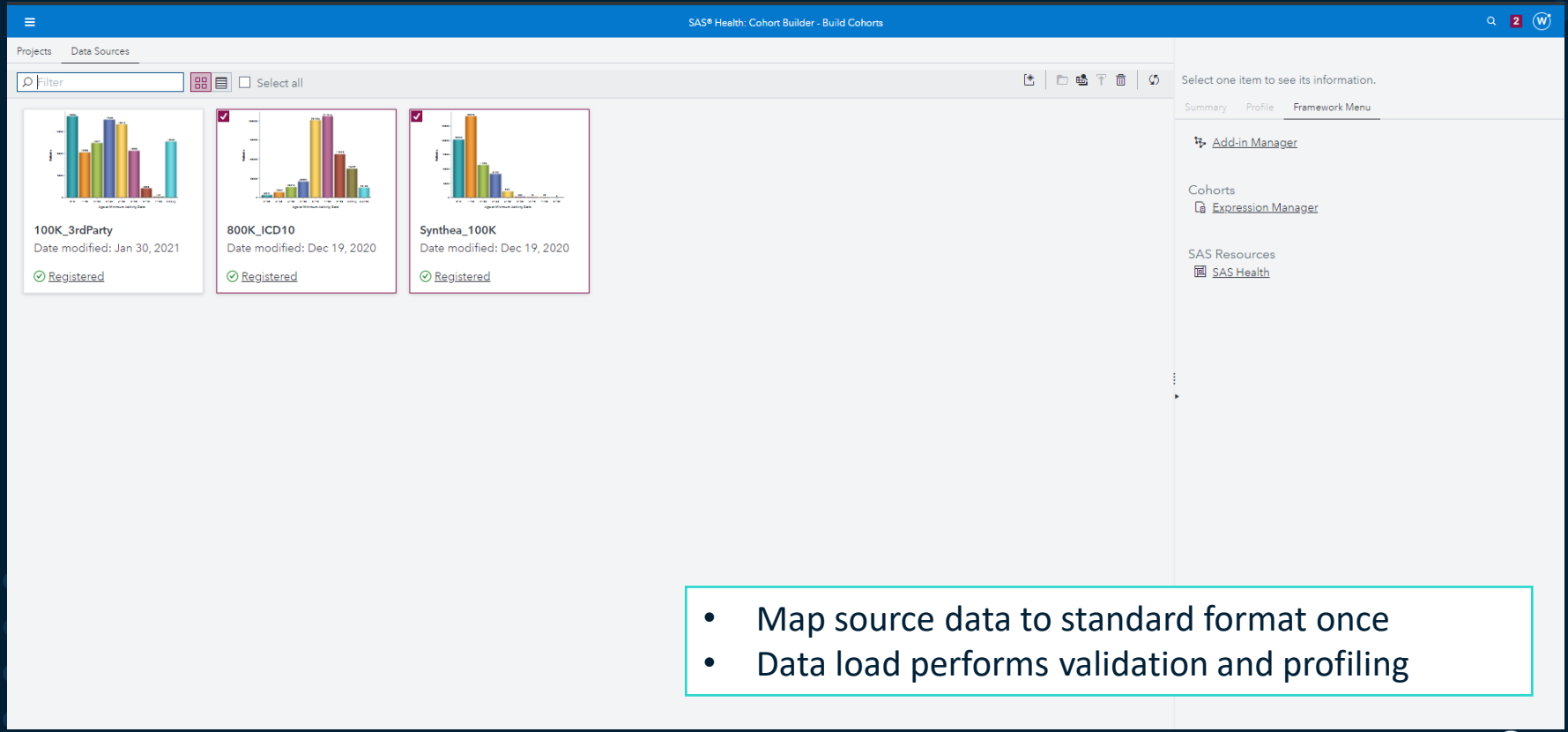
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Project Management



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

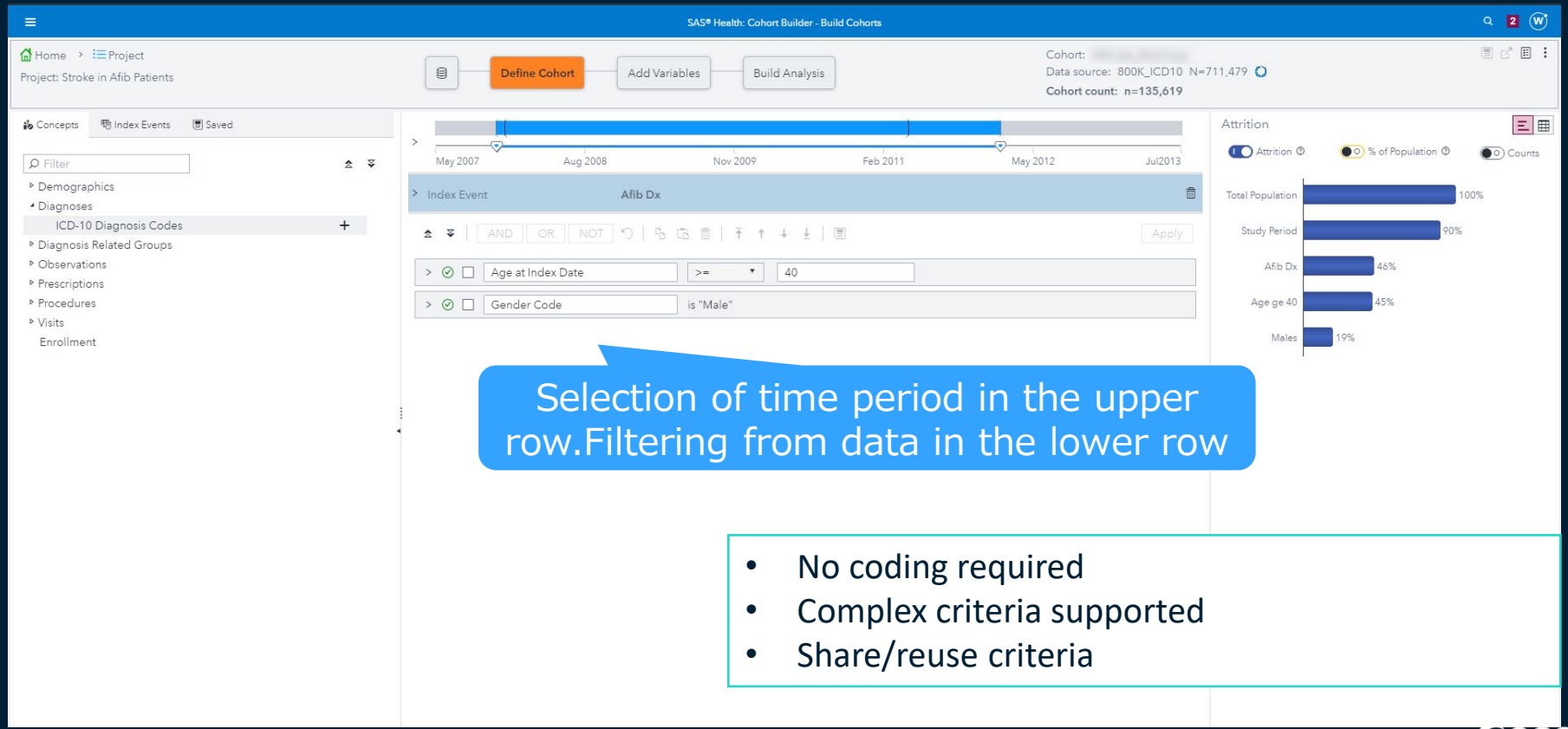
Data Source Selection



- Map source data to standard format once
- Data load performs validation and profiling

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Define Inclusion and Exclusion Criteria

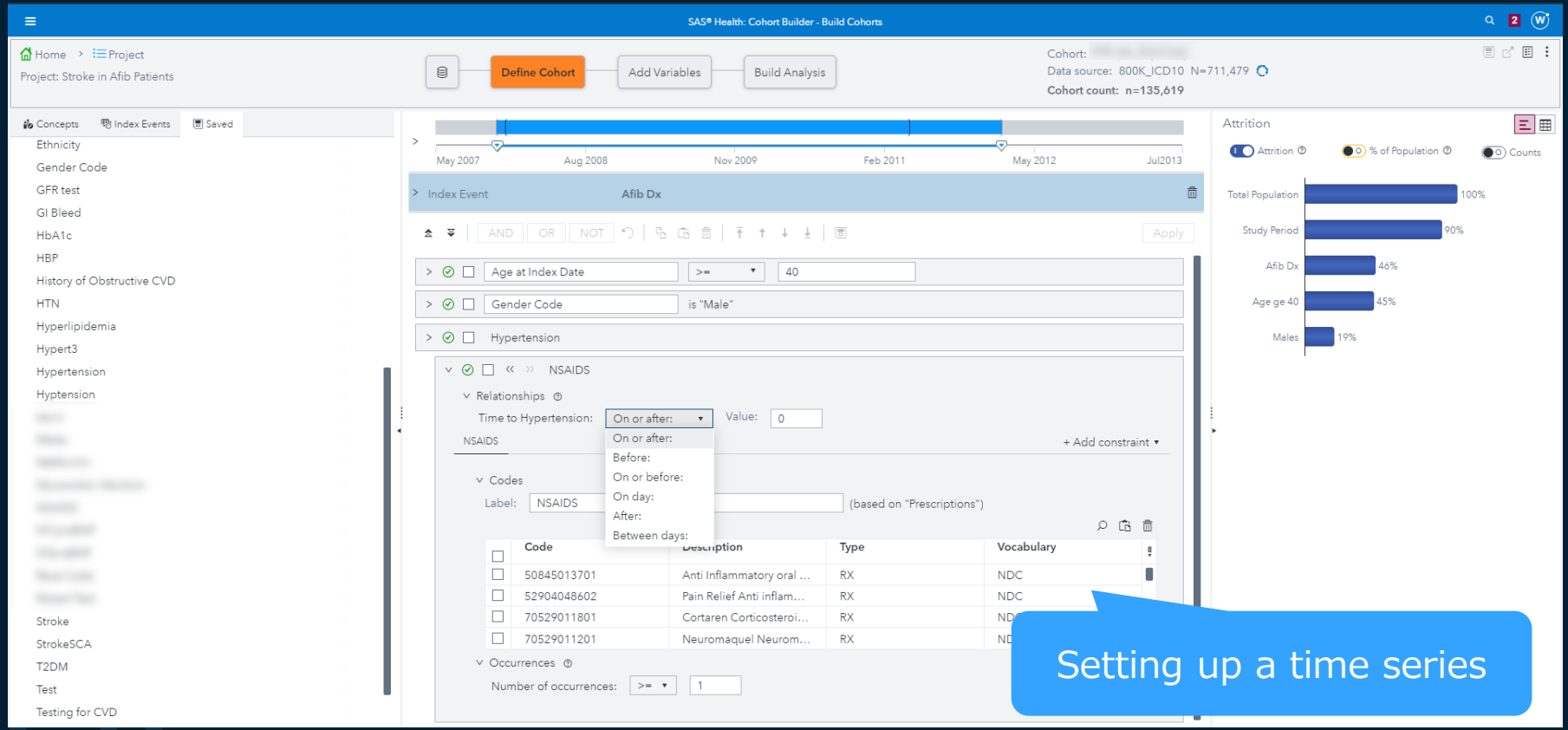


Selection of time period in the upper row.Filtering from data in the lower row

- No coding required
- Complex criteria supported
- Share/reuse criteria

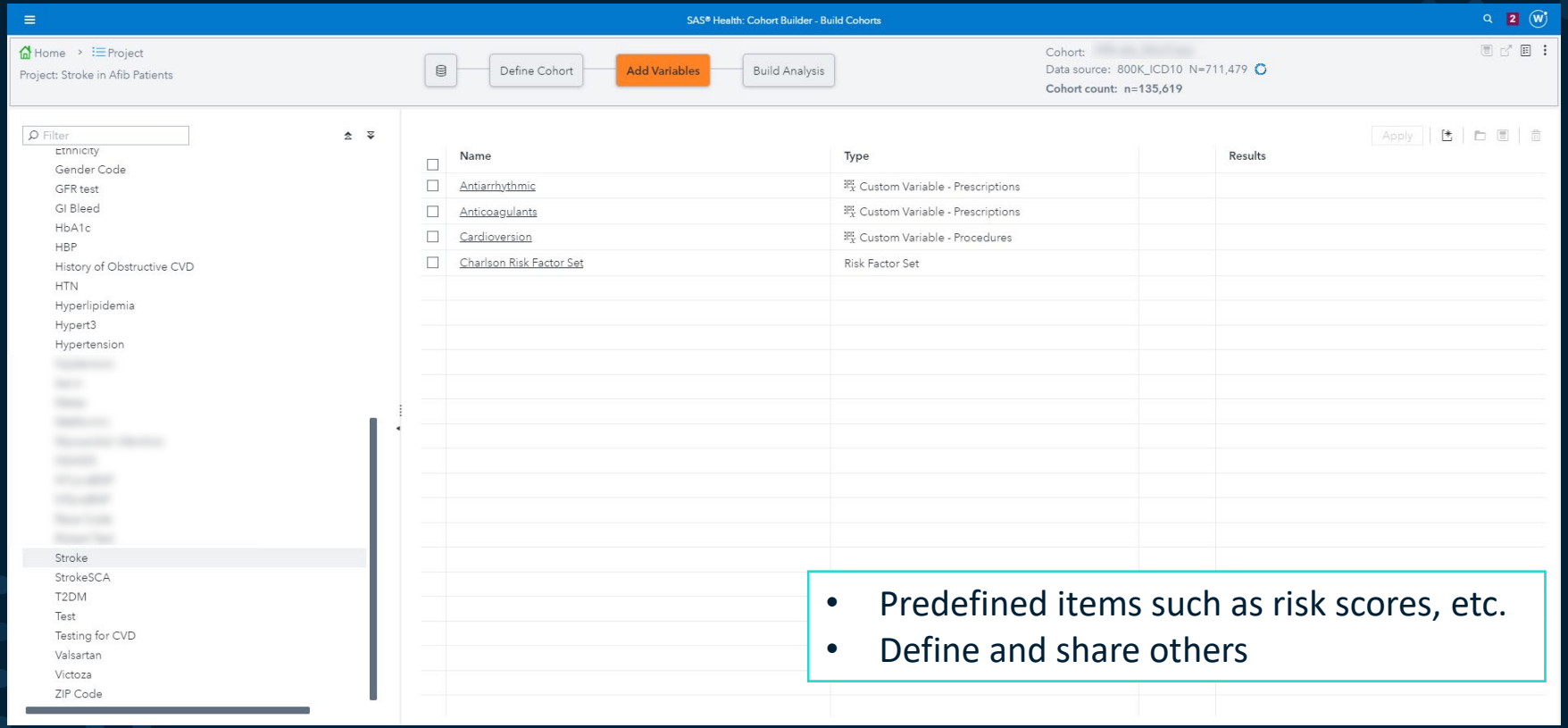
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Define Inclusion and Exclusion Criteria



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

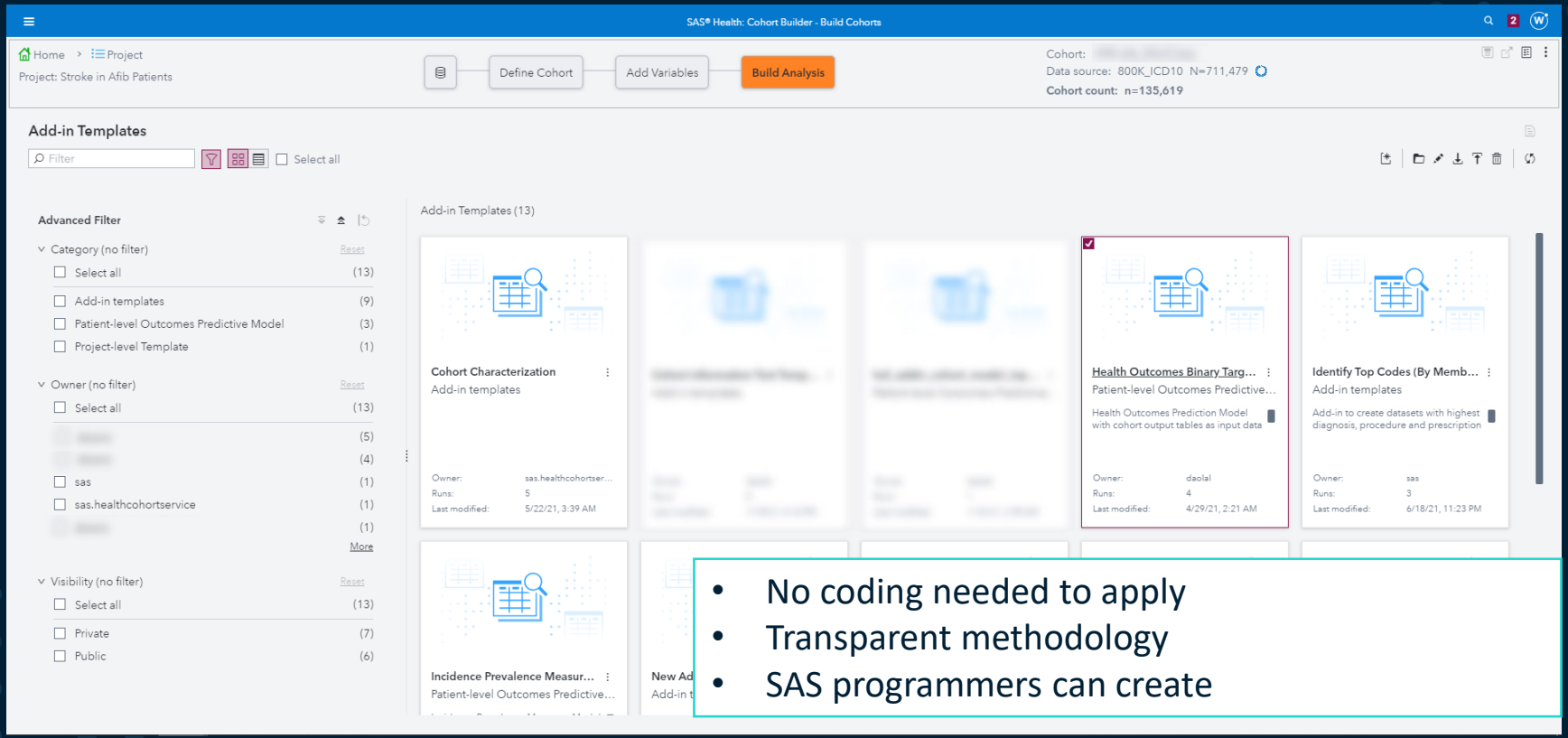
Definition of additional variables
(e.g., used when there is data that could be a risk factor)



- Predefined items such as risk scores, etc.
- Define and share others

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

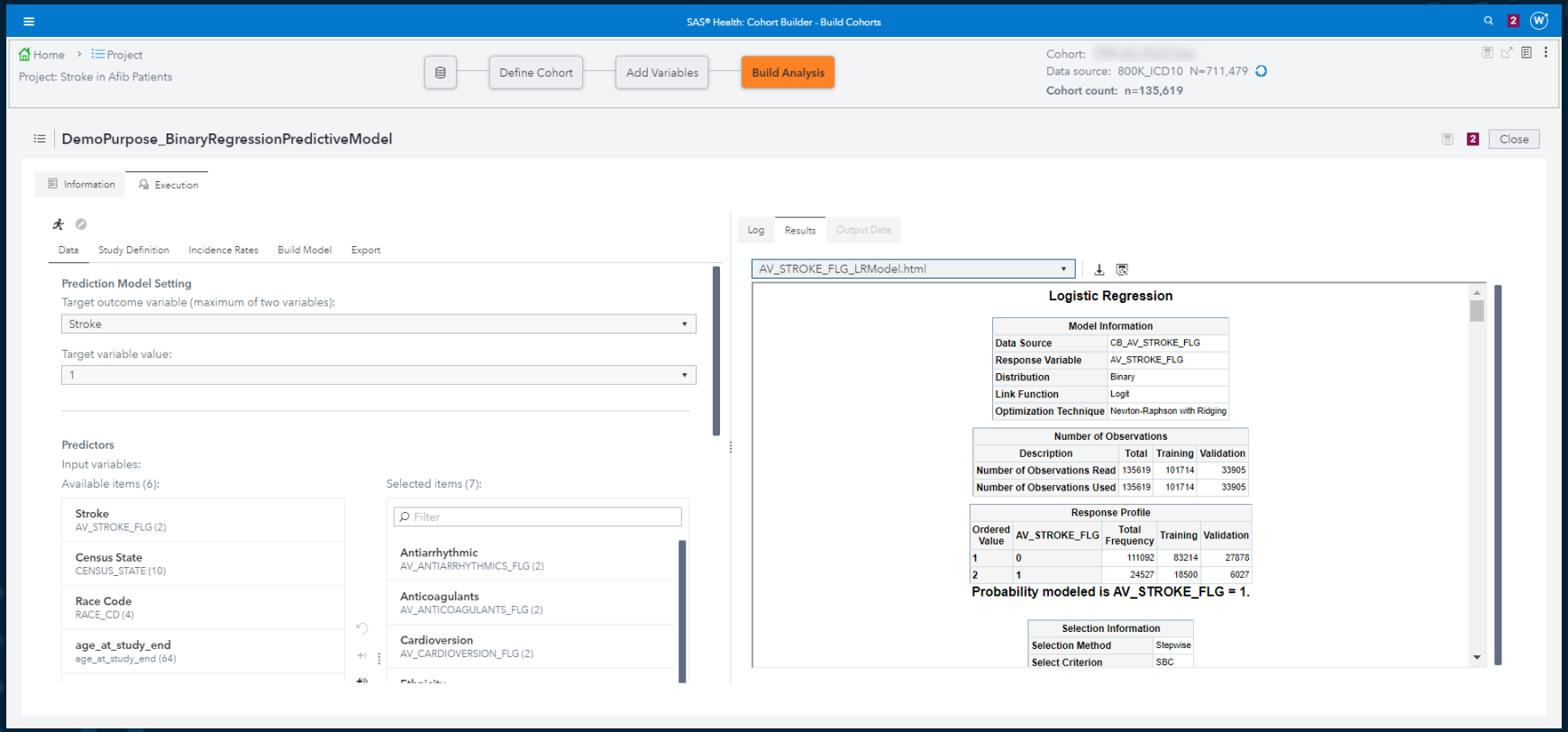
Utilization of Analysis Templates (pre-created template selection)



- No coding needed to apply
- Transparent methodology
- SAS programmers can create

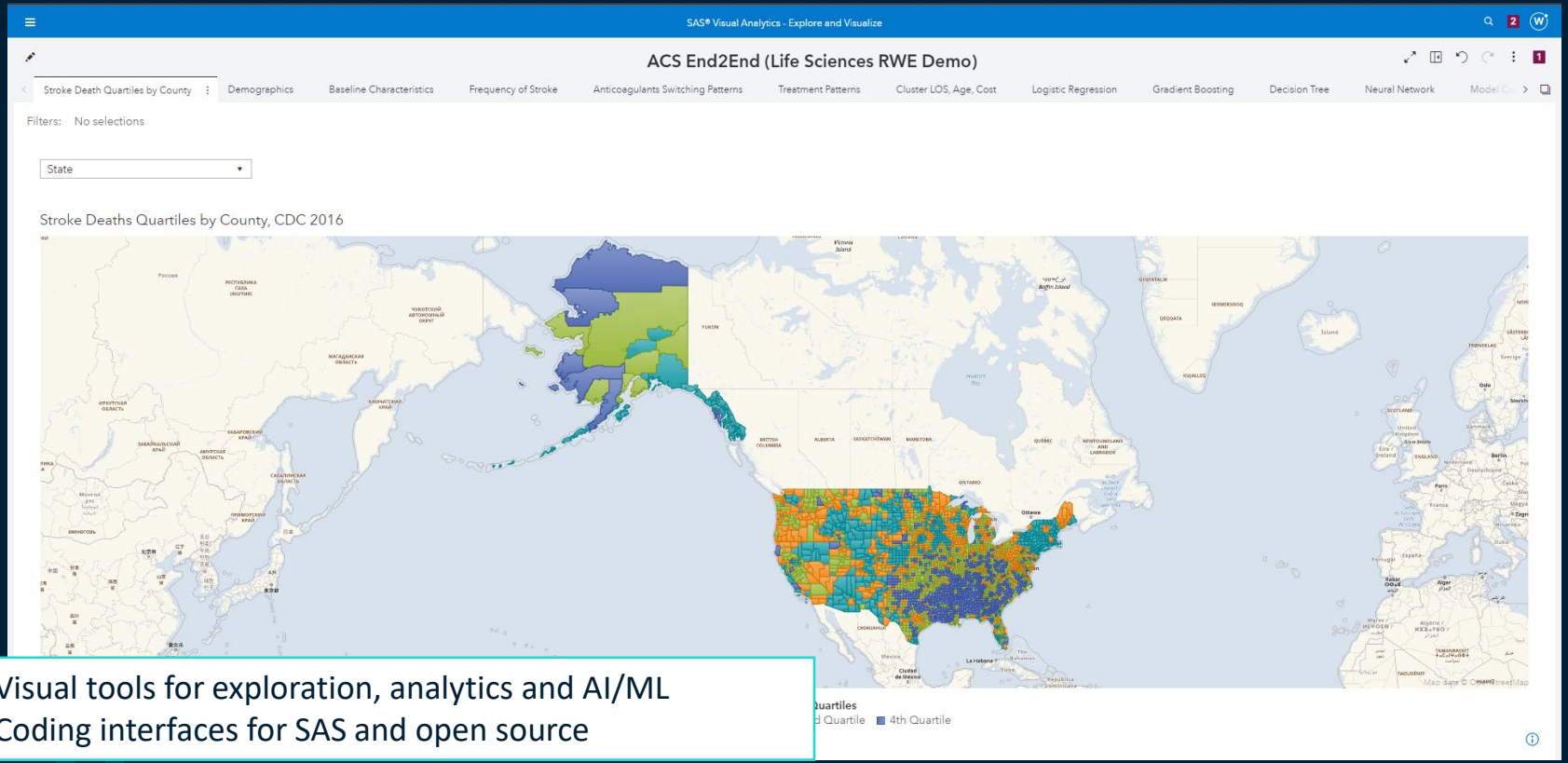
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Adjustment of Output Variables



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

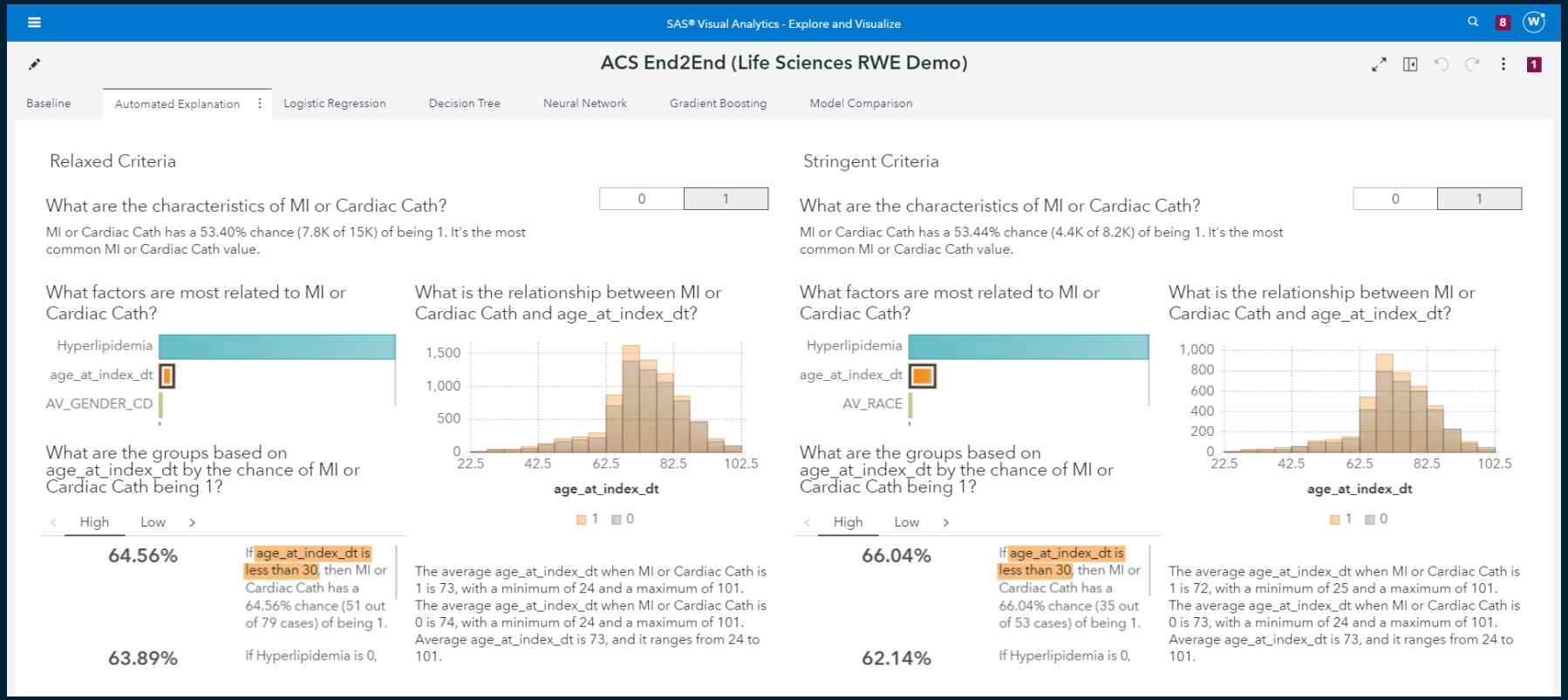
Visualization of Analysis Outputs (VA function)



- Visual tools for exploration, analytics and AI/ML
- Coding interfaces for SAS and open source

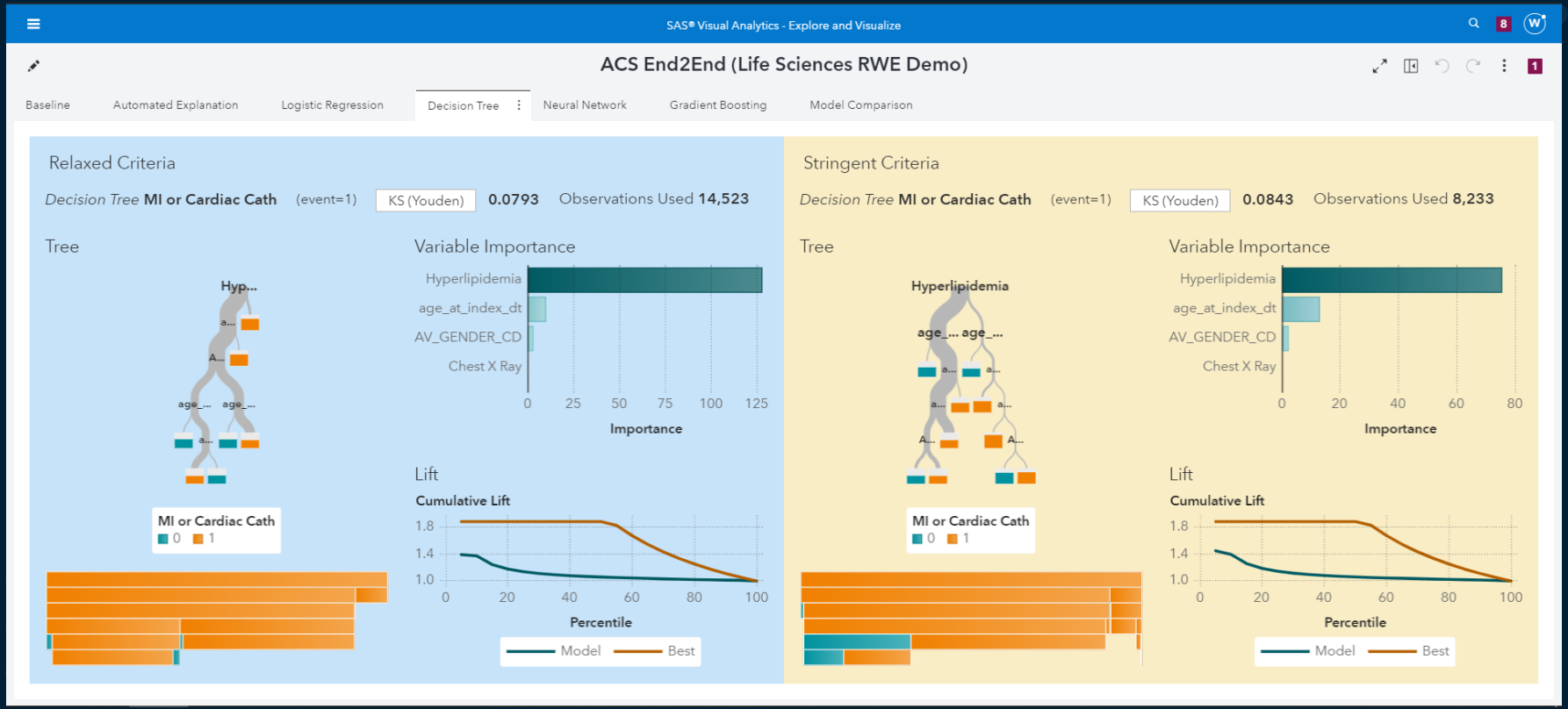
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Utilization of analysis results.
Automatic analysis function for output (AI function)



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Utilization of analysis results. Automatic analysis function for output (AI function)



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS® Clinical Enrollment Simulation (Overview)

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Most clinical trials fail to meet enrollment timelines.

Approximately **90%** of clinical trials do not meet patient enrollment targets on time.

Every day of delay in clinical trial completion can cost sponsors **millions**.

Missing clinical subject recruitment milestones can **negatively impact the reputation** of a Clinical Research Organization (CRO).

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Traditional Approach to Projecting Enrollment

Using Excel to Calculate Future

- Typically work backwards from goal
- Unrealistic assumptions from static estimates with no variability in inputs
- Doesn’t account for enrollment decays over time
- Approximately 20% of sites never enroll anyone
- Costs are not accounted for
- Difficult to track “what if” scenarios

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

SAS Helps You Optimize Study Start-up and Progress

Identify the right sites and optimal clinical strategy.

Ensure clinical trials get up and running quickly, efficiently and in keeping with your milestones for completion.

Company Confidential – For I
Copyright © SAS Institute Inc. All rights reserved.

Optimize Study Start-up and Progress

How SAS Delivers

- Powerful simulation analytics to quickly obtain insights
- Simulate different enrollment scenarios, costs and global regulatory timelines
- Better insights to inform decision making and trial strategy
- Easy data integration and real-time visualizations

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Our Approach

Discrete Event Simulation Yields Better Enrollment Projections

Develop Enrollment Projections

- Enter all assumptions and simulate multiple replications of the enrollment
- Show likelihood to achieve specific targets

Capture Variability

- Get a better understanding of likely outcomes
- Produce more accurate predictions for achieving targets

Realistic Enrollment Estimates

- Obtain peak and lower enrolment period windows to account for enrolment decay

Include Costs

- Include startup costs for countries and sites and per-patient costs
- See the cost impact of different scenarios

Scenario Tracking

- Compare and track multiple scenarios with varying inputs
- Test the impact of factors such as adding new sites and/or countries or changing baseline assumptions

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

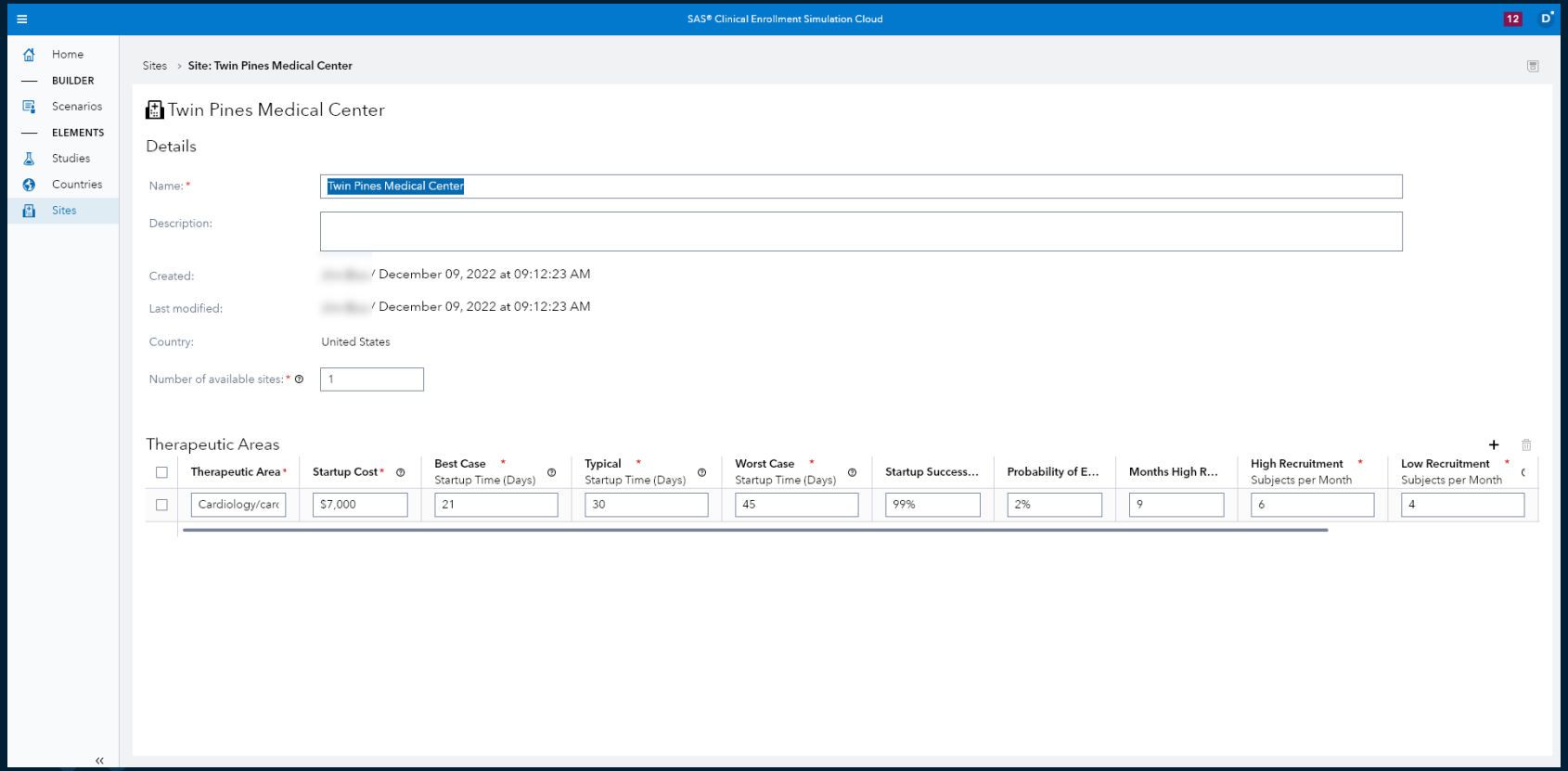
Simulating Enrollment output例

Calculate Probabilities of Success

			Success Rate Range		
Target Name	**Target Date**	**Success Rate**	**Best**	**Median**	**Worst**
Dates					
First Country Approval	Not provided	N/A	July 26, 2022	August 6, 2022	August 25, 2022
First Site Startup	August 31, 2022	46%	August 19, 2022	September 1, 2022	September 21, 2022
First Subject Screening	Not provided	N/A	August 23, 2022	September 5, 2022	September 25, 2022
First Subject Enrollment	September 15, 2022	89%	August 23, 2022	September 6, 2022	September 25, 2022
First Subject's First Visit	Not provided	N/A	August 30, 2022	September 13, 2022	October 2, 2022
First Subject's Last Visit	Not provided	N/A	February 19, 2023	March 5, 2023	March 24, 2023
End of Enrollment	December 31, 2023	69%	November 2, 2023	December 1, 2023	March 25, 2024
Last Subject's First Visit	Not provided	N/A	November 9, 2023	December 8, 2023	April 1, 2024
Last Subject's Last Visit	Not provided	N/A	April 30, 2024	May 29, 2024	September 21, 2024
Cost	**Target Cost**	**Success Rate**	**Best**	**Median**	**Worst**
Estimated Cost	$2,900,000	61%	$2,802,916	$2,885,824	$2,974,546

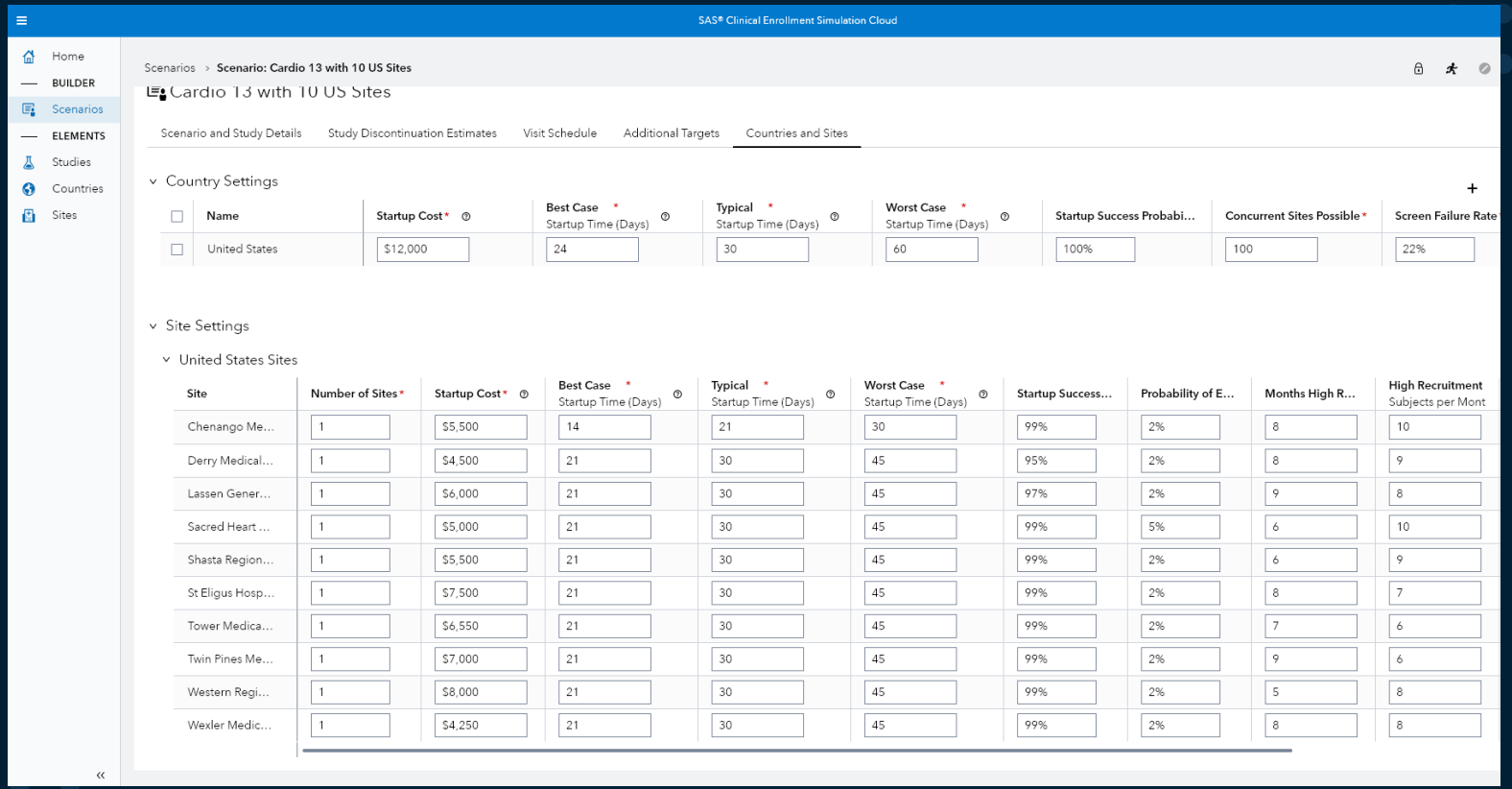
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Site Setup Values



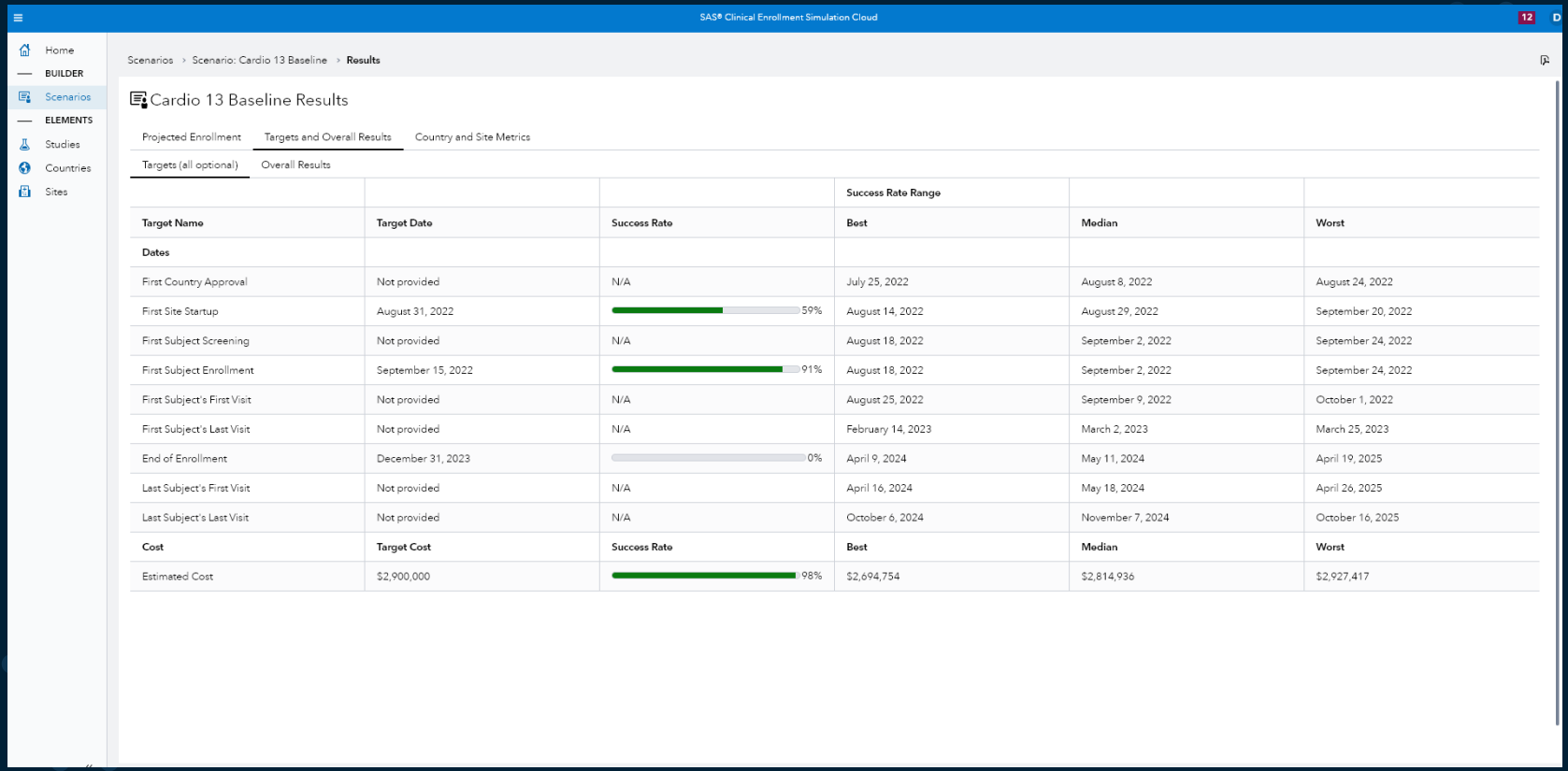
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Setting of simulation parameters for the entire clinical trial



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

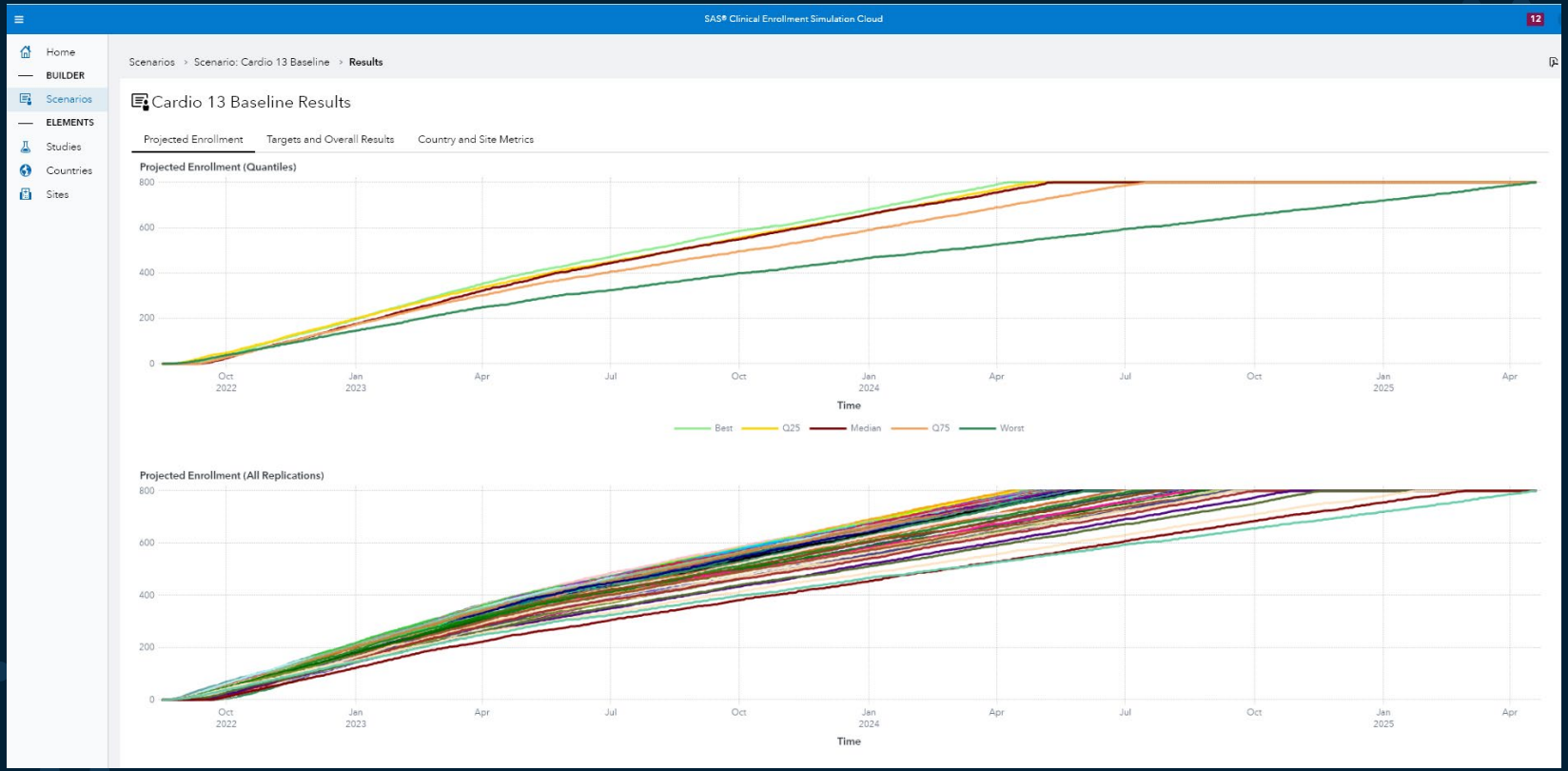
Simulation Result Screen



			Success Rate Range		
Target Name	**Target Date**	**Success Rate**	**Best**	**Median**	**Worst**
Dates					
First Country Approval	Not provided	N/A	July 25, 2022	August 8, 2022	August 24, 2022
First Site Startup	August 31, 2022	59%	August 14, 2022	August 29, 2022	September 20, 2022
First Subject Screening	Not provided	N/A	August 18, 2022	September 2, 2022	September 24, 2022
First Subject Enrollment	September 15, 2022	91%	August 18, 2022	September 2, 2022	September 24, 2022
First Subject's First Visit	Not provided	N/A	August 25, 2022	September 9, 2022	October 1, 2022
First Subject's Last Visit	Not provided	N/A	February 14, 2023	March 2, 2023	March 25, 2023
End of Enrollment	December 31, 2023	0%	April 9, 2024	May 11, 2024	April 19, 2025
Last Subject's First Visit	Not provided	N/A	April 16, 2024	May 18, 2024	April 26, 2025
Last Subject's Last Visit	Not provided	N/A	October 6, 2024	November 7, 2024	October 16, 2025
Cost	**Target Cost**	**Success Rate**	**Best**	**Median**	**Worst**
Estimated Cost	$2,900,000	98%	$2,694,754	$2,814,936	$2,927,417

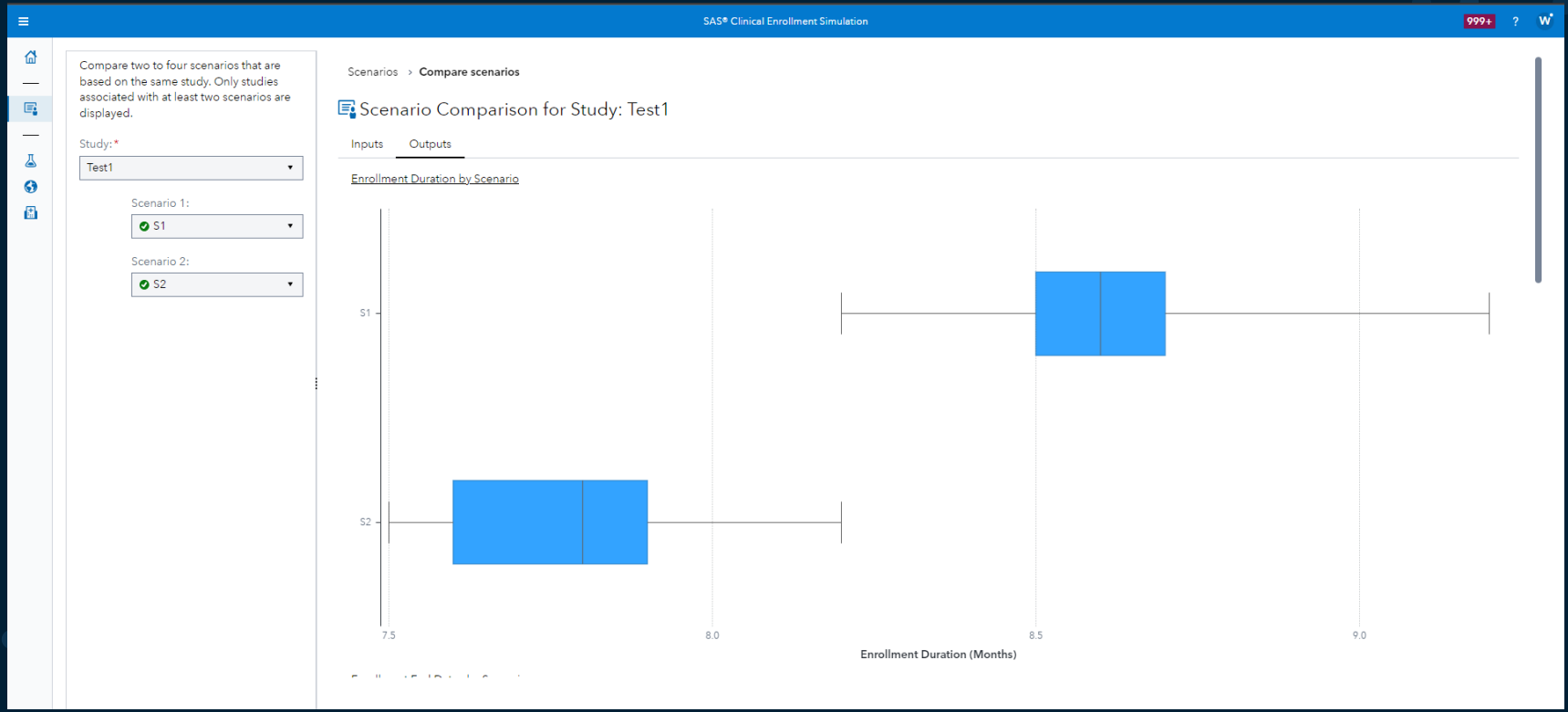
Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Simulation Result Screen



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Simulation Result Screen
Recruitment Period



Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.

Thank you!!

- Today's presentation may seem to be a bit busy, as we have explained several products in a short time. If you are interested, please feel free to contact us.

- Contact :

SAS Japan Consulting Service Supervisory Division

Life Science Team

Toshiaki Habu

Mail: toshiaki.habu@sas.com

Company Confidential – For Internal Use Only
Copyright © SAS Institute Inc. All rights reserved.