# Democratize advanced analytics for everyone while maintaining the integrity and reproducibility of evidence using SAS

SAS Institute Japan Ltd.

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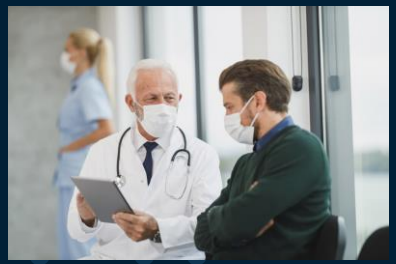
# Trend of Life Science Industry
## Real World Evidence

"Real World Evidence (RWE) is the clinical evidence regarding the usage and potential benefits, or risks, of a medical product derived from analysis of Real World Data (RWD)"

*(Framework for FDA's Real-World Evidence Program, 2018)*



FDA's Real World Evidence Program

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# Trend of Life Science Industry

## Acceleration of RWE Usage

**Changes in external environment**

**Sophistication of needed information & insight**

- Need for medical evaluation from various perspectives such as long-term outcomes and QOL
- Need for actual clinical information that contributes to personalized medicine
- Need for precise understanding of pathology for more complex and sophisticated treatment

**Increase of opportunities to generate insight through data analysis**

- Advances in machine learning and other advanced analytics
- Increased data processing speed
- Development of a data utilization platform as a national policy
- Creation of diverse data, from pre-disease to post-disease

**Application examples**

**R&D-related departments**
(drug discovery, clinical development, etc.)

- ✓ Profiling of patient attributes based on diverse information
- ✓ Development of clinical prediction models for each patient attribute
- ✓ Identification of unmet medical needs and characterization of the patient profile
- ✓ Realization of single-arm study

**Other departments**
(MA, Safety, Sales, etc.)

- ✓ Detailed description of Patient Journey to evaluate business potential and refine product positioning
- ✓ Early establishment of product profile/economic value under actual practice
- ✓ Propose disease management based on the behavioral characteristics of patients

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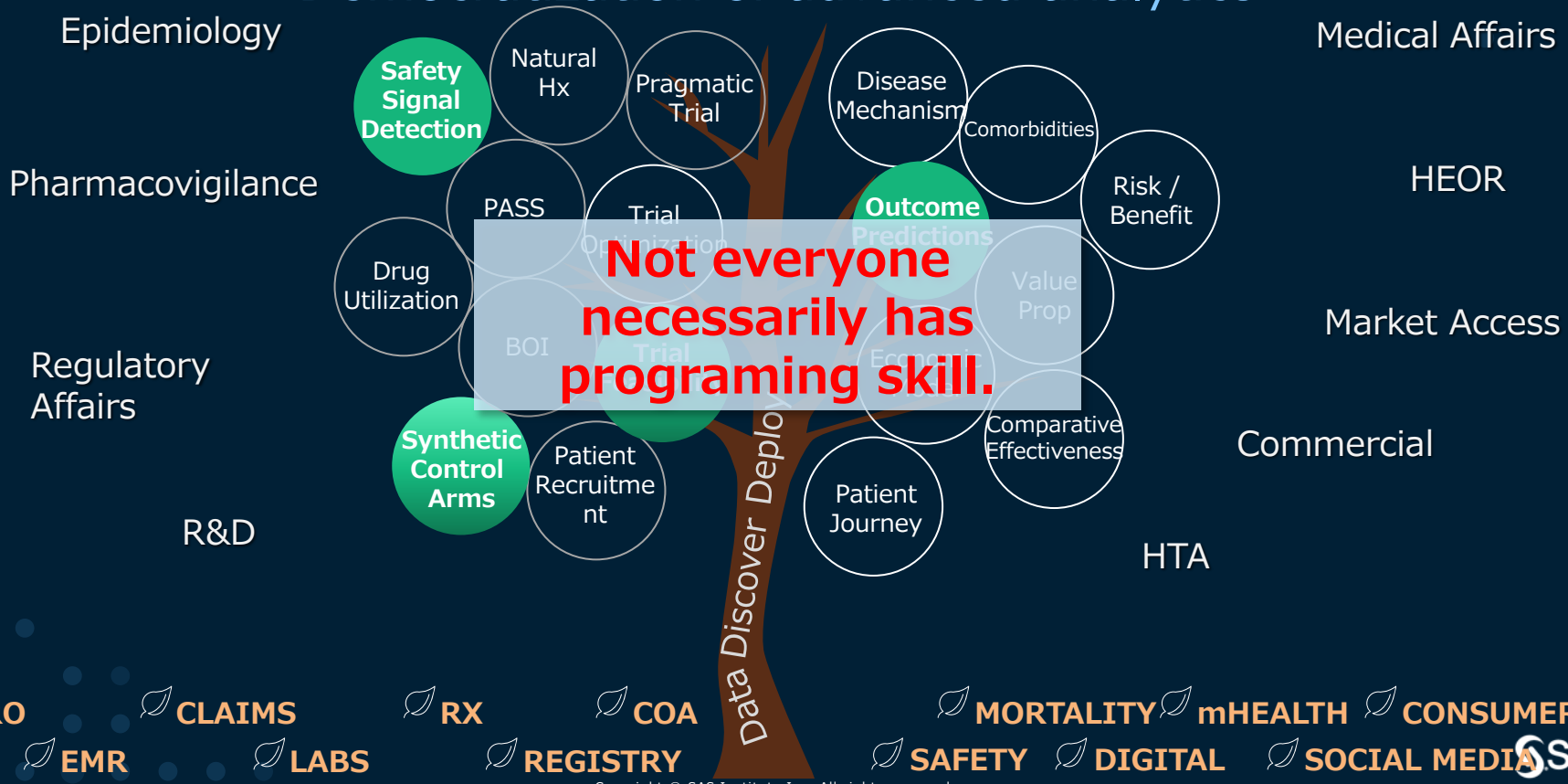
# Challenges for RWE

## Democratization of advanced analytics

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# Challenges for RWE
## Typically, big data

Examples of Japanese RWD

| Type | DB name | Data provider | Total number of registered patients |
|---|---|---|---|
| Provider -base | MIA | [illegible] | About **20M** |
| | RWD Database | [illegible] | About **21M** |
| | EBM Provider® | [illegible] | About **33M** |
| Payer -base | National Database | MHLW | About **120M** |
| | JMDC Claims Database | JMDC | About **10M** |
| Pharmacy -base | JMIRI database | INTAGE Real World | About **39M** |
| | IQVIA NPA data | IQVIA Solutions Japan | About **33M** |

**Existing H/W cannot support and then must leverage the latest technologies.**


Source: Pharmacoepidemiology & Database Taskforce, Japanese Society for Pharmacoepidemiology. Survey of Japanese databases in Japan available for clinical/pharmacoepidemiology. (Accessed: October 21, 2021)

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# Challenges for RWE
## Reliability of analysis results

### Pfizer Uses EHR Data to Support Expanded Indication for Breast Cancer Drug

***"The approval is ba***

*records and post-ma*

*male patients sourc*

*Insurance database,*

*database and the Pfizer global safety database"*

**More reliability of analysis results is needed as RWE plays critical role.**


https://www.raps.org/news-and-articles/news-articles/2019/4/pfizer-uses-ehr-data-to-support-expanded-indicatio

Reference: "*Real World Evidence in Clinical development, life cycle management and/or repurposing*"
( Julijana Dukanovic, Andrew Leary – Dr. Regenold GmbH, SAS HLS Exec Forum Basel, 25 June 2019 )

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# SAS Health: Cohort Builder

## The solution specialized for RWE

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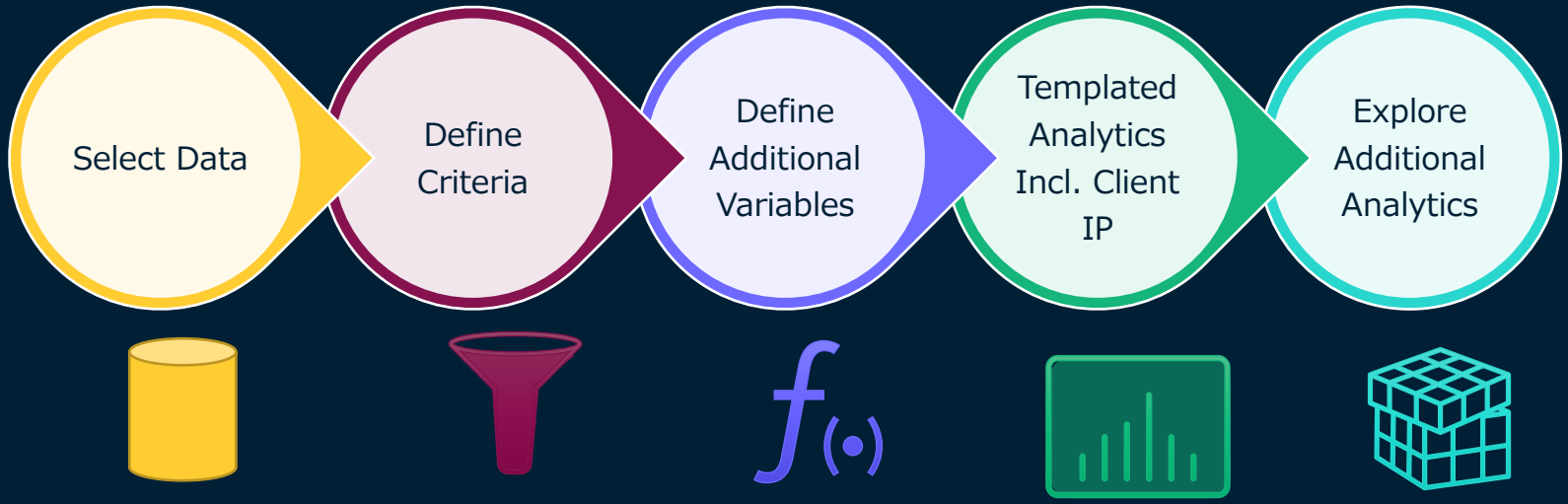
# Cohorts Are *Not* the Goal!!!

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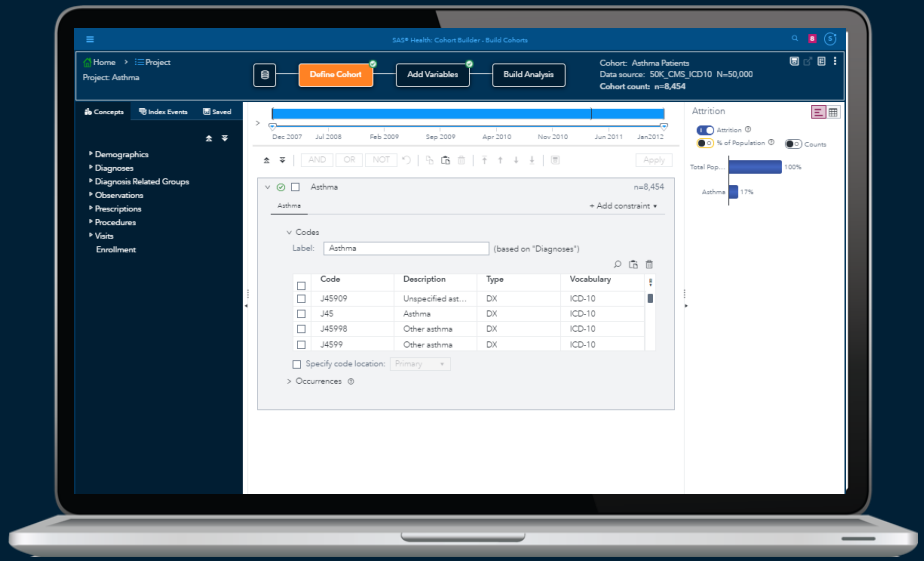
# SAS® Health

## 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

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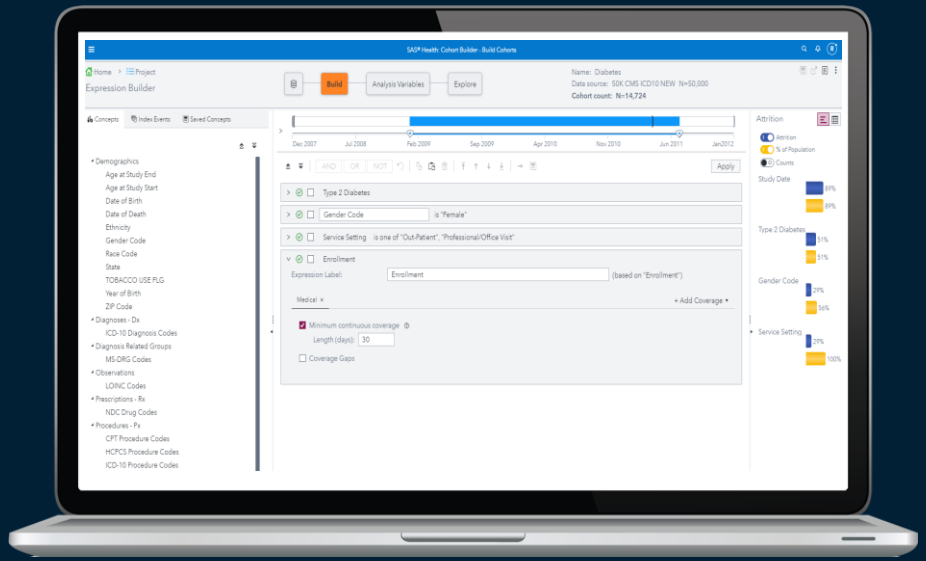


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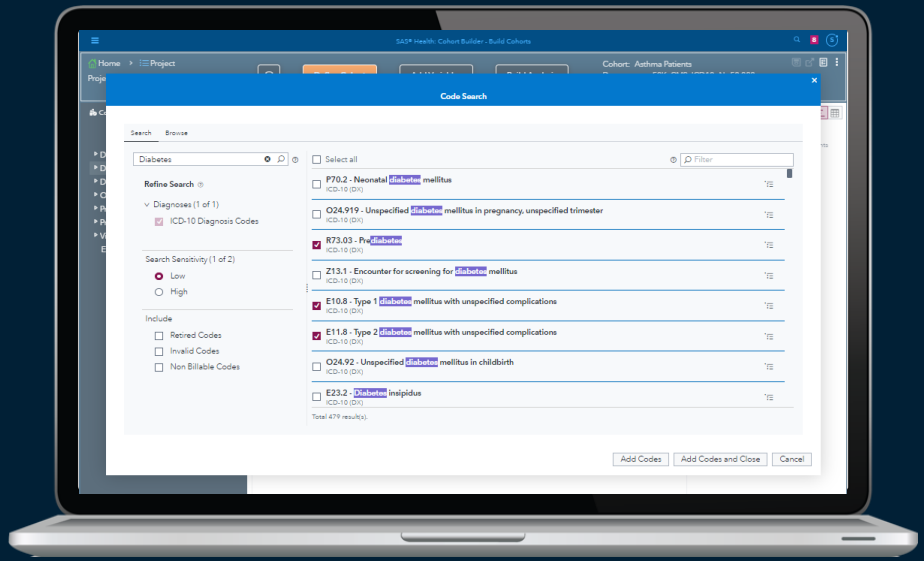


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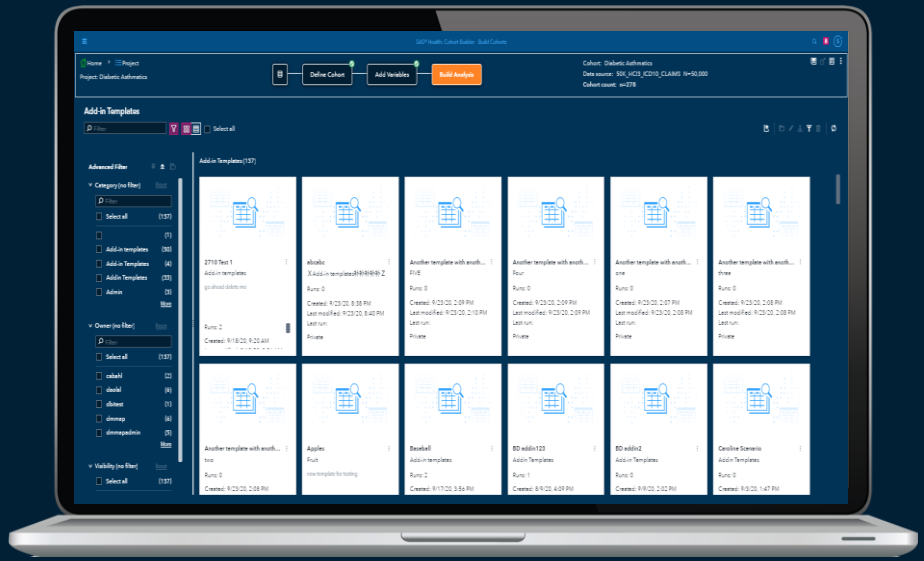
- Leverage and extend your own analytic assets

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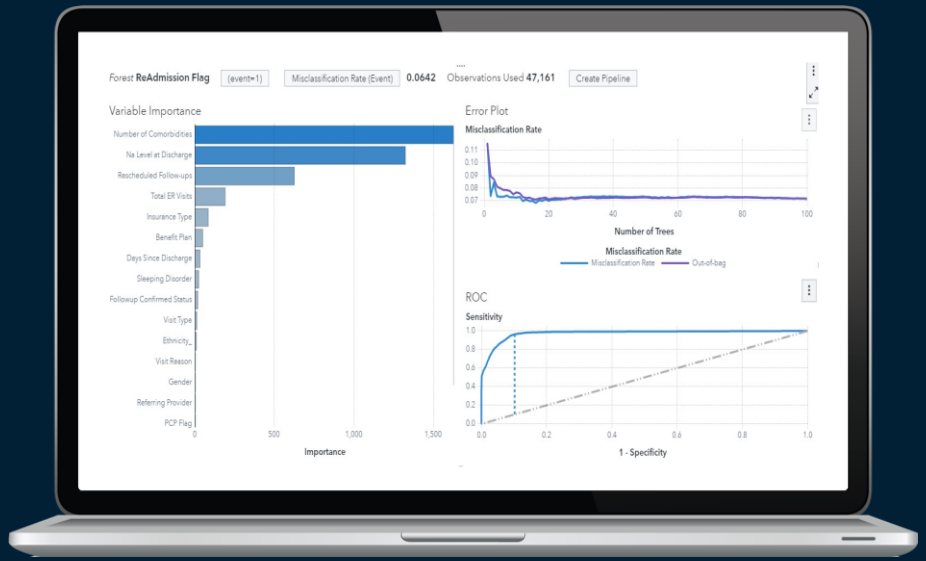
- Leverage and extend your own analytic assets
- Gain fast, easy access to advanced health analytics and visualizations

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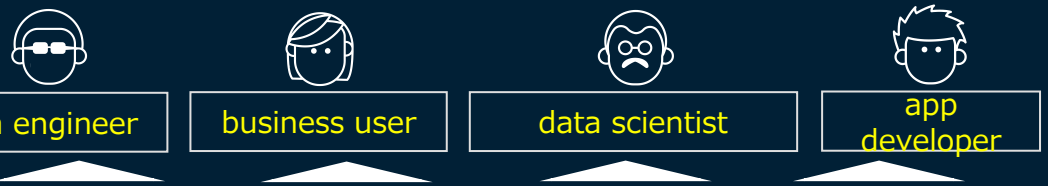
# SAS Viya

Provide the entire set of functions and software required to promote data utilization on a single platform




stream
Cloud-DB
Hadoop
RDB
Data Source

data management | analytics | visualization

Search and Insight

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

Data preparation

Access・Data catalog and data processing・Cleansing

Deployment and application

Model management, automation and monitoring

In-memory analysis engine | integrated repository | parallel distributed processing

Automation, Security, Governance, Metadata Management, Workflow

cloud

User Interface / API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# Two Viya engines including SAS Compute and CAS

Viya can support not only big data & AI/ML but also traditional bio-stat programs developed by SAS 9.

SAS® Viya



For traditional statistical analysis

For big data handling, Simulation, AI & ML

SAS 9.4 code processing engine

Next-generation engine for in-memory, distributed processing

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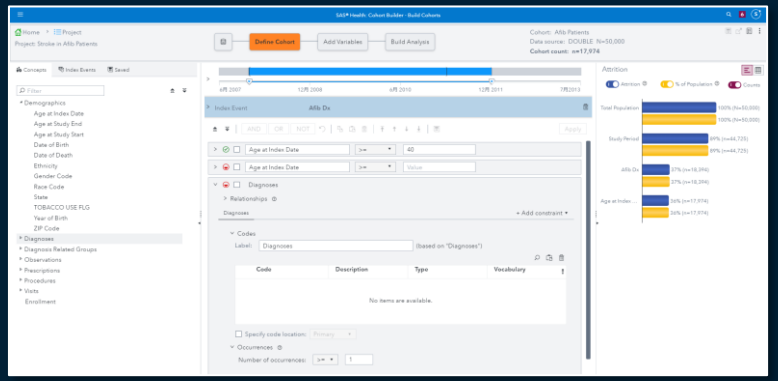
# How can you use *SAS Health: Cohort Builder*?

## Short demo

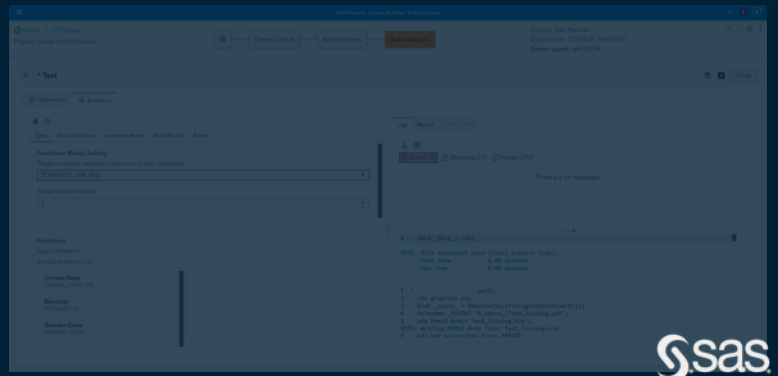
### Cohort Builder

- *To apply one of inclusion criteria using GUI*
  - The patients whose ages are over 40 when diagnosed as “atrial fibrillation” (≒index event)
  - Also, the patients are males
  - However, the patients are not hypertension



### Add-in

- *To execute advanced analytics with no / low codes*
  - To predict patients who will experience the stroke



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# Project Information: Stroke in Afib Patients

Manage Cohorts | Manage Project Add-ins

Filter

Clear Filters

- Type
  - Index Event Cohort (5)
  - Population Cohort (1)
- Data Sources
  - DOUBLE (6)
- Index Event
  - Afib Dx4 (1)
  - Afib Dx5 (1)
  - Afib Dx7 (1)
  - Afib Dx8 (1)
  - Afib Dx9 (1)
- Owner
  - sasdemo02 (1)
  - sasdemo01 (5)

## Population Cohorts

| Status | Name | Description | Count | Data Source | Owner |
|---|---|---|---|---|---|
| | Afib Patients4 | Created on Sep 2, 2021, 10:53:32 AM | | DOUBLE | sasdemo01 |

## Index Event Cohorts

| Status | Name | Description | Count | Index Event | Data Source | Owner |
|---|---|---|---|---|---|---|
| ✓ | Afib Patients2 | Created on Sep 1, 2021, 1:33:54 PM | 2,400 | Afib Dx4 | DOUBLE | sasdemo02 |
| ✓ | Afib Patients3 | Created on Sep 2, 2021, 8:44:45 AM | 2,400 | Afib Dx5 | DOUBLE | sasdemo01 |
| ✓ | Afib Patients5 | Created on Sep 14, 2021, 2:05:45 PM | 2,400 | Afib Dx7 | DOUBLE | sasdemo01 |
| ✓ | Afib Patients6 | Created on Sep 28, 2021, 10:19:54 AM | 2,400 | Afib Dx8 | DOUBLE | sasdemo01 |
| ✓ | Afib Patients7 | Created on Oct 14, 2021, 3:39:22 PM | 2,718 | Afib Dx9 | DOUBLE | sasdemo01 |

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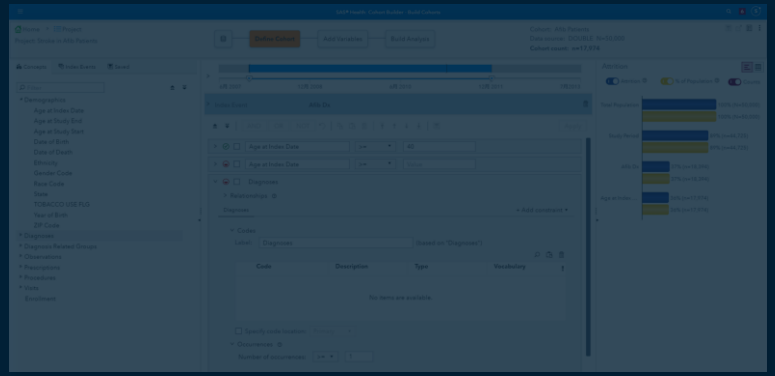

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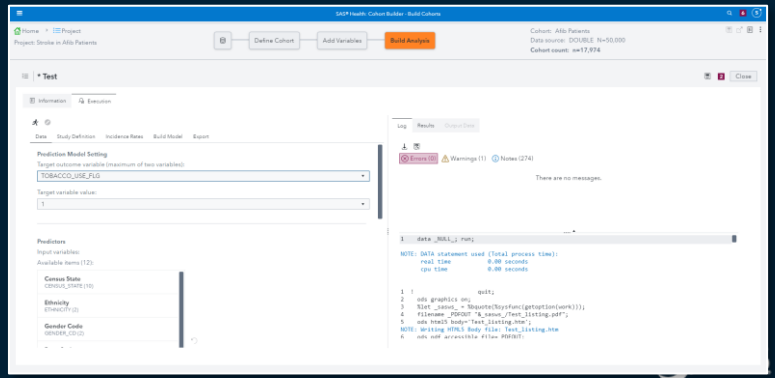


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## Add-in Templates

Filter | Select all

**Advanced Filter**

Category (no filter) Reset
- Select all (15)
- Add-in templates (8)
- Patient-level Outcomes Predictive Model (3)
- Project-level Template (4)

Owner (no filter) Reset
- Select all (15)
- sas.healthcohortservice (1)
- sasdemo01 (13)
- sasdemo02 (1)

Visibility (no filter) Reset
- Select all (15)
- Private (6)
- Public (9)

Add-in Templates (15)

**Cohort Characterization**
Add-in templates
Owner: sas.healthcohortser...
Runs: 6
Last modified: 4/2/21, 4:32 PM

**Cohort Characterization_ND**
Add-in templates
Owner: sasdemo01
Runs: 1
Last modified: 4/8/21, 10:23 AM

**Example Report Data Genera...**
Add-in templates
Example of an add-in created to take cohort information to do the following:
Owner: sasdemo01
Runs: 1
Last modified: 4/8/21, 10:24 AM

**haf_addin_cohort_model_inp...**
Patient-level Outcomes Predictive...
Owner: sasdemo01
Runs: 0
Last modified: 8/16/21, 9:36 AM

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# Merit about SAS Health: Cohort Builder

- Not only skilled programmers but also domain experts such as epidemiologists can execute cohort building & advanced analytics
  - Trials and errors in development of research question
- Validated programs can be widely used within organizations
- High performance visualization & analytics can be available through leveraging SAS Viya

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# SAS Office Analytics: Enterprise Guide and Access Interface

## The solution specialized for SAS programing/DB

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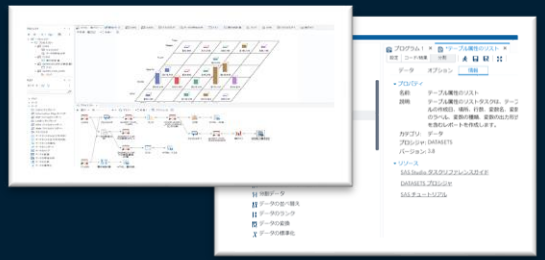
# Solution Overview: SAS Office Analytics

## Support not only power but also light users for efficient collaboration

heavy user

Creating efficient analysis flows with GUI tools

(1) Enterprise Guide



2) SAS Studio

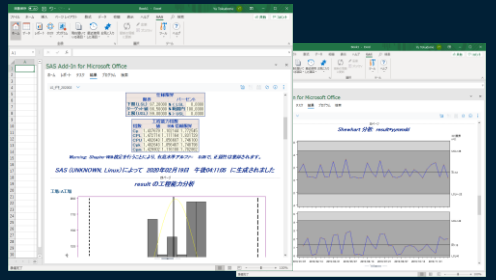
Development of SAS programs using a web browser

light user

3) Add-in for Microsoft Office

Easy data analysis with Office add-ins

- ✓ Call up the shared flows from familiar tools such as Excel, and analyze it while changing conditions for filtering, etc.



SAS Office Analytics

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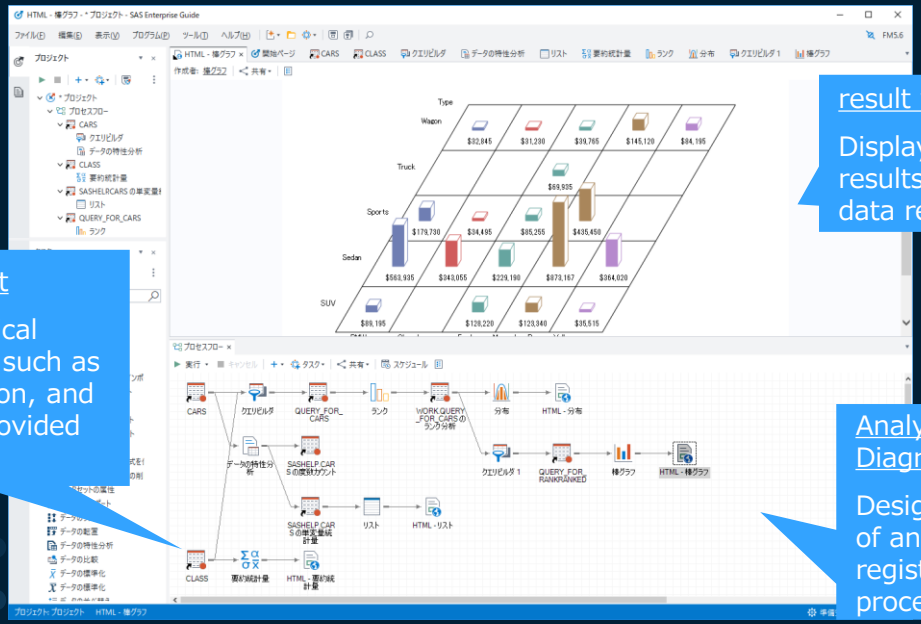
# ①SAS Enterprise Guide

## Versatile tool covering data preparation, visualization & analysis

- SAS Enterprise Guide is a highly ad-hoc analysis tool that covers a wide range of data processing functions, reporting functions such as tabulation and graphing, and even statistical analysis functions.
- The analysis process is visualized as a flow, which makes it easy to share, prevents dependency, and promotes democratization of data and analysis



**Analysis Task List**

Advanced analytical functions of SAS such as query, aggregation, and prediction are provided as a menu.

**result window**

Display analysis results and perform data review

**Analysis Process Flow Diagram**

Design/management of analysis flow and registration of stored processes

### Main Functions

- data processing
- Advanced analysis using statistical methods
- Quick statistics (data profiles)
- Ad hoc data exploration
- Various graphs
- Report writing
- Stored process creation
- Analysis Process Flow Sharing
- Create/edit/run SAS code
- Project management in conjunction with GIT

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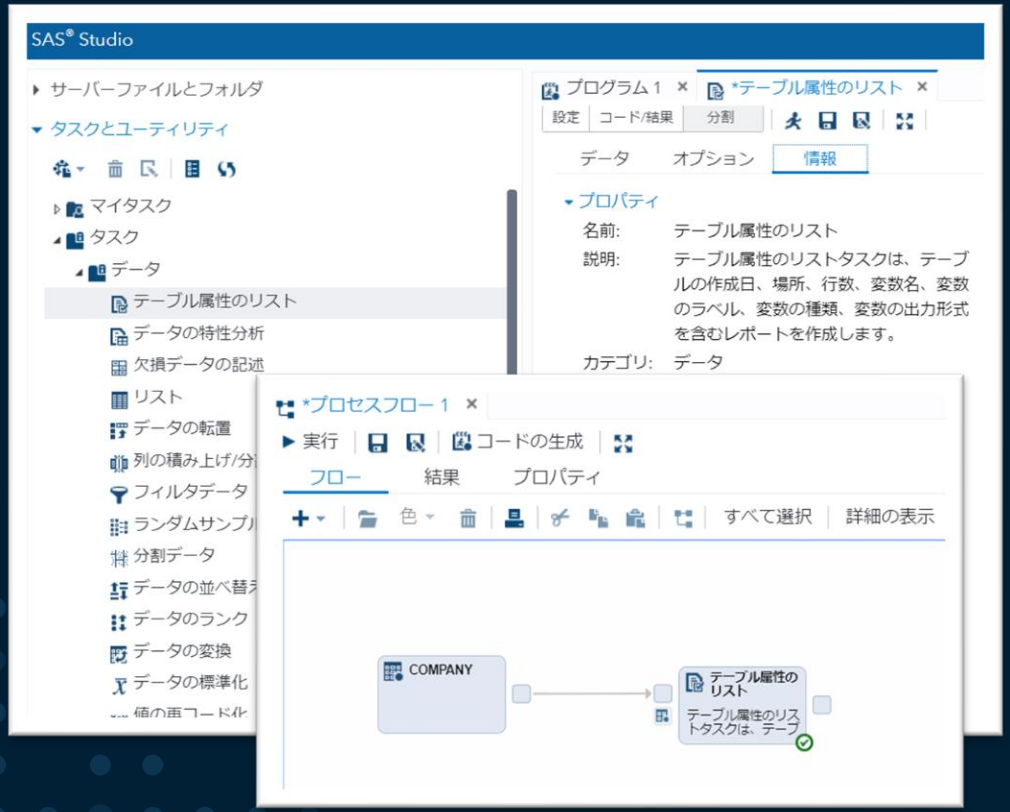
# ②SAS Studio

## Web-based highly functional SAS editor




- ✓ Access from a web browser. SAS programming on the go, even from a Mac.
- ✓ Similar feel to DMS (conventional SAS screen)
- ✓ Various program support functions
  - ✓ input completion function
  - ✓ Automatic display of syntax help
  - ✓ Tasks such as graphs
  - ✓ SQL edit screen
  - ✓ Customizable code snippets
  - ✓ process flow
- ✓ Processing is done on the server, so high performance processing
- ✓ SAS execution logs are automatically output to the server to ensure security

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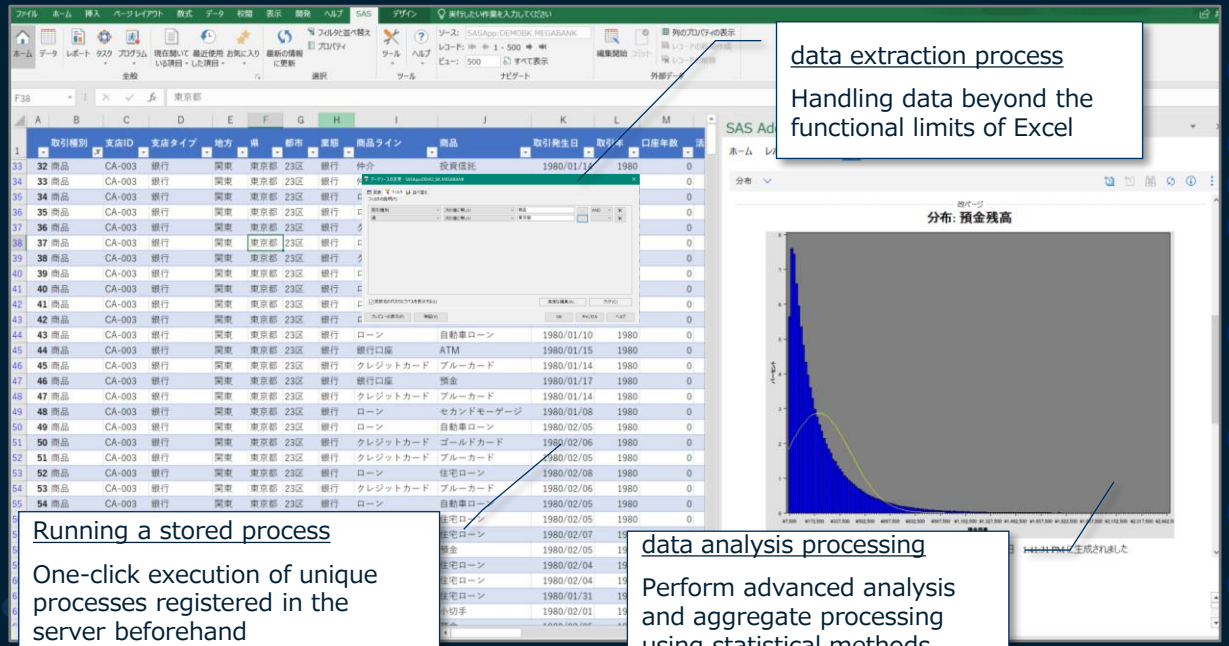
# ③SAS Add-in for Microsoft Office

## Analyze against server data from familiar Excel

It is possible to extract SAS data on the server and execute SAS programs on the server from MS Office tools, and can be used by a wide range of users regardless of their skills.




### Main Functions

- Extraction of data on the server (no limit on the number of rows)
- ad hoc query
- Advanced analysis using statistical methods
- Execute custom processes registered with the server, and
  Get the latest analysis results
- Create optimal graphs automatically by simply selecting items.
  Graph output in Excel format
- Graph gallery with a list of graphs that can be created
- Save, share, and re-execute settings and results of analysis processes, etc.
- Free report creation by linking with Office functions
- Data exploration and reporting with SAS Visual Analytics reporting integration

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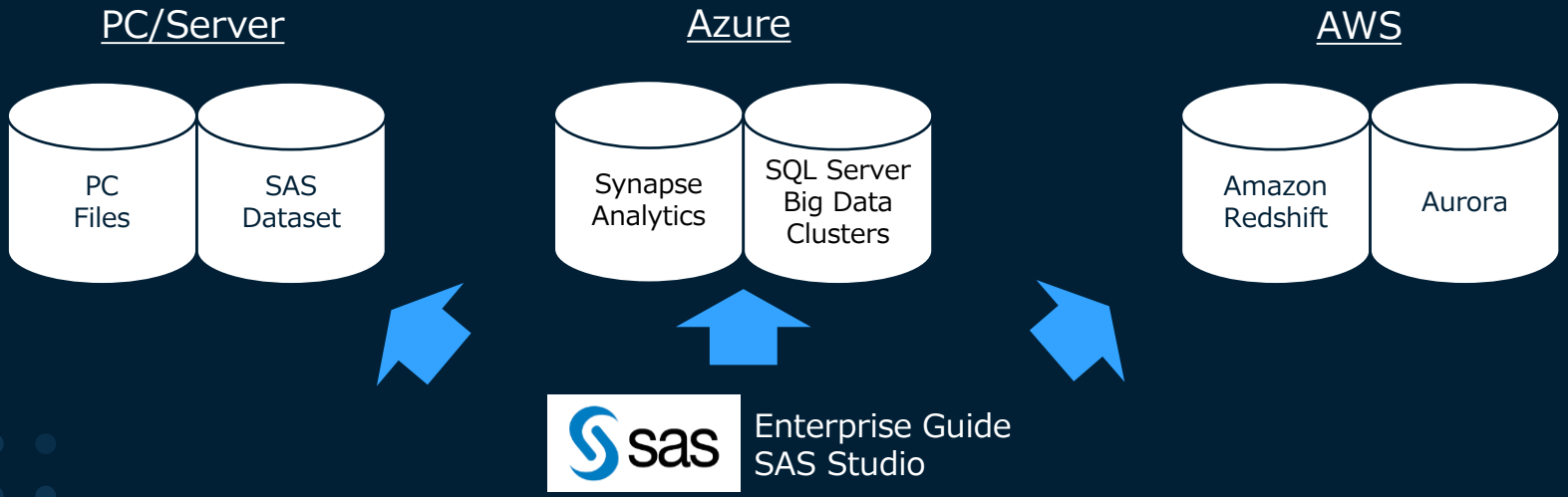
# ④Other function : SAS Interface

- Office Analytics can Access to databases.
  - When install SAS Office Analytics and SAS Interface modules, you can use databases via SAS.
  - For example:

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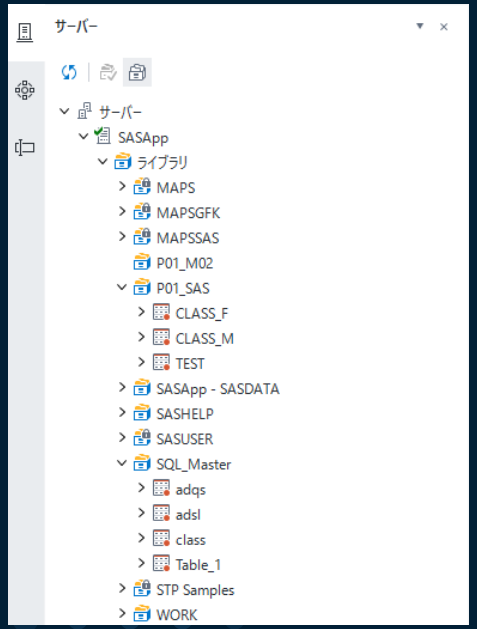
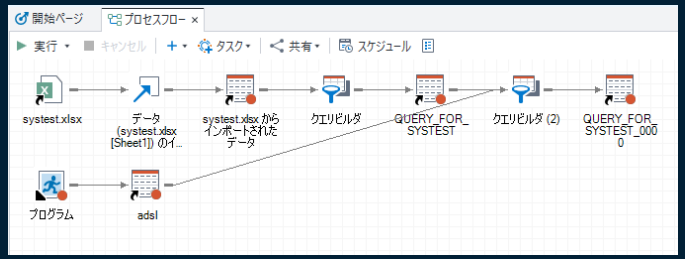
# ④Other function : SAS Interface
# How to use databases

- It is so easy. After access modules installed, you only set up the library. The following sample is used in Enterprise Guide.

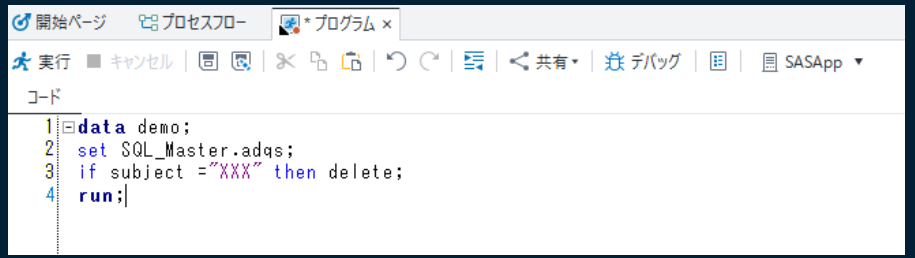
## 1. Resisted library




## 2-a. GUI on Enterprise Guide




## 2-b. SAS program

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# ④Other function : SAS Interface Merit about SAS Office Analytics

- We don’t need to learn a new program language. We can use SAS programing in Enterprise Guide or SAS Studio.
- Using SAS Enterprise Guide, we don’t need programing skill. Only GUI.
- Collaborate any other department via SAS product.
  - We can share the SAS program and SAS datasets via SAS Server.

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# Thank you

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