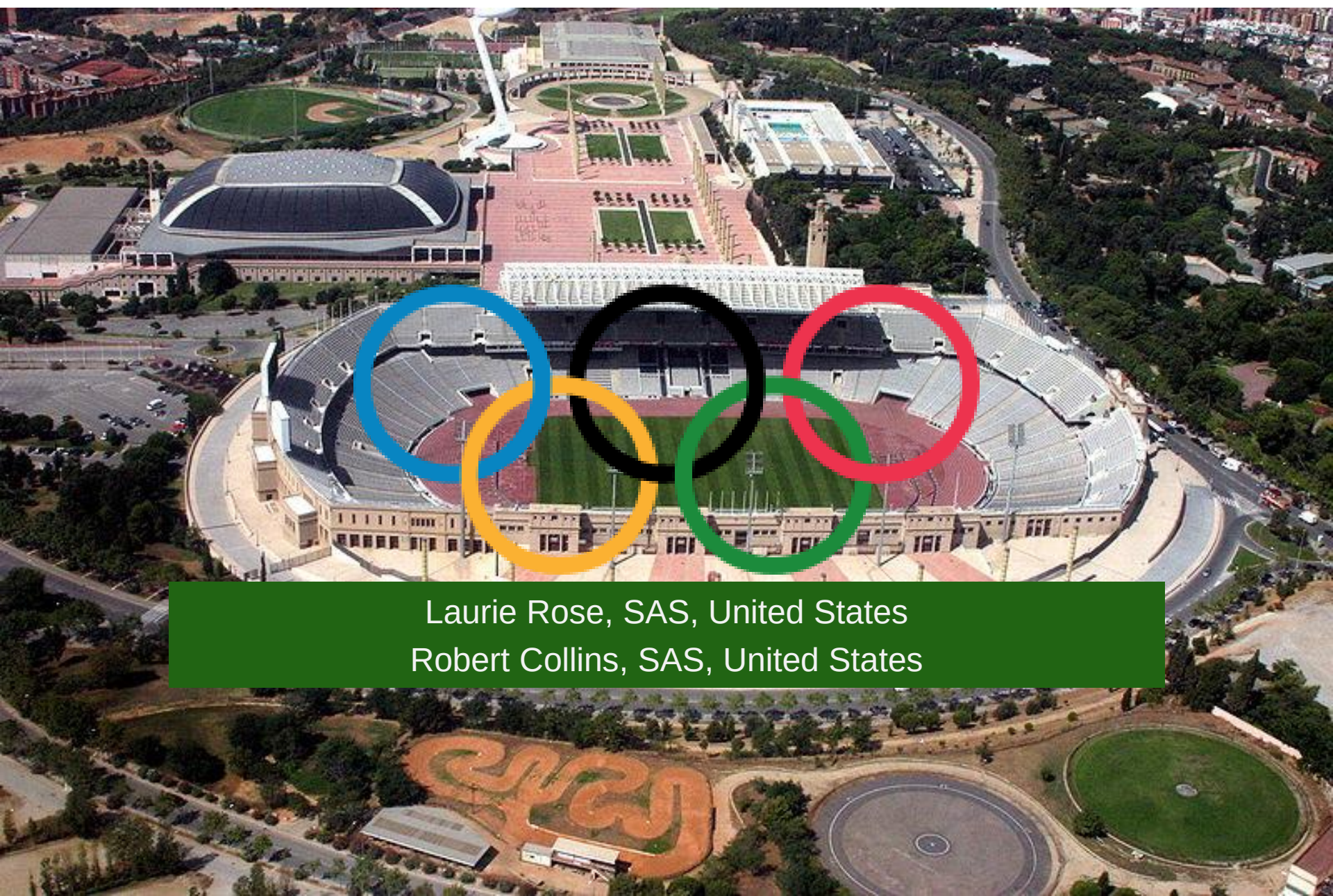
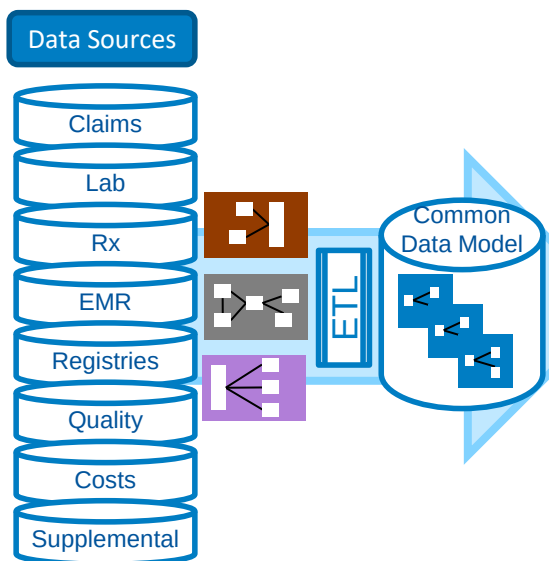


THE PLAYBOOK: FROM REAL WORLD DATA TO REAL WORLD INTELLIGENCE

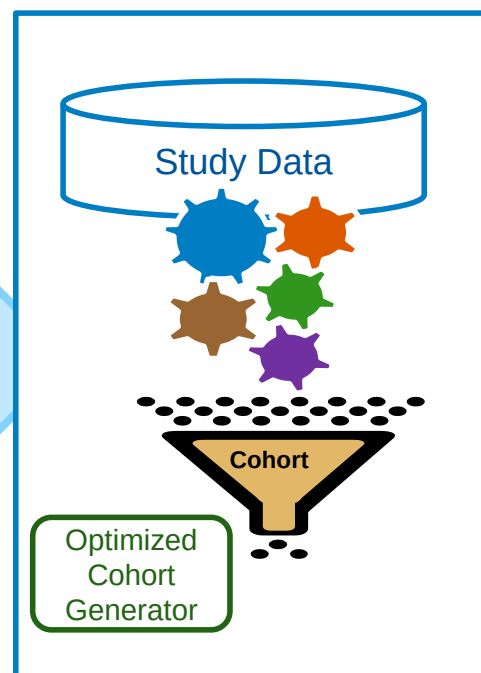


Laurie Rose, SAS, United States
Robert Collins, SAS, United States

THE PLAYERS



SKILLS AND DRILLS



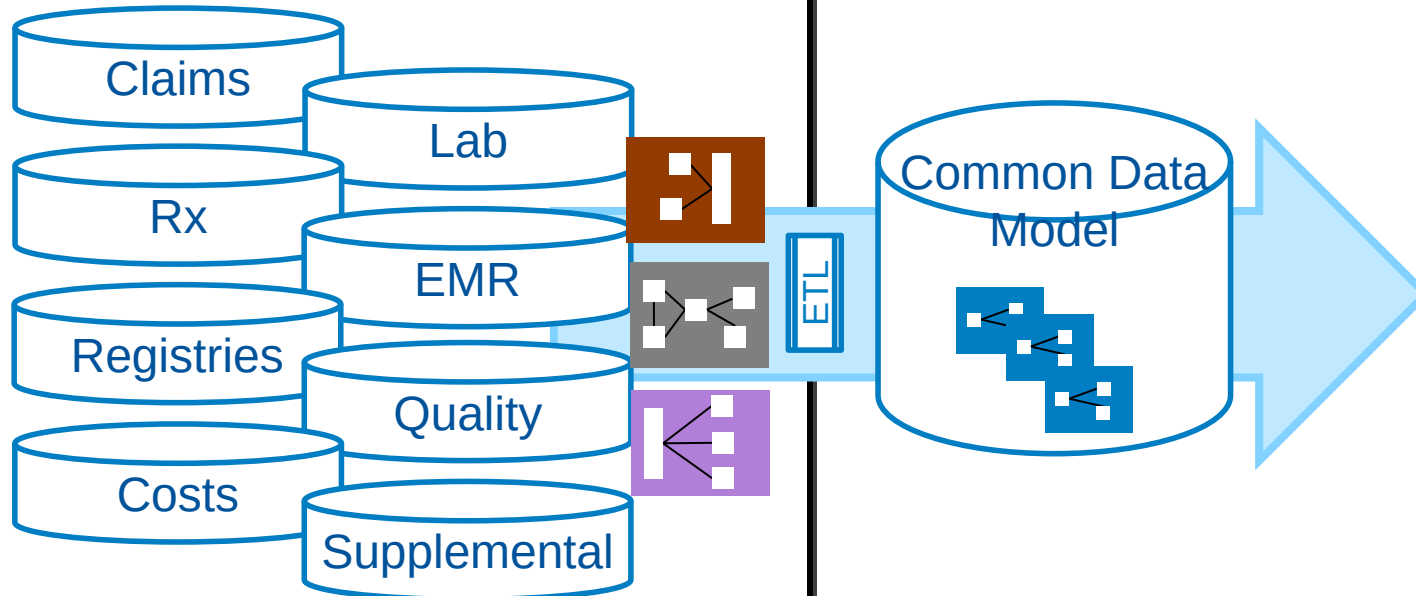
THE PLAYS



← **RULES OF THE GAME (REGULATORY)** →

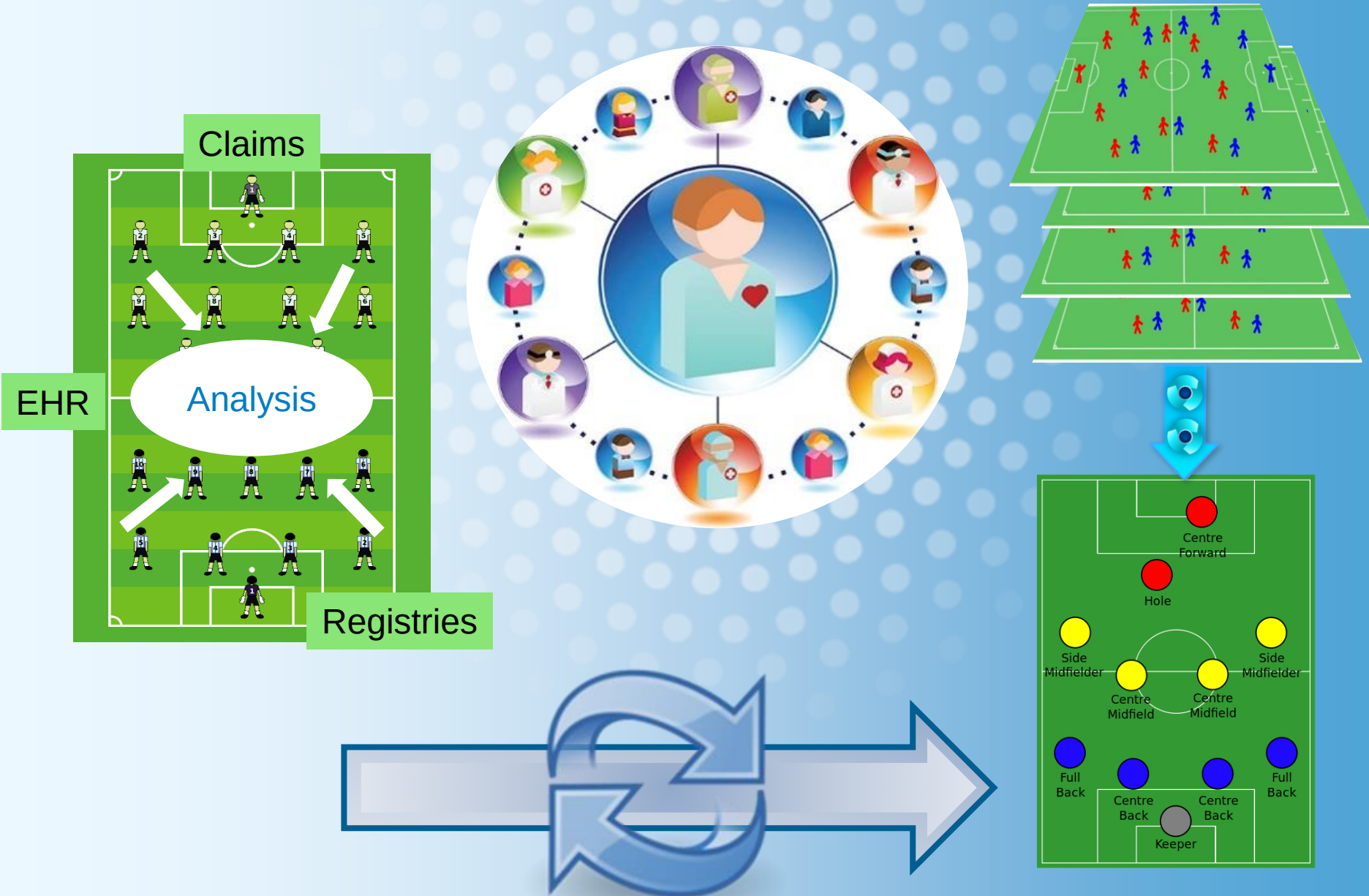
THE PLAYERS

Data Sources



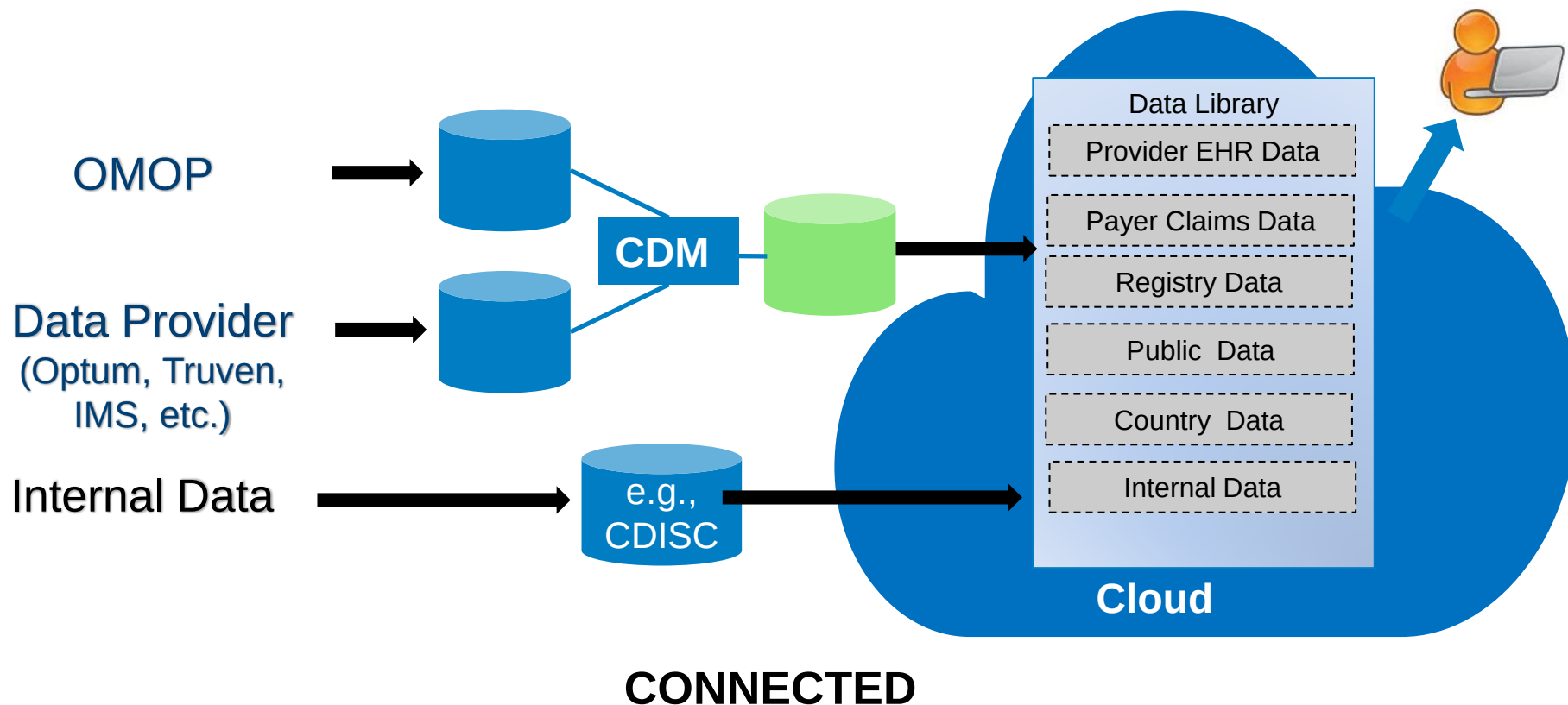
COMMON DATA MODEL

CHARACTERISTICS

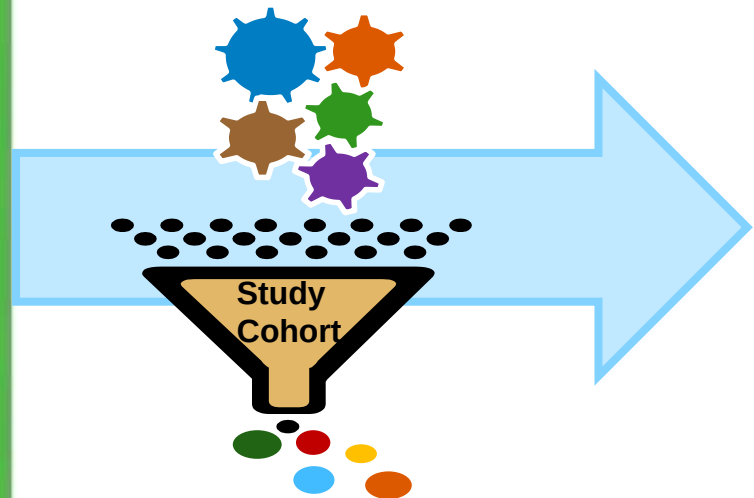
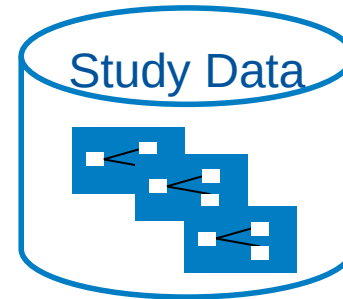
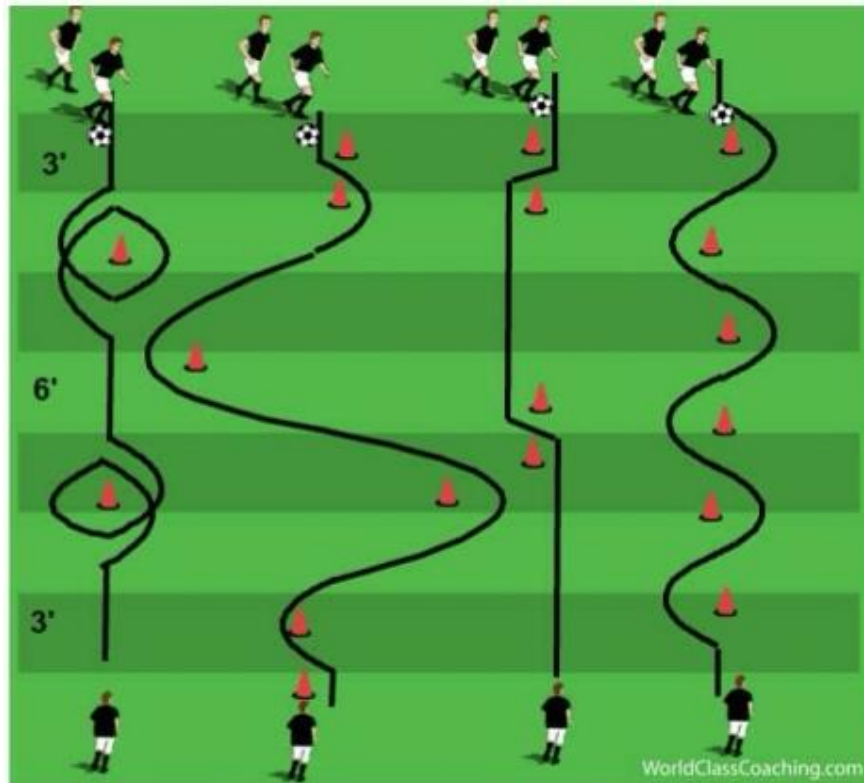


COMMON DATA MODEL

FOUNDATION FOR STREAMLINED COMPARATIVE ANALYTICS



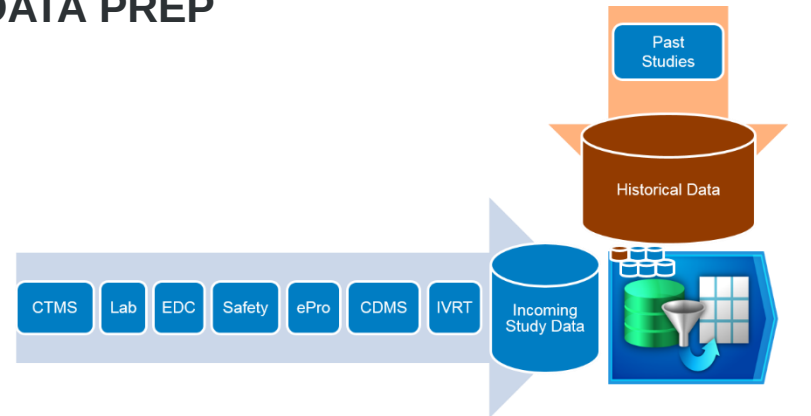
SKILLS AND DRILLS



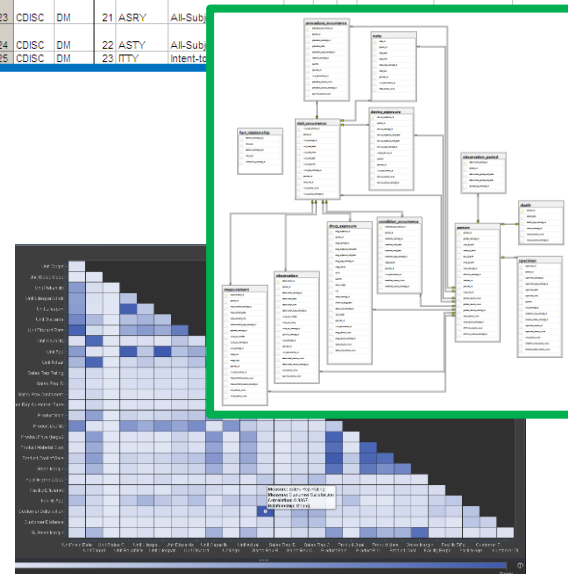
Optimized Cohort Generator

SKILLS AND DRILLS CHALLENGES OF DATA PREP

- Create event-driven scenarios and population cohorts
- Delivery of real-time and historical information
- Integration of multiple systems
- Differentiation of RWD and randomized clinical trial (RCT) data
- Correlate clinical and financial impacts on patient health



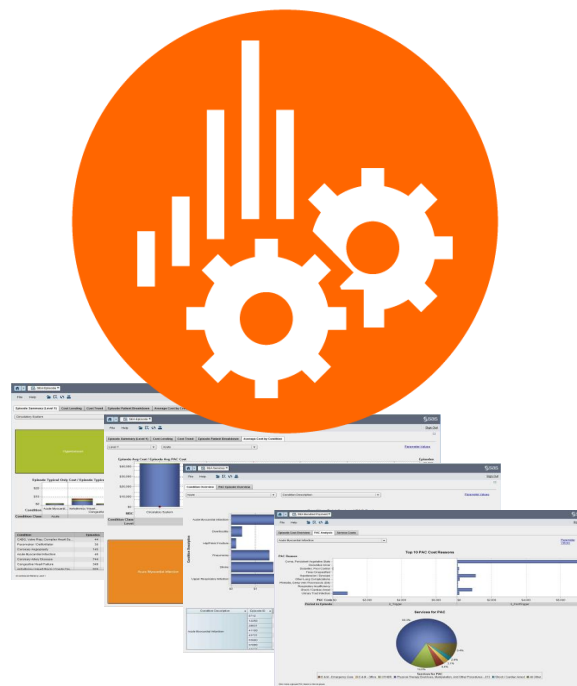
1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	CDISC	DM	1	STUDYID	Study Identifier	Char	20	1			CRF	Identifier	Req	N	
3	CDISC	DM	2	DOMAIN	Domain Abbreviation	Char	40	2	DOMAIN	SPONSOR	Derived	Identifier	Req	N	
4	CDISC	DM	3	SUBJID	Unique Subject Identifier	Char	40	2			Sponsor Defined	Identifier	Req	N	Concat
5	CDISC	DM	4	SUBJID	Subject Identifier for the	Char	40					Topic	Req	N	
6	CDISC	DM	5	RFSTDT	Subject Reference Start	Char	19		ISO8601		Sponsor Defined	Timing	Exp	N	Equal to random
7	CDISC	DM	6	RFENDTC	Subject Reference End	Char	19		ISO8601		Sponsor Defined	Timing	Exp	N	Equal to last will be
8	CDISC	DM	7	SITD	Study Site Identifier	Char	20				CRF or Derived	Record Qualifier	Req	N	
9	CDISC	DM	8	INVID	Investigator Identifier	Char	20				CRF or Derived	Record Qualifier	Perm	N	
10	CDISC	DM	9	INNVAM	Investigator Name	Char	40				CRF or Derived	Synonym Qualifier	Perm	N	
11	CDISC	DM	10	BRTHDTC	Date/Time of Birth	Char	19		ISO8601		CRF or Derived	Result Qualifier	Perm	N	
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	CDISC	DM	21	ASRY	All-Sub							Result Qualifier	Perm	Y	Subject rule
24	CDISC	DM	22	ASTY	All-Sub							Result Qualifier	Perm	Y	Subject
25	CDISC	DM	23	ITTY	intent-to							Result Qualifier	Perm	Y	Subject



ANALYTIC CONSIDERATIONS WITH REAL-WORLD DATA

New-found importance outside of randomized clinical trial data:

- Data quality issues
- Missing values
- “Big data”
- Treatment group bias
- Repeated measures
- Varying durations of treatment and censoring
- Time-varying predictors
- Confounding and random effects
- Resource valuation
- Skewness (e.g., costs)



THE PLAYS

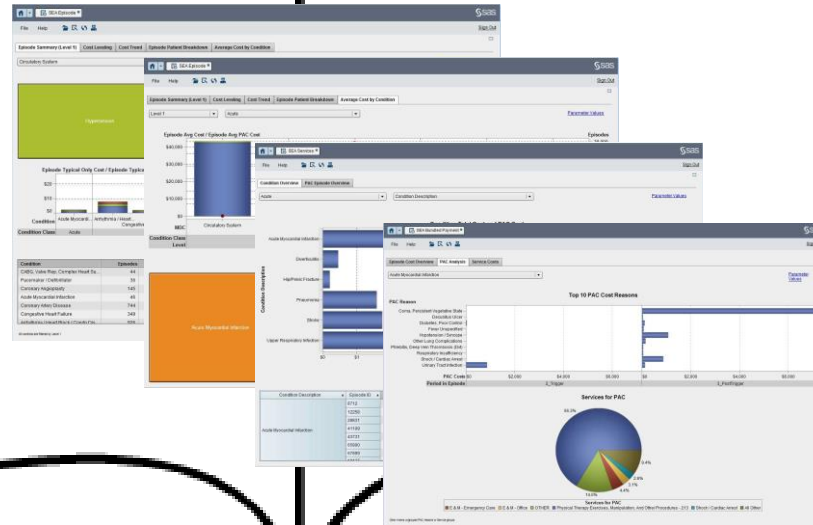
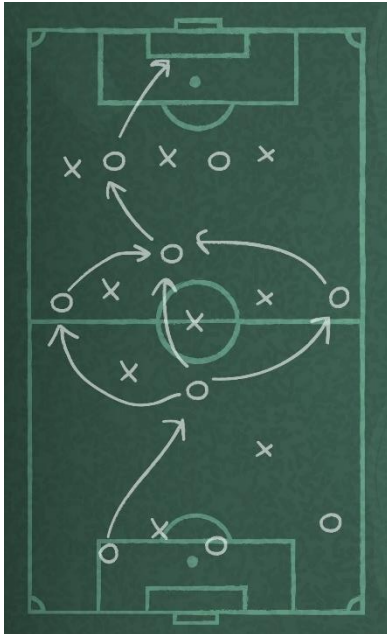
Export Data, Visualize,
Analyze, Explore



Cohort Subset



Analytical Tables



APPLICATIONS OF REAL-WORLD EVIDENCE

- Care pathways and point-of-care guidance
- Policy
- Extend therapy decisions beyond safety and efficacy to include economic, clinical and humanistic outcomes
- Formulary management
- Resource allocation
- Pharma
 - Stages
 - Development
 - Launch
 - In-Market
 - Areas
 - HEOR & safety
 - Commercial & brand teams
 - R&D

PROPENSITY-SCORE MATCHING

SAS® Studio

Server Files and Folders

- sea31-server
 - Folder Shortcuts
 - Files (Home)
 - SAS
 - sasuser.v94
 - sea_services
 - database_sea31
 - ojdbc7.jar
 - seademo_system_users_0
 - setupSEASrv
 - t.sh

Tasks and Utilities

- Snippets
- Libraries
- File Shortcuts

*Program 1 x *CaseControlMatching x *CaseControlMatching 1 x

Settings Code/Results Split

Logistic Regressor

DATA

WORK.HISTORY_DIA

ROLES

*Dependent variable: (1 item)

case

*Patient ID variable: (1 item)

ptid

Other grouping variable (Site, Region)

Column

Effects variables:

- sexfemale
- racewhite
- HxAAngina

CODE LOG RESULTS

Table of Contents

Method	Num DF	Den DF	F Value	Pr > F
Satterthwaite	Unequal	1378.6	4.62	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	1077	4377	1.84	<.0001

Distribution of Propensity

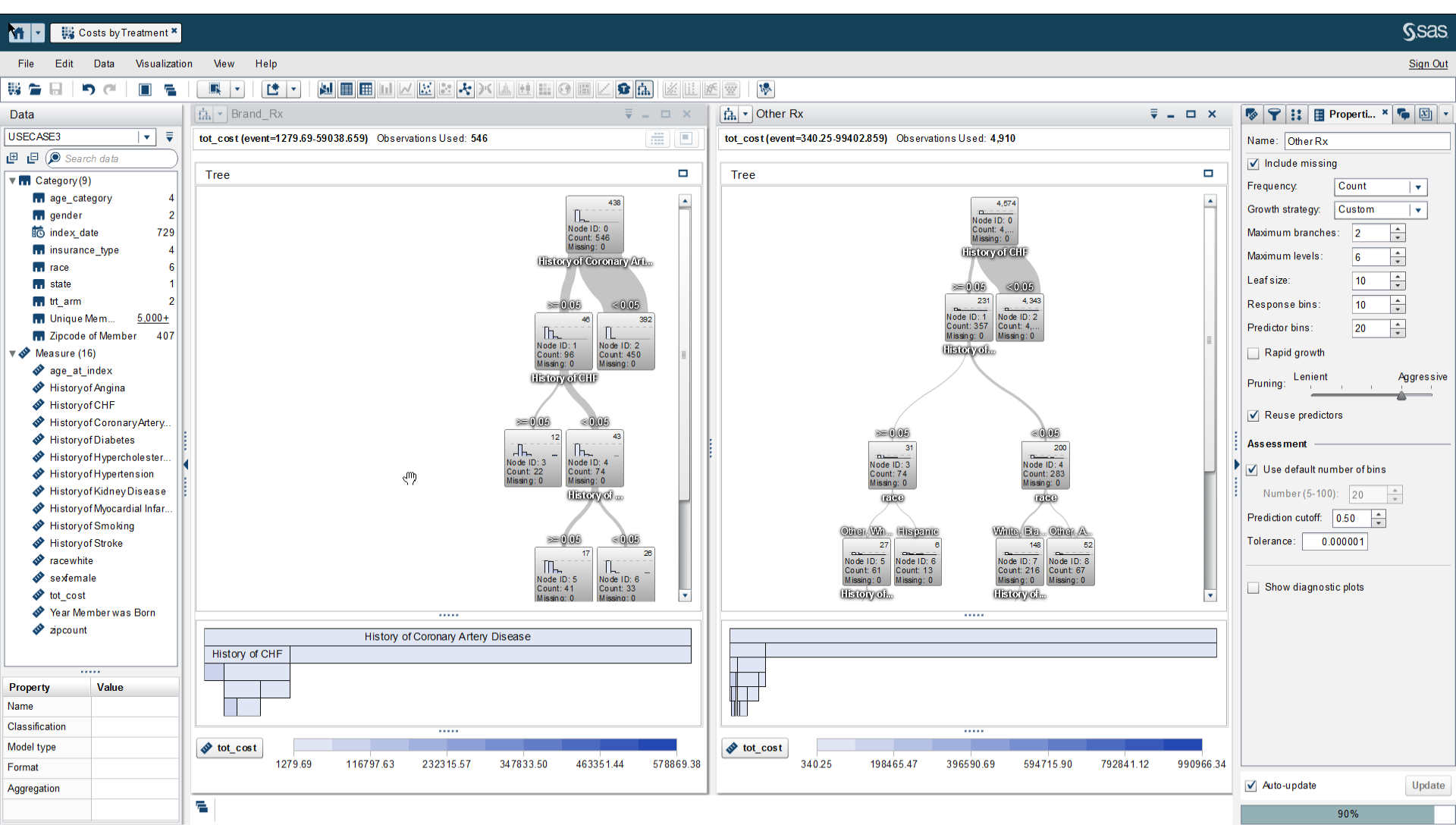
Percent

Estimated Probability

case

0-O Plots of Propensity

EVALUATING COSTS AND RISKS ASSOCIATED WITH CARE PATHWAYS



POPULATION HEALTH

Cost Outliers

File Edit Data Visualization View Help

Cost Outliers

Search data

Category (5)

- Age Category 4
- Birth Date 729
- Gender 2
- Member ID 5,000+
- Race 6

Geography (1)

- Member ZIP 407

Measure (12)

- Age
- Birth Year
- Days Since Last PCP
- ER Cost, 12m
- ER Visits, 12m
- Inpatient Cost, 12m
- Inpatient Days, 12m
- Inpatient Visits, 12m
- Other Cost, 12m
- Outpatient Cost, 12m
- Rx Cost, 12m
- Total Cost, 12m

Property	Value
Name	
Classification	
Model type	
Format	
Aggregation	

Visualization 1

Member ID	Total Cost, 12m	Days Since Last PCP	Age	Gender	Race
0000885673	\$178,377	192	64	Female	Black
0000070850	\$131,774	182	38	Female	Black
0000635826	\$131,149	188	64	Female	Black
0000864145	\$129,906	197	60	Male	White
0000489733	\$127,411	183	60	Female	White
0000108676	\$105,449	208	60	Female	White
0000761636	\$105,226	251	63	Male	White
0000352963	\$98,278	223	57	Male	White
0000904203	\$93,582	188	62	Male	Black
0000546616	\$88,352	182	34	Male	White
0000324972	\$86,682	191	57	Male	White
0000708738	\$80,747	206	58	Male	White
0000134037	\$76,601	201	62	Female	White
0000902707	\$66,512	190	49	Male	White
0000707783	\$63,709	189	46	Female	American Indian
0000017728	\$62,081	210	57	Female	White
0000171508	\$60,797	187	38	Male	White
0000714153	\$59,203	225	63	Male	White
0000019171	\$57,679	183	26	Male	White
0000782087	\$54,882	198	60	Female	Asian
0000480287	\$53,665	184	46	Male	White
0000020688	\$52,274	180	63	Male	White
0000528045	\$50,788	182	62	Female	Hispanic
0000103721	\$50,429	218	57	Male	White
0000041854	\$42,846	219	65	Female	White
0000498066	\$41,452	208	60	Female	White
0000447082	\$41,340	192	47	Male	White
0000670455	\$39,356	229	52	Male	White
0000792627	\$39,212	192	61	Female	White
0000761882	\$38,158	183	41	Male	White
0000025004	\$38,047	188	54	Male	Black
0000769671	\$36,866	181	57	Male	White
0000874148	\$36,564	239	47	Female	White

Visualization 2

Frequency of Days Since Last PCP and Total Cost, 12m

Days Since Last PCP

Frequency

Filters

COST_OUTLIERS

Days Since Last PCP

30 317

180 317

Visualization

Drop data items here to filter this visualization.

☒ Auto-update Update

3%

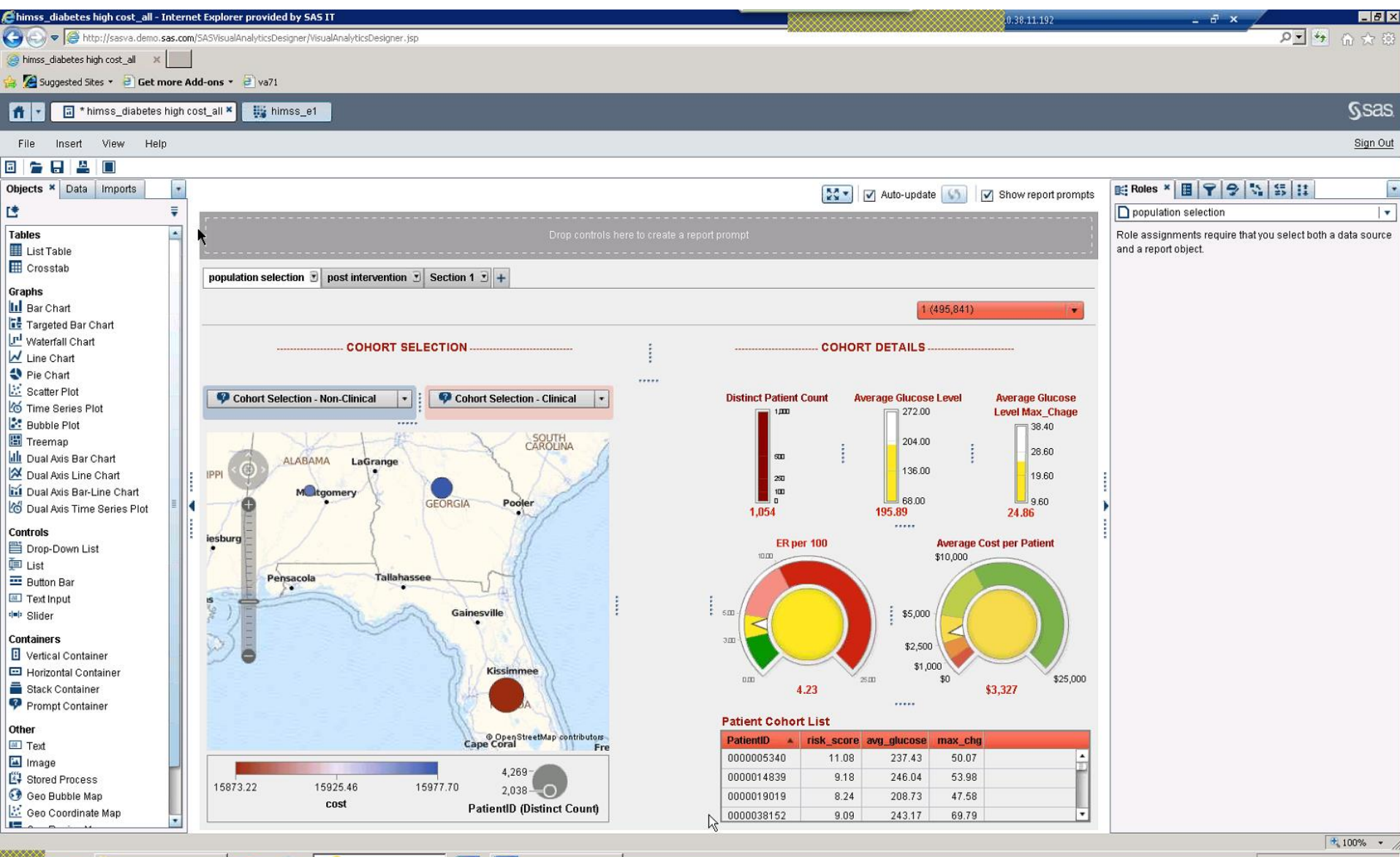
THE POWER TO KNOW.

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MODELING DATA FOR CARE MANAGEMENT



CARE MANAGEMENT DASHBOARD

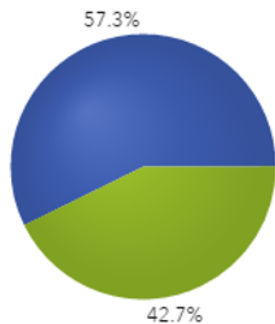


CLINICAL TRIAL PLANNING

All type 2 diabetes

Cohort Gender Distribution

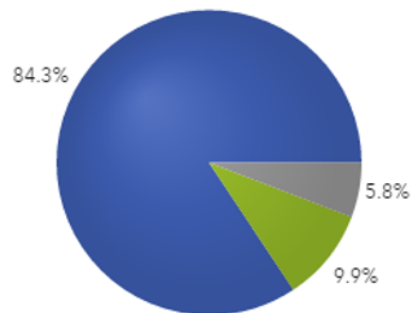
Patients



Gender
■ Female
■ Male

Cohort Race Distribution

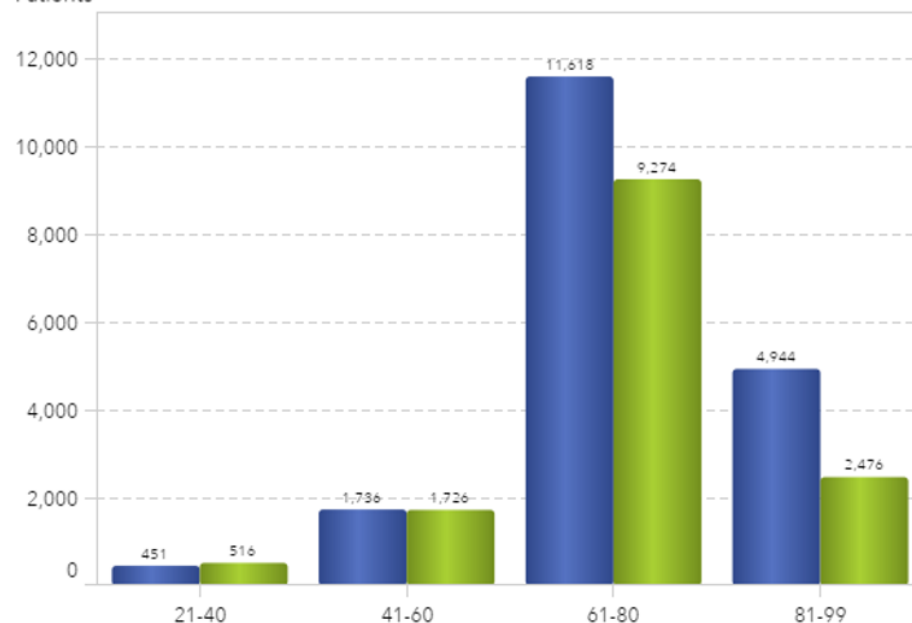
Patients



Race
■ White
■ Black
■ Other

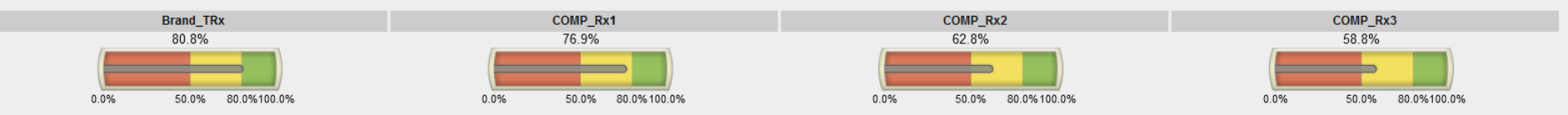
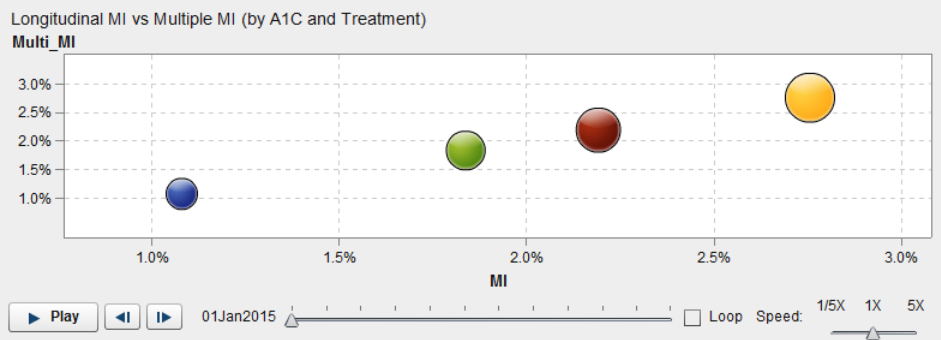
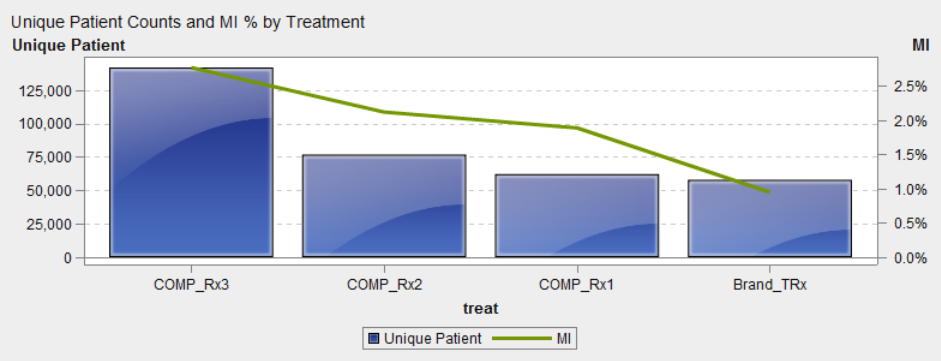
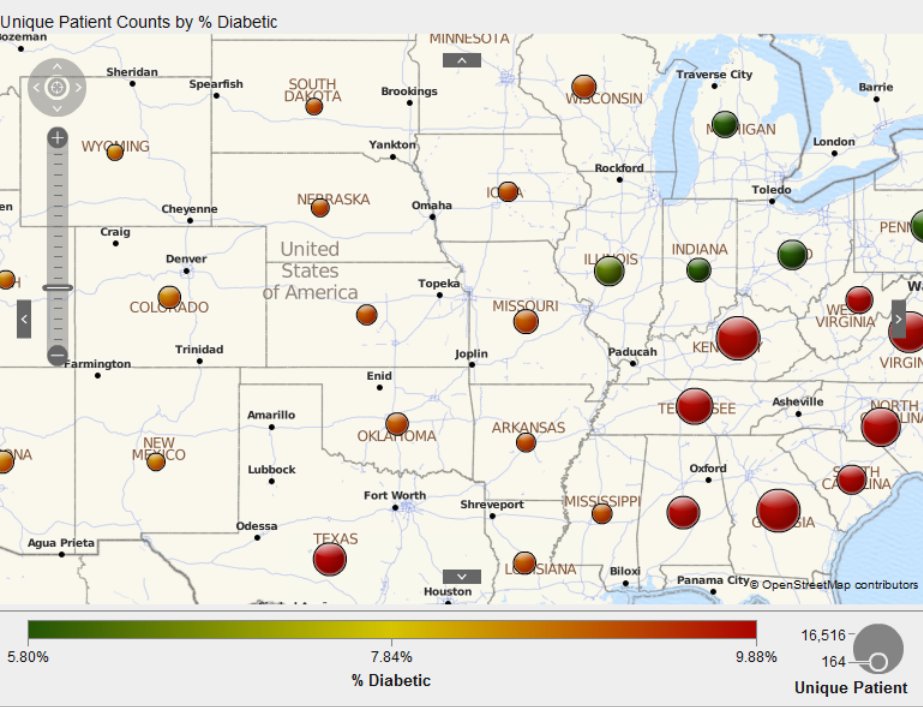
Cohort Age Groups

Patients

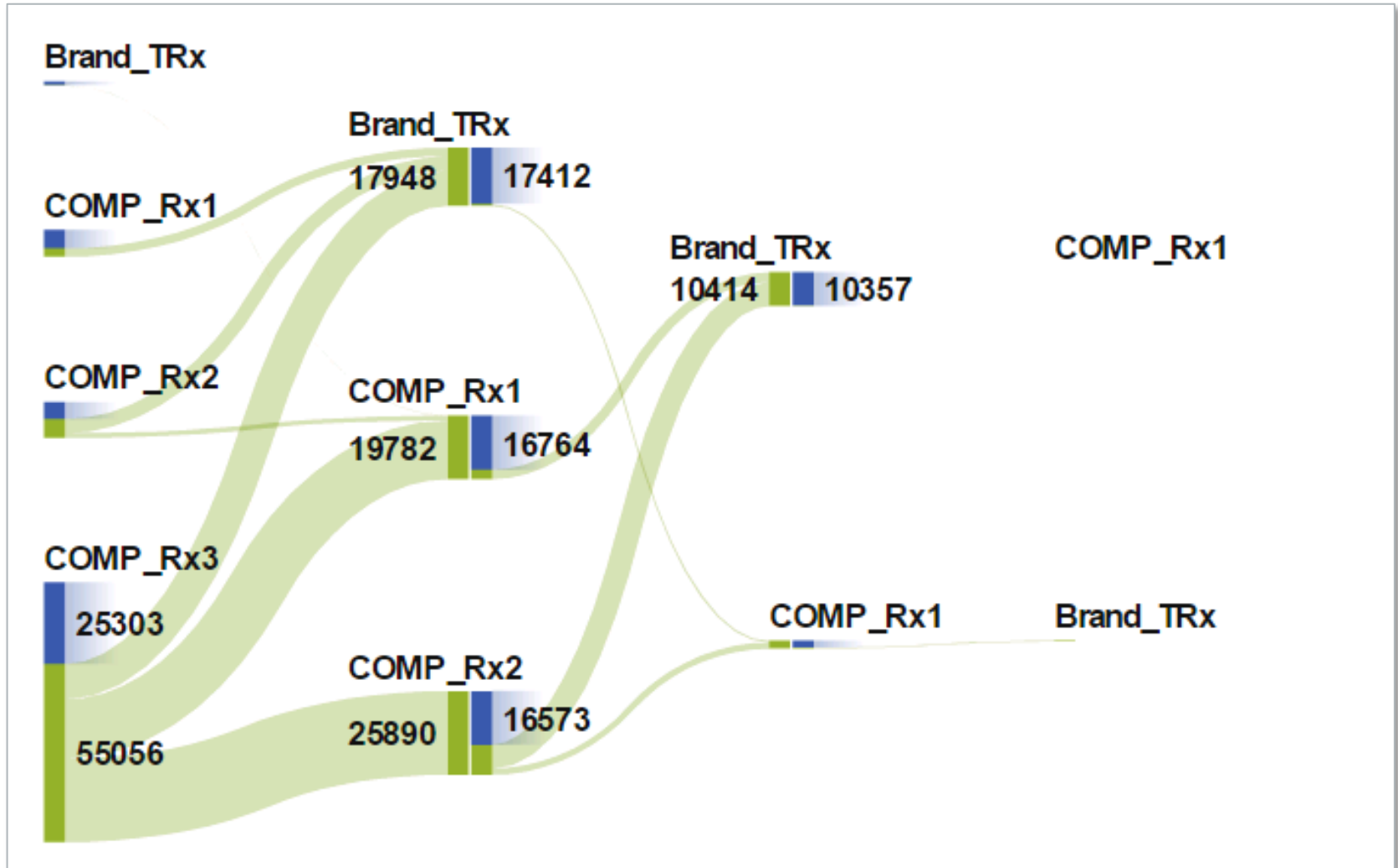


Gender
■ Female ■ Male

COMMERCIAL ANALYTICS



TREATMENT SWITCHES OR OTHER STATUS CHANGES



Real-world Data Analytics Platform

Cohort Selector /Dataset Generator

Technologies

Visualization

Advanced
Analytics

Cloud Hosting

Data Library

OMOP Data

Claims Data

Observational
Data

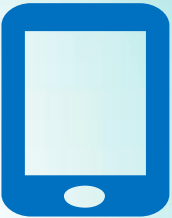
3rd Party Data

Analytics Library

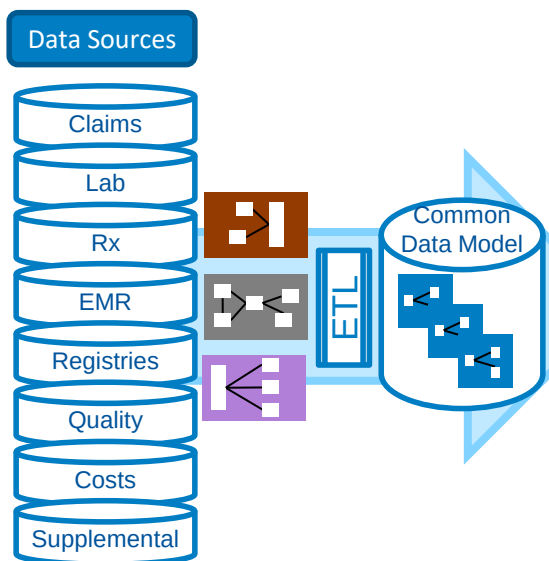
Analytic Model 1

Analytic Model 2

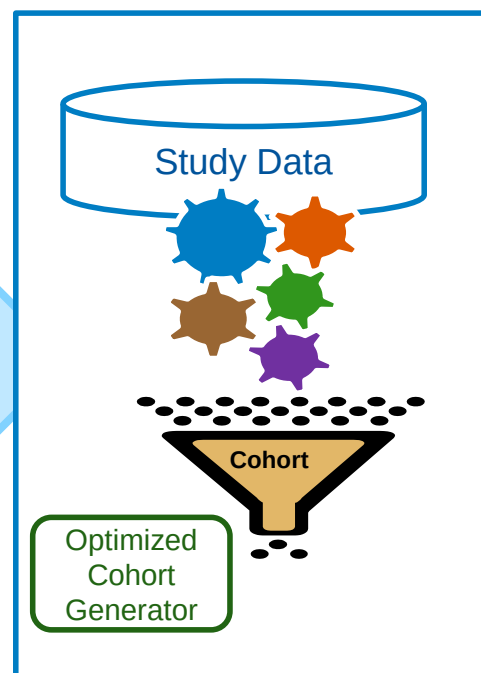
Analytic Model n



THE PLAYERS



SKILLS AND DRILLS



THE PLAYS



← **RULES OF THE GAME (REGULATORY)** →



ROBERT.COLLINS@SAS.COM

LAURIE.ROSE@SAS.COM