

MAXIMIZING THE USE OF PATIENT DATA WAREHOUSE VIA VISUAL ANALYTICS

2019 PhUse US Connect

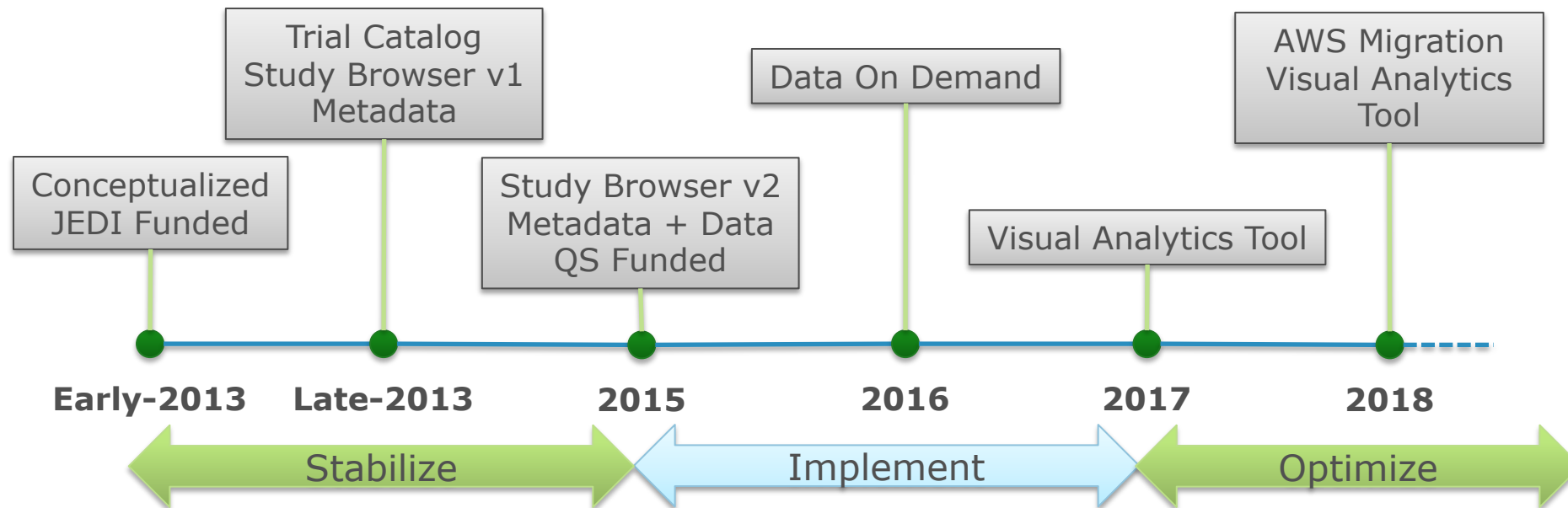
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PATIENT DATA WAREHOUSE

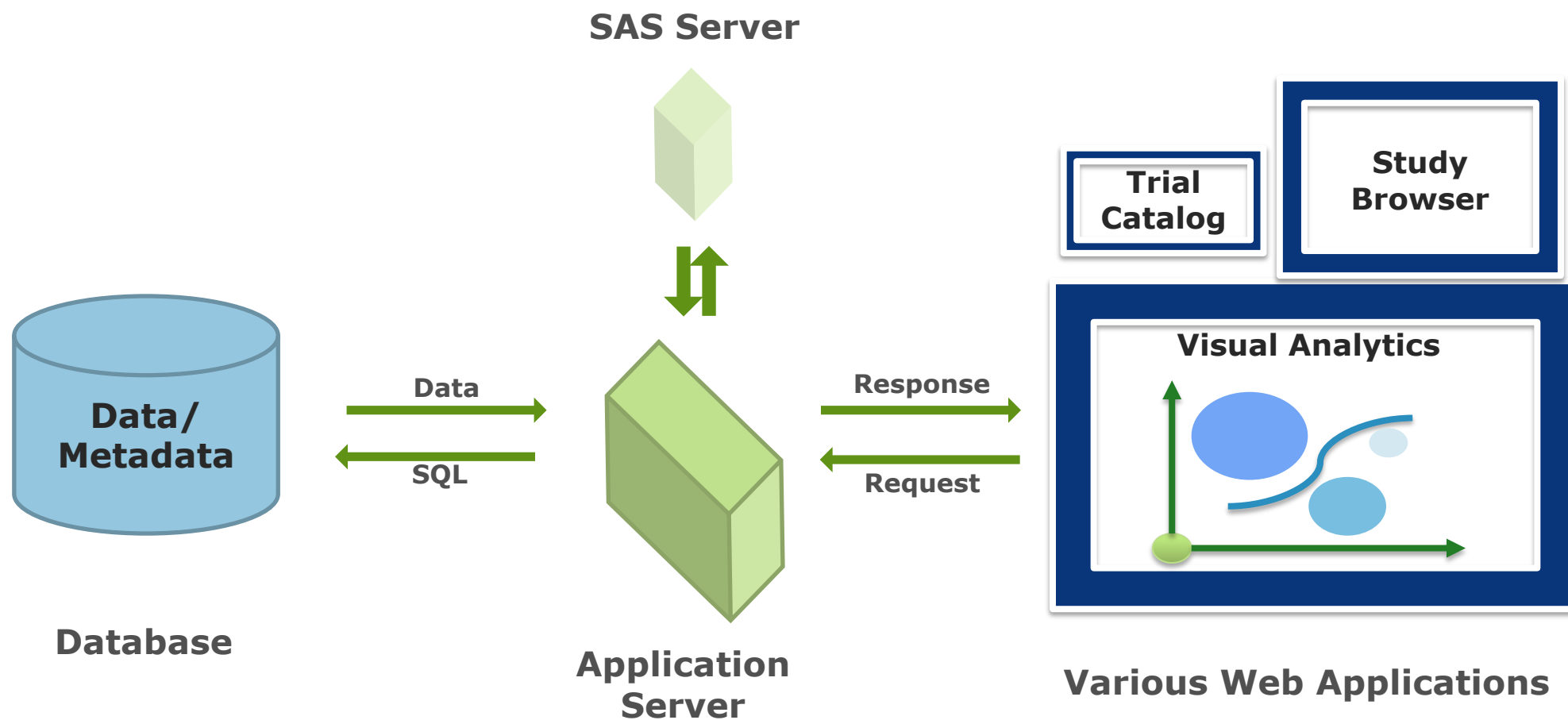
ENABLING EXPLORATION OF PATIENT DATA ACROSS JANSSEN TRIALS

Patient Data Warehouse – PDW

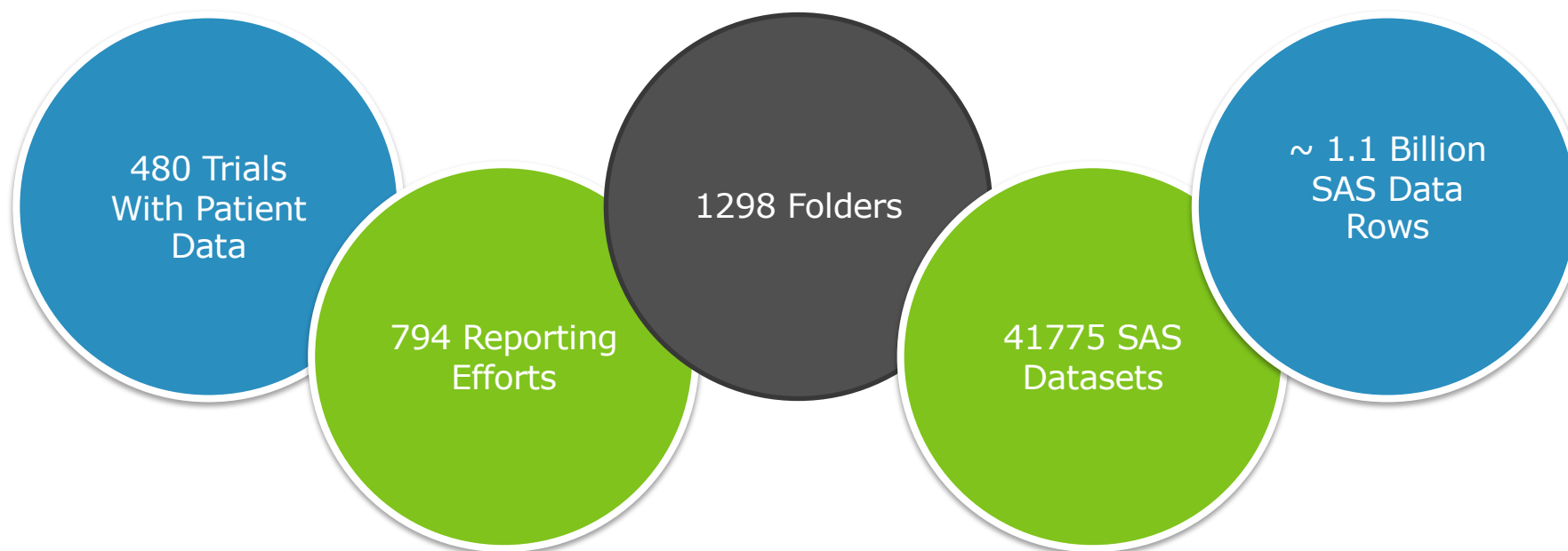
- A centralized repository for:
 - Study documents : Protocol | SAP | CSR
 - Clinical trial data : SAS datasets
- A technical capability for, originally for QS:
 - Data driven decision making
 - Search, subset, integrate, export, analyze



PDW System Architecture

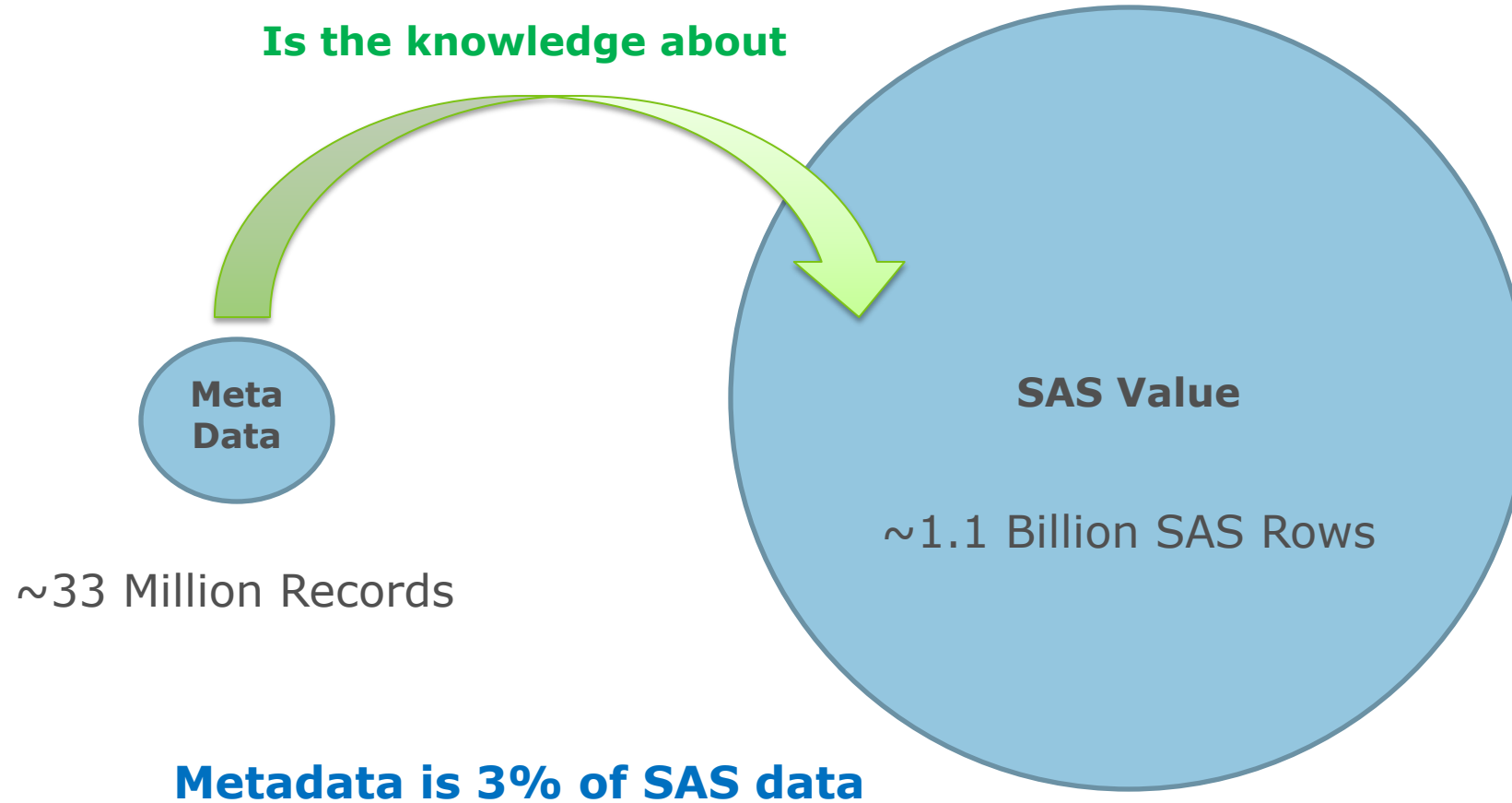


PATIENT DATA WAREHOUSE CONTENTS



*All SAS datasets were loaded into database as is

Data Divided Into Two Broad Sections



Business Needs

- **Traditional Data Access and Data Integration (per study data stored under file servers):** For large scale cross-study integration/investigation, analysis and reporting, reliance on SAS programming is high and costly when data, programs and outputs are stored under study folders and subfolders.
- **Patient Data Warehouse (centralized database and automated data access, data integration and analyses):** The Patient Data Warehouse platform with clinical trials data and metadata stored in a centralized relational database, which afforded us with the ability to quickly access data across studies and made way for the use of modern techniques in data extraction, integration and analyses.

PDW Use Cases

- 1.Signal Detections (9 studies) - PDW POC for Global Medical Safety
- 2.Placebo Data Extraction (10 studies) - EMIF Metabolic: reuse of Placebo data from completed clinical trials
- 3.Placebo Response (10 studies) – identify possible factors which resulted in high placebo response rate
- 4.Hy's Law by compound (17 studies in a compound)
- 5.Time-to-event for Major Adverse Events (10 studies)
- 6.Concomitant Medication & PK response (**80** studies) - Impact of a concomitant medication co-administration on PK of approved Janssen mAbs
- 7.Explore opportunities to increase trial participation (**252** studies)
- 8.Patient disposition rate by reasons of discontinuation (**304** studies)
- 9.Efficacy Analysis by Biological Age (**all** PDW studies) – Janssen Prevention Center proposal for analysis based on biological age in clinical trials

PATIENT DATA WAREHOUSE

DATA SOURCE (SAS Data Folders)

a **SDTM** SAS Dataset Folder

Dataset, Variable **Metadata**

SDTM: AE SAS Dataset

Name	Size
Ezview	
Metadata	
20180621-181...	62 KB
ae.sas7bdat	2,520 KB
cm.sas7bdat	5,312 KB
co.sas7bdat	192 KB
dm.sas7bdat	512 KB
ds.sas7bdat	1,664 KB
dv.sas7bdat	192 KB
eg.sas7bdat	8,832 KB
ex.sas7bdat	9,600 KB
fa.sas7bdat	2,560 KB
ie.sas7bdat	256 KB
is.sas7bdat	7,704 KB
lb.sas7bdat	133,120 KB
mh.sas7bdat	4,160 KB
pc.sas7bdat	2,816 KB
pr.sas7bdat	192 KB
qs.sas7bdat	774,272 KB
relrec.sas7bdat	704 KB
se.sas7bdat	704 KB
su.sas7bdat	768 KB
suppae.sas7b...	1,600 KB
suppcm.sas7b...	9,088 KB
suppdm.sas7...	192 KB
suppds.sas7b...	192 KB
suppdv.sas7b...	192 KB
suppex.sas7b...	20,608 KB
supplb.sas7b...	305,920 KB
suppqs.sas7b...	84,608 KB
suppsu.sas7b...	576 KB
sv.sas7bdat	2,944 KB
ta.sas7bdat	192 KB
te.sas7bdat	192 KB
ti.sas7bdat	192 KB
ts.sas7bdat	192 KB
tv.sas7bdat	192 KB
vs.sas7bdat	5,120 KB
zr.sas7bdat	1,216 KB

	DOMAIN	AESQ	AETERM	AELLT	AEDECOD	AEHLT	AEHLGT	AEBODSYS	AESOC
1	AE	1	LIVER FAILURE	Liver failure	Hepatic failure	Hepatic failure an...	Hepatic and hep...	Hepatobiliary diso...	Hepatobiliary diso...
2	AE	1	ACUTE SINUSITIS	Acute sinusitis	Acute sinusitis	Upper respiratory ...	Infections - patho...	Infections and inf...	Infections and inf...
3	AE	3	HEMNATED DI...	Herniated disc	Intervertebral disc prot...	Intervertebral dis...	Musculoskeletal ...	Musculoskeletal ...	Musculoskeletal ...
4	AE	5	INFLUENZA	Influenza	Influenza	Influenza viral inf...	Viral infectious di...	Infections and inf...	Infections and inf...
5	AE	6	INFLUENZA	Influenza	Influenza	Influenza viral inf...	Viral infectious di...	Infections and inf...	Infections and inf...
6	AE	7	SINUSITIS	Sinusitis	Sinusitis	Upper respiratory ...	Infections - patho...	Infections and inf...	Infections and inf...
7	AE	8	SLEEP APNEA	Sleep apnea	Sleep apnea syndrome	Breathing abnorm...	Respiratory disor...	Respiratory, thora...	Respiratory, thora...
8	AE	9	UPPER RESPIR...	Upper respiratory ...	Upper respiratory tract...	Upper respiratory ...	Infections - patho...	Infections and inf...	Infections and inf...
9	AE	10	WORSENING O...	Worsening of dia...	Diabetes mellitus	Diabetes mellitus ...	Glucose metaboli...	Metabolism and n...	Metabolism and n...
10	AE	11	WORSENING O...	Worsening of dia...	Diabetes mellitus	Diabetes mellitus ...	Glucose metaboli...	Metabolism and n...	Metabolism and n...
11	AE	1	ACNE	Acne	Acne	Skin appendage ...	Skin and subcuta...	Skin and subcuta...	Skin and subcuta...
12	AE	2	FLEETING TING...	Tingling of extrem...	Paraesthesia	Paraesthesias an...	Neurological diso...	Nervous system ...	Nervous system ...
13	AE	1	DIARRHEA	Diarhea	Diarhoea	Diarhoea (excl in...	Gastrointestinal m...	Gastrointestinal di...	Gastrointestinal di...
14	AE	2	DIARRHEA - UN...	Diarhea NOS	Diarhoea	Diarhoea (excl in...	Gastrointestinal m...	Gastrointestinal di...	Gastrointestinal di...
15	AE	3	HERPES SIMPL...	Herpes labialis	Oral herpes	Herpes viral infec...	Viral infectious di...	Infections and inf...	Infections and inf...
16	AE	4	INJECTION SITE...	Injection site bru...	Injection site bruising	Injection site reac...	Administration at...	General disorders...	General disorders...
17	AE	5	INJECTION SITE...	Injection site itch...	Injection site pruritus	Injection site reac...	Administration at...	General disorders...	General disorders...
18	AE	6	INJECTION SITE...	Injection site stin...	Injection site pain	Injection site reac...	Administration at...	General disorders...	General disorders...
19	AE	7	INJECTION SITE...	Injection site stin...	Injection site pain	Injection site reac...	Administration at...	General disorders...	General disorders...
20	AE	8	INJECTION SITE...	Injection site stin...	Injection site pain	Injection site reac...	Administration at...	General disorders...	General disorders...
21	AE	9	INJECTION SITE...	Injection site stin...	Injection site pain	Injection site reac...	Administration at...	General disorders...	General disorders...
22	AE	10	INJECTION SITE...	Injection site bru...	Injection site bruising	Injection site reac...	Administration at...	General disorders...	General disorders...
23	AE	11	INJECTION SITE...	Injection site bru...	Injection site bruising	Injection site reac...	Administration at...	General disorders...	General disorders...
24	AE	12	INJECTION SITE...	Injection site ble...	Injection site haemorrh...	Injection site reac...	Administration at...	General disorders...	General disorders...
25	AE	13	INJECTION SITE...	Injection site bru...	Injection site bruising	Injection site reac...	Administration at...	General disorders...	General disorders...
26	AE	14	LABIAL HSV INF...	Oral herpes	Oral herpes	Herpes viral infec...	Viral infectious di...	Infections and inf...	Infections and inf...
27	AE	16	NAUSEA	Nausea	Nausea	Nausea and vomit...	Gastrointestinal di...	Gastrointestinal di...	Gastrointestinal di...
28	AE	18	SKIN TRAUMA L...	Skin injury	Skin injury	Skin injuries NEC	Injuries NEC	Injury, poisoning ...	Injury, poisoning ...
29	AE	19	TRAUMA INDUC...	Bruising	Contusion	Skin injuries NEC	Injuries NEC	Injury, poisoning ...	Injury, poisoning ...
30	AE	20	UNCONTROLLE...	Loss of control of...	Diabetes mellitus inad...	Diabetes mellitus ...	Glucose metaboli...	Metabolism and n...	Metabolism and n...
31	AE	21	UNCONTROLLE...	Uncontrolled hyp...	Hypertension	Vascular hyperten...	Vascular hyperten...	Vascular disorders	Vascular disorders
32	AE	22	URTI	URTI	Upper respiratory tract...	Upper respiratory ...	Infections - patho...	Infections and inf...	Infections and inf...
33	AE	23	URTI	URTI	Upper respiratory tract...	Upper respiratory ...	Infections - patho...	Infections and inf...	Infections and inf...

Library	AE	Obs	Vars	#	Variable	Type	Length	Format	Informat	Label
AE		7606	34	1	STUDYID	Character	40			Study Identifier
BE		1058	13	2	DOMAIN	Character	2			Domain Abbreviation
CE		152940	12	3	USUBJID	Character	70			Unique Subject Identifier
CM		27588	22	4	AESQ	Numeric	8	8.	8.	Sequence Number
DM		2189	30	5	AESPID	Character	200			Sponsor-Defined Identifier
DS		11824	11	6	AETERM	Character	200			Reported Term for the Adverse Event
DV		214	7	7	AEMODIFY	Character	200			Modified Reported Term
EX		10742	17	8	AELLT	Character	100			Lowest Level Term
FA		41276	17	9	AELLTCD	Numeric	8	8.	8.	Lowest Level Term Code
HO		411	10	10	AEDECOD	Character	200			Dictionary-Derived Term
IE		899	14	11	AEPTCD	Numeric	8	8.	8.	Preferred Term Code
LB		585510	33	12	AEHLT	Character	100			High Level Term
MB		6717	24	13	AEHLTCD	Numeric	8	8.	8.	High Level Term Code
MH		22528	15	14	AEHLGT	Character	100			High Level Group Term
PC		16945	27	15	AEHLGTC	Numeric	8	8.	8.	High Level Group Term Code
QS		635728	22	16	AEBODSYS	Character	100			Body System or Organ Class
RELREC		51051	7	17	AEBOSYCD	Numeric	8	8.	8.	Body System or Organ Class Code
SG		13357	12	18	AESOC	Character	100			Primary System Organ Class
SU		1408	11	19	AESOC	Character	100			Primary System Organ Class
SUPPAE		26010	10	20	AESOC	Character	100			Primary System Organ Class
SUPPCE		16949	10	21	AESOC	Character	100			Primary System Organ Class
SUPPCM		188127	10	22	AESOC	Character	100			Primary System Organ Class
SUPPDM		9551	10	23	AESOC	Character	100			Primary System Organ Class
SUPPDS		99	10	24	AESOC	Character	100			Primary System Organ Class
SUPPEX		106198	10	25	AESOC	Character	100			Primary System Organ Class
SUPPFA		5227	10	26	AESOC	Character	100			Primary System Organ Class
SUPPHO		410	10	27	AESOC	Character	100			Primary System Organ Class
SUPPLB		928415	10	28	AESOC	Character	100			Primary System Organ Class
SUPPMH		12667	10	29	AESOC	Character	100			Primary System Organ Class
SUPPQS		5354	10	30	AESOC	Character	100			Primary System Organ Class
SUPPSG		40477	10	31	AESOC	Character	100			Primary System Organ Class
SUPPSU		693	10	32	AESOC	Character	100			Primary System Organ Class
SUPPXZ		7	10	33	AESOC	Character	100			Primary System Organ Class
SV		20232	9	34	AESOC	Character	100			Primary System Organ Class
TI		80	5							
XA		20902	26							
XI		1463	17							
XZ		2280	15							

Browsed from SAS Universal Viewer

PDW Database – Core Concepts

- ❖ **Study Info Metadata** – SAS data location file per TA, compound, indication, phase, protocol number, reporting effort, data type (analysis, tabulation, raw), etc.
- ❖ **Study Data Metadata** (created automatically during SAS to database loading)
 1. Dataset
 2. Variable
 3. Variable Value
 4. Parameter Value
- **Study Data** – a normalized structure stores each data element (one cell in a SAS table) as one row in a patient value database table, no changes to the source data value
- ❖ **PDW metadata are designed to facilitate the cross-study metadata review and data extraction.**

PDW STUDY BROWSER

ENABLING AUTOMATED DATA INTEGRATION & SUBJECT SUBSETTING

PDW Study Browser (SB) – Metadata Review & Data Extraction

- PDW SB is designed for metadata review and data extraction:
 - Cross-study metadata review (any data element).
 - Automated data integration to stack datasets across studies.
 - Automated patient profile creation for subjects meet criteria.
- Users take the extracted data (output datasets/files) to perform analysis using other tools such as Spotfire, SAS, R, etc.
- Many earlier PDW use case support were utilizing PDW SB to output files and load files into Spotfire to create analysis.

Study Browser – Data Integration

Cross-Study Dataset, Variable, Row Selection

Studies

Data Set	Description	CSR_Final	CSR_Final	CSR_Final	CSR_Week 052	CSR_Week 052	CSR_Week 052	CSR_Week 052	CSR_Final	CSR_Week 104	CSR_Week 104	CSR_Final	CSR_Week 052	CSR_Final	CSR_Final	CSR_Final
☒ ADAE	Adverse Event Analysis Dataset															
☒ ADCM	Concomitant Medications Analysis Dataset															
☒ ADDS	Disposition Analysis Dataset															
☒ ADEFF	Efficacy Analysis Dataset															
☒ ADES	Exposure Summary															
☒ ADLB	Lab Analysis Data															
☒ ADSL	Subject-level Analysis Dataset															
☒ ADTTE	Time to Event															

Variables

Variable	Data Set	Label	CSR_Final	CSR_Final	CSR_Final	CSR_Week 052	CSR_Week 052	CSR_Week 052	CSR_Week 052	CSR_Final	CSR_Week 104	CSR_Week 104	CSR_Final	CSR_Week 052	CSR_Final	CSR_Final	CSR_Final
☒ AVAL	ADLB	Analysis Value															
☒ AVISIT	ADLB	Analysis Visit															
☒ AVISITN	ADLB	Analysis Visit (N)															
☒ BASE	ADLB	Baseline Value															
☒ CHG	ADLB	Change from Baseline															
☒ DTYPE	ADLB	Derivation Type															
☒ PARAM	ADLB	Parameter															
☒ PARAMCD	ADLB	Parameter Code															

Build Condition

Logic AND OR

Variable Value Add

Parameter Value Add

Condition Review Edit

Blood 1,25-Dihydroxy Vitamin D (pmol/L)(Code="B125D")
Blood 25-Hydroxy Vitamin D (nmol/L)(Code="B25H")
Blood Activated Partial Thromboplastin Time (s)
Blood Alanine Aminotransferase (U/L)(Code="BALT")
Blood Albumin (g/L)(Code="BALB")
Blood Alkaline Phosphatase (U/L)(Code="BALP")
Blood Anisocytosis(Code="BANISO")
Blood Aspartate Aminotransferase (U/L)(Code="BAST")
Blood Basophilic Stippling(Code="BBASOSTI")
Blood Basophils (x10E9/L)(Code="BBASO")
Blood Basophils/Leukocytes (%) (Code="BBASO")

AND

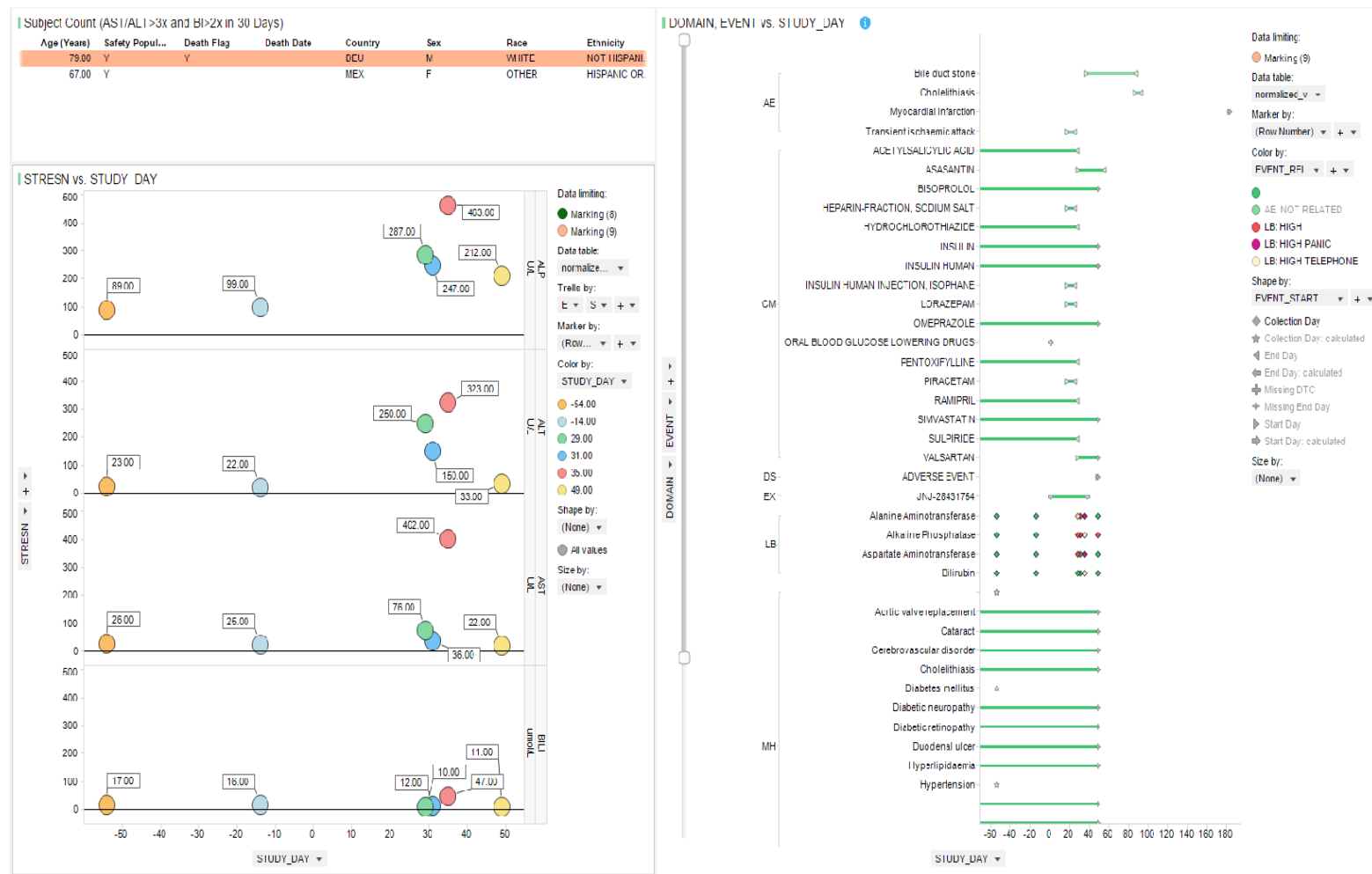
("PARAMCD" in ("BALT","BAST","SALT","SAST","ALT","AST") AND ("AVAL" > "LBSTNRH" - 3)) OR ("PARA

Values, Conditions

- ❖ Users' decision for analysis & reporting tools to perform research/analysis based on extracted data from PDW Study Browser.

A visualization of a Hy's Law subject

AST/ALT > 3xUL and TB > 2xUL in 30 days



PDW VISUAL ANALYTICS

ENABLING AUTOMATED DATA INTEGRATION & ANALYSIS

PDW Visual Analytics Data Integration & Analysis Tool (in development)

End-to-End platform by enabling automated analysis from metadata browsing to data extraction to final integrated analysis:

- Set up the connections from a visualization tool to PDW database
- Set up on-demand framework for data query from PDW database to facilitate analysis
- Design and create reusable analysis templates which will populate analysis results based on the data query created by the selected metadata.

PDW Visual Analytics

An Example Application Design

Figure 1: 46 SDTM studies were selected from 3 compounds

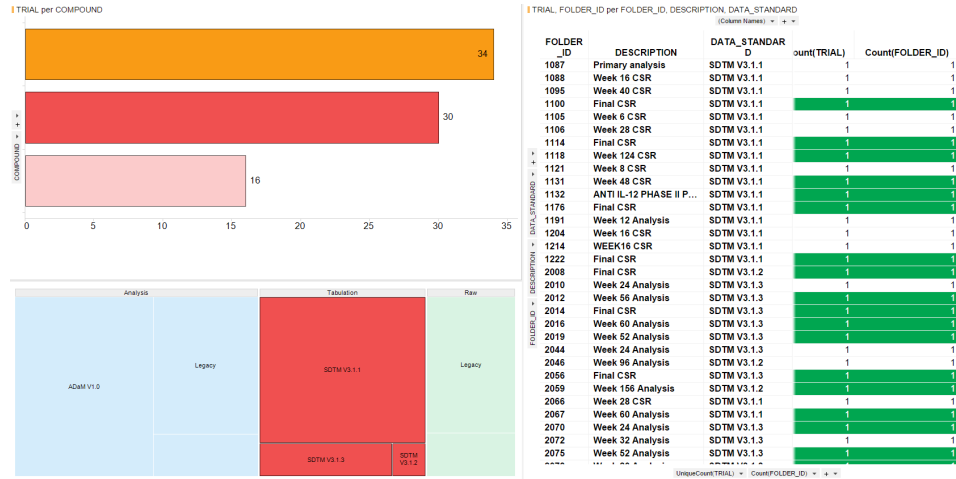


Figure 3: Select variables to facilitate analysis

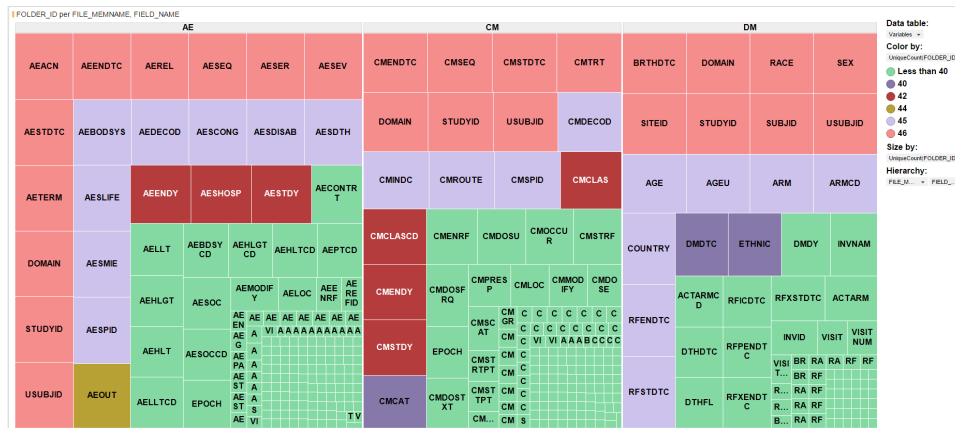


Figure 2: Select interested datasets (AE,CM, DM)

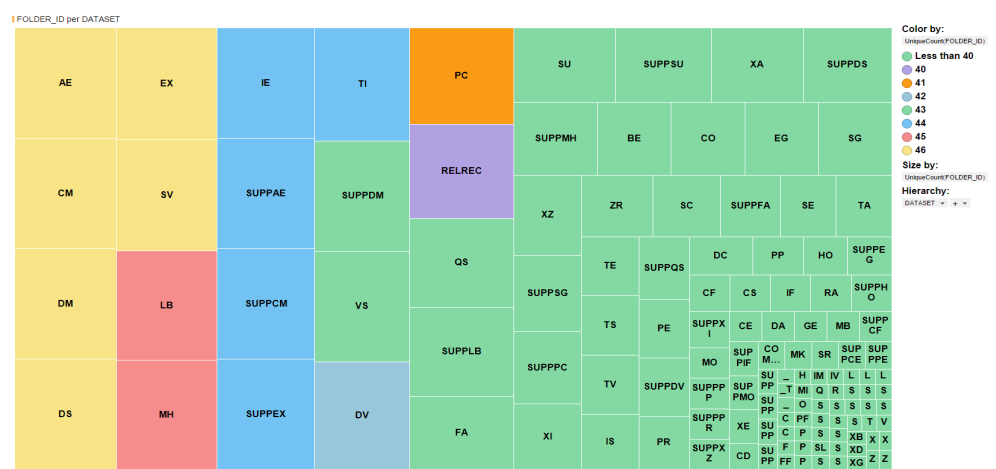
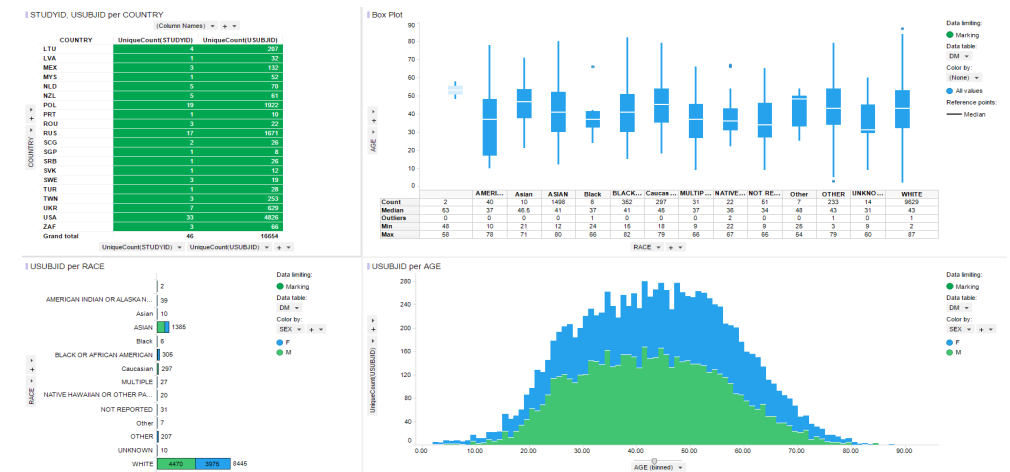


Figure 4: refreshed analysis results from an analysis template



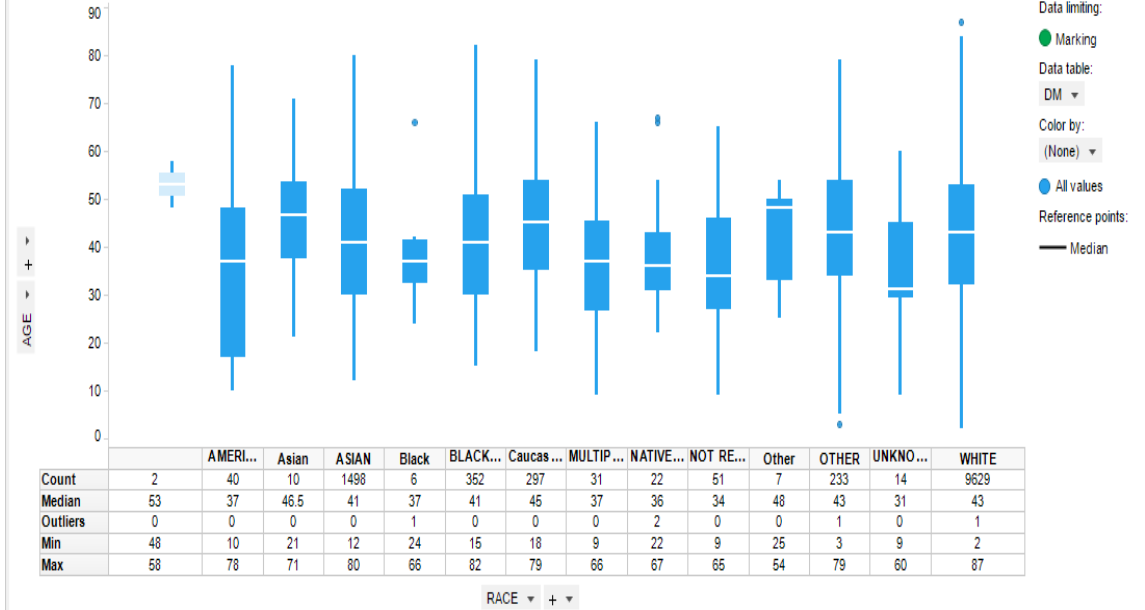
STUDYID, USUBJID per COUNTRY

(Column Names) +

COUNTRY	UniqueCount(STUDYID)	UniqueCount(USUBJID)
LTU	4	207
LVA	1	32
MEX	3	132
MYS	1	52
NLD	5	70
NZL	5	61
POL	19	1922
PRT	1	10
ROU	3	22
RUS	17	1671
SCG	2	26
SGP	1	8
SRB	1	26
SVK	1	12
SWE	3	19
TUR	1	28
TWN	3	253
UKR	7	629
USA	33	4826
ZAF	3	66
Grand total	46	16654

UniqueCount(STUDYID) UniqueCount(USUBJID) +

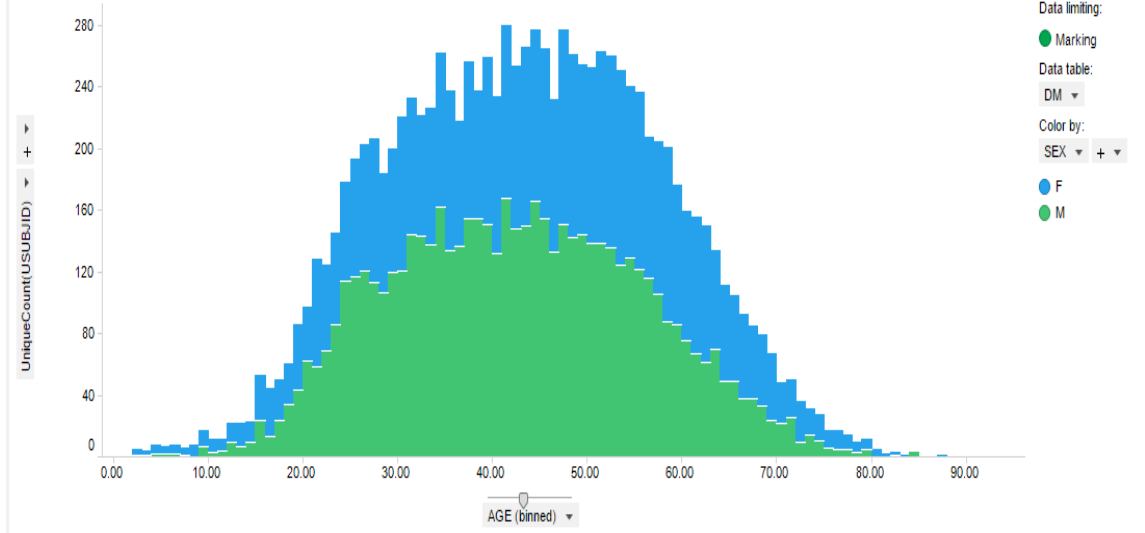
Box Plot



USUBJID per RACE



USUBJID per AGE



Conclusion

- The new capabilities to search, query and perform analysis over hundreds of studies from PDW platform is a big achievement.
- Adherence to clinical data standards is key to address diverse questions accurately, confidently, and in a timely manner.
- As PDW data content increases, we are continuously improving our technological solutions to address performance issues.
- The PDW Visual Analytics platform technologies will shape the clinical trial processes to make analysis at “real-time” possible during any time point of the drug development cycle.

