



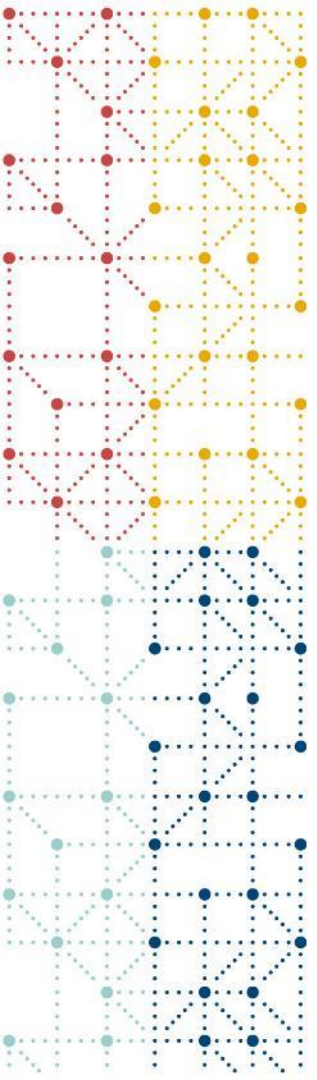
DS09: Pre-launching CDISC Analysis Results Standards

PHUSE US Connect: March 08, 2023

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Bess LeRoy, MPH, Head of Data Standards, CDISC





Agenda

1. Background
2. Use Cases for Analysis Results Standards
3. Analysis Results Key Objectives and Key Results
4. Analysis Results Logical Metamodel
 - Representations of model in CMAP, Markdown, and JSON Schema
5. ARS Development on GitHub
6. Review Examples
7. Reference implementation
8. ARS Roadmap
9. Q&A

CDISC Foundational Standards

Data Collection
CDASH

Data Aggregation
SDTM

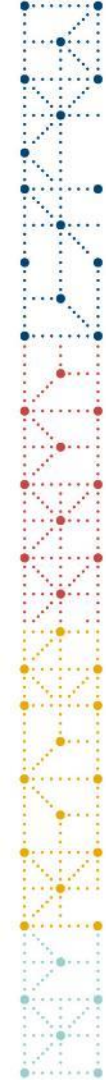
Analysis
ADaM

Results
???

Table 4.2.2: HbA1c Longitudinal Repeated Measures Analysis Results Metadata

Metadata Field	Metadata
DISPLAY IDENTIFIER	Table 4.2.1/Figure 4.2.1
DISPLAY NAME	Mean Change from Baseline in HbA1c (Percent) Longitudinal Repeated Measures Analysis, 24-Week Short-term Double-blind Treatment
RESULT IDENTIFIER	Treatment difference results (LSMean, confidence interval, p-value)
PARAM	HbA1c (%)
PARAMCD	HBA1C
ANALYSIS VARIABLE	CHG (Change from baseline)
ANALYSIS REASON	SPECIFIED IN SAP
ANALYSIS PURPOSE	PRIMARY OUTCOME MEASURE
ANALYSIS DATASET	ADHBA1C

ARM for Define.XML



Use Cases for Analysis Results Standards

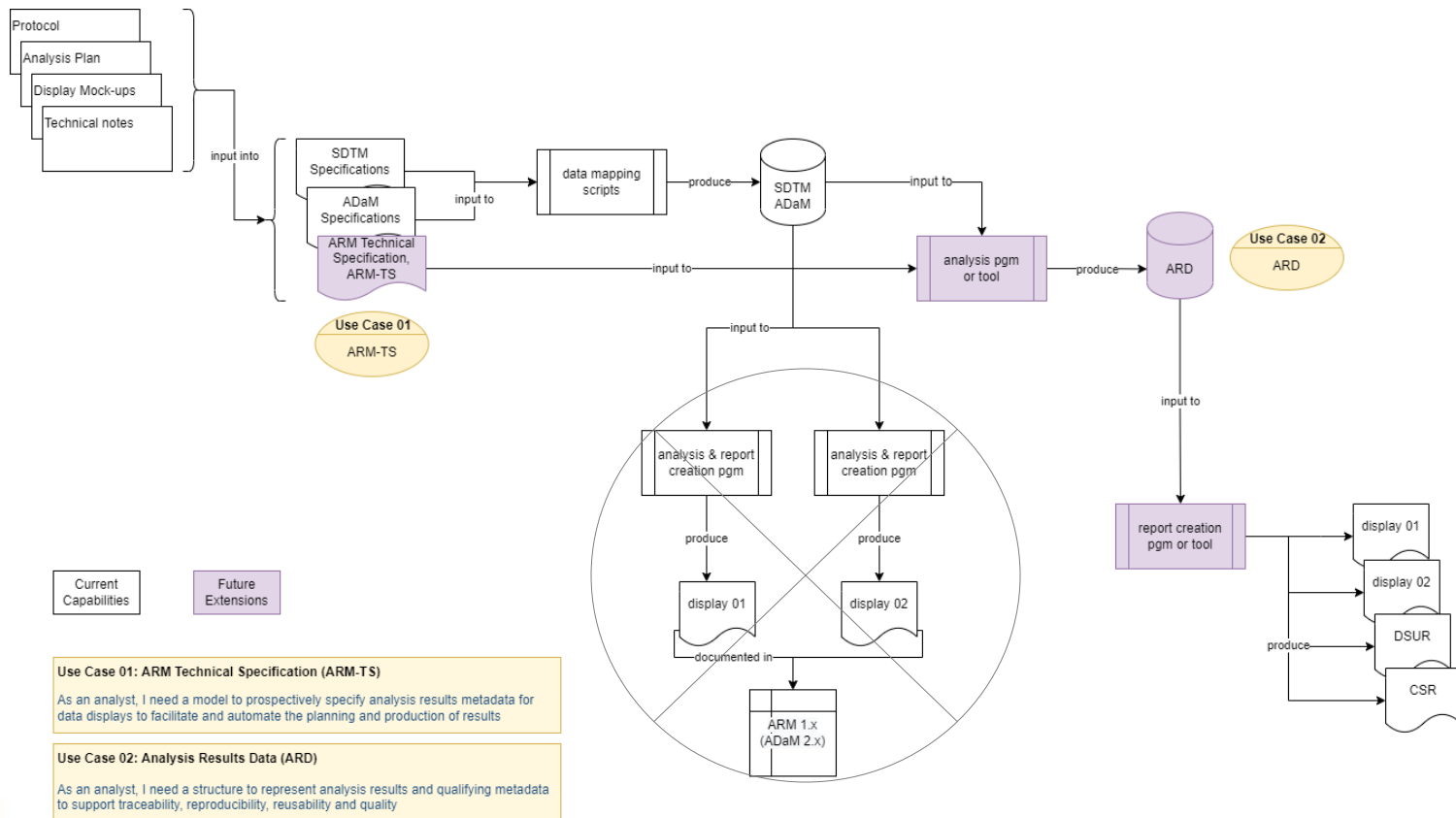
- Use Case 01:

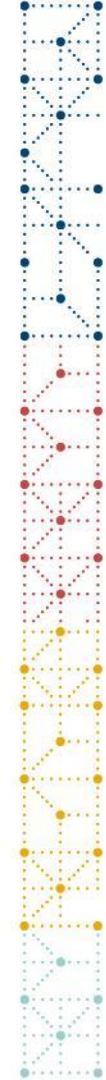
As an analyst, I need a technical specifications to prospectively specify analysis results metadata for data displays to facilitate and automate the planning and production of results

- Use Case 02:

As an analyst, I need a structure to represent analysis results and qualifying metadata to support traceability, reproducibility, reusability and quality

Workflow with Future Extensions





Analysis Results Key Objectives

- Use analysis results metadata to drive the automation of results
- Support storage, access, processing and reproducibility of results
- Improved navigation and reusability of analyses and results
- Traceability to Protocol/SAP and to input ADaM data

Initial Analysis Results Standards Key Results



Develop a technical specification to prospectively leverage Analysis Results Metadata to drive automation



Develop a structure to represent Analysis Results as data



Illustrate and exercise with a set of common data displays

Concepts Team Consulted Published Layouts

- PH

- Treatment

- T1
(N = xxx)

-

- JPI

- T2
(N = xxx)

- PL
(N = xxx)

- Re

- Sul

Scatterplot and Shift Table Summary of Absolute Lab values –
Lab Test 1 Minimum Baseline vs Minimum Post-baseline

3.14安全性の解析（バイタルサイン、身体的所見及び安全性に関連する
Table summary of vital signs by visit

<Parameter> BDS.PARAM
<Visit> BDS.AVISIT
n
Mean (SD)
Median BDS.AVAL
Min - Max

N = number of subjects in each group
of subjects in each group using the reference
demographics.
上記例は、絶対値の集計の場合。
バイタルサインのベースラインからの変化量を集計する必要がある場合
の場合は BDS.PCHG を使用する

Table 3. Laboratory Abnormalities that Worsened from Baseline to Grade 3 or 4
Occurring in $\geq 1\%$ of Patients with dMMR Endometrial Cancer Receiving
Product in Study

Laboratory Test	Product N = 104	
	All Grades ^a %	Grade 3 or 4 ^a %
Hematology		
Decreased lymphocytes	37	9
Decreased leukocytes	21	2.9
Chemistry		
Decreased albumin	30	2.9
Increased creatinine	27	2.9
Increased alkaline phosphatase	25	2.9
Increased aspartate aminotransferase	16	1.9
Increased alanine aminotransferase	15	2.9
Electrolytes		
Decreased sodium	26	4.8
Increased calcium	15	1.9
Decreased potassium	15	1.9

^a Consists of new onset of laboratory abnormality or worsening of baseline laboratory abnormality.

Focus on Concepts, Not Layout

Parameter (Units)	Treatment X (N=XX)	Treatment Y (N=XX)	Total (N=XX)
Visit			
<Parameter 1> (<unit>)			
Baseline			
n	XX	XX	XX
Mean (SD)	XX.X (XX.XX)	XX.X (XX.XX)	XX.X (XX.XX)
Median	XX.X	XX.X	XX.X
Q1, Q3	XX.X, XX.X	XX.X, XX.X	XX.X, XX.X
Min, Max	XX, XX	XX, XX	XX, XX
< Visit n >			
n			
Mean (SD)			
Median			
Q1, Q3			
Min, Max			
< Visit n Change from Baseline >			
n			
Mean (SD)			
Median			
Q1, Q3			
Min, Max			

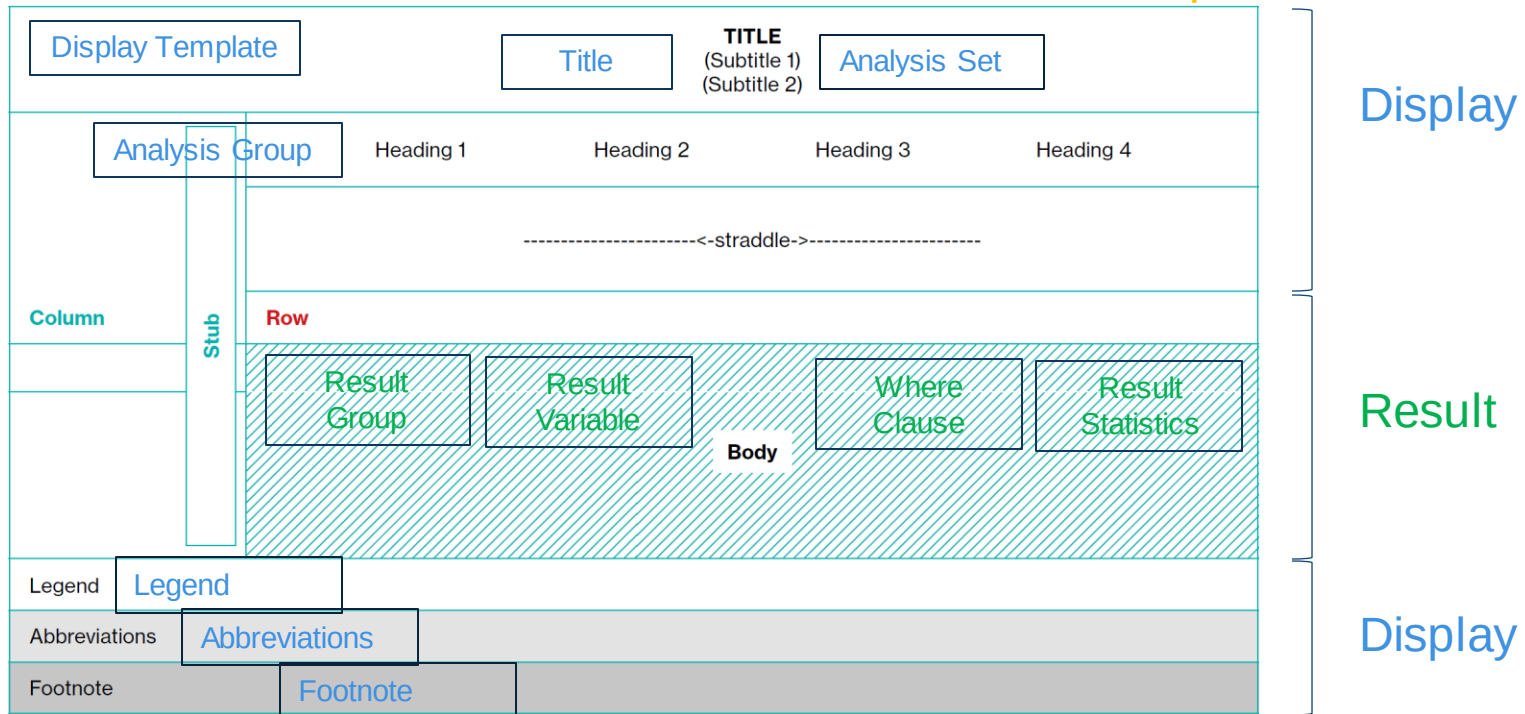
	Treatment X (N=XX)		Treatment Y (N=XX)		Total (N=XX)	
Parameter (Units)						
Visit	Observed	CFB	Observed	CFB	Observed	CFB
<Parameter 1> (<unit>)						
Baseline						
n	XX		XX		XX	
Mean (SD)	XX.X (XX.XX)		XX.X (XX.XX)		XX.X (XX.XX)	
Median	XX.X		XX.X		XX.X	
Q1, Q3	XX.X, XX.X		XX.X, XX.X		XX.X, XX.X	
Min, Max	XX, XX		XX, XX		XX, XX	
...						
<Visit n>						
n	XX	XX	XX	XX	XX	XX
Mean (SD)	XX.X (XX.XX)	XX.X (XX.XX)	XX.X (XX.XX)	XX.X (XX.XX)	XX.X (XX.XX)	XX.X (XX.XX)
Median	XX.X	XX.X	XX.X	XX.X	XX.X	XX.X
Q1, Q3	XX.X, XX.X	XX.X, XX.X	XX.X, XX.X	XX.X, XX.X	XX.X, XX.X	XX.X, XX.X
Min, Max	XX, XX	XX, XX	XX, XX	XX, XX	XX, XX	XX, XX

plays not on subjective

S

Key Metadata Elements of a Table

Output



Reference: PHUSE White Paper “General Output Tips and Considerations”, Doc ID: WP-034, Version 1.0, Aug 2020

Demographics Analysis Results and Metadata

[Display Template](#)[Title](#)[Analysis Set](#)

Table 2. Baseline Demographic and Clinical Characteristics, Safety Population, Pooled Analyses (or Trial X)

Analysis Group	Drug Name	Drug Name	Placebo	Active Control	Total
	Dosage X N = XXX n (%)	Dosage Y N = XXX n (%)	N = XXX n (%)	N = XXX n (%)	Population N = XXX n (%)
Characteristic					
Sex, n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Male	n (%)	n (%)	n (%)	n (%)	n (%)
Female	n (%)	n (%)	n (%)	n (%)	n (%)
Age, years	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)
Mean (SD)	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)	X.X (Y.Y)
Median (min, max)	X.X (Y.Y, Z.Z)	X.X (Y.Y, Z.Z)	X.X (Y.Y, Z.Z)	X.X (Y.Y, Z.Z)	X.X (Y.Y, Z.Z)
Age groups (years), n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
≥17 to <65	Result Group	Result Variable	Where Clause	Result Statistics	n (%)
≥65					n (%)
≥65 to <75					n (%)
≥75	n (%)	n (%)	n (%)	n (%)	n (%)
Race, n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
American Indian or Alaska Native	n (%)	n (%)	n (%)	n (%)	n (%)
Asian	n (%)	n (%)	n (%)	n (%)	n (%)
Black or African American	n (%)	n (%)	n (%)	n (%)	n (%)
Native Hawaiian or Other Pacific Islander	n (%)	n (%)	n (%)	n (%)	n (%)
White	n (%)	n (%)	n (%)	n (%)	n (%)
Other	n (%)	n (%)	n (%)	n (%)	n (%)

Source: [include Applicant source, datasets and/or software tools used].

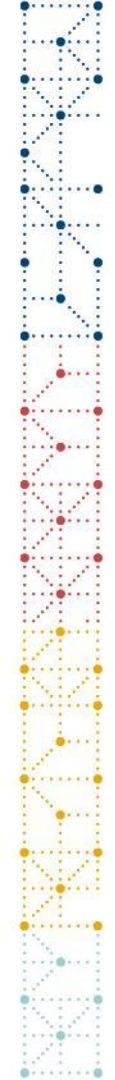
¹ Difference is shown between [treatment arms] (e.g., difference is shown between Drug Name dosage X vs. placebo).

Abbreviations: N, number of patients in treatment arm; n, number of patients with given characteristic; SD, standard deviation

[Footnote](#)[Abbreviations](#)[Legend](#)

Analysis Results and Associated Metadata Example

Identifiers		Analysis Group			Result Variable			Results Statistic		
Name	Title	Dataset	Variable	Value	Variable	Value	Label	Value	Name	Label
Table 2	Baseline Demographics and Clinical Characteristics, Safety Population	ADSL	TR01X	Drug Name Dosage X	SEX	M	Male	53	Count	n
Table 2	Baseline Demographics and Clinical Characteristics, Safety Population	ADSL	TR01X	Drug Name Dosage X	SEX	M	Male	61.6	Percent	%
Table 2	Baseline Demographics and Clinical Characteristics, Safety Population	ADSL	TR01X	Drug Name Dosage X	SEX	F	Female	33	Count	n
Table 2	Baseline Demographics and Clinical Characteristics, Safety Population	ADSL	TR01X	Drug Name Dosage X	SEX	F	Female	38.4	Percent	%

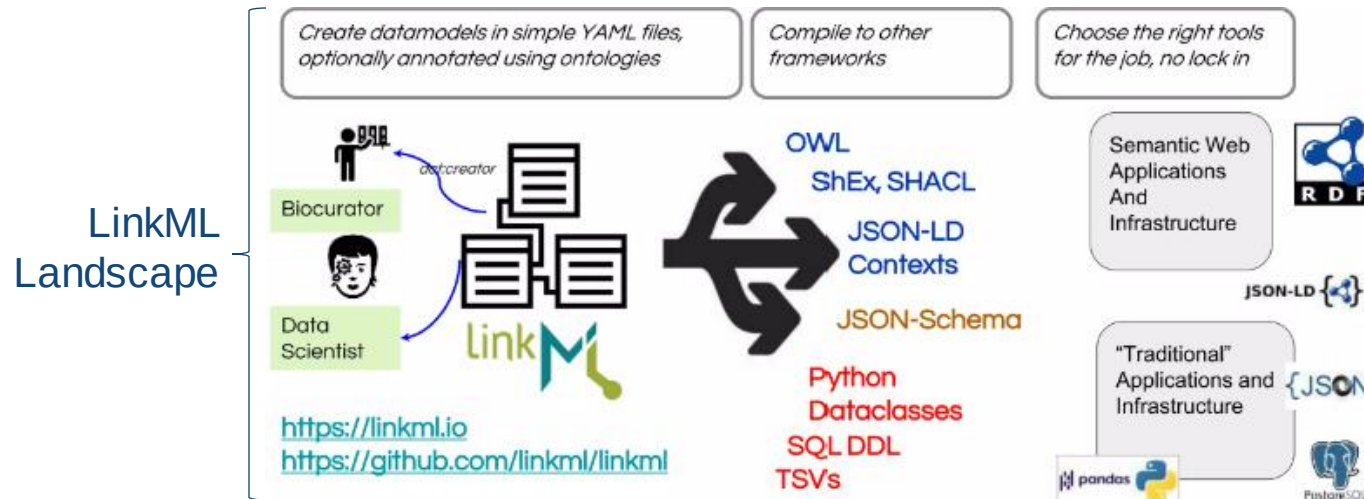


Moving Towards a Logical Model

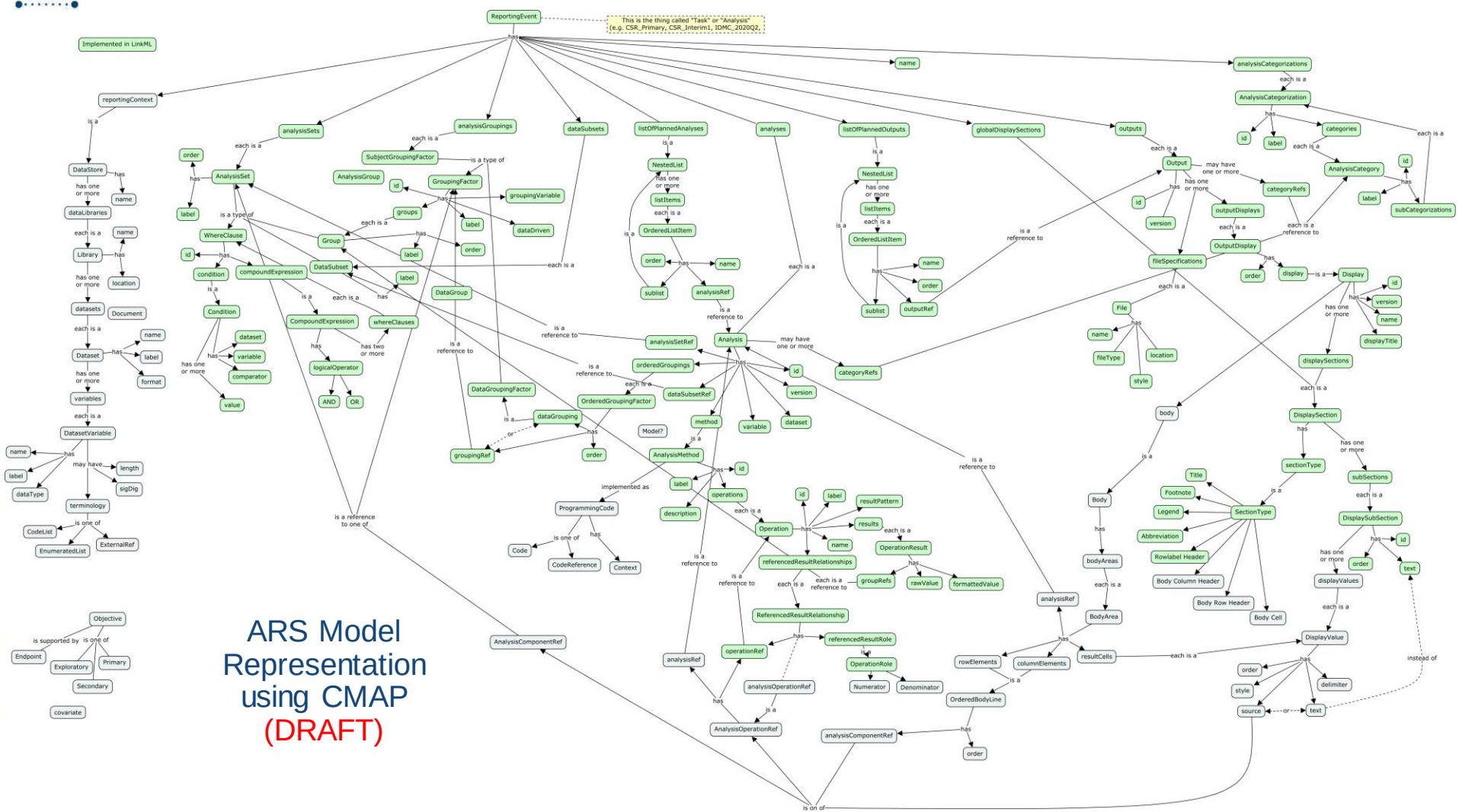
- Logical model that describes analysis results and associated metadata which will support:
 - Analysis Results Metadata Technical Specification (ARM-TS), to support automation, traceability, and creation of data displays
 - Define an Analysis Results Data (ARD) structure, to support reuse, reproducibility, and traceability of results data
- Model definition and documentation
- Illustrate and exercise with a common safety displays
 - Vital signs
 - Demographics
 - Adverse Events

Using LinkML to Create Analysis Results Model

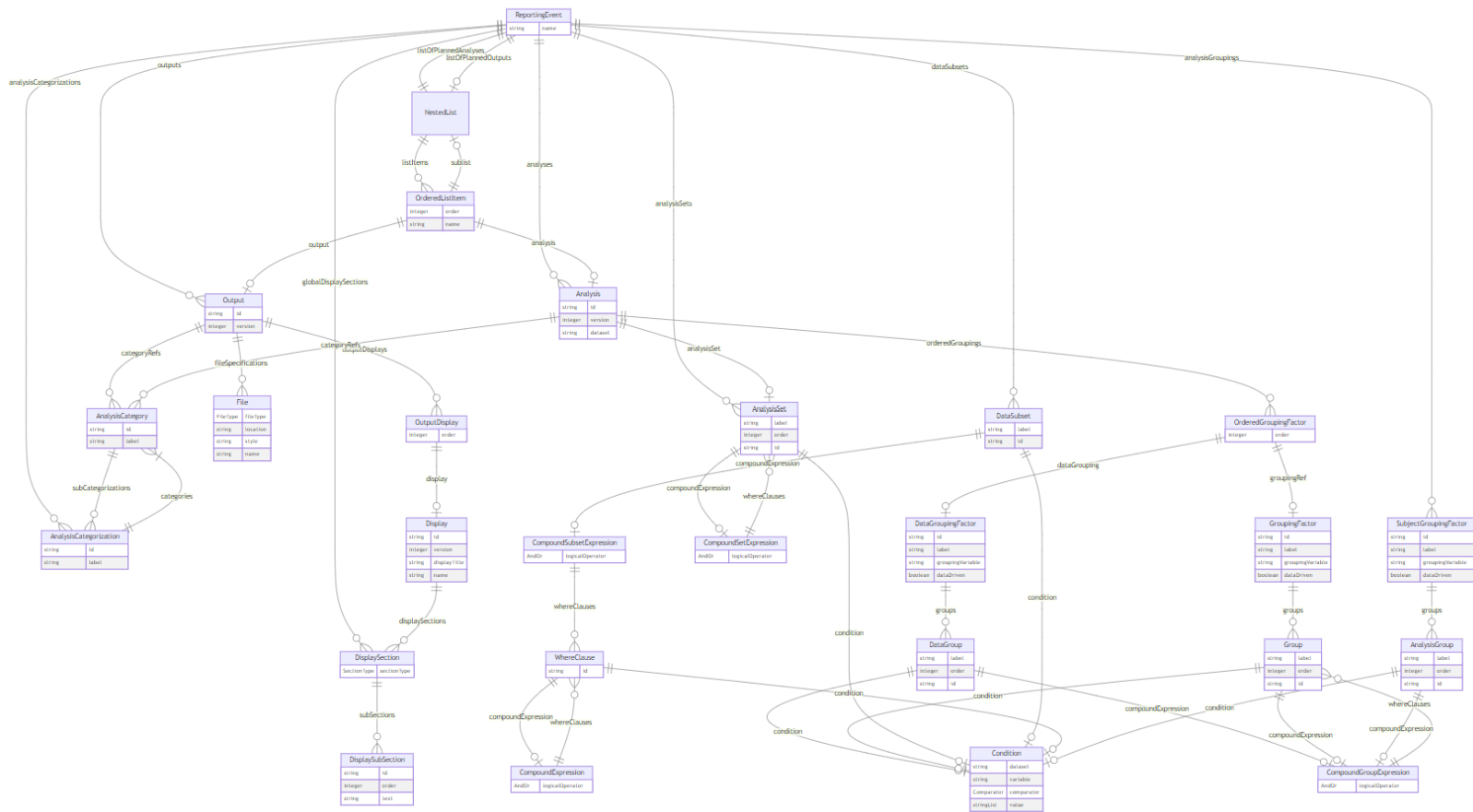
- LinkML is a general-purpose modeling language that can be used with linked data, JSON, and other formalisms



Reference: <https://www.slideshare.net/cmungall/linkml-intro-july-2022pptx>

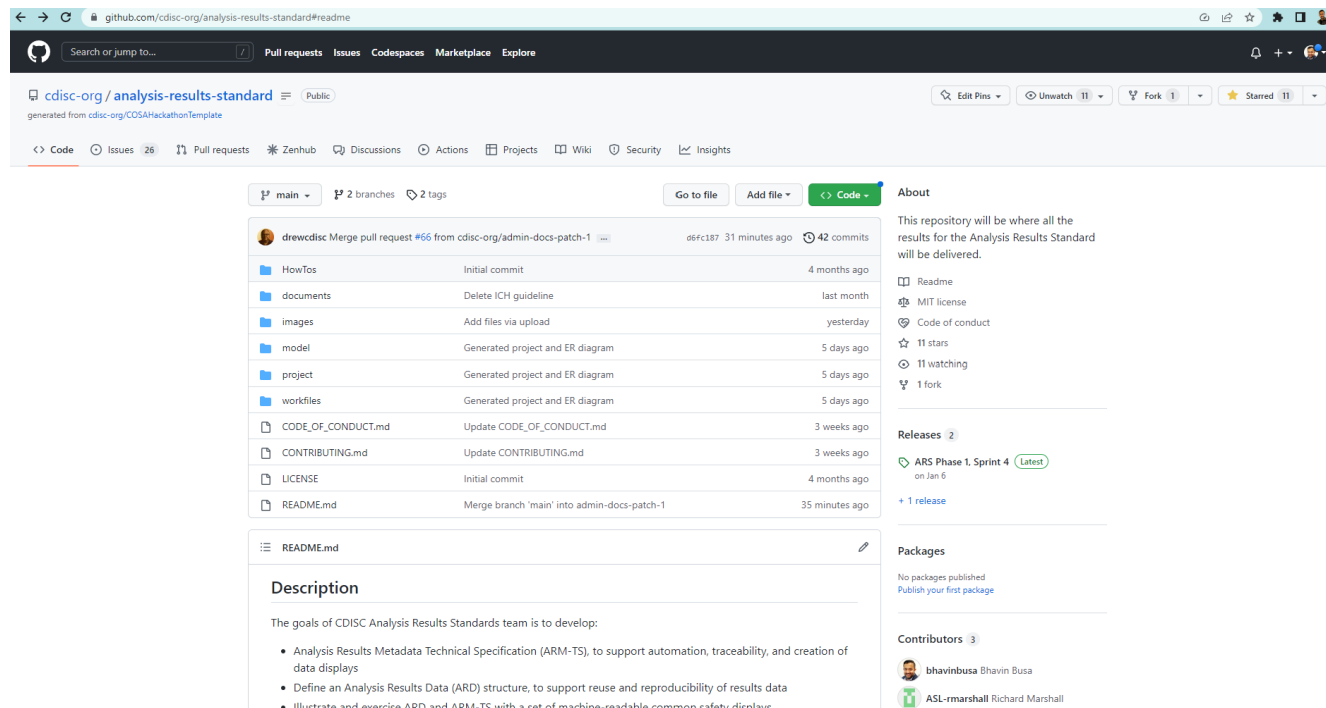


ARS Model Representation using Markdown (DRAFT)



Analysis Results Standard Repo on GitHub

- <https://github.com/cdisc-org/analysis-results-standard>



The screenshot displays the GitHub repository page for `cdisc-org/analysis-results-standard`. The repository is public and was generated from the `cdisc-org/COSAHackathonTemplate`. It has 11 forks and 11 stars. The repository is currently on the `main` branch, which has 2 branches and 2 tags.

The file list shows the following files and their commit history:

File	Commit Message	Commit Time
HowTos	Initial commit	4 months ago
documents	Delete ICH guideline	last month
images	Add files via upload	yesterday
model	Generated project and ER diagram	5 days ago
project	Generated project and ER diagram	5 days ago
workfiles	Generated project and ER diagram	5 days ago
CODE_OF_CONDUCT.md	Update CODE_OF_CONDUCT.md	3 weeks ago
CONTRIBUTING.md	Update CONTRIBUTING.md	3 weeks ago
LICENSE	Initial commit	4 months ago
README.md	Merge branch 'main' into admin-docs-patch-1	35 minutes ago

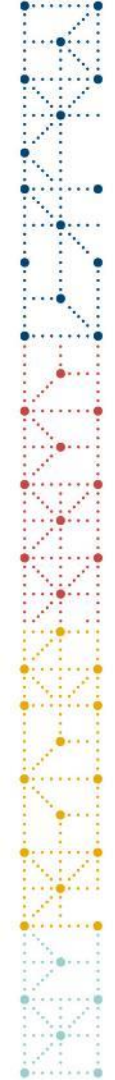
The README.md file is selected, showing the following description:

Description

The goals of CDISC Analysis Results Standards team is to develop:

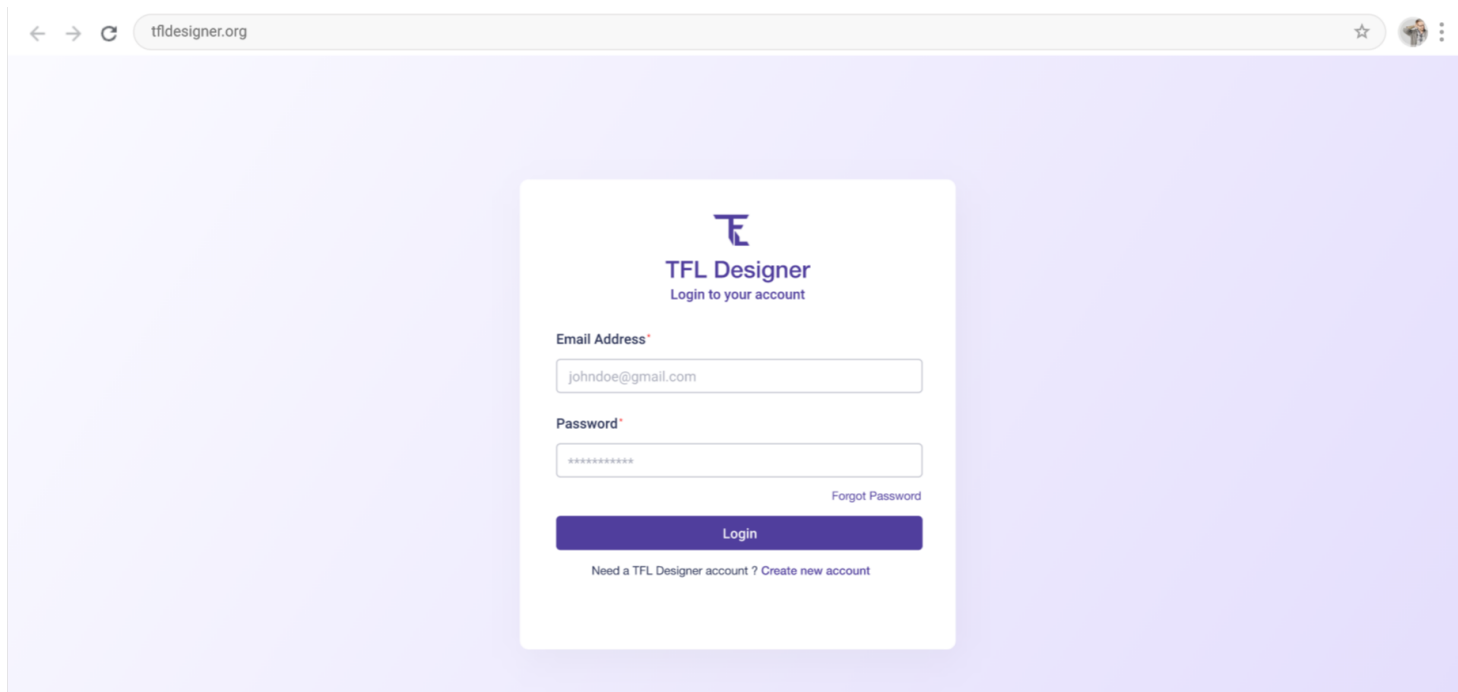
- Analysis Results Metadata Technical Specification (ARM-TS), to support automation, traceability, and creation of data displays
- Define an Analysis Results Data (ARD) structure, to support reuse and reproducibility of results data
- Illustrate and exercise ARD and ARM-TS with a set of machine-readable common safety data

The right sidebar shows the repository's metadata, including the description, license (MIT), code of conduct, 11 stars, 11 watching, and 1 fork. It also lists the releases, with the latest release being `ARS Phase 1, Sprint 4` on Jan 6. The packages section shows no packages published, and the contributors section lists `bhavinbusa` and `ASL-rmarshall`.



ARS model will drive automation and open-source tool development

Reference Implementation Example



A screenshot of a web browser displaying the login page for TFL Designer. The browser's address bar shows the URL "tfl designer.org". The page has a light purple background. In the center, there is a white login card. At the top of the card is the TFL Designer logo, which consists of a stylized 'T' and 'F' in purple, followed by the text "TFL Designer" and "Login to your account". Below the logo, there are two input fields: "Email Address*" and "Password*". The email field contains the text "johndoe@gmail.com" and the password field contains eight asterisks. To the right of the password field is a link that says "Forgot Password". Below the input fields is a purple "Login" button. At the bottom of the card, there is a link that says "Need a TFL Designer account ? Create new account".

← → ↻ tfl designer.org ☆


TFL Designer
Login to your account

Email Address*

Password*

[Forgot Password](#)

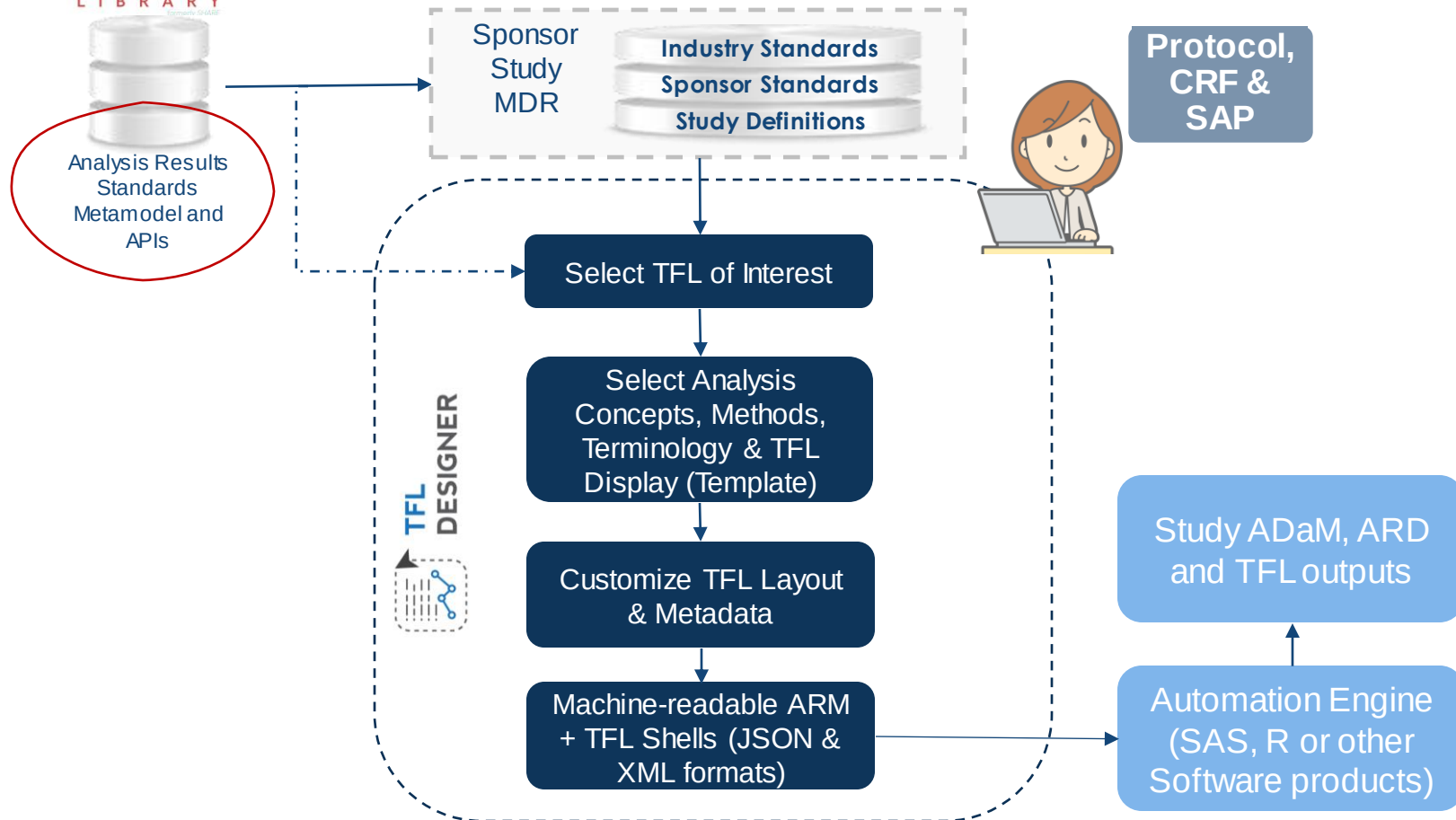
[Login](#)

[Need a TFL Designer account ? Create new account](#)

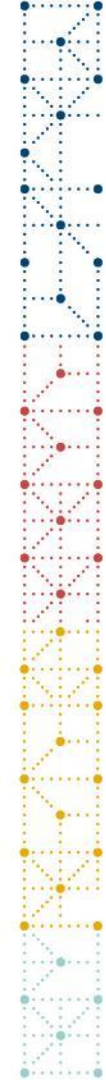
TFL Designer



- Open-source tool to design tables, figures, and listings (TFL) and generate associated analysis results metadata to support clinical trial data reporting
- CDISC COSA approved
- Align with CDISC ARS logical model
- Community beta version release (access limited to beta users): Apr 2023



* Open-Source TFL Designer, Bhavin Busa
Link to GitHub: <https://github.com/bhavinbusa/tfldesigner>



ARS Roadmap

MVP for v1.0 (Summer 2023)

- Logical Model of to support ARM TS/ARD
- Four common safety examples based on team developed tables
 - Demographics
 - Adverse Events
 - Vital signs

Future Development

- Expanded use cases
- Machine readable TFLs available on the CDISC website
- Conformance rules
- Terminology



Contact Details

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CDISC ARS GitHub Repo:

<https://github.com/cdisc-org/analysis-results-standard>

