



EXPERTISE

SAFETY

SOLUTIONS

DH10: Clean Data One Click Away: Using Backend Library Rules To Clean On SDTM Datasets

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WHEN YOU NEED TO BE SURE

SGS

DISCLAIMER AND DISCLOSURES

- *The views and opinions expressed in this presentation are those of the author(s) and do not necessarily reflect the opinions of PHUSE members, respective companies or organizations.*



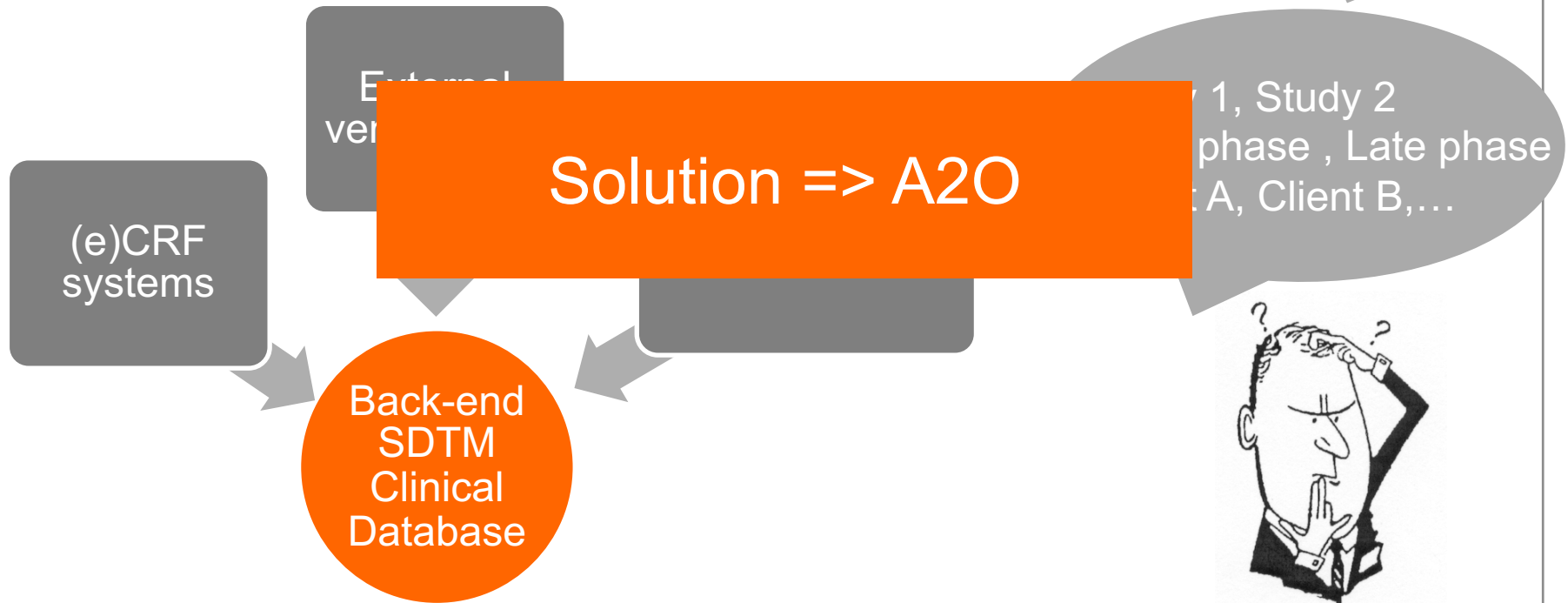
Rules

- Data cleaning challenges
- All2One Tool
- Case study
 - Selecting back-end rules
 - Creating new rules
- Past improvements/Future plans
- Conclusion

Rules

Data cleaning challenges

DATA CLEANING CHALLENGES



Rules

All2One Tool

- In-house developed application for data cleaning
- First Release in 2011
- Contains a master cleaning library that can be applied to trials
- Library populated with rules that have been validated (controlled validation process, no study validation needed)
- A2O rules will run on the backend SDTM database
- Used by both Clinical Data Manager (CDM) and Clinical Data Programmer (CDP)
- CDM is able to select relevant rules for a trial from the library
- CDM is able to create new rules

- New trial
- Use protocol, eCRF/aCRF and DTA's
- Determine data cleaning needs
- Create data cleaning package
 - Selecting all appropriate back-end library rules
 - Create new study specific rules
 - Update help tables
 - Create manual rules



EXPERTISE

Rules

Selecting back-end rules

- Rules are divided in Checks and Listings

Detail	Copy	Library Rule Name	Version	Type	Panel	Description	Message
Detail	☐	AE_003_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = 'TRIAL TERMINATION'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]	The adverse event end date is after the date ([DSSTDTC]) of the trial termination ([DSTERM]). Please check and correct where necessary.

- All output needs to be investigated
- If all data is ok => no output in A2O

panel	rulename	ruletype	state	version	tot	new	ind	cie	qtp	chg	nan	hld
AE	AE_006_L	CHECK	ACCEPTED	V01.00	0	0	0	0	0	0	0	0
AE	AE_007_L	CHECK	ACCEPTED	V01.00	0	0	0	0	0	0	0	0
AE	AE_008H_L	CHECK	ACCEPTED	V01.00	0	0	0	0	0	0	0	0

SELECTING BACK-END RULES

- Rules are divided in Checks and Listings

Detail	Copy	Library Rule Name	Version	Type	Panel	Description	Message
Detail	☐	VS_006_L	V01.00	LISTING	VS	List per subject and visit the distinct date of vital signs ([VSDTC]) and the screening visit date ([SVSTDTC] where [VISIT] = 'SCREENING'). Add an indication when [VSDTC] < [SVSTDTC] or [VSDTC] > current date. Reported: [VISITNUM], [VSDTC], [SVSTDTC#SCREENING], [IND] Order by: [SITEID], [USUBJID], [VISITNUM]	



- Always output
- Uses indications to facilitate cleaning

panel	rulename	ruletype	state	version	tot	new	ind	de	qtp	chg	nan
VS	VS_004_L	LISTING	ACCEPTED	V02.00	367	367	0	0	0	0	0
VS	VS_538_L	LISTING	ACCEPTED	V02.00	773	254	18	0	0	0	519



File Rules Cleaner DCFs ZZ Tables SDTM Rules DVP SAE Reports Windows Help

Rule Package

New Rules All Trials

Copy Library Rule

Add New Rule

Rule Package Statistics

Copy From Trial: No Trial Selected ☐ Copy DVP Info

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Detail	Copy	Library Rule Na...	Version	Type	Panel	Description	Message	CDP
Detail	☐	AE_003_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = 'TRIAL TERMINATION'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]	The adverse event end date is after the date ([DSSTDTC]) of the trial termination ([DSTERM]). Please check and correct where necessary.	HANNELOR
Detail	☐	AE_003A_L	V01.00	CHECK	AE	Check that the end date of the adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSCAT] = 'DISPOSITION EVENT'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]	The adverse event end date is after the date ([DSSTDTC]) of the trial termination ([DSTERM]). Please check and correct where necessary.	HANNELOR
Detail	☐	AE_003B_L	V01.00	CHECK	AE	Check that end date of AE ([AEENDTC]) <= study discontinuation date ([DSSTDTC] where [DSCAT] = 'DISPOSITION EVENT' and [EPOCH] <> 'TREATMENT' or not completed). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSSTDTC#STUDY]	End date of AE ([AEENDTC]) is after the study discontinuation date ([DSSTDTC#STUDY]). Please check and correct where necessary. If the AE was ongoing at the time of study discontinuation, please tick the according option.	NIELS_VAN
Detail	☐	AE_003C_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) >= minimum administration start date of primary medication (min [EXSTDTC] where [EXTRT] = [TRT#ZZ_EX]) and <= current date. Refer to table [ZZ_EX] for specifications about primary medication. Reported: [AESPID], [AETERM], [AEENDTC], [TRT#ZZ_EX], [EXSTDTC]	End date of adverse event is prior to the first administration of [TRT#ZZ_EX] or is a future date. Please check and correct where necessary.	LUIS_TORR
Detail	☐	AE_003D_L	V01.00	CHECK	AE	Check that the end date of AE ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = [DSSCAT] of the record in [ZZ_DS] where [EVENT] = 'TRIAL TERMINATION'). Refer to table [ZZ_DS] for specifications about termination records. Reported: [AETERM], [AESTDTC], [AEENDTC], [DSSTDTC], [X1SPID#ZZ], [X1TESTCD#ZZ], [X1ORRES#ZZ]	The adverse event end date ([AEENDTC]) is after the date of the trial termination ([DSSTDTC]). Please check and correct where necessary.	SANDRA_D
Detail	☐	AE_003E_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) >= minimum administration start date of primary medication (min [ECSTDTC] where [ECRTT] = [TRT#ZZ_EC]) and <= current date. Refer to table [ZZ_EC] for specifications about primary medication. Reported: [AESPID], [AETERM], [AEENDTC], [TRT#ZZ_EC], [ECSTDTC]	End date of adverse event is prior to the first administration of [TRT#ZZ_EC] or is a future date. Please check and correct where necessary.	LUIS_TORR
Detail	☒	AE_006_L	V01.00	CHECK	AE	Check if adverse event outcome ([AEOUT]) = 'FATAL' that the AE is considered serious ([AESER] = 'Y'). Reported: [AETERM], [AESTDTC], [AEOUT], [AESER]	Adverse event outcome is fatal, but the adverse event is not considered serious. Please check and correct where necessary.	MAARTEN
Detail	☒	AE_007_L	V01.00	CHECK	AE	Check if concomitant therapy is not given because of adverse event ([AECONTRT] = 'N') or if concomitant therapy given ([AECONTRT]) is not completed, that no linking with a concomitant therapy record exists in [RELREC]. Reported: [AETERM], [AESTDTC], [AECONTRT]	There was no concomitant therapy given because of adverse event, but there is a link with a concomitant therapy reported. Please check and correct where necessary.	ELMA_HAD
Detail	☐	AE_007D_L	V01.00	CHECK	AE	Check if concomitant therapy is not given because of adverse event ([AECONTRT] = 'N') or if concomitant therapy given ([AECONTRT]) is not completed, that no linking with a concomitant therapy record exists (no linking via [AEGRPID] and [CMSEQ] exists in [RELREC]). Reported: [AETERM], [AESTDTC], [AECONTRT]	There was no concomitant therapy given because of adverse event, but there is a link with a concomitant therapy reported. Please check and correct where necessary.	GOMES_BA
Detail	☒	AE_008_L	V02.00	CHECK	AE	Check that start date of adverse event ([AESTDTC]) > the date of informed consent ([DSSTDTC] where [DSDECODE] = 'INFORMED CONSENT OBTAINED') and <= current date. Reported: [AETERM], [AESTDTC], [DSDECODE], [DSSTDTC]	Start of adverse event is before or on the date of informed consent ([DSSTDTC]) or is a future date. Please check and correct where necessary.	SELDA_CIN
		AE_008B_L	V01.00	CHECK	AE	Check that start date of serious adverse event ([AESTDTC] where [AESER] = 'Y') >= the date of informed consent ([DSSTDTC] where [DSDECODE] = 'INFORMED CONSENT OBTAINED') and <= current date. Reported: [AETERM], [AESTDTC], [DSDECODE], [DSSTDTC]	Start of serious adverse event ([AESTDTC]) is prior to date of informed consent ([DSSTDTC]) or is a future date. Please check and correct where necessary.	ZAHRA_KAI

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Edit Filter

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Copy From Trial: No Trial Selected

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Detail	Copy	Library Rule Na... ▲	Version	Type	Panel	Description
Detail	☐	AE_003_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = 'TRIAL TERMINATION'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]
Detail	☐	AE_003A_L	V01.00	CHECK	AE	Check that the end date of the adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSCAT] = 'DISPOSITION EVENT'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]
Detail	☐	AE_003B_L	V01.00	CHECK	AE	Check that end date of AE ([AEENDTC]) <= study discontinuation date ([DSSTDTC] where [DSCAT] = 'DISPOSITION EVENT' and [EPOCH] <> 'TREATMENT' or not completed). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSSTDTC#STUDY]

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A20 - CDM - GLENN_BORGMANS - (1914715) - [Copy Library Rules]									
File Rules Cleaner DCFs ZZ Tables SDTM Rules DVP SAE Reports Windows Help									
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Drag a column header here to group by that column									
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x ☒ [Copy Status] <> 'Missing flags.'									
Edit Filter									

Copy From Trial:		No Trial Selected					☐ Copy D		
		Trial Name	TrialId	Library	Sponsor Name	Compound Name			
Drag a column header			1803831	SDS32_SGSIG50	Client A Client B				
			1502009	SDS32_SGSIG50					
			1507300	SDS32_SGSIG50					
			1507302	SDS32_SGSIG50					
			1605772	SDS32_SGSIG50					
			1805324	SDS32_SGSIG50					
			1601039	SDS32_SGSIG50					
			1801534	SDS32_SGSIG50					
			1801535	SDS32_SGSIG50					
			1901116	SDS32_SGSIG50					
			1803871	SDS32_SGSIG50					
			2000229	SDS32_SGSIG50					
		x ☒ [Library] = 'SDS32_SGSIG50'					Edit Filter		
		x							
		AE_003E_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) >= minimum administration date. Refer to primary medication.			

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Drag a column header		Trial Name	TrialId	Library	Sponsor Name	Compound Name
Detail	Copy		1803831	SDS32_SGSIG50		
			1502009	SDS32_SGSIG50		
			1507300	SDS32_SGSIG50		
Detail	☐		1507302	SDS32_SGSIG50		
			1605772	SDS32_SGSIG50		
			1805324	SDS32_SGSIG50		
			1601039	SDS32_SGSIG50		
			1801534	SDS32_SGSIG50		
			1801535	SDS32_SGSIG50		
			1901116	SDS32_SGSIG50		
			1803871	SDS32_SGSIG50		
			2000229	SDS32_SGSIG50		
		x ☒ [Library] = 'SDS32_SGSIG50'				Edit Filter
		x				
		AE_003E_L	V01.00	CHECK	AE	Check that end date of adverse event ([AEENDTC]) >= minimum administration date. Refer to primary medication.

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Drag a column header here to group by that column

	Detail	Copy	Library Rule Na... ▲	Version	Type	Panel	Description
▶	Detail	☐	AE_003_L	V01.00	CHECK	AE	Check that end date of adverse event is not null (i.e. 'TERMINATION'). Reported: [AETERM], [AESTDTC],
	Detail	☐	AE_003A_L	V01.00	CHECK	AE	Check that the end date of the adverse event is not null (i.e. 'DISPOSITION EVENT'). Reported: [AETERM], [AESTDTC],
	Detail	☐	AE_003B_L	V01.00	CHECK	AE	Check that end date of AE ([AEENDTC]) is not null (i.e. 'TREATMENT EVENT' and [EPOCH] <> 'TREATMENT'). Reported: [AETERM], [AESTDTC],
	Detail	☐	AE_003C_L	V01.00	CHECK	AE	Check that end date of adverse event is not null (i.e. [EXSTDTC] where [EXTRT] = [TRT] medication). Reported: [AESPID], [AETERM], [AESTDTC],

Rule Name	AE_003_L	Version	V01.00	Library Name	AE_003_L
Domain	AE	Responsible	DCF		
Rule Type	CHECK	Rule State	ACCEPTED	Comments	Rule accepted by LIB team
Description	Check that end date of adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = 'TRIAL TERMINATION'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]				
Message	The adverse event end date is after the date ([DSSTDTC]) of the trial termination ([DSTERM]). Please check and correct where necessary.				
Rule SQL	<pre>SELECT AE.RECID, AE.SITEID, AE.USUBJID, AE.ARMCD, AE.AETERM, AE.AESTDTC, AE.AEENDTC, DS.DSTERM, DS.DSSTDTC FROM CTSS\$PROTOCOL.AE AE LEFT JOIN (SELECT USUBJID, DSTERM, DSSTDTC FROM CTSS\$PROTOCOL.DS WHERE DSSCAT = 'TRIAL TERMINATION') DS ON (AE.USUBJID = DS.USUBJID) WHERE TLS_UTILS.FNC_COMPARE_DATES (AE.AEENDTC, DS.DSSTDTC) > 0</pre>				
Communication					
Reason Change Request					
Change Request Rejected					

Save

Save/Next

Save/New

Accept

Close

Rule Name	AE_003_L	Version	V01.00	Library Name	AE_003_L
Domain	AE	Responsible	DCF		
Rule Type	CHECK	Rule State	ACCEPTED	Comments	Rule accepted by LIB team

Description	Check that end date of adverse event ([AEENDTC]) <= trial termination date ([DSSTDTC] where [DSSCAT] = 'TRIAL TERMINATION'). Reported: [AETERM], [AESTDTC], [AEENDTC], [DSTERM], [DSSTDTC]
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Message	The adverse event end date is after the date ([DSSTDTC]) of the trial termination ([DSTERM]). Please check and correct where necessary.
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Rule SQL	<pre>SELECT AE.RECID, AE.SITEID, AE.USUBJID, AE.ARMCD, AE.AETERM, AE.AESTDTC, AE.AEENDTC, DS.DSTERM, DS.DSSTDTC FROM CTS\$PROTOCOL.AE AE LEFT JOIN (SELECT USUBJID, DSTERM, DSSTDTC FROM CTS\$PROTOCOL.DS WHERE DSSCAT = 'TRIAL TERMINATION') DS ON (AE.USUBJID = DS.USUBJID) WHERE TLS_UTILS.FNC_COMPARE_DATES (AE.AEENDTC, DS.DSSTDTC) > 0</pre>
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SELECTING BACK-END RULES

■ Help tables

- For general rules that often vary between studies
- Enter/update study specific parameters

Table Name: ZZ_WINDO		Table Name: ZZ_VSRANGES Flags: ☒ Ready To Review ☒ Reviewed								
Drag a column header here		Drag a column header here to group by that column								
	VISITREF		POS	TESTCD	OPERATOR1	VALUE1	OPERATOR2	VALUE2	VISIT_X1	X1SPID
▶ 1	PERIOD 1 DAY 1	▶ 1		TEMP	>=	35	<=	37.9		
2	PERIOD 1 DAY 1	2		RESP	>=	10	<=	24		
3	PERIOD 1 DAY 1	3		BMI	>=	18	<=	30		
4	PERIOD 1 DAY 1	4		WEIGHT	>=	50				
5	PERIOD 1 DAY 1	5	SUPINE	SYSBP	>	90	<=	140		
6	PERIOD 1 DAY 1	6	SUPINE	DIABP	>	50	<=	90		
7	PERIOD 1 DAY 1	7	SUPINE	PULSE	>	45	<	120		
8	PERIOD 2 DAY 1									

■ Help tables

- For general rules that often vary between studies
- Enter/update study specific parameters

■ DVP (Data validation plan)

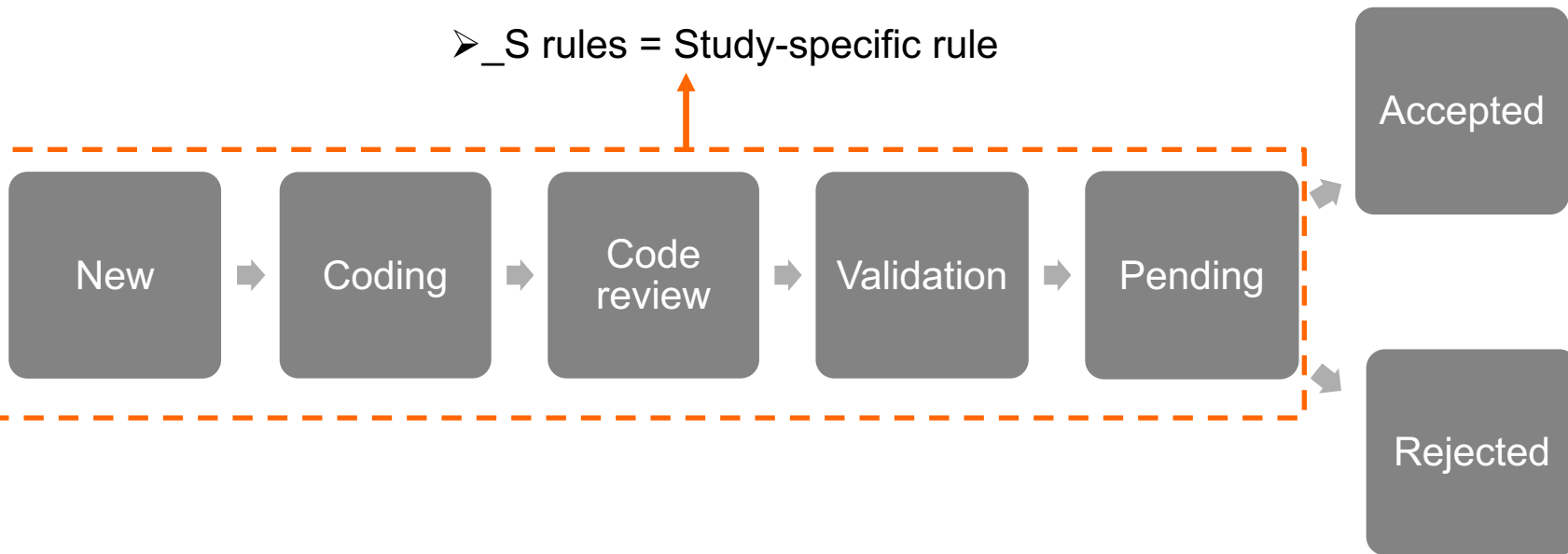
- Contains all selected rules and help tables
- Reviewed by 2nd CDM
- Can be exported and reviewed by client if required

Rules

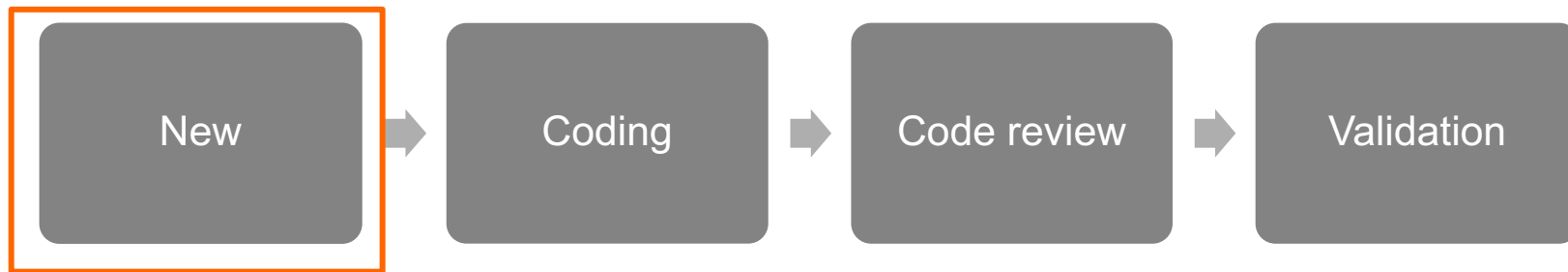
Rule creation flow

RULE CREATION FLOW

➤ _S rules = Study-specific rule



RULE CREATION FLOW



- CDM defines new rule

Rule Name		Version		Library Name	
Domain		Responsible			
Rule Type		Rule State		Comments	
Description					
Message					
Rule SQL					
Communication					
Reason Change Request					
Change Request Rejected					

Save

Save/Next

Save/New

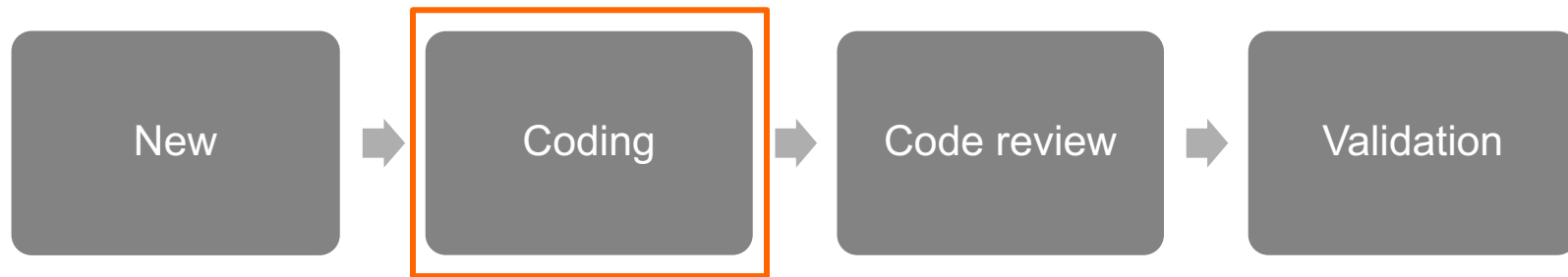
Delete

Change Request

Accept

Close

RULE CREATION FLOW



- CDM defines new rule
- CDP programs SQL

Rule Name		Version		Library Name	
Domain		Responsible			
Rule Type		Rule State		Comments	
Description					
Message					
Rule SQL					
Communication					
Reason Change Request					
Change Request Rejected					

Save

Save/Next

Save/New

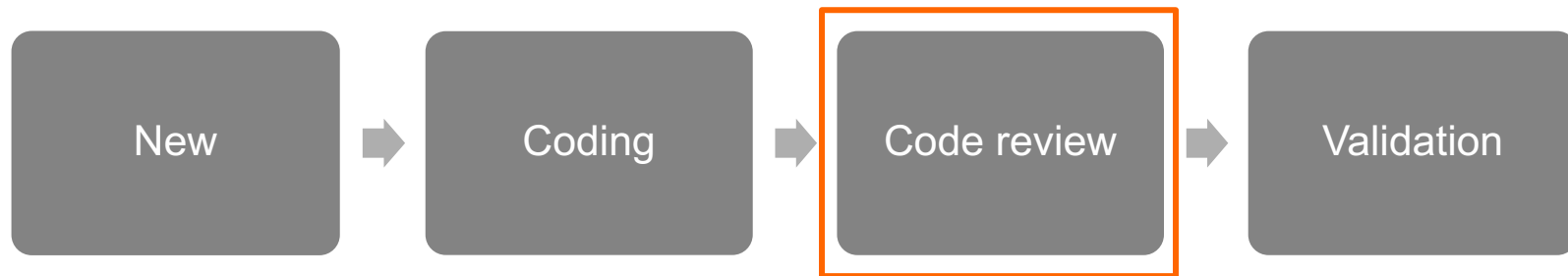
Delete

Change Request

Accept

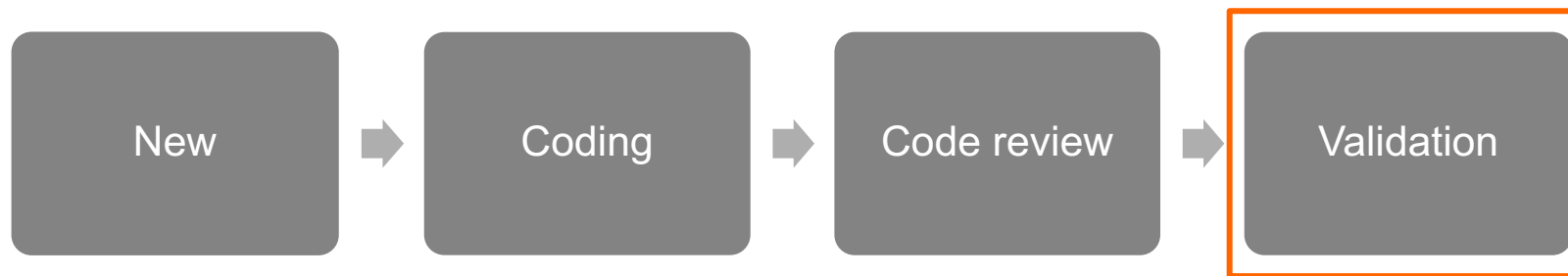
Close

RULE CREATION FLOW



- CDM defines new rule
- CDP programs SQL
- Code review by 2nd CDP

RULE CREATION FLOW



- CDM defines new rule
- CDP programs SQL
- Code review by 2nd CDP
- Validated by CDM

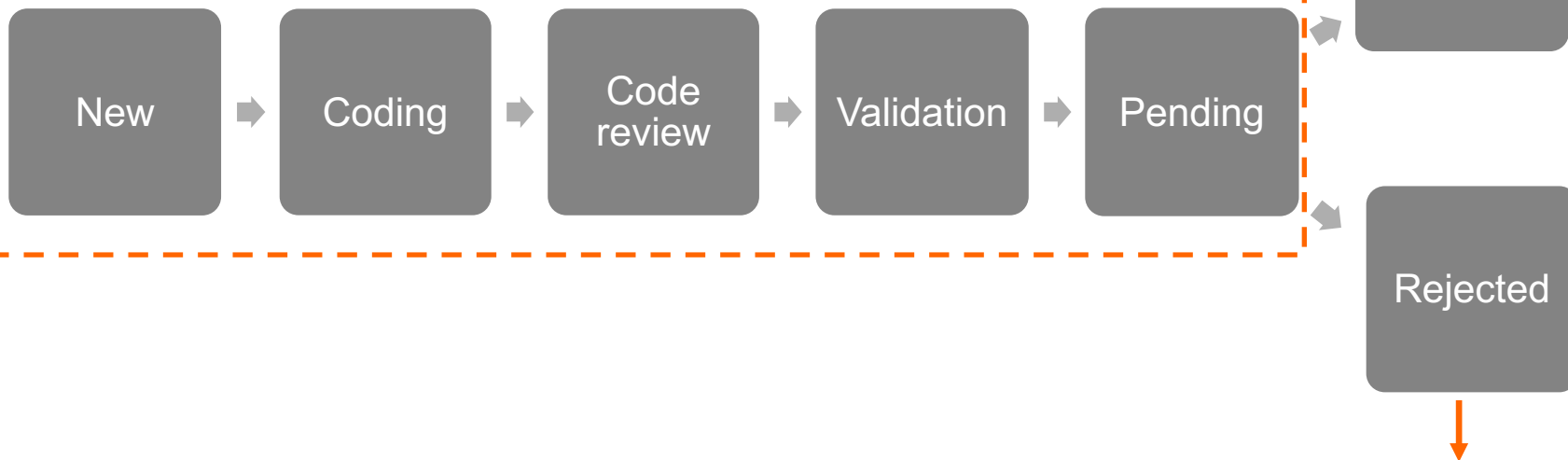
Validation for checks:
The SQL code and the pre-defined discrepancies match.
The SQL code meets the All2One criteria.

Validation for listings:
The SQL code meets the All2One criteria

RULE CREATION FLOW

➤ _L rules = Library rule

➤ _S rules = Study-specific rule



➤ _S rules = Study-specific rule

■ L rules = Library rules

Name	Type	Main Domain	PD	Description	Notes	Annotated Description	Proposed Query Text
LB_614_L	LISTING	LB		02. Inconsistent data - Check that the clinical significance is completed when a value is out of range. - Check that lab normal range indicator is completed.	The second indication does not necessarily require action; a value can be within ranges and still have clinical significance completed, e.g. in case of hemolytic sample.	List per subject, visit and time point all lab test results [LBSTRESC] and the corresponding clinical significance ([QVAL] where [QNAM] = 'LBCLSIG' and [IDVAR] = 'LBSEQ'). Add a first indication when a value is out of range ([LBNRIND] <> 'NORMAL') and the corresponding clinical significance is not completed. Add a second indication when the clinical significance is completed but the corresponding value is not out of range. Add a third indication when reference range indicator ([LBNRIND]) is not completed. Reported: [VISITNUM], [LBTPPT], [LBTPPTNUM], [LBOTC], [LBCAT], [LBSCAT], [LBTESTCD], [LBTEST], [LBORRES], [LBORRESU], [LBORNRLLO], [LBORNRI], [LBSTRESC], [LBSTRESU], [LBSTNRLO], [LBSTNRHI], [LBSTNRC], [LBNRIND], [QNAM], [QVAL], [LBSTAT], [LBREASND], [IND#1], [IND#2], [IND#3] Order by: [SITEID], [USUBJID], [LBTESTCD], [LBOTC]	

RULE CREATION FLOW

- _L rules = Library rules
- _S rules = Study-specific rule

Name	Type	Main Domain	PD	Description	Notes	Annotated Description	Proposed Query Text
AE_001_S	LISTING	AE		02. Inconsistent data Check if the information in QNAM -Panel 1 (AEACNS1/2/3/4 and AERELS1/2/3/4) -Panel 2 (AEACNS5/6/7 and AERELS5/6/7) is completed correctly: - If a subject never received study drug, action taken must always be 'not applicable' and relation 'not related'. - If the AE starts and ends before first intake of study treatment or after the last intake of study treatment, the relationship is expected to be 'not related' and action taken 'not applicable'. - All other scenarios (AE duration overlaps partially/entirely with period of first-to-last study drug intake) require an action: • DOSE NOT CHANGED • DOSE INCREASED • DOSE REDUCED • DRUG WITHDRAWN (=administration study medication terminated permanently) • UNKNOWN -> If action taken is 'unknown', it is expected that subject is 'lost to follow-up' (reason for withdrawal) -> If action taken is 'Dose reduced/drug interrupted/drug withdrawn', it is expected that relation is 'related'		List per subject all adverse events ([AETERM]) with start date ([AESTDTC]), end date/ongoing ([AEENDTC]), [AEENRPT]), severity ([AESEV]), seriousness ([AESER]), outcome ([AEOUT]), stabilization date ([QVAL] where [QNAM] = 'AESBDTC'), concomitant therapy taken ([AECONTRT]), action taken regarding study drug ([QVAL] where [QNAM] = 'AEACNS1', 'AEACNS2', 'AEACNS3', 'AEACNS4', 'AEACNS5', 'AEACNS6', 'AEACNS7') and relation to study drug ([QVAL] where [QNAM] = 'AERELS1', 'AERELS2', 'AERELS3', 'AERELS4', 'AERELS5', 'AERELS6', 'AERELS7'). Reported: [AETERM], [AESTDTC], [AEENDTC], [AEENRPT], [AESEV], [AESER], [AEOUT], [QNAM#AESBDTC], [QVAL#AESBDTC], [AECONTRT], [QNAM#AEACNS1], [QVAL#AEACNS1], [QNAM#AEACNS2], [QVAL#AEACNS2], [QNAM#AEACNS3], [QVAL#AEACNS3], [QNAM#AEACNS4], [QVAL#AEACNS4], [QNAM#AEACNS5], [QVAL#AEACNS5], [QNAM#AEACNS6], [QVAL#AEACNS6], [QNAM#AEACNS7], [QVAL#AEACNS7], [QNAM#AERELS1], [QVAL#AERELS1], [QNAM#AERELS2], [QVAL#AERELS2], [QNAM#AERELS3], [QVAL#AERELS3], [QNAM#AERELS4], [QVAL#AERELS4], [QNAM#AERELS5], [QVAL#AERELS5], [QNAM#AERELS6], [QVAL#AERELS6], [QNAM#AERELS7], [QVAL#AERELS7] Order by: [SITEID], [USUBJID], [AETERM], [AESTDTC]	

RULE CREATION FLOW

- _L rules = Library rules
- _S rules = Study-specific rule
- _M rules = Manual rule (exceptional cases)
 - Normally no SAE reconciliation expected in early phase
 - Be prepared (pro-active approach)

AE_004_M	MANUAL	AE	 	08. Fatal Adverse Events For AEs with outcome Fatal: * Severity should be SEVERE * the AE record should be 1 day and no end date should be entered for the fatal AE		
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Rules

Past improvements/
Future plans

EXPERTISE

■ Past improvements

- Added change request function
- Implementation of help tables
- Merging of different implementation guide libraries

■ In progress

- Automated checks on rule naming conventions
- Automatic assignment flow in A2O for new rules
- Option to clean on source or SDTM data
- Add tags to increase efficiency in proposing rules

■ Future plans

- Standard queries automatically populated in the eCRF system
- Keep expanding and streamlining the existing library

Rules

Conclusion

Rules

■ Drawbacks

- Library will never be finished
- Growing library can result in too much choice in rules -> pitfall for new users
 - ⇒ Important to use filter/search options (active/inactive rules)
 - ⇒ Maintenance is needed

Rules

■ Benefits

- No need to start from scratch for new studies
- Immediate release and use of validated library rules (clean data one click away)
- Allows fast set-up (without CDP)
- Client specific library: next study => easier to select rules and consistent data cleaning
- Allows more standardisation & automatization
- Less chance for human errors



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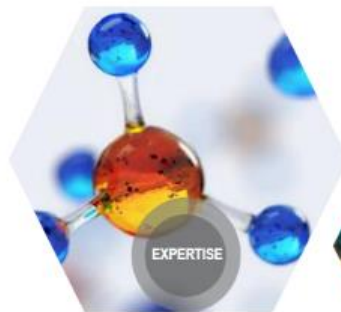
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