

# Automatisierte Erstellung einer Mapping- Spezifikation für eine gepoolte Datenbank

Thomas Wollseifen

---

14./15. September 2022

**KSFE** 2022



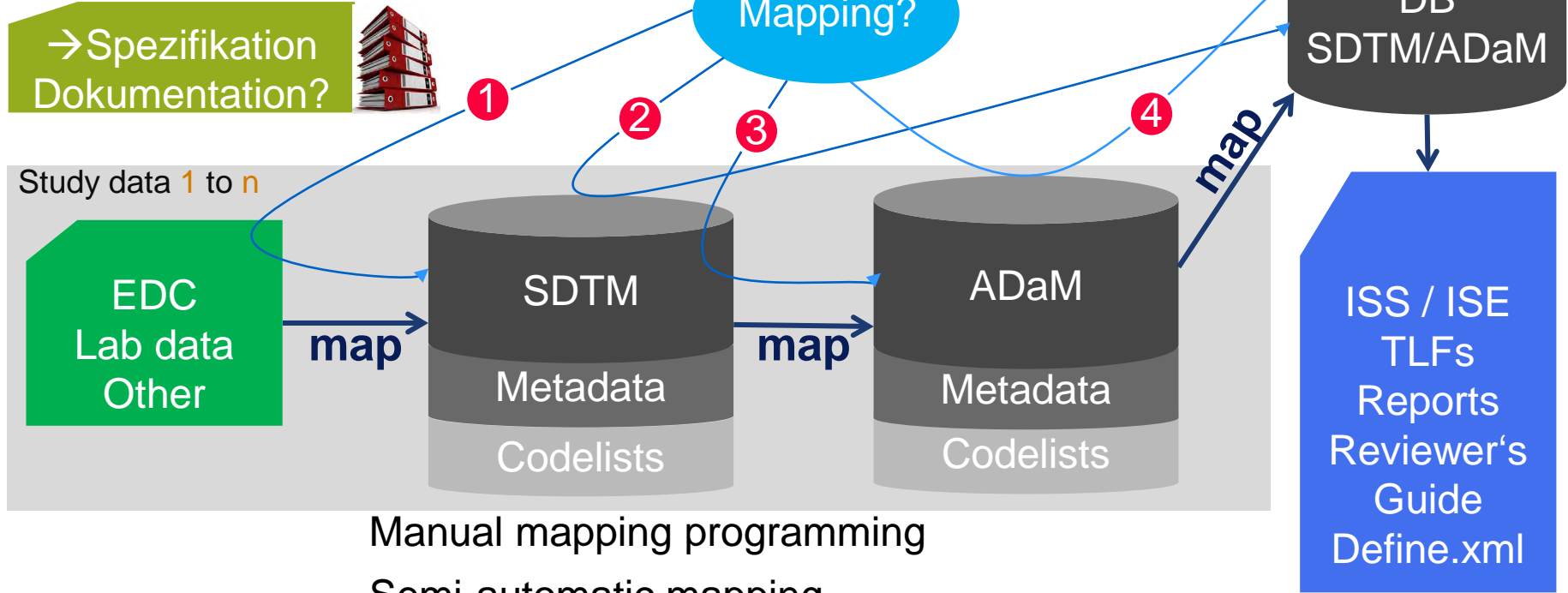
## AGENDA

- 01 Einführung – Datenfluss in klinischen Studien
- 02 Makro %m\_create\_metadata\_docu\_xls()
- 03 Mapping-Vorschläge – Fuzzy matching
- 04 Berücksichtigung vorheriger Mapping-Beschreibungen
- 05 Zusammenfassung

# 01 Einführung - Datenfluss in klinischen Studien

---

# Datenfluss in klinischen Studien



→Spezifikation Dokumentation?

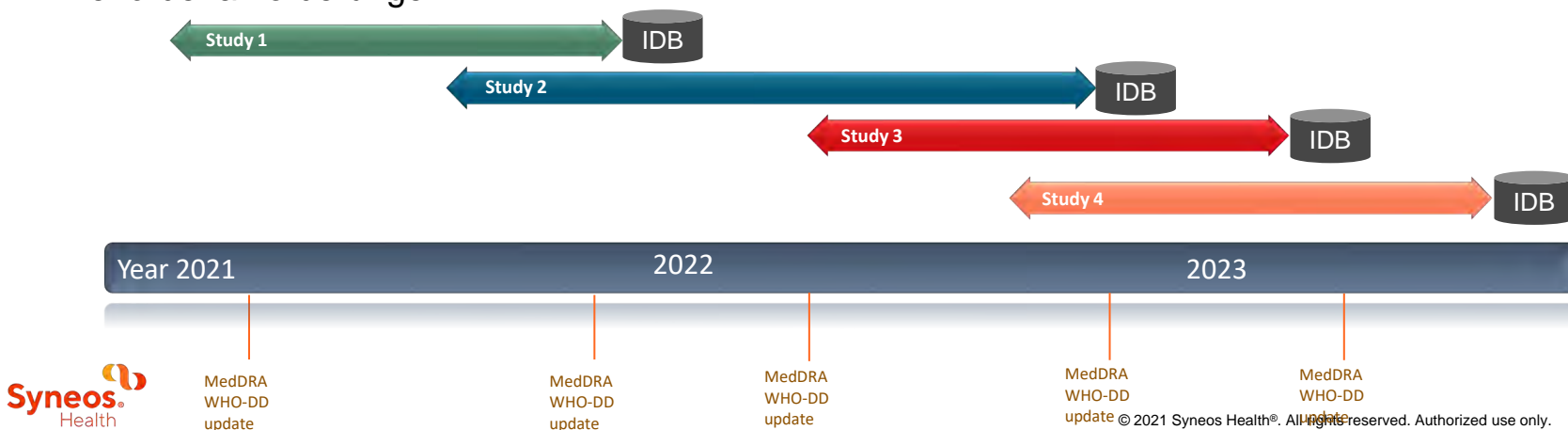


- Manual mapping programming
- Semi-automatic mapping
- Automatic mapping
- Meta data repository (MDR)

# Eigenschaften des Datenflusses/IDB auf die Dokumentation

- Studiendaten zu verschiedenen Zeitpunkten hinzufügen
- Mapping kann sich aufgrund von Anfragen ändern
- Neue Variablen / neue Domänen
- Struktur der IDB kann sich ändern
- SDTM oder ADaM IDB
- Pflege der IDB (MedDRA, WHO-DD Update, Korrekturen)
- Behördenanforderungen

→ Wie wird es dokumentiert?

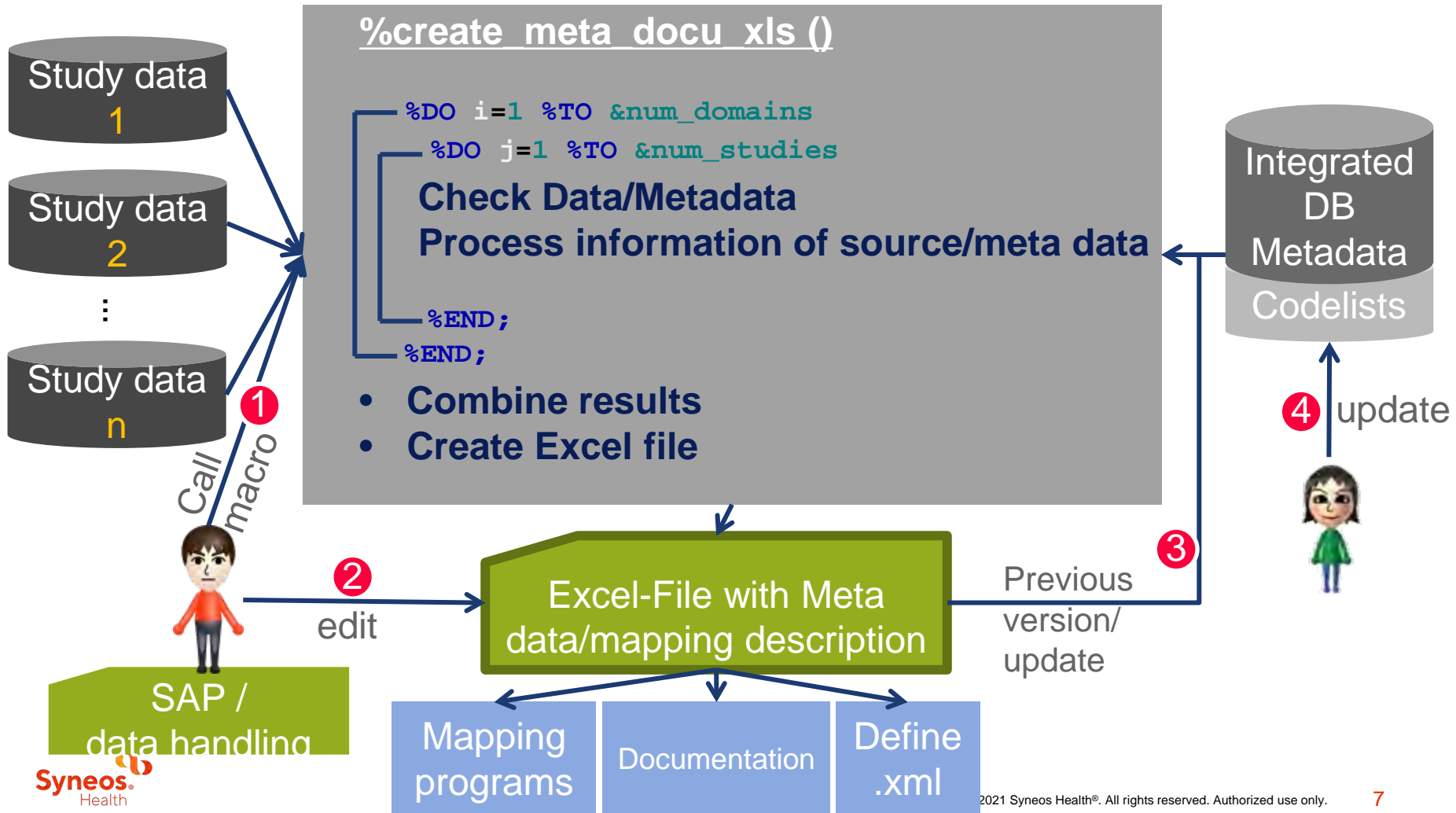


## 02 Makro %m\_create\_metadata\_docu\_xls()

### → Dokumentation

	A	B	C	D	DOMA	VARIABLE	VARNUM	LABEL	TYPE	LENG	CODEL	Structur	SN_1000	SN_1001	SN_1002
1	Domains Pool	SN_1000	SN_1001	SN_1002								TARGE			
2	AE	AE	AE	SUPPAE AE	TV	TRIALNO							VISDES TRIALNO	Variable does not exist	Variable does not exist
3	CM	COMED	CM	CM	TV	VISITSP							VISDES VISITSP	Variable does not exist	Variable does not exist
4	DM	not available or not assigned	DM	SUPPDM DM	TV	VIS_SDRS							VISDES VIS_SDRS contains only missings	Variable does not exist	Variable does not exist
5	DS	PROTOCOL ENDPOINT DV	DS	DS	TV	VIS_SDRS							VISDES VIS_SDRS contains only missings	Variable does not exist	Variable does not exist
6	EX	DOSE	EX	SUPPEX EX	TV	STUDYID	1	Study Identifier	C	10		ADS SDTM		TV.STUDYID	TV.STUDYID Length/meta data definition
7	LB	LAB	LB	SUPPLB LB	TV	DOMAIN	2	Domain Abbreviation	C	2	DOMAIN	SDTM		TV.DOMAIN	TV.DOMAIN.Codelist is different, \$
8	MH	MHIS	MH	MH	TV	VISITNUM	3	Visit Number	N	9.4	P_VISIT	ADS SDTM		TV.VISITNUM	TV.VISITNUM.Codelist is different, \$
9	SE	not available or not assigned	SE	SE	TV	VISIT	4	Visit Name	C	40		ADS SDTM	VISDESC VISIT.Type is different than in definition	TV.VISIT	TV.VISIT
10	SV	VISIT	SV	SV	TV	VISITN	5	Visit Name (N)	N	14.6	ZVISIT	ADS		TV.VISITN	TV.VISITN
11	TA	not available or not assigned	TA	TA	TV	VISITDY	6	Planned Study Day of Visit	N	6		ADS SDTM		TV.VISITDY	TV.VISITDY
12	TE	not available or not assigned	TE	TE	TV	ARMCD	7	Planned Arm Code	C	20	ZARMCD	ADS SDTM		TV.ARMCD	TV.ARMCD.Codelist is different, \$ contains only missings
13	TS	PROTOCOL	TS	TS	TV	ARM	8	Description of Planned Arm	C	50		ADS SDTM		TV.ARM	TV.ARM contains only missings
14	TV	VISDES	TV	TV	TV	TVSTRL	9	Visit Start Rule	C	100		ADS SDTM		TV.TVSTRL	TV.TVSTRL
15	VS	not available or not assigned	VS	VS	TV	TVENRL	10	Visit End Rule	C	100		ADS SDTM		TV.TVENRL	TV.TVENRL contains only missings

Info AE CM DM DS EX LB MH SE SV VS TA TE TS TV



# Mapping-Dokumentation – Beispiel

## Info – Mapping Überblick

## Blatt für jede Domäne

	A	B	C	D	A	B	C	D	E	F	G	H	I	J	K	
1	Domains Pool	SN 1000	SN 1001	SN 1002	1	DOMAIN	VARIABLE	VARNUM	LABEL	TYPE	LENGT	CODELIST	BSP.TARGET	SN 1000	SN 1001	SN 1002
2	AE	AE	AE	SUPPAE AE												
3	CM	COMED	CM	CM												SUPPAE QVAL where SUPPAE QVAL eq AESHOSPR
4	DM	not available or not assigned	DM	SUPPDM DM	24	AE	AESHOSPR							Variable does not exist	Variable does not exist	
5	DS	PROTOCOL ENDPOINT DV	DS	DS												SUPPAE QVAL where SUPPAE QVAL eq AESHOSPR
6	EX	DOSE	EX	SUPPEX EX	25	AE	AESHOSPR							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE QVAL eq AESHOSPR
7	LB	LAB	LB	SUPPLB LB	26	AE	AESOSP							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE QVAL eq AESOSP
8	MH	MHS	MH	MH												
9	SE	not available or not assigned	SE	SE	35	AE	AETRLPRC							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE QVAL eq AETRLPRC
10	SV	VISIT	SV	SV												
11	TA	not available or not assigned	TA	TA	71	AE	STUDYID	1	Study Identifier	C	10		DAD ADS SOTM		AE STUDYID	AE STUDYID.Length=meta data definition
12	TE	not available or not assigned	TE	TE	72	AE	DOMAIN	2	Domain Abbreviation	C	2	DOMAIN	DAD SOTM		AE DOMAIN	AE DOMAIN.CodeList is different. \$
13	TS	PROTOCOL	TS	TS												
14	TV	VISDES	TV	TV	73	AE	USUBID	3	Unique Subject Identifier	C	27		DAD ADS SOTM		AE USUBID	AE USUBID
15	VS	not available or not assigned	VS	VS												
16					74	AE	SURJDN	4	Study (N)	N	11		DAD ADS		AE SURJDN	
17					75	AE	AESIQ	5	Sequence Number	N	81		DAD ADS SOTM		AE AESIQ	AE AESIQ
					76	AE	AENYN	6	Any AEs? (N)	N	3	NY			AE AENYN	
					77	AE	AEGRPID	7	Group ID	C	20		DAD ADS SOTM			
					78	AE	AEREPID	8	Reference ID	C	30		DAD ADS SUPP		AE AEREPID	

%create\_meta\_docu\_xls(

```

project = Drugname
,libmeta = meta
,studyid = 1000#1001#1002
,pathstudydata = &source1 #&source2 #&source3
,inbase = patinfo#dm#dm#dm
,domains = ae cm dm ds ex lb mh se sv vs ta te ts tv vs
,pathoutfile = &outpath./docum
,outfilename = drugname_mapping_documentation_&date._test.xlsx
,standard = SDTM
,mapto = 1000: COMED->CM#(PROTOCOL ENDPOINT DV)->DS#DOSE->EX#LAB->LB#MHS->MH#VISIT->SV#
        PROTOCOL->TS#VISDES->TV
/1001:
/1002: (SUPPAE AE)->AE#(SUPPDM DM)->DM#(SUPPEX EX)->EX#(SUPPLB LB)->LB
    
```



# Mapping-Dokumentation – Domänen und Mapping-Zuweisung

	A	B	C	D
1	Domains Pool	SN_1000	SN_1001	SN_1002
2	AE	AE	AE	SUPPAE AE
3	CM	COMED	CM	CM
4	DM	not available or not assigned	DM	SUPPDM DM
5	DS	PROTOCOL ENDPOINT DV	DS	DS
6	EX	DOSE	EX	SUPPEX EX
7	LB	LAB	LB	SUPPLB LB
8	MH	MHIS	MH	MH
9	SE	not available or not assigned	SE	SE
10	SV	VISIT	SV	SV
11	TA	not available or not assigned	TA	TA
12	TE	not available or not assigned	TE	TE
13	TS	PROTOCOL	TS	TS
14	TV	VISDES	TV	TV
15	VS	not available or not assigned	VS	VS

```
%create_meta_docu_xls(
,domains = AE CM DM DS EX LB MH SE SV VS TA TE TS TV VS
,studyid = 1000#1001#1002
,mapto = 1000: COMED->CM#(PROTOCOL ENDPOINT DV)->DS#DOSE->EX#LAB->LB#MHS->MH#VISIT->SV# PROTOCOL->TS#VISDES->TV
/1001:
/1002: (SUPPAE AE)->AE#(SUPPDM DM)->DM#(SUPPEX EX)->EX#(SUPPLB LB)->LB
```

- 1:1 Mapping / Multiple Quelldomänen / SUPP-Domäne
- Information Domäne ‘not available’ / ‘not assigned’
- Mapto = **STUDYID: (domain1...domain n | SUPPdomain) -> TARGET**

# Variablenzuordnung in den Domänen

	A	B	C	D	E	F	G	H	I	J	K
	DOMAIN	VARIABLE	VARNUM	LABEL	TYPE	LENGT	CODELIST	BSP_TARGET	SN_1000	SN_1001	SN_1002
10	AE	AEMROBT							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AEMROBT
17	AE	AESBDTC							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AESBDTC
18	AE	AESBYN							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AESBYN
24	AE	AESHOSPP							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AESHOSPP
25	AE	AESHOSPR							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AESHOSPR
26	AE	AESOSP							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AESOSP
35	AE	AETRLPRC							Variable does not exist	Variable does not exist	SUPPAE QVAL where SUPPAE.QNAM eq. AETRLPRC
1	AE	STUDYID	1	Study Identifier	C	10		OAD ADS SDTM		AE.STUDYID	AE.STUDYID.Length>meta data definition
72	AE	DOMAIN	2	Domain Abbreviation	C	2	DOMAIN	OAD SDTM		AE.DOMAIN	AE.DOMAIN,Codelist is different;S
73	AE	USUBJID	3	Unique Subject Identifier	C	27		OAD ADS SDTM		AE.USUBJID	AE.USUBJID
74	AE	SUBJIDN	4	Subject Identifier for the Study (N)	N	11		OAD ADS		AE.SUBJIDN	
75	AE	AESEQ	5	Sequence Number	N	8,1		OAD ADS SDTM		AE.AESEQ	AE.AESEQ
76	AE	AENYN	6	Any AEs? (N)	N	3	NY	OAD		AE.AENYN	
77	AE	AEGRPID	7	Group ID	C	20		OAD ADS SDTM			
78	AE	AEREFID	8	Reference ID	C	30		OAD ADS SUPP		AE.AEREFID	
79	AE	AEREFID2	9	Reference ID 2	C	30		OAD ADS SUPP			
80	AE	AESPID	10	Sponsor-Defined Identifier	C	60		OAD ADS SDTM		AE.AESPID	AE.AESPID
81	AE	AELNKID	11	Link ID	C	65		OAD ADS SDTM			
82	AE	AETERM	12	Reported Term for the Adverse Event	C	200		OAD ADS SDTM		AE.AETERM	AE.AETERM

Zusätzliche Variablen die nicht gemappt wurden

Zielstruktur

gefundene /

nicht gefundene

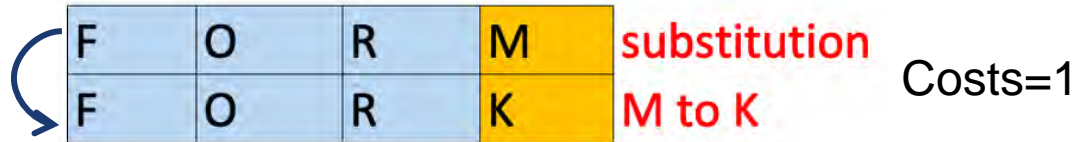
Variablen

- Farben zeigen an ob eine Variable gefunden / nicht gefunden / zusätzlich vorhanden
- Mapping Vorschläge für zusätzlich gefundene Variablen
- Metadaten-Check und Metadateninformation

## 03 Mapping-Vorschläge – Fuzzy matching

---

Levenshtein distance



## Mapping-Vorschläge – Fuzzy matching techniques

```
data suggestion&_std.&target.;
  set suggestion&_std.&target.;
  dist1=spedis(sasname, variable);
  dist2=complev(sasname, variable);
  sound_dist=complev(soundex(sasname), soundex(variable));
  dist3_label=complev(label,label&_std);
  dist4_label=spedis(label, label&_std);
  if (type='C' and type&_std.=2) or
     (type='N' and type&_std.=1)
  then type_cost=0; else type_cost=3;
  if soundex(sasname)=soundex(variable) then sound_cost=0;
  else sound_cost=2;
  sum_costs=sum(dist1,dist2,comp_,type_cost, sound_dist,
               dist3_label,dist4_label);
  if sasname=variable then match=1;
run;
```

### Kostenfunktionen

- **SOUNDEX** – phonetic matching
- **SPEDIS** – spelling distance
- **COMPLEV** – Levenshtein Distanz
- Variablenamen, Label, Typen
- Kostensummierung – wähle die geringsten Kosten als passende Zuordnung

# Mapping-Vorschläge – Beispiel 1

DOMAIN	VARIABLE	LABEL	TYP	LENG.	CODELI	BSP_TARGET	SN_1000	SN_1001	SN_1002
DM	BIRTH_D						PATIENT.BIRTH_D , mapping suggestion: BRTH_D	Variable does not exist	Variable does not exist
DM	BIRTH_M						PATIENT.BIRTH_M , mapping suggestion: BRTH_M	Variable does not exist	Variable does not exist
DM	BIRTH_Y						PATIENT.BIRTH_Y , mapping suggestion: BRTH_Y	Variable does not exist	Variable does not exist
DM	BRTHDTC	Birth	C	19		SDTM		DM.BRTHDTC	DM.BRTHDTC
DM	BRTH_D	Day of Birth	N	2		ADS		DM.BRTH_D	
DM	BRTH_M	Month of Birth	N	2		ADS		DM.BRTH_M	
DM	BRTH_Y	Year of Birth	N	4		ADS		DM.BRTH_Y	

variable	label1	SASNAME	suggest1	dist	dist2	dist3	sound1	sound2	sound_dist	type_cost	sound_cost	sum_costs	match	cost_min
Variable Name	Variable Label													
BIRTH_D	Day of Birth	BRTH_D	BRTH_D	8	1	100	B633	B633	0	0	0	11	.	11
BIRTH_M	Month of Birth	BRTH_M	BRTH_M	8	1	100	B635	B635	0	0	0	11	.	11
BIRTH_Y	Year of Birth	BRTH_Y	BRTH_Y	8	1	100	B63	B63	0	0	0	11	.	11
RACEC	Race	RACE	RACE	12	1	10	R2	R22	1	0	2	19	.	19

Vorschlag falls Kosten < Limit (user defined =75)

Vorschläge nur für Variablen, die nicht gefunden oder gemappt wurden

Vorschläge kann man per Makrovariable ausschalten

## Mapping-Vorschläge – Beispiel 2

DOMAIN	VARIABLE	TY	LI	SN 1000	SN 1001	SN 1002
MH	MHNY			MHIS.MHNY, Variable not in metadata , mapping suggestion: MHNYN	Variable does not exist	Variable does not exist
MH	MHNYN	N	NY	MHIS.MHNY mapped to MHNYN according to NY codelist	MH.MHNYN	Set to 1 when medical history is available

variable Variable Name	SASNAME	suggest1	dist	dist2	sound_dist	comp_	dist4_label	type_cost	dist5_label	sum_costs
MHNY	MHNYN	MHNYN	7	1	1	5	8	0	20	42

→ **Levenshtein** distance=1

→ **SPEDIS** distance=7 (probability of two phrases matching)

Vorschlag falls Kosten < Limit (user defined =75)

Vorschläge nur für Variablen, die nicht gefunden oder gemappt wurden

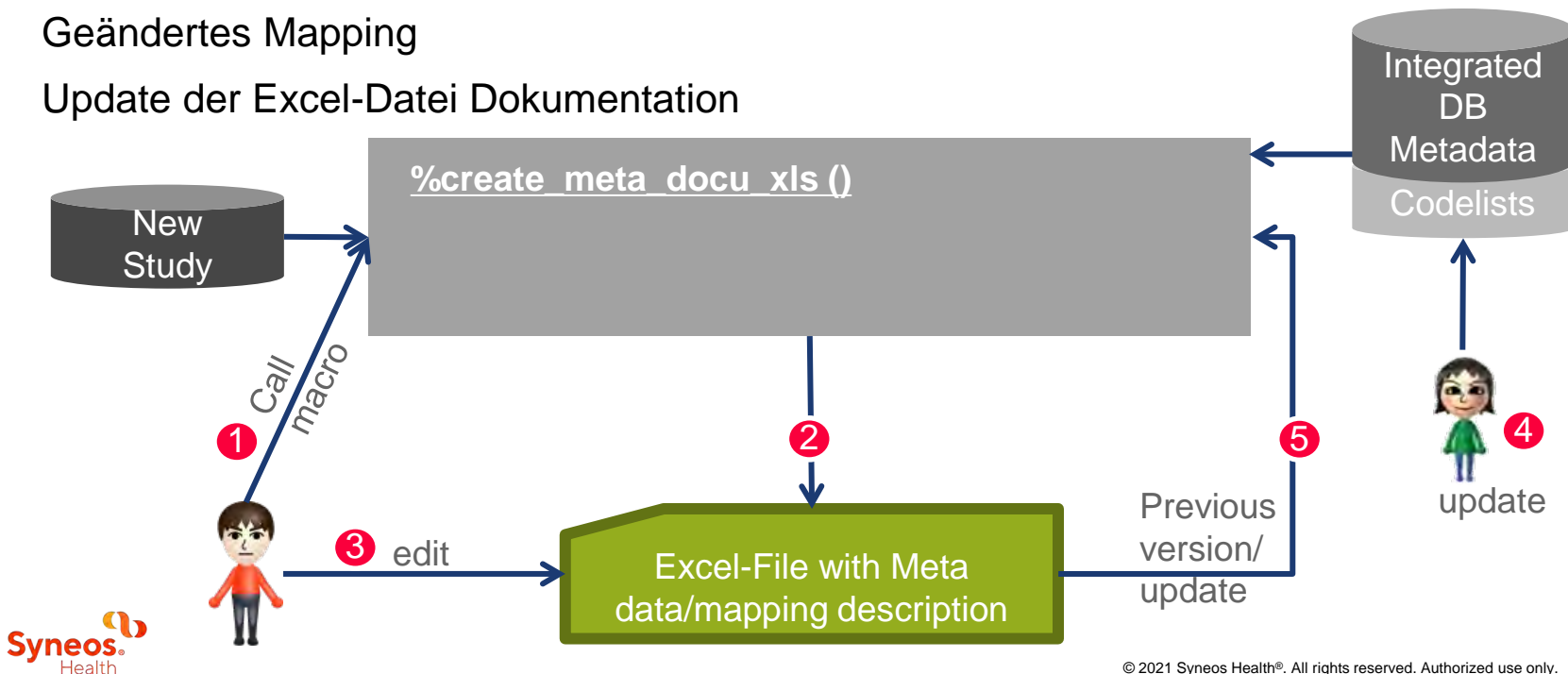
Vorschläge kann man per Makrovariable ausschalten

## 04 Vorherige Mapping-Beschreibung berücksichtigen

---

## Einbau einer vorher erstellten Mapping-Beschreibung

- Update der Metadaten der IDB
- Neue Studie
- Geändertes Mapping
- Update der Excel-Datei Dokumentation





# Beispiel: Hinzufügen einer neuen Studie mit %create\_meta\_docu\_xls

Ändere nur wenige Parameter im Makro!

1	Domains Pool	SN_1000	SN_1001	SN_1002
2	AE	AE	AE	SUPPAE AE
3	CM	COMED	CM	CM
4	DM	assigned	DM	SUPPDM DM
5	DS	DV	DS	DS
6	EX	DOSE	EX	SUPPEX EX
7	LB	LAB	LB	SUPPLB LB
8	MH	MHIS	MH	MH
9	SE	assigned	SE	SE
10	SV	VISIT	SV	SV
11	TA	assigned	TA	TA
12	TE	assigned	TE	TE
13	TS	PROTOCOL	TS	TS
14	TV	VISDES	TV	TV
15	VS	assigned	VS	VS

Study  
1003

1	Domains Pool	SN_1000	SN_1001	SN_1002	SN_1003
2	AE	AE	AE	SUPPAE AE	AE
3	CM	COMED	CM	CM	CM
4	DM	assigned	DM	SUPPDM DM	DM
5	DS	DV	DS	DS	DS
6	EX	DOSE	EX	SUPPEX EX	EX
7	LB	LAB	LB	SUPPLB LB	LB
8	MH	MHIS	MH	MH	MH
9	SE	assigned	SE	SE	SE
10	SV	VISIT	SV	SV	SV
11	TA	assigned	TA	TA	TA
12	TE	assigned	TE	TE	TE
13	TS	PROTOCOL	TS	TS	TS
14	TV	VISDES	TV	TV	TV
15	VS	assigned	VS	VS	VS

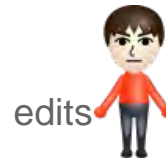
```
%create_meta_docu_xls(  
  project          = Drugname  
  ,libmeta         = meta  
  ,studyid        = 1000#1001#1002#1003  
  ,pathstudydata  = &source1 #&source2 #&source3#&source4  
  ,inbase         = patinfo#dm#dm#dm  
  ,domains        = ae cm dm ds ex lb mh se sv vs ta te ts tv vs  
  ,pathoutfile    = &outpath./docum  
  ,outfilename    = drugname_mapping_documentation_&date._test.xlsx  
  ,standard       = SDTM  
  ,previousfile   = &pathto_excel_documentation/project_drugname_2021-06-10.xlsx  
  ,mapto         = 1000: COMED->CM#(PROTOCOL ENDPOINT DV)->DS#DOSE->EX#LAB->LB#MHIS->MH#VISIT->SV# PROTOCOL->TS#VISDES->TV  
                  /1001:  
                  /1002: (SUPPAE AE)->AE#(SUPPDM DM)->DM#(SUPPEX EX)->EX#(SUPPLB LB)->LB  
                  /1003: <add mapping if necessary>  
);
```

# Beispiel: Verwende eine manuell geänderte Exel-Dokumentation als Input

DOMAIN	VARIABLE	VARNU	LABEL	TYPE	LENGT	CODELIST	SN_1000	SN_1001	SN_1002
MH	STUDYID	1	Study Identifier	C	10			MH.STUDYID	MH.STUDYID,Length>meta data definition
MH	DOMAIN	2	Domain Abbreviation	C	2	DOMAIN		MH.DOMAIN	MH.DOMAIN,Codelist is different,\$
MH	USUBJID	3	Unique Subject Identifier	C	27			MH.USUBJID	MH.USUBJID
MH	SUBJIDN	4	Subject Identifier for the Study (N)	N	11			MH.SUBJIDN	
MH	MHSEQ	5	Sequence Number	N	8			MH.MHSEQ	MH.MHSEQ
MH	MHNYN	6	Any Medical History findings (N)	N	3	NY		MH.MHNYN	
MH	MHGRPID	7	Group ID	C	20				

DOMAIN	VARIABLE	VARNU	LABEL	TYPE	LENGT	CODELIST	SN_1000	SN_1001	SN_1002
MH	STUDYID	1	Study Identifier	C	10		MHIS.TRIALNO in character format	MH.STUDYID	"1002"
MH	DOMAIN	2	Domain Abbreviation	C	2	DOMAIN	"MH"	MH.DOMAIN	MH.DOMAIN
MH	USUBJID	3	Unique Subject Identifier	C	27		Concatenation of MHIS.TRIALNO and MHIS.PATNO in character format	MH.USUBJID	MH.USUBJID
MH	SUBJIDN	4	Subject Identifier for the Study (N)	N	11		MHIS.PATNO	MH.SUBJIDN	Substring of USUBJID in numeric format. (=input((substr(USUBJID,19)),best))
MH	MHSEQ	5	Sequence Number	N	8		MHIS.MHSEQ	MH.MHSEQ	MH.MHSEQ
MH	MHNYN	6	Any Medical History findings (N)	N	3	NY	MHIS.MHNY mapped to NY codelist	MH.MHNYN	Set to 1 when medical history is available
MH	MHGRPID	7	Group ID	C	20		Variable is not populated	Variable is not populated	Variable is not populated



edits

`%create_meta_docu_xls`

Excel-File with manually changed mapping description

- Makro verknüpft die manuellen Einträge mit der Informationen die im Run verarbeitet werden
- Dunkel grüne Farben zeigen, dass ein Originaleintrag geändert wurde in der vorherigen

## 05 **Zusammenfassung**

---

## Eigenschaften von %create\_meta\_docu\_xls

- Verarbeitung von SDTM / ADaM
- Mehrere Studien gleichzeitig
- Mehrere Quell-Domains können einer Zieldomäne zugeordnet werden  
(source1...source N) → target
- Berücksichtigung von SUPP-Domänen
- Information zu den Variablen hinzufügen
- Mapping-Vorschläge
- Verarbeitung einer vorher erstellten Excel-Mapping-Dokumentation
- Berücksichtigung eines Updates von Quell- / Zielmetadaten
- Farben die den User unterstützen
- Mapping-Spezifikation (draft) / define.xml / Dokumentation

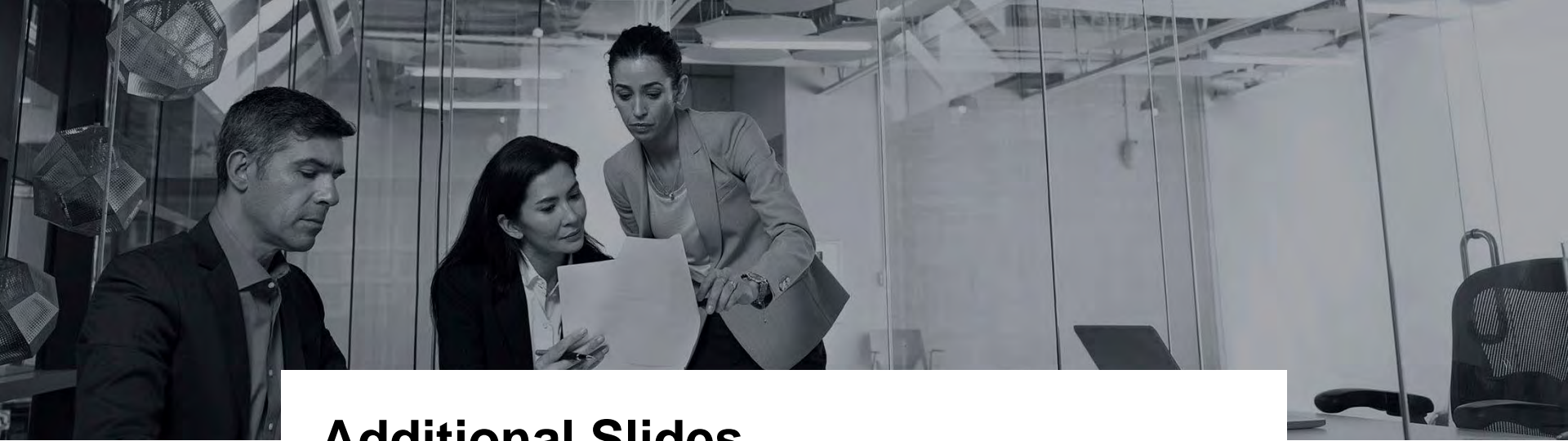


Thomas Wollseifen  
thomas.wollseifen@syneoshealth.com

# Shortening the Distance from Lab to Life<sup>®</sup>.

---





## Additional Slides

# Proc Report - ODS

```
ods excel options(sheet_name = "%upcase(&_domain.)" autofilter='on' frozen_headers='on' zoom='85' tab_color = "&color_domain_sheet.") ;

proc report nowd data=&_domain. style(header)={background=white};
  column domain variable varseq label type outform codlst
    %do i=1 %to &numstudyid.;
      var_org&i
      varstudy&i
      _flagexistencce&i
    %end;
  ;
  /*Pool definition */
  define domain / display 'DOMAIN' style(header)={background=Gainsboro cellwidth=.7in};
  define varseq / display 'VARNUM' style(header)={background=Gainsboro cellwidth=.6in} style(column)={background=colin.};
  define variable / display 'VARIABLE' style(header)={background=Gainsboro cellwidth=0.8in};
  define label / display 'LABEL' style(header)={background=Gainsboro cellwidth=1.4in};
  define type / display 'TYPE' style(header)={background=Gainsboro cellwidth=0.5in};
  define outform / display 'LENGTH' style(header)={background=Gainsboro cellwidth=0.5in};
  define codlst / display 'CODELIST' style(header)={background=Gainsboro cellwidth=0.9in};
  define derivation / display 'DERIVATION' width=100 style(header)={background=Gainsboro cellwidth=2in};

  /*Study definition */
  define derivation / display noprint;
  %do i=1 %to &numstudyid.;
    define _flagexistencce&i / display noprint;
  %end;
  %do i=1 %to &numstudyid.;
    define var_org&i / display noprint;
    define varstudy&i / "%left(%upcase(&studyvarprefix.)%qscan(&studyid.,&i,#))" width=100 style(header)={background=LIBGR cellwidth=1.8in}
  %end;
  %do i=1 %to &numstudyid.;
    compute _flagexistencce&i;
    if _flagexistencce&i=' ' then call define("varstudy&i", "style", "style={background=Azure color=BLACK}");
    else if _flagexistencce&i='Expected variable not in domain' then call define("varstudy&i", "style", "style={background=&color_var_expected_not_available color=BLACK}");
    else if index(_flagexistencce&i, 'Variable should not be in domain')>0 then call define("varstudy&i", "style", "style={background=&color_var_notavail. color=BLACK}");
    else if index(_flagexistencce&i, 'Variable OK in meta data')>0 and varstudy&i ne var_org&i then call define("varstudy&i", "style", "style={background=&color_var_available_changed. co.
    else call define("varstudy&i", "style", "style={background=&color_var_available color=BLACK}"); /*color variable availabel in data and ok*/
  endcomp;
  %end;
run;
```