

GROUPE DES UTILISATEURS FRANCOPHONES DES STANDARDS CDISC, Paris, 2 février 2016

Strength through Collaboration

CDISC en 2016: Avancement des projets et orientations pour le futur

Pierre-Yves LasticChief Privacy Officer, SanofiPast-Chair of the Board, CDISC



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The Clinical Data Interchange Standards Consortium

- Global, open, multi-disciplinary, vendorneutral, non-profit standards developing organization (SDO)
- 501(c)(3) charitable non-profit Founded 1997, incorporated 2000
- Member-supported (>380 academia, biopharma, service provider organizations)
- Associations with ISO TC 215 (Liaison A), HL7, Global Joint Initiative Council (JIC), IHE, NCI-EVS, CFAST, IMI, PhUSE, others
- Coordinating Committees in Europe, China, Japan, Asia-Pacific
- Standards users from > 90 countries
- Standards freely available



The CDISC Vision: Informing patient care and safety through higher quality medical research



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- Committee Reports and Recommendations
 - Financial Oversight Committee
 - Governance
 - Technical Advisory Committee
 - Strategy Committee
 - Fund Development Committee
- Operations Update; CDISC Roadmap
- SHARE Business Model Discussions/Decisions
- CDISC Strategic Goals → Operational Goals



CDISC Strategic Goals 2015-2017

#1 Promote and support the continued global adoption of harmonized data standards throughout the clinical research lifecycle by engaging regulatory agencies, research sponsors, academia and other stakeholders through education, advocacy and collaboration.

#2 Implement clinical research standards that are complementary to standards in the broader healthcare ecosystem and thus add value for clinical researchers, healthcare providers and patients.

#3 Leverage the Shared Health And Research Electronic Library (SHARE) and other tools to further expedite the development and facilitate the implementation of harmonized standards for clinical research.

≻Approved by the CDISC Board of Directors, February 2015



CDISC Roadmap 2015-2017







Foundational Standards SDTM, CDASH, ADaM, Controlled Terminology, Protocol, Glossary, XML Technologies to Streamline Research Data Flow from Beginning to End, Healthcare Link, Regulatory Submissions, Data Sharing, etc.

CDISC Foundational standards are at the core of CDISC to streamline research from protocol and data collection through analysis and reporting.

- Harmonize CDISC standards from beginning to end.
- Align with Therapeutic Area Standards and leverage SHARE.
- Improve the Controlled Terminology process and transparency.
- Facilitate implementation of the CDISC Protocol Standards.
- Address CDISC validation rules internationally.
- Update Foundational Standards to support CDISC Healthcare Link.
- Create a new Version of the CDISC Glossary.



CFAST

Towards Beginning to End Automation → SHARE-generated Therapeutic Area Stndards (Prostate Cancer); PMDA Input & FDA TA Specifications Initiate 1-2 Oncology TA Standards and Others in Pipeline Protocol, CDASH and ADaM for other TAs

CDISC Therapeutic Area Standards complement the Foundational Standards such that they apply to specific therapeutic areas.

- Begin to develop 'complete' research standards, including Foundational, Therapeutic Area (TA) augmentations and Controlled Terminology from Protocol through SDTM/ADaM.
- Use SHARE to build TA standards from the start, re-using prior TAs; Prostate Cancer is the first use case.
- Modularize the TA standards, including specifications for the FDA Standards Catalog.
- Support the development of additional TAs, including those by developed entirely volunteer teams.



Adoption

Education, Survey and Implementation Calls; SHARE Roll-out; IntraChange, Interchanges, CFAST TA Standards Workshops, Summit, New Messaging & Publications

The broader the adoption of CDISC Standards globally, the more valuable they will become--- accelerating the research process by facilitating protocol development, data collection, data aggregation, reporting or submission of data and data sharing.

- Provide CDISC Education: online, webinars, classroom, private.
- Hold CDISC Interchanges, IntraChange and TA Workshops.
- Complete surveys and 'Listening Tours' to understand implementation issues with CDISC standards.
- Expand collaboration/alliances to support SHARE, TA standards.
- Enhance member relations, CDISC Advisory Council.
- Improve CDISC Communications and leverage new messaging.



Healthcare Link

Complete ACC Registry Project; Launch eSource HCL Projects To provide direct links between healthcare and research

The CDISC Healthcare Link Initiative is designed to streamline clinical research by using eSource data (from electronic health records, eDiaries and other eSource tools) to:

- a) enable the entry of data once for multiple purposes,
- b) to make it easier for clinicians and patients to participate in research,
- c) to improve data quality and patient safety.
- Deliver on project for EHRs to streamline the population of registries.
- Support the use of EHRs for clinical research (E2C and more) by academia and biopharma, working with FDA on lessons learned.
- Initiate eSource Stakeholders Group.
- Gather metrics and communicate on these processes/ROI.



SHARE

Support "Beginning to End" for TA Standards and Modular Publication; Support Healthcare Link and eSource Projects; Demonstrate and Publish on Value

SHARE is a global, accessible electronic library that enables precise and standardised data element definitions that can be used in applications and studies to improve biomedical research and its link with healthcare.

- Deliver all CDISC standards electronically in various formats.
- Deliver TA standards electronically in modules.
- Leverage SHARE to develop TA standards faster.
- Leverage SHARE for Healthcare Link projects.
- Harmonize standards beginning to end, including protocol.
- Enable interfaces to automate use of SHARE content.
- Collaborate on additional SHARE content.



Foundational Standards

SDTM, CDASH, ADaM, Controlled Terminology, Protocol, Glossary, XML Technologies to Streamline Research Data Flow, from Beginning to End, Healthcare Link, Regulatory Submissions, Data Sharing, etc.

CFAST

Towards Beginning to End Automation → SHARE-generated TA (PrCa) -FMDA input & FDA TA Specs; Initiate 1-2 Oncology TA standards and Others in Pipeline

Adoption

Education, Survey and Implementation Calls; SHARE Roll-out; IntraChange, Interchanges, CFAST TA Standards Workshops, Summit, New Messaging & Publications

Healthcare Link

Complete ACC Registry Prc ject; Launch eSource HCL Projects To provide direct links between healthcare and research

SHARE

Support "Beginning to End" for TA Standards and Modular Publication; Support Healthcare Link and eSource Projects; Demonstrate and Publish Value





there will be global. open standards available electronic ally through SHARE to streamline research. from protocol through reporting for all maior disease areas in support of a learning health system.

Bv 2017

CDISC Strategic Goals 2015-2017

#1

Promote and support the continued global adoption of harmonized data standards throughout the clinical research lifecycle by engaging regulatory agencies, research sponsors, academia and other stakeholders through education, advocacy and collaboration.





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2014 Data from recent Tufts CSDD Survey

Education Metrics 2012-2015



Classroom Courses







Public Courses in Paris, France



Sanofi 1 Avenue Pierre Brossolette Chilly-Mazarin 91385 France



<u>Course Information:</u> Name: 2-day SDTM Theory and Application Date/Time: 7-8 Mar 2016; 09:00-17:00 Instructor: Niels Both Course Language: English



Cowboy Up! An Evening of Live Music Collaborating for PTS & Mental Health Research

> o3 March 2016 Austin, Texas



2016 CDISC Europe Interchange

> 25 – 29 April 2016 Vienna, Austria



2016 CDISC Japan Interchange

30 May – 03 June 2016 Tokyo, Japan



International Interchange 26-29 September 2016 Bethesda, MD

Members by Country





The Value of Using Standards from the Start





Timeline for Establishment of the Framework for Electronic Study Data Utilization in PMDA

Tacke	J-FY 2014	▼ J-FY 2015	J-FY 2016		
Idaka	5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3		
Guidance and related documents	The Basic Policy Release of related information	 Technical Notification Technical conformant Notification on the original e-data submission 	on the e-study data submis ce guide consultation for hission		
Review	1 st Pilot 2 nd Pilot	Pilot	e-study data submission for NDA with 3.5 years transitional period		
Consultation for e-study data submission	Pilot	New consultation frameworl System Development	K		
System Development		Pilot	for data submission Source: PMDA		



www.fda.gov



Keeping up with CDISC Standards



Technical Plan Updates

The CDISC Ter deliverables for are posted sep technical roadr formulated, and standards.

Because projec availability of o check regularly

Technical Plan (

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vailable: SDTMIC:

CDISC Technical Update - June 2015

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- Semantics:
- Terminology Package 23, with 210 new terms, will be posted for comment in late June.

Therapeutic Areas:

- The provisional CFAST TAUG for Chronic Hepatitis C was released on May 8.
- The provisional CFAST TAUGs for Schizophrenia and Dyslipidemia are being readied for publication in June.

cdisc.org

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Technical Plan Project

A 0 0

• Next up is the CFAST TAUGs for Traumatic Brain Injury, expected to go to public comment in June.

Foundational Standards:

- The ADaM v1.3 validation checks were posted on May 16.
- The ADaM Structure for Occurrence Data (OCCDS), which extends the ADaM ADAE Data Structure to other occurrence data such as ConMeds, should be published in June.
- Next up from ADaM is the draft ADaM Data Structure for Integration (ADSL), due to be posted for comment in June.
- The CDISC PGx team is finalizing the provisional version of the SDTMIG for Pharmacogenomics/Genetics data for publication in early June.

THE MOVEMENT DO IT HUMANS ND FAMIL **CFAST Therapeutic-Area Data Standards:** It's about Patients, People! DS USH

FO

CHILDRE



AUGHTER



- Launched in 2012 by partners CDISC and C-Path
- SAC initiated in 2013
- Asthma Pilot completed November 2013 included:
 - Enhanced development process*
 - Introduced new roles*
 - TA User Guide content & layout*
 - Concept modeling using concept maps*
 - Metadata displays*
 - SDTM
- Goal is to expand content to developing concept level "Beginning to End" Biomedical Concepts

(* new aspects)





Working Principles

- Focus on Core concepts that apply to all phases of clinical trials in a specific TA
 - Minimal Valuable Product (MVP) for 1st versions
- Minimize text, where possible
 - Focus on explaining concept maps, metadata and examples
- Use SHARE eco-system tools, where possible
 - As tools become available, use them to develop concept metadata
- Re-use existing content to assemble TA packages



Published Standards





http://www.cdisc.org/therapeutic

Standards Available for Download!

CDISC Standards

CDISC Standards specify <u>how</u> to structure the data to support efficient data sharing for regulated clinical trials

CDISC Standards <u>**Do Not</u>** specify what data should be collected or how to conduct clinical trial protocols, assessments or endpoints.</u>







Program Overview – January 2016

Therapeutic Area Charter Approved		Check of Concepts Completed	Posted for Internal Review	Posted for Public Review	Projected Publication	
Breast Cancer v1	Oct 14	Oct 14	Mar 15	Nov 15	Q116	
COPD v1	Sep 14	Dec 14	Jul 15	Nov 15	Q116	
Diabetic Kidney Disease v1	May 15	Aug 15	Jan	Feb	Q216	
Tuberculosis v2	Apr 15	Apr 15	Sep 15	Oct 15	Q116	
Rheumatoid Arthritis v1	Jun 15	Oct 15	Jan	Mar	Q216	
CV Imaging v1	May 15	Jul 15		Feb	0216	046.
Prostate Cancer v1	Nov 15	opcomin	g Public	cations		010:
Major Depressive Disorder (Bi-Polar, General Anxiety Disorder)	Dec 15	•COPD			Q316	
Kidney Transplant	Jan	•Breast C	ancer		Q316	
Colorectal Cancer v1	Q116	 Diabetic 	Kidney I	Disease	Q416	
Vaccines*		•Tubercul	osis v2	Q116	Q216	
Ebola*	Sep 15	•Rheuma	toid Arth	ritis	Q316	
Malaria*	Oct 15	•CV/Imac	ina		Q316	
Nutritional Standards*	Mar 15	Q116	Q216	Q316	Q416	
Cardiovascular Concepts in Traditional Chinese Medicine*	Q116	Q216			Q416	

Stage 0 - Scoping , Stage 1 - Concept Modeling, Stage 2 - Standards Development, Stage 3a - Internal Review, Stage 3b - Public Review, Stage 3c - Publication

Key| Stage completed | Stage ongoing ||All months reflect when stage is, or is projected to be, completed.

*Project duration depends on volunteer resource variability



CFAST Pipeline

CFAST Therapeutic Area Standards Project Pipeline as of September 2015

2012-2015 Published	2015 to be Published	2015 In-Process or Planned Starts	2016 Planned Starts
Asthma v1	Traumatic Brain Injury ⁴	Diabetic Kidney Disease ²	Oncology-Lung ^{2,5}
Alzheimer's v2	Oncology - Breast Cancer ²	Rheumatoid Arthritis ²	Psoriasis
Multiple Sclerosis v1	COPD	Tuberculosis v2	Duchenne Muscular Dystrophy ^{1, 2}
Diabetes v1 ²	Diabetes ADaM Supplement	CV Imaging (Echo) ⁴	Clostridium difficile associated diarrhea (CDAD) ^{1,3}
Cardiovascular Endpoints v1 ⁴	Virology v2 (Viral Resistance)	Oncology - Prostate ³	PostMenopausal Osteoporosis ²
QT Studies		Major Depressive Disorder ⁴	Skin and Skin Structure Infections ^{1,2}
Influenza		Generalized Anxiety Disorder	
Hepatitis C ²		Bipolar ¹	
Schizophrenia ⁴		Solid Organ Transplantation - Kidney² (Q4 Start)	
Dyslipidemia ²		Oncology-colorectal ³ (Q4 Start)	

Projects in Italics are candidates to be scheduled and subject to change

¹Indicates Project Proposal Summary and Approval Pending

²Indicates FDA recommendations project completed

³Indicates FDA recommendations project planned or in process

⁴Indicates CDE inputs or domain analysis models from third party (e.g., DCRI)

⁵Indicates high NCI Priority

http://www.cdisc.org/system/files/all/CFAST_ProjectPipeline.pdf



CDISC TA Standards Development Process



MRC = Modeling Review Committee SRC= Standards Review Council

Process for developing content

Set scope

- Enough to be useful
- Not too much to achieve in 10-12 months
- Identify regulatory and clinical guidelines
- Involve clinicians
- Start with system-independent concept maps
 - Where does the data come from?
 - What are the data items and what do they mean?
 - How are the data items related?

Stage 1 Scoping



Process for developing content

- Develop "biomedical concept" metadata
 - Based on the BRIDG model to provide underlying consistence
 - Includes CDASH and SDTM metadata
 - Includes controlled terminology values and subsets of values
- Develop implementation examples
- Create TA User Guide Modules
- CDISC review process
 - "Internal" cross-team review
 - Public Review







Beginning to End Coverage

- The first CDISC TA standard (TB, 2012) was a supplement to the SDTM Implementation Guide
 - Organized by SDTM domain
 - No mention of any other standard
- CFAST TA projects expanded to other standards
 - Asthma: SDTM, prototype biomedical concept metadata
 - Diabetes: added CDASH examples
 - QT Studies: included ADaM examples
 - Schizophrenia: includes trial design examples



Adding depth

- Biomedical concept metadata: a small package of relevant variables and terminology for a particular research concept (e.g., a particular test)
 - CDASH prompt/question text
 - SDTM domain, test/test code
 - Applicable variables
 - Computational method, if applicable (e.g., BMI)
 - Subset of relevant controlled terminology
- To be curated in SHARE metadata repository



TA User Guide Contents - Example SDTM metadata

- Introduction
- A list of patient directed resources on the Indication
- SDTM domains
- SDTM Metadata Examples

Rows 1-4:	Show examples of oral Glucose administration for two subjects at each of two different visits. The date and time of the start and end of the glucose
	administration was collected.

	AP-AP-										
Row	STUDYID	DOMAIN	USUBJID	AGSEQ	AGTRT	AGCAT	AGPRESP	AGOCCUR	AGDOSE	AGDOSU	AGROUTE
1	XYZ	AG	XYZ-001-001	1	GLUCOSE	ORAL GLUCOSE TOLERANCE TEST	Y	Y	75	G	ORAL
2	XYZ	AG	XYZ-001-001	2	GLUCOSE	ORAL GLUCOSE TOLERANCE TEST	Y	Y	75	G	ORAL
3	XYZ	AG	XYZ-001-002	1	GLUCOSE	ORAL GLUCOSE TOLERANCE TEST	Y	Y	75	G	ORAL
4	XYZ	AG	XYZ-001-002	2	GLUCOSE	ORAL GLUCOSE TOLERANCE TEST	Y	Y	75	G	ORAL

Row	VISIT	AGDTC	AGSTDTC	AGENDTC
l (cont)	VISIT 1	2008-05-01	2008-05-01T08:50	2008-05-01T08:53
2 (cont)	VISIT 5	2008-08-01	2008-08-01T07:30	2008-08-01T07:33
3 (cont)	VISIT 1	2008-06-07	2008-06-07T08:30	2008-06-07T08:35
4 (cont)	VISIT 5	2008-09-01	2008-09-01T08:00	2008-09-01T08:05



ag ynt
TA User Guide Contents – Concept Maps

- Illustrates relationships among concepts and attributes
- Facilitates understanding (semantic interoperability) among functions involved in standards development

Self-Monitoring Blood Glucose (SMBG) – example



Diagram 2: Self-Monitoring Blood Glucose

Glucose measurements typically performed by subjects with diabetes are indicated. The glucose meter device requires a whole blood sample, but the glucose reading may be read as either a whole blood equivalent or a plasma equivalent.

TA User Guide Contents – CDASH Annotated CRFs

CDASH Annotated CRF example – Hypoglycemia

CETERM = Hypoglycemic Event CECAT = HYPO EVENTS	
Any Hypoglycemic Events Experienced?	No Yes (If yes complete for each event) CEYN
Sponsor Defined ID CESPID	001
Date/Time of Event CESTDTC	(DD-MMM-YYYY): (24 hour clock) CESTDAT CESTTIM
When Did the Hypoglycemic Event Occur?	Between Bedtime and Waking FAORRES when OBJ= Hypoglycemic Event and FATEST= "When Did the Hypoglycemic Event Occur?"
In the Opinion of the Investigator Was This an Adverse Event?	No Yes WASAEYN
Was a Glucose Measurement Obtained at the	No
Time of the Event? LBSTAT	Yes (If yes enter result and unit below)
	Glucose Result LBORRES mg/dL mmol/L LBORRESU
Last Study Medication Taken	Name/Reference
EXSTDTC	(DD-MMM-YYYY): (24 hour clock) EXSTDAT EXSTTIM
	dose EXDOSE EXDSTXT units EXDOSU
Last Concomitant Diabetic Medication Taken	Name/Reference CMTRT
CMSTDTC	(DD-MMM-YYYY): (24 hour clock) CMSTDAT CMSTTIM
	dose CMDOSE units CMDOSU CMDSTXT
Date/Time of Last Meal MLSTDTC	(DD-MMM-YYYY): (24 hour clock) MLSTDAT MLSTTIM



TA User Guide Contents - CDASH (CRF) Metadata

CDASH CRF Metadata for Hypogycemia

						Case Report		
		CDASH		SDTM		Form		
		Variable	CDASH	Variable	SDTM	completion		
Question Text	Prompt	Name	Core	Name	Core	instructions	Mapping Instructions	Implementation Instructions
Any Hypoglycemic Events Experienced?	Any Hypoglycemic Events Experienced?	CEYN	0	N/A	N/A	Indicate whether or not any hypoglycemic events occurred	This variable does not map to SDTM	Primary intent/purpose of field is to help with data cleaning and monitoring
Sponsor Defined ID		CESPID	HR	CESPID	Perm			Can be pre-populated Row or Sequence Number to Identify Event (SPID)
Date/Time of Event		CESTDAT CESTTIM	HR	CESTDTC	Exp	Record start date using DD- MMM-YYYY format. Record time using a 24 hour clock.	For SDTM-based dataset, SDTM IG variable ECSTDTC is derived by concatenating CDASH Start Date (CESTDAT) and Time (CESTTIM if time is collected) and converting to ISO 8601 format. For more detail see the CDASH v1.1 Best Practice section This field does not map directly into SDTM.	CDASH recommends the unambiguous format DD-MMM-YYYY where "DD" is a 2-digit numeric value for day, "MMM" is a 3-character letter abbreviation for month, and "YYYY" is a 4-digit numeric value for year.
Hypoglycemic Term		NA	0	CETERM	Req			Not typically entered by an investigative site. May appear as a label or header on the case report form.
When Did the Hypoglycemic Event Occur?		FAORRES	HR	FAORRES	Exp	Record the time period during which the hypoglycemic event occurred	FAORRES when OBJ= Hypoglycemic Event, and FATEST= "When Did the Hypoglycemic Event Occur?"	Recommend response choices: "Between Bedtime and Waking" and "Between Waking and Bedtime".



CDISC SHARE Metadata Example

CM and Treatment Naïve

BRIDG-based concept variable	Value(s)	Attribute	SDTM variable		Shows
MEDCRIT Defined Drug.classCode.DSET <cd> item.code</cd>	from drug dictionary				BRIDG
MEDCRIT.Defined.Drug.classCode.DSET <cd>.item.displayName.value</cd>	from drug dictionary	Pre-specified class	in CMCAT		bitibo
MEDCRIT.Defined.Drug.classCode.DSET <cd>.item.originalText.value</cd>	free text	1 -		Block for pre-	basis and
MEDCRIT.Defined.Drug.code.CD.code	from drug dictionary			specified properties or	detailed
MEDCRIT.Defined.Drug.code.CD.displayName.value	from drug dictionary	Pre-specifieddrug CMTRT		kind of medication on	values
MEDCRIT.Defined.Drug.code.CD.originalText.value	free text]		which question or	
MEDCRIT.Defined.Drug.formCode.CD.code	from codelist C66726			data collection is	
MEDCRIT.Defined.Drug.formCode.CD.displayName.value	from codelist C'66726	Pre-specified dose form	in CMCAT	focused	
MEDCRIT.Defined.Drug.formCederCB.onginaText.value	free text				
MEDCRIP Defined Drug, description. ST. value	free tert	Pre-specified description	in CMCAT		
MINCRIT.DefinedSubstanceAdministration.routeOfAdministrationCode.CD.code	ficin codelist C66729	Pre-specified route of	in CMCAT		
ADMINCRIT.DefinedSubstanceAdministration.routeOfAdministrationCode.CD.displayName.value	from codelist C66729	adminstration	III CMCAI		
ADMINCRIT.DefinedSubstanceAdministration.targetAnatomicSiteCode.CD.code	from codelist C74456				
ADMINCRIT.DefinedSubstanceAdministration.targetAnatomicSiteCode.CD.displayName.value	from codelist C74456	Pre-specified target site	in CMCAT	Block for pre-	
ADMINCRTP. DefinedSubstanceAdministration.targetAnatomicSiteCode.CD.originalText.value	free text			specified properties of	
ADMINCRIT.DefinedSubstanceAdministration approachAnatomicSiteCode.CD.code	from codelist C74456			kind of medication	
ADMINCRIT.DefinedSubstanceAdministration.approachAnatomicSiteCode.CD.displayName.value	from codelist C74430	Pre-specified site of	in CMCAT	administration on	
ADMINCRIT.DefinedSubstanceAdministration.approachAnatomicSiteCode.CD.originalText.value	free text	administration		which question or	
ADMINCRIT.DefinedSubstanceAdministration.approachAnatomicSiteLateralityCode.CD.code	C25228, C25229		in CMCAT	data collection is	
ADMINCRIT.DefinedSubstanceAdministration.approachAnatomicSiteLateralityCode.CD.displayName.value	RIGHT, LEFT			focused	
ADMINCRIT.DefinedSubstanceAdministration.reasonCode.DSET <cd> item.code</cd>	sponsor codelist				
ADMINCRIT.DefinedSubstanceAdministration.reasonCode.DSET <cd>.item.displayName.value</cd>	sponsor codelist	Pre-specified indication	in CMCAT		
ADMINCRIT.DefinedSubstanceAdministration.reasonCode.DSET <cd> item originalText.value</cd>	free text				
CMQ_O.DefinedObservation.focalDuration PQ.value	SDTM uses ISO8601			Block for pre-	





- Single, trusted, authoritative source for **CDISC** data standards
- Concepts, metadata, collections, relationships, value sets across the full spectrum of CDISC content
- Links research to healthcare concepts to support interoperability
- Aligned with NCI Semantic Systems



Adapted from Source by Sue Dubman, Sanofi-Aventis



SHARE Video



http://www.youtube.com/watch?v=gCy VdvgVpY8&feature=youtu.be



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FAST TA Standards Specification for FDA & User Guides Modularized Content

Non-Normative



Normative

- TA User Guides
 - For data managers, programmers, others...
 - Includes:
 - Implementation instructions
 - Concept maps and explanations
 - Examples
 - SDTM, Controlled Terminology and other standards
 - Appendices
 - Glossary
 - Known issues
 - References
 - Team list
 - IP policy



- TA Specifications
 - For FDA data standards catalogue
 - Includes:
 - New domains/variables specifications
 - Domain tables
 - New variables
 - » Standard and Non-Standard
 - SDTM Rules
 - Controlled Terminology
 - Known issues
 - Evolve to Biomedical Concept Metadata tables – over time



CDISC's Culture of Learning

• Assessment & Feedback

- Lessons Learned
- Does it work/not work?
- Make needed changes
- Group Interaction
 - Use of dialogue & skillful discussion to draw out group intelligence that is greater than the sum of individual member's talent.
- Coaching
 - Modeling Expert
 - CDISC Experts, SRC, etc.
- Forums
 - Concept Modeling
 - Metadata Development
- Best Practices
 - Process documentation
 - Tools, Checklists, etc
- Leverage Technology
 - CDISC SHARE



(Adapted from Peter Senge, The Dance of Change: The Challenges of Sustaining Momentum in Learning Organizations, Doubleday, New York, 1999)



Lessons Learned



- TA standards development will drive/are driving development of most CDISC standards
- Attention to project scope is essential
- Point to reference material, don't repeat it
- Smaller, experienced resourced teams
 - Focused clinical input
 - Large review community input at Internal and Public Review



Path Forward

- Streamlining & Modularizing TA User Guides
 - focus on "Core" information
- Use Pre-populated templates, where possible
- Produce Normative Specifications for all TA User Guides for FDA
- Update Published TA User Guides (point versions) to remove <u>draft domains</u>
 - Create an area on the wiki where those draft SDTM domains and other proposed changes can be maintained.
- Extract <u>examples</u> from older TA User Guides and loading them into SHARE.
- Continually observe what works & what doesn't



How to get Involved

- Join a TA working group
- Comment on draft standard at the Internal Review and/or Public Review
- Attend the Interchange
- Participate in the CDISC Fellow program





CDISC Fellows Program

CDISC Fellows:

- Actively participate in the development of CDISC standards on a near full-time basis for a fixed period of time (nominally one year)
- Develop proficiency in the development, use and maintenance of standards
- Acquire knowledge that can be leveraged internally by sponsoring companies
- Provide ongoing part-time expertise
 - as a reviewer or other participant to the CDISC collaboration community

http://www.cdisc.org/cdisc-fellows-program



CDISC Fellows Class of 2015-2016

- Mikenlette Avent, UCB
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- Kapila Patel, InventiveHealth
- Dr. Helen Sile, FDA*
- Sharon Powell, Independent*
- Sandeep Savant, InventiveHealth*
- Junchao Chen, Shanghai University of TCM*
- Anayansi Van Der Berg, RA eClinical Solutions*
- Ruiling Peng, Beijing Improve-Quality Technology Ltd. Co.
- Phillip Ho, Rundo Int Pharmaceutical Research & Development Co.
- Qingna (Joy) Li, Xiyuan, Hospital, China Academy of Chinese Medical Sciences

*not pictured





CDISC Strategic Goals 2015-2017

#2

Implement clinical research standards that are complementary to standards in the broader healthcare ecosystem and thus add value for clinical researchers, healthcare providers and patients.





09 June 2010 EMA/INS/GCP/454280/2010 GCP Inspectors Working Group (GCP IWG) Date for coming into effect 01 August 2010 Reflection paper on expectations for electronic source data and data transcribed to electronic data collection tools in clinical trials References 2. CDISC (Clinical Data Interchange Standards Consortium) Clinical Research Glossary Version 8.0, DECEMBER 2009

http://www.cdisc.org/stuff/contentmgr/files/0/be650811feb46f381f0af41ca40ade2e/misc/cdisc 2009 glossar y.pdf.

3. CDISC e-source standard requirements-CDISC (Clinical Data Interchange Standards Consortium) Version 1.0 20 November 2006.



eSource = data entered electronically first, i.e.EHRs, eDiaries....



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Synergistic Standards Available





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EHR to Electronic Data Capture (CDASH) with IHE Retrieve Form for Data Capture (RFD)



"We owe it to patients who participate in research to use their data wisely."





The NEW ENGLAND JOURNAL of MEDICINE

Fostering Responsible Data Sharing through Standards

Rebecca Kush, Ph.D., and Michel Goldman, M.D., Ph.D.

C hildren with muscular dystrophy and their families make sacrifices to engage in clinical research studies, providing valuable data they expect will contribute to the discovery of a cure, although they know it may not be found in time to help them. This message was emphasized at a recent meeting organized by the Institute of Meditreatment of Alzheimer's disease have led several companies to begin collaboratively developing innovative study designs requiring extensive data sharing.

Unfortunately, the diverse ways in which data are collected and reported in clinical studies make it difficult or impossible to query across data sets, pool and share data, or integrate data for metadata, such confusion is inevitable. Units and other metadata are critical in medical research as well. Standard data and metadata formats are required for efficient aggregation of patient-level data, trustworthy statistical analyses, and accurately informed clinical decisions. When such standards are not implemented by all parties at the



eSource Stakeholders Group

CDISC Contact: Andrea Vadakin +1.316.558.0160 avadakin@cdisc.org FOR IMMEDIATE RELEASE CDISC to Convene eSource Stakeholders Group to Encourage Use of EHRs for Research

Austin, TX – 14 January 2016 – The Clinical Data Interchange Standards Consortium (CDISC) announced today the establishment of the "eSource Stakeholders Group," an open, inclusive forum which will provide coordination and focus to the increasing community of stakeholders interested in realizing the benefits of using eSource, also known as electronic source data, in clinical trials and meeting regulatory requirements for eSource data, provenance and electronic records. This news follows the FDA's announcement in June 2015 encouraging organizations to propose demonstration projects, the September 2013 FDA Guidance encouraging the use of electronic source data in the conduct of clinical investigations, and, most recently, the updated Electronic Health Record (EHR) eSource webpage on the FDA-CDER website.

"The use of electronic health records has the potential to foster efficiency and further innovation in regulated clinical research," said Janet Woodcock, M.D., director of FDA's Center for Drug Evaluation and Research. "Demonstration projects that test and evaluate the performance of end-to-end EHR-to-EDC single-point data capture approaches are an important source of information as we collectively work to ensure the quality of data from electronic source to electronic regulatory submission."



CDISC Strategic Goals 2015-2017

#3

Leverage the Shared Health And Research Electronic Library (SHARE) and other tools to further expedite the development and facilitate the implementation of harmonized standards for clinical research.





CDISC SHARE



What is SHARE?

CDISC SHARE, a cornerstone of the CDISC technical roadmap, is a global electronic repository for developing, integrating and accessing CDISC metadata standards in electronic format. SHARE is envisioned to help users find, understand and use rich metadata and controlled terminologies relevant to clinical studies more efficiently and consistently, and to improve integration and traceability of clinical data from protocol through analysis.

SHARE Team Still Accepting Volunteers

The SHARE Team is accepting new volunteers to our growing list of participants. There are a number of sub-teams that are either underway or planning to start in the near future. A current list of sub-

--Public Review--

ADaM Integration-IADSL v1 Draft Comments due 10 July 2015

CDISC eSHARE Downloads Now Available for Platinum Members!

If your organization is a Platinum member, please sign in with your organization's email address.

Volunteer for CDISC

SHARE Related Downloads / Links

eSHARE Content Catalog Subscribe to SHARE_News Volunteer for SHARE SHARE on CDISC Wiki CDISC SHARE Video SHARE Requirements (pdf) 2013 International Interchange SHARE Presentation (pdf)

SHARE Through the Eyes of a Child





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A World Without Data Standards





Elements, Metadata, Terminology





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User Guides / Solution Kits



© CDISC 2015



326

LEGD

Research Concepts



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Begin with the End in Mind: How Important is Concept or Value-Level Metadata?

Event	Time	D	S	F
Begin	9/23/99 02:01:00	121,900,000	12,300	143.878
End	9/23/99 02:17:23		9,840	

Event	Time	D	S	F
Start	19990923 05:01:00	196,200,000	5.5	640
Finish	19990923 05:17:23		4.4	

Source: Dave Christiansen



In this case \$125,000,000: Mars Climate Orbiter



Mars Orbit	M/D/Y HH:MM:SS PDT	Distance (miles)	Speed	Force
Insertion Burn	(Earth Receive Time, 10		(miles/hr)	(Pounds)
	min. 49 sec. Delay)			
Begin	9/23/99 02:01:00	121,900,000	12,300	143.878
End	9/23/99 02:17:23		9,840	
Mars Orbit	YYYYMMDD EDT	Distance (km)	Speed	Force
Insertion Burn	(Earth Receive Time, 10		(km/sec)	(Newtons)
	min. 49 sec. Delay)			
Start	19990923 05:01:00	196,200,000	5.5	640
Finish	19990923 05.17.23		44	





Research Concepts

Metadata set Components

I				\downarrow	•	*				
STUDYID	DOMAIN	USUBJID .	VSTESTCD	VSTEST	VSPOS	VSORRES	VSORRESU	VSSTRESC	VSSTRESN	VSSTRESU
CDISCPIL	VS	01-701-1015 1	DIABP	Diastolic Blood Pressure	SUPINE	64	mmHg	64	64	mmHg
CDISCPIL	VS	01-701-1015 2	DIABP	Diastolic Blood Pressure	STANDING	83	mmHg	83	83	cm
CDISCPIL	VS	01-701-1015 3	DIABP	Diastolic Blood Pressure	STANDING	57	mmHg	57	57	mmHg
CDISCPIL	VS	01-701-1015 4	DIABP	Diastolic Blood Pressure	SITTING	68	mmHg	68	68	mmHg
CDISCPIL	VS	01-701-1015 5	DIABP	Diastolic Blood Pressure	STANDING	59	mmHg	59	59	mmHg
CDISCPIL	VS	01-701-1015	HEIGHT	Height	SITTING	58.0	mmHg	147.32	147.32	cm
CDISCPIL	VS	01-701-1015	PULSE	Pulse Rate	SUPINE	57	BEATS/MIN	57	57	BEATS/MIN
CDISCPIL	VS	01-701-1015	PULSE	Pulse Rate	STANDING	ARNING: VSP	OS 'SITTING' i	s not valid VSI	POS value for	Test Code 'HEIO
CDISCPIL	VS	01-701-1015	PULSE	Pulse Rate	STANDING	65	BEATS/MIN	65	65	BEATS/MIN
CDISCPIL	VS	01-701-1015	SYSBP	Systolic Blood Pressure	SUPINE	131	mmHg	131	131	mmHg
CDISCPIL	VS	01-701-1015	SYSBP	Systolic Blood Pressure	STANDING	129	mmHg	129	129	mmHg
CDISCPIL	VS	01-701-1015	SYSBP	Systolic Blood Pressure	STANDING	147	cm	147	147	mmHg
CDISCPIL	VS	01-701-1015	SYSBP	Systolic Blood Pressure	SUPINE	138	mmHg	138	138	mmHg
CDISCPIL	VS	01-701-1015	SYSBP	Diastolic Blood Pressure	STANDING	137	mmHg	137	137	mmHg
CDISCPIL	VS	01-701-1015	TEMP	Temperature		96.9	F	36.06	36.06	C
CDISCPIL	VS	01-701-1015	TEMP	Temperature	SITTING	97.0	F	36.11	36.11	C
CDISCPIL	VS	01-701-1015	TEMP	Temperature		97.2	F	36.22	36.22	C

Source: Jozef Aerts (Adapted)



A Voyage Through Visit Dates

What is the visit name?	Visit	VISIT	PlannedActivity.name*	A clinical encounter that encompasses planned and unplanned trial inventions, procedures, and assessments that may be performed on a subject.	When applicable (e.g., on paper CRFs), record the visit name.	This is typically populated. *See the BRID complete path.	y pre-printed/pre- G model for		
What is the visit number?	Visit Number	VISITNUM	PlannedSubjectActivityG roup.sequenceNumber	A number assigned to a clinical encounter.	When applicable (e.g., on paper CRFs), record the	This is typically populated.	pre-printed/pre-		
What is the visit date?	Visit Date		ASH:	15-AF	PR-20	15 collected some be done once for VISDAT or ma	ay be used to mological order counters. collected are e should be way. This may or the visit using y be done at the		
					ļ	CRF level using	g the domain-		
VISITNUM	Visit Numbe]	Exp
VISIT	Visit Name	SD	FM: 2	015-0	4-15		r. ISITDY.	I	Pern
VISITDY	Planned Stu	<u> </u>					C in Demograph	ics.	Pern
QSDTC	Date/Time of Fi	inding C	har ISO 8601	Timing Date of qu	estionnaire.			I	Exp
ADT	A nolonia D	ata Num	- I I	Derm The data area	anistad mith ATTAT and	AVAT C	form	iat.	

AVISIT

Ababaris Data I Num I The data associated with AVAL and/or AVALC in any of format. ADDAM: Integer with Format ISIT), derived visit have to map to cord, but it does not



SHARE and End-to-End Standards





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CDISC SHARE



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What is SHARE?



Shared Health and Research Electronic Library (SHARE)

SHARE is a global electronic repository. With SHARE, you can:

- Develop, integrate and access CDISC standards metadata in electronic format.
- Dramatically improve quality, reusability and integration across CDISC standards and controlled terminologies.
- Improve interoperability with healthcare.

SHARE is a prerequisite for standards-based automation, which is key to ROI from standards implementation



eSHARE Content TODAY

eSHARE Content

- Foundational standards:
 - SDTM-IG 3.1.2, 3.1.3, 3.2, 3.3
 - CDASH 1.1
 - SEND-IG 3.0, 3.1
 - ADaM 2.1
- Medical Device standards
- Therapeutic Area Standards
- Controlled Terminology

eSHARE Formats

- ODM 1.3.2
- Define-XML v1.0
- Define-XML v2.0
- CSV
- Excel
- RDF/OWL
- Bundles

All standards will be loaded into SHARE prior to public review



SHARE and Therapeutic Area Standards Development

TA Standards Available:

- Asthma
- Alzheimer's
- Virology
- Cardiovascular
- Diabetes
- Influenza
- Multiple Sclerosis

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- QT
- Dyslipidemia
- CHCV



Future: TA Standards

- Specification documents generated from SHARE
- Metadata
 - CDASH, SDTM, & ADaM
- Examples
- Rules
- Biomedical Concepts
- Diff files
- Annotations
What Can SHARE Do for ME?





eSHARE Downloads Page

CDASH			eSHARE Standards Catalog				
Date Posted	Content	Version	Туре	Download Files			
CDASH 1.1							
2014-06- 02	CDASH	1.1	Metadata	ODM v1.3.2 CSV Excel			
2014-06- 02	CDASH + CT	1.1+2013- 12	Bundle	ODM Excel			
2014-06- 02	CDASH	1.1	Document	PDF			
2014-06- 02	CDASH UG	1.1	Document	PDF			
CDASH Terminology							
2015-04- 10	CDASH Terminology	2015-03	Metadata	ODM v1.3.1 RDF Excel Define-XML v2.0 Diff			
2014-10- 17	CDASH Terminology	2014-09	Metadata	ODM v1.3.1 RDF Excel Define-XML v1.0 Define-XML v2.0			
2014-10- 17	CDASH Terminology	2014-03	Metadata	ODM v1.3.1 RDF Excel Define-XML v1.0 Define-XML v2.0			
2014-06- 02	CDASH Terminology	2013-12	Metadata	ODM v1.3.1 RDF Excel Define-XML v1.0 Define-XML v2.0			
CDASH To SDTM Map							
2015-02- 02	CDASH To SDTM Map	1.1 to 3.1.2	For Review	Excel			



eSHARE Content: For Review & Experimental

TAUG								
Date Posted	Content	ontent Version Type Download Files						
Asthma 1.0								
2015-03- 23	Asthma TA	1.0	For Review (Experimental)	Asthma TAUG Metadata Bundle				
2015-04- 28	Asthma TA	1.0 (Draft)	For Review	Asthma TAUG Metadata				
2015-04- 28	Alzheimer's TA	1.0 (Draft)	For Review	Alzheimer's TAUG Metadata				
2015-04- 28	SDTM UG	1.0 (Draft)	For Review	Virology TAUG Metadata				
2015-05- 05	Cardiovascular TA	1.0 (Draft)	For Review	Cardiovascular TAUG Metadata				
05	TA							



SHARE Tomorrow

- RDF
- Loaded Define-XML v2.0
- Biomedical Concepts
- Example repository
- Validation rules
- keyCRF / E2C content
- Controlled Terminology subsets
- SHARE API
- Standards governance workflow
- Standards request capture and process



Early Evidence of Success





Baseline Findings before SHARE

- Time component: "To update metadata through the manual process, it takes an average of an hour per domain depending on how many variables need to be added, and how many labels and descriptions need to be added."
- Effort of QC: "This time [average of one hour] does not account for the occurrence of human error, for further QC to make sure all of the new domains and variables have been added, or for the time it takes to update old domains based on changes in the standard."



Early Examples of Demonstrated Value

- "Before the variables of the SDTM-IG were published electronically in eSHARE, it took me all my evenings during two weeks to copy and paste the information from a new SDTM-IG into my SDTM-ETL mapping software. After the variables were published in eSHARE as a worksheet, it took me just 2 hours."
- "Once CDISC publishes the variables of the SDTM-IG as a Define-XML template, it will take me 2 minutes."



That's Exciting! Do I Have Access?





CDISC Membership Benefits

eSHARE Access for Gold and Platinum CDISC Member Organizations

- *New* Access to eSHARE
- *New* ALL CDISC Standards
 - (Provisional and Final)
 - Foundational Standards
 - Terminology
 - Therapeutic Area Standards
 - Clinical Outcome Assessments and Questionnaires
- ALL Formats, including Excel, XML, RDF, Define-XML, ODM, PDF, CSV
- Access to Members Only Area for all employees of member organizations
- Monthly Members Only Mini-Training Webinars on industry hot topics
- 20% Discounts on CDISC Training Courses and Events
- Opportunity to be a CDISC Registered Solution Provider; RSPs serve as subject matter resources to organizations who want to implement CDISC standards
- Opportunity for your database to be Operational Data Model (ODM) certified to improve the quality of metadata and data interchange throughout the clinical development process
- Enroll in the CDISC Licensed Training Program which allows your staff to become authorized instructors to do in-house training on CDISC standards
- Receipt of personalized Gold Member plaque



SHARE is also Accessible to Academic Researchers

Where is eSHARE?

- eSHARE exists as part of the CDISC web site
- Access to eSHARE can be found on CDISC.org under Members Only
 - http://www.cdisc.org
 - Select "MEMBERS ONLY"
 - Select "eSHARE Downloads"
- Or, by loading eSHARE directly
 - http://cdisc.org/eshare-downloads
- The eSHARE catalog is located at:
 - http://cdisc.org/cdisc-share



How to Access eSHARE?

- Go to the CDISC web site and logon
 - Create your account if you haven't already
 - Use your corporate email account
 - http://cdisc.org
- Go to the eSHARE page using the URL
 - http://cdisc.org/eshare-downloads
- Agree to the EULA End User License Agreement
 - Required the first time you access eSHARE



eSHARE End-User License Agreement



CDISC eShare Agreement

CDISC eSHARE Enterprise Subscription

Your access and use of CDISC eSHARE is subject to the terms and conditions of this CDISC eSHARE Enterprise Subscription License (the "Agreement"). Accordingly, You automatically accept the terms and conditions of this Agreement (and are bound hereunder) when You (e.g., via Your employee, agent or representative) access or use CDISC eSHARE. If You do not want to accept use of CDISC eSHARE under the terms and conditions of this Agreement, then: (a) before using CDISC eSHARE, destroy all originals and copies of any access keys or codes in Your

I agree to the Terms & Conditions *

Continue

Cancel





I'd Like to be Involved!





eSHARE Requests for Feedback

- Requests for specific content not currently published on eSHARE, or feedback on current content
- Feedback on how to change or improve existing content
 - Create a JIRA issue
 - Jira.cdisc.org
 - SHARE project
 - Email me: <u>shume@cdisc.org</u>



Keep up with eSHARE News

- Periodically check the website
 - <u>http://cdisc.org/cdisc-share</u>
- CDISC Newsletter
- Follow our Social Media:
 - Twitter: follow @CDISC, @cdiscSHARE, @swhume
 - LinkedIn Group: CDISC
 - CDISC Facebook Group
- SHARE space on the CDISC Wiki
 - http://wiki.cdisc.org
- Sam's blog on SHARE topics
 - <u>http://mungingmetadata.blogspot.com/</u>



T Q

/ Edit

Watch

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Tools -

Share

SHARE Home

Added by Max Kanevsky, last edited by Julie Chason on May 05, 2015 (view change)



Quick Links

SHARE R3 Progress Report for Q2 SHARE page at CDISC website eSHARE Downloads (CDISC Platinum Members) FAQ Blog Volunteer for CDISC Sub-Team Roster How To: Log SHARE Review Comments in CDISC JIRA Metadata Listing (Domain Catalog, SUPPQUAL Listing)



SHARE Wiki

 s)
 Planning

 R2 Milestones

 SHARE Release 3

 Wish List

 CDISC Standards: Content and Meeting Notes

 SDTM

 SC JIRA

 Listing)

 V

 ADaM

 Therapeutic Area User Guides

 Research Concepts

 RC Pilots



Public Comment Tracker – CDISC Needs You!

Site Actions 👻 📄 Browse	e Items List								
	PORTAL	Public Comment Trac	cker → Comments → All Com	iments -					
								All Sites	¢)
Home Portal BOD E	E3C Education CDISC U	ser Networks CAB J3C	OPS Teams Projects C3C	CAB VP CDER	Classroom Training	FDA Training	Public Comment Tracker	Team Comment Tracker	Therapeu
Help	🔲 🖉 Comment Title	Comment	Document Being Commented On	Document Section	Comment Category	Current State	Comment Author	Assigned T	o - Team R
Review Documents Comments Assigned To Me	NUMLIV instead of NUJMLIV Request for Additional Example	page 9, RD.XPT, Row 2, RDTESTCD: NUMLIV instead of NUJMLIV	XXX Comment Period Closed - SDTM IG 003 - RD Reproductive Details v3.1.4 Draft	6.3.14.2	Select or Blank	Closed	Lorenz Dolanski-Ag	jhamanoukjan	
By Assigned To By Document Number - Title By Current State By Comment Author By Comment Category By CDISC Disposition		Would it be possible to add an additional example of how to collect data in EX domain for combination drugs. For example, 1 tablet contains 3 drugs: Drug A (10mg), Drug B(50mg) Drug C(30mg). Since this is a combination I am not sure what to put in EXDOSE.	XXX Comment Period Closed - SDTM IG 001 - EX and EC ExposureDomains v3.1.4 Draft		Suggestion	Select or Blan	ık David Ramage		
All Site Content	comments to EX and EC doc	 EXMOOD has controlled terminology (MOOD). The most recent CT does not contain CT for this, so want to make sure that this will be released in conjunction with the 3.1.4 release? Is it intentional that BRIDG mapping is missing for EXDIR and EXPORTOT? Same question as #1 for EXPORTOT (PORTOT). EXMETHOD (MTHADM), etc. font size inconsistencies on page 	XXX Comment Period Closed - SDTM IG 001 - EX and EC ExposureDomains v3.1.4 Draft		Select or Blank	Select or Blan	ık kris ilano		
		20 5. Page 24, second paragraph of Example 2, should say 'ABC123- 0201' instead of 'ABC123- 1001' to be consistent							





Annual Public Report

CDISC 2014 Annual Report



COLLABORATE

"Perfect as the wing of a bird may be, it will never enable the bird to fly if unsupported by the air. Facts are the air of science. Without them a man of science can never rise." —Ivan Pavlov, Nobel Prize Winner in Physiology or Medicine, 1904



MAKE A GIFT CONTACT LIST SIGNUP

RESOURCES

CDISC Strength Through Collaboration

STANDARDS COLLABORATIONS ABOUT

Public Courses in Paris, France

Sanofi 1 Avenue Pierre Brossolette Chilly-Mazarin 91385 France



Course Information: Name: 2-day SDTM Theory and Application Date/Time: 7-8 Mar 2016; 09:00-17:00 Instructor: Niels Both Course Language: English

Name: 1/2-day ADaM Primer Date/Time: 9 Mar 2016, 13:00-17:00 Instructor: Niels Both Course Language: English

Name: 1-day ADaM Theory and Application Date/Time: 10 Mar 2016; 09:00-17:00 Instructor: Niels Both Course Language: English

Name: 1-day Define-XML Date/Time: 11 Mar 2016; 09:00-17:00 Instructor: Jozef Aerts Course Language: English

Register by 6 Feb 2016 to avoid late registration fees

Registration for Payment by Credit Card Registration for Payment by Invoice Course Fees

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IN

Merci pour votre attention!

pierre-yves.lastic@sanofi.com



Strength through collaboration.

