Don’t Leave Encounters with Real World Data to Chance

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Meet the Speaker

Ingeborg Holt

Title: Founder

Organization: Orizaba Solutions

Ingeborg Holt is the Founder of Orizaba Solutions, helping clients tackle challenges in data standardization, integration, and analysis. With over 20 years of experience at the intersection of data, technology, and healthcare, she has led major digital transformation initiatives across government and industry. She previously served as a Project Manager and Health Informatics Consultant at IBM and as Director of Federal Consulting at Commonwealth Informatics. Ingeborg holds an MS in Computer Science from Johns Hopkins University and a BA in Biology from Smith College. She is passionate about using data and digital tools to improve health and lives.

Meet the Speakers

Sarah Ferko

Title: Senior Managing Consultant

Organization: IBM Consulting

Sarah Ferko is a Senior Managing Consultant and Project Management Professional (PMP) in IBM's Artificial Intelligence and Analytics service line within the Data and Technology Transformation practice area supporting US Federal projects within IBM Consulting. Sarah has supported multiple offices at the FDA since 2017, including CDER OB, OSP, OCS, and OND. Sarah holds a B.S./M.S. in Applied Mathematics from the University of Akron in Akron, Ohio.

Jeffrey Abolafia

Title: Director of Product Innovation

Organization: Certara

Jeff Abolafia is currently Director of Product Innovation at Pinnacle 21. Previously Jeff held the position of Chief Strategist of Data Standards and was a member of the faculty in the Department of Biostatistics at the University of North Carolina. Jeff has been involved with public health research and data standards for over thirty years. Jeff co-founded the RTP CDISC User's Group and is a member of the CDISC ADaM and RWD Lineage teams and several PHUSE Real World Evidence working groups. His areas of interest include real world evidence, mobile health, data standards, and regulatory submissions.

Disclaimer and Disclosures

The views and opinions expressed in this presentation are those of the author(s) and do not necessarily reflect the official policy or position of CDISC, IBM, or Pinnacle21 by Certara.

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Agenda

- Introduction & Background
- Current State
- RWD Models
- Challenges & Recommendations
- Summary & Conclusion

Introduction

- Defining RWD & RWE
- Previous Papers
- RWD Background

Defining Real World Data (RWD) & Real World Evidence (RWE)

- Section 505F(b) of the FD&C Act defines RWE as *"data regarding the usage, or the potential benefits or risks, of a drug derived from sources other than traditional clinical trials"* (21 U.S.C. 355g(b)).
  - **Real-World Data (RWD)**: Data relating to patient health status and/or the delivery of health care routinely collected from a variety of sources; and
  - **Real-World Evidence (RWE)**: The clinical evidence about the usage and potential benefits or risks of a medical product derived from analysis of RWD.
- For the purposes of this paper, we will use the working definition of RWD as data relating to patient health status and/or the delivery of health care that is not collected under a protocol, and RWE as the data derived from the RWD to be submitted to the FDA.
- We are also defining **RWD studies** as those done retrospectively, where data was collected prior to the development of a protocol and are excluding studies using RWD that are conducted prospectively under a protocol.

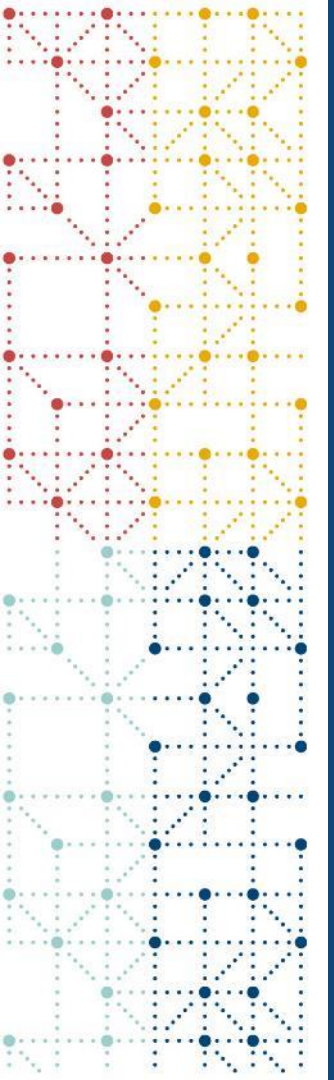
Challenges for Submitting Non-RCT Data

Challenges presented in our previous six papers:

1. Abolafia J, Ferko S, Holt I (2024). “Future Clinical Data Submission Standards: CDISC, FHIR, OMOP, or Hybrid Model.” Pharmaceutical Users Software Exchange (PHUSE) US, Bethesda, MD. Feb 25-28, 2024. https://www.lexjansen.com/phuse-us/2024/re/PAP_RE03.pdf
2. Abolafia, J, Ferko, S, & Holt, I. (2023). “Submission Standards for Real World Data: Gaps, Limitations and Recommendations”. Paper presented at the PHUSE Annual Conference 2023, Birmingham, United Kingdom. https://phuse.s3.eu-central-1.amazonaws.com/Archive/2023/Connect/EU/Birmingham/PAP_RE03.pdf
3. Ferko, S., Holt, I., & Abolafia, J., (2023). “Challenges and Considerations for Submitting Real World Data”. Paper presented at the PHUSE US Annual Conference 2023, Orlando, FL. https://phuse.s3.eu-central-1.amazonaws.com/Archive/2023/Connect/US/Florida/PRE_RE05.pdf
4. Abolafia, J, Ferko, S, & Holt, I. (2022). “Submission Standards for RWD: The Good, the Bad and the Ugly”. Paper presented at the PHUSE Annual Conference 2022, Belfast, United Kingdom. https://phuse.s3.eu-central-1.amazonaws.com/Archive/2022/Connect/EU/Belfast/PRE_RE09.pdf
5. Abolafia, J, Ferko, S, & Holt, I. (2024). “Considerations for the Submission of RWD using CDISC with Insights from HL7 FHIR and OMOP”. Paper presented at the PHUSE Annual Conference 2024, Strasbourg, France. https://phuse.s3.eu-central-1.amazonaws.com/Archive/2024/Connect/EU/Strasbourg/PAP_RE03.pdf
6. Abolafia, J, Ferko, S, & Holt, I. (2025). “AE, CE, & MH Considerations for the Submission of RWD using CDISC, with Insights from HL7 FHIR and OMOP”. Paper presented at the PHUSE Annual Conference 2025, Orlando, FL. https://phuse.s3.eu-central-1.amazonaws.com/Archive/2025/Connect/US/Orlando/PAP_RE02.pdf

RWD Background

- Increase in RWD and RWE submitted as part of NDAs/BLAs
- RWD has variable quality and is usually collected at inconsistent intervals based on patient need
- CDISC is the current submission standard required for all study data submitted to CDER and CBER
  - Designed for representing high quality, protocol-specified randomized controlled trial (RCT) data
  - CDISC does not contain all the necessary domains or data elements for RWD
  - Challenging for both FDA and sponsors
- Data standards for RWD exist, including OMOP, HL7 FHIR, and PCORnet
  - Designed for specific uses with RWD
  - Can help inform on the data needed for RWD to meet regulatory review needs



Current State

- Subject Visits Background
- CDISC SV & DM Domains
- BIMO Data
- Subject Visits: RCTs vs. RWD
- Gaps in Subject Visits

Subject Visits Background

- CDISC SDTM Subject Visits (SV) Domain designed for RCTs
  - Visits are driven by the protocol's Schedule of Activities
  - Provider and Care site are not expected to change
  - Relevant data is documented clearly in a CRF

Example Schedule of Activities

	STUDY PERIOD							
	Enrolment	Allocation	Post-allocation					Close-out
	Enrolment visit	Allocation visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Close-out visit
TIMEPOINT, days	**-14 to 0**	**0**	**14 ± 2**	**30 ± 2**	**60 ± 2**	**90 ± 2**	**120 ± 2**	**30 POST**
Enrolment								
Eligibility screening	X							
Informed consent	X							
Allocation		X						
Interventions								
Treatment with 3-mont HR (Control arm)			←	—	→			X
Treatment with 3-month HP (experimental-1 arm)			←	—	→			X
Treatment with 4-month R (experimental-2 arm)			←	—	—	—	→	X
Assessments								
Demographics, medical history, physical exam, & chest X-ray [1]	X							
Blood test	X		X	X	X	X [2]	X	
Concomitant medication			X	X	X	X	X [3]	
Adherence			X	X	X	X	X [3]	
Adverse events			X	X	X	X	X [3]	X
Treatment conclusion								X

CDISC SDTM SDTMIGv3.4

SV – Specification

sv.xpt, Subject Visits — Special Purpose. One record per actual or planned visit per subject, Tabulation.

Variable Name	Variable Label	Type	Controlled Terms, Codelist or Format[1]	Role	CDISC Notes	Core
STUDYID	Study Identifier	Char		Identifier	Unique identifier for a study.	Req
DOMAIN	Domain Abbreviation	Char	SV	Identifier	Two-character abbreviation for the domain most relevant to the observation. The domain abbreviation is also used as a prefix for variables to ensure uniqueness when datasets are merged.	Req
USUBJID	Unique Subject Identifier	Char		Identifier	Identifier used to uniquely identify a subject across all studies for all applications or submissions involving the product.	Req
VISITNUM	Visit Number	Num		Topic	Clinical encounter number. Numeric version of VISIT, used for sorting.	Req
VISIT	Visit Name	Char		Synonym Qualifier	Protocol-defined description of a clinical encounter.	Perm
SVPRESP	Pre-specified	Char	(NY)	Variable Qualifier	Used to indicate whether the visit was planned (i.e., visits specified in the TV domain). Value is "Y" for planned visits, null for unplanned visits.	Exp
SVOCCUR	Occurrence	Char	(NY)	Record Qualifier	Used to record whether a planned visit occurred. The value is null for unplanned visits.	Exp
SVREASOC	Reason for Occur Value	Char		Record Qualifier	The reason for the value in SVOCCUR. If SVOCCUR="N", SVREASOC is the reason the visit did not occur.	Perm

Variable Name	Variable Label	Type	Controlled Terms, Codelist or Format[1]	Role	CDISC Notes	Core
SVCNTMOD	Contact Mode	Char	(CNTMODE)	Record Qualifier	The way in which the visit was conducted. Examples: "IN PERSON", "TELEPHONE CALL", "IVRS".	Perm
SVEPCHGI	Epi/Pandemic Related Change Indicator	Char	(NY)	Record Qualifier	Indicates whether the visit was changed due to an epidemic or pandemic.	Perm
VISITDY	Planned Study Day of Visit	Num		Timing	Planned study day of VISIT. Should be an integer.	Perm
SVSTDTC	Start Date/Time of Observation	Char	ISO 8601 datetime or interval	Timing	Start date/time of an observation represented in IS0 8601 character format.	Exp
SVENDTC	End Date/Time of Observation	Char	ISO 8601 datetime or interval	Timing	End date/time of the observation represented in IS0 8601 character format.	Exp
SVSTDY	Study Day of Start of Observation	Num		Timing	Actual study day of start of observation expressed in integer days relative to the sponsor-defined RFSTDTC in Demographics.	Perm
SVENDY	Study Day of End of Observation	Num		Timing	Actual study day of end of observation expressed in integer days relative to the sponsor-defined RFSTDTC in Demographics.	Perm
SVUPDES	Description of Unplanned Visit	Char		Record Qualifier	Description of what happened to the subject during an unplanned visit. Only populated for unplanned visits.	Perm

CDISC's Demographics (DM) Specification and Assumptions

Variable Name	Variable Label	Type	Controlled Terms, Codelist or Format[1]	Role	CDISC Notes	Core
STUDYID	Study Identifier	Char		Identifier	Unique identifier for a study.	Req
DOMAIN	Domain Abbreviation	Char	DM	Identifier	Two-character abbreviation for the domain.	Req
USUBJID	Unique Subject Identifier	Char		Identifier	Identifier used to uniquely identify a subject across all studies for all applications or submissions involving the product. This must be a unique number, and could be a compound identifier formed by concatenating STUDYID-SITEID-SUBJID.	Req
SUBJID	Subject Identifier for the Study	Char		Topic	Subject identifier, which must be unique within the study. Often the ID of the subject as recorded on a CRF.	Req
RFSTDTC	Subject Reference Start Date/Time	Char	ISO 8601	Record Qualifier	Reference Start Date/time for the subject in ISO 8601 character format. Usually equivalent to date/time when subject was first exposed to study treatment. See Assumption 9 for additional detail on when RFSTDTC may be null.	Exp
RFENDTC	Subject Reference End Date/Time	Char	ISO 8601	Record Qualifier	Reference End Date/time for the subject in ISO 8601 character format. Usually equivalent to the date/time when subject was determined to have ended the trial, and often equivalent to date/time of last exposure to study treatment. Required for all randomized subjects; null for screen failures or unassigned subjects.	Exp
RFXSTDTC	Date/Time of First Study Treatment	Char	ISO 8601	Record Qualifier	First date/time of exposure to any protocol-specified treatment or therapy, equal to the earliest value of EXSTDTC.	Exp
RFXENDTC	Date/Time of Last Study Treatment	Char	ISO 8601	Record Qualifier	Last date/time of exposure to any protocol-specified treatment or therapy, equal to the latest value of EXENDTC (or the latest value of EXSTDTC if EXENDTC was not collected or is missing).	Exp
RFICDTC	Date/Time of Informed Consent	Char	ISO 8601	Record Qualifier	Date/time of informed consent in ISO 8601 character format. This will be the same as the date of informed consent in the Disposition domain, if that protocol milestone is documented. Would be null only in studies not collecting the date of informed consent.	Exp
RFPENDTC	Date/Time of End of Participation	Char	ISO 8601	Record Qualifier	Date/time when subject ended participation or follow-up in a trial, as defined in the protocol, in ISO 8601 character format. Should correspond to the last known date of contact. Examples include completion date, withdrawal date, last follow-up, date recorded for lost to follow up, or death date.	Exp
DTHDTC	Date/Time of Death	Char	ISO 8601	Record Qualifier	Date/time of death for any subject who died, in ISO 8601 format. Should represent the date/time that is captured in the clinical-trial database.	Exp
DTHFL	Subject Death Flag	Char	(NY)	Record Qualifier	Indicates the subject died. Should be "Y" or null. Should be populated even when the death date is unknown.	Exp
SITEID	Study Site Identifier	Char	*	Record Qualifier	Unique identifier for a site within a study.	Req
INVID	Investigator Identifier	Char		Record Qualifier	An identifier to describe the Investigator for the study. May be used in addition to SITEID. Not needed if SITEID is equivalent to INVID.	Perm
INVNAM	Investigator Name	Char		Synonym Qualifier	Name of the investigator for a site.	Perm

DM Specification

- SITEID: Unique identifier for a study site
- INVID: Unique identifier for the investigator at the study site

DM Assumptions

- Subject will be seen at a single, consistent site
- Investigator is accountable for care and conducting the study per protocol
- Subject will be seen by one physician (investigator) associated with that site
- Site and investigator information will be submitted in the BIMO data package
  - DM SITEID matches a SITEID in BIMO

Bioresearch Monitoring (BIMO) Program and Data

- Monitors all aspects of the conduct and reporting of FDA regulated research
- Facilitates the analysis of site-specific efficacy results, ensuring that one site is not unduly influencing the study results
- Data is submitted for each study that is part of a New Drug Application (NDA) or Biologics License Application (BLA) and must adhere to the eCTD[1] format
- Bioresearch Monitoring Technical Conformance Guide contains non-binding recommendations for data submission
  - The format for Clinical Site Lists contains a unique Site Identifier, the investigator name, and site address

Protocol Number: Protocol Title			
Site Identifier	**Investigator Name (Prior Clinical Investigator(s))**	**Site Address at Time of Clinical Study (Updated Site Address when exists and available)**	**Site Contact Information at Time of Clinical Study (Updated Contact Information when exists and available)**
SITEID	**LASTNAME, FRSTNAME, MINITIAL**	**FACILITY NAME STREET CITY, STATE, POSTAL COUNTRY**	**PHONE FAX EMAIL**
0001*	Doe, John M.	Doe University Department of Medicine 1 Main St., Suite 100 Silver Spring, MD 20850 USA	Phone: 1-555-555-5555 Fax: 1-555-555-5555 Email: john.doe@mail.com
0002	Doe, Jean (Smith, John)	Doe University Department of Medicine 1 Main St., Suite 100 Silver Spring, MD 20850 USA	Phone: 1-555-555-5555 Fax: 1-555-555-5555 Email: john.smith@mail.com (Phone: 1-555-555-5554 Email: jean.doe@mail.com)
003	Dietric-Fischer, Inge	Hartmannstrasse 7 5300 Bonn 1 Germany	Phone:49-555-555-5555 Fax: 49-555-555-5555 Email: Dietric.Fischer@web.de
* Site terminated, or clinical investigator changed, at request of sponsor before study completion.			

[1]Reference: Electronic Common Technical Document (eCTD) | FDA

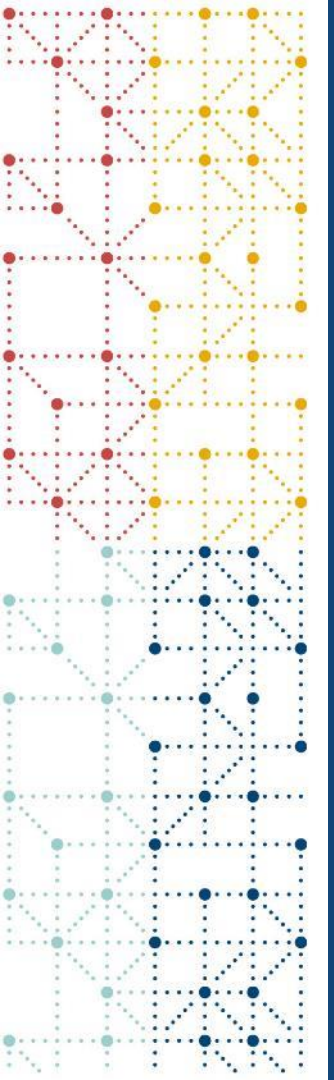
Subject Visits: RCTs vs RWD

Topic	Randomized Controlled Trial	Real World Data
Scheduled Patient Provider Interaction / Healthcare Delivery	**Protocol-defined** visit	Encounter (patient-initiated)
Unscheduled Patient Provider Interaction / Healthcare Delivery	Unscheduled visit (not protocol-defined)	Encounter (patient-initiated)
Treatment Facility and Provider	Subject assigned to **one site and one investigator**	Site and care provider may vary widely
Schedule Cadence	Pre-specified and **protocol driven**	Driven by **patient need**, standard of care, reimbursement
Care Structure	**Driven by a protocol**, upon which all investigators are trained	Heterogenous and **can vary by site, system, payer, etc**
Recording Structure	Highly-standardized **Case Report Form (CRF),** upon which study site staff have been trained	Source dependent, often a **non-standardized electronic system** that is customized by the individual provider site
Timing	Nominal VISIT/VISITNUM, actual dates, study days based on reference dates and a protocol defined **index date**	Calendar dates when an encounter took place, **encounters may span multiple dates,** or **multiple encounters may occur on the same date**
Outcomes and Safety	**Prospectively defined endpoints; solicited adverse events** (AEs)	**Opportunistic outcomes**, **AEs not systemically solicited** and rely on patient and/or physician to initiate the report
Visit Content / Actions Taken	**Protocol-mandated** assessments (e.g., labs with specified panels, PROs, imaging)	Varies per patient **based on the provider judgement** and may be influenced by payer decisions

Gaps in Subject Visit Domain

Assumptions are made based on the way RCTs are commonly run, including:

- SV domain primarily contains timing variables without many other visit details to provide context
  - Site and investigator information is in the study protocol, BIMO and related study documents, not CDISC
- Only one provider (investigator) can be specified in DM, and provider specialty not specified
- Only one location/facility can be specified in DM
  - The Healthcare Encounters (HO) domain contains data for inpatient and outpatient healthcare events
  - Provider and facility location are not in HO, but could be provided in a supplemental domain
- DM.SITEID and DM.INVID identifiers assigned by the sponsor and are not standardized but do specify Type
- SITEID can be used as a unique key in BIMO and in DM, but currently not enforced by the standard
  - This enables a site to have more than one investigator and an investigator to work at more than one site, but a different SITEID is required for each investigator
  - To identify the visit healthcare provider, SITEID and INVID both need to be in the SV dataset
- No stated rule that the BIMO SITEID and investigator information match DM.SITEID and DM.INVNAM, although it is assumed this is required
  - SITEID matches could be electronically implemented, but INVNAM would be harder to do electronically given the field formatting differences in BIMO and CDISC DM.
    - This may be remedied by the work FDA is currently doing to standardize the BIMO file



RWD Models

- HL7 FHIR
- PCORnet
- OMOP
- Sentinel

Subject Encounter Entities in HL7 FHIR R4

HL7 FHIR Release 4

Entities #1	Entities #2	Workflow	Management
• Organization 3	• Substance 2	• Task 2	• Encounter 2
• OrganizationAffiliation 0	• BiologicallyDerivedProduct 0	• Appointment 3	• EpisodeOfCare 2
• HealthcareService 2	• Device 2	• AppointmentResponse 3	• Flag 1
• Endpoint 2	• DeviceMetric 1	• Schedule 3	• List 1
• Location 3		• Slot 3	• Library 2
		• VerificationResult 0	

cdisc

Source: https://hl7.org/fhir/R4/clinicalsummary-module.html

Subject Encounter Resource in HL7 FHIR R4

Encounter Resource: Designed to represent interactions between a patient and healthcare provider(s) for the purpose of documenting healthcare service(s) and/or assessing the health status of a patient

Structure

Name	Flags	Card.	Type	Description & Constraints
Encounter	TU		DomainResource	An interaction during which services are provided to the patient Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	Identifier(s) by which this encounter is known
status	?! Σ	1..1	code	planned | arrived | triaged | in-progress | onleave | finished | cancelled + EncounterStatus (Required)
statusHistory		0..*	BackboneElement	List of past encounter statuses
status		1..1	code	planned | arrived | triaged | in-progress | onleave | finished | cancelled + EncounterStatus (Required)
period		1..1	Period	The time that the episode was in the specified status
class	Σ	1..1	Coding	Classification of patient encounter V3 Value SetActEncounterCode (Extensible)
classHistory		0..*	BackboneElement	List of past encounter classes
class		1..1	Coding	inpatient | outpatient | ambulatory | emergency + V3 Value SetActEncounterCode (Extensible)
period		1..1	Period	The time that the episode was in the specified class
type	Σ	0..*	CodeableConcept	Specific type of encounter Encounter type (Example)
serviceType	Σ	0..1	CodeableConcept	Specific type of service Service type (Example)
priority		0..1	CodeableConcept	Indicates the urgency of the encounter v3 Code System ActPriority (Example)
subject	Σ	0..1	Reference(Patient | Group)	The patient or group present at the encounter
episodeOfCare	Σ	0..*	Reference(EpisodeOfCare)	Episode(s) of care that this encounter should be recorded against
basedOn		0..*	Reference(ServiceRequest)	The ServiceRequest that initiated this encounter
participant	Σ	0..*	BackboneElement	List of participants involved in the encounter
type	Σ	0..*	CodeableConcept	Role of participant in encounter Participant type (Extensible)
period		0..1	Period	Period of time during the encounter that the participant participated
individual	Σ	0..1	Reference(Practitioner | PractitionerRole | RelatedPerson)	Persons involved in the encounter other than the patient
appointment	Σ	0..*	Reference(Appointment)	The appointment that scheduled this encounter
period		0..1	Period	The start and end time of the encounter
length		0..1	Duration	Quantity of time the encounter lasted (less time absent)
reasonCode	Σ	0..*	CodeableConcept	Coded reason the encounter takes place Encounter Reason Codes (Preferred)
reasonReference	Σ	0..*	Reference(Condition | Procedure | Observation | ImmunizationRecommendation)	Reason the encounter takes place (reference)
diagnosis	Σ	0..*	BackboneElement	The list of diagnosis relevant to this encounter
condition	Σ	1..1	Reference(Condition | Procedure)	The diagnosis or procedure relevant to the encounter
use		0..1	CodeableConcept	Role that this diagnosis has within the encounter (e.g. admission, billing, discharge …) DiagnosisRole (Preferred)
rank		0..1	positiveInt	Ranking of the diagnosis (for each role type)
account		0..*	Reference(Account)	The set of accounts that may be used for billing for this Encounter
hospitalization		0..1	BackboneElement	Details about the admission to a healthcare service
preAdmissionIdentifier		0..1	Identifier	Pre-admission identifier
origin		0..1	Reference(Location | Organization)	The location/organization from which the patient came before admission
admitSource		0..1	CodeableConcept	From where patient was admitted (physician referral, transfer) Admit source (Preferred)
reAdmission		0..1	CodeableConcept	The type of hospital re-admission that has occurred (if any). If the value is absent, then this is not identified as a readmission v2 RE-ADMISSION INDICATOR (Example)
dietPreference		0..*	CodeableConcept	Diet preferences reported by the patient Diet (Example)
specialCourtesy		0..*	CodeableConcept	Special courtesies (VIP, board member) Special courtesy (Preferred)
specialArrangement		0..*	CodeableConcept	Wheelchair, translator, stretcher, etc. Special arrangements (Preferred)
destination		0..1	Reference(Location | Organization)	Location/organization to which the patient is discharged
dischargeDisposition		0..1	CodeableConcept	Category or kind of location after discharge Discharge disposition (Example)
location		0..*	BackboneElement	List of locations where the patient has been
location		1..1	Reference(Location)	Location the encounter takes place
status		0..1	code	planned | active | reserved | completed EncounterLocationStatus (Required)
physicalType		0..1	CodeableConcept	The physical type of the location (usually the level in the location hierachy - bed room ward etc.) Location type (Example)
period		0..1	Period	Time period during which the patient was present at the location
serviceProvider		0..1	Reference(Organization)	The organization (facility) responsible for this encounter
partOf		0..1	Reference(Encounter)	Another Encounter this encounter is part of

Source: https://build.fhir.org/index.html

Organization and Location Resources in HL7 FHIR R4

Organization Resource: Contains information about healthcare providers(s)

Location Resource: Contains Details and position information for a physical place where services are provided and resources and participants may be stored, found, contained, or accommodated

ORGANIZATION

Structure

Name	Flags	Card.	Type	Description & Constraints
Organization	I TU		DomainResource	A grouping of people or organizations with a common purpose *+ Rule: The organization SHALL at least have a name or an identifier, and possibly more than one* Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ I	0..*	Identifier	Identifies this organization across multiple systems
active	?! Σ	0..1	boolean	Whether the organization's record is still in active use
type	Σ	0..*	CodeableConcept	Kind of organization Organization type (Example)
name	Σ I	0..1	string	Name used for the organization
alias		0..*	string	A list of alternate names that the organization is known as, or was known as in the past
telecom	I	0..*	ContactPoint	A contact detail for the organization *+ Rule: The telecom of an organization can never be of use 'home'*
address	I	0..*	Address	An address for the organization *+ Rule: An address of an organization can never be of use 'home'*
partOf	Σ	0..1	Reference(Organization)	The organization of which this organization forms a part
contact		0..*	BackboneElement	Contact for the organization for a certain purpose
purpose		0..1	CodeableConcept	The type of contact Contact entity type (Extensible)
name		0..1	HumanName	A name associated with the contact
telecom		0..*	ContactPoint	Contact details (telephone, email, etc.) for a contact
address		0..1	Address	Visiting or postal addresses for the contact
endpoint		0..*	Reference(Endpoint)	Technical endpoints providing access to services operated for the organization

LOCATION

Structure

Name	Flags	Card.	Type	Description & Constraints
Location	TU		DomainResource	Details and position information for a physical place Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	Unique code or number identifying the location to its users
status	?! Σ	0..1	code	active | suspended | inactive LocationStatus (Required)
operationalStatus	Σ	0..1	Coding	The operational status of the location (typically only for a bed/room) v2 BED STATUS (Preferred)
name	Σ	0..1	string	Name of the location as used by humans
alias		0..*	string	A list of alternate names that the location is known as, or was known as, in the past
description	Σ	0..1	string	Additional details about the location that could be displayed as further information to identify the location beyond its name
mode	Σ	0..1	code	instance | kind LocationMode (Required)
type	Σ	0..*	CodeableConcept	Type of function performed V3 Value SetServiceDeliveryLocationRoleType (Extensible)
telecom		0..*	ContactPoint	Contact details of the location
address		0..1	Address	Physical location
physicalType	Σ	0..1	CodeableConcept	Physical form of the location Location type (Example)
position		0..1	BackboneElement	The absolute geographic location
longitude		1..1	decimal	Longitude with WGS84 datum
latitude		1..1	decimal	Latitude with WGS84 datum
altitude		0..1	decimal	Altitude with WGS84 datum
managingOrganization	Σ	0..1	Reference(Organization)	Organization responsible for provisioning and upkeep
partOf		0..1	Reference(Location)	Another Location this one is physically a part of
hoursOfOperation		0..*	BackboneElement	What days/times during a week is this location usually open
daysOfWeek		0..*	code	mon | tue | wed | thu | fri | sat | sun DaysOfWeek (Required)
allDay		0..1	boolean	The Location is open all day
openingTime		0..1	time	Time that the Location opens
closingTime		0..1	time	Time that the Location closes
availabilityExceptions		0..1	string	Description of availability exceptions
endpoint		0..*	Reference(Endpoint)	Technical endpoints providing access to services operated for the location

Source: https://build.fhir.org/index.html

Subject Encounters Data in PCORnet v7.0

PROVIDER Domain Description:
Data about the providers who are involved in the care processes documented in the PCORnet® CDM.

Relational Integrity:
The PROVIDER table contains one record per PROVIDERID.

Primary Key: PROVIDERID

Foreign Keys:
PROVIDER.PROVIDERID is a foreign key to ENCOUNTER.PROVIDERID (one-to-many relationship)
PROVIDER.PROVIDERID is a foreign key to DIAGNOSIS.PROVIDERID (one-to-many relationship)
PROVIDER.PROVIDERID is a foreign key to PROCEDURES.PROVIDERID (one-to-many relationship)
PROVIDER.PROVIDERID is a foreign key to PRESCRIBING.RX_PROVIDERID (one-to-many relationship)
PROVIDER.PROVIDERID is a foreign key to MEDADMIN.MEDADMIN_PROVIDERID (one-to-many relationship)

Constraints:
PROVIDERID (unique; required, not null)

PROVIDER Table Implementation Guidance
Guidance
• Include one record per provider.
• When populating provider specialty, if multiple values are available, use the specialty believed to be primary.

Source: https://pcornet.org/data/common-data-model/

Subject Encounter Data in OMOP v5.4

visit_occurrence

Table Description

This table contains Events where Persons engage with the healthcare system for a duration of time. They are often also called "Encounters". Visits are defined by a configuration of circumstances under which they occur, such as (i) whether the patient comes to a healthcare institution, the other way around, or the interaction is remote, (ii) whether and what kind of trained medical staff is delivering the service during the Visit, and (iii) whether the Visit is transient or for a longer period involving a stay in bed.

location

Table Description

The LOCATION table represents a generic way to capture physical location or address information of Persons and Care Sites.

provider

Table Description

The PROVIDER table contains a list of uniquely identified healthcare providers; duplication is not allowed. These are individuals providing hands-on healthcare to patients, such as physicians, nurses, midwives, physical therapists etc.

care_site

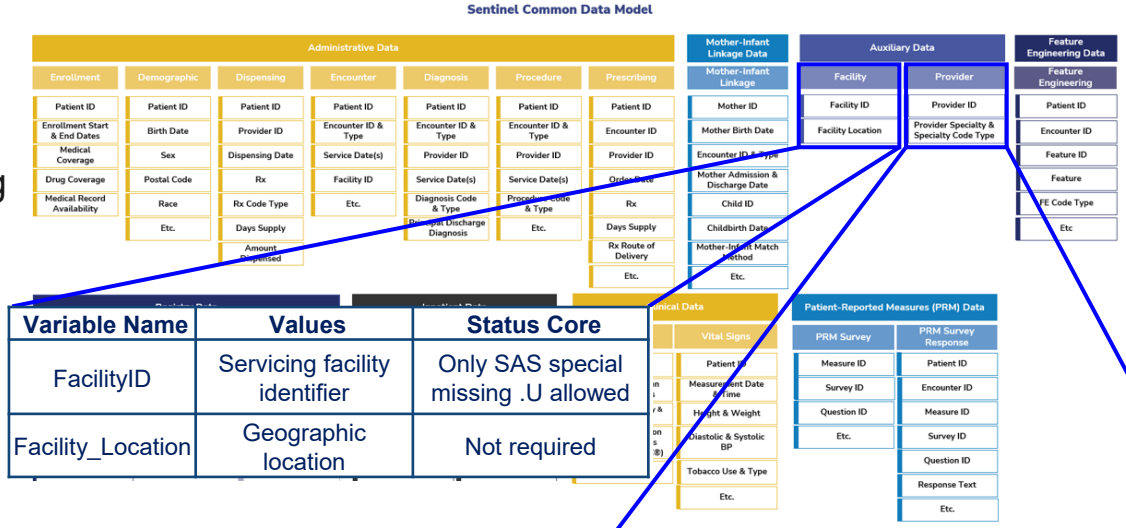
Table Description

The CARE_SITE table contains a list of uniquely identified institutional (physical or organizational) units where healthcare delivery is practiced (offices, wards, hospitals, clinics, etc.).

Source: https://ohdsi.github.io/TheBookOfOhdsi/CommonDataModel.html

Sentinel Common Data Model, Facility & Provider

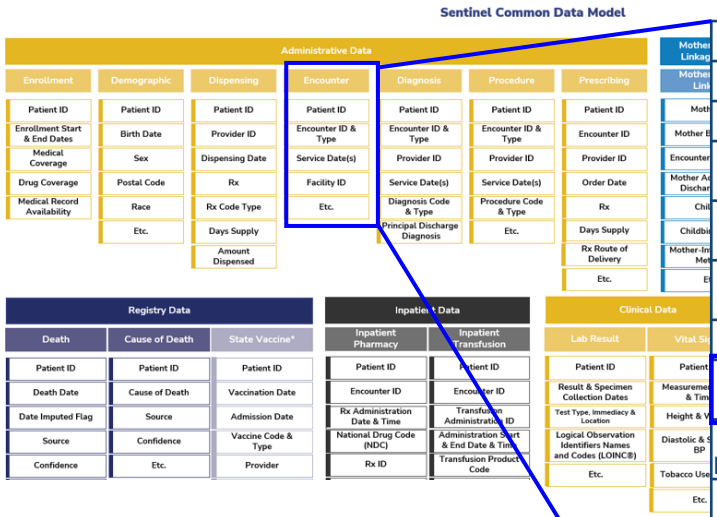
- **Facility and Provider tables,** each have unique identifiers
- **Facility ID** is a foreign key in the Encounter table, identifying treatment facility of the encounter
- **Provider ID** is a foreign key in **Diagnosis, Procedure, Prescribing tables have Encounter ID** allowing identification of the healthcare provider who made the diagnosis, performed the procedure, and/or prescribed the drug in the encounter
- Dispensing Table also has the Provider ID



Variable Name	Values	Status Core
FacilityID	Servicing facility identifier	Only SAS special missing .U allowed
Facility_Location	Geographic location	Not required

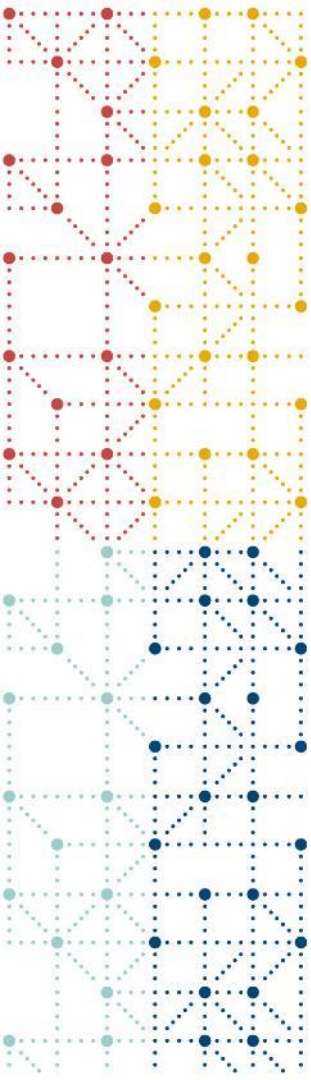
Variable Name	Values	Status Core
ProviderID	Unique provider identifier	Only SAS special missing .U allowed
Specialty	Provider specialty	Not required
Specialty_CodeType	CMS or NPI	Not required

Sentinel: Encounter



Encounter		
Variable Name	**Values**	**Status / Core**
PatID	Unique patient identifier	Required
EncounterID	Unique encounter identifier	Required
ADate	Encounter or admission date	Required
DDate	Discharge date	Conditional on `EncType` value
EncType	Encounter Type	Required
FacilityID	Servicing provider identifier	Required
Discharge_ Disposition	Discharge Disposition Code	Conditional on `EncType` value
Discharge_Status	Discharge Location or Type Information	Conditional on `EncType` value
DRG	Diagnosis Related Group	Conditional on `EncType` value
DRG_Type	DRG Version	Conditional on `EncType` value
Admitting_Source	Admitting Facility or Healthcare Professional Type	Conditional on `EncType` value

- Facility and provider IDs allows a patient to have encounters performed by multiple providers at a variety of sites
- Additional variables provide useful context for the encounter



Challenges & Recommendations

- Additional Variables
- Concepts to Address Gaps
- Recommendations for CDISC & FDA BIMO

Recommendations for Updates to CDISC

- The four RWD standards reviewed were assessed for both commonalities and areas of uniqueness in RWD representation
- Focus on the benefits seen in the RWD standards, primarily the ability to facilitate the analysis of potential bias
- Consider the models' commonalities and but are grounded in reviewer needs documented in FDA guidance
- Recommendations: Add variables and/or domains to standardize
  - Identifying the Provider(s) for the Encounter/Subject Visit
  - Identify the Facility where the Encounter/Subject Visit took place
  - A patient encounter with more than one provider and/or at more than one site
  - The encounter disposition (or discharge reason/status for the visit)

Concepts to Address Gaps in CDISC SDTM for RWD

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Encounter ID	Source encounter identifier to identify unique interactions between an individual patient and the healthcare system	●	●	●	●	●
Provider ID	Unique identifier for provider		●	●	●	●
Facility ID	Unique identifier for facility (care site)		●	●	●	●
Appointment	Link to appointment that scheduled this encounter		●			
Part of care plan	Link to another care plan encounter this encounter is part of		●			
Urgency	Indicates the urgency of the encounter		●			●
Part of	Link to another Encounter this encounter is part of		●			●
Based on	Request that initiated this encounter		●			●
Status	Current state of the encounter (e.g., completed, in-progress)		●			●
Service	Broad categorization of the service that is to be provided (e.g. cardiology)		●			●
Reason for visit	List of medical reasons that are expected to be addressed during the episode of care		●			
Reason for missed visit	Reason for missed encounter	●	●			
Class	Classification of patient encounter (e.g., ambulatory (outpatient), inpatient, emergency, home health)		●			●
Discharge status	Category or location after discharge (e.g., home, long-term care)		●	●	●	●

Concepts to Model Provider & Healthcare Facility Information

Provider Information

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Provider ID	Unique Provider Identifier for the practitioner responsible for a given encounter, could be NPI	●	●	●	●	●
Specialty	The specific type of healthcare provider or field of expertise		●	●	●	●

Healthcare Facility Information

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Facility ID	Identifier for the care site	●	●	●	●	●
Facility Name	Name of the facility responsible for the encounter		●	●		●
Facility Type	The type of facility, e.g. hospital, ER, Urgent Care, ambulatory visit		●		●	●
Location	Geographic location or address of site where healthcare received		●	●	●	●

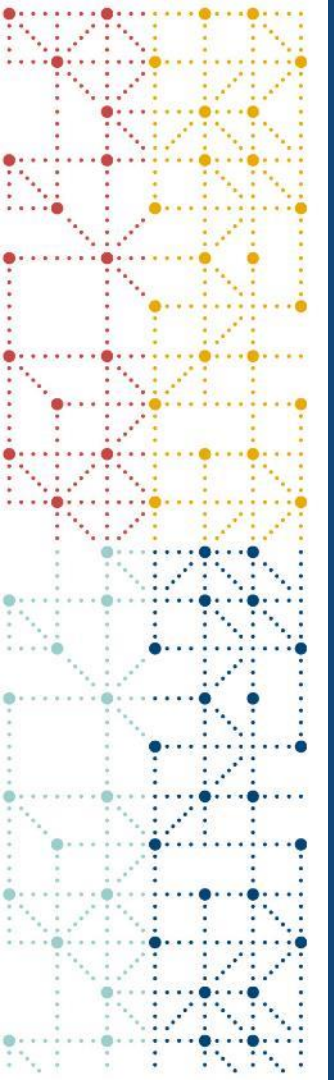
Summary of Concepts to Address Gaps in CDISC SDTM to Handle RWD

Concept	BIMO	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Unique Provider Identification	Y*	Y*	Y	Y	Y	Y
Provider Specialty	N	N	Y	Y	Y	Y
Unique Facility ID	Y*	Y*	Y	Y	Y	
Facility Location	Y	N	Y	Y	Y	Y
Facility Type	Y	N	Y	N	Y	Y**
Unique Encounter/Subject Visit ID	N/A	Y	Y	Y	Y	Y
Provider of the Encounter/Subject Visit	N/A	Assumed	Y	Y	Y	Y
Facility of the Encounter/Subject Visit	N/A	Assumed	Y	Y	Y	Y
Encounter Discharge Status	N/A	If AE, yes DS Domain not linked to SV directly	Y	Y	Y	Y

* Currently only one per patient
** Derivable from Encounter Type

Recommendations for CDISC & FDA BIMO for Use with RWD

- Add domains to represent providers and facilities which link to Subject Visits (SV)
  - Implemented solution should support multiple providers and sites for a patient's care
- SV should include the identifiers for facility and provider where visit occurred, diagnosis made, drug prescribed, etc.
  - This satisfies the need for identifying potential bias in a RWD study
  - Care needs to be traced to the facility location and physician specialty at a minimum
- Evaluate SITEID, INVAM and INVID variables used in BIMO, DM for RWD to determine if optimally placed
  - Updates may include identifying which SITE and INVID to represent in DM (e.g., Primary Care Physician or first visit or the group that is reusing the data)
  - Clarify use of BIMO file and DM domain for RWD submissions vs an RCT
- Expand SV to include additional qualifying information for the encounter
- Recommended variables to add (minimum)
  - Unique Provider Identifier
  - Provider Specialty
  - Visit Discharge status
  - Unique Facility Identifier
  - Facility Location
  - Facility Type



Summary and Conclusion

Summary

- Gaps for representing RWD exist in current CDISC SDTM
  - Only 1 provider and care site can be represented
  - No standard way to represent healthcare provider or facility information for a specific visit
  - No standard way to provide more contextual information in Subject Visits (SV)
  - Adequate for RCTs where captured data is planned and known- study protocol provides contextual information
- RWD has unique requirements for representation in submitted data
  - More robust capture of provider and care facility needed for real-world encounters/subject visits
  - Need ability to identify any bias present in a non-randomized RWD study where care is not protocol driven
  - Need context which can help the evaluator understand the level of data accuracy and quality in RWD
- Addressing gaps
  - Enhancements to CDISC to represent providers and facilities, link this information to SV domain
  - FDA's BIMO standards may provide a way to capture site and provider information
    - Ensure that this will not obscure information needed to facilitate BIMO investigations
  - CDISC may consider expanding relevant domain specifications to incorporate use of RWD for regulatory review
  - CDISC is designed for RCTs, using an existing RWD standard may be more straightforward than updating

Conclusion

- Guidance for submitting RWD is evolving
- Standards for representing RWD is also evolving
- Current submission standards have gaps for representing RWD and require supplemental domains and variables to represent RWD for submission
- Much can be learned and incorporated from existing CDMs designed for RWD, including HL7 FHIR, OMOP, PCORnet, and Sentinel
  - Purpose of these models needs to be understood
- In the interim, early communication with regulatory authorities is key to meet review needs and should be done before you begin formatting data

Thank You!

Questions?

References

Concepts to address gaps in CDISC SDTM to handle RWD

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Encounter ID	Source Encounter ID. Identifies unique interactions between an individual and the health care system	N/A (uses VISITNUM)	Encounter. Identifier	Visit_occurence.visit_ occurrence_id	Encounter. encounterid	EncounterID
Provider ID	Unique identifier for provider	N/A	Encounter. Service Provider	Visit_occurence. provider_id	Encounter .providerid	ProviderID
Care Site ID	Unique identifier for care site	N/A	Organization. Identifier	Visit_occurence. care_site_id	Encounter. Facilityid	FacilityID
Appointment	Link to appointment that scheduled this encounter	N/A	Encounter. appointment	N/A	N/A	N/A
Part of larger care plan	Link to another encounter this encounter is part of	N/A	Encounter. partOf	N/A	N/A	N/A
Urgency	Indicates the urgency of the encounter	N/A	Encounter .priority	N/A	N/A	Derivable from Admitting_Source
Part of	Another Encounter this encounter is part of	N/A	Encounter. partOf	N/A	N/A	Derivable from Admitting_Source

Concepts to address gaps in CDISC SDTM to handle RWD, cont'd.

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Based on	The request that initiated this encounter	N/A	Encounter. basedOn	N/A	N/A	Admitting_ Source
Status	The current state of the encounter (i.e., completed, in-progress)	N/A	Encounter. status	N/A	N/A	Discharge_ Status
Service	Broad categorization of the service that is to be provided (e.g. cardiology)	N/A	Encounter. serviceType	N/A	N/A	DRG (Diagnosis Related Group)
Reason for visit	List of medical reasons that are expected to be addressed during the episode of care	N/A	Encounter. Reason	N/A	N/A	No
Reason for missed visit	Reason for missed encounter	SVREASOC	Appointment. cancellation Reason	N/A	N/A	No
Class	Classification of patient encounter such as ambulatory (outpatient), inpatient, emergency, home health	N/A	Encounter. Class	N/A	N/A	EncType
Discharge status	Category or kind of location after discharge (i.e., Home, Long-term care)	N/A	Encounter. admission. Discharge Disposition	Visit_ Occurence. discharged_to_ source_value	Encounter. discharge_ status	Discharge_ Status

Concepts to Model Provider & Healthcare Facility Information

Provider Information

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Provider ID	Unique Provider Identifier for the practitioner responsible for a given encounter, could be NPI	DM.INVID (Limited to one provider per subject)	Practitioner. identifier	Visit_occurrence. provider_id; Provider.NPI	Encounter. providerid, Provider.NPI	Unique provider identifier (UPI)
Specialty	The specific type of healthcare provider or field of expertise	N/A	PractitionerRole. specialty	Provider. specialy_source_ vaue	Provider. provider_ specialty_primary	Provider.specialty

Healthcare Facility Information

Concept	Definition	CDISC SDTMIG v3.4	HL7 FHIR R4	OMOP v5.4	PCORnet v7.0	Sentinel v8.2.1
Facility ID	Identifier for the care site	DM.SITEID (Limited to one site per subject)	Organization. identifier	Visit_occurence. care_site_id	Encounter. facilityid	FacilityID
Facility Name	Name of the facility responsible for the encounter	N/A	Encounter. serviceProvider	Care_site.care_ site_name	N/A	Linkable from FacilityID
Facility Type	The type of facility, e.g. hospital, ER, Urgent Care, ambulatory visit	N/A	Organization. Type	N/A	Encounter. facility_type	Can be derived from Encounter Type
Location	Geographic location or address of site where healthcare received	N/A	Location. address	Location. Address_1	Encounter. facility_ location	Facility_ Location