# 2026 Europe Interchange

THE FUTURE IS CONNECTED: STANDARDS AND AI POWERING DIGITAL TRANSFORMATION

MILAN, ITALY | MAIN CONFERENCE: 20-21 MAY | TRAININGS & WORKSHOPS: 18, 19, & 22 MAY

# Harmonizing Global Standards in the Pediatric Transplantation Domain – Protect-Child

Rhonda Facile, Consultant, HL7 Europe

# Agenda

1. CDISC and RWD
2. Mapping and xShare
3. The Protect-Child Consortium
4. HL7 FHIR IG
5. Protect-Child Mapping
6. Conclusion

# Speaker

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Consultant
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Rhonda is a clinical research and data standards expert with over 30 years of global experience across CROs, SDOs, and the pharmaceutical and biotechnology sectors. She previously held a VP-role at CDISC and is widely recognized for her contributions, including CDASH, Therapeutic Area standards development and strategic partnerships. She has authored or co-authored numerous publications. Based in Stockholm, Sweden, Rhonda is a consultant with HL7 Europe, supporting operations, project management, and communications.

# CDISC and Real-World Data HX

- Active in HL7 BR&R Committee
  - connecting HL7 FHIR exchange standards to CDISC submission standards
- Delphi survey peer-reviewed paper:
  - There are many standardization efforts around Health data standards, each vary widely in definitions, levels of granularity, and purpose
  - CDISC works well for clinical trials but is hard to apply to real-world data due to complexity and limited support.
  - Recommendation - Better tools, training, and collaboration are needed.
  - Using CDISC more broadly could link trial data with real-world data and drive innovation

*Paper*
*Delphi Survey*
*(2022)*

Published on 27.Jan.2022 in Vol 10, No 1 (2022): January

Preprints (earlier versions) of this paper are available at https://preprints.jmir.org/preprint/30363, first published 01.Jun.2021.

**Use of Clinical Data Interchange Standards Consortium (CDISC) Standards for Real-world Data: Expert Perspectives From a Qualitative Delphi Survey**

Rhonda Facile[1]; Erin Elizabeth Muhlbradt[2]; Mengchun Gong[3,4]; Qingna Li[5,6,7]; Vaishali Popat[8]; Frank Pétavy[9]; Ronald Cornet[10]; Yaoping Ruan[11]; Daisuke Koide[12]; Toshiki I Saito[13]; Sam Hume[1]; Frank Rockhold[14]; Wenjun Bao[15]; Sue Dubman[1]; Barbara Jauregui Wurst[1]

Article | Authors | Cited by (52) | Tweetations (3) | Metrics

- Abstract
- Introduction
- Methods
- Results
- Discussion
- References
- Abbreviations
- Copyright

**Abstract**

**Background:**
Real-world data (RWD) and real-world evidence (RWE) are playing increasingly important roles in clinical research and health care decision-making. To leverage RWD and generate reliable RWE, data should be well defined and structured in a way that is semantically interoperable and consistent across stakeholders. The adoption of data standards is one of the cornerstones supporting high-quality evidence for the development of clinical medicine and therapeutics. Clinical Data Interchange Standards Consortium (CDISC) data standards are mature, globally recognized, and heavily used by the pharmaceutical industry for regulatory submissions. The CDISC RWD Connect Initiative aims to better understand the barriers to implementing CDISC standards for RWD and to identify the tools and guidance needed to more easily implement them.

**Objective:**

Facile R, et. al. URL: https:/
/medinform.jmir.org/2022/1/e30363
DOI: 10.2196/30363

*Opinion Paper (2025)*

# Standards in Sync: 5 principles

1. reuse existing standards where possible
2. avoid mapping
3. implement standards at the start of a project
4. participate in standards development activities with standards development organizations (SDOs)
5. work toward harmonization of standards across SDOs to achieve semantic meaning in support of Trustworthy, Reusable, Understandable data Elements (TRUE) research data for healthcare.

## Standards in sync: five principles to achieve semantic interoperability for TRUE research for healthcare

Rhonda Facile [1], Catherine Chronaki [2], Peter van Reusel [1], Rebecca Kush [3]

Affiliations + expand

PMID: 40538570 PMCID: PMC12176726 DOI: 10.3389/fdgth.2025.1567624

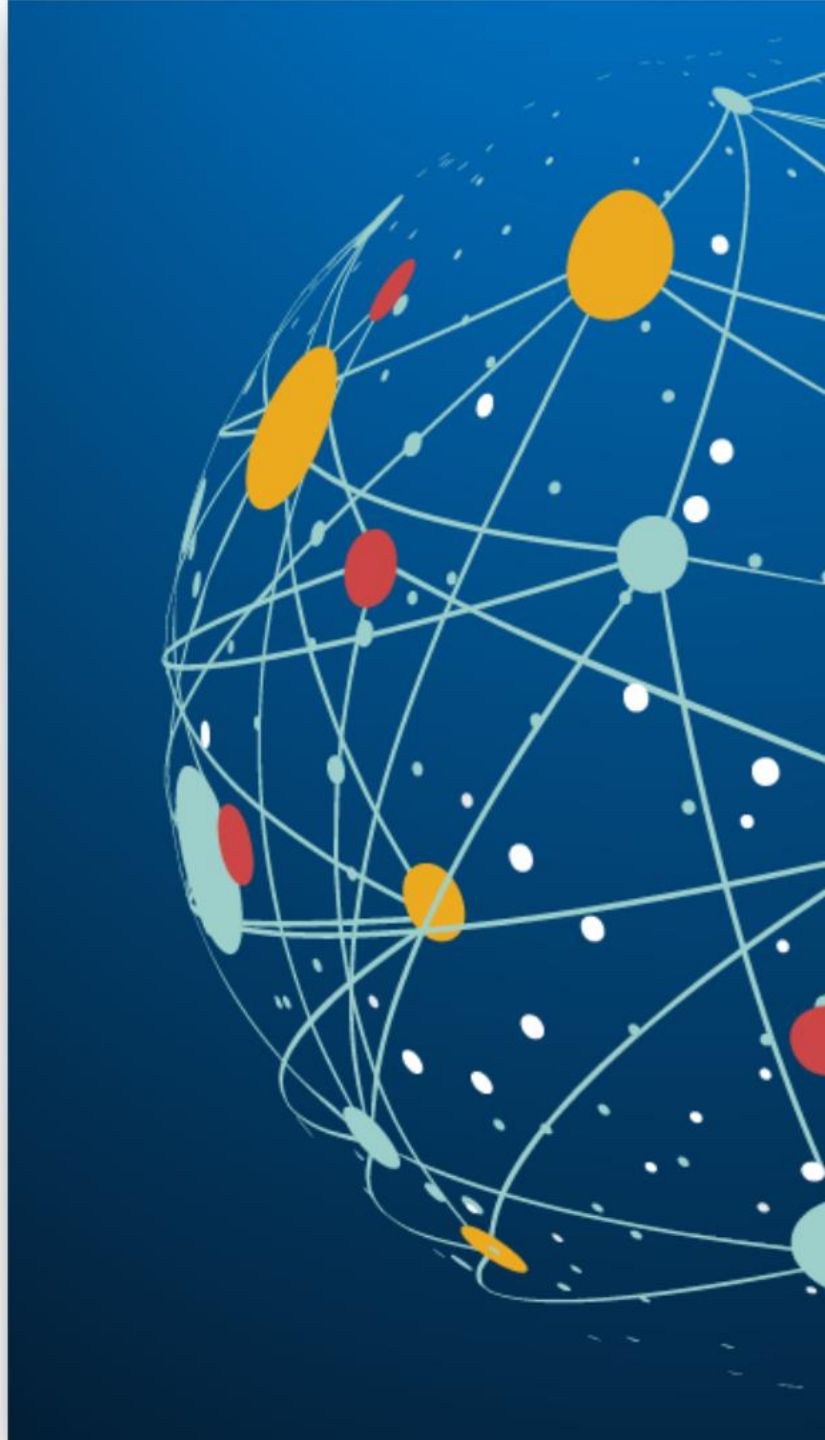
**Abstract**

The effective and meaningful exchange of data is pivotal for patient care, informed decision-making, and advancements in research and technology. This opinion piece explores the critical role of semantic interoperability (SI) in ensuring meaningful health data sharing across diverse systems. Emphasizing the imperative of synchronizing the use of data standards, we address the challenges posed by disparate data formats and underscore the impact on patient outcomes. International, harmonized standards are presented as a cornerstone for achieving SI, while the drawbacks of proprietary standards are examined. Case studies, including the complementary use of International Organization for Standardization (ISO), Health Level Seven Fast Healthcare Interoperability Resources (HL7 FHIR), and Clinical Data Interchange Standards Consortium (CDISC) standards, offer practical insights. We offer here five simple principles [reuse existing standards where possible, avoid mapping, implement standards at the start of a project, participate in standards development activities with standards development organizations (SDOs), and work toward harmonization of standards across SDOs] for achieving semantic meaning in support of Trustworthy, Reusable, Understandable data Elements (TRUE) research data for healthcare. We hope to provide a view to a future where standards are in sync and the proposed five principles are deployed globally to ensure the conduct of trustworthy research for the sake of improving health outcomes for all.

Facile R, Chronaki C, van Reusel P, Kush R. Standards in sync: five principles to achieve semantic interoperability for TRUE research for healthcare. Front Digit Health. 2025 Jun 5;7:1567624. doi: 10.3389/fdgth.2025.1567624. PMID: 40538570; PMCID: PMC12176726.

# The Idea

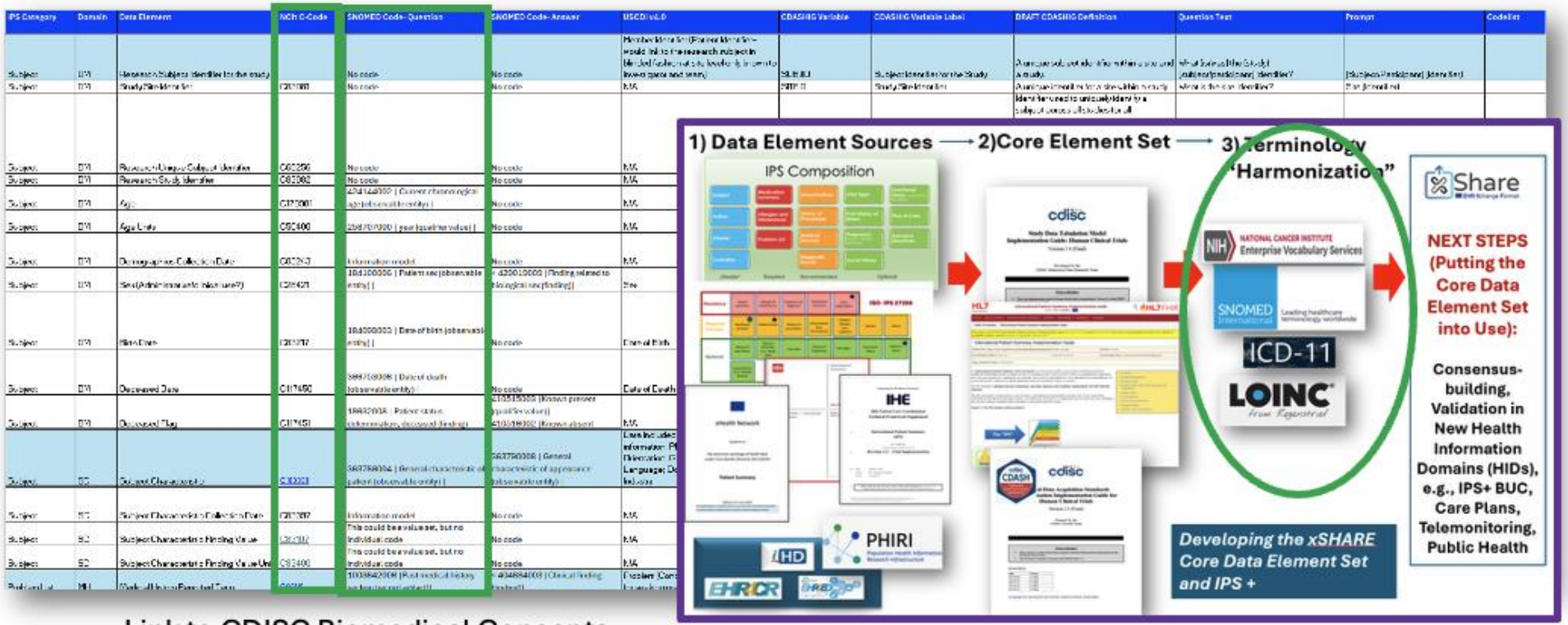
Harmonizing standards across healthcare, research, and regulatory systems,
to transform data from diverse sources into trusted, submission-ready evidence,
shortening the path from discovery to delivery and getting treatments and therapies to patients faster.



# xShare example-mapping across standards IPS+ R

| IPS Category | CDISC Domain | Data Element | NCIt C-Code | SNOMED Code - Question | SNOMED Code - Answer | USCDI v4.0 Data Element | CDASHIG Variable Label | CDASHIG Definition |
|---|---|---|---|---|---|---|---|---|
| xShare Core Harmonized Data Elements | | | | | | | | |

| CDASH Question Text | CDASH Prompt | CDISC Codelist |
|---|---|---|
| | | |




Link to CDISC Biomedical Concepts

# The Protect-Child Project

https://protect-child.eu
https://cordis.europa.eu/project/id/101137423

protect child

## Improving Pediatric Transplant Outcomes with Genomic Data Integration

**PROTECT-CHILD** brings together European efforts to reduce complications in pediatric transplants through advanced research and data technologies, improving outcomes for children needing life-saving transplants.

- ***Enhance pediatric transplant outcomes.*** *Improve treatment and follow-up care through advanced data integration.*
- ***Ensure secure & ethical data use.*** *Develop privacy-preserving solutions for responsible health data sharing.*
- ***Leverage cutting-edge technology.*** *Support clinical decision-making with advanced technology, like AI, federated learning, and quantum computing.*


This project has received funding from the European Union's Horizon Europe research and innovatio programme under grant agreement N° 101137423, as well as the Swiss State Secretariat for Educatior Research and Innovation (SERI).

Project Information

**PROTECT-CHILD**
Grant agreement ID: 101137423

**DOI**
10.3030/101137423

**EC signature date**
30 June 2024

**Start date**
1 June 2024

**End date**
30 November 2028

**Funded under**
Health

**Total cost**
€ 8 091 327,50

**EU contribution**
€ 8 091 327,50

**Investment in EU policy priorities**

| | | | |
|---|---|---|---|
| Digital agenda | ◐ | Clean air | ○ |
| Artificial Intelligence | ◐ | Climate action | ○ |
| Biodiversity | ○ | | |

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Spain

# Protect-Child Project Context

## Motivation in Numbers

The context of the project:

**+ 5k**

Pediatric transplants occur annually in Europe, but unmet needs persist

**20**

Patients per day die while waiting for a transplant due to organ shortages

**22**

Countries collaborate within the TransplantChild ERN

**34**

Hospitals and institutions participate, ensuring broad clinical and research integration

**+ 10%**

Improving transplant outcomes through genomic data and personalized treatments

## Technological and Research Infrastructure

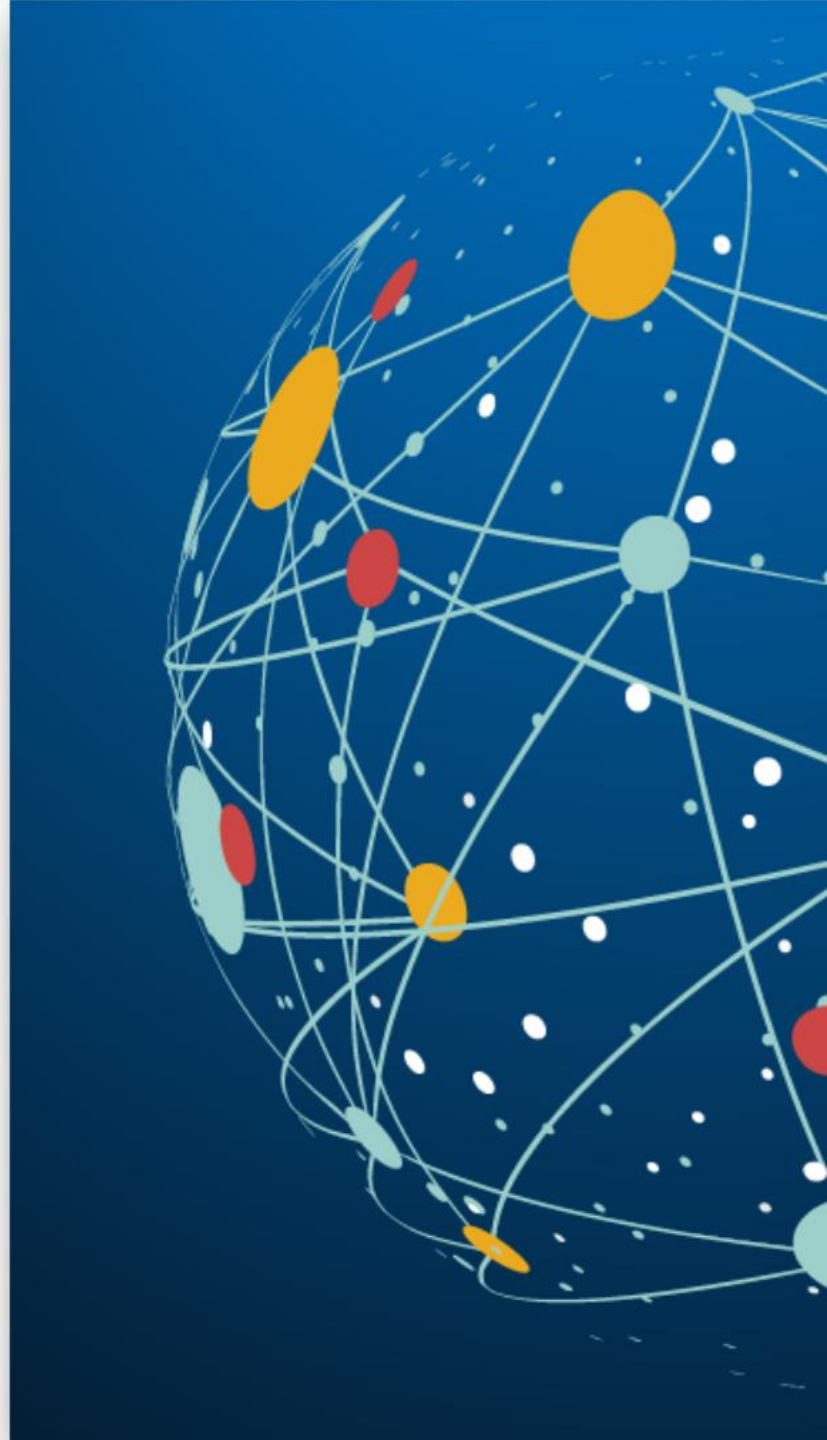
PROTECT-CHILD leverages cutting-edge technology and a robust research infrastructure to securely integrate clinical and genomic data for pediatric transplants. Its architecture aligns with the European Health Data Space (EHDS), using interoperable standards like OMOP and FHIR. The project builds on the Genomic Data Infrastructure (GDI) and ELIXIR for large-scale data sharing and advanced analytics.

A federated learning framework ensures secure multi-party data processing, while AI-driven models support personalized medicine. PROTECT-CHILD employs EHDS Capsules for privacy-preserving data management, enabling seamless collaboration across EU hospitals. This integration fosters innovation, accelerates research, and advances data-driven healthcare while maintaining strict compliance with European data regulations.

PROTECT-CHILD results

PROTECT-CHILD resources

**From an interoperability perspective, the project is focused on alignment with the EHDS and harmonizing heterogeneous data across sources using: HL7 FHIR, OHDSI OMOP and the Protect-Child data model while exploring the connection to CDISC KT TAUG v1.**



# Protect-Child Data Sources

- Electronic Health Records (EHRs)
- Transplant registries
- Laboratory and immunology systems
- Pathology and biopsy data
- Donor information systems
- Imaging systems
- Clinical outcomes & longitudinal follow-up data
- Genomic and molecular assay platforms
- Clinical research and trial datasets

This diversity is exactly why interoperability standards are essential. Without harmonization, combining these data sources consistently would be extremely difficult.

# Protect-Child Implementation Guide

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## PROTECT-CHILD Pediatric Transplant Data Implementation Guide

0.1.0-ci-build -



PROTECT-CHILD Pediatric Transplant Data Implementation Guide - Local Development build (v0.1.0-ci-build) built by the FHIR (HL7® FHIR® Standard) Build Tools. See the Directory of published versions

## 1 Home

| | |
|---|---|
| *Official URL*: **https://hl7.eu/fhir/ig/hl7.eu.fhir.protect-child/ImplementationGuide/hl7.eu.fhir.protect-child** | *Version*: **0.1.0-ci-build** |
| Draft as of 2026-05-15 | *Computable Name*: ProtectChildIG |

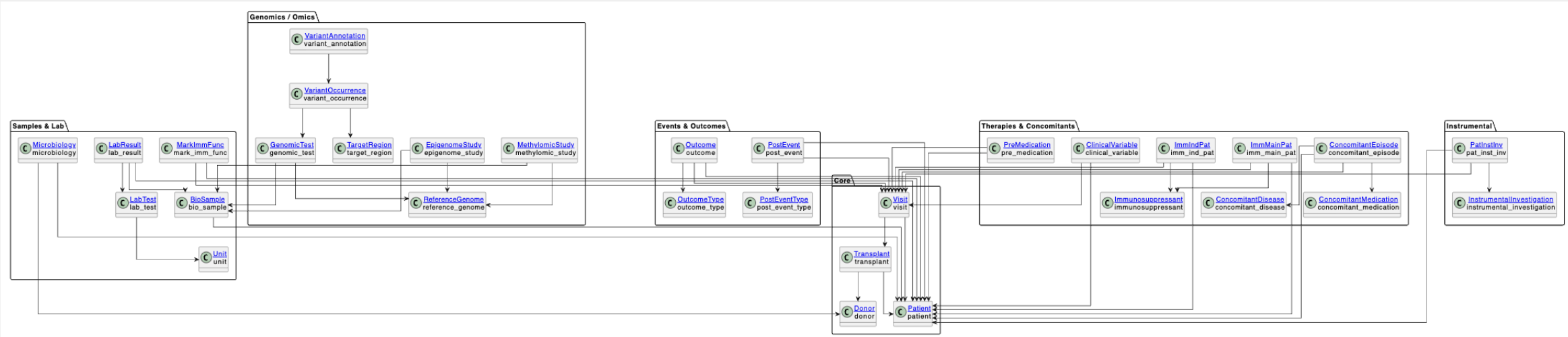
## PROTECT-CHILD Transplant Data Implementation Guide (DRAFT)

**Status:** This Implementation Guide is a **draft** and may change based on ongoing work in PROTECT-CHILD.

# 4 Logical Models

## 4 Example use-case: paediatric liver transplant journey (PROTECT-CHILD)

Mila (7) is registered as a transplant candidate (Patient). During evaluation and waiting-list follow-up visits (Visit), clinicians capture vitals and growth (PcClinicalVariable), order and record lab tests/results (LabTest, LabResult), document imaging and other investigations (PatInstInv), and record infection screening/monitoring relevant to transplant (Microbiology). Any intercurrent episodes (e.g., cholangitis) and their treatments are logged (ConcomitantEpisode, ConcomitantMedication), alongside her regular pre-transplant medications (PreMedication). When a suitable donor organ becomes available (Donor), the transplant procedure and key graft/operative details are recorded (Transplant). Post-operatively, induction and maintenance immunosuppression (and drug monitoring) are captured (ImmIndPat, ImmMainPat), and complications (e.g., Delayed Graft Function) are recorded as typed post-transplant events (PostEventType, PostEvent). At longer-term follow-up (e.g., 1 year), Mila's status is summarised as outcomes (OutcomeType, Outcome).



# Protect-Child IG: Logical Model Example

## 2 Patient logical model

Logical model: patient-lm Primary FHIR profile: patient-transplant (Patient)

Logical model representing the PROTECT-CHILD data model entity `patient`, aligned with DMv1.0. DMv1.0 removed `birthdate` / `current_age` and added `age`.

| Logical element | Card. | Logical type | FHIR profile | FHIR element path | Notes |
|---|---|---|---|---|---|
| `patientId` | `1..1` | `string` | patient-transplant | `Patient.identifier.value` | Maps PROTECT-CHILD patient_id. |
| `gender` | `1..1` | `code` | patient-transplant | `Patient.gender` | Mandatory in DMv1.0. |
| `age` | `0..1 MS` | `integer` | patient-age-observation | `Observation.valueInteger` | DMv1.0 removed birthdate/current_age and added patient.age. Unit/anchor date needs data-model clarification. |
| `bloodGroup` | `0..1 MS` | `code` | patient-abo-group-observation | `Observation.valueCodeableConcept` | Recommended in DMv1.0. |
| `rhFactor` | `0..1 MS` | `code` | patient-rh-factor-observation | `Observation.valueCodeableConcept` | Recommended in DMv1.0. |

# Protect-Child FHIR IG – Takeaways

The Protect-Child FHIR IG is a semantic interoperability framework for pediatric transplantation. It provides:

- structured FHIR representations
- terminology harmonization
- logical models
- mappings to relevant standards – OMOP, CDISC
- **Enables – the exchange of kidney transplant data consistently between hospitals, registries, laboratories, research platforms, and regulatory environments**

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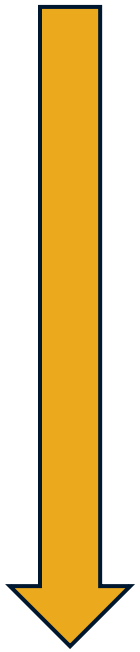
# Protect-Child – Standards Mapping

HL7 FHIR / OMOP (logic-driven) → P-C DM (harmonized layer) → CDISC (regulatory driven)

RWD



Submission

- **HL7 FHIR**
  - Purpose: Enable real-time data exchange across healthcare systems
  - Perspective: Clinical / operational (patient care, workflows, interoperability)
- **OMOP**
  - Purpose: Standardize data for large-scale analytics and research
  - Perspective: Analytical / population-level (real-world evidence, studies)
- **Protect-Child DM**
  - Purpose: Harmonize pediatric transplant data across sources
  - Perspective: Project-specific / research integration (bridging clinical + research needs)
- **CDISC**
  - Purpose: Standardize clinical trial data for regulatory submission
  - Perspective: Regulatory / trial-focused (compliance, traceability, submission-ready)

# Mapping Medical History

| Concept | Hl7 FHIR | OMOP CDM | Protect-Child DM | CDISC SDTM |
|---|---|---|---|---|
| Medical history record | Condition | CONDITION_OCCURRENCE | medical_history / condition | Medical History |
| Prior kidney transplant | Procedure with status completed, code = kidney transplant | PROCEDURE_OCCURRENCE | procedure_history / transplant_history | PR, PRTRT = KIDNEY TRANSPLANT, PRCAT = PRIOR |
| Prior other organ transplant | Procedure.code = liver/pancreas/heart transplant | PROCEDURE_OCCURRENCE.procedure_concept_id | prior_transplant.organ_type | PRTRT = LIVER/PANCREAS/HEART TRANSPLANT, PRCAT = PRIOR |
| Occurrence yes/no | Procedure.status or Observation if collected as questionnaire item | Presence/absence of record; optionally OBSERVATION for "history of" question | occurrence_flag | PROCCUR; PRPRESP = Y when pre-specified |
| Start date | Procedure.performedDateTime/ performedPeriod.start | procedure_date / procedure_datetime | start_date | PRSTDTC |
| End date | Procedure.performedPeriod.end | procedure_end_date if available, or derived/custom extension | end_date | PRENDTC |
| ESRD history | Condition.code = End stage renal disease | CONDITION_OCCURRENCE | condition = ESRD | MH, MHTERM = END STAGE RENAL DISEASE |
| ESRD cause | Condition.evidence, Condition.extension, or linked Observation | condition_occurrence linked to cause condition, or OBSERVATION | cause | non-standard CAUSE |
| Diagnostic criterion met | Observation or Condition.evidence | OBSERVATION | diagnostic_criterion_met | non-standard DCRTMT, e.g. CHRONIC DIALYSISor KIDNEY TRANSPLANT (DCRTMT:Planned Arm Code - treatment the subject is planned to receive) |

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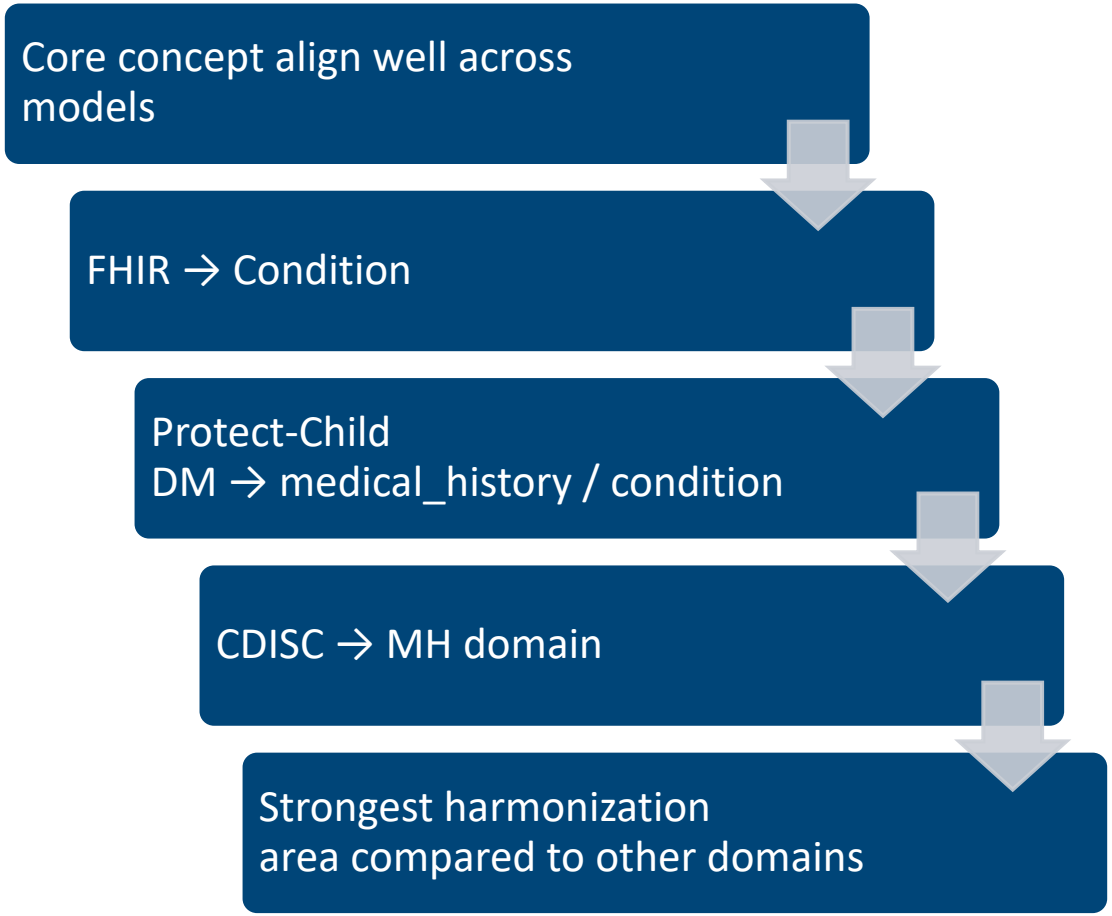
# Takeaways – Medical History Mapping




## Notes:

- Granularity and richness vary
- HL7 FHIR
  - Rich context: severity, body site, verification status
- OMOP DM
  - Standardized but has fewer hierarchical relationships and less nested structure.
- CDISC
  - Structured - specific to a prospective study
- Protect-Child DM
  - Captures additional clinical nuance
- But mapping can lead to loss of detail

# Mapping: Prior Transplantation

| Concept | HL7 FHIR | OMOP CDM | Protect-Child DM | CDISC SDTM |
|---|---|---|---|---|
| Prior Transplant (General) | Procedure (status = completed, category = surgical) | PROCEDURE_OCCURRENCE | procedure_history / transplant_history | PR (Procedures) with PRCAT = PRIOR |
| Transplant Type (Organ) | Procedure.code (e.g., kidney, liver transplant – SNOMED CT) | procedure_concept_id (standard concept, e.g., SNOMED) | organ_type(controlled terminology) | PRTRT (e.g., "KIDNEY TRANSPLANT") |
| Occurrence (Yes/No) | Presence of Procedure OR Procedure.status | Presence of record (or optional OBSERVATION for questionnaire-style data) | occurrence_flag | PROCCUR (Y/N) |
| Start Date (Transplant Date) | Procedure.performedDateTime or performedPeriod.start | procedure_date / procedure_datetime | start_date | PRSTDTC |
| End Date | Procedure.performedPeriod.end (if applicable) | procedure_end_date (if available) | end_date | PRENDTC |
| Ongoing Status | Procedure.status = in-progress OR no end date | Open-ended record (no end date) | ongoing_flag | PRENRTPT = ONGOING |
| Reason / Indication | Procedure.reasonCode or linked Condition | Link to CONDITION_OCCURRENCE | indication | Not standard (can be SUPPPR) |

# Takeaways - Prior Transplantation

Prior transplantation is one of the cleanest mappings structurally, but still requires care:

Easy to align as a procedure event

Harder to:

- preserve relationships (donor, outcomes)
- standardize organ terminology

Notes:

CDISC has:

- Clear labeling (PRCAT = PRIOR)
- Regulatory-ready

OMOP

- Useful for querying “prior” transplant populations (analysis)

FHIR

- Useful for detailed clinical representation and data exchange

# Example Mapping: HLA-A typing (Allele result)

| Concept | FHIR | OMOP CDM | Protect-Child DM | CDISC (GF Domain) |
|---|---|---|---|---|
| Allele Result (General) | Observation | MEASUREMENT | genetic_result / lab_result | GF (Genomics Findings) |
| Gene / Locus (e.g., HLA-A) | Observation.code or Observation.focus | measurement_concept_id | gene | GFTEST / GFGENE |
| Allele Value (e.g., HLA-A*02:01) | Observation.valueCodeableConceptor valueString | value_as_concept_id or value_as_string | allele | ALLELE or ORRES |
| Genotype (paired alleles) | Observation.component or grouped Observations | Multiple MEASUREMENTrows | genotype(explicit field) | GFGENOTYP |
| Zygosity | Observation.component | value_as_concept_id or OBSERVATION | zygosity | GFZYG |
| Phenotype (e.g., metabolizer status) | Observation.interpretation or separate Observation | OBSERVATION | phenotype | GFPHENO |
| Test Method | Observation.method | measurement_type_concept_id | method | GFMETHOD |
| Specimen | Specimen resource | SPECIMEN table | specimen | GFSPEC |
| Timing / Date | effectiveDateTime | measurement_date | result_date | GFDTC |

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# Takeaways – Allele Result Mapping

Significantly improves semantic alignment for allele data

Bridges the gap between:

- HL7 FHIR clinical models
- CDISC regulatory datasets

OMOP requires careful design decisions regarding genomics structure

Notes:

- Allele results are observations, but not simple ones.
- Challenges:
  - Terminology gaps and different modeling paradigms
  - Biological complexity
  - Derived vs observed data
  - differing levels of granularity

# Mapping: Inclusion/Exclusion Criteria

| Concept | HL7 FHIR | OMOP CDM | Protect-Child DM (P-C DM) | CDISC |
|---|---|---|---|---|
| Eligibility Definition | `EvidenceVariable` with characteristics: • Age ≥ 18 • `exclude = true` for prior transplant | `COHORT_DEFINITION` Logic: • age ≥ 18 • NOT condition = transplant | Study entity`eligibility_criteria_definition`Structured rules | IE domain Free text: "Subjects ≥18 years; no prior transplant" |
| Inclusion Criterion | `characteristic`: Age ≥ 18 | Concept: age derived from PERSON.year_of_birth | criteria_type = Inclusioncriterion = age ≥18 | IE - Text in TS - "Subjects ≥18 years; no prior transplant" |
| Exclusion Criterion | characteristic.exclude = trueCondition: transplant | Concept set: transplant procedures/conditions | criteria_type = Exclusioncriterion = prior transplant | IE - Text in TS - "Subjects ≥18 years; no prior transplant" |
| Patient-Level Evidence | • Age → derived from `Patient.birthDate` • Transplant → `Condition` / `Procedure` | • Age → derived • Transplant → `CONDITION_OCCURRENCE` / `PROCEDURE_OCCURRENCE` | Stored as patient attributes or linked clinical events | Stored indirectly in SDTM domains (DM, MH, PR) |
| Eligibility Evaluation | `ResearchSubject.status = eligible / ineligible` | `COHORT table (subject included/excluded)` | `eligible_flag or screening_outcome` | `DS domain: e.g. DSDECOD = SCREEN FAILURE` |

# Takeaways – Inclusion/Exclusion Criteria

Different structures:
HL7 FHIR is flexible, OMOP is indirect, and CDISC is highly structured.

Loss of detail
Complex logic and timing in FHIR often get simplified when mapped to CDISC.

OMOP limitation:
No native eligibility concept so criteria must be inferred from patient data.

Data vs decision gap:
FHIR/OMOP store clinical facts; CDISC requires yes/no eligibility outcomes.

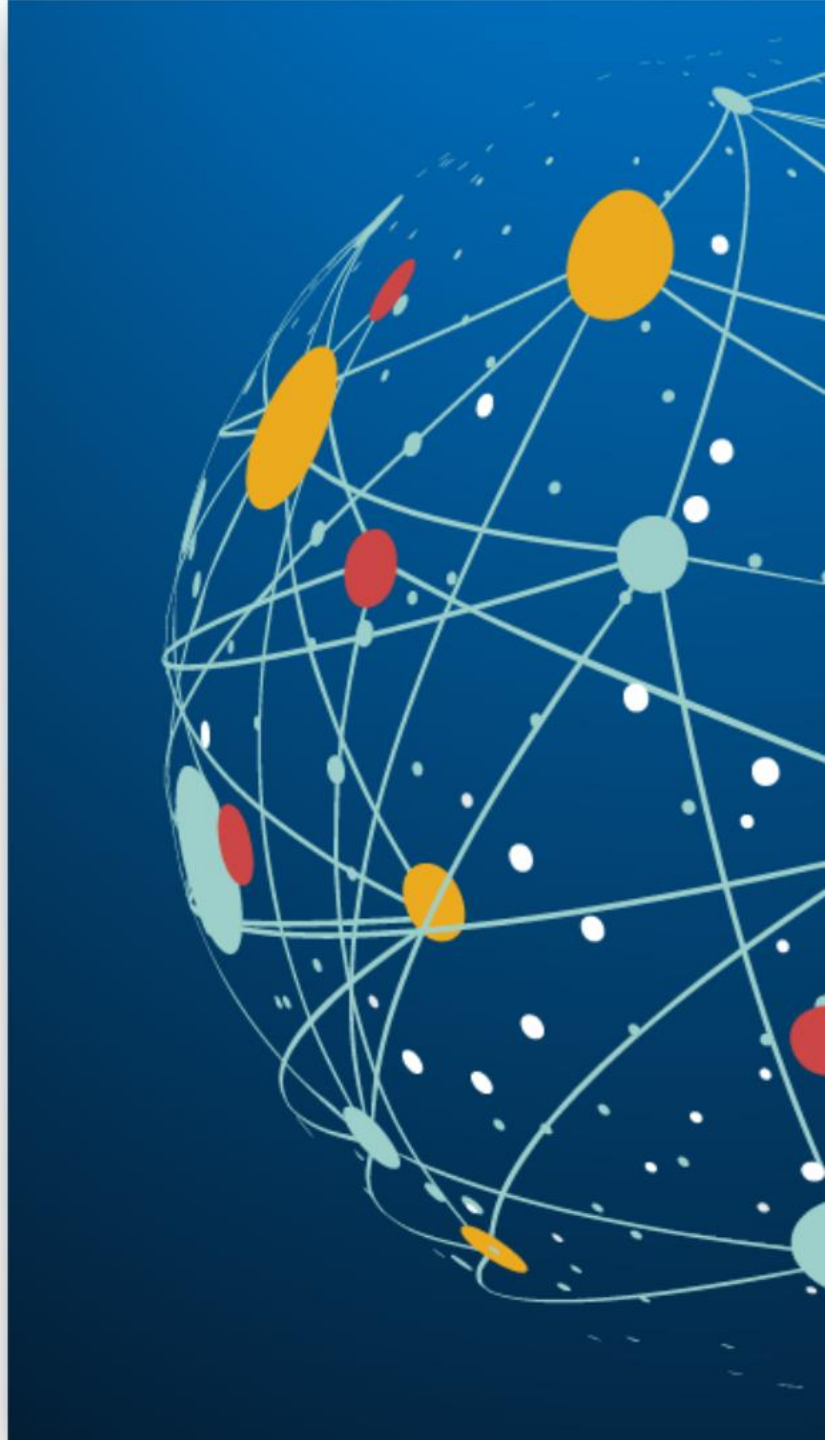
Notes:

- Mapping between vocabularies (e.g., SNOMED ↔ CDISC) is essential.
- Temporal logic is hard: Time-based rules (e.g., “within 12 months”) are difficult to standardize across models.
- **But work is ongoing!**
- EMA and ICH M11 initiative
- CDISC USDM - to support structured protocol information exchange
- TransCelerate’s Common Protocol Template (CPT)
- CDISC Digital Data Flow (DDF

# Terminology Notes

- CDISC: Fixed, curated controlled terminology (NCI-EVS) creates high consistency for clinical trials. SDTM can carry LOINC explicitly via dedicated variables, and UCUM via standardized unit fields.
- FHIR: Uses external vocabularies (SNOMED, LOINC, RxNorm) that are flexible and interoperable, but variable.
- OMOP Common Data Model: Maps multiple vocabularies to standard concepts, harmonized and analytics-ready, requires mapping effort.

*Standardization vs. flexibility vs. harmonization each solves a different need.*



# Conclusion 1

- Each standard is created for different purposes, use cases, local/national adaptations, etc.
- Mapping is not simple
  - challenging
  - but should be done to 1) promote understanding 2) reduce duplication 3) prevent the creation of new standards
- Follow the 5 principles
- CDISC has been a leader in connecting RWD to clinical trials for over a decade with its engagement with HL7, and other global SDOs.

# Conclusion 2

- Linking clinical trial data with real-world data unlocks powerful, end-to-end insights that can accelerate innovation.
  - This is not theoretical - it's already happening today and is increasingly part of European initiates like xShare, Protect-Child and READI.
- The impact is tangible: reduced duplication, faster evidence generation, and more efficient use of time and resources.

***Most importantly, it has the potential to shorten the path from discovery to delivery, getting the right treatments and therapies to patients sooner.***

# Thank You!

# Questions?