

Vaccine Certificates, Digital Documentation of COVID-19 Certificates and the International Patient Summary

Connectathon + Regional Meeting on Digital Transformation of the Health Sector, Santiago, Chile

Dr Carl Leitner, World Health Organization, Switzerland

Demonstration: International Patient Summary and Digital Covid Credentials

World Health Organization

Goals for today

- Brief introduction to SMART Guidelines
- Discuss the relationship between IPS and Digital Covid Credentials
- Review HL7 FHIR resources and their use for exchange and transformation of health data
- Describe how to submit data collected in a questionnaire to generate a covid credential
- Demonstrate creating covid credentials from IPS document

NOT FOR DISTRIBUTION

Today, WHO guidelines can take years to be fully adopted by member states,

and accuracy can be compromised during adaptation



World Health Organization (WHO)

Develops guidelines using global evidence base

Ministry of Health (MoH)

Adapts guidelines into national guidelines comprising procedures, protocols, datasets and indicators

Implementation & Technology Partners

Translate national guidelines into digital solutions

Health Workforce

Deliver and document health services in accordance with national guidelines

Health Service Users

Access quality person-centered care, delivered in accordance with national directives on guideline use

Evidence from countries inform

Today's guidelines are

- ✕ **Not integrated quickly or fully into practice**
- ✕ **Resource intensive to adapt and scale to broader use**
- ✕ **Difficult to update or digitize with fidelity**
- ✕ **Infrequently digitized with interoperability and indicator standards**

However, the potential benefits of guidelines are diluted and delayed…

Current State		Implications
 Time delays	→	Patients are denied access
 Diminished accuracy	→	Health services are compromised
 Limited ability to evaluate and adapt	→	Delayed improvements to health practices
 Passive dissemination mechanism	→	Lack of impact at scale

Strategic Pillars and Objectives

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Vision

The WHO envisions a future where everyone in the world benefits fully and immediately from clinical, public health, and data use guidelines.

Process

Foster a **new way of developing WHO guidelines** & engaging Ministries of Health and **their technology partner of choice**

Technology

Create an **ecosystem of tools** to develop SMART Guidelines and facilitate adoption at country level.

People

Strengthen **capacity building at all levels** within WHO, Ministries of Health, technology partners and implementers.

WHO SMART Guideline components

World Health Organization

EXISTING MODEL WITH ENHANCEMENTS

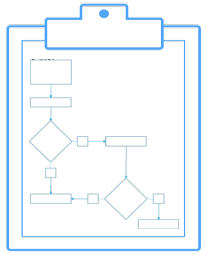
L1: Narrative



- Living guidelines approach
- Digital curation of recommendations
- Panels include medical informatics experts

PREPARING TO GO DIGITAL

L2: Operational



- Human-readable operational components
- Structured workflows
- Decision-support documentation
- Data dictionaries
- Specificity of user(s), beneficiaries

INTEROPERABLE DIGITAL COMPONENTS

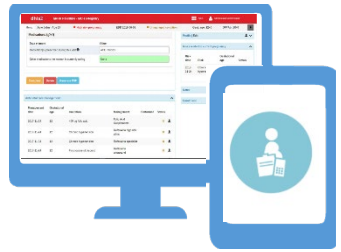
L3: Machine Readable



- FHIR IG based on Clinical Practice Guidelines IG
- Standard terminologies, value sets, calculations for decision-support and indicator population and data exchange

CUSTOMIZABLE SOFTWARE

L4: Executable



- Fully executable software tools
- Mechanism for real-time updates

ADVANCED ANALYTICS FOR PRECISION HEALTH

L5: Dynamic



- Advanced analytics for greater local relevance and precision
- AI-based decision support
- Continuous improvement of software code

Smart Guidelines - Busting the Myths

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Smart Guidelines are NOT	Smart Guidelines ARE
✗ A digital app version of the guidelines	✓ A pathway, or systematic approach, to digitizing guidelines (complementing *living guidelines*)
✗ Bound to a specific digital solution, product, or platform	✓ A set of generic components applicable to many digital systems
✗ Just a clinical solution, or data solution	✓ An operational hybrid of clinical and data recommendations intertwined
✗ A way to push ministries into specific software solutions	✓ A way to give ministries control over the digital products and services they implement
✗ A singular solution to system interoperability and health information exchange	✓ Data standards that enable health information exchange between numerous solutions, and enabling consistent calculation of metrics
✗ Only about digital	✓ An approach to improve guideline curation and use, even without digitization

Reference software and SMART Guidelines Pipeline

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Health Domain (L1)	Digital Adaptation Kits (L2)	Machine Readable (L3)	Executable Software (L4)
Antenatal Care (**ANC**)	Published	Published	Reference software exists
Family Planning (**FP**)	Published	Value sets only	MVP available
Sexually Transmitted Infections (**STI**)	Will be published soon	Value sets only	
Adolescent Sexual Reproductive Health (**ASRH**) *overlay integrated across the health domains*	Published		
HIV	Will be published soon	In progress	
Immunizations **(EIR)**	In progress	In progress	Being discussed
Child Health in Emergency Settings **(Em Care)**	In progress	In progress	In progress
Digital Documentation of COVID-19 Certificates: **Vaccination Status**	Published	Published	Reference software exists
Digital Documentation of COVID-19 Certificates: **Test Results**	In progress	In progress	In progress
Self Care – Sexual and Reproductive Health	In progress		
Nutrition	Being discussed		
Postnatal Care	Being discussed		

DDCC Guidance Documents

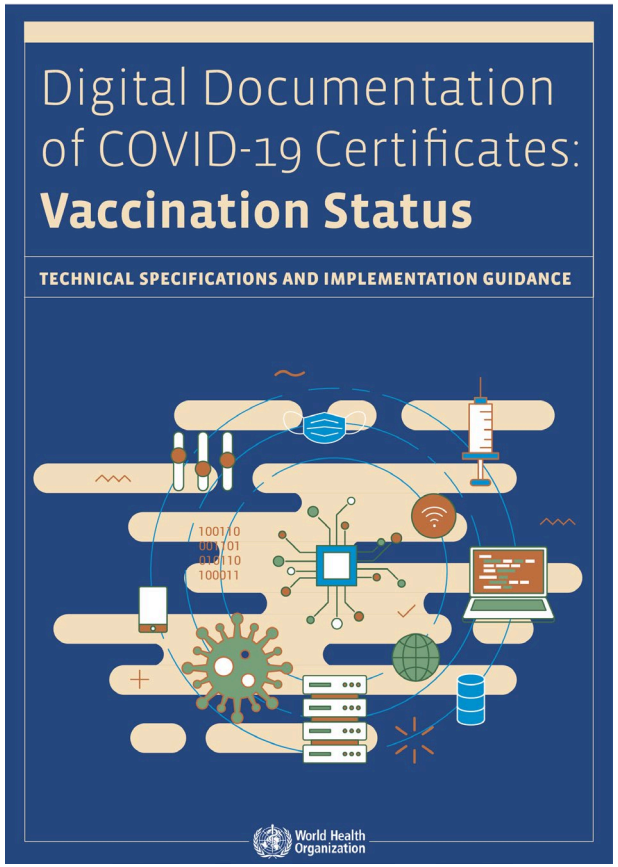
Requirements and specifications for technology implementers

- **Scenarios of use**
- Business processes, workflows & use cases
- Core data elements mapped to standard terminology code sets (including an annexed spreadsheet)
- Functional and non-functional requirements
- Overview of signing a digital certificate with PKI
- HL7 FHIR Implementation Guide (linked website) detailing relevant standards for consistent representation and interoperability

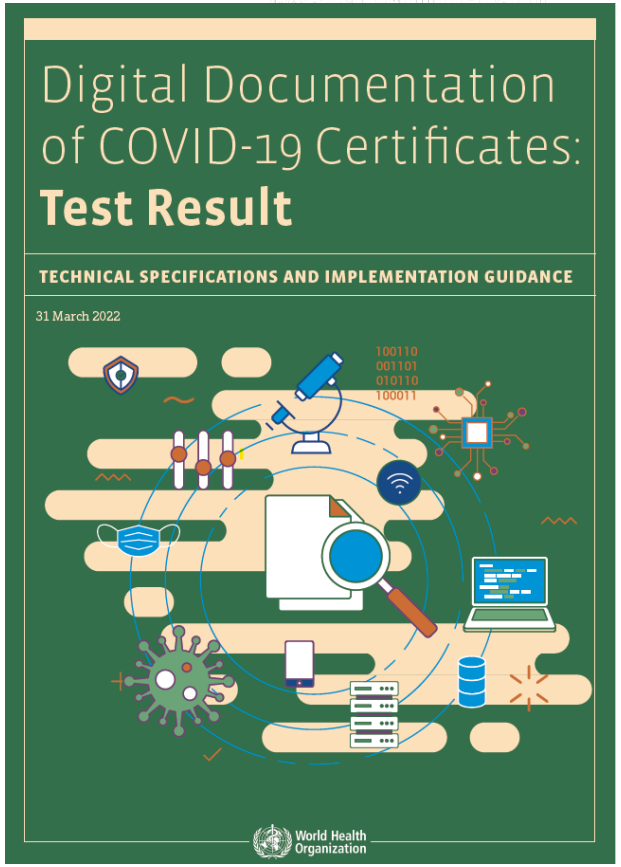
Implementation considerations

- Data protection principles
- Ethical considerations
- National governance considerations

✓ **Continuity of care**
✓ **Proof of vaccination**



✓ **Proof of negative test result**
✓ **Proof of previous SARS-CoV-2 infection**



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Exchanging Trusted Health Documents

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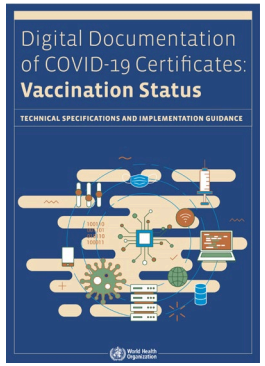
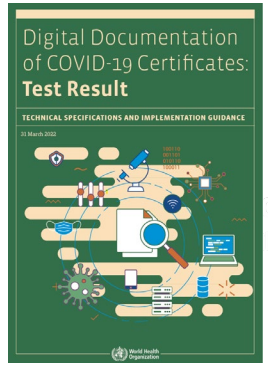
- **Health content**
  - Is the correct content included in the certificate/credential or health document?





- **Trust and trust networks**
  - Is the COVID certificate verifiably from the purported issuer?
  - Has the certificate remained unaltered since it was issued?
  - Is the certificate issuer trusted by the verifier?

→ *LAC Chain*
Public Key Infrastructure (PKI)
GCCN / Trust over IP
EU DCC Gateway
Vaccine Credential Initiatives (VCI)
etc.

- **Identity authentication and identity binding**
  - Is the individual person who they purport to be?
  - Is the COVID certificate about this person?

→ *out of scope*

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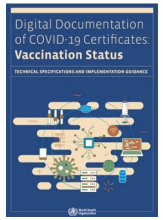
DDCC is “umbrella” specification – there is a need for directory to federate across trust networks

WHO DDCC Document
Signed HL7 FHIR document





can be used to generate multiple respresentations of a test result certificate

- EU Digital COVID Certificate (DCC)
- ICAO Visible Digital Seal for Non-Constrained Environments (VDS-NC)
- Digital Infrastructure for Vaccination Open Credentialing (DIVOC)
- SMART Health Cards (SHC)
- *another certificate standard(s) linked to other trust network(s)*

Need for a **trust network federator** that facilitates trust across multiple certificate types and implementations

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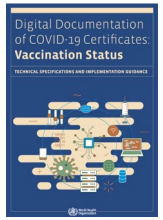
DDCC is “umbrella” specification – there is a need for directory to federate across trust networks

World Health Organization

WHO DDCC Document
Signed HL7 FHIR document





*



HL7 FHIR

can be used to generate multiple respresentations of a test result certificate

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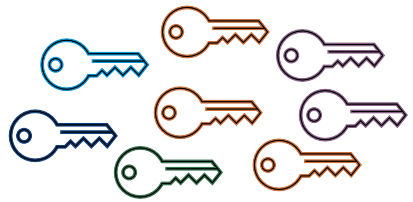

* Not all fields (market authorization) are in IPS

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SECTION

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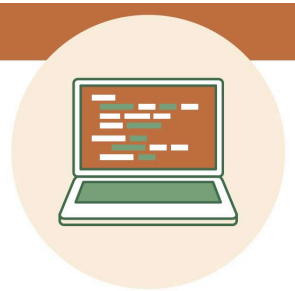
DDCC:VS core data set



L2: Data Dictionary

Table 11
Data for each vaccination event, with preferred code system

Data element label	Description	Data type	Preferred code system	Requirement status for Continuity of Care	Requirement status for Proof of Vaccination
Vaccine or prophylaxis	Generic description of the vaccine or vaccine sub-type (e.g. COVID-19 mRNA vaccine, HPV vaccine).	Coding	ICD-11	Required	Required
Vaccine brand	The brand or trade name used to refer to the vaccine received.	Coding	As defined by Member State	Required	Required
Vaccine manufacturer	Name of the manufacturer of the vaccine received (e.g. Serum Institute of India, AstraZeneca). **If vaccine manufacturer is unknown, market authorization holder is REQUIRED.**	Coding	As defined by Member State	Required – conditional	Required – conditional
Vaccine market authorization holder	Name of the market authorization holder of the vaccine received. **If market authorization holder is unknown, vaccine manufacturer is REQUIRED.**	Coding	As defined by Member State	Required – conditional	Required – conditional
Vaccine batch number	Batch number or lot number of the vaccine.	String	Not applicable	Required	Required
Date of vaccination	Date on which the vaccine was provided.	Date	Complete date, following ISO 8601	Required	Required
Dose number	Vaccine dose number.	Quantity	Not applicable	Required	Required
Total doses	Total expected doses as defined by Member State care plan and immunization programme policies.	Quantity	Not applicable	Optional – recommended	Optional – recommended
Country of vaccination	The country in which the individual has been vaccinated.	Coding	ISO 3166-1 alpha-3 (or numeric)	Required	Required
Administering centre	The name or ID of the vaccination facility responsible for providing the vaccination.	String	As defined by Member State	Required	Optional – recommended
Signature of health worker	The health worker who provided the vaccination or the supervising clinician's handwritten signature. **REQUIRED for PAPER vaccination certificates that have been filled out with handwriting ONLY.** A printed paper vaccination certificate does not require the handwritten signature of a health worker.	Signature	Not applicable	Optional – recommended	Required – conditional
Health worker identifier	**OPTIONAL for DIGITAL and PAPER vaccination certificates.** The unique ID for the health worker as determined by the Member State. There can be more than one unique ID used (e.g. system-generated ID, health profession number, cryptographic signature, or any other form of unique ID for a health worker). This can be used in lieu of a paper-based signature.	ID	Not applicable	Optional – recommended	Optional – recommended
Disease or agent targeted	Name of disease that vaccine given to protect against (such as COVID-19).	Coding	ICD-11	Optional – recommended	Optional – recommended
Due date of next dose	Date on which the next vaccination should be administered, if a second dose is required.	Date	Complete date, following ISO 8601	Optional – recommended	Not needed

HPV: human papilloma virus; ICD-11: International Classification of Diseases 11th Revision; ID: identifier; ISO: International Organization for Standardization; mRNA: messenger ribonucleic acid.

Table 12
Vaccination certificate metadata

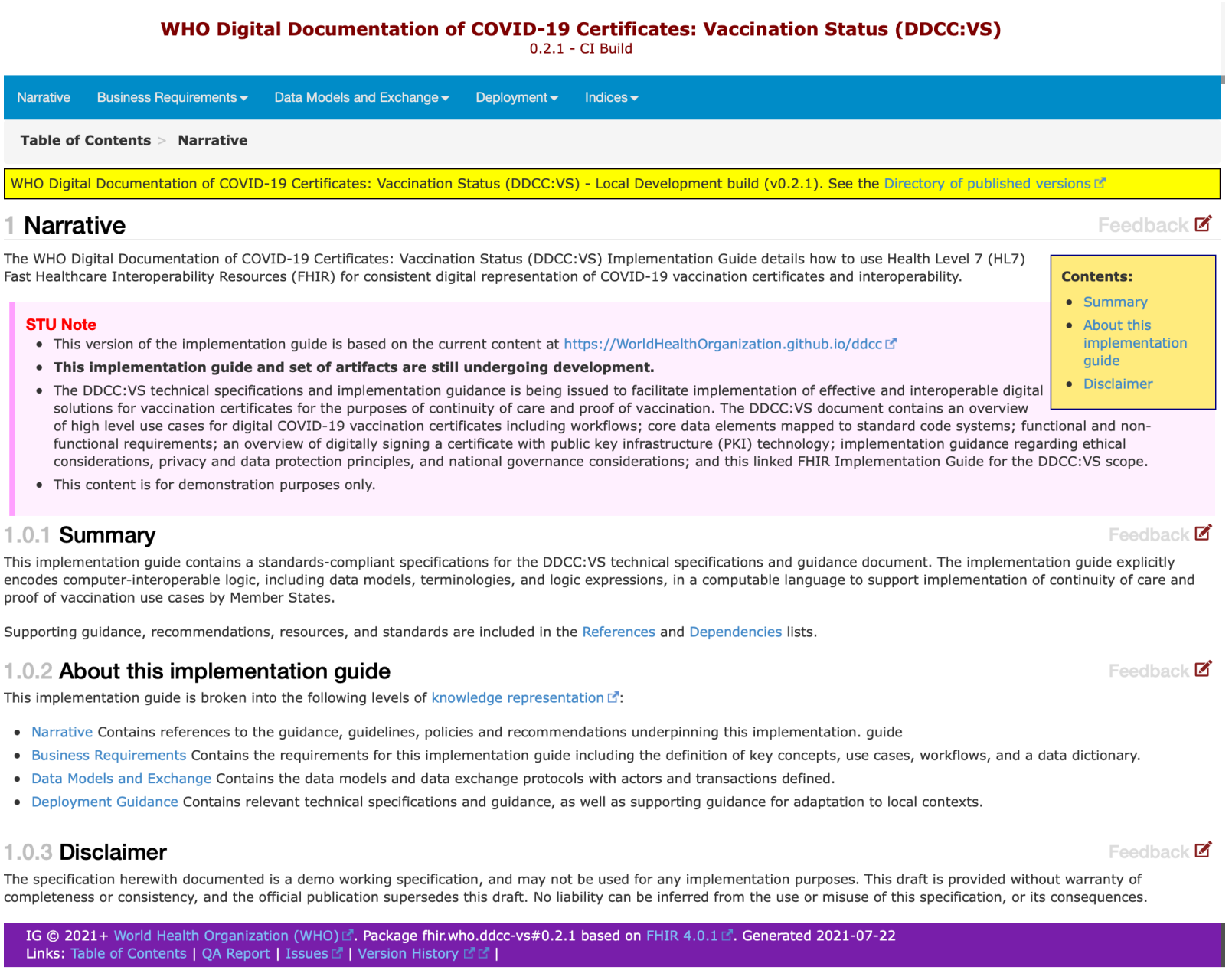
Data element label	Description	Data type	Preferred code system	Requirement status for Continuity of Care	Requirement status for Proof of Vaccination
Certificate issuer	The authority or authorized organization that issued the vaccination certificate.	String	Not applicable	Required	Required
Health certificate identifier (HCID)	Unique ID used to associate the vaccination status represented in a paper vaccination card to its digital representation(s).	ID	Not applicable	Required	Required
Certificate valid from	Date on which the certificate became valid. No health or clinical inferences should be made from this date.	Date	Complete date, following ISO 8601	Optional	Optional
Certificate valid until	Last date on which the certificate is valid. No health or clinical inferences should be made from this date.	Date	Complete date, following ISO 8601	Optional	Optional
Certificate schema version	Version of the core data set and HL7 FHIR implementation guide that the certificate is using.	String	Not applicable	Required	Required

FHIR: Fast Healthcare Interoperability Resources; HL7: Health Level Seven; ID: identifier; ISO: International Organization for Standardization.

WHO DDCC:VS FHIR Implementation Guide (L3)

HL7 Fast Health Interoperability Resources (FHIR) Implementation Guide details:

- Machine readable standards
- Terminologies mapped to standards (ICD, SNOMED GPS)
- Business requirements
- Supports consistent representation for data exchange



WHO Digital Documentation of COVID-19 Certificates: Vaccination Status (DDCC:VS)
0.2.1 - CI Build

Narrative | Business Requirements | Data Models and Exchange | Deployment | Indices

Table of Contents > Narrative

WHO Digital Documentation of COVID-19 Certificates: Vaccination Status (DDCC:VS) - Local Development build (v0.2.1). See the Directory of published versions

1 Narrative

Feedback

The WHO Digital Documentation of COVID-19 Certificates: Vaccination Status (DDCC:VS) Implementation Guide details how to use Health Level 7 (HL7) Fast Healthcare Interoperability Resources (FHIR) for consistent digital representation of COVID-19 vaccination certificates and interoperability.

Contents:
- Summary
- About this implementation guide
- Disclaimer

STU Note
- This version of the implementation guide is based on the current content at https://WorldHealthOrganization.github.io/ddcc
- **This implementation guide and set of artifacts are still undergoing development.**
- The DDCC:VS technical specifications and implementation guidance is being issued to facilitate implementation of effective and interoperable digital solutions for vaccination certificates for the purposes of continuity of care and proof of vaccination. The DDCC:VS document contains an overview of high level use cases for digital COVID-19 vaccination certificates including workflows; core data elements mapped to standard code systems; functional and non-functional requirements; an overview of digitally signing a certificate with public key infrastructure (PKI) technology; implementation guidance regarding ethical considerations, privacy and data protection principles, and national governance considerations; and this linked FHIR Implementation Guide for the DDCC:VS scope.
- This content is for demonstration purposes only.

1.0.1 Summary

Feedback

This implementation guide contains a standards-compliant specifications for the DDCC:VS technical specifications and guidance document. The implementation guide explicitly encodes computer-interoperable logic, including data models, terminologies, and logic expressions, in a computable language to support implementation of continuity of care and proof of vaccination use cases by Member States.

Supporting guidance, recommendations, resources, and standards are included in the References and Dependencies lists.

1.0.2 About this implementation guide

Feedback

This implementation guide is broken into the following levels of knowledge representation:

- Narrative Contains references to the guidance, guidelines, policies and recommendations underpinning this implementation. guide
- Business Requirements Contains the requirements for this implementation guide including the definition of key concepts, use cases, workflows, and a data dictionary.
- Data Models and Exchange Contains the data models and data exchange protocols with actors and transactions defined.
- Deployment Guidance Contains relevant technical specifications and guidance, as well as supporting guidance for adaptation to local contexts.

1.0.3 Disclaimer

Feedback

The specification herewith documented is a demo working specification, and may not be used for any implementation purposes. This draft is provided without warranty of completeness or consistency, and the official publication supersedes this draft. No liability can be inferred from the use or misuse of this specification, or its consequences.

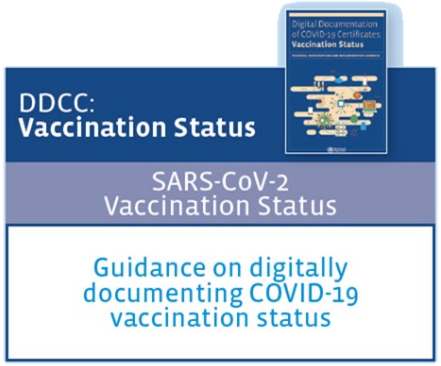
IG © 2021+ World Health Organization (WHO). Package fhir.who.ddcc-vs#0.2.1 based on FHIR 4.0.1. Generated 2021-07-22
Links: Table of Contents | QA Report | Issues | Version History |

https://worldhealthorganization.github.io/ddcc/

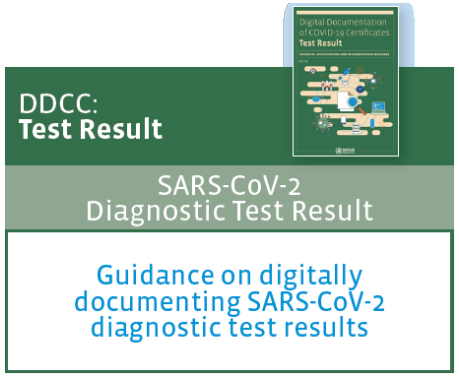
Architecting for the future

The Digital Documentation of COVID-19 Certificate specifications set the foundation for supporting an internationally recognized patient summary that is held by an individual, enabled by the HL7 FHIR interoperability standard

DIGITAL DOCUMENTATION OF COVID-19 CERTIFICATES



Documents **COVID-19 vaccination events**



Documents:

- **SARS-CoV-2 test results**
- **Proof of previous SARS-CoV-2 infection**

HL7 FHIR

Data model can also be used to document **routine immunizations for children**

DIGITAL PERSONAL HEALTH RECORD

Can also support:

- **Electronic health wallet**
- **FHIR International patient summary standard**
- **Immunization/ Maternal / Child Card**
- **Risk factors**
- **Allergies**
- **Other health events**

HL7 FHIR

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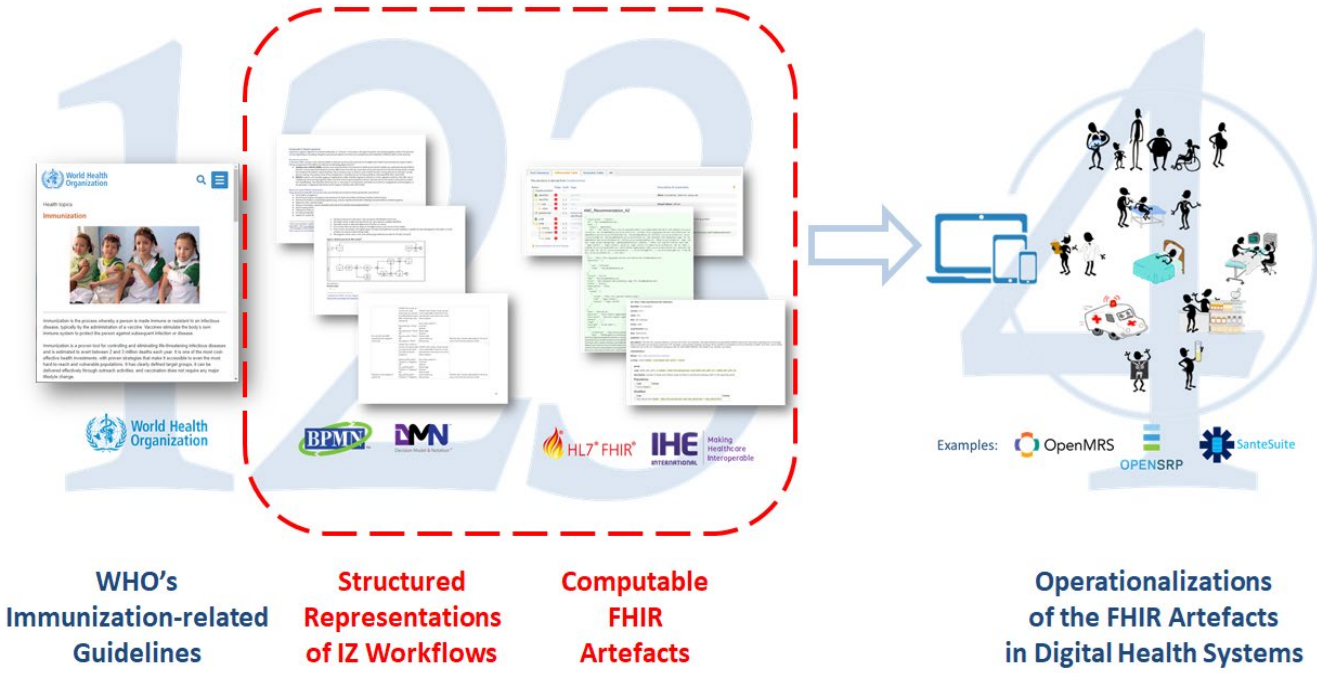
WHO SMART Guideline - Immunizations

FHIR resources and CQL decision logic will be created to leverage the International Patient Summary as a FHIR Implementation Guide.



https://github.com/WorldHealthOrganization/smart-immunizations

- Represents core data elements in use cases related to immunization
  - Data elements reflect the FHIR International Patient Summary requirements for patients and immunization
- Maps data elements to standard terminology including:
  - International Classification of Diseases, 11th Revision (ICD-11)
  - International Classification of Diseases, 10th Revision (ICD-10)
  - Logical Observation Identifiers Names and Codes (LOINC) version 2.68
  - International Classification of Health Interventions (ICHI)
  - International Classification of Functioning, Disability and Health (ICF)
  - Systematized Nomenclature of Medicine -- Clinical Terms (SNOMED CT) International edition

WHO SMART Guideline - Immunizations

World Health Organization

L2: Decision Logic Table

Decision ID	IMMZ.DT.01.BCG		
Business rule	If child or person has not been vaccinated, give BCG vaccine as soon as possible after birth		
Trigger	Patient has never had BCG vaccination		
Inputs	**Output**	**Action**	**Annotations**
"TST- or IGRA test" = "TST- or IGRA-negative"	Immunize Patient for BCG - TST- or IGRA-negative	Should vaccinate patient for BCG	Provide BCG immunizations – using the "BCG vaccine immunization – NO PREVIOUS" schedule (1 dose scheme)
"BCG vaccine immunization history" = "No-doses"	Immunize Patient for BCG - No Doses	Should vaccinate patient for BCG	Provide BCG immunizations – using the "BCG vaccine immunization – NO PREVIOUS" schedule (1 dose scheme)
"BCG vaccine immunization history" = "Unknown"	Immunize Patient for BCG - History Unknown	Should vaccinate patient for BCG	Provide BCG immunizations – using the "BCG vaccine immunization – NO PREVIOUS" schedule (1 dose scheme)
"HIV Status" = "Positive and immunicologicall y stable"	Immunize Patient for BCG - HIV Status Positive and immunicologically stable	Should vaccinate patient for BCG	Provide BCG immunizations – using the "BCG vaccine immunization – NO PREVIOUS" schedule (1 dose scheme) if CD4% >25% for children aged <5 years or CD4 count ≥200 if aged >5 years

L3: Clinical Quality Language (CQL)

```
define "Should vaccinate patient for Dengue because 1st dose given 6 months ago in a 3 dose scheme":
    (("Dengue vaccine immunization history = 1 dose") and ("Last dose given" more than 6 months before
    and not(IMMZCom."Pregnant")
    and not exists(IMMZCom."Individual is Seronegative for Dengue")

/*
 * @dataElement 2 doses
 */
define "Dengue vaccine immunization history = 2 doses":
    Count(IMMZCom."Dengue Doses Administered to Patient" H) = 2

/*
 * Rule: Should vaccinate patient for Dengue because 2nd dose given 6 months ago in a 3 dose scheme
 * Annotations:
 *   - Provide Dengue immunizations – using the "Dengue vaccine immunization – 2 PREVIOUS" schedule (3
 * Outputs:
 *   - Immunize Patient for Dengue - 2 Doses given 6 months ago
 * References:
 *  - WHO recommendations for routine immunization - summary tables: https://www.who.int/teams/immuniz
 * Logic:
 *   (("Dengue vaccine immunization history" = "2 doses") and ("Last dose given" >= "6 months"))
 */
define "Should vaccinate patient for Dengue because 2nd dose given 6 months ago in a 3 dose scheme":
    (("Dengue vaccine immunization history = 2 doses") and ("Last dose given" more than 6 months befor
    and not(IMMZCom."Pregnant")
    and not exists(IMMZCom."Individual is Seronegative for Dengue")
```

Useful Resources for document production & transformation

- FHIR Structure Definition
  - Description: Used, among other things, for defining **Logical Models**
- FHIR Document Reference
  - Description: Provides metadata around a health document such as location, provenance and digital signatures
- FHIR Bundle (document)
  - Description: bundle is a collection of FHIR related resources for various use cases. Document bundles are for health documents.
  - Operations: **$docref** produces Document Reference resources for a particular document
- FHIR Composition
  - Description: describes structure of a particular FHIR document
  - Operations: **$document** generates a FHIR document bundle for a given patient

- FHIR Value Set
  - Description: List of codes, from one or more code systems (e.g ICD, SNOMED GPS), for a given use case
- FHIR Concept Map:
  - Description: Describes relationship between codes in two value sets
  - Operations: **$translate** used to map from a source code to target code based on a concept map

- FHIR Questionnaire & QuestionnaireResponse:
  - Description: Set of structured questions with logic for end user data collection
  - Operations: **$extract** extracts data from a Questionnaire Response into relevant FHIR resources
- FHIR Structure Map:
  - Description: Given a hierarchy of FHIR resources, describes a way to map to another set of FHIR resources. Not human consumable
  - Operations: **$transform** takes a source (root of hierarchy) FHIR resources transforms it to the target based on the structure map
- FHIR Mapping Language (FML)
  - Description: human readable language that can be used to generate Structure Maps
- Clinical Quality Language
  - Description: Querying an analytics language that is "FHIR-aware" used for decision support services/business rules and indicator calculations.

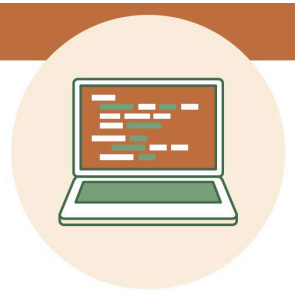
Useful FHIR Implementation Guides and IHE Profiles

- **Sharing Value Sets and Concept Maps (SVCM):** describes set of capabilities for interacting with a terminology service to support code lookup, validation and mapping
- **Structured Data Capture (SDC):** describes how to structure questionnaire and extract data using FHIR PATH and Structure Maps
- **International Patient Access (IPA):** describes how to generate and return refences to health documents
- **Mobile Health Document Sharing (MHDS):** describes how to manage collections (FHIR List) of native FHIR documents with a registry and repository
- **International Patient Summary (IPS):** describes a particular health document providing a summary of health information about a certain person
- **Digital Documentation of Covid Certificates (DDCC):** describes a particular health document for covid credentials and ways to interact with those documents

SECTION

5

DDCC:VS core data set



22.9.1 Logical Model: DDCC Core Data Set Logical Model - Vaccination Status - Continuity of Care

Feedback

Official URL: **http://worldhealthorganization.github.io/ddcc/StructureDefinition/DDCCCoreDataSet.VS.CoC**	*Version*: **1.0.0**
Draft as of 2022-05-27	*Computable Name*: DDCCCoreDataSet_VS_CoC

Data elements for the DDCC Core Data Set - Vaccination Status - Continuity of Care.

Usage:

- This Logical Model Profile is not used by any profiles in this Implementation Guide

22.9.1.1 Formal Views of Profile Content

Feedback

Description of Profiles, Differentials, Snapshots and how the different presentations work.

Text Summary | Differential Table | **Snapshot Table** | Snapshot Table (Must Support) | All

Name	Flags	Card.	Type	Description & Constraints
DDCCCoreDataSet		0..*	DDCCCoreDataSet_VS	DDCC Core Data Set Logical Model - Vaccination Status - Continuity of Care
name	Σ	1..1	string	Name
birthDate	Σ	0..1	date	Date of birth
identifier	Σ	0..1	Identifier	Unique identifier
certificate	Σ	0..1	BackboneElement	Certificate Metadata
issuer	Σ	1..1	Reference(DDCC Organization)	Certificate issuer
hcid	Σ	1..1	Identifier	Health certificate identifier (HCID)
ddccid	Σ	0..1	Identifier	DDCC Identifier
version	Σ	1..1	string	Certificate schema version
period		0..1	Period	Certificate Validity Period
start		0..1	date	Certificate valid from
end		0..1	date	Certificate valid until
vaccination	Σ I	1..1	BackboneElement	Vaccination Event
vaccine	Σ	1..1	Coding	Vaccine or prophylaxis **Binding:** WHO Vaccine List (COVID-19) (preferred)
brand	Σ	1..1	Coding	Vaccine brand
manufacturer	Σ	0..1	Coding	Vaccine manufacturer
maholder	Σ	0..1	Coding	Vaccine market authorization holder
lot	Σ	1..1	string	Vaccine lot number
date	Σ	1..1	dateTime	Date of vaccination
validFrom		0..1	date	Vaccination valid from
dose	Σ	1..1	positiveInt	Dose number
totalDoses		0..1	positiveInt	Total doses
country	Σ	1..1	Coding	Country of vaccination **Binding:** Iso3166-1-3 (preferred)
centre		1..1	string	Administering centre
signature		0..1	Signature	Signature of health worker
practitioner		0..1	Identifier	Health worker identifier
disease		0..1	Coding	Disease or agent targeted **Binding:** WHO Disease or Agent Targeted (COVID-19) (preferred)
nextDose		0..1	date	Due date of next dose
sex	Σ	0..1	code	Sex **Binding:** AdministrativeGender (required)

Documentation for this format

L3: FHIR Implementation Guide

World Health Organization

Codings, Value Sets and Concept Maps

Preferred to use WHO Vaccine List.

vaccine	Σ	1..1	Coding	Vaccine or prophylaxis **Binding:** WHO Vaccine List (COVID-19) (preferred)

WHO Vaccine List is a FHIR Value Set of ICD-11 Codes.

What if you are not using ICD-11?



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Codings, Value Sets and Concept Maps

Preferred to use WHO Vaccine List.

WHO Vaccine List is a FHIR Value Set of ICD-11

vaccine

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Table of Contents > **Artifacts Summary** > **WHO_DDCC_Map_CVX_To_ICD11_Vaccines**

This is the continuous build for version 1.0.0. This version is based on the current content of https://github.com/WorldHealthOrganization/ddcc and changes regularly.

Narrative Content | XML | JSON | TTL

22.94.1 ConceptMap: WHO_DDCC_Map_CVX_To_ICD11_Vaccines (Ex

Official URL: **http://worldhealthorganization.github.io/ddcc/ConceptMap/WHO_DDCC_Map_CVX_To_ICD11_Vaccines**

Draft as of 2022-05-23

Rule-based mappings between CVX and ICD-11 and for COVID-19 Vaccines

22.94.2 ICD11_SNOMED_CT_COVID19_vaccines (http://worldhealthorganization.github.io/ddcc/ConceptMap/WHO_DDCC_

Mapping from http://hl7.org/fhir/sid/cvx to http://id.who.int/icd11/mms

DRAFT (not intended for production usage). Published on 2022-05-23 by WHO (WHO: http://who.int).

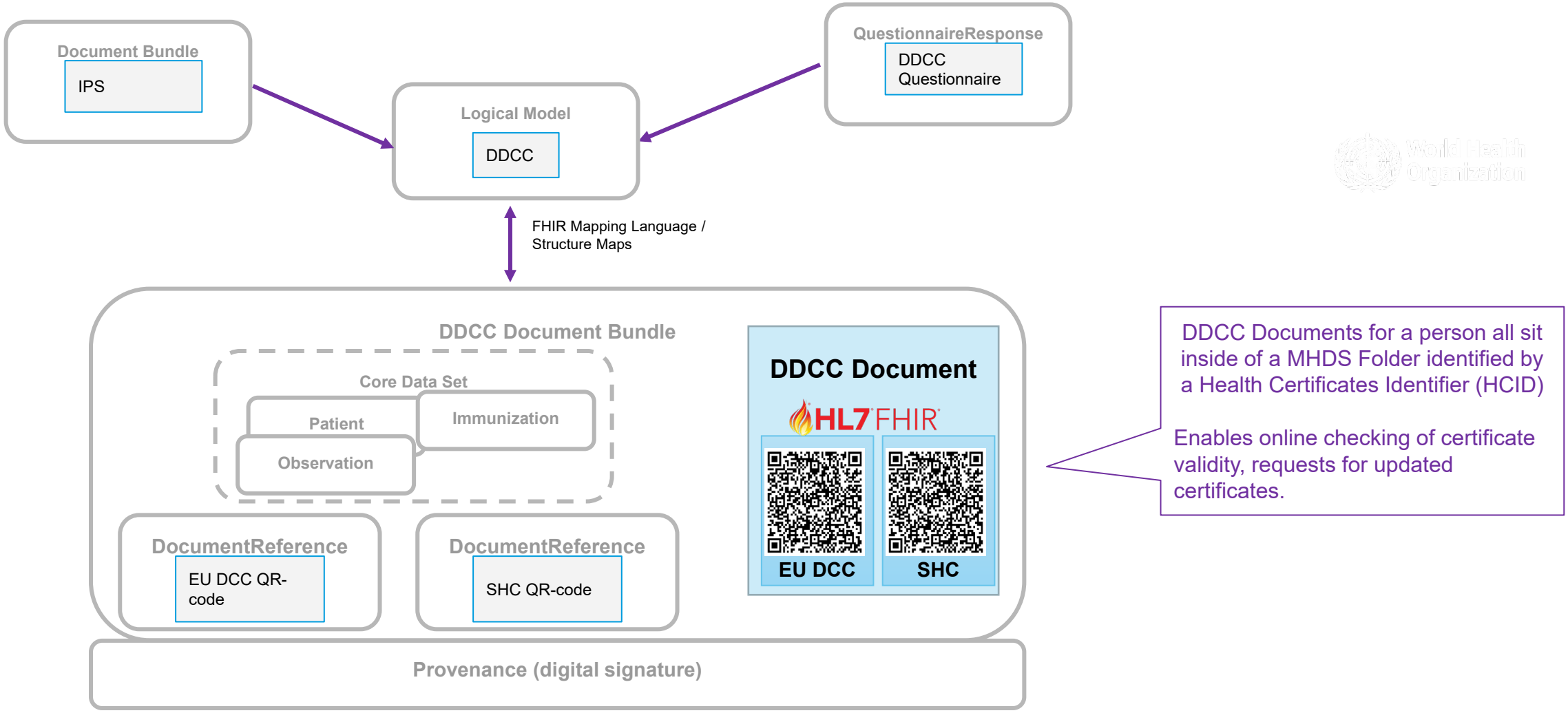
Rule-based mappings between CVX and ICD-11 and for COVID-19 Vaccines

Source Code	Relationship	Destination Code
Mapping from PH_VaccinesAdministeredCVX_CDC_NIP to DDCC Codes for ICD11		
208 (COVID-19, mRNA, LNP-S, PF, 30 mcg/0.3 mL dose)	is equivalent to	XM0GQ8 (COVID-19 vaccine, RNA based)

```
{
  "source" : "http://hl7.org/fhir/sid/cvx",
  "target" : "http://id.who.int/icd11/mms",
  "element" : [
    {
      "code" : "208",
      "target" : [
        {
          "code" : "XM0GQ8",
          "equivalence" : "equivalent"
        }
      ]
    }
  ],
```

NOT FOR

DDCC Document and QR Codes



DDCC Documents for a person all sit inside of a MHDS Folder identified by a Health Certificates Identifier (HCID)

Enables online checking of certificate validity, requests for updated certificates.

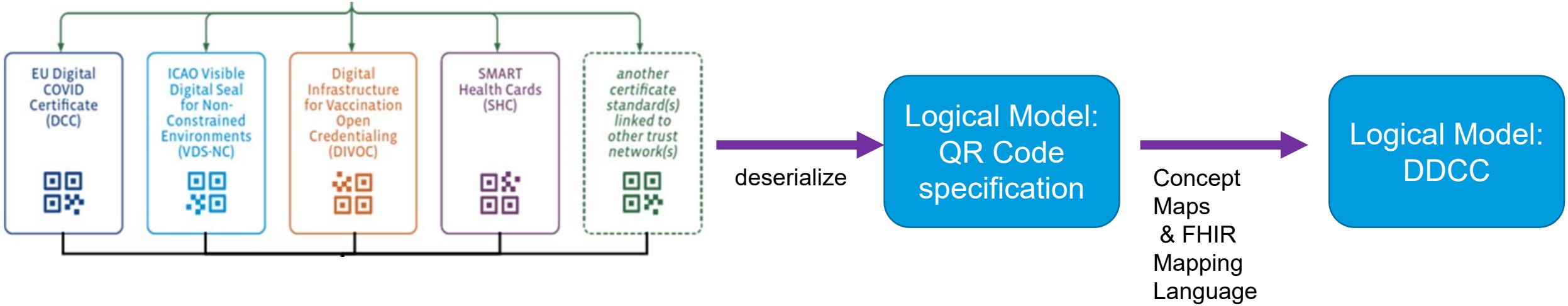
How do we know which QR code specifications align to DDCC data model?

World Health Organization

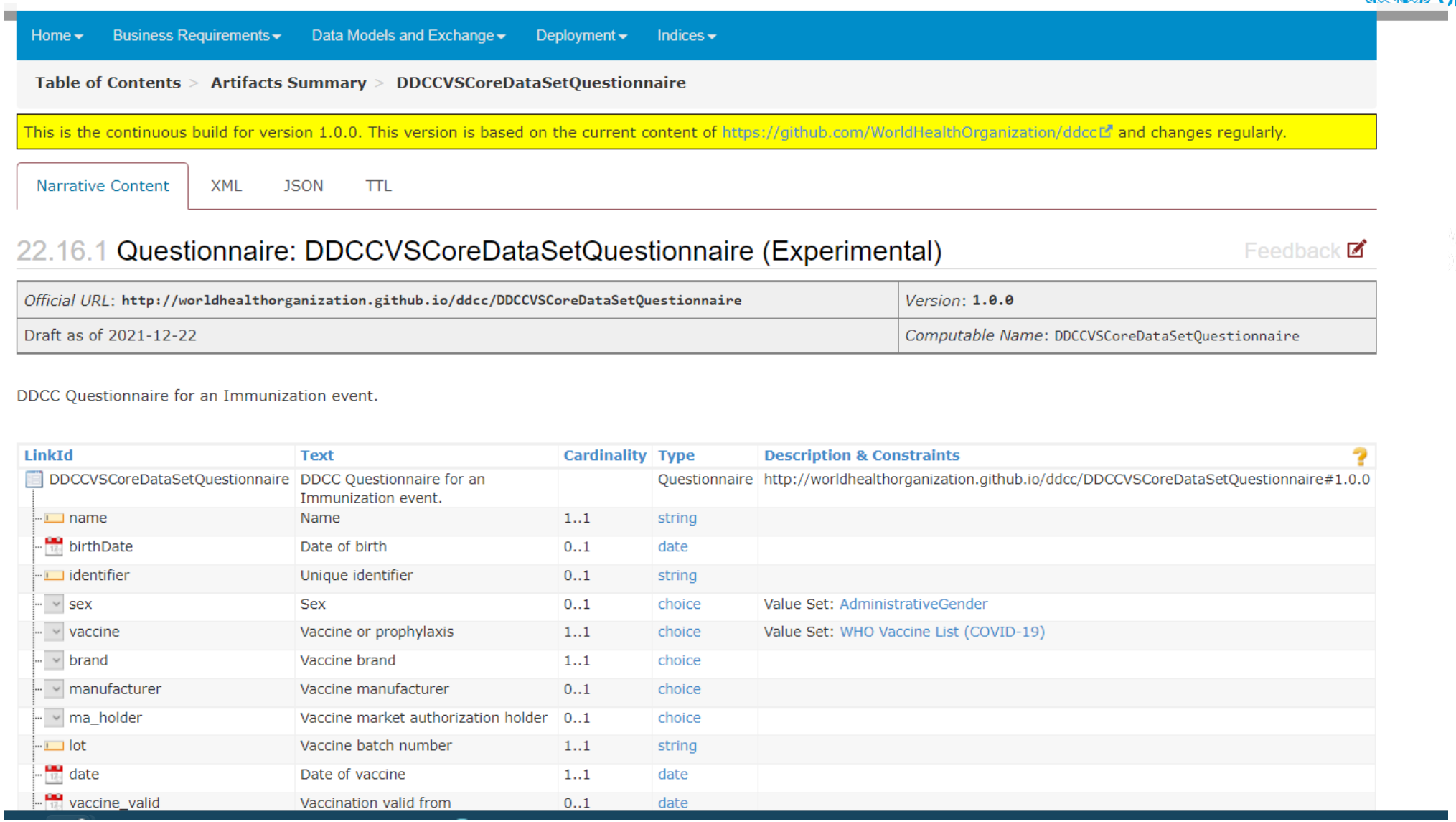
Use Case: Checklist for QR Code Specifications

To have Covid Credentials QR code specification tested in the pilot it needs:

- FHIR Logical Model for defining data schema
- Open specification for deserialization of QR code
- QR codes are signed using a private key which is paired with a public key
- Open source software libraries for codes into Logical Model
- Mappings (FHIR mapping language, Structure and Concept Maps) to DDCC Logical Model



Questionnaires & DDCC



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This is the continuous build for version 1.0.0. This version is based on the current content of https://github.com/WorldHealthOrganization/ddcc and changes regularly.

Narrative Content | XML | JSON | TTL

22.16.1 Questionnaire: DDCCVSCoreDataSetQuestionnaire (Experimental)

Feedback

Official URL: **http://worldhealthorganization.github.io/ddcc/DDCCVSCoreDataSetQuestionnaire**	*Version*: **1.0.0**
Draft as of 2021-12-22	*Computable Name*: DDCCVSCoreDataSetQuestionnaire

DDCC Questionnaire for an Immunization event.

LinkId	Text	Cardinality	Type	Description & Constraints
DDCCVSCoreDataSetQuestionnaire	DDCC Questionnaire for an Immunization event.		Questionnaire	http://worldhealthorganization.github.io/ddcc/DDCCVSCoreDataSetQuestionnaire#1.0.0
name	Name	1..1	string	
birthDate	Date of birth	0..1	date	
identifier	Unique identifier	0..1	string	
sex	Sex	0..1	choice	Value Set: AdministrativeGender
vaccine	Vaccine or prophylaxis	1..1	choice	Value Set: WHO Vaccine List (COVID-19)
brand	Vaccine brand	1..1	choice	
manufacturer	Vaccine manufacturer	0..1	choice	
ma_holder	Vaccine market authorization holder	0..1	choice	
lot	Vaccine batch number	1..1	string	
date	Date of vaccine	1..1	date	
vaccine_valid	Vaccination valid from	0..1	date	

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Compositions/Documents & DDCC

World Health Organization

22.19.1 Resource Profile: DDCC Composition

Describes the logical structure for a Digital Documentation of COVID-19 Certificates (DDCC).

22.19.1.1 Formal Views of Profile Content

Description of Profiles, Differentials, Snapshots and how the different presentations work.

Text Summary | **Differential Table** | Snapshot Table | Snapshot Table (Must Support) | All

This structure is derived from Composition

Name	Flags	Card.	Type	Description & Constraints
Composition		0..*	Composition	A set of resources composed into a single coherent clinical statement with clinical attestation
identifier	S	1..1	Identifier	Version-independent identifier for the Composition
system	S	1..1	uri	The namespace for the identifier value
value	S	1..1	string	The value that is unique
status	S	1..1	code	preliminary | final | amended | entered-in-error
type		1..1	CodeableConcept	Kind of composition ("DDCC") **Required Pattern:** At least the following
coding		1..*	Coding	Code defined by a terminology system **Fixed Value:** (complex)
system		1..1	uri	Identity of the terminology system **Fixed Value:** http://loinc.org
code		1..1	code	Symbol in syntax defined by the system **Fixed Value:** 82593-5
subject	S	1..1	Reference(DDCC Patient)	Who and/or what the composition is about
reference	S	1..1	string	Literal reference, Relative, internal or absolute URL
title	S	1..1	string	Human Readable name/title **Required Pattern:** Digital Documentation of COVID-19 Certificate (DDCC)
attester	S	1..1	BackboneElement	Attests to accuracy of composition
mode		1..1	code	personal | professional | legal | official **Required Pattern:** official
party	S	1..1	Reference(DDCC Organization)	Who attested the composition
event		0..1	BackboneElement	The clinical service(s) being documented
period				
start		0..1	dateTime	Starting time with inclusive boundary

2.48.1 Resource Profile: DDCC:VS Composition

Feedback

escribes the logical structure for a Digital Documentation of COVID-19 Certificates - Vaccination Status (DDCC:VS).

2.48.1.1 Formal Views of Profile Content

Feedback

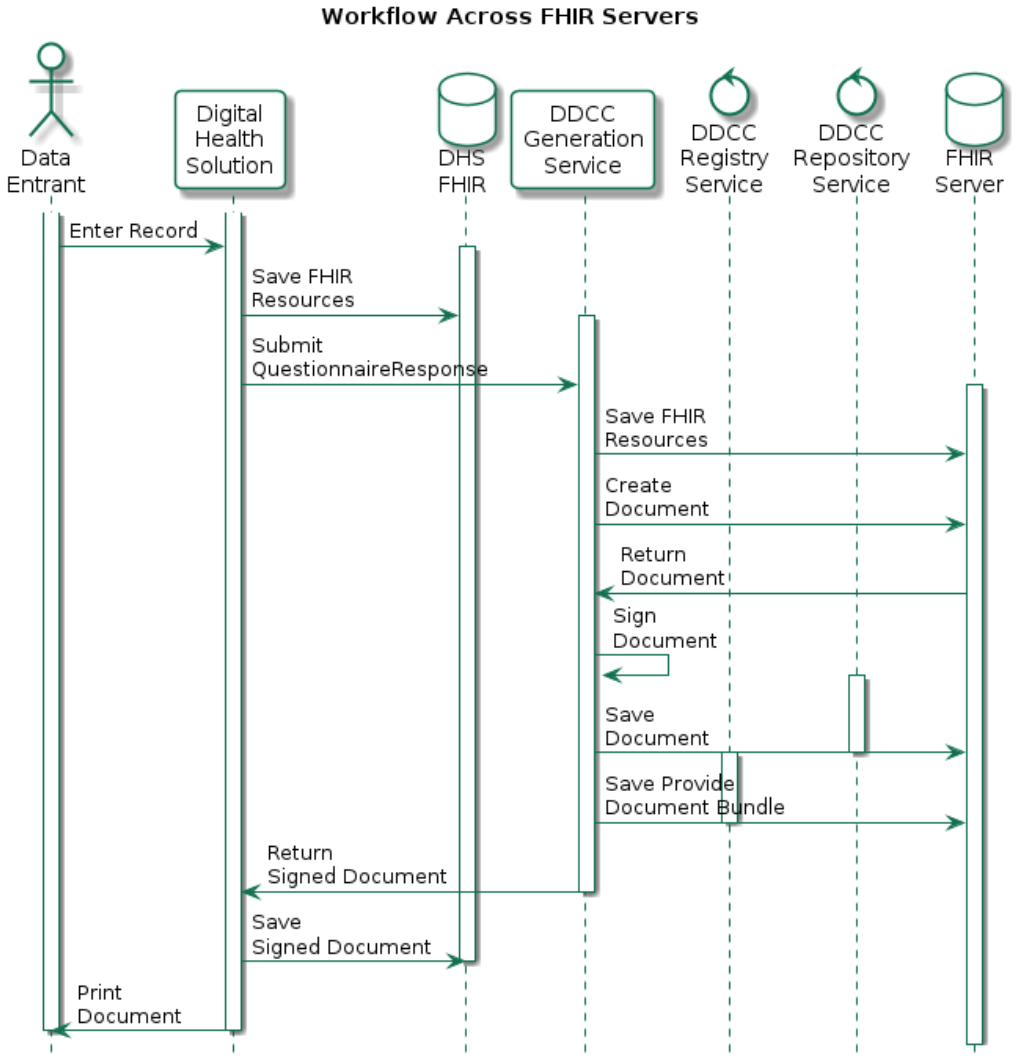
escription of Profiles, Differentials, Snapshots and how the different presentations work.

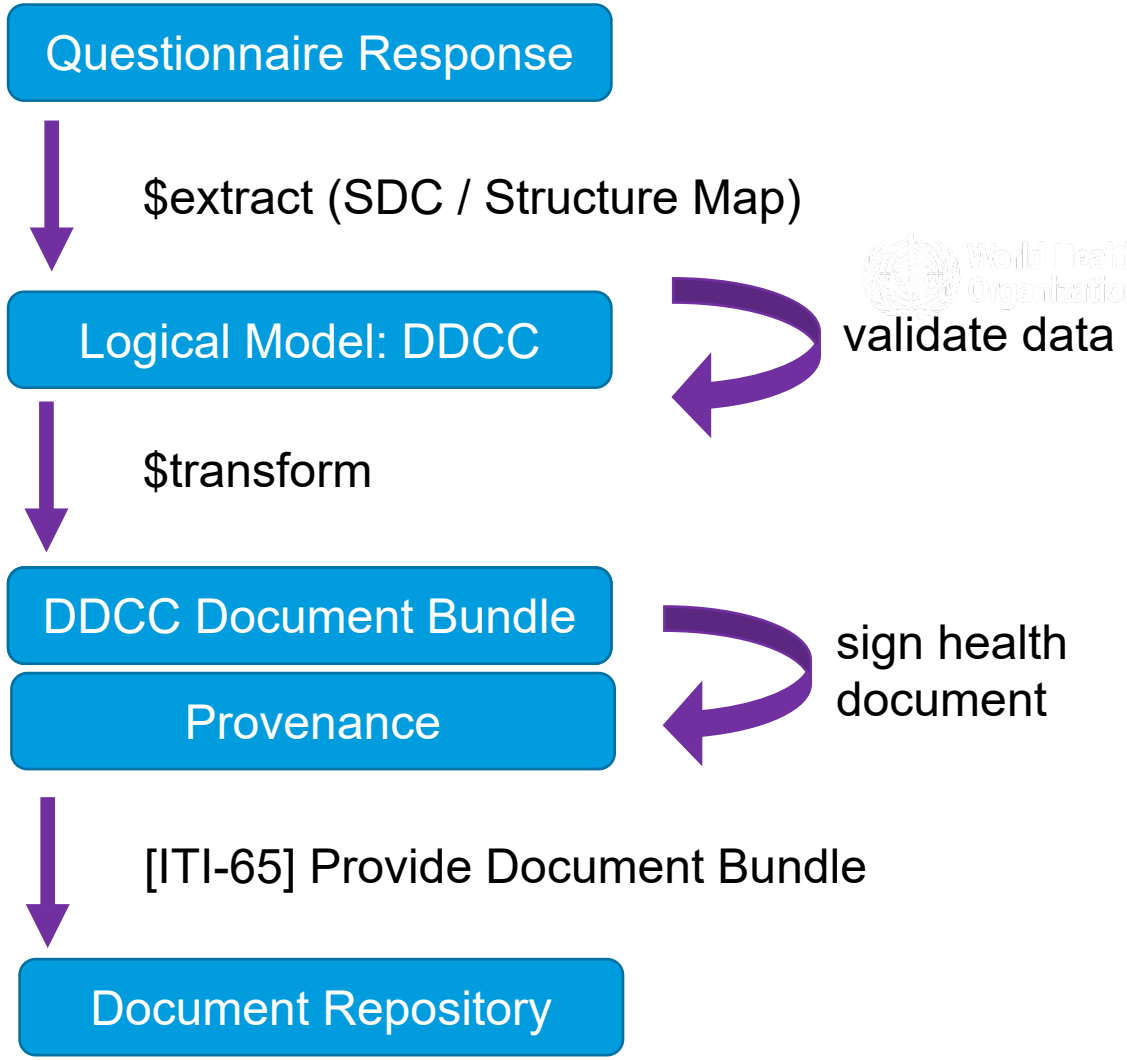
Text Summary | **Differential Table** | Snapshot Table | Snapshot Table (Must Support) | All

This structure is derived from DDCCComposition

Name	Flags	Card.	Type	Description & Constraints
Composition		0..*	DDCCComposition	A set of resources composed into a single coherent clinical statement with clinical attestation
category		0..*	CodeableConcept	Categorization of Composition **Required Pattern:** At least the following
coding		1..*	Coding	Code defined by a terminology system **Fixed Value:** (complex)
system		1..1	uri	Identity of the terminology system **Fixed Value:** http://worldhealthorganization.github.io/ddcc/CodeSystem/DDCC-Composition-Category-CodeSystem
code		1..1	code	Symbol in syntax defined by the system **Fixed Value:** ddcc-vs
Slices for section		*1..**	*BackboneElement*	*Composition is broken into sections* ***Slice:** Unordered, Closed by value:code, type:focus*
section:vaccination	S	1..1	BackboneElement	Vaccination Status Section
code		1..1	CodeableConcept	Classification of section (recommended) **Required Pattern:** At least the following
coding		1..*	Coding	Code defined by a terminology system **Fixed Value:** (complex)
system		1..1	uri	Identity of the terminology system **Fixed Value:** http://loinc.org
code		1..1	code	Symbol in syntax defined by the system **Fixed Value:** 11369-6
focus	S	1..1	Reference(DDCC Immunization)	Who/what the section is about, when it is not about the subject of composition
entry		0..*	Reference(DDCC Immunization | DDCC DocumentReference return for QR | DDCC	A reference to data that supports this section

Questionnaire and Covid Credentials





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Structure Maps and FHIR Mapping Language

This is the continuous build for version 1.0.0. This version is based on the current content of https://github.com/WorldHealthOrganization/ddcc and changes regularly.

Narrative Content | XML | JSON | TTL

22.83.1 StructureMap: IPSToCoreDataSetVS

Feedback

Official URL: **http://worldhealthorganization.github.io/ddcc/StructureMap/IPSToCoreDataSetVS**	*Version*: **1.0.0**
Draft as of 2022-05-27	*Computable Name*: IPSToCoreDataSetVS

```
map "http://worldhealthorganization.github.io/ddcc/StructureMap/IPSToCoreDataSetVS" = "IPSToCoreDataSetVS"


uses "http://hl7.org/fhir/StructureDefinition/Bundle" alias IPS as source
uses "http://hl7.org/fhir/StructureDefinition/Bundle" alias DDCCBundle as target
uses "http://worldhealthorganization.github.io/ddcc/StructureDefinition/DDCCCoreDataSet.VS.PoV" alias DDCC as produced

group IPSToCoreDataSetVS(source ips : IPS, target ddccBundle : DDCCBundle) {
  ips.id as id -> ddccBundle.id = id "set id";
  ips.entry first as compentry then {
    compentry.resource : Composition as composition then {
      composition.subject as subject then {
        subject.reference as patientid then {
          ips.entry as findpatient where resource.is(Patient) and (resource.id = patientid.replaceMatches('.*Patient/(?<id>[A-Za-z0-9\\-\\.]{1,64})$', '${id}')) th
en {
            findpatient.resource as patient then {
              ips.entry as entry then {
                entry.resource : Immunization as immunization where vaccineCode.memberOf('http://worldhealthorganization.github.io/ddcc/ValueSet/who-ddcc-allowed-v
accines-covid-19') ->  ddccBundle.entry as outentry,  create('http://worldhealthorganization.github.io/ddcc/StructureDefinition/DDCCCoreDataSet.VS.PoV') as ddcc th
```

IPS Example

International Patient Summary (IPS) Viewer* for Connectathon

Links to published Implementation Guide and the latest CI build
Please note that this tool is an open-source project under development. It only renders the following sections of IPS bundles: Allergies, Immunizations, Medications,

Submit Data

This is for test data only. **Please do not submit PHI.**

Paste your IPS here:

```
<td>1</td>\r\n          <td>Intramuscular</td>\r\n          <td>Right Arm</td>\r\n
<td>Non-Eligible</td>\r\n          <td>Given</td>\r\n          <td>\r\n                </td>\r\n
\r\n        </tr>\r\n        </tbody>\r\n      </table>\r\n    </div>"
                },
                "entry": [
                  {
                    "reference": "Immunization/6b99962d-30fc-4d13-942f-961568eeb9ea"
                  },
                  {
                    "reference": "Immunization/41f5535d-d7c1-4530-842e-66521454ff3a"
```

Try a sample

Repository of IPS Samples

Clear | View IPS | Displaying Entries

View IPS

Header

International Patient Summary

Summary Date: 2021-09-10

Patient

Birth Date: 1956-09-30
Name: PETER KEITH, JONES

Allergies and Intolerancies

allergy - - Criticality: undefined
No known allergies (no-known-allergies)

Active problems / Diagnosis

undefined Hypertension (38341003) [Uncoded text shown]: G20.00 (Hypertension)

undefined Gout (90560007)

Current Medications

http://nzmt.org.nz cilazapril 500 microgram tablet, 90 (31099751000116106)

http://nzmt.org.nz Apo-Prednisone - prednisone 5 mg tablet (10060691000116108)

Posología				
Route	**Qty**	**Unit**	**Freq. Qty**	**Freq. Period**
Swallow, oral	1	undefined		

http://nzmt.org.nz colecalciferol 1.25 mg capsule (46227861000116109)

Posología				
Route	**Qty**	**Unit**	**Freq. Qty**	**Freq. Period**
Swallow, oral	1	undefined		

Immunizations

2021-08-27
http://hl7.org/fhir/sid/cvx SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 30 mcg/0.3mL dose (208)

2021-08-05
http://hl7.org/fhir/sid/cvx TEST SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 30 mcg/0.3mL dose (208)

2021-05-31
http://hl7.org/fhir/sid/cvx Influenza, seasonal, injectable (141)

2020-05-01
http://hl7.org/fhir/sid/cvx Influenza, seasonal, injectable (141)

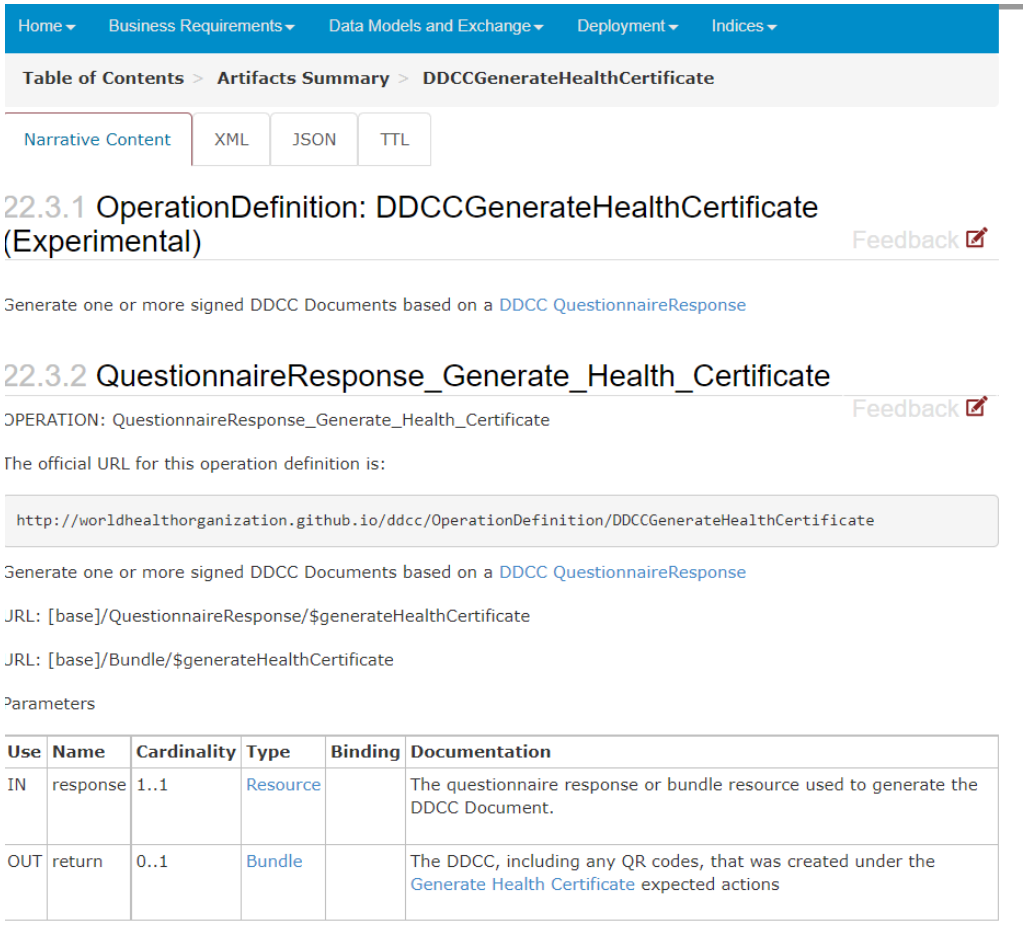
Observations

Name	Date	Value	Category

* Originally created by Alejandro Lopez Osornio, Diego Kaminker and Fernando Campos. Modified by John D'Amore

Questionnaires, IPS & DDCC Certificate Generation Service

- **{{IP ADDRESS}}**/ddcc/Bundle/submitIPSCertificate where you POST the IPS document
- **{{IP ADDRESS}}**/ddcc/Questionnaire/generateHealthCertificate where you POST one or more QuestionnaireResponses
- Certificate Generation Service will be available for testing your IPS documents and Covid Credential workflows soon



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Narrative Content | XML | JSON | TTL

22.3.1 OperationDefinition: DDCCGenerateHealthCertificate (Experimental) Feedback

Generate one or more signed DDCC Documents based on a DDCC QuestionnaireResponse

22.3.2 QuestionnaireResponse_Generate_Health_Certificate Feedback

OPERATION: QuestionnaireResponse_Generate_Health_Certificate

The official URL for this operation definition is:

```
http://worldhealthorganization.github.io/ddcc/OperationDefinition/DDCCGenerateHealthCertificate
```

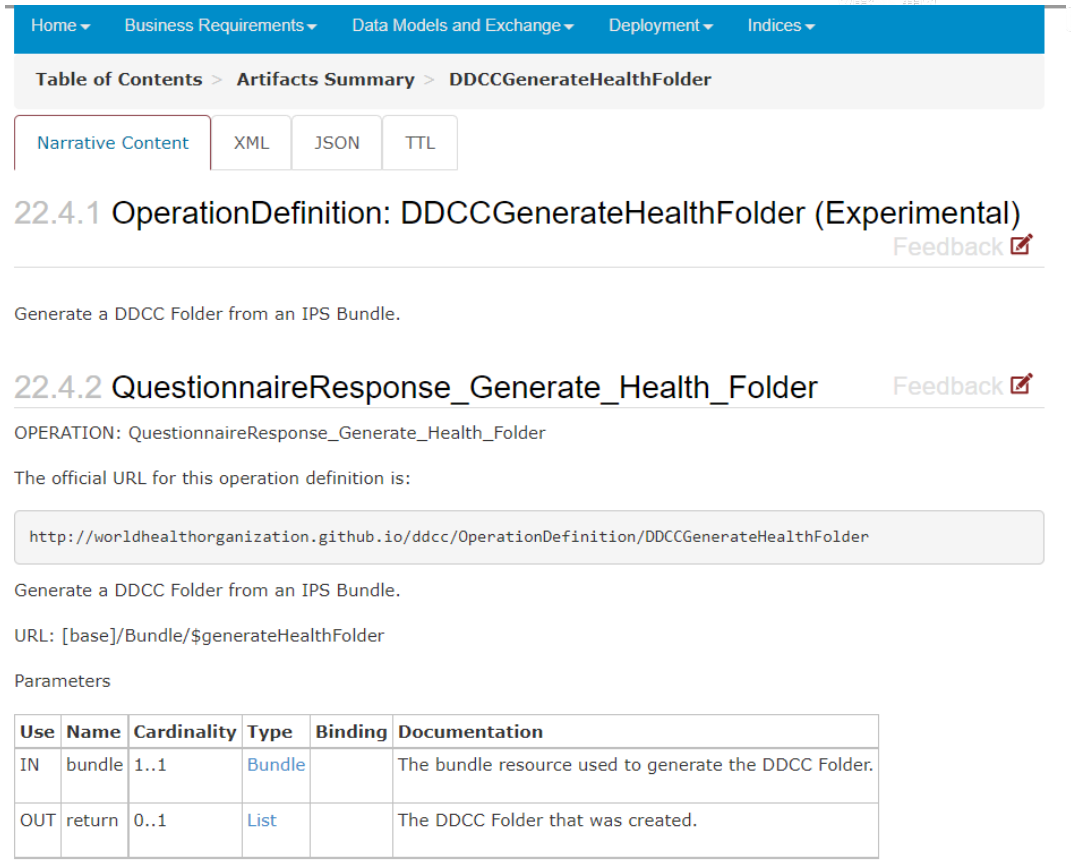
Generate one or more signed DDCC Documents based on a DDCC QuestionnaireResponse

URL: [base]/QuestionnaireResponse/$generateHealthCertificate

URL: [base]/Bundle/$generateHealthCertificate

Parameters

Use	Name	Cardinality	Type	Binding	Documentation
IN	response	1..1	Resource		The questionnaire response or bundle resource used to generate the DDCC Document.
OUT	return	0..1	Bundle		The DDCC, including any QR codes, that was created under the Generate Health Certificate expected actions



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Narrative Content | XML | JSON | TTL

22.4.1 OperationDefinition: DDCCGenerateHealthFolder (Experimental) Feedback

Generate a DDCC Folder from an IPS Bundle.

22.4.2 QuestionnaireResponse_Generate_Health_Folder Feedback

OPERATION: QuestionnaireResponse_Generate_Health_Folder

The official URL for this operation definition is:

```
http://worldhealthorganization.github.io/ddcc/OperationDefinition/DDCCGenerateHealthFolder
```

Generate a DDCC Folder from an IPS Bundle.

URL: [base]/Bundle/$generateHealthFolder

Parameters

Use	Name	Cardinality	Type	Binding	Documentation
IN	bundle	1..1	Bundle		The bundle resource used to generate the DDCC Folder.
OUT	return	0..1	List		The DDCC Folder that was created.


Gracias.
Preguntas?
smartvaccination@who.int