

Data Quality in FHIR: Lessons from the Field

Carol Graham, Clinical Architecture



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Carol Graham

- **RN / Informaticist** with 25+ years combined experience in healthcare delivery and healthcare IT
- **Product Manager** for Pivot and FHIR-enabled solutions at Clinical Architecture
- Member of HL7
- Active in Vocabulary Work Group



Clinical Architecture®






Delivering innovative solutions that maximize the effectiveness of healthcare since 2007.

Based in Carmel, Indiana, USA

Company Focus: Healthcare enterprise data quality

Solution Platforms:

- 
Symedical® – *Comprehensive terminology management, enterprise semantic interoperability, and normalization solution*
- 
Pivot – *Managed interoperability and data quality solution, powered by Symedical®*
- 
ClinEvolve® – *Next generation framework for high-resolution clinical information*

Market Segments: Health Systems, Analytics, Health Information Exchanges, Government, Content Providers

Lessons Learned in Data Quality

- Use Case Emphasis
- Assumed Knowledge Background
- Working Definition of Data Quality
- Best Practices – ways to improve data quality and semantic interoperability when using FHIR ValueSets




Use Case Emphasis

- FHIR Solution Implementers
 - Transmitting data via FHIR resources
 - Using FHIR ValueSets in FHIR-enabled solutions
- FHIR Terminology Services Implementers

Assumed Knowledge Background

- The **FHIR Terminology Model** and its Resources
- Distinction between **Code System** and **Value Set**
 - Code System – the definition of a collection of concepts along with their codes, meanings, and relationships
 - Value Set – a named collection of codes drawn from one or more CodeSystems that are the valid for use in a particular context
- Distinction between **Value Set Definition** and **Value Set Expansion**
 - Value Set Definition – description of the set of concepts (rules for inclusion and exclusion)
 - Value Set Expansion – the actual set of concepts (the list of codes and descriptions)
 - *The FHIR specification treats these as one resource, called ValueSet*

 To learn more:

- <https://www.hl7.org/fhir/terminology-module.html>
- <https://www.hl7.org/fhir/terminologies.html>
- **FHIR Introduction** or **FHIR Terminology Services** tracks at DevDays

Working Definition of Data Quality

- The Four C's:
 - **Correct** – accurate and precise; reflects reality
 - **Current** – up-to-date, relevant, utilizes terminology and resources appropriately
 - **Consistent** – predictably conformant
 - **Complete** – has all the necessary details

Correct

- Structural Correctness


- Valid elements
- Respecting Cardinality and Data Types

- Terminology Bindings

- Use the specified value set for the element
- Verify received codes wherever possible (don't assume correctness)

status	?! Σ	1..1	code	draft active retired unknown PublicationStatus (Required)
experimental	Σ	0..1	boolean	For testing purposes, not real usage
date	Σ	0..1	dateTime	Date last changed
publisher	Σ	0..1	string	Name of the publisher (organization or person)
contact	Σ	0..*	ContactDetail	Contact details for the publisher
description		0..1	markdown	Natural language description of the value set
useContext	Σ TU	0..*	UsageContext	The context that the content is intended to be used in
jurisdiction	Σ	0..*	CodeableConcept	Intended jurisdiction for value set (if applicable) Jurisdiction (Extensible)
immutable	Σ	0..1	boolean	Indicates whether or not any change to the value set is allowed

- Use of ID, URL, and Identifier

- ValueSet.id – the logical id on the system that holds the value set (varies by server)
- ValueSet.URL – the canonical URL that never changes for a value set (same on all servers) 
- ValueSet.Identifier - A system/value pair *used in non-FHIR context* such as designs, profiles, CDA template (e.g., OIDs)

Current

- Value Set Versioning
 - Align the value set version with the version of the FHIR resource being generated
 - HL7 Unified Terminology Governance (UTG) – on the horizon: content will have version updates
- Value Set Status: Active | Draft | Retired
 - Align with organizational data governance policy on use of non-active value set content
- Active vs. Inactive Codes
 - May need to use inactive (retired) codes to represent historical data or quality measure look-backs
 - Otherwise, align with organizational data governance policy and use judiciously

Consistent

- Terminology Server Capability Statement
 - Defines a server's default behaviors, e.g.,
 - Declaring supported and default code system versions
 - Support for pagination, term count limits on \$expand operations, etc.
 - Places restrictions on capabilities that a server supports, e.g.,
 - Operations
 - Searching and filtering – wildcard support, filter exclusions, etc.



Implementation Alert: Allowable variations between servers can yield inconsistent results for the same operation.



Consistent (cont.)

- Terminology Bindings – normalize local codes to FHIR ValueSets
 - Resource elements with *required* terminology bindings should be populated using valid codes from the specified FHIR ValueSet
 - Automated terminology management solutions can significantly improve accuracy / consistency and reduce repetitive work involved in mapping
- Preferred Display
 - May send more than one translation code if relevant
 - Valid to send an application-specific display
 - Should send the “preferred” display, if one is designated as such

Consistent (cont.)

- Intensional vs. Extensional Value Sets
 - Value sets can be described as intensional (rules-based) or extensional (list-based)
 - Expansion may change each time the underlying code system is updated
- Implicit Value Sets
 - Value sets that are indirectly defined based on the grammar of the underlying code system
 - E.g., “is-a” (subsumption) or “reference set” relationships in SNOMED CT
 - May change each time the underlying code system is updated

Complete

- Perform and Cache Expansions Thoughtfully
 - Value sets may be stored locally for performance reasons
 - Stored value sets should be re-verified regularly to ensure they remain valid
 - Stored value set expansions should include the value set definition (filters, search parameters, version, date of expansion) to ensure clarity and consistency
- Support Value Set Extensions and Extensible Bindings
 - ValueSet extensions are used in Profiles
 - *Extensible* bindings allow additional value set members that may not exist in the original code system
 - Need a way to validate and persist the additional codes

Data Quality in FHIR – Flexibility with Balance

The Four C's	Aspects of Data Quality in using FHIR ValueSets
Correct	<ul style="list-style-type: none">• Structural Correctness• Terminology Bindings – part I• Use of ID, URL, and Identifier
Current	<ul style="list-style-type: none">• Value Set Versioning• Value Set Status• Active vs. Inactive Codes
Consistent	<ul style="list-style-type: none">• Terminology Bindings – part II• Preferred Display• FHIR Terminology Server Capability Statement• Intensional and Extensional Value Sets• Implicit Value Sets
Complete	<ul style="list-style-type: none">• Perform and Cache Expansions Thoughtfully• Supporting Value Set Extensions and Extensible Bindings

Contact me



- Email: carol_graham@clinicalarchitecture.com
- LinkedIn: www.linkedin.com/in/caroldgraham/
- Twitter: [@CaroldGraham](https://twitter.com/CaroldGraham)



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