Achieving Interoperability and Safe Exchange of Health Information/Records - How Meaningful Use Stage 2 (MU 2) Falls Short

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FIT(ness) for Primary Use: for clinical care, interventions and decision making

Source Health Information/Record is invariably:
- **Source of Truth and**
- **Anchor for Trusted Exchange**

- **Start at Point of Origination and continue to ultimate Point of Clinical Access/Use (Left to Right ➔)**
- **Show Fitness for Primary Use (Far Right Pair➔)**

Origination (source)	Retention - in source system	Transformation 1 from Source Internal Representation to Exchange Artifact	Transmittal	Exchange	Receipt	Transformation 2 from Exchange Artifact to Receiver Internal Representation	Retention - in Receiving System	Access/Use (IF FIT)	Claimed "Interoperability" via MU 2-required Exchange Artifacts: HL7 CCD, C-CDA documents, v2 or other messages	Old School - Reproduction of Original Manual/Paper Record via Fax or Photocopy
			MU 2 Required Exchange Artifact - Document/Message						FITNESS	FITNESS

KEY DEFINITIONS of "Interoperability"

➔	IEEE (1990)	(IEEE - Out of Scope)			(IEEE - Out of Scope)		
➔	Health Level Seven (HL7) "Coming to Terms" - analysis of "interoperability" definitions from ~100 sources - US and international (2007)	(Clinical) **Process**	(EHR Record Management) **Process**	**Exchange**	(Record Management) **Process**	(Clinical) **Use** (IF FIT)	

HEALTH INFORMATION/RECORD FLOW - Source to Clinical User - via Health Information/Record Exchange

	Information is…	Originated	At Rest	In Motion	At Rest	Accessed/Used (IF FIT)
	Information Flow…	➔	➔	➔	➔	➔

Typical "Interoperability" Scenario:
1) **Clinical Action Taken - by one or more clinical Actor(s); then**
2) **Action documented/recorded in EHR Record Entry - in source EHR System - by one or more Author(s); then later**
3) **Source content (data) exchanged with other authorized system(s), typically requiring double transformation from Source to MU 2-required Exchange Artifact (document/message) to Receiver; then**
4) **Source content (data) (or it's transformed alternative?) accessed/used for Clinical Care, Interventions and Decision Making - primary data uses - by one or more clinical Actor(s).**

What	Action Taken - e.g., Registration/Admission, Vital Signs, History and Physical, Assessment, Progress Note, Care Plan, Order, Result, Observation, Patient Summary, Medication Reconciliation…	[Action ID]	*Without Modification* ➔		[Action ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Action ID]	Caution	N/A
ACTION RELATED DOCUMENTATION - Provenance, Metadata							
Who	Patient - Subject of Care	[Patient ID]	*Without Modification* ➔		[Patient ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Patient ID]	Caution	N/A
	Organizational Provider	[Provider ID]	*Without Modification* ➔		[Provider ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Provider ID]	Caution	N/A
	Individual Provider(s)	[Individual Provider ID]	*Without Modification* ➔		[Individual Provider ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Individual Provider ID]	Caution	N/A
	Provider(s) Clinical Credentials in terms of Action Taken - e.g., MD, RN…	[Provider Clinical Credentials]	*Without Modification* ➔		[Provider Clinical Credentials]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Provider Clinical Credentials]	Caution	N/A
	Provider(s) Role in Action Taken - e.g., admitting/attending, nurse, therapist…	[Provider Role]	*Without Modification* ➔		[Provider Role]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Provider Role]	Caution	N/A
	Provider(s) Participation in Action Taken - Perform, Assist, Observe	[Provider Participation]	*Without Modification* ➔		[Provider Participation]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Provider Participation]	Caution	N/A
	Author(s), Originator(s) of Record Entry(ies) for Action Taken	[Individual Entry Author ID]	*Without Modification* ➔		[Individual Entry Author ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Individual Entry Author ID]	Caution	N/A
	Originating System	[Originating System ID]	*Without Modification* ➔		[Originating System ID]	100%	N/A
			Transform 1 ➔	Transform 2	[Alternate System ID]	Caution	N/A
When	Date/Time/Duration of Action Taken	[Action Date/Time/Duration]	*Without Modification* ➔		[Action Date/Time/Duration]	100%	100%
	Date/Time of Corresponding Record Entry(ies)	[Entry Date/Time]	*Without Modification* ➔		[Entry Date/Time]	100%	100%
Where	Physical Location where Action Taken	[Action Physical Location ID]	*Without Modification* ➔		[Action Physical Location ID]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Physical Location ID]	Caution	N/A
	Device ID and/or Network Address where Record Entry(ies) Created or Amended	[Entry Device ID/Network Address]	*Without Modification* ➔		[Entry Device ID/Network Address]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Device ID/Network Address]	Caution	N/A
Why	Rationale(s) for Action Taken	[Action Rationale(s)]	*Without Modification* ➔		[Action Rationale(s)]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Action Rationale(s)]	Caution	N/A
	Purpose(s) of Data Capture	[Data Purpose(s)]	*Without Modification* ➔		[Data Purpose(s)]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Data Purpose(s)]	Caution	N/A
ACTION RELATED DOCUMENTATION - Evidence/Assurance of…							
	Author's Signature - e.g., digital signature encapsulated with source content	[Signature Bound to Content]	*Without Modification* ➔		[Signature Bound to Content]	100%	100%
			<Out of scope for MU 2; also, invalid if signature/content binding transformed>			0%	N/A
	Attestation for: • Accuracy • Completeness	[Signature Bound to Content]	*Without Modification* ➔		[Signature Bound to Content]	100%	100%
			<Out of scope for MU 2; also, invalid if signature/content binding transformed>			0%	N/A
	Indelibility, Non-Alteration, Fidelity to Source	[Signature Bound to Content]	*Without Modification* ➔		[Signature Bound to Content]	100%	100%
			<Out of scope for MU 2; also, invalid if signature/content binding transformed>			0%	N/A
	Reference Pointer to Source Record Entry	[Reference Pointer]	*Without Modification* ➔		[Reference Pointer]	100%	N/A
ACTION RELATED DOCUMENTATION - Clinical Data and Context - Facts, Findings and Observations							
	Clinical Facts, Findings and Observations pertinent to Action Taken	[Clinical Data Items(s)]	*Without Modification* ➔		[Clinical Data Items(s)]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Clinical Data Items(s)]	Caution	N/A
	• Discrete data items w/structured content	[Structured Content]	*Without Modification* ➔		[Structured Content]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate [un-]Structured Content]	Caution	N/A
	• Discrete data items w/unstructured content	[Unstructured Content]	*Without Modification* ➔		[Unstructured Content]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate [un-]Structured Content]	Caution	N/A
	• Item Unit of Measure, e.g., lbs, kg, in, cm	[Unit of Measure]	*Without Modification* ➔		[Unit of Measure]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Unit of Measure]	Caution	N/A
	• Item Format, i.e., Data Type	[Data Type]	*Without Modification* ➔		[Data Type]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Data Type]	Caution	N/A
	• Item Value	[Value(s)] from Standard Value Set(s)	*Without Modification* ➔		[Value(s)]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Value(s)] from Alternate Value Set(s)	Caution	N/A
	• Item Coding, Classification	[Code(s)] from Standard Vocab/Terminology System(s) - e.g., SNOMED, LOINC, ICD, CPT	*Without Modification* ➔		[Code(s)]	100%	100%
			Transform 1 ➔	Transform 2	[Alternate Code(s)] from Alternate Vocab/Terminology System(s)	Caution	N/A

RECOMMENDATIONS for IMMEDIATE IMPLEMENTATION - Both Preferred - Minimally addressing "Yellow" Zone Issues

1) At each point of exchange, original/source data item content is carried alongside transformed data item content. (Source and transformed data item content are both evident to each ultimate clinical user.)
2) At each point of transformation pre or post exchange, transformed data item content is marked/tagged as such. (Transformed from source data item content is evident to each ultimate clinical user.)

KEY - Fitness for Primary Use - for clinical care, interventions and decision making

100%	FULL ASSURANCE: Health information/records accessed/used for primary clinical purposes are assured true to source health information/records, fully supporting the integrity of clinical practice and all aspects of patient health and safety.
Caution	VALIDITY UNCERTAIN or AT RISK!! USE WITH EXTREME CAUTION!! Health information/records accessed/used after double transformation from source health information/records may be found: • Mismatched, e.g., source content incorrectly matched, including Patient or Provider identity; structured content mapped to/from unstructured content; disjoint data types; source codes/values mapped one to many • Incomplete or missing, e.g., no target data item or source content/context not fully represented when transformed twice: • to exchange artifact (standard message/document) • to receiver internal representation • Less Precise, e.g., source codes/values mapped many to one • Skewed, as the effect of double transformation: 1 off + 1 off = 2 off
0%	Out of Scope for Meaningful Use Stage 2; also invalid if signature/content binding transformed from source; thus NO ASSURANCE as to: • author's signature • signature binding to content authored/amended • attestion for accuracy, completeness • indelibility, non-alteration
N/A	Not Applicable

References:
ISO/HL7 10781 EHR System Functional Model
ISO 21089 Trusted End-to-End Information Flows
Link for HL7 "Coming to Terms" Interoperability Analysis