Quick Reference Guide

Advanced FHIR terminology

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About this Quick Reference Guide

This Quick Reference Guide (QRG) summarises the key concepts, tables and reference information from the Advanced FHIR Terminology course. Use it to refresh your understanding during knowledge checks and the final case study, or as an ongoing reference while implementing FHIR terminology solutions.

Topic: FHIR Terminology in the Australian Healthcare Context

Essential Terminology Foundations

Core Principles:

- Concept Permanence (Code Immutability): Once a code is assigned, its meaning never changes. Updates use versioning. Example: SNOMED CT-AU code 38341003 always means "Hypertension".
- Concept Hierarchies: Terminologies organise concepts in parent-child relationships (is-a, part-of). Example: In AMT, "amoxicillin 500 mg capsule" IS-A "penicillin".
- Clinical Terminology vs Classification Systems: Terminologies provide clinical precision; classifications enable administrative grouping.

Comparing Terminology and Classification

The following table compares clinical terminology (SNOMED CT-AU) with classification systems (ICD-10-AM) using Type 2 diabetes with renal complications as an example.

SNOMED CT-AU (Terminology)	**ICD-10-AM (Classification)**	**Attribute**	**SNOMED CT-AU (Terminology)**
Clinical care, My Health Record	Hospital funding (ABF), statistics	Purpose	Clinical care, My Health Record
350,000+ concepts	~14,000 codes	Number of codes	350,000+ concepts
Clinicians, clinical systems	Health information managers, IHPA	Primary users	Clinicians, clinical systems
"Type 2 diabetes mellitus with diabetic nephropathy"	E11.2 "Type 2 diabetes with renal complications"	Example code	"Type 2 diabetes mellitus with diabetic nephropathy"

The Australian Digital Health Ecosystem

Key organisations and their roles in Australia's terminology infrastructure are summarised below.

Organisation	Role	Key Resource
Australian Digital Health Agency (the Agency)	Owns the National Clinical Terminology Service (NCTS), responsible for digital health in Australia	NCTS – free Ontoserver licensing, monthly SNOMED CT-AU/LOINC updates
CSIRO (Australian e-Health Research Centre)	Develops and maintains Ontoserver; operates NCTS on behalf of the Agency; leads Sparked	Ontoserver – FHIR-native terminology server
HL7 Australia	Develops and maintains AU Base and AU Core implementation guides	AU Base, AU Core profiles
IHACPA	Manages ICD-10-AM for hospital funding and Activity Based Funding (ABF)	ICD-10-AM (current AU standard for hospitals)
AIHW	National health statistics agency; publishes code systems and value sets	Meteor portal (meteor.aihw.gov.au)

Key Australian Terminologies

The table below summarises the primary terminologies used in Australian FHIR implementations and their appropriate use cases.

Terminology	Type	Primary Use in FHIR	Key Notes
SNOMED CT-AU (incl. AMT)	Clinical terminology	Condition.code, Procedure, Observation, MedicationRequest (AMT for medications)	Polyhierarchy; 350,000+ concepts; monthly updates; AMT integrated component
LOINC	Clinical terminology	Observation.code for lab tests and vital signs	6-axis multi-dimensional structure; primary pathology terminology in AU
UCUM	Units of measure	Quantity data type — lab results, vital signs, medication doses	PATIENT SAFETY CRITICAL: always use for measurement units (e.g., mmol/L, mg, mL)
ICD-10-AM	Classification system	Dual coding in Condition for billing/ABF (alongside	Groups ~14,000 codes; NOT for clinical detail; NOS codes

		SNOMED CT-AU)	change with versions — always preserve version
ICD-11 (future)	Classification system	Not yet mandated in Australia; IHACPA evaluating timeline	WHO released 2022; FHIR ConceptMaps support gradual transition via dual coding
PBS Item Codes	Supporting / billing	PBS claim processing, billing/reimbursement only	NOT for medication coding — use AMT instead
AIR Vaccine Codes	Supporting / clinical	Immunisation resources	Australia-specific vaccine products
DVA	Identifiers	Patient entitlement, AU Base profiles	Patient identifiers, not clinical codes

AU Base and AU Core

Code Systems and ValueSets provide the vocabulary (lists of codes). AU Base and AU Core are Implementation Guides that define how data should be structured, which terminologies to use and how strictly.

- AU Base: Foundational Australian profiles, extensions and terminology bindings (SNOMED CT-AU, AMT, AIR, PBS codes, Australian identifiers IHI, Medicare, DVA).
- AU Core: Builds on AU Base to define core conformance requirements (must-support elements, binding strengths, specific ValueSets). Example: AU Core Condition profile binds Condition.code to NCTS Clinical Condition ValueSet (extensible).

Typical binding patterns: Required (essential/safety-critical) → Preferred (common in AU) → Extensible (encouraged, flexibility allowed).

Topic: Terminology Artefacts and Principles

This topic covers the three key FHIR terminology resource types — CodeSystem, ValueSet and ConceptMap — and how they work together to enable interoperable coded data.

The Three Core Terminology Resources

CodeSystem, ValueSet and ConceptMap are the three foundational resource types that underpin FHIR terminology. Each serves a distinct purpose as described below.

Resource	Analogy	Purpose	Example
CodeSystem	The Dictionary	Defines a collection of codes and their meanings. Contains all possible codes	SNOMED CT-AU, LOINC, local hospital

		in a terminology, including definitions, display text, synonyms and properties.	codes
ValueSet	The Selection	Specifies which codes from one or more CodeSystems are appropriate for a particular use. Composed using include/exclude rules.	"Diabetes Conditions" ValueSet selecting ~120 relevant codes from SNOMED CT-AU
ConceptMap	The Translation	Provides mappings between codes in different systems. Defines equivalence between concepts. Enables interoperability between systems using different terminologies.	SNOMED CT-AU to ICD-10-AM mappings

CodeSystem Key Elements

The five essential elements of a CodeSystem resource are described in the table below.

Element	**Purpose**	**Example**
url (Canonical ID)	Permanent, unique identifier NEVER changes	http://snomed.info/sct
version	Specific release — critical for reproducibility	http://snomed.info/sct/32506021000036107/version/20241031 (October 2024 SNOMED CT-AU release)
status	Lifecycle state	active | draft | retired | unknown
content	Completeness of this resource	complete | fragment | not-present
concept	The actual code definitions	code: "44054006", display: "Type 2 diabetes mellitus", definition, properties

ValueSet Composition Strategies

There are three main strategies for composing ValueSets. The table below compares each approach to help you choose the right one for your use case.

Strategy	When to Use	Advantages	Considerations
1. Explicit Listing (List codes manually)	Codes unlikely to change; small stable set (5-10 codes); complete control needed	Complete control; obvious what's included	Must update manually; doesn't adapt to terminology updates; high maintenance for large sets
2. Hierarchical Rules (is-a filter)	Large sets of related codes; codes may be added over time; want automatic adaptation to updates	Efficient; maintainable; future-proof (new subtypes auto-included); mirrors clinical thinking RECOMMENDED approach	May include unwanted codes (use exclusions); less obvious what's included (use $expand to check); versioning decision required
3. Hierarchical Rules + Exclusions	Start with hierarchical inclusion but need to remove specific codes for business reasons	Documents business logic; automatically includes NEW types; maintainable with clear intent	Requires governance of exclusion list

ConceptMap Equivalence Types

When mapping between terminologies, the equivalence value indicates how well concepts align. Choose the correct equivalence type to communicate information loss accurately.

Equivalence	Meaning	Safe for Auto-Translation?	Example
equivalent	Same meaning — safe to substitute	Yes	SNOMED CT "Type 2 DM" ↔ Local code "Type 2 DM"
narrower	Target is MORE specific (gains information)	Yes	ICD "Diabetes mellitus" → SNOMED CT "Type 2 diabetes mellitus"
wider	Target is BROADER (loses information) — MOST COMMON	Caution	SNOMED CT "Type 2 DM with diabetic nephropathy" → ICD-10-AM E11.2 (specific nephropathy detail lost)
relatedto	Associated but not hierarchical	No — needs review	Diagnosis "Appendicitis" → Procedure "Appendectomy"
inexact	Approximate match	No — needs manual verification	Similar concepts but not identical
unmatched	No equivalent exists in target system	No	Source-only concept with no target equivalent

Key Message: Multiple SNOMED CT codes may map to the SAME ICD-10-AM code — this is expected and normal. The clinical system retains the detailed code; billing uses the broader classification.

Binding Strength

Binding strength determines how strictly a ValueSet must be followed. Match strength to consequences — safety-critical fields require Required binding.

Binding Strength	Requirement	When to Use
Required	Must use codes from the specified ValueSet — no extensions allowed	Safety-critical fields where any code outside the set is invalid (e.g., administrative gender codes, observation status)
Extensible	Should use the ValueSet; only	Most clinical fields in AU Core — encourages

	use other codes if no suitable match exists	standard codes while allowing local extensions when needed
Preferred	Recommended to use the ValueSet but not enforced	Fields where a standard exists but implementation flexibility is needed
Example	Provides a starting example only; not required or preferred	Guidance purposes; rarely used in production profiles

FHIR Data Types for Coded Data

Four FHIR data types carry coded data. Understanding which to use prevents implementation errors.

Data Type	Use For	Key Properties	Example
code	Simple single code from a required binding; no system needed (implied by context)	Just the code string	Observation.status: "final"
Coding	Single code with explicit system reference	system, version, code, display, userSelected	{ system: "http://snomed.info/sct", code: "44054006", display: "Type 2 diabetes mellitus" }
CodeableConcept	One or more codings from different systems + optional text (enables dual coding)	coding[] array + text	Condition.code holding both SNOMED CT-AU and ICD-10-AM codes
Quantity	Measurements with standardised UCUM units — PATIENT SAFETY CRITICAL	value, unit, system (UCUM URL), code	{ value: 6.1, unit: "mmol/L", system: "http://unitsofmeasure.org", code: "mmol/L" }

Topic: Supporting Coded Data Across FHIR Resources

This topic explains how terminology resources ensure semantic consistency across FHIR's clinical resources and profiles, enabling interoperability, clinical decision support and data analytics.

Coded Fields in Key FHIR Resources

The following table identifies the key coded fields in commonly used FHIR resources, the recommended terminologies and the data types used.

FHIR Resource	Key Coded Field(s)	Recommended Terminology	Data Type
Condition	code	SNOMED CT-AU (clinical detail) + ICD-10-AM (billing) — dual coding	CodeableConcept
Observation	code (what was measured)	LOINC for lab tests and vital signs	CodeableConcept
Observation	value[x] for measurements	UCUM for units in Quantity	Quantity (with UCUM units)
MedicationRequest / MedicationStatement	medication[x] or medicationCodeableConcept	AMT (part of SNOMED CT-AU) for medication products	CodeableConcept
Procedure	code	SNOMED CT-AU procedures + Medicare MBS item numbers (dual coding)	CodeableConcept
AllergyIntolerance	code (substance)	SNOMED CT-AU; AMT for medication substances	CodeableConcept
Patient	gender	AdministrativeGender ValueSet (required binding)	code

Dual Coding — Australian Best Practice

Australian implementations typically include both a clinical terminology code and an administrative classification code in the same CodeableConcept. This gives you clinical specificity for patient care and the codes required for billing and reporting in a single FHIR field.

- Clinical detail: SNOMED CT-AU code 127013003 "Type 2 diabetes mellitus with diabetic nephropathy"

- Billing/reporting: ICD-10-AM code E11.2 "Type 2 diabetes with renal complications"
- Similarly: AMT codes + PBS item codes for medications; SNOMED CT-AU + MBS item numbers for procedures.

Key Message: Both codes sit inside the same CodeableConcept. Systems extract the code relevant to their purpose — clinical systems use SNOMED CT-AU; billing systems use ICD-10-AM.

FHIR Profiles and Terminology Binding

FHIR profiles (like AU Base and AU Core) constrain FHIR resources for specific use cases. They specify exactly which ValueSets to use, the binding strength and any Australian-specific extensions.

The table below shows examples of terminology binding in AU Core profiles.

Profile	Element	ValueSet / Terminology	Binding Strength
AU Core Condition	Condition.code	NCTS Clinical Condition ValueSet (SNOMED CT-AU)	Extensible
AU Core Observation	Observation.code	LOINC (laboratory and vital signs)	Preferred / Extensible
AU Core MedicationRequest	medication.code	AMT (Australian Medicines Terminology)	Preferred
AU Base Patient	Patient.indigenous-status (extension)	Australian Indigenous Status ValueSet	Required
AU Base Patient	Patient.gender-identity (extension)	Australian Pronouns ValueSet	Required

Topic: Implementing Coded Data and Terminology Operations

This topic provides practical guidance on the four core FHIR terminology operations, implementation decisions about coding strategies and common pitfalls to avoid.

The Four Core FHIR Terminology Operations

These four operations handle approximately 95% of terminology tasks. The table below summarises each operation, when to use it and a practical example.

Operation	Question It Answers	When to Use	Example Use Case
$expand	What codes are in this ValueSet?	Populating UI dropdowns or pick lists; type-ahead/autocomplete search; testing ValueSets	User types "diab" → server returns diabetes codes from the ValueSet for the dropdown
$validate-code	Is this code valid for this purpose?	Validating data received from external systems; real-time checking of codes against a ValueSet	Referral arrives with a condition code → validate it belongs to the expected ValueSet
$translate	What's the equivalent code in another system?	Dual coding (SNOMED CT-AU → ICD-10-AM for billing); legacy system integration; international exchange	Clinician enters SNOMED CT code → system automatically generates ICD-10-AM code for billing
$lookup	What does this code mean?	Displaying code information and definitions to users; understanding hierarchy relationships	User hovers over a code → pop-up shows full definition, synonyms and parent concepts

Additional Operations (Advanced)

- $subsumes — Tests hierarchical relationships. "Is code X a type of code Y?" Use case: allergy checking — is this medication a type of penicillin?
- $closure — Generates a mini-hierarchy for a set of codes. Returns relationships between codes. Use case: advanced CDR integration for sophisticated queries.

Implementation Decisions: Coding Strategy Comparison

One of the most consequential implementation decisions is how you handle terminology. The table below compares the three main approaches.

Approach	Best For	Main Advantages	Main Challenges
Native standard codes (RECOMMENDED)	New systems; CDS priority; long-term sustainability	No information loss; immediate interoperability; CDS works immediately; lower long-term cost; better data quality	May require user training; initial setup effort; legacy data may need conversion
Local/Proprietary	Legacy	Familiar to existing users;	Ongoing maintenance is

codes with mapping	constraints; vendor limitations; existing systems that can't change	faster initial implementation; legacy system compatibility	expensive; inevitable information loss; version management complexity; delayed interoperability
Hybrid ValueSets (Alternative)	Coverage gaps in standard terminologies; maximise standard use	Combines standard + local codes; boosts standard codes in search; all codes available	More complex to maintain; still requires some local code governance; mixed code sources

Key Message: Use standard codes from the point of data entry whenever possible. Mapping is always costly — only map when truly necessary and budget for ongoing maintenance.

Common Implementation Mistakes to Avoid

- Not planning for versioning — creates expensive data quality issues later.
- Using local codes instead of standards — creates ongoing mapping burden.
- Using shortlists instead of full ValueSets — introduces data bias.
- Building your own terminology server instead of using Ontoserver (free in Australia via NCTS).
- Deploying multiple terminology server instances — causes version drift and inconsistent results.
- Using context-insensitive caching — cache decisions must account for user context (e.g., specialty, location).

Topic: FHIR Terminology Services — Capabilities and Usage Scenarios

This topic provides the big picture of how FHIR terminology servers bring it all together — their capabilities, common usage scenarios and Australian implementation best practices.

What is a FHIR Terminology Service?

A FHIR terminology service is a server that hosts terminology content (CodeSystems, ValueSets, ConceptMaps), implements FHIR terminology operations ($expand, $validate-code, $translate, $lookup), manages terminology versions and provides a standardised API for terminology functions.

Think of it as: A specialised service that handles all the complexity of terminologies so your applications don't have to.

Common Usage Scenarios

The table below maps common clinical and technical use cases to the FHIR terminology operations that support them.

Usage Scenario	Operations Used	Example
Data entry and UI support (pick lists, autocomplete)	$expand	GP types "hyper" → dropdown shows hypertension codes from validated AU Core ValueSet
Data validation on receipt	$validate-code	Lab system receives LOINC code from external lab → validate it's in the expected lab results ValueSet
Dual coding for billing	$translate	Clinician enters SNOMED CT-AU diagnosis → system auto-generates ICD-10-AM code for ABF billing
Clinical decision support	$expand, $validate-code, $subsumes	System identifies all patients with any type of diabetes using hierarchical SNOMED CT-AU query
Allergy checking	$subsumes	Patient allergic to penicillin → system checks if prescribed medication IS-A penicillin derivative
Analytics and cohort identification	$expand + hierarchical queries	Find all patients with COPD (and all subtypes) overdue for review
Code display and exploration	$lookup	User hovers over clinical code → system displays full SNOMED CT definition and synonyms
Terminology authoring	ValueSet $validate-code, $expand	Validate locally authored ValueSet contains expected codes before publishing