BRITISH COLUMBIA | Ministry of Health

British Columbia

Health Information Standards

Drug Data Model Guidance

Version 2.3

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Comments:

Questions, feedback and/or requests for new concepts or synonyms related to this standard can be directed at:

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1.0 Acknowledgements

The Conformance, Integration and Standards (CIS) in the Connected Services Division, B.C. Ministry of Health, gratefully acknowledges the individuals and organizations whose expertise and collaboration made this document possible.

1.1. Territorial Acknowledgement

We respectfully acknowledge that this standard was researched, drafted, and refined in Victoria, B.C on the territories of the Coast Salish peoples, whose deep connections with this land continue to this day in this land we call British Columbia.

We also gratefully acknowledge the contributions of the following clinical advisors to this standard:

1.2. Clinical & Informatics Advisors

- William Clifford OBC, BMedSci, MScF, MD, FCFP
- Taryn Drlik, RPh, CTSS, Clinical Lead PharmaNet, Pharmaceutical Systems

2.0 Introduction

The BC Drug Data Model defines a standardized, interoperable framework for representing medications across prescribing, dispensing, administration, and clinical decision support workflows. Its purpose is to promote **safe medication use**, **clear and unambiguous communication of clinical intent**, and **consistent system behavior** across health information systems.

The Standard applies to electronic prescribing systems, pharmacy dispensing systems, medication administration records, and medication history, analytics, and clinical decision support solutions. It is designed to be jurisdiction-neutral while supporting alignment with British Columbia's Provincial Prescription Management (PPM) electronic prescribing program and Canadian Medicines Terminology (CMT) health information standards.

By clearly distinguishing between **what a drug is**, **how it is supplied**, **how it is administered**, and **why it is prescribed**, the model ensures that each concept is represented at an appropriate level of abstraction. Within electronic prescribing systems, it supports dose-based prescribing by providing the structure and safeguards necessary to reduce ambiguity and improve clarity for prescribers and pharmacists.

Through this Standard and accompanying guidance, the model establishes a consistent, structured approach to medication representation that strengthens interoperability, safety, and clinical effectiveness across digital health systems.

The BC Drug Data Model provides a structured foundation to address issues related to drug order(s) and their relationships.

2.1. Target Audience

The intended audience for this document is developers, technical staff, and clinicians involved in application design, development, and integration of point-of-service (POS) systems connecting with the Ministry PharmaNet (PNET) system and Health Authority clinical repositories.

2.2. Background

Drug orders are legal and clinical instructions to administer a medication to a patient. Electronic prescribing systems must represent these instructions in a way that is **unambiguous, safe, and interoperable**, while supporting established clinical workflows involving prescribers, pharmacists, and other administering clinicians (e.g., nurses).

Historically, community prescribing has followed a paper-based approach that varies widely in completeness and structure. When replicated directly in electronic systems, this variability can undermine safety and efficiency.

To address medication management challenges caused by fragmented, ambiguous, or incomplete drug-related information across healthcare systems (e.g., electronic medical records, laboratories, pharmacies, outpatient clinics, hospitals, long-term care facilities, central repositories), the BC Drug Data Model builds on foundational ontologies like the Prescription Drug Ontology (PDRO), to address key issues including:

- Missing prescription details (e.g., indication, duration)
- Ambiguity in drug names or dosage instructions
- Poor interoperability across systems (EMRs, CIS, pharmacies, EHRs)
- Lack of visibility into patient behavior outside clinical settings

By providing a semantic model (ontology) approach that enables integration of heterogeneous data sources, removal of ambiguity through precise definitions, and logical reasoning over drug-related processes, the BC Drug Data model uses information entities (e.g., prescriptions, drugs) and the relationships between them (e.g., administration, dispensing) to enable a clear interpretation of the data and accurate lifecycle of drug prescriptions, from intent to administration, by structuring relevant entities and processes.

Example:

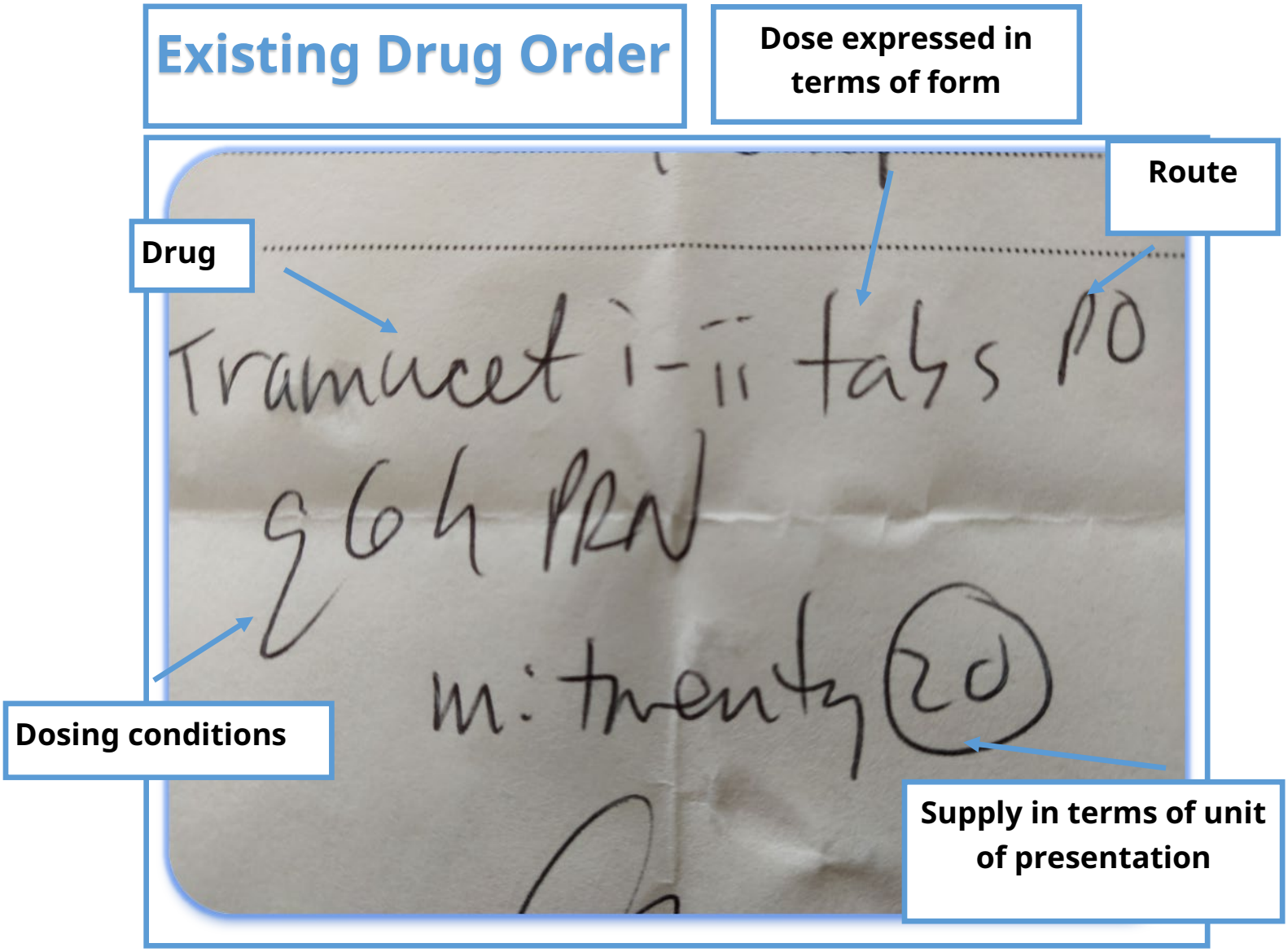

Figure 1

Below are the Brand Name equivalents available for dispensing, based on the therapeutic name of the prescription information provided:

Drug Name (TM)	Brand Name equivalents (MP) Details
TRAMADOL	• Acetaminophen 325 mg + Tramadol Hydrochloride 37.5 mg oral tablet • Acetaminophen 325 mg + Tramadol Hydrochloride 37.5 mg oral tablet • Acetaminophen 325 mg + Tramadol Hydrochloride 37.5 mg oral tablet • Act Tramadol/Acet • Apo-Tramadol/Acet • Auro-Tramadol/Acetaminophen • Ipg-Tramadol/Acet • JAMP-Acet-Tramadol • Lupin-Tramadol/Acet • Mar-Tramadol/Acet • Mint-Tramadol/Acet • Mylan-Tramadol/Acet • Pat-Tramadol/Acet • PMS-Tramadol-Acet • Priva-Tramadol/Acet • PRZ-Tramadol/Acet Acetaminophen 325 mg + Tramadol Hydrochloride 37.5 mg oral tablet • Riva-Tramadol/Acet • Taro-Tramadol/Acet • Teva-Tramadol/Acetaminophen • Tramacet • Tramadol/Acet • Tramadol/Acetaminophen • Tramadol-Acet • Tramaphen-Odan

3.0 Normative Design Principles

The following principles govern the design and implementation of the BC Drug Data Model:

Principle	Details
1) Separation of Intended Therapeutic Intervention and Product Selection	• Systems SHOULD distinguish between what is prescribed (therapeutic intervention) and what is dispensed (manufactured product).
2) Appropriate Levels of Abstraction	• Drug information SHOULD be represented at the lowest level necessary to convey intent, and no lower.
3) Safety First Representation	• All data elements SHOULD support unambiguous interpretation by prescribers, dispensers, administrators, and systems.
4) Standards Alignment	• Terminology and value sets SHOULD align with recognized Canadian and international standards to maximize interoperability and longevity.

By modeling medications at the appropriate level of abstraction and aligning with Canadian and international standards, the model supports both clinician workflow and system-level safety, analytics, and interoperability.

This drug data model enables:

- Clear separation of therapeutic intervention, clinical abstraction, and manufactured products
- Safe dose-based prescribing
- Flexible dispensing and administration
- Robust clinical decision support
- More efficient order management,
- Improved reporting at the practice and system level.
- High interoperability through standardized value sets

The implementation guide will also help vendors improve drug management within their applications with less ambiguity.

3.1. BC Drug Data Model Details

The BC Drug Data Model provides a structured representation of medications to support safe, interoperable, and flexible electronic prescribing, dispensing, administration, and clinical decision support. As described in Section 2.0, the drug model distinguishes between **what a drug is**, **how it is supplied**, **how it is administered**, and **why it is prescribed**, ensuring that each concept is represented at the appropriate level of abstraction.

The concepts related to a medication order, dispense, administration or documentation of historical administration, and their relationships, are sketched out in the BC Drug Data model below:

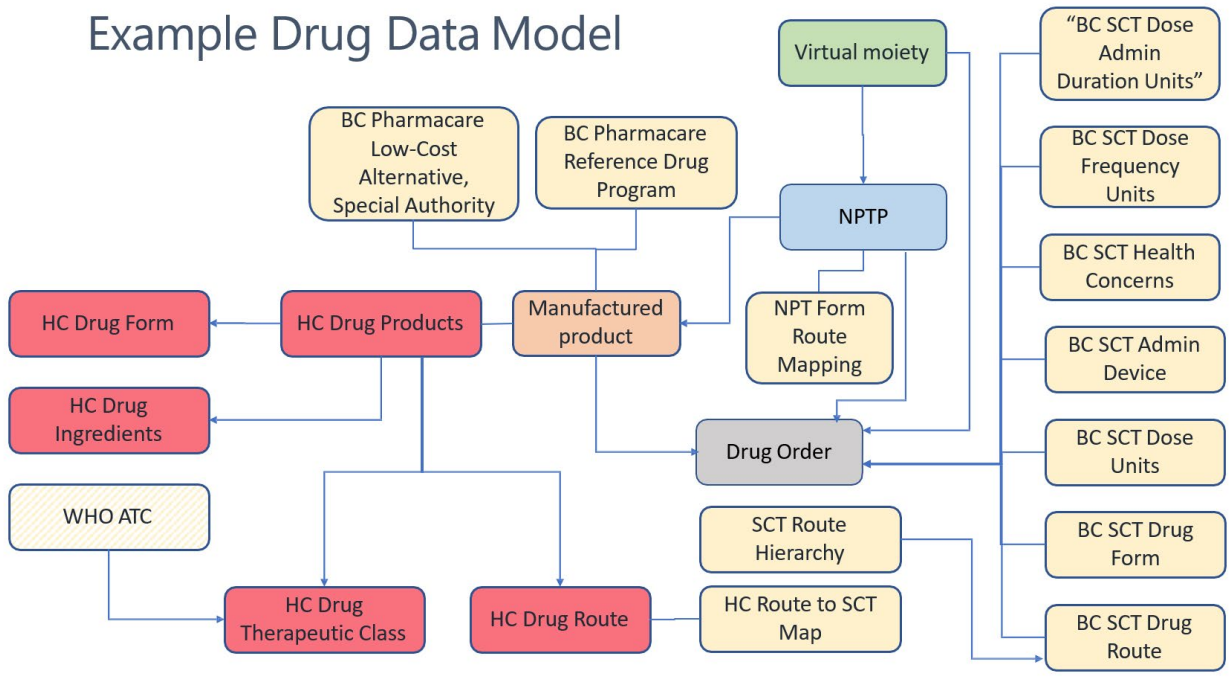

Figure 2

The BC Drug Data Model uses standards to reduce variability making it less confusing for mapping 'idiosyncratic' differences (e.g., caplet), allows unambiguous and safer pick lists for clinicians, better clinical decision support, and support for secondary uses such as medication profile management.

Drug products SHOULD be represented using a multi-level hierarchy, each serving a distinct clinical and operational purpose. As such, drug products are modeled at **three distinct** but related levels:

Level	Description
1) Manufactured Product (MP)	Represents a specific, branded item produced by a manufacturer. It precisely defines: • Active ingredient(s) • Strength • Dose form • Unit of presentation • Packaging and manufacturer attributes MPs are typically selected during dispensing, especially when product specific characteristics such as patient tolerance, packaging, stability, or availability are important.

Level	Description
2) Non-Proprietary Therapeutic Product (NTP)	(Sometimes referred to as a generic drug product[1] or a virtual drug product) is a brand independent, clinically oriented representation of a medication abstracted away from specific manufactured products. It includes: • Active ingredient(s) • Quantitative strength(s) • Dose form • Route of administration • Unit of presentation when possible[2] NTPs are the **preferred** level for prescribing, particularly when multiple manufactured products exist for the same ingredients, strength and form. This approach allows clinicians to express therapeutic intent while leaving final product selection to the pharmacist, considering availability, formularies, and benefit programs. Some NTP's, especially those intended for injection require specification of specific routes e.g., subcutaneous rather than intramuscular or intravenous.
3) Therapeutic Moiety (TM)	Represents the active substance(s) only, without reference to a specific product or excipients. It is considered "virtual" or "therapeutic" because it abstracts away manufacturing attributes. Clinicians often think in terms of TMs when prescribing single ingredient drugs (e.g., ramipril, pantoprazole). In settings such as acute care formularies, TMs are commonly used when product selection is intentionally deferred to the supplier or administering entity. Because TMs only specify ingredients without regard to strength, form or route, they do require specification of all those attributes to ensure safe and effective administration (e.g., liquid formulations for pediatric patients).

[1] A generic product is a manufactured product separately branded from an original licensed product and is technically not the same as non-proprietary product.
[2] A unit of presentation only exists when the drug dose can be administered by the entire contents of that specific container (e.g. tablet, capsule, actuation, unit dose syringe).

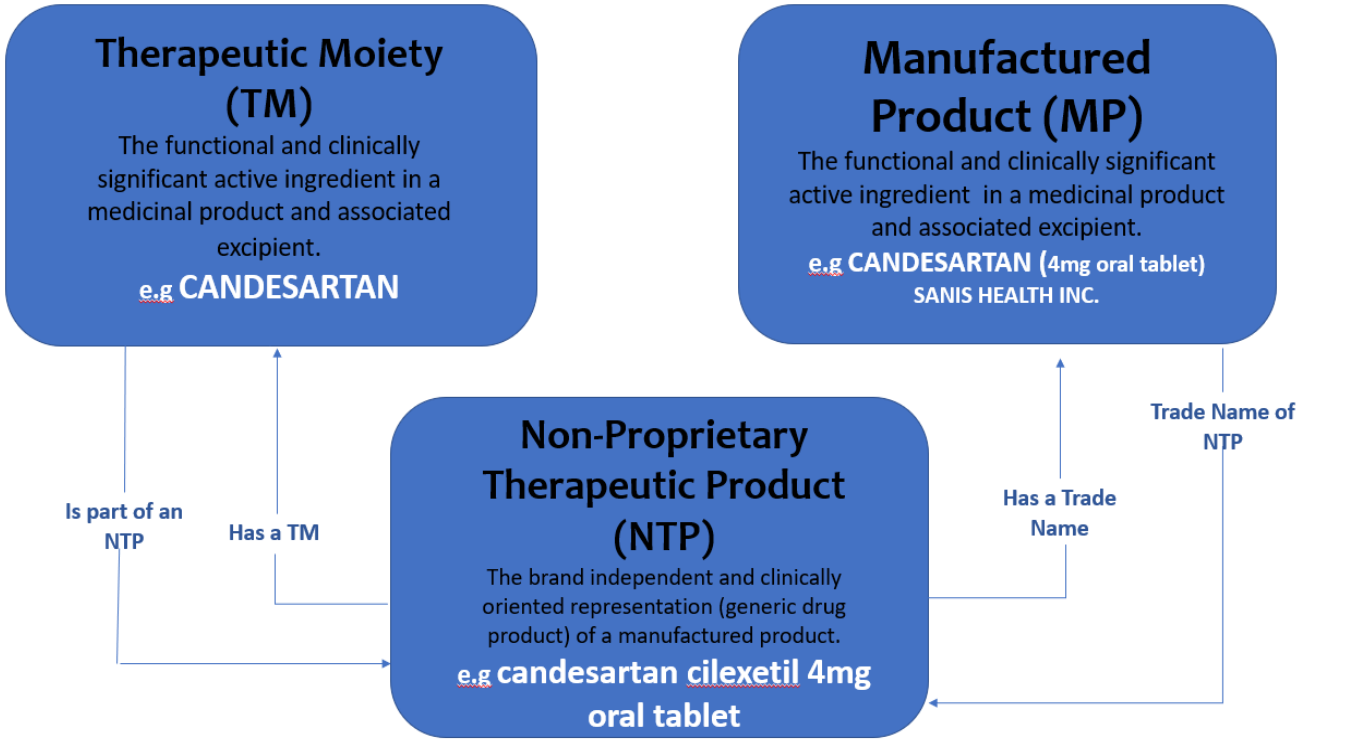

Figure 3

Relationship Between Drug Product, Form, and Route

Every drug product has:

- A defined **therapeutic moiety** (TM)
- A specific **form**
- One or more permissible **routes of administration**

The combination of TM, form and route constrains which products are clinically deliverable. As a result, prescribing and dispensing systems should support form and route specifications even when a prescriber does not select a specific manufactured product.

3.1.1. Medication Lifecycle Model

The BC Drug Data Model SHALL explicitly represents **end-to-end medication lifecycle** as a set of linked entities and processes:

Drug Order (MedicationRequest)

- Dispensing Interpretation
- Dispense Event (MedicationDispense)
- Drug Administration Course
    - Dose Administration Events (MedicationAdministration)
- Patient Medication Statement (OPTIONAL)

NOTE: This aligns the BC Drug Data Model with formal ontology-based representations of medication processes and ensures traceability across systems.

3.1.2. Drug Administration Course

Drug Administration Course
A logical entity representing the complete set of dose administration events intended or performed for a given drug order.

Requirements

- SHALL aggregate all MedicationAdministration events associated with a single MedicationRequest
- SHALL represent:
    - intended vs actual administration
    - adherence over time
- SHALL be uniquely identifiable

FHIR Alignment

- Represented via:
    - grouping identifier or CarePlan/MedicationUsage abstraction
    - MedicationRequest & MedicationAdministration instances

Note: This enables adherence calculation, comparison of prescribed vs actual therapy, and CDS reasoning over treatment completion.

3.2. Dose-Based Electronic Prescribing

Electronic prescribing is based on a **dose-based prescribing paradigm**, in which responsibilities are clearly divided:

- **Prescribers** specify the intended therapeutic intervention (e.g., a non-proprietary therapeutic product or virtual moiety to reduce blood pressure, remove infection, lower lipids).
- **Pharmacists** select and prepare the most appropriate manufactured product in the current context (e.g., availability, patient benefits etc.).
- **Drug administrators** deliver the medication according to instructions.

Under this model, the prescriber typically specifies:

- The **therapeutic moiety** (active ingredient) or non-proprietary therapeutic product
- The **dose**
- The specific **route of administration**
- The **frequency of administration**

This means that the prescriber may typically first select a drug name and then define a dose quantity (e.g., 500 mg), a route (e.g., oral) and a frequency (e.g., four times a day), commonly expressed on paper by its Latin abbreviation 'qds[3]' to produce:

Example:

- acetaminophen 500 mg – orally – four times daily

In electronic systems, combinations of drug name and route can be used to map to a **set of compatible products**. For many medications, dose, route, and frequency are sufficient to define an administratively equivalent set of products.

However, some prescriptions require additional detail to ensure the correct product is selected. In the example above, the prescriber may specify the form as an "oral liquid" if it is for a pediatric patient. The Drug Data Model supports this by allowing progressive refinement from TM → NTP → MP and their dose and administration attributes as needed.

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[3] U*se of abbreviated Latin forms in this example is intended to reflect existing paper-based practice, not as an example of best practice within electronic systems. See link for* Dangerous Abbreviations, Symbols, and Dose Designations

This structure maps directly to the BC Drug Data Model's emphasis on prescribing at the **Therapeutic Moiety (TM)** or **Non-Proprietary Therapeutic Product (NTP)** level rather than at the Manufactured Product (MP) level.

By modeling drug orders as a composition of product, dosing, supply, and indication specifications, electronic prescribing systems can fully realize the safety and efficiency benefits that paper-based prescribing cannot achieve.

When aligned with a structured Drug Data Model, electronic prescribing systems can:

- Support dose-based prescribing safely and consistently
- Separate therapeutic intent from product selection
- Reduce ambiguity and workflow risk
- Enable pharmacist judgment and flexibility in the context of available supply, drug benefit coverage and patient characteristics.
- Improve interoperability and clinical decision support

Electronic systems SHOULD support mapping between drug orders and sets of compatible products based on:

- Drug product abstraction
- Form
- Route
- Dose constraints

For many medications, these attributes are sufficient to define a safe equivalence set. When they are not, systems SHOULD support incremental refinement of the order without altering the original prescribing intent. For many drugs, selection of one component can limit further options, sometimes to only one. For example, a drug may only exist as an oral tablet so form and route can automatically be applied by the digital health system (DHS). A DHS may support "look ahead" filtering for reduced administrative burden in prescribing.

This standard defines the minimum requirements necessary to move beyond paper-based prescribing while preserving its legal foundations and improving patient safety.

3.2.1. Legal Nature of a Drug Order in B.C.

A prescription is legally defined as an **instruction to administer** a drug to a patient. In most cases, the prescriber's instruction is interpreted by a pharmacist, who selects:

- The appropriate dose form
- The appropriate strength
- The quantity and days of supply
- The final manufactured product

For this interpretation to be correct and safe, the drug order must clearly and precisely communicate the prescriber's intended therapeutic intervention.

Electronic systems SHOULD represent this instruction in a manner that allows unambiguous interpretation by downstream users and systems, particularly pharmacists and administering clinicians.

Because pharmacists are typically responsible for selecting the final manufactured product, drug orders SHOULD focus on communicating with intent rather than mandating a specific commercial product, unless clinically necessary.

3.2.2. Value Sets and Terminology Alignment

The Drug Data Model relies on controlled terminology and curated value sets for consistency and interoperability.

Systems SHOULD use standardized value sets for:

- Drug products (MP, NTP, TM)
- Dose forms
- Routes of administration
- Dose units, frequencies and intervals
- Clinical indications

Value sets SHOULD be:

- Centrally governed
- Versioned
- Aligned with national and international standards
- Reusable across EMR domains (e.g., prescribing, problems, referrals)

Most elements of the BC Drug Data Model rely on **standardized value sets**, supporting interoperability and consistency across systems:

- **Drug products** (MP, NTP, TM): Canadian Clinical Drug Dataset (CCDD) Drug Product Database (DPD) and Licensed Natural Health Product Database (LNHPD)
- **Therapeutic classification**: WHO Anatomical Therapeutic Chemical (ATC), linked with CCDD via the DPD.
- **Dose forms**: SNOMED CT form value sets
- **Routes of administration**: SNOMED CT route value sets, expanded for clinically appropriate specificity
- **Dose units, frequencies and intervals**: SNOMED CT and Unified Code for Units of Measure (UCUM)
- **Indications**: SNOMED CT findings value sets (e.g., BC Health Concerns Value Set (HCVS))

These value sets are aligned, where possible, with national and international standards to maximize durability and reuse across jurisdictions and health-IT systems.

3.2.3. Limitations of Paper Based and Naïve Electronic Models

Many electronic medical record (EMR) and electronic health record (EHR) systems have implemented drug ordering by mimicking paper processes. This often results in:

- Over-reliance on lists of manufactured products
- Limited clinical abstractions
- Increased cognitive burden on prescribers
- Suboptimal and potentially unsafe workflows

Such implementations fail to distinguish between therapeutic intent and product realization, a key principle addressed by the BC Drug Data Model.

Systems that directly replicate paper-based prescribing workflows particularly by presenting prescribers with undifferentiated lists of manufactured products fail to meet the objectives of this standard.

Such approaches:

- Obscure therapeutic intent
- Increase cognitive burden
- Introduce safety risks
- Undermine interoperability

Compliant systems SHOULD instead implement the structured abstractions and relationships defined by the BC Drug Data Model.

3.3. Governance and Conformance

This Drug Data Model is a **living standard**.

Governance bodies SHOULD:

- Oversee updates to value sets and terminology mappings
- Review changes for clinical safety and interoperability impact
- Ensure backward compatibility where feasible
- Provide clear versioning and implementation guidance

Governance authorities SHOULD maintain conformance criteria to ensure ongoing safety and interoperability.

Systems claiming conformance to this standard SHOULD:

- Implement prescribed abstractions (TM, NTP, MP)
- Enforce structured dosing, administration and supply specifications
- Support indication capture
- Align with governed value sets and terminology
- Preserve separation between the intended therapeutic intervention and product selection.
- Maintain traceable links between:
    - MedicationRequest → MedicationDispense
    - MedicationDispense → MedicationAdministration
    - MedicationAdministration → Drug Administration Course
- Preserve original prescribing intent across lifecycle transformations

3.4. Safety and Implementation Considerations

The model incorporates guidance and rules to promote safe medication use, including:

- Standardized numeric formatting (e.g., leading and trailing zeros) to reduce dosing errors
- Support for user interface design that aligns with PharmaNet interface standards
- Strategies for integrating third-party drug utilization and interaction checking tools

Where third-party systems providing clinical decision support require a Drug Identification Number (DIN), a representative manufactured product generated in the background may be used when prescribing at the NTP or TM level.

By representing medications at appropriate levels of abstraction and aligning with Canadian and international standards, the BC Drug Data Model supports clinician workflows while strengthening system-level safety, analytics, and interoperability. The model enables a clear separation between intended therapeutic intervention, clinical abstraction, and dispensed manufactured products, supporting **safe dose-based prescribing**, **flexible dispensing and administration**, and **robust clinical decision support**.

Systems SHALL distinguish:

Concept	Description
Prescribing Intent	MedicationRequest
Dispensing Interpretation	Pharmacist-applied logic BEFORE dispensing
Dispensing Execution	MedicationDispense
Administration Execution	MedicationAdministration

Note: This prevents incorrect inference of clinical intent from downstream data.

Through BC Pharmaceutical standardized value sets, the model improves order management efficiency, enhances reporting at both practice and system levels, and promotes high interoperability across health information systems. These value sets and associated code systems serve as a single source of truth for medication standardization, including codes, strength, form, route, unit of presentation, DIN, ATC classifications, regulatory flags, and manufacturer information, all of which are mapped directly to HL7 FHIR elements.

Together, the Standard and implementation guidance support vendors in delivering clearer, less ambiguous medication management within their applications while enabling consistent, safe, and interoperable use of medication data across clinical and technical domains.

3.4.1. Dispensing Interpretation Layer

Dispensing Interpretation
A representation of pharmacist decision-making applied to a drug order prior to dispensing.

SHALL include:

- substitution decision (generic vs brand)
- dose adaptation
- packaging decisions
- regulatory compliance logic

FHIR Implementation

- Extension on MedicationDispense OR
- Separate intermediary resource (recommended for advanced systems)

SHALL NOT:

- overwrite original MedicationRequest
- be conflated with actual dispensing record

3.5. Structured Composition of a Drug Order

A compliant drug order SHOULD be represented as a structured composition of the following elements:

- 1) **Drug Product Specification** (TM, NTP, or MP)
- 2) **Drug Dosing Specification**
- 3) **Drug Supply Specification**
- 4) **Drug Order Restrictions** (e.g., do not substitute)
- 5) **Drug Order Repeat Specification**
- 6) **Indication**
- 7) **Drug Course Specification**

Together, these elements constitute a complete, legally and clinically interpretable drug order. The concepts related to a drug order and their relationships are identified in the BC Drug Data Model ontology.

Guidance:

Every medication instance SHALL be logically constrained by:

- A therapeutic moiety
- A clinically appropriate form
- One or more permissible routes of administration

Systems SHALL ensure that:

- Only valid form-route combinations are selectable.
- Route specificity may be greater than that provided by product labeling where clinically appropriate.
- Pediatric, geriatric, and special-population considerations are supported through form selection (e.g., suspension vs. tablet).

3.5.1. Drug Product Specification (TM, NTP, or MP)

Drug products SHOULD be represented using a three-level hierarchy, each serving a distinct clinical and operational purpose.

A drug may be specified in an order at different levels of abstraction:

- As a **Manufactured Product (MP)** (brand-specific)
- As a **Non-Proprietary Therapeutic Product (NTP)** (strength, formand when appropriate, unit of presentation specific)
- As a **Therapeutic Moiety (TM)** (ingredient only)

Prescribers typically prefer to order at the **NTP or TM level**, particularly when:

- Multiple manufactured products are equivalent
- Formulary or benefit considerations apply
- Pharmacist judgment is desired or needed

Drug products as defined by the BC Drug Data Model:

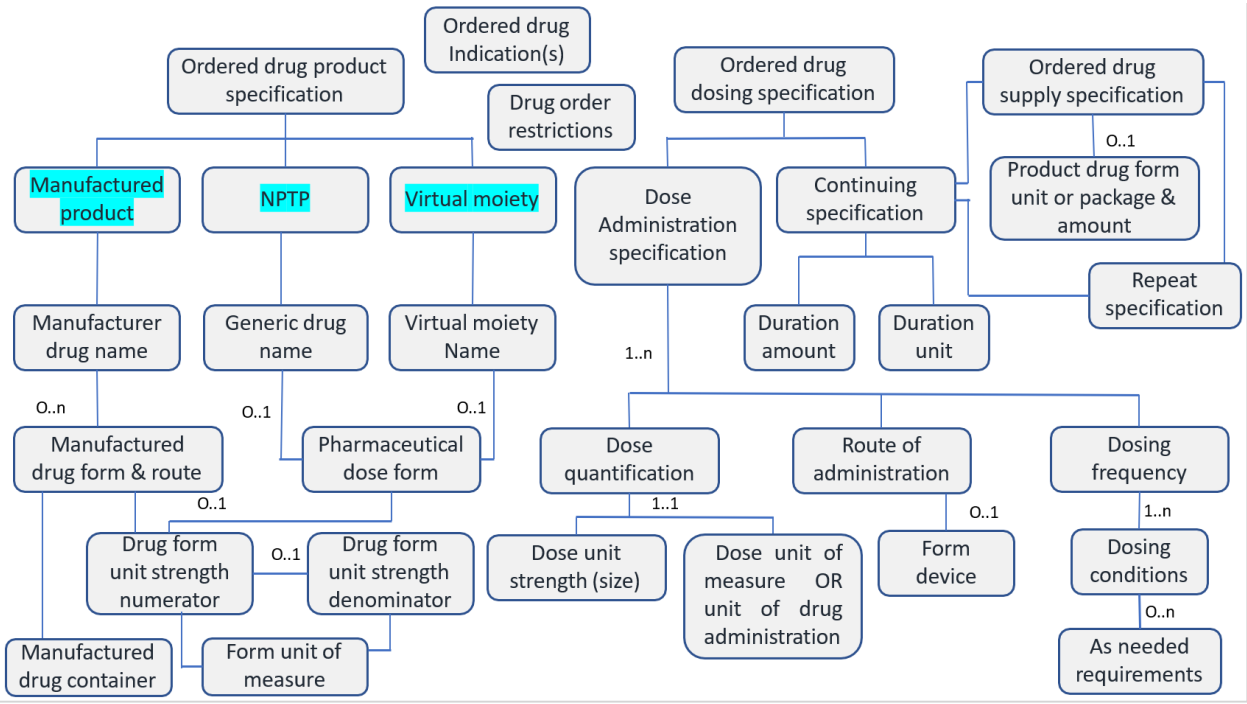

Figure 4

Level of Abstraction	Description	Guidance Intent
Manufactured Product (MP)	Represents a specific commercial product supplied by a manufacturer. An MP SHOULD uniquely identify: • Active ingredient(s) • Strength • Dose form • Unit of presentation when present • Manufacturer and packaging attributes An MP SHOULD be used in a drug order when: • Product specific characteristics are clinically required • Regulatory or safety requirements mandate a specific product MP selection SHOULD otherwise occur at the dispensing stage.	MPs SHOULD be used for dispensing, administration, inventory management, and regulatory reporting. They SHOULD NOT be required at the point of prescribing unless product specific characteristics are clinically necessary.

Level of Abstraction	Description	Guidance Intent
Non-Proprietary Therapeutic Product (NTP)	A brand independent, clinically oriented representation of a medication. An NTP expresses therapeutic intent while remaining brand independent and SHOULD include: • Active ingredient(s) • Quantitative strength • Dose form • Route of administration • Unit of presentation when present This supports prescribing flexibility while enabling pharmacists to apply professional judgment. It also relieves providers from the burden of selecting from a long list of manufacturer specific products while also reducing the need to add specific form, route and unit of presentation details. An NTP SHOULD be the preferred level for most routine prescribing, particularly in community and ambulatory care.	NTPs SHOULD be the preferred level for prescribing in ambulatory and community care settings. They allow prescribers to express therapeutic intent with less burden while enabling pharmacists to select an appropriate manufactured product based on availability, formulary status, and benefit programs.

Level of Abstraction	Description	Guidance Intent
Therapeutic Moiety (TM)	Represents the active substance(s) only and excludes manufacturing, formulation, and excipients. A TM MAY be used to express intent when: • A single ingredient drug is being prescribed • Product selection is intentionally deferred (e.g., formulary driven settings) When a TM is used, systems SHALL support explicit specifications of dose, dose form and route to ensure safe administration.	TMs MAY be used as the prescribing level in formulary driven or acute care settings where product selection is intentionally deferred and dosing / dose administration is often more complex. When a TM is used, systems SH require additional specification of dose form and route to ensure safe administration. Recognizing that some third-party adjuncts such as drug-drug interaction checking depend on product level identifiers (e.g., DINs), implementers MAY: • Resolve NTP or TM selections to representative manufactured products • Preferably incorporate route and form when selecting representative MPs This accommodation SHOULD NOT alter the prescribing intent and SHOULD be transparent to the end user.

3.5.2. Drug Dosing Specification

The **drug dosing specification** builds upon the selected drug product or drug product abstraction and consists of two main components:

1) Dose Administration Specification

Each dose administration includes:

- Dose strength defined by product or amount per administration (e.g., “take one 250 mg capsule”) OR dose defined by amount of active ingredient (e.g., “250 mg orally”)
- Route of administration (which may be more specific than but in keeping with the product’s licensed route e.g., “250 mg intravenous” as a specific route instead of “for injection”)
- Optional administration device (e.g., nebulizer, metered-dose inhaler)

In many cases, the administration device corresponds directly to the unit of presentation of the manufactured product. It also may indirectly correspond to the unit of presentation e.g., the unit of presentation from a metered dose inhaler is an “actuation”.

2) Timing and Conditionality

Dose timing is expressed using **conditional rules**, such as:

- Period (interval)-based conditions (e.g., “every 6 hours”)
- Frequency-based conditions (e.g., “four times per day”)
- Event-based conditions (e.g., “before procedure” or “with meals”)
- Combinations of event and period (e.g., “one hour before procedure”)
- Additional constraints or qualifiers (e.g., “as needed for pain”)
- Duration may be expressed as:
    - Quantity (e.g., “30 capsules”)
    - Time period (e.g., “10 days”)

These distinctions are clinically meaningful, as they affect when administration conditions are satisfied. Systems SHALL NOT treat these timing types as interchangeable, as they have distinct clinical meanings.

The **continuing specification** implies maintaining a stable therapeutic concentration of a drug in the body over a period which may be expressed as:

- A duration (e.g., 3 months)
- A quantity of doses

For medications intended to be taken indefinitely, the duration is often implicit. In such cases, a **drug supply specification** is required to define a legally dispensable quantity and to determine when repeat orders are needed. Repeats are limited by regulatory requirements.

The BC Drug Data Model normalizes these variations by requiring explicit representation and SHOULD define:

- Dose amount
- Dose unit
- Dose Timing
- Duration or supply
- Route of administration

Route MAY be specified more granularly than product labeling to reflect clinical intent or implied by the chosen form when therapeutically appropriate.

This approach aligns directly with the BC Drug Data Model's hierarchy and supports safer workflows than presenting prescribers with long and cumbersome undifferentiated lists of manufactured products.

3.5.3. Drug Supply Specification

Drug orders SHOULD include a **drug supply specification** that defines:

- Quantity dispensed
- Days of supply
- Number of authorized repeats
- Supply SHALL NOT be interpreted as equivalent to duration
- Supply SHALL support, but not replace, course specification

For continuous therapies, the supply specification governs refill timing and renewal requirements. Supply and repeat specifications SHOULD comply with applicable regulatory and payer constraints and SHOULD support both episodic and long-term therapy models.

3.5.4. Drug Order Repeat Specification

Drug orders SHALL express treatment continuation through:

- Explicit duration, or
- Number of doses, or
- Implicit continuation for chronic therapies

When continuation is implicit, the drug order SHOULD include a corresponding supply specification to establish a legally valid dispense quantity.

3.5.5. Drug Order Restrictions (e.g., do not substitute)

Drug Order Restrictions captures constraints such as “do not substitute” or “do not adapt.”

3.5.6. Indication (Reason for therapeutic intervention)

Every medication order SHOULD include an **indication**, expressed as a diagnosis or clinical finding (e.g., *eczema*, *fever*) using SNOMED CT concepts providing **why the medication is prescribed**, for dispensing, administration, and clinical decision support.

Including indication:

- Clarifies reason for the therapeutic intervention
- Supports appropriate dispensing and administration
- Enables context-appropriate clinical decision support
- Reduces incorrect assumptions about patient conditions

This requirement is especially critical for medications with multiple therapeutic uses, such as beta blockers, where dosing, monitoring, and risk considerations vary significantly by indication. These components together form a complete, unambiguous drug order consistent with the BC Drug Data Model. Indication should not be conflated with a procedure or service in the context of the drug ordered. An example is in a communicable disease outbreak, where patients may be at increased risk of exposure to that specific disease and they may even be known to have been exposed to it. The distinction can easily be made with event or risk SNOMED-CT concepts such as “At increased risk of exposure to Bordetella pertussis” versus “Exposure to Bordetella pertussis” rather than referring to the procedure that was done in response to the risk or exposure, e.g. “Pre-exposure prophylaxis or “Post-exposure prophylaxis”. In this example, the immunizing agent given may contain multiple agents so naming the specific condition (finding, diagnosis or event) is less ambiguous.

3.5.7. Drug Course Specification

A structured representation of the **conditions governing initiation, continuation, and termination of a drug therapy**.

SHALL include:

- Start condition:
  - explicit date/time OR
  - clinical trigger (e.g., post-procedure)
- Stop condition:
  - duration (time)
  - number of doses
  - clinical condition (e.g., symptom resolution)
- Continuity type:
  - acute / chronic / PRN
- Link to indication (e.g., Health Concern)

Therapy Continuity Semantics

Systems SHALL classify drug orders as:

- Acute therapy
- Chronic therapy
- PRN therapy

This classification SHALL influence CDS rules, constrain duration logic, and aligns with indication where applicable.

Note: This resolves ambiguity between supply vs intended therapy duration and acute vs chronic therapies.

Conformance Rules

- Systems SHALL NOT rely solely on supply or repeats to infer duration
- Duration SHALL be explicitly represented or computable

3.6. Integration of Third-Party Drug Utilization Evaluation Systems

Some health-IT vendors integrate third-party drug utilization evaluation (DUE) tools, such as drug-drug interaction or allergy checking systems into prescribing and dispensing workflows. These tools are frequently **dependent on Drug Identification Numbers (DINs)** from the Drug Product Database (DPD) as their primary means of identifying medications.

This dependency presents a known interoperability challenge when prescribing or processing drug orders at higher levels of abstraction, such as **Non-Proprietary Therapeutic Products (NTPs)** or **Therapeutic Moieties (TMs)**. In these cases, a DIN may not be directly available, as DINs are inherently associated with **Manufactured Products (MPs)** rather than with abstract clinical or therapeutic concepts.

To support compatibility with DIN-based third-party systems while preserving the integrity of the Drug Data Model, this challenge MAY be accommodated by resolving the abstract drug representation to a **representative manufactured product**. Specifically:

- A **child MP DIN** may be selected (as much as possible by the system, not the provider) to serve as a proxy for interaction checking.
- Where possible, selection SHOULD consider **route of administration** to better reflect the possible interactions or effects e.g., topical versus oral versions of a drug ingredient.
- The representative DIN is used **solely for evaluation purposes** and SHOULD NOT be interpreted as a prescriber's intent to specify a particular branded or manufactured product.
- DIN-based evaluation artifacts SHALL be explicitly distinguished from:
    - prescribing intent
    - dispensing interpretation

This approach allows systems to leverage existing third-party capabilities without collapsing the intended separation between therapeutic intent and product realization.

The guidance provided in this standard for **searching, prescribing, and representing medications** does not assume that all third-party drug databases will fully support, or correctly interpret, the structured relationships among **DPD Manufactured Products (MPs), Non-Proprietary Therapeutic Products (NTPs), and Therapeutic Moieties (TMs)**.

In practice:

- Third-party systems may equate “generic” drug names with what this model defines as a Therapeutic Moiety (TM) or a Non-proprietary Therapeutic Product (NTP).
- Branded drug names are generally treated as Manufactured Products (MPs).
- Support for intermediate clinical abstractions such as NTPs may be incomplete or absent.

In summary, vendors implementing third-party DUE systems within a Drug Data Model–aligned architecture SHOULD:

- Preserve TM / NTP / MP distinctions internally
- Use representative DINs only as a compatibility mechanism
- Do not require providers to select the representative DIN but may expose that DIN to users for possible override.
- Prefer route-specific DIN selection
- Avoid leaking DIN-based assumptions into prescribing workflows
- Clearly separate **evaluation artifacts** from **clinical intent**

Semantic Classification Layer

Each resource SHALL be classified as one of:

Semantic Type	Examples
Directive Information	MedicationRequest
Interpretive Artifact	Dispensing Interpretation
Planned Process	Dispensing
Administration Process	MedicationAdministration
Data Record	MedicationDispense record
Aggregated Process	Drug Administration Course

NOTE: This introduces ontology-level clarity without breaking FHIR compatibility.

Accordingly, implementations SHOULD:

- Preserve the Drug Data Model's abstractions for prescribing, dispensing, and governance purposes.
- Provide controlled, transparent adaptation mechanisms where DIN-based third-party systems are involved.
- Avoid assuming that the availability or use of the DPD MP–NTP–TM relationship structure is universal across all external systems.

This ensures that **clinical intent, system safety, and interoperability** are maintained, while recognizing and pragmatically accommodating external system constraints.

4.0 BC Drug Data Model Ontology Mapping

The purpose of the BC Drug Data Model is to ensure consistent, interoperable implementation of drug ordering, dispensing, administration, and clinical decision support across Canadian health-information systems that aligns with **HL7® FHIR® R4 or greater** and the **Canada Core (CA-CORE) medication profiles**.

The high-level concept mapping is **informative** where systems claiming conformance to the Drug Data Model SHOULD conform to the mappings and constraints described herein unless explicitly stated otherwise.

Applicable Standards and Profiles

The following standards and implementation guides apply:

- **HL7® FHIR® R4** (primary baseline)
- **Canada Core Profiles (CA-CORE)**
    - CA-Core-Medication
    - CA-Core-MedicationRequest
    - CA-Core-MedicationDispense
    - CA-Core-MedicationAdministration
- Provincial and national medication value sets (e.g., BC Medication Value Sets, CCDD/ DPD)

The BC Drug Data Model Ontology distinguishes between **therapeutic intent**, **clinical abstraction**, and **commercial products**. This separation aligns naturally with FHIR's resource model when implemented using references rather than flattened representations.

R4 implementations SHOULD maintain a clear separation between definitional (Medication, Substance) and event-based (MedicationRequest, MedicationDispense, MedicationAdministration) resources to ensure compatibility and alignment to R5 or R6 including:

- MedicationKnowledge (for richer definitional content)
- Improved support for packaged products and regulatory properties

Note: The BC Pharmaceutical value set components are reusable in other parts of the EMR (e.g., problem list, encounter diagnoses, reason for referral).

4.1. High-Level FHIR Concept Mapping

Drug Data Model Concept	FHIR Resource	CA CORE Profile
Therapeutic Moiety (TM)	Substance	FHIR Core
Non-Proprietary Therapeutic Product (NTP)	Medication	CA Core Medication
Manufactured Product (MP)	Medication	CA Core Medication
Drug Order (Intent)	MedicationRequest	CA Core MedicationRequest
Dispensing Event	MedicationDispense	CA Core MedicationDispense
Administration Event	MedicationAdministration	CA Core MedicationAdministration
Drug Administration Course	CarePlan / grouping mechanism	CA Core MedicationDispense
Dispensing Interpretation	Extension / Task	CA Core MedicationDispense
Therapy Course Specification	MedicationRequest.extension	CA Core MedicationRequest. ext
Indication	MedicationRequest.reasonCode	SNOMED CT bound
Supply & Repeats	MedicationRequest.dispenseRequest	CA Core
Regulatory / Safety Flags	Extension	CA Core compatible
CDS Alerts	DetectedIssue, Observation, RiskAssessment	CA Core compatible

4.1.1. FHIR Resource Alignment Details

Medication (CA-Core-Medication)

The Medication resource SHOULD be used to represent drug products, at both the NTP and MP levels.

Level of Abstraction	Description	Guidance Alignment
Non-Proprietary Therapeutic Product (NTP)	When representing an NTP: • Medication.code SHOULD identify the generic clinical product (e.g., from BC medication value sets or CCDD). • Medication.form SHOULD specify the dose form. • Medication.ingredient SHOULD represent active ingredient(s) and strengths. • Manufacturer and product identifiers SHOULD be omitted or left abstract.	NTPs represent therapeutic intent without constraining product selection.
Manufactured Product (MP)	When representing an MP: • Medication.code SHOULD carry a product specific identifier (e.g., DIN). • Medication.manufacturer SHOULD be populated where known. • Packaging and presentation details MAY be included.	MPs are mostly selected during dispensing or administration, not prescribing.

Level of Abstraction	Description	Guidance Alignment
Therapeutic Moiety (TM)	The Substance resource SHOULD be used to represent Therapeutic Moieties (TMs). • Substance.code SHOULD identify the active substance using a controlled terminology. • The Substance SHOULD NOT contain strength, form, route, or therapeutic indication.	When a TM is used, its therapeutic purpose is derived from its context, formulation, dosage, and regulatory approval for use in a patient. Systems SHOULD require additional specification of dose form and route to ensure safe administration.

4.1.2. MedicationRequest (CA-Core-MedicationRequest)

The **MedicationRequest** resource SHOULD represent the **legal and clinical drug order**.

Medication Reference	Dosing Specification	Supply and Repeats	Indication	Guidance Alignment
• MedicationRequest.medication SHOULD reference a Medication resource. • Prescribing systems SHOULD reference NTP level Medication resources. • MP level references MAY be used when clinically required.	The following elements SHOULD be used: • dosageInstruction.doseAndRate.doseQuantity • dosageInstruction.route • dosageInstruction.timing Dose frequency-interval SHOULD be expressed using structured timing rules, not free text.	• dispenseRequest.quantity • dispenseRequest.expectedSupplyDuration • dispenseRequest.numberOfRepeatsAllowed These elements SHOULD be populated when required for legal dispensing.	• MedicationRequest.reasonCode SHOULD be populated using SNOMED CT. • Indication SHOULD NOT be inferred from medication type or class.	Indication is a clarification of intent, not a classification.

4.1.3. MedicationDispense (CA-CORE-MedicationDispense)

The **MedicationDispense** resource SHOULD represent pharmacist interpretation and fulfillment of a drug order.

- medication SHOULD reference an MP-level Medication.
- quantity and days supply SHOULD reflect what was actually dispensed.
- linkage to the originating MedicationRequest SHOULD be maintained.

4.1.4. MedicationAdministration (CA-Core-MedicationAdministration)

The **MedicationAdministration** resource SHOULD represent actual administration of a medication to a patient.

- medication SHOULD reference the MP administered.
- dosage.dose SHOULD reflect the administered amount, which MAY differ from the originally ordered dose.
- route and time of administration SHOULD be explicit.

By harmonizing drug orders with the BC Drug Data Model, electronic prescribing systems SHOULD:

- Enable safe, dose-based prescribing
- Preserve clinician intent
- Support pharmacist judgment
- Reduce ambiguity and workflow risk
- Facilitate interoperable exchange and advanced clinical decision support

4.2. Clinical Decision Support (CDS) Alignment

The Drug Data Model enables CDS without misuse of hierarchies or therapeutic inference.

CDS Use Case	FHIR Artifact
Regimen complexity	Observation
Drug burden	RiskAssessment
Safety triggers	DetectedIssue
Interaction checks	Medication, MedicationRequest attributes
Indication specific rules	reasonCode

Systems SHOULD NOT infer indication, class, or risk solely from medication coded hierarchies.

CDS engines SHOULD use:

- Drug Administration Course (for adherence)
- Course Specification (for duration validation)
- Indication (for context-sensitive rules)

4.3. Patient Medication Representation Reality

Systems SHOULD support representation of medication use outside formal prescribing/dispensing processes.

SHALL support:

- MedicationStatement (patient-reported use)
- OTC medication capture
- missed or skipped doses

SHOULD:

- link to Drug Administration Course where applicable

NOTE: This addresses known gaps in medication safety due to out-of-system drug use.

4.4. Terminology Binding Guidance

Systems SHOULD bind FHIR elements to governed terminology as follows:

- **Medication products:** Provincial medication value sets / CCDD/ DPD/ LNHPD
- **Active ingredients:** Provincial medication value sets / CCDD/ DPD/ LNHPD
- **Forms and routes:** SNOMED CT
- **Dose units:** SNOMED CT & UCUM
- **Indications**: SNOMED CT clinical concepts

Terminology bindings SHOULD be versioned and centrally governed.

4.5. Conformance Statement

A system conforms to the Drug Data Model and this FHIR / CA-CORE alignment if it:

- 1) Implements TM, NTP, and MP distinctions using FHIR resources
- 2) Uses MedicationRequest to represent prescribing intent
- 3) Preserves separation of intent and product selection
- 4) Captures dosing, supply, and indication explicitly
- 5) Aligns with CA-CORE medication profiles and governed value sets

4.6. BC Medication Value Set – FHIR Medication mapping

The BC Pharmaceutical Value Set value set explicitly provides:

- TM, NPT, MP linkages
- Normalized brand names & market status
- Normalized company names and company abbreviations
- Normalized ingredients & strengths
- SNOMED form, route, unit of presentation
- BC virtual name derived from Health Canada Ingredient names
- ATC (WHO Anatomic Therapeutic Chemical) classifications
- AIG (Active Ingredient Group) number
- DIN /PIN
- Regulatory flags (Prescription, CDSA, Schedule D, hazardous, biosimilar, Controlled Prescription Program etc.)

The Pharmaceutical value set mapping is as follows:

BC Value Set Field	FHIR Element
ntp_code / ntp_formal_name	Medication.code
tm_code	Medication.ingredient.itemCodeableConcept
HC_DIN	Medication.identifier
BC_SCT_form_code	Medication.form
BC_SCT_route_code	Medication.extension:route
Unit_of_Presentation	Medication.extension:unitOfPresentation
WHO_ATC	Medication.code.coding
Manufacturer / company	Medication.manufacturer
Schedule / CPP flags/ OAT flag/ Hazardous flag	Medication.category / extension
mp_status / HC_last_status	Medication.status

4.7. Examples of TM, NTP and MP FHIR profile messages

4.7.1. Therapeutic Moiety (TM) – Substance

TM – Substance	Code Type	Example Message	Notes
Acetaminophen	JSON	{"resourceType": "Substance", "id": "tm-acetaminophen", "code": { "coding": [{"system": "https://terminology.hlth.gov.bc.ca/tm", "code": "8001044", "display": "Acetaminophen"}]}}``	• Ingredient only • No strength, no form, no intent

4.7.2. Non-Proprietary Therapeutic (NPT) Product – Medication

NPT Product – Medication	Code Type	Example Message	Notes
Acetaminophen 500 mg oral tablet	JSON	{"resourceType": "Medication","meta": {"profile": ["http://hl7.org/fhir/ca/core/StructureDefinition/ca-core-medication"]}, "id": "npt-acetaminophen-500mg-tab", "code": { "coding": [{"system": "https://terminology.hlth.gov.bc.ca/bc-medication-vs", "code": "9001728",	• Fully BC value set derived • CA CORE Medication compliant • Used for **prescribing**

NPT Product – Medication	Code Type	Example Message	Notes

		"display": "acetaminophen 500 mg oral tablet"},
		{"system": "http://www.whocc.no/atc",
		"code": "N02BE01",
		"display": "Acetaminophen"}]},
		"form": {
		"coding": [
		{"system": "http://snomed.info/sct",
		"code": "421026006","display": "Oral tablet"}]},
		"ingredient": [
		{"itemCodeableConcept": {"coding": [
		{"system": "https://terminology.hlth.gov.bc.ca/tm",
		"code": "8001044",
		"display": "acetaminophen"}]},
		"strength": {
		"numerator": { "value": 500, "unit": "mg", "system": "http://unitsofmeasure.org", "code": "mg" },
		"denominator": { "value": 1, "unit": "tablet" }}}],
		"status": "active"}	

4.7.3. Manufactured Product (MP) – Medication

MP – Medication	Code Type	Example Message	Notes
Brand selected by pharmacist	JSON	{"resourceType": "Medication","meta": {"profile": ["http://hl7.org/fhir/ca/core/StructureDefinition/ca-core-medication"]}, "id": "mp-acetaminophen-din-02252813", "code": {"coding": [{"system": "http://hlth.gov.bc.ca/DIN", "code": "02252813", "display": "ACETAMINOPHEN 500MG TABLETS EXTRA STRENGTH"}]}, "manufacturer": {"display": "CellChem Pharmaceuticals Inc."}, "status": "active"}``	• DIN specific • Used only at **dispense / administration**

4.7.4. Dispensed Medication – MedicationDispense

Dispensed Medication	Code Type	Example Message	Notes
Manufactured product dispensed by pharmacist	JSON	{"resourceType": "MedicationDispense","meta": {"profile": ["http://hl7.org/fhir/ca/core/StructureDefinition/ca-core-medicationdispense"]}, "status": "completed", "medicationReference": {"reference": "Medication/mp-acetaminophen-din-02252813"}, "quantity": { "value": 60, "unit": "tablet" }, "daysSupply": { "value": 15 }}	

4.7.5. Prescribing Intent – MedicationRequest

Prescribing Intent	Code Type	Example Message	Notes

Dose-based Prescribing	JSON	{"resourceType": "MedicationRequest",
		"meta": {"profile": [
		"http://hl7.org/fhir/ca/core/StructureDefinition/ca-core-medicationrequest"]},
		"status": "active",
		"intent": "order",
		"medicationReference": {
		"reference": "Medication/npt-acetaminophen-500mg-tab"},
		"subject": { "reference": "Patient/example" },
		"dosageInstruction": [{
		"route": {"coding": [{"system": "http://snomed.info/sct",
		"code": "26643006",
		"display": "Oral route"}]},
		"doseAndRate": [{ "doseQuantity": { "value": 500, "unit": "mg", "system": "http://unitsofmeasure.org", "code": "mg" } }],
		"timing": {"repeat": { "frequency": 4, "period": 1, "periodUnit": "d" }}}],
		"reasonCode": [{"coding": [{"system": "http://snomed.info/sct",
		"code": "88805009",
		"display": "Fever"}]}]}
			• Dose based prescribing
			• Ontology intent preserved

4.7.6. Administration – MedicationAdministration

Administration	Code Type	Example Message	Notes
Medication Administered	JSON	{"resourceType": "MedicationAdministration","meta": {"profile": ["http://hl7.org/fhir/ca/core/StructureDefinition/ca-core-medicationadministration"]}, "status": "completed", "medicationReference": {"reference": "Medication/mp-acetaminophen-din-02252813"}, "dosage": {"dose": { "value": 500, "unit": "mg", "system": "http://unitsofmeasure.org", "code": "mg" }}}	

5.0 Resources

The following is a list of resources the readers may find helpful:

Type	Standard	URL
National	Canadian Clinical Drug Data Set	https://infocentral.infoway-inforoute.ca/en/standards/canadian/ccdd
	Drug Product Database (DPD) Data Extract All Files – Health Canada	https://open.canada.ca/data/en/dataset/bf55e42a-63cb-4556-bfd8-44f26e5a36fe
	DPD API Guide	https://health-products.canada.ca/api/documentation/dpd-documentation-en.html#a4
	DPD Data Extract – Health Canada	https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/drug-product-database/what-data-extract-drug-product-database.html
	Read Me File –DPD Data Extract – Health Canada	https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/drug-product-database/read-file-drug-product-database-data-extract.html
National	Prescription of Drugs Ontology (PDRO): GRIIS	Ontological Analysis of Drug Prescriptions Ontologies
National	Semantics of Drug Prescriptions	Improving the Semantics of Drug Prescriptions
International	Drug prescriptions and pharmacist documents	Classification of instructions in drug prescriptions and pharmacist documents
International	Prescription of Drug Ontology 2.0 (PDRO)	Prescription of Drug Ontology 2.0 (PDRO)

5.1. Related Standards

Type	Standard	URL
National	Canadian Clinical Drug Data Set	https://infocentral.infoway-inforoute.ca/en/standards/canadian/ccdd
	Canada Health Infoway – CA Core +	CA Core+ CA Core+ - SIMPLIFIER.NET
	DPD Data Extract All Files – Health Canada	https://open.canada.ca/data/en/dataset/bf55e42a-63cb-4556-bfd8-44f26e5a36fe
	Health Canada – Drug and Health Products	Drugs and health products - Canada.ca
	ISMP Canada	https://ismpcanada.ca/
	National Association of Pharmacy Regulatory Authorities (NAPRA)	Model Standards of Practice for Pharmacists and Pharmacy Technicians in Canada
International	HL7 FHIR	Medications-module - FHIR v4.0.1 Medications-module - FHIR v5.0.0
	SNOMED CT – Pharmaceutical and Biologic Product	https://docs.snomed.org/snomed-ct-specifications/snomed-ct-editorial-guide/readme/authoring/domain-specific-modeling/pharmaceutical-and-biologic-product
	Unified Code for Units of Measure (UCUM)	https://ucum.org/ucum
	World Health Organization – Anatomical Therapeutic Chemical (ATC) Classification	https://www.who.int/tools/atc-ddd-toolkit/atc-classification