Graduate Certificate – Assignment Learning Summary

COURSE #1 - HINF 535

Assignment 1: SNOMED CT & Terminology Services

- Applied SNOMED CT coding to clinical diagnoses using the Canadian Edition, ensuring appropriate hierarchy selection, semantic tag accuracy, and dialect-specific preferred terms (en-ca and fr-ca).
- Interpreted and encoded ambiguous clinical terms (e.g., abbreviations, acronyms, misspellings) by researching medical meanings and resolving terminology ambiguities.
- Created and validated postcoordinated SNOMED CT expressions using the International Postcoordination Demonstrator, incorporating appropriate attributes and relationships per MRCM guidelines.
- Authored and executed complex Expression Constraint Language (ECL) queries in both the SNOMED International Browser and CSIRO Shrimp Browser, comparing output across platforms.
- Leveraged the SNOMED CT compositional grammar, postcoordination guide, and machine-readable concept model (MRCM) to transform clinical statements into structured and interoperable terminologies.
- Explored user interface implications for structured clinical data entry by populating a simulated EHR using SNOMED CT search functions and ECL-based value sets.
- Demonstrated understanding of clinical terminology tooling by navigating multiple SNOMED CT platforms including the CSIRO Shrimp Browser, SNOMED CT International Browser, and Search Demo.
- Investigated inactive SNOMED CT concepts by interpreting Concept Inactivation Indicators and Historical Association Reference Sets using the SNOMED CT Browser.
- Used SNOMED CT's Release File Specifications and ECL Specification to understand component lifecycle management, including inactivation tracking and historical mapping to active concepts.
- Executed advanced ECL queries to retrieve and compare inactive concepts and their replacements across both SNOMED International and CSIRO Shrimp Browsers.
- Analyzed and documented differences in query behavior and result sets between terminology platforms, accounting for server configurations and terminology versioning.

Assignment 2: ICD-10-CA, CCI, and Terminology Mapping)

- Encoded clinical statements using ICD-10-CA and CCI by identifying lead and secondary terms and applying Canadian Coding Standards and CIHI classification tools (Folio Views, Tabular Index, Alphabetical Index).
- Analyzed and coded diagnoses and interventions from discharge summary cases using both ICD-10-CA/CCI and SNOMED CT, applying diagnosis type classifications (e.g., M, 1, 2, 3) per CIHI guidelines.
- Conducted data quality assurance by comparing manually derived ICD-10-CA codes against SNOMED CT to ICD-10 map outputs; documented discrepancies and reviewed mapping advice.
- Performed frequency analysis of ICD-10-CA diagnosis codes in Discharge Abstract Database (DAD) records by chapter, block, and fiscal quarter using Excel tools and online analyzers.
- Interpreted and applied SNOMED CT complex map reference sets to identify corresponding ICD-10 codes, including reviewing mapping logic and relationship types (e.g., "SAME AS", "MAP SOURCE").
- Created a simple SNOMED CT to ICD-10 mapping dataset using the Snap2Snomed tool; structured mappings with relationship types, concept IDs, and fully specified names, and exported to TSV format.
- Demonstrated working knowledge of clinical classification systems and standards including SNOMED CT, ICD-10-CA, CCI, and CIHI discharge summary documentation requirements.
- Applied clinical reasoning to encode multi-diagnosis discharge summaries and selected interventions using appropriate rubric + qualifier combinations in CCI.

Assignment 3: Report on Terminology Standard (SNOMED CT)

- Formal Report: "SNOMED CT in Practice" – Explored the structure, governance, implementation, and real-world application of SNOMED CT as a clinical terminology standard, including Canadian use cases and interoperability challenges.
    - Researched and authored a formal report on SNOMED CT, covering its purpose, key features, governance model, and international implementation in clinical systems.
    - Analyzed the structure and use of SNOMED CT as a reference terminology across healthcare domains, with focus on clinical decision support, data interoperability, and electronic health record integration.
    - Investigated real-world implementation examples of SNOMED CT, including its deployment in Canadian health systems, and evaluated associated benefits, such as semantic interoperability and improved clinical data quality.
    - Identified and discussed challenges and barriers to SNOMED CT adoption, including terminology mapping complexity, resource requirements, and integration with existing classification systems like ICD-10-CA.
    - Demonstrated ability to synthesize academic literature and implementation reports into a coherent, evidence-based narrative aligned with health informatics best practices.

Assignment 4: HL7 V2, UML, and LOINC/pCLOCD

- Validated and corrected HL7 v2 messages (ADT and VXU) using 7Edit, identifying structural, syntax, and segment-level errors, and applying fixes to support message conformance to HL7 v2.3.1 standards.
- Translated a clinical scenario into a complete set of HL7 v2 message segments (e.g., MSH, PID, PV1, RXA), adhering to message structure requirements and using validation tools to ensure accuracy.
- Developed a UML class diagram for immunization records using Lucidchart, based on CDC IIS functional standards and aligned with ERD elements from Alberta and ECDC immunization data standards.
- Conducted a comparative analysis of immunization data models from CDC IIS (U.S.), Alberta (Canada), and ECDC (Europe), identifying semantic and structural differences across jurisdictions.
- Mapped laboratory test concepts related to Hemoglobin A1c using both LOINC and pCLOCD standards; extracted and compared metadata including components, long names, and pan-Canadian names.
- Retrieved and analyzed pCLOCD data using Infoway InfoCentral, and cross-compared results with those from LOINC.org to assess data harmonization in pan-Canadian lab standardization.
- Applied HL7 v2 immunization message guidelines from CDC and VAERS, demonstrating understanding of public health reporting standards and immunization information system requirements.

Assignment 5: Clinical Information Modeling & FHIR Integration

- Compared conceptual, logical, and data models across jurisdictions (FHIM, Ontario EHR CIM, CIHI EMR MDS, OntarioMD CDS) to evaluate allergy and intolerance value sets and their sources (e.g., SNOMED CT, HL7).
- Analyzed and harmonized allergy-related data elements across national and international sources including FHIR, OpenEHR CKM, and Australian Detailed Clinical Models (DCMs), documenting differences in field structure, value domains, and coded choices.
- Designed and implemented a COVID-19 screening questionnaire using LHC FHIR Tools, integrating SNOMED CT-coded open-choice fields for symptoms and diagnoses, and exporting the final product in FHIR R4 and HL7 v2 formats.
- Created a UML-based COVID-19 questionnaire structure, including demographic, vital signs, and clinical data elements, and validated interoperability outputs as HL7 v2 (OBR/OBX) and FHIR DiagnosticReport formats.
- Researched and compared COVID-19 diagnostic and billing codes across SNOMED CT, ICD-10-CA, CIHI guidance, and LOINC/pCLOCD, compiling a harmonized view of Canadian standards for public health reporting.
- Demonstrated advanced understanding of FHIR resources (e.g., AllergyIntolerance, Questionnaire, DiagnosticReport), FHIR terminology bindings, and reference set queries (ECL) within the Canadian Edition of SNOMED CT.

- Used OpenEHR CKM to extract structured symptom and vital sign elements from the COVID-19 Pneumonia Diagnosis and Treatment template, highlighting terminology use and structural design of clinical archetypes.
- Compared international COVID-19 implementation guides (e.g., Logica, SNOMED International) and identified differences in value sets, concept usage, and terminology bindings for clinical and administrative data.

Assignment 6: FHIR, CDA, and Patient Summary Standards

- Analyzed HL7 Continuity of Care Documents (CCD) by reviewing CDA templates, LOINC-coded section identifiers, and structural differences between Level 2 and Level 3 CDA examples; validated sample XML documents using Lantana's CDA validator.
- Compared synoptic pathology reports for melanoma by analyzing CAP protocol templates and aligning them with a CDA-encoded pathology report; identified gaps and proposed alignment strategies with current CAP standards.
- Created a FHIR Immunization Profile using Forge Profile Editor, documenting datatype constraints and terminology bindings, and comparing HL7 base, eHealth Ontario, and PS-CA implementation profiles.
- Designed and built FHIR-based patient scenarios using clinFHIR, generating linked resource bundles including Patient, Condition, Observation, and MedicationAdministration resources for export in FHIR JSON format.
- Explored FHIR resource relationships and terminology bindings using clinFHIR's Graph Builder and Patient Viewer tools; documented coded elements including code systems, values, and SNOMED CT display terms.
- Developed a COVID-19 clinical scenario using FHIR resources and exported the completed scenario as HL7 v2 and FHIR DiagnosticReport messages; mapped data to SNOMED CT, LOINC, and pan-Canadian terminology.
- Conducted a comparative analysis of International vs. Pan-Canadian Patient Summary FHIR Implementation Guides, evaluating profile-specific value sets, conformance levels, and terminology differences across sections such as Medications, Allergies, Problems, and Procedures.
- Demonstrated proficiency with FHIR tooling including Forge, clinFHIR, and LHC FHIR tools for creating and validating profiles, questionnaires, bundles, and diagnostic reports.

Assignment 7: Report on HIE Standard (HL7 v2.3)

- Authored a formal report on HL7 Version 2.3, analyzing its origins, message structure, and enduring role in healthcare interoperability for administrative and clinical data exchange.
- Investigated the use of HL7 v2.3 in real-world hospital settings, including message types (e.g., ADT, ORU, VXU), trigger events, and segments (e.g., MSH, PID, OBX).
- Evaluated the benefits of HL7 v2.3 such as broad adoption, flexibility, and backward compatibility, alongside challenges including variation in implementation and lack of semantic consistency.
- Summarized governance and maintenance of HL7 v2 by Health Level Seven International, and examined its role within the broader HL7 standard family (v3, CDA, FHIR).
- Highlighted lessons learned from Canadian and international implementations, including barriers to standardization and approaches to migrating or coexisting with newer standards (e.g., HL7 FHIR).

COURSE #2 - HINF 536

Assignment 1: Business Case – Controlled Terminology Implementation

- Developed a business case for implementing a controlled terminology standard to improve discharge diagnosis documentation in the Emergency Department at the Dr. Everett Chalmers Regional Hospital.

- Analyzed the limitations of free-text entry in the Meditech EDM module, highlighting challenges such as typographical errors, inconsistent terminology, and downstream impacts on data quality and clinical communication.
- Evaluated candidate controlled terminologies based on organizational readiness, terminology alignment, integration feasibility, and support for quality improvement and analytics use cases.
- Assessed the costs, benefits, and risks of implementing a picklist-based approach using standardized terms, following the recent Meditech system upgrade enabling terminology integration.
- Aligned report structure with the Government of Canada Business Case Template, demonstrating applied knowledge in health IT evaluation and terminology governance.

Assignment 2: Adoption Strategy - Controlled Terminology Implementation

- Developed an adoption strategy for implementing a controlled terminology-based picklist in the Emergency Department Management (EDM) module at the Dr. Everett Chalmers Regional Hospital.
- Defined project governance and stakeholder engagement model including executive sponsors, clinical champions, business leads, and a terminology working group.
- Outlined key technical processes including terminology subset development, mapping of legacy free-text entries, tool configuration in Meditech EDM, and quality assurance procedures.
- Identified required roles and skill sets such as clinical informaticists, terminology analysts, health data stewards, and technical system analysts.
- Addressed education and training needs for physicians and allied staff, emphasizing clarity in diagnosis selection, consistency in documentation, and downstream data benefits.
- Evaluated expected workflow impacts and proposed mitigation strategies, including physician involvement in early testing and terminology review.
- Proposed a phased implementation timeline with a pilot in a single department, followed by staged rollout and iterative evaluation based on usage metrics and coded data completeness.

Activities

- **Activity 1 – Terminology Evaluation (Technical Criteria):**
  - Evaluated the International Classification for Nursing Practice (ICNP) against Canada Health Infoway's technical criteria for terminology standards, focusing on attributes such as concept orientation, synonym support, formal definitions, multi-hierarchical structure, and technical interoperability with SNOMED CT.
- **Activity 2: Terminology Evaluation (Pan-Canadian Criteria):**
  - Assessed the International Classification for Nursing Practice (ICNP) against Canada Health Infoway's pan-Canadian principles and criteria, examining clinical relevance, cross-sector usability, governance structure, affordability, bilingual support, and alignment with national health data strategy and policy frameworks.
- **Activity 3: Terminology Mapping (Pan-Canadian Criteria):**
  - Created a terminology map using SNOMED International's Snap2Snomed tool, linking local clinical terms to SNOMED CT concepts. Performed auto-mapping, reviewed and modified relationship types, and exported the finalized map to support standardized data capture and semantic interoperability.
- **Activity 4: Postcoordination (SNOMED CT and ICD-11):**
  - Created a terminology map using SNOMED International's Snap2Snomed tool, linking local clinical terms to SNOMED CT concepts. Performed auto-mapping, reviewed and modified relationship types, and exported the finalized map to support standardized data capture and semantic interoperability.
- **Activity 5: Subset Development (Emergency Medicine Diagnoses):**
  - Designed a SNOMED CT extensional subset for Emergency Department discharge diagnoses, based on the Canadian Edition and adapted from existing Infoway and UK reference sets. Defined a structured governance and validation process involving physicians, HIM professionals, and IT analysts, with publication in RF2 format and a defined maintenance strategy.

- **Activity 6: Terminology Data Retrieval (ECL + SQL):**
    - Constructed and executed SNOMED CT expression constraints for IPS value sets (e.g., allergies, medications, procedures), retrieving concepts via the SNOMED CT Browser. Replicated ECL queries using SQL queries in SQLite by building a local SNOMED CT database and importing transitive closure tables and snapshot data from the Canadian Edition.
- **Activity 7: Terminology Quality Assurance and Auditing**
    - Performed QA checks for SNOMED CT maps, post-coordinated expressions, extensions, and subsets, assessing attributes like completeness, correctness, and consistency. Conducted an audit of Canadian extension concepts using SNOMED CT Browser and evaluated national subsets against expected hierarchies to identify hierarchy drift, ambiguous labels, and definition gaps.
- **Activity 8: Technical Requirements Development:**
    - Defined SNOMED CT implementation requirements for ED Discharge Diagnosis fields based on earlier business case and adoption strategy. Specified mandatory and recommended conditions for data storage, capture, retrieval, and exchange using standards-based language (e.g., MUST, SHOULD). Requirements emphasized dual storage of Concept ID and description, user-friendly search functionality, resilient data retrieval, and standards-aligned mapping for exchange.

COURSE # 3 - HINF 537

Assignment 1: Graduate Field Project Proposal (Nursing Informatics Education)

- Proposed an educational eLearning module to teach undergraduate nursing students foundational concepts in health data standards and terminology (e.g., SNOMED CT, HL7 v2.3, FHIR, pCLOCD).
- Aligned the project with the 2025 CASN Nursing Informatics Entry-to-Practice Competencies and the CHIMA Canadian Terminology Standards Certification curriculum.
- Applied the ADDIE instructional design framework to structure the program development timeline and deliverables.
- Designed a five-part curriculum covering data quality, interoperability, data governance (DAMA model), controlled terminologies, HIE standards, and ethical considerations in AI.
- Used Moodle as the proposed delivery platform, incorporating narrated PowerPoint modules and quiz-based evaluations.
- Mapped the project to Canada Health Infoway's standards lifecycle stage "Support Uptake," promoting terminology education to improve HIE adoption readiness.

Assignment 2: Health Information Exchange Case Study Report (Patient Summaries)

- Conducted a global environmental scan of International Patient Summary (IPS) implementations, examining technical architectures, terminology standards, and national adaptation efforts including the Pan-Canadian Patient Summary (PS-CA).
- Analyzed the structure and exchange of IPS documents using HL7 CDA and FHIR standards, along with IHE profiles to understand real-world interoperability workflows.
- Assessed the role of terminologies such as SNOMED CT, LOINC, ATC, and Canadian-specific systems (pCLOCD, CCDD) in enabling semantic interoperability through value set bindings and data mapping.
- Identified implementation challenges related to data summarization processes, variable binding strengths, and limitations in structured vs. narrative data representation.
- Demonstrated familiarity with international standards (ISO 27269, CEN 17269) and their application within national specifications and terminology governance frameworks.

Assignment 3: Executive Brief (HL7 FHIR for Health Information Exchange)

- Developed a non-technical executive summary explaining the business context, benefits, and implementation challenges of the HL7 FHIR standard for managers and analysts.

- Analyzed FHIR's structured content model and real-time RESTful API capabilities, emphasizing its role in improving data interoperability and clinician access to complete patient histories.
- Identified implications for organizations, including terminology support (e.g., SNOMED CT, LOINC), implementation complexities, and the importance of FHIR profiling and security infrastructure.
- Reviewed Canadian and international documentation and support networks, including Infoway's FHIR working group and HL7's global collaboration platforms.

Assignment 4: Mapping and Managing Health Information Exchange Standards

- Mapped HL7 v2 elements to HL7 FHIR resources (e.g., Patient Class and Next of Kin Relationship), analyzing binding strengths and terminology alignment between legacy and modern interoperability standards.
- Conducted terminology mapping for local clinical document types using the acCDR Worksheet, proposing RFCs and identifying appropriate standardized values from ConnectingOntario and LOINC.
- Created a SNOMED CT mapping project in Snap2SNOMED for OLIS specimen source codes, including generation of FHIR-compliant ConceptMap resources and manual refinement of automated mappings.
- Coded allergy-related data elements to SNOMED CT concepts from appropriate hierarchies, designed extensional value sets, and authored ECL rules to validate hierarchical consistency.
- Demonstrated proficiency with Canadian editions of SNOMED CT, LOINC, HL7 v2, and HL7 FHIR R4, and practical application of mapping tools such as Snap2SNOMED and the LOINC Search Tool.

Assignment 5: Social Determinants of Health and FHIR Questionnaires

- Designed and implemented HL7 FHIR-compliant questionnaires for PRAPARE 2016 and 2022 using the LHC Form Builder, leveraging LOINC, SNOMED CT, and ICD-10-CM for question and response coding.
- Conducted terminology mapping across multiple standards (LOINC, SNOMED CT, ICD-10-CM), verifying code accuracy and hierarchy placement using SNOMED CT Canadian Edition and other official tools.
- Generated and submitted standardized Questionnaire and QuestionnaireResponse FHIR resources to a public HAPI FHIR server, simulating real-world EHR integration workflows with API query verification.
- Demonstrated ability to work across clinical terminology systems and FHIR standards to support structured data capture and interoperability in digital health applications.

Assignment 6: FHIR Standards, Tooling, and Terminology Integration

- Reviewed and compared Canadian FHIR CA Core+ profiles with provincial projects (BC Immunization Gateway and Ontario eReferral), analyzing data type and value set bindings to assess implementation alignment and interoperability.
- Used Forge Editor to create and modify FHIR structure definitions; created a custom Medication profile with updated bindings and cardinalities, and uploaded the revised profile to a Simplifier test project.
- Executed FHIR RESTful API interactions using Web Postman, including POST, PUT, GET, and DELETE operations on synthetic patient data across multiple resource types (e.g., Patient, Encounter, Condition, Observation).
- Created FHIR-compliant value sets for AllergyIntolerance.category and condition severity using CSIRO Snapper, applying SNOMED CT codes and Expression Constraint Language (ECL) rules to define inclusion criteria and validate resource consistency.
- Validated and published value sets to public FHIR terminology servers and confirmed expansion through API-based $expand queries using Postman.