College of Health and Human Services

Spring 2026

Syllabus

Course Information: HI 459: Health Data Standards and Interoperability

Course Location and Time: Peterson Hall 2413, F, 1:30 pm - 4:10 pm

Instructor: Hua Min, Ph.D.

Email: hmin3@gmu.edu (email is the preferred communication method)

Phone: 703-993-5648

Office Hours: Monday 1:00 – 3:00 pm

Office Location: Peterson Hall: Office # 4416

Course Description:
Introduction to prevailing and emerging data standards applicable in health information technology. Students will learn about standard-making organizations, such as HL7 and Healthcare Information Technology Standards Panel (HITSP), and their standardization processes. The structure of and relationship between standard terminologies applicable in healthcare, such as International Classification of Diseases (ICD), Logical Observation Identifiers Names and Codes (LOINC) and Systematized Nomenclature of Medicine–Clinical Terms (SNOMED-CT), will be explained.

Course Objectives:

- Understand the critical role of standards in realization of interoperability goal for health IT
- Understand the process of standardization: the stakes, the functions and the roles of different parties involved in the process
- Participate in the standard development process at organization and industry levels
- Evaluate the compliance to applicable standards of health information systems
- Advocate for applicable standards in health information systems in organizational communication
- Identify appropriate level of HITSP (the Health Information Technology Standards Panel) standards for IT problems and select an appropriate standard within that level
- Create use cases to define an interoperability standard for a specific healthcare/regional situation
- Design organizational processes to implement applicable standards
- Assist others in the use of most popular applicable standards in health IT.

Required Text:

1. Pradeep K. Sinha, Gaur Sunder, Prashant Bendale, Manisha Mantri, Atreya Dande "Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures". ISBN: 978-1-118-28134-5 Wiley-IEEE Press
2. Tim Benson. "Principles of Health Interoperability HL7 and SNOMED CT". Health Informatics Series. Springer 2010 or later editions.

Course Requirements:
Please read the syllabus carefully, specifically the grading policy section.

Each student is expected to play an active role in the classroom. Opportunities for class participation will include but not be limited to reviewing assigned readings; discussing homework assignments; engaging in weekly discussion topics; participating in a team project.

All examinations and homework will be given at stated times during the course. Such times are published in the course schedule.

The student is responsible to take the examination as scheduled, unless expressed permission to take it at except for cases of illness or death in the family. For the final examinations, the catalog policy shall prevail: Absence from final examinations will not be excused except for sickness on the day of the examination or for other cause approved by the student's academic dean. **Late submission penalty is 20% of the grade**.

If a student fails to take an exam as scheduled, it is the students' responsibility to contact the professor within 24 hours of the missed examination. Make up exams or homework may be given at a stated time in person, or the instructor may prepare an examination for the student to be taken at an arranged time in person. The length of time allowed will be the same as for scheduled examinations.

Team Project Presentations: Students will be assigned to small teams for the purpose of researching a specific healthcare standard or tool and presenting team findings to the class.

Groups will be determined based on class size but should not exceed 4 members. Each team will produce a PowerPoint presentation. The instructor will grade each presentation based on the quality of the content, skill of presenters and accuracy of the findings. The instructor reserves the right to give varying grades to each team member based on perception of the quality of each participant's effort.

Teaching Methods:
(X) Lecture (X) Group work () Independent research ( ) Field work
( ) Papers () Guest speakers (X) Student presentations ( ) Case Studies ( ) Lab
(X) Class discussion ( ) Other _____

Evaluations and Grading:
Midterm – 25%
Final – 35%
Homework – 10%
Participation – 10%
Presentation - 20%

Grading Scale:
93+ A
90-93 A -
88-89 B +
83-87 B
80-82 B-
78-79 C+
73-77 C
70-72 C-
68-69 D+
63-67 D
60-62 D-
<59 F
Plagiarism: Automatic F

General Course Policies:

Academic Integrity:
Mason Honor Code:
To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set for this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.
(From the 2024-2025 Catalog – Mason Honor Code)

Individuals with Disabilities:

The university is committed to providing equal access to employment and educational opportunities for people with disabilities.
Mason recognizes that individuals with disabilities may need reasonable accommodations to have equally effective opportunities to participate in or benefit from the university educational programs, services, and activities, and have equal employment opportunities. The university will adhere to all applicable federal and state laws, regulations, and guidelines with respect to providing reasonable accommodations as necessary to afford equal employment opportunity and equal access to programs for qualified people with disabilities.
Applicants for admission and students requesting reasonable accommodations for a disability should call the Office of Disability Services at 703-993-2474. Employees and applicants for employment should call the Office of Equity and Diversity Services at 703-993-8730. Questions regarding reasonable accommodations and discrimination on the basis of disability should be directed to the Americans with Disabilities Act (ADA) coordinator in the Office of Equity and Diversity Services.
(University Policy 1203: https://universitypolicy.gmu.edu/policies/non-discrimination-and-reasonable-accommodation-on-the-basis-of-disability/)

Email and Canvas:
Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly. Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service.
(From the 2024-25 Catalog – https://catalog.gmu.edu/policies/student-rights-responsibilities/)

Mason Diversity Statement:
The College of Health and Human Services, Department of Health Administration and Policy, an intentionally inclusive community, promotes and maintains an equitable and just work and learning environment. We welcome and value individuals and their differences including race, economic status, gender expression and identity, sex, sexual orientation, ethnicity, national origin, first language, religion, age, and ability status.

- We value our diverse student body and desire to increase the diversity of our faculty and staff.
- We commit to supporting students, faculty and staff who have been the victims of bias and discrimination.
- We promote continuous learning and improvement to create an environment that values diverse points of view and life experiences.
- We believe that faculty, staff and students play a role in creating an environment that engages diverse points of view.
- We believe that by fostering their willingness to hear and learn from a variety of sources and viewpoints, our students will gain competence in communication, critical thinking and global

understanding, and become aware of their biases and how they affect their interactions with others and the world.

[This statement was created by the School of Integrative Studies faculty]

Course Logistics:

In a typical week, you will:

- Attend each class on time.
- Watch mini-lectures and videos.
- Participate in class activities.
- Submit all assignments through Canvas according to the assignment schedule.

You should expect to spend an average of 10 hours each week (this includes the time you would have spent in a classroom).

Course Expectations:

Log-in Frequency: Students must actively check the course Canvas site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 2 times per week.

Participation: Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.

Technical Competence: Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.

Technical Issues: Students should anticipate some technical difficulties during the semester and should, therefore, budget their time accordingly. Late work will not be accepted based on individual technical issues.

Workload: Please be aware that this course is not self-paced. Students are expected to meet specific deadlines and due dates listed in the Course Schedule section of this

Syllabus: It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities and assignments due.

Instructor Support: Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. Those unable to come to a Mason campus can meet with the instructor via web conference. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.

Course Schedule

Week One- Welcome to the Course and Introduction to Electronic Health Records (EHR) – (Jan 20, 2026)

a. Videos:
    i. Meet Your Professor
b. Documents:
    i. Syllabus
c. Assignments:
    i. Introduction Post
    ii. Group Formation
        1. Based off the topic
            a. Students will select topic of interest to join the group
            b. Usually 25 students
                i. Groups should be between 4-5
        2. Have a group presentation (due on Week 13)

d. Videos:
    i. Introduction to Health Informatics
    ii. Introduction to EHR
    iii. 3. Clinical Decision Support, Electronic Health Records (EHR, EMR), Health Information Exchange (HIE), Interoperability
e. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 1: Introduction to EHR
    ii. Literature:
        1. Bernstam EV, Smith JW, Johnson TR. What is biomedical informatics? J Biomed Inform. 2010 Feb;43(1):104-10. doi: 10.1016/j.jbi.2009.08.006. Epub 2009 Aug 13. PMID: 19683067; PMCID: PMC2814957.
        2. Evans RS. Electronic Health Records: Then, Now, and in the Future. Yearb Med Inform. 2016 May 20;Suppl 1(Suppl 1):S48-61. doi: 10.15265/IYS-2016-s006. PMID: 27199197; PMCID: PMC5171496.
        3. Lapatas V, Stefanidakis M, Jimenez RC, Via A, Schneider MV. Data integration in biological research: an overview. J Biol Res (Thessalon). 2015 Sep 2;22(1):9. doi: 10.1186/s40709-015-0032-5. PMID: 26336651; PMCID: PMC4557916.
f. Assignment 1: EHR

Week Two: SD2- SDOs, Standards, and Interoperability (Jan 26, 2026)

g. Videos:
    i. IEEE Standards Association: Innovation and Standards
    ii. IEEE Standards Association: The values of standards
    iii. Learn more about the coding: http://www.medicalbillingandcoding.org/learn-more-about-coding/
h. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 2: Standard for EHR Architecture
        2. Chapter 3: Standard for Healthcare Concepts
        3. Chapter 4: Standard for EHR Functional Specification
        4. Chapter 5: Standard for EHR Communication
    ii. Literature
        1. Lehne M, Sass J, Essenwanger A, Schepers J, Thun S. Why digital medicine depends on interoperability. NPJ Digit Med. 2019 Aug 20;2:79. doi: 10.1038/s41746-019-0158-1. PMID: 31453374; PMCID: PMC6702215.
i. Assignment 2: Standards

Week Three: SD3-Bio-Ontologie (February 2, 2026)

j. Videos:
    i. What is an ontology?
    ii. Description Logic
k. Readings:
    i. Cimino JJ. Desiderata for controlled medical vocabularies in the twenty-first century. Methods Inf Med. 1998 Nov;37(4-5):394-403. PMID: 9865037; PMCID: PMC3415631.
    ii. Bodenreider O. Biomedical ontologies in action: role in knowledge management, data integration and decision support. Yearb Med Inform. 2008:67-79. PMID: 18660879; PMCID: PMC2592252.
l. Assignment 3: Bio-ontologies

Week Four: SD4- Unified Medical Language System (February 9, 2026)

m. Videos:
    i. Introduction to the UMLS https://www.nlm.nih.gov/bsd/disted/video/clin_info/umls.html
    ii. MetaMap Transfer (MMtx): https://www.nlm.nih.gov/bsd/videos/p68639600-2.mp4
n. Readings:

i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
    1. Chapter 16 Unified Medical Language System
ii. Literature:
    1. Jing X. The Unified Medical Language System at 30 Years and How It Is Used and Published: Systematic Review and Content Analysis. JMIR Med Inform. 2021 Aug 27;9(8):e20675. doi: 10.2196/20675. PMID: 34236337; PMCID: PMC8433943.

o. Assignment 4: UMLS

Week Five: SD5- SNOMED CT (1) (February 16, 2026)

p. Videos:
    i. Dr. Kent Spackman (IHTSDO Chief Terminologist) Part 1: https://www.youtube.com/watch?v=ISfoMR4aygc
    ii. Dr. Kent Spackman (IHTSDO Chief Terminologist) Part 2: https://www.youtube.com/watch?v=jcohuHGjLLk
    iii. Exploring SNOMED CT
q. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 15 Comprehensive Coding System for Clinical Terms
    ii. Literature:
        1. Chang E, Mostafa J. The use of SNOMED CT, 2013-2020: a literature review. J Am Med Inform Assoc. 2021 Aug 13;28(9):2017-2026. doi: 10.1093/jamia/ocab084. PMID: 34151978; PMCID: PMC8363812.
r. Assignment 5: SNOMED CT Part 1

Week Six: SD5- SNOMED CT (2) (February 23, 2026)

s. Videos:
    i. Powering clinical data analytics with SNOMED CT
t. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 15 Comprehensive Coding System for Clinical Terms
    ii. SNOMED CT Starter Guide:

https://confluence.ihtsdotools.org/display/DOCSTART/SNOMED+CT+Starter+Guide

u. Assignment 6: SNOMED CT Expressions

Week Seven: Midterm (March 2, 2026)

Spring Break (March 9, 2026)

Week Eight: SD6-LOINC (March 16, 2026)

v. Videos:
   i. LOINC 101: Understanding LOINC concepts and uses
   ii. Understanding the structure of LOINC names

w. Readings:
   i. Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
      1. Chapter 12 Coding System for Laboratory Test and Observations
   ii. Literature
      1. Stram M, Gigliotti T, Hartman D, Pitkus A, Huff SM, Riben M, Henricks WH, Farahani N, Pantanowitz L. Logical Observation Identifiers Names and Codes for Laboratorians. Arch Pathol Lab Med. 2020 Feb;144(2):229-239. doi: 10.5858/arpa.2018-0477-RA. Epub 2019 Jun 20. PMID: 31219342.

x. Assignment7: LOINC

Week Nine: SD7-ICD (March 23, 2026)

y. Videos:
   i. Introduction to ICD 10 coding
   ii. Medical billing and coding: https://www.medicalbillingandcoding.org/medical-billing-coding/

z. Readings:
   i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
      1. Chapter 11 Coding System for Classification of Disease and Related Health Problems
   ii. Literature:
      1. Watzlaf V, Alkarwi Z, Meyers S, Sheridan P. Physicians' Outlook on ICD-10-CM/PCS and Its Effect on Their Practice. Perspect Health Inf Manag. 2015 Jan 1;12(Winter):1b. PMID: 26807074; PMCID: PMC4700867.
      2. Harrison JE, Weber S, Jakob R, Chute CG. ICD-11: an international classification of diseases for the twenty-first century. BMC Med Inform Decis Mak. 2021 Nov 9;21(Suppl 6):206. doi: 10.1186/s12911-021-01534-6. PMID: 34753471; PMCID: PMC8577172.

aa. Assignment 8: ICD

Week Ten: SD8-HL7 v2.x (March 30, 2026)

bb. Videos:
    i. HL7 introduction
cc. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 6 Messaging Standard for Healthcare Data
    ii. Literature:
        1. Dolin RH, Alschuler L. Approaching semantic interoperability in Health Level Seven. *J Am Med Inform Assoc*. 2011;18(1):99-103. doi:10.1136/jamia.2010.007864
        2. White paper: The HL7 evolution
dd. Assignment 9: HL7 v2

Week Eleven: SD9-HL7 v3 and RIM (April 6, 2026)

ee. Videos:
    i. History of RIM: https://vimeo.com/27716374
ff. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 7 Model-based Messaging Standard for Healthcare Data
    ii. Literature:
        1. Priyatna F, Alonso-Calvo R, Paraiso-Medina S, Corcho O. Querying clinical data in HL7 RIM based relational model with morph-RDB. J Biomed Semantics. 2017 Oct 5;8(1):49. doi: 10.1186/s13326-017-0155-8. PMID: 28982381; PMCID: PMC5629785.
gg. Assignment 10: HL7 v3

Week Twelve: SD10-HL7 CDA and FHIR (April 13, 2026)

hh. Videos:
    i. Introduction to HL7 CDA
    ii. HL7 FHIR Basics
ii. Readings:
    i. Textbook: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
        1. Chapter 8 Clinical Document Standards
    ii. Literature:
        1. Saripalle R, Runyan C, Russell M. Using HL7 FHIR to achieve interoperability in patient health record. J Biomed Inform. 2019 Jun;94:103188. doi: 10.1016/j.jbi.2019.103188. Epub 2019 May 4. PMID: 31063828.

2. Dolin RH, Alschuler L, Boyer S, Beebe C, Behlen FM, Biron PV, Shabo Shvo A. HL7 Clinical Document Architecture, Release 2. J Am Med Inform Assoc. 2006 Jan-Feb;13(1):30-9. doi: 10.1197/jamia.M1888. Epub 2005 Oct 12. PMID: 16221939; PMCID: PMC1380194.

jj. Assignment 11: HL7 CDA

Week Thirteen: SD11-Meaningful Use (April 20, 2026)

kk. Videos:
   i. The HITECH Act: Electronic Health Records and Meaningful Use

ll. Readings:
   i. Text: Sinha et al., Electronic Health Record: Standards, Coding Systems, Frameworks, and infrastructures
      1. Chapter 31 USA's HER Meaningful Use
   ii. Literature
      1. Jha AK. Meaningful use of electronic health records: the road ahead. JAMA. 2010 Oct 20;304(15):1709-10. doi: 10.1001/jama.2010.1497. PMID: 20959581.

mm. Assignments:
   i. Assignment 12: Meaningful use
   ii. Group presentation

Week Fourteen: Final Exam (April 27, 2026)