



Statewide Framework Document for:

 **512208 Systems Medicine**

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments and leadership alignment may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of Lab science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a [three-dimensional manner](http://nextgenscience.org/three-dimensions). The details about each performance expectation can be found at [Next Generation Science Standards](http://nextgenscience.org/next-generation-science-standards), and the supporting evidence statements can be found under [Resources](http://nextgenscience.org/ngss-high-school-evidence-statements).

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| **Enter Your School District Name** |
| **Course Title:** Systems Medicine | **Total Framework Hours:** 180 |
| **CIP Code:** 512208 | **[x]** Exploratory **[ ]** Preparatory | **Date Last Modified:** October 30, 2020; June 20,2025 |
| **Career Cluster:** Biotechnology Researchand Development | **Cluster Pathway:** Biotechnology Researchand Development  |
| **Course Summary**: Systems Medicine is an exploratory course in which students actively engage in a series of hands-on laboratory, computer-, and community-based units involving medical systems that aim to be participatory, personalized, predictive, and preventative. Systems-driven medicine - focused on optimizing an individual’s wellness and identifying the earliest opportunities to reverse or even prevent disease - will soon be transforming the U.S. healthcare system. It will require a new generation of collaborative and interdisciplinary STEM and healthcare professionals trained in biology, engineering, physics, computer science, environmental sustainability, health, big data, and technology. It will also require a new generation of citizens who can think at a high level while actively participating in this new systems medicine economy. This course will focus on building and deepening interdisciplinary skills for applying biotechnology, biological sciences, biochemistry, genetics, history, technology, engineering, statistics, mathematics, bioinformatics, ethics, systems thinking, and patient-driven advocacy to learn about and explore careers and participation in the health and medical systems in our communities. This course will culminate in a capstone project that will be presented to community stakeholders. |
| **Eligible for Equivalent Credit in:** 3rd credit in lab science | **Total Number of Units:** 6 |
| **Course Resources:** National Consortium of Health Science Education [National Health Science Standards](https://healthscienceconsortium.org/standards/); [Career Ready Practices](https://careertech.org/wp-content/uploads/2024/10/Career-Ready-Practices.pdf) |

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| **Unit 1:** History | **Total Learning Hours for Unit:** 20 |
| **Unit Summary**: This is a unit that introduces students to the history of medicine and how its evolution has been driven by advances in technology, science and engineering toward systems medicine. This unit includes case studies, an introduction to Bioethics and collection of familial information.**Suggested Curriculum components:*** Introduction to Systems Medicine
	+ PowerPoint and information from Systems Biology on Big Changes
* Introduction to Ethical Practice [www.NWABR.org/teacher-center](http://www.nwabr.org/teacher-center)
* Bioethics Primer
* Bioethics 101
* NIH Curriculum Supplement – Exploring Bioethics <https://www.thehastingscenter.org/wp-content/uploads/Exploring-Bioethics-NIH-curriculum-_-teachers-guide.pdf>
* Students begin collecting information on the health systems that they and their parents, their grandparents/great grandparents have experienced and how these systems have changed over the person’s lifetime.
	+ NOTE: Health System, also referred to as health care system, includes but is not limited to the organization of people, institutions, technology and resources that deliver health care services and information to meet the health needs of target populations.
		- People: relatives, doctors, nurses, acupuncturists, naturopath, herbalist, friends, physical therapists, coach, Teledoc, etc.
		- Institutions: Hospitals, clinics, school, community health center, mobile lab, urgent care, etc.
		- Technology: Health records, medical equipment, communication devices, medical devices, etc.
		- Resources: Internet, Teledoc, friends, family, community members, books, pamphlets, magazine, YouTube, social media, 23 and Me, etc.
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| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:** As a group, research and create a media product to communicate the changes in access to healthcare and treatment of a patient experiencing one of the following over time (influenza, cancer, heart disease, hearing defect, polio, loss of limb, heart attack, bacterial infection). Students present major developments that occurred in at least three decades (including the present), e.g. 1920, 1960, 2000, present.
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| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * As a group, students will access and evaluate information (4.A.1), create a media project (5.B.1) and be flexible (7.B.3) while researching and communicating the changes in access to healthcare and treatment of a patient experiencing one of the following over time (influenza, cancer, heart disease, hearing defect, polio, loss of limb, heart attack, bacterial infection).
* Students present major developments that occurred in at least 3 different decades (including the present), e.g. 1920, 1960, 2000, present. Produce Results [10.B.1 (a-h)]
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| **Industry Standards and/or Competencies**:**National Health Science Standards****Foundation Standard 6: Ethics****Understand acceptable ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment**.6.1. Ethical Practice6.1.1. Differentiate between ethical and legal issues impacting healthcare6.1.2. Identify ethical issues and their implications related to healthcare (such as: Ethics committee; Euthanasia; Immunizations; In vitro fertilization; Organ Donation/transplantation; Scope of Practice) 6.2 Cultural, Social, and Ethnic Diversity6.2.1. Discuss religious and cultural values as they impact healthcare (such as: Ageism; Ethnicity; Gender; Race; Religion)6.2.2 Demonstrate respectful and empathetic treatment of all patients/clients/families. (such Civility; Customer service; Patient satisfaction). |
| **Aligned Washington State Academic Standards** |
| **Science** | HS-LS4 Biological Evolution: Unity and DiversityHS-LS4-4 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive.HS-ETS1-1 Engineering DesignHS-ETS1-1 Engineering Design: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Engaging in argument from evidence | HS-LS4.C: Adaption | Cause and Effect |
| Obtaining, Evaluating and Communicating Information | ETS1.A Defining and Delimiting Engineering Problems | Stability and Change |
|  |  | Systems and System Models |

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| **Unit 2:** Models of Systems | **Total Learning Hours for Unit:** 20 |
| **Unit Summary**: This is a unit that introduces students to the concept of system science. They will explore network concepts using a familiar system (cell phones) and later apply their knowledge to a living system. Students will use the four basic principles of bioethics and be introduced to HIPAA in this unit. Careers highlighted in this unit are geneticist, genetic counselor, medical scribe, health information technician, software engineer, health navigator, and epidemiologist.**Suggested Curriculum components:***Suggested Concepts and guiding questions:* What is a healthcare team? What are the roles and responsibilities of the team members? What are the characteristics of effective teams? How do you build positive team relations? How do you manage team conflict? What are the possible connections and disconnections that may occur within the system of medicine? What are the advantages and disadvantages of these? How does HIPPA impact information sharing across the network?*Suggested labs*Lab 1 Introduction to Systems (module)  Lesson 1: Cell phone Lab/activity (Institute for Systems Biology)* Students are introduced to a system, its basic construction and how to analyze a system.
* Students create and analyze a cell phone network.

<https://see.systemsbiology.net/introduction-to-systems/lesson-1-cell-phone-network-introduction/> *Suggested Concepts:** Math and data components: Nodes, Knockouts, Networks, Spreadsheets, Edges, Reactivating, Data Entry: Follow a line of communication through a network, Analyzing simple data.

 Lesson 2: Cytoscape Cell phone Network – Class Activity with Demonstration (Institute for Systems Biology) * Students observe a computer program (Cytoscape) track the flow of information through a network.
* Students use a computer program (Cytoscape) to interpret the impact of altering the network.
* Students look at data trend and analyze data using web-based tools

<https://see.systemsbiology.net/introduction-to-systems/lesson-2-cytoscape-cell-phone-network/> *Suggested Concepts and guiding questions:* * Predictive models: Remind students of models of system wide predictability they are familiar with such as Punnett squares, predator-prey, energy flow/energy pyramid, probability, photosynthesis or plant experiment in class, experimental cycle
* Possible models for new application of systems predictability – weather, cancer (BRCA 1 and 2), other virtually developed models. Where do they come from? How are they developed?
* What do percentages in the model mean? i.e. What does it mean when there is 40% chance of getting breast cancer?
* Connect the cell phone network analogy to the real-world content of systems medicine.

 *Sample Reading:* Reductionism/Holism/Systems Thinking: The Demise of Bill and The Salvation of Doug. [*https://review.ucsc.edu/spring04/bio-debate.html*](https://review.ucsc.edu/spring04/bio-debate.html)This reading gives two perspectives of analysis of the same situation*Possible Performance Assessment for Systems Model: Use the medical systems information collected previously and build their first version of the historical network diagram for each decade. Their network diagram should show the connections, disconnects, and hypothetical lines where they suspect there should be connection within that medical system. These systems should be saved, evaluated and updated throughout the course as new data is discovered/collected.* *Resources for Careers*: <https://explorehealthcareers.org> <https://worksourcewa.com> [www.careerbridge.wa.gov](http://www.careerbridge.wa.gov)*Resources for Case Studies:*Bioethics Case Studies for the Classroom: [http://www.biotech.iastate.edu/bioethics-case-studies/](https://bioethics.las.iastate.edu/a-note-about-case-studies-for-the-classroom/)General and Human Biology Case Studies:  **https://www.nsta.org/case-studies/biology** |
| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:** Engage in argument from evidence to analyze an ethical dilemma justifying a position using knowledge of the four ethical principles, stakeholder perspectives and scientific facts.
* Using current news and/or articles, students will obtain, evaluate and communicate information through a formal discussion (such as a debate, group dialogue, Socratic seminar), about a complex medical ethical, moral or legal issue.
* Demonstrate understanding of systems by producing a 2D model of a system in their own life (other than cell phones). The network diagram should show the connections, disconnects and hypothetical lines where they suspect there should be connections within the system. Students should articulate how HIPAA impacts information sharing across the network.
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| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * Students will make judgments and decisions (2.C.1; 2.C.2; 2.C.4) and will communicate clearly (3.A.1; 3.A.2; 3.A.3) as they engage in arguments from evidence to analyze an ethical dilemma, justifying a position using knowledge of ethical principles, stakeholder perspectives and scientific facts.
* Students will reason effectively (2.A.1) as they use current news and/or articles to obtain, evaluate and communicate information about a complex medical ethical, moral or legal issue.
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| **Industry Standards and/or Competencies**:**National Health Science Standards****Foundation Standard 5: Legal Responsibilities****Describe legal responsibilities, limitations, and implications on healthcare worker actions**.5.2 Legal Practices5.2.1 Apply standard for the safety, privacy and confidentiality of health information (HIPAA, privileged communication). |
| **Aligned Washington State Academic Standards** |
| **Science** | HS-LS Ecosystems: Interactions, Energy, and DynamicsHS – LS2–7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.HS – LS2-8 Evaluate evidence for the role of group behavior on individual and species’ chances to survive and reproduce.HS-ETS1Engineering DesignHS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constrains on interactions within and between systems relevant to the problem. |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Developing and Using Models | HS-LS2.C Ecosystem Dynamics, Functioning, and Resilience | Patterns |
| Analyzing and Interpreting Data | HS-LS2.D Social Interactions and Group Behavior | Cause and Effect |
| Using Mathematics and Computational Thinking | HS-ETS1.B Developing Possible Solutions | Scale Proportion and Quantity |
| Obtaining, Evaluating & communicating Information |  | Systems and Systems models |
| Engaging in Argument from Evidence |  | Structure & Function |
|  |  | Stability and Change |

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| **Unit 3:** Factors that Affect Health and Wellness | **Total Learning Hours for Unit:** 50 |
| **Unit Summary**: This unit introduces students to the factors that affect health and wellness. Students will use model organisms to observe how an organism’s phenotype is affected by a combination of environmental and genetic factors. Students will demonstrate their understanding of ethical compliance while working with model organisms. Careers highlighted in this unit are: bioethicist, bioengineer, protein chemist, compliance manager, microbiologist, research scientist, cellular biologist, animal lab technician, bioinformaticist, data scientist.**Suggested Curriculum components:***Suggested Labs* 1. Nematode Lab – environmental impact

[*https://gsoutreach.gs.washington.edu/files/worm\_unit\_gem\_final816.pdf*](https://gsoutreach.gs.washington.edu/files/worm_unit_gem_final816.pdf)1. Environmental Influence on Gene Network Lab – can use Halobacteria or Nematodes for this lab

[*https://see.systemsbiology.net/environmental-influence/environmental-influence-on-gene-networks-module-unit-plan/*](https://see.systemsbiology.net/environmental-influence/environmental-influence-on-gene-networks-module-unit-plan/)1. Nematode (Dumpy Lab) Knockout (Contact Joan Griswold at the University of Washington Genome Sciences ( jcgriz@uw.edu)
2. Skin Cancer Link: Effect of UV Radiation

[*https://www.microbiology.ubc.ca/sites/default/files/roles/drupal\_ungrad/JEMI/1/1-32.pdf*](https://www.microbiology.ubc.ca/sites/default/files/roles/drupal_ungrad/JEMI/1/1-32.pdf)[*https://www1.udel.edu/GK-12/Material/2007/CM/Foster/Bacteria-Genetic%20mutations/Bacterial%20Mutation%20Lab\_UV.doc*](https://www1.udel.edu/GK-12/Material/2007/CM/Foster/Bacteria-Genetic%20mutations/Bacterial%20Mutation%20Lab_UV.doc) 5. Yeast lab (mutations) - University of Washington Genome Sciences - Contact Dr. Maitreya ; J. Dunham, PhD (maitreya@u.washington.edu) *Suggested Concepts and guiding questions:* * Extend student learning beyond factors studied in the lab to all factors that potentially influence one’s health and wellness.
* Importance and ethical use of model organisms in research. [www.nwabr.org/teacher-center/animals-research#overview](http://www.nwabr.org/teacher-center/animals-research#overview)
* Math and data concepts: making sense of multiple and diverse data types; collection and visualization of data; population data; standard deviation; quantitative versus qualitative data.
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| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:** As a result of performing a lab that tests the effects of an environmental factor on an organism, using systems thinking, they ask questions of the data and think creatively to develop an innovative solution to change the effect of the original environmental factor and/or to improve wellness.
* Complete an inquiry investigation to analyze the phenotypic effect of mutations on an inherited genome. (Central Dogma, i.e. Sickle Cell)
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| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * Students use systems thinking (2.B.1) as they perform a lab testing the effects of an environmental factor on an organism**.** They will ask questions of the data and think creatively (1.A.1; 1.A.2) to develop an innovative solution (1.C.1) to change the effect of the original environmental factor.
* Students use and manage information (4.B.1; 4.B.2) as they complete an inquiry investigation analyzing the phenotypic effects of mutations on an inherited genome. (Central Dogma, i.e. Sickle Cell)
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| **Industry Standards and/or Competencies**:**National Health Science Standards****Foundation Standard 6: Ethics****Understand acceptable ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.** 6.1. Ethical Practice 6.1.1. Differentiate between ethical and legal issues impacting healthcare |
| **Aligned Washington State Academic Standards** |
| **Science** | HS-LS1 From Molecules to Organisms: Structures and ProcessesHS-LS2 Ecosystem: Interactions, Energy, and DynamicsHS-LS2.8 Evaluate evidence for the role of group behavior on individual and species’ chances to survive and reproduce.HS-LS3 Heredity: Inheritance and Variations of TraitsHS-LS4 Biological Evolution: Unity and Diversity |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Analyzing and Interpreting Data | HS-LS2.A Interdependent Relationships in Ecosystems | Cause and Effect |
| Asking Questions and Defining Problems | HS - LS2.B Cycle of Matter and Energy Transfer in Ecosystems | Patterns |
| Engaging in Argument from Evidence | HS-LS2D: Social Interactions and Group Behavior | Scale, Proportion and Quantity |
| Obtaining, Evaluating and Communicating Information |  | Systems and Systems Models |
| Planning and Carrying out Investigations |  | Stability and Change |
| Using Mathematics and Computational Thinking |  | Structure and Function |
| Developing and Using Models |  | Energy and Matter |
| Constructing Explanations and Designing Solutions |  |  |

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| **Unit 4:** Personal Perspective – Patient-driven Advocacy (self and others) | **Total Learning Hours for Unit:** 20 |
| **Unit Summary**: This is a unit that brings together the previous three units to introduce the future of medicine which takes a systems, holistic approach for all humans. Students will apply previous knowledge to compare and contrast standard medical practices with case studies that demonstrate a collaborative, systems medicine approach. Students have looked at how environmental factors affect model organism populations. Now, students will use a research based, holistic approach to look at data focused on individuals (preferably themselves). Careers highlighted in the unit are: phlebotomist, Teladoc, pathologist, medical technologist, medical lab technician, OT/PT, Yoga/LMP, exercise science, lifestyle/wellness coach, application architect.**Suggested Curriculum components:***Suggested Concepts and Guiding Question:** What are the different types of personal health data that can be collected?
* Who collects and analyzes the data?
* Who keeps the data safe and secure?
* Who has access to the data?
* Who advocates for equitable treatment of all individuals in healthcare?

*Suggested Activities and/or labs for data collection and analysis to better understand an individual’s health.* * Collaboratively collect information by researching the roles and responsibilities of various positions and institutes (eg. clinic, hospital, drug store, eye doctor, dentist, insurance provider) involved in the healthcare system and organize the information by subsystem one would go to for assistance, treatment, or questions for a medical issue.
* Complete a lifestyle questionnaire.
	+ Collect lifestyle questionnaires from a variety of specialists. Design a new electronic questionnaire that would be useful over time. Explain and be prepared to defend why you include each item on the form.
* Collect and analyze personal health data over time: i.e., Pulse, respiration per minute, blood pressure, weight, sleep log, diet log, exercise/activity log/steps, urine collection and dipstick analysis at home. (*Abnormal values/results= students referred to health room)*
* Using health department or Blood bank resources to determine what information one gets from biological samples, i.e., blood, tissue, urine, feces,

cheek swab, saliva, etc.* Organize and/or assist with a free physical night.
* Collect nutrition data on foods eaten.
	+ Measure McMush Lab - methods for testing for macromolecules in foods students eat. (Google McMush Lab)
	+ Read and research nutrition labels. What do they really mean? Research current FDA regulations for nutritional labels.
* Research how a scientist gathers genetic, protein, environmental, and RNA data. What does the analysis reveal? What questions can be asked? How can the information be used, now and in the future, to improve one’s health and wellness?
* Learn about biomarkers through readings and discussions. What are biomarkers? How they are measured? What are the types of biomarkers?
	+ [www.dexafit.com](http://www.dexafit.com)
	+ [www.ncbi.nlm.nih.gov/pmc/articles/PMC3078627](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078627)
	+ [www.personalizedmedicinecoalition.org/education/types\_of\_biomarkers](http://www.personalizedmedicinecoalition.org/education/types_of_biomarkers)
	+ [www.ncbi.nlm.nih.gov/books/NBK220298](http://www.ncbi.nlm.nih.gov/books/NBK220298)
	+ Case Studies are increasingly available through organizations such as Institute for Systems Biology; Shoreline Community College Biotechnology Program; Fred Hutch Science Education Partnership; HHMI
	+ *Caffeine markers* [*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4595102/*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4595102/)
	+ Decoding Cancer [*www.decodingcancer.org*](http://www.decodingcancer.org)

Simulation lab: [*https://phet.colorado.edu/en/simulation/legacy/eating-and-exercise*](https://phet.colorado.edu/en/simulation/legacy/eating-and-exercise) |
| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:** Create a network map of the current healthcare system in their community identifying the roles and responsibilities of each subsystem (specialty area -- e.g. cardiology, gastroenterology, radiology/imaging) and describe how the subsystems interact with each other to create a pipeline for standard of care.
* In diverse teams select a specific subsystem (medical specialty), interview or collaborate with a professional working in that field to develop a list of questions that a patient might ask a Doctor/Health Care professional during a medical visit or call.
* Use the questions their team developed for their specialty area to create three media products for three generations (grandparents, parents and adolescent) in the form of an electronic (i.e. phone, tablet) app, social media, database, information card, or brochure that is patient friendly. The students present the product to professionals or emerging professionals from the healthcare field. (i.e. local physicians, local medical office assistants, medical assistants, nurse practitioners, nurses, Public Health office, Western Washington AHEC or Eastern Washington AHEC, medical administrators, retired medical professionals)
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| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * Community Service project: Students create, present and provide their media products (5.B.1; 5.B.2) to the PTA; patients, staff, and family at an Assisted Living Care Facility; local library; clinic; Public Health office and/or other local community organizations.
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| **Industry Standards and/or Competencies**:**National Health Science Standards****Foundation Standard 3: Systems****Identify how key systems affect services performed and quality of care.**3.1 Healthcare delivery systems 3.1.1 Differentiate healthcare delivery systems and healthcare related agencies. a. Types of practice settings* + - * Acute care
			* Ambulatory care
			* Behavioral and mental health services
			* Home care
			* Long-term care
			* Medical and dental practices

 b. Specialty medical and dental practices* Cosmetic surgery
* Orthodontics
* Pulmonology
* Surgical

 c. Government agencies: * Centers for Disease Control and Prevention (CDC);
* Centers for Medicare & Medicaid Services (CMS);
* National Institutes of Health (NIH); Occupational Safety and Health Administration (OSHA);
* US Department of Veterans Affairs (VA);
* US Food and Drug Administration (FDA);
* U.S. Public Health Service (USPHS)

d. Related organizations: * American Cancer Society,
* American Heart Association,
* American Red Cross,
* March of Dimes,
* World Health Organization, etc.

**Foundation Standard 5: Legal Responsibilities****Describe legal responsibilities, limitations, and implications of on healthcare workers actions.**5.2 Legal Practices 5.2.3 Summarize the essential characteristics of a patient’s basic rights within a healthcare setting.**Foundation Standard 6: Ethics****Understand acceptable ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.** 6.2 Cultural, Social, and Ethnic Diversity 6.2.1 Discuss religious and cultural values as they impact healthcare (such as: Ageism; Ethnicity; Gender; Race; Religion) 6.2.2 Demonstrate respectful and empathetic treatment of all patients/clients/families (such as Civility; Customer Service; Patient  Satisfaction). |

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| **Aligned Washington State Academic Standards** |
| **Science** | HS - LS1 From Molecules to Organisms: Structures and ProcessesHS - LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.HS – LS3 Heredity: Inheritance and Variation of Traits |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Analyzing Data | LS1.A: Structure and Function | Cause and Effect |
| Asking Questions and Defining Problems | LS3.B: Variation of Traits | Patterns |
| Constructing Explanations & Designing Solutions |  | Systems and System Models |
| Developing and Using Models |  |  |
| Obtaining, Evaluating and Communicating Information |  |  |

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| **Unit 5:** Communal Perspective – Issues of Health from a Communal View | **Total Learning Hours for Unit:** 25 |
| **Unit Summary**: In this unit, students will explore environmental hazards and assets, and evaluate the overall health and resilience of their community. Students take action based on their system analysis of health and the environment OR analyze global environmental health data connected to chronic and acute disease frequency. Based on their interests, students explore the chronic health issues (acute health issues are not addressed in this unit) and environmental impacts. Students apply their systems medicine understanding by using integrated, innovative approaches to improve their community. Careers highlighted in the unit are: patient advocate, biostatistician, community health worker, and nurse educator.**Suggested Curriculum components:***Suggested Labs and Resources** Water testing lab: Gather water samples from different communities, both from environmental water sources and the tap and test water quality to determine relative health.
* Air Quality lab: Design an inexpensive way to collect air quality data. What information/data can you collect about air? What can you determine from this Data? [www.epa.gov/air-quality-data-and-tools](http://www.epa.gov/air-quality-data-and-tools)
* Tools for collecting and analyzing data: BenMAP; Airbeam
* Environmental Health Disparities map Seattle Times <https://fortress.wa.gov/doh/wtn/WTNIBL>
* Climate and Health assessment <https://health2016.globalchange.gov>
* Contact the local utility company for educational resources on water quality and impact on human health
* Contact Regional Environmental Protection Agency (EPA) education representative.
* Contact the City or County Planner
* Contact the Regional HealthCare Authority regarding factors affecting health disparities in the local area
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| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:*Complete project #1 consisting of three main components:* Investigate
* Identify existing environmental hazards that affect the community’s health
* Collect and/or use data to evaluate environmental hazards, i.e. water quality, air quality, soil contamination, light pollution, and sound pollution
* Compare and contrast technologies, citizen science projects, and political solutions to the environmental hazards impacting the community’s health
* Map
* Generate a map of environmental hazards and assets in their community
* Solve
* Leverage their social or political capital to advocate for improved environmental health through the implementation of a specific environmental policy or new technology for use in their community

**OR**Complete project #2 consisting of three main components: * Investigate
* Identify and investigate social, cultural, biological, and economic factors that explain patterns in chronic disease prevalence, morbidity, and mortality in their community
* Collect and/or use data to evaluate health disparities on the basis of race, class, gender, sexuality, and age and apply this lens to their own community
* Compare and contrast technologies and solutions for prevention and treatment of the chronic health issue
* Map:
* Generate a map of their school or community, identifying features that contribute to or help solve a local chronic health issue they choose (i.e. AED locations, fast food restaurants)
* Solve
* Compare, integrate, and evaluate sources of information on a chronic disease of their choice, focusing on the root causes of the issue and the demographic groups that are most affected in order to propose possible solutions for prevention and treatment of the chronic health issue
* Articulate and argue for funding priorities to address the health disparities
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| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * Thinking creatively (1.A.1; 1.A.2), students work independently (8.B.1) to either create a social media campaign applying technology effectively (6.A.2) or use systems thinking (2.B.1) and attend a local political event to advocate for an environmental health policy of their choice. (Health Literacy 12.D.5)
* Working in collaborative groups (3.B.1; 3.B.3), students use and manage information (4.B.1) to produce results [10.B.1 (a-h)] around a chronic health issue. They will identify 3 funding priorities and make judgements and decisions (2.C.1; 2.C.2; 2.C.4) around what would make a measurable difference in health outcomes related to the chronic condition.
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| **Industry Standards and/or Competencies**:**Common Ready Practices** * Consider the environment and economic impacts of decisions
* Collaborate productively while using cultural & global competencies.

**National Health Science Standards****Foundation Standard 3: Systems****Identify how key systems affect services performed and quality of care.**3.1 Healthcare delivery systems 3.1.3 Analyze the impact of emerging issues on healthcare delivery systems. (Behavior/Mental Health; Bioethics; Epidemiology;  Socioeconomics; Technology)**Foundation Standard 5: Legal Responsibilities****Describe legal responsibilities, limitations, and implications of on healthcare workers actions.**5.2 Legal Practices 5.2.3 Summarize the essential characteristics of a patient’s basic rights within a healthcare setting.**Foundation Standard 6: Ethics****Understand acceptable ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.** 6.2 Cultural, Social, and Ethnic Diversity 6.2.1 Discuss religious and cultural values as they impact healthcare (such as: Ageism; Ethnicity; Gender; Race; Religion) 6.2.2 Demonstrate respectful and empathetic treatment of all patients/clients (such as Civility; Customer Service; Patient Satisfaction). |
| **Aligned Washington State Academic Standards** |
| **Science** | HS – LS2 Ecosystems: Interactions, Energy, and DynamicsHS – LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.HS – LS2-8 Evaluate evidence for the role of group behavior on individual and species’ chances to survive and reproduce.HS – ETS1 Engineering DesignHS – ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Analyzing and Interpreting Data | HS - LS2.C: Ecosystem Dynamics, Functioning, and Resilience | Cause and Effect |
| Asking Questions and Defining Problems | HS – LS2.D: Social Interactions and Group Behavior | Patterns |
| Constructing Explanations and Designing Solutions | HS - LS4.D: Biodiversity and Humans | Systems and System Models |
| Engaging in Argument from Evidence | HS - ETS1.B Developing Possible Solutions |  |
| Obtaining, Evaluating and Communicating Information |  |  |
| Planning and Carrying Out Investigations |  |  |
| Using Mathematical and Computational Thinking |  |  |
| Developing and Using Models |  |  |

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| **Unit 6:** Capstone Proposal for the Future System of Healthcare | **Total Learning Hours for Unit:** 45 |
| **Unit Summary:** *Ideas incorporated below as a start to building the final project for this course.* *Capstone Project key elements:** *Collaborative, team approach for students*
* *Possible community stakeholders as mentor for project (community health workers; patient advocate);*
* *Presentation to outside stakeholders*

*Suggested Guiding Questions* *“What does health care look like when systems medicine is in place with a focus on wellness?”** *How does an interdisciplinary team approach in patient care differ from the linear hierarchical specialty approach? Students may need to refer to the information gathered on roles and responsibilities of various positions and institutes involved in the healthcare system from Unit Four.*
	+ *Compare the arrangement and dynamics of various teams in different subsystems within healthcare.*
* *How does an interdisciplinary approach, i.e., Emergency Room, compare to specialty care, i.e., neurology, cardiology, oncology, orthopedics, allergists, physical therapists, etc?*
* *Based on the comparison, what components and interactions are in place and which ones are not?*
* *Using your developed network map and comparisons of the approaches to health care, propose the ideal subsystems to include for an optimal system of healthcare?*
	+ *How much influence does each subsystem have on the whole system?*
	+ *What are the outlier systems? e.g. herbalist, chiropractor*
	+ *How do you work with outliers?*
	+ *What are the boundaries for a system?*
	+ *How do the interactions work to support the system (network)?*
	+ *What does it look like when systems healthcare is not happening (network is broken)? How does one know it is not happening?*
	+ *How might one turn a broken system into a functioning system?*
	+ *How do you get all the systems to work together? How might diverse health care systems integrate?*
* *How do you create the pipeline for a healthcare system? What would be your personal entry point into the system?*
* *How might you create a program that manages the flow of information in a healthcare system?*
* *How do you rework the system to not negatively affect the standard of care while people are still in the system?*

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| **Performance Assessments**:(Districts to complete for each unit)*Example assessments for this unit include:*Working with a community stakeholder as a mentor (community health workers; patient advocate), students, in teams, collaborate while investigating and researching “what it looks like when systems medicine is in place”:*1. Analyze the problem to be solved: “****What does health care look like when systems medicine is in place with a focus on wellness?”****In their analysis, students will:** Compare an interdisciplinary team approach to patient care to the linear hierarchy specialty approach
	+ Based on the comparison, identify the major and minor components and interactions which are present and absent.
* Using your developed concept map for health care, identify the essential subsystems to include in an overall system of medicine
* Describe how much influence each subsystem has on the whole system
* Determine and describe the boundaries for a system
* Identify the outlier systems (e.g. herbalist, chiropractor)
	+ Explain how to work with outliers
* Identify the interactions that work to support the system (network)
* Explain what it looks like when system medicine is not happening (network is broken). Identify the indicators when it is not happening.
* Describe the challenge with a rationale for why it is a major health priority to create a system medicine approach focused on wellness versus a focus on a specific disease or illness in the health care system.
* Describe, qualitatively and quantitatively, the extent and depth of the problem and its major consequences to society and/or the natural world on both global and local scales if it remains unsolved; and
	+ Document background research on the problem from two or more sources, including research journals.

2. **Develop and design a solution which leads to a systems medicine approach to wellness with the individual as the principal lead of the system.*** Specify qualitative and quantitative criteria and constraints for acceptable solutions to the problem.
* Explain how to get all the systems to work together, including a description of how one might integrate diverse health care systems.
* Create a proposed pipeline for future employees to enter the system, including what would be their personal entry point into the system.
* Develop and explain the flow of information in the healthcare system
* Propose the steps of implementation for a Systems Medicine Approach that should be taken that will minimize negative impacts on a patient’s standard of care in the current conventional system.

3. **Gather feedback from peers and evaluate proposed solutions*** Verify three or more realistic criteria and two or more constraints are included in the solution, such as cost, safety, reliability, and aesthetics
* Assign priorities for each criterion and constraint that allows for a logical and systematic evaluation of the solution.
* Analyze (quantitatively where appropriate) and describe the strengths and weaknesses of the solution with respect to each criterion and constraint, as well as social and culturally acceptability and environmental impacts
* Describe possible barriers to implementing each solution, such as cultural, economic, or other sources of resistance to potential solutions
* Provide evidence-based suggestions on how to optimize the solution, based on prioritized criteria, analysis of the strengths and weaknesses (costs and benefits) of the solution, and barriers to overcome.

4. **Refine and/or optimize the solution based on feedback from peers.**5. **Present to stakeholders.** |
| **Leadership Alignment**: (Districts to complete for each unit)*Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.* *Example:* * Students will collaborate with others (3.B.1; 3.B.3) and produce results [10B.1 (a-h)] when presenting as a team to respective stakeholders.
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| **Industry Standards and/or Competencies**:**Career Ready Practices**Think critically to make sense of problems & persevere in solving them.Collaborate productively while using cultural & global competencies. **National Health Science Standards****Foundation Standard 3: Systems****Identify how key systems affect services performed and quality of care.**3.1 Healthcare delivery systems 3.1.1 Differentiate healthcare delivery systems and healthcare related agencies. a. Types of practice settings* Acute care
* Ambulatory care
* Behavioral and mental health services
* Home care
* Long-term care
* Medical and dental practices

 b. Specialty medical and dental practices* Cosmetic surgery
* Orthodontics
* Pulmonology
* Surgical

 c. Government* Centers for Disease Control and Prevention (CDC)
* Centers for Medicare & Medicaid Services (CMS)
* National Institutes of Health (NIH)
* Occupational Safety and Health Administration (OSHA)
* U.S. Department of Veterans Affairs (VA)
* U.S. Food and Drug Administration (FDA)
* U.S. Public Health Service (USPHS)

 d. Related organizations; * American Cancer Society (ACS)
* American Heart Association (AHA)
* American Red Cross (ARC)
* March of Dimes
* World Health Organization (WHO)

**Foundation Standard 5: Legal Responsibilities****Describe legal responsibilities, limitations, and implications of on healthcare workers actions.**5.2 Legal Practices 5.2.3 Summarize the essential characteristics of a patient’s basic rights within a healthcare setting.**Foundation Standard 6: Ethics****Understand acceptable ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.** 6.2 Cultural, Social, and Ethnic Diversity 6.2.1 Discuss religious and cultural values as they impact healthcare (such as: Ageism, Ethnicity; Gender; Race; Religion) 6.2.2 Demonstrate respectful and empathetic treatment of all patients/clients (such as Civility; Customer Service; Patient Satisfaction).**Foundation Standard 8: Teamwork****Identify roles and responsibilities of individual members as part of the healthcare team.**  8.1 Healthcare teams 8.1.1 Evaluate roles and responsibilities of healthcare team members.  8.1.2 Identify characteristics of effective teams.* Collaboration
* Defined roles
* Effective communication
* Effective leadership
* Measurable processes and outcomes
* Mutual respect
* Shared goals

 8.2 Team member participation 8.2.4 Evaluate why teamwork is an important part of healthcare and how it improves patient care.  |

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| **Aligned Washington State Academic Standards** |
| **Science** | HS-ETS1Engineering DesignHS-ETS1-1 Engineering Design: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.HS–ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constrains on interactions within and between systems relevant to the problem. |
| **Science and Engineering Practice** | **Disciplinary Core Idea** | **Crosscutting Concept** |
| Asking Questions and Defining Problems | ETS1A: Defining and Delimiting and Engineering Problem | Systems and Systems Model |
| Constructing explanations and designing solutions | HS - ETS1.B Developing Possible Solutions | Influence of Science, Engineering, and Technology on Society and the Natural World |
| Using Mathematics and computational thinking |  |  |