

# HEALTHCARE SYSTEMS ENGINEERING (HSEG)

---

## **HSEG 515 Healthcare Delivery Systems (3 semester hours)**

Mandatory entry-level course for 4+1 students and other students transitioning from non-healthcare fields. History, cultural tradition, and operations of U.S. private, non-profit, hybrid, and government healthcare delivery systems, including discussion of the multifaceted U.S. trauma care system and the U.S. system for mass casualty events. Case study discussions emphasizing the quality and ethical issues challenging the U.S. healthcare system today and its comparative performance amongst the industrialized world. Additional important themes of medical professionalism, and the profession's social contract with society as central to the culture of healthcare professionals and administrators functioning within systems of care. Costs and payment systems. Successes and challenges in modern healthcare. Introduction to: electronic records and their portability; Health Insurance Portability and Accountability Act; technology (e.g., surgical robots) and integrated systems. Review of quality, safety, and regulatory systems. Non-U.S. healthcare delivery systems. Medical and healthcare jargon. Provider burnout.

## **HSEG 535 Lean Healthcare (3 semester hours)**

The US healthcare system is in crisis. While costs continue to rise to unsustainable levels, the average quality of care lags that of other industrialized nations. The professionals delivering health care are overworked and frustrated. Lean has been extraordinarily effective in increasing the efficiency of manufacturing processes. However, health care is not a simple manufacturing-like operation - it is a highly complex enterprise, with many stakeholders, very complex processes, non-standardized patients and medical problems, and great variability in processes and demand. These factors challenge the application of traditional lean techniques derived from manufacturing. This class will bridge the gap between traditional lean practices and the needs of healthcare enterprises. The class will begin with a review of basic lean concepts, with examples of how they can be applied to health care processes. Next, the class will review issues that complicate the application of lean to complex, high variability processes - such as many healthcare processes. These issues include handling variation; people and corporate culture issues; and the modifications required to make lean tools effective. Finally, implementation and sustainment issues will be covered. The class will mix traditional lecture-based instruction with a variety of active learning exercises, project work and a day-long clinic simulation.

## **HSEG 545 Healthcare Seminar (3 semester hours)**

Twelve to fourteen invited prominent experts present guest lectures with significant systems engineering component.

## **HSEG 598 Special Studies (1-3 semester hours)**

## **HSEG 599 Independent Studies (1-3 semester hours)**

## **HSEG 605 Healthcare Systems Engineering (3 semester hours)**

This is a foundational course for the Healthcare Systems Engineering master's program at LMU and provides the framework for the remainder of the program. Detailed knowledge of the process of Lean Healthcare Systems Engineering (LHSE) is essential for completing capstone projects. This course is divided into two modules: Module I - Deep dive into the LHSE process. Topics include background and literature review analysis of current state with tools such as value-stream mapping, Ishikawa diagrams and the N2 matrix, culminating in a problem statement design of future state with a goal statement, requirements, analysis of alternatives, system architecting, risk management, validation and verification, ethics, and lessons learned Module II - Overview of systems thinking in healthcare and beyond, including the principles of unintended consequences, the common good and public interest, and ethics. Enrollment limited to Healthcare Systems Engineering students.

## **HSEG 625 Patient Safety and Quality Systems (3 semester hours)**

This course is focused on patient safety as a principle of quality medical care, addressing the following topics: 1) Errors vs. adverse events. 2) Error tracing, analysis and reporting. 3) Errors in different settings: medical, surgical, pharmacy, hand off and transition of care. 4) Evolution of safety systems 5) Solutions and system design around patient safety 6) Human factors and human/machine interactions in healthcare. 7) Team building and culture of safety. 8) Workforce training and culture of learning. This course will give students a global understanding of how patient safety is considered in every step of medical decision-making process. By the end of the course, students will have a deeper appreciation of clinicians' approach to patient safety. Lectures will often be augmented with guest speakers. Speakers are experienced professionals in their respective fields who will provide a venue for interaction with students, allowing for a forum of Q&A on the application of concepts learned during lectures.

## **HSEG 635 Advanced Lean Management of Healthcare (3 semester hours)**

This course begins with a review of Lean basics, followed by a thorough review of the various venues where healthcare is practiced: the virtual environment, outpatient clinics, mental health settings, inpatient hospital settings, emergency departments, operating and procedural rooms, laboratories, pharmacies, diagnostic imaging departments, and other administrative/support venues. Students will become familiar with the operations and challenges as well as potential solutions (lean enablers) for each venue. Prerequisite: HSEG 535.

## **HSEG 655 Medical Devices and Integrated Systems (3 semester hours)**

This course provides students with exposure to the medical device industry, including the development process, regulations, and technical integration within the U.S. health care system. The course provides an overview of medical device development, implementation, and integration processes in healthcare delivery organizations. Students will review medical device types and interoperability and interconnectivity with IT systems.

**HSEG 665 Population Health and Big Data Analytics (3 semester hours)**

Electronic access to huge databases of patients provides new extraordinary potential for improving clinical diagnosis and treatments, including genomics, studies of genetic, lifestyle, environmental, clinical and other factors. The course explores the opportunities for healthcare analytics and clinical treatment developments. The course will cover the research lifecycle from formulation of clinical questions, to big data access and extraction, extraction, statistical analysis, evidence formulation, and clinical implementation methods. Statistical topics will include clustering, extrapolation, scaling, dimensionality, supervised and unsupervised learning, decision trees, handling uncertainty, Bayesian methods, Hidden Markov models, model selection, validation, data visualization, support vector machines, and so forth. The role of Healthcare Systems Engineers in such projects will be explored. Undergraduate-level Statistics is recommended. This course is available only to Healthcare Systems Engineering students.

**HSEG 675 Healthcare Enterprise Informatics and Electronic Health Records (3 semester hours)**

This course provides a strong foundation in health information technology (HIT) for those working in healthcare, with an emphasis on the development of knowledge and skills to plan, manage, and implement HIT systems in healthcare delivery organizations with clinical and business partners, and evolving HIT spaces. Successful development, implementation, and management of integrated HIT is a major priority in health care organizations today.

**HSEG 695 Preparation for Capstone Project (0 semester hours)**

This course is typically taken prior to the HSEG 696, the Integrative Project/Thesis. The student develops a project plan and gains advisor approval.

**HSEG 696 Project in Healthcare (3 semester hours)**

Capstone course in which each student working individually demonstrates the mastery of the systems engineering process applied to a healthcare problem of interest. This course should be taken in the last semester of the study program. The project must be carried out by the student in the semester of the registration. This course is available only to Healthcare Systems Engineering students, and the students of the Certificate in Lean Healthcare.

**HSEG 698 Special Studies (1-3 semester hours)**

**HSEG 699 Independent Studies (1-3 semester hours)**