Purdue University CHE 59700: Analytical Approach to Healthcare Delivery (Fall 2019)

A. Instructor. William R. Clark, M.D.

B. Course Description. This course provides a “real world” overview of healthcare delivery in the United States (US). The topics covered include the major medical product segments, regulatory framework, and financial considerations, including costs, health insurance, and reimbursement. Following a focused review of relevant physiology and pathophysiology, a series of critical medical conditions having the highest impact on the US healthcare system are discussed. An important aspect of the course is a team project, occurring over the last half of the semester and consisting of two presentations and a final report (in lieu of examinations). Finally, a number of emerging healthcare developments, including precision medicine, artificial intelligence, digital health, and value-based care, are addressed.

C. Course requirements. The course is open to all undergraduate students and all students enrolled in the Graduate School. BIOL 23000 or equivalent course is recommended but not mandatory.

D. Recommended (NOT REQUIRED) Texts.


E. Course Learning Objectives. The overall objective of this course is to provide students a detailed overview of the US healthcare system, with emphasis on the important role of engineers. The course is structured in three parts:

- **Overview of healthcare industry.** Describe the different environments in which patients receive care (hospital, outpatient, home); understand US health economics by identifying the major cost drivers in the system, including hospital care and physician costs along with drugs and other medical products; develop a basic understanding of the sources of health insurance coverage in the US, including the differences between government-based (Medicare/Medicaid) and commercial payers; characterize the major segments of medical products (pharmaceutical/biotechnology compounds, medical devices/diagnostics, and consumer products) along with the regulatory framework applying to each of these segments (especially in relation to the approval pathways for new products); describe the different approaches used to reimburse medical manufacturers for use of their products; delineate the major components of both pharmaceutical and medical device companies, in particular those functions for which engineers play an important role (research and development, manufacturing, regulatory affairs, sustaining engineering, and intellectual property).

- **Highest-impact clinical conditions.** After a focused physiology/pathophysiology review, understand the impact of the following conditions, not only from a clinical perspective but also a resource utilization (cost) perspective: coronary artery disease, heart failure, diabetes, cancer, obesity, Alzheimer’s disease, chronic kidney disease, stroke, arthritis, sepsis, and acute kidney injury; characterize the clinical characteristics along with the causes, demographics, and current treatment of each of these disorders.

- **Addressing unmet clinical needs.** For one of the above disorders or another disease, develop an understanding of an unmet clinical need and propose an engineering-based solution addressing that need.

F. Course Meeting Schedule.

<table>
<thead>
<tr>
<th>Lectures:</th>
<th>Tuesday and Thursday</th>
<th>1:30-2:45 PM</th>
<th>KNOY B033</th>
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<tbody>
<tr>
<td>Presentation 1:</td>
<td>11/05 (Tuesday)</td>
<td>1:30-2:45 PM</td>
<td>KNOY B033</td>
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At the approximate mid-point of the semester, students will assemble into groups of four and choose a high-impact clinical condition to study. Each group will provide two progress updates (Presentations 1 and 2) during the course of the semester in lieu of formal examinations. A complete written summary of each group’s assessment (Final Report) will be due at semester’s end in lieu of a final examination.

G. Assessment of Course Outcomes. A weighted average grade will be calculated as follows.

- Homework assignments (2): 20% of total
- Presentations (2): 40% total
- Final report: 40% of total

Group projects

Student groups may assess a high-impact clinical condition from the list of those discussed in class or another one (with instructor approval). In either case, each group should plan to meet with Professor Clark before beginning work on the project to set expectations. The assessment will include the clinical characteristics of the disorder along with its causes, demographics, and current treatment – these topics will be presented in Presentation 1. With Professor Clark or another engineering faculty member serving as a mentor, an unmet clinical need for the disorder will be identified along with an engineering-based solution for the problem – these considerations will be the focus of Presentation 2. For a particular disorder, the engineering approach can have a direct clinical effect (e.g., improved medical device treatment) or indirect clinical effect (e.g., novel manufacturing approach for pharmaceuticals).