CHE 59700-H02/CHE 49700-H01
Analytical Approach to Healthcare Delivery (Fall 2022)

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 major medical technology segments (pharmaceutical compounds and medical devices) are a significant focus, including their research and development processes, regulatory framework, and market approaches. Another highlight of the course is an assessment of a series of critical medical conditions having the highest impact on the US healthcare system. Clinical cases illustrating these conditions along with case studies designed to provide practical examples of healthcare developments and challenges are included. A number of emerging healthcare developments, including precision medicine, artificial intelligence, digital health, and value-based care, are addressed. In addition, the numerous ways in which the COVID-19 pandemic has affected patients and the manner in which they receive healthcare are discussed. In lieu of examinations, a team project consisting of two oral presentations and a final report is an important aspect of the course.

While the course is relevant to a broad spectrum of students, those planning a career in the healthcare industry may find it particularly useful. The course content is geared toward students interested in the pharmaceutical or medical device industry along with those pursuing post-graduate clinical training (e.g., medical school, osteopathic school).

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. Instructor Biographical Information: Dr. Clark is a nephrologist (kidney specialist) and chemical engineer by training. He received his M.D. degree along with specialty and sub-specialty training in internal medicine and nephrology, respectively, at Indiana University School of Medicine. In addition, he received both his B.S and M.S. degrees in chemical engineering from Purdue University, at which he is now Professor of Engineering Practice in the Davidson School of Chemical Engineering. Before joining the Purdue faculty, Dr. Clark worked in the medical device (dialysis) industry for more than 20 years in a variety of positions. Dr. Clark continues to serve as a consultant in the dialysis industry.

E. Recommended (NOT REQUIRED) Texts.

- *Guyton and Hall Textbook of Medical Physiology*, Edited by John E. Hall, Elsevier, 2016, 13th ed, ISBN: 978-1-4557-7005-2
- *Crowley's An Introduction to Human Disease: Pathology and Pathophysiology Correlations*, Edited by Emily Reisner, Howard Reisner, Jones and Bartlett Learning, 2017, 10th ed, ISBN 978-1284050233
- *Jonas and Kovner's Health Care Delivery in the United States,* Edited by James R. Knickman and Brian Elbel, Springer, 2019, 12th ed, ISBN: 9780826172723

F. Course Learning Outcomes.

- Evaluate the impact of the following conditions, from both a clinical and 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.
- Analyze the major segments of medical products (pharmaceutical/biotechnology compounds and medical devices) along with the regulatory framework applying to each of these segments.
- For the biopharmaceutical industry, determine the major components of the drug development process and the manner in which drug pricing factors into the risk/reward equation.

- Assess US health economics by identifying the major cost drivers in the healthcare system (hospital care; physician costs; drugs and other medical products).
- Formulate a basic understanding of the sources of health insurance coverage in the US, including the differences between government-based (Medicare/Medicaid) and commercial payers.
- Explain several evolving trends which have the potential to influence healthcare substantially in the future, including precision medicine, artificial intelligence, digital health, and value-based care.

G. Course Meeting Schedule.

Lectures:	Tuesday/Thursday 3:00-4:15 PM; HAMP 2102
Presentation 1:	TBD
Presentation 2:	TBD
Final Report due:	TBD

At the approximate mid-point of the semester, students will assemble into groups of 2-3 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.

H. Instructor Contact Information.

Professor William R. Clark – Email: clarkw@purdue.edu, Telephone: (765) 496-8647 (office); (317) 691-1438 (cell)
Office: FRNY 1055
Office Hours: TBD

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

Homework assignments (4): 20% of total
Presentations (2): 40% total
Final report: 40% of total

The grading scale will be as follows.

A: 100 – 85% of the weighted points
B: 84.9 – 75% of the weighted points
C: 74.9 – 65% of the weighted points
D: 64.9 – 55% of the weighted points
F: Less than 55% of the weighted points

Note that students with grades within 3 weighted percentage points of either the upper or lower bounds of a grade range listed above will receive a "plus" or "minus" mark, respectively, after his/her score (*e.g.*, scores between 75% and 78% of the total weighted points would earn an B–). Marks of an A– will not be given.

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).

J. Course Schedule (subject to change)

Lecture	Topic
Lecture 1	Intro and US healthcare system overview
Lecture 2	Cardiovascular disease
Lecture 3	Obesity
Lecture 4	Diabetes
Lecture 5	Kidney disease
Lecture 6	Clinical case 1
Lecture 7	Cancer
Lecture 8	Arthritis and autoimmune disease
Lecture 9	Neurologic disorders (Alzheimer's disease and stroke)
Lecture 10	Chronic liver disease
Lecture 11	Critical care medicine (acute kidney injury and sepsis)
Lecture 12	Clinical case 2
Lecture 13	Biopharmaceutical industry (1)
Lecture 14	Biopharmaceutical industry (2)
Lecture 15	Case study: Biopharmaceutical manufacturing*
Lecture 16	Case study: Drug discovery*
Lecture 17	Medical device industry
Lecture 18	Healthcare spending/financing
Lecture 19	Health insurance
Lecture 20	Case study: technology evolution in healthcare
Lecture 21	Clinical research
Lecture 22	Case study: medical device company*
Lecture 23	Case study: healthcare entrepreneurship*
Lecture 24	Case study: electronic medical record*
Lecture 25	Emerging healthcare developments (1)
Lecture 26	Emerging healthcare developments (2)
Lecture 27	Health equity and access to care*
Lecture 28	COVID-19
Lecture 29	No class**
Lecture 30	No class**

*: guest lecturer
**: make-up for evening presentation session