CHE 59700-H02: Analytical Approach to Healthcare Delivery (Fall 2024)

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 biopharmaceutical industry as the leading medical technology sector is a significant focus - analyses of the research and development, manufacturing, and commercial operations of a typical company are performed. 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 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 especially toward students interested in the biopharmaceutical field.

C. Course requirements. 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 medical device industry.

E. Recommended (NOT REQUIRED) Texts.

- *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
- *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

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.
- 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:	October 22: 8:00-10:00 PM (location: FRNY B124)
Presentation 2:	November 25: 8:00-10:00 PM (location: FRNY G124)
Final Report due:	December 11

Early in 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

#1: assigned September 17/due September 27
#2: assigned September 27/due October 7
#3: assigned October 11/due October 21
#4: assigned November 15/due November 26

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 a 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 (Aug 20)	Introduction and US healthcare system overview
Lecture 2 (Aug 22)	Cardiovascular disease
Lecture 3 (Aug 27)	Obesity
Lecture 4 (Aug 29)	Diabetes
Lecture 5 (Sep 3)	Kidney disease
Lecture 6 (Sep 5)	Clinical case 1
Lecture 7 (Sep 10)	Cancer
Lecture 8 (Sep 12)	Arthritis and autoimmune disease
Lecture 9 (Sep 17)	Neurologic disorders (Alzheimer's disease and stroke)
Lecture 10 (Sep 19)	Chronic liver disease
Lecture 11 (Sep 24)	Critical care medicine (acute kidney injury and sepsis)
Lecture 12 (Sep 26)	Clinical case 2
Lecture 13 (Oct 1)	Biopharmaceutical industry (1)
Lecture 14 (Oct 3)	Biopharmaceutical industry (2)
Lecture 15 (Oct 10)	Biopharmaceutical manufacturing*
Lecture 16 (Oct 15)	Drug discovery*
Lecture 17 (Oct 17)	Medical device industry
Lecture 18 (Oct 22)	Healthcare spending/financing
Lecture 19 (Oct 24)	Health insurance
Lecture 20 (Oct 29)	Case study: technology evolution in healthcare
Lecture 21 (Oct 31)	Clinical research
Lecture 22 (Nov 5)	Emerging healthcare developments (1): precision medicine
Lecture 23 (Nov 7)	Emerging healthcare developments (2): value-based care
Lecture 24 (Nov 12)	Emerging healthcare developments (3): artificial intelligence
Lecture 25 (Nov 14)	Case study: healthcare entrepreneurship*
Lecture 26 (Nov 19)	Emerging healthcare developments (4): digital health*
Lecture 27 (Nov 21)	Case study: Cook Biotech*
Lecture 28 (Nov 26)	The business of medicine/wrap-up
Lecture 29 (Dec 3)	No class**
Lecture 30 (Dec 5)	No class**

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