**IE 5080: Topics in Industrial Engineering – Healthcare Analytics**

**Fall 2023 – Syllabus**

**Lectures:** Tue, 12:20-2:15pm, Lind Hall 302

**Instructor:** Saumya Sinha ([saumya@umn.edu](mailto:saumya@umn.edu))

**Course Description:** This course provides an overview of data-driven approaches to make better decisions in healthcare operations and delivery. Students will learn about concepts, metrics, and constraints that are relevant in this domain. The class will focus on a combination of methodology and applications. Methods include decision trees, regression, and Monte Carlo simulations. Applications include public health and policy, healthcare operations, and medical decision-making.

**Prerequisites:** IE 3521 or STAT 3021 or graduate student

**Course Goals and Learning Objectives:** On successful completion of the course, students will be:

* Familiar with areas of healthcare decision-making where data-driven approaches and mathematical modeling can be useful.
* Aware of metrics, objectives, and concepts that commonly arise in healthcare decision-making, such as QALYs, hazard ratios, ICER, and effect size.
* Able to identify appropriate modeling approaches and their strengths and limitations for several healthcare applications.

**Textbooks:** There is no required textbook for the class. We will use the following books as references:

* Operations Research and Health Care: A Handbook of Methods & Applications (Margaret L. Brandeau, Francois Sainfort, William P. Pierskalla, eds., 2004)
* Handbook of Healthcare Operations Management: Methods & Applications (Brian T. Denton, ed., 2013)

e-copies of these books are available through UMN Libraries. Other reference material (book

chapters, journal articles, etc.) will be shared through the class Canvas page.

**Workload and Assessment**

Assessment will be based on weekly homework, short in-class quizzes, and a project; there will be no exams. The contributions of these components towards the final grade will be as follows:

Homework 50%

Quizzes 20 %

Project 30%

**Tentative Schedule of Topics**

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| Weeks 1-2 | Introduction & overview; Survival analysis |
| Week 3-4 | Regression for risk stratification |
| Weeks 5-6 | Markov models for disease progression |
| Week 7 | Infectious disease modeling |
| Week 8 | Cost-effectiveness analysis and resource allocation for public health interventions |
| Weeks 9-10 | Treatment planning for radiation therapy |
| Weeks 11-12 | Policy design for organ allocation |
| Week 13-14 | Clinical trial design |
| Week 15 | Project presentations |