I. **Course information**

The health care system involves the interaction of three main types of agents:

- Consumers/patients
- Health insurers/managed care organizations (public & private)
- Providers of medical goods and services, including
  - Physicians
  - Pharmaceutical & medical device companies
  - Hospitals

We will provide a framework for understanding the economic factors underlying the health care system and the interaction of its agents. For several reasons, standard economic models are not adequate to understand markets for health care. For example, it is difficult for the consumer/patient to evaluate the quality of the services received. Costs are uncertain, and insurance reduces the incentive of the consumer/patient or physician to seek the most economical means of treatment.

We will focus primarily on the structure and economics of health insurance and the demand for health care, pricing of drugs and hospital services, cost-benefit analyses employed by payers and consumers of health care products and services, mechanisms used for paying physicians and its impact on the provision of care, and the role of information in the selection and provision of medical goods and services.

The major topics covered in this course will include:

- Health technology assessment and cost-effectiveness analysis
- Personalized medicine, pharmacogenomics, and companion diagnostics
- Medication adherence
- Health insurance benefit design
- Pay for performance in healthcare
- Drug pricing and reimbursement
- Patents and intellectual property
- Role of information in health care

Brief descriptions of most of these topics, and selected cases and other materials related to them, are provided in Section II. More detailed descriptions of some of the cases and other materials are provided in Section III.
Assignment and Coursework Structure. The course will be taught using a combination of case discussions and lectures, including a few guest lectures. Students will be evaluated on the basis of class participation (20%), several homework assignments (20%), and a final exam (60%).

Connection with the core. The learning in this course will utilize, build on, and extend concepts covered in the following core courses:

<table>
<thead>
<tr>
<th>Core Course</th>
<th>Topics</th>
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<tbody>
<tr>
<td><strong>MANAGERIAL ECONOMICS</strong></td>
<td>• Maximization and thinking on the margin</td>
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<td>• Analyzing complex decision-making under uncertainty</td>
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<td>• Pricing with market power</td>
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<td></td>
<td>• Market segmentation and other advanced pricing strategies</td>
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<td>• Understanding market competition and equilibrium thinking (in the short run)</td>
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<td>• Market equilibrium thinking (in the long-run) and barriers to entry</td>
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<td>• Strategic interaction among firms</td>
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<tr>
<td><strong>CORPORATE FINANCE</strong></td>
<td>• Risk (health insurance)</td>
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<td></td>
<td>• Incremental cost/benefit (of medical expenditure)</td>
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<tr>
<td><strong>GLOBAL ECONOMIC ENVIRONMENT I</strong></td>
<td>• GDP (as an incomplete measure of economic prosperity)</td>
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Student focus: Students who plan to work in any of the following segments of the health care field should find this course to be valuable:
- pharmaceutical, biotechnology, and medical device companies
- health insurance companies and managed care organizations
- hospitals and physician practices
- financial services focused on health care
- public and not-for-profit organizations focused on health care

Core culture. This course adheres to Columbia Core Culture. Students are expected to be:
- Present: (1) On time and present for every session; (2) Attendance tracked
- Prepared: (1) Complete pre-work needed, expect cold calling; (2) Bring nameplates and clickers
- Participating: (1) Constructive participation expected and part of grade; (2) No electronic devices unless explicitly called for by the instructor

II. Brief descriptions of some major topics

Health technology assessment and cost-effectiveness analysis

Health technology assessment is a multidisciplinary process that summarizes information about the medical, social, economic and ethical issues related to the use of a health technology in a systematic, transparent, unbiased, robust manner. Cost-effectiveness analysis is a form of economic analysis that compares the relative costs and outcomes (effects) of two or more courses...
of action. Cost-effectiveness analysis is distinct from cost–benefit analysis, which assigns a monetary value to the measure of effect.

Selected cases and other materials:
- Exubera and NICE
- New treatments for genotype 1 hepatitis C infections
- PCSK9 Inhibitor Therapies for High Cholesterol: Effectiveness, Value, and Value-Based Price Benchmarks
- Cost-effectiveness of malaria diagnostic methods in sub-Saharan Africa in an era of combination therapy

Personalized medicine, pharmacogenomics, and companion diagnostics

Personalized medicine is a medical model that proposes the customization of healthcare - with medical decisions, practices, and/or products being tailored to the individual patient. Pharmacogenomics is the study of how genes affect a person's response to drugs. This relatively new field combines pharmacology (the science of drugs) and genomics (the study of genes and their functions) to develop effective, safe medications and doses that will be tailored to a person's genetic makeup: “the right drug for the right patient at the right dose at the right time.” Companion diagnostics are assays (a test or measurement) intended to assist physicians in making treatment decisions for their patients. They do so by elucidating the efficacy and/or safety of a specific drug or class of drugs for a targeted patient group or sub-groups.

Selected cases and other materials:
- Plavix: Drugs in the Age of Personalized Medicine
- Decision-analytic modeling for economic evaluation of new diagnostic tests
- Managing Drugs on the Forefront of Personalized Medicine: The Erbitux and Vectibix Story

Medication adherence

Medication adherence, or taking medications correctly, is generally defined as the extent to which patients take medication as prescribed by their doctors.

Selected cases and other materials:
- Listen to your doctor, or else!: medication underuse and overuse and the longevity of Danish diabetes patients
- CVS Health: Promoting Drug Adherence

Health Insurance Benefit Design

Why are some health treatments covered by insurance, while others are not? Why do some treatments have higher copays than others? These considerations are a result of how health benefits are designed.

Selected cases and other materials:
- Plan choice and adverse selection: should self-insured employers “tax” some of their health plans and subsidize others?
- Optimal Drug Benefit Design: The Case of Cholesterol-Lowering Therapy

**Pay for performance**

Pay for performance in healthcare gives financial incentives to clinicians for better health outcomes. Clinical outcomes, such as longer survival, are too difficult to measure, so pay for performance systems usually measure process outcomes, such as measuring blood pressure, lowering blood pressure, or counseling patients to stop smoking.

Selected cases and other materials:
- Performance Pay for Massachusetts General Orthopedic Associates Physicians
- Incentives in HMOs
- Do doctors practice defensive medicine?

**Drug pricing and reimbursement**

Selected cases and other materials:
- Merck: Pricing Gardasil
- Did CMS’ Functional Equivalence Decision Result in Equitable Payments?

**III. More detailed descriptions of some of the cases and other materials**

*Developing and Marketing a Blockbuster Drug: Lessons from Eli Lilly's Experience with Prozac*

In 1987, **Eli Lilly** began to market Prozac, the first available drug in a new class of psychotropic drugs called selective serotonin reuptake inhibitors (SSRIs). Prozac, and other SSRIs that followed it, revolutionized the treatment of depression and changed the philosophy and practice of psychiatry. It allowed depression to be treated by nonpsychiatrist physicians, substantially increased the number of depressed patients who had access to treatment, and lowered the cost of treating depression and other mental illnesses. Prozac quickly became the biggest selling drug in the history of the pharmaceutical industry. Explores the history of Prozac and the factors that combined to make it the best-selling drug of all time. Provides a brief history of depression and the theories that led some scientists to pursue SSRIs. Covers Lilly's uncertain development of Prozac, the thoughtful marketing that went into the launch, and the company's post-launch marketing strategies as the drug became widely used. Emphasizes the management difficulties, including product lawsuits and patent expirations, generated by blockbuster drugs.
Learning objective: To look at the process of developing and launching a pharmaceutical drug, especially one that achieves blockbuster status; to help students identify and discuss the issues to consider in launching and supporting a new drug, from initial development to patent expiration when the drug becomes a generic and loses most of its market; and to analyze Lilly's choice and actions in launching Prozac, considering the factors that helped turn Prozac into a blockbuster drug.

Merck: Pricing Gardasil

Allison Watkins, senior director of Merck's Vaccines Division, needed to decide on the pricing of Gardasil, Merck's newest vaccine and one of the company's most important product launches of the year. The outside consulting firm she had hired to recommend a price for Gardasil had suggested a price of $120 per dose (or $360 per person, as each person required three doses over six months to achieve adequate immunity). The Gardasil marketing team disagreed about this recommended price; some thought it was clearly too high, whereas others said it was too low. The latter group argued that Merck would be missing a major opportunity by setting the price at such a low level. Watkins now needed to decide whether to follow the consulting firm's recommendation or to set a different price.

Learning objective: The case highlights the complexity and issues around pricing in the pharmaceutical industry. To decide on the price of Merck's new vaccine, students will work through product economics and be introduced to the role of economic modeling in determining appropriate prices in the biomedical industry. The case is unique because it gives students an opportunity to calculate a cost per quality adjusted life year (cost per QALY), and in the process discover the power and limitations of such an analysis.

Did CMS' Functional Equivalence Decision Result in Equitable Payments?

In late 2002, the Center for Medicare and Medicaid Services (CMS) decided that it would pay half as much for Amgen's new drug for chemotherapy-related anemia in cancer patients, darbepoetin alfa (trade name: Aranesp), as it would have paid under its standard reimbursement rules. According to CMS, the new drug was “functionally equivalent” to an older drug—epoetin alfa (trade name: Procrit), marketed by Ortho Biotech, a division of Johnson & Johnson, approved by the FDA in June 1989—and the payment reduction was necessary to achieve “equitable payments.” The decision may have allowed a more equitable or efficient use of Medicare funds under certain assumptions, but not under other (perhaps equally plausible) assumptions.

Learning objective: To help students understand (1) how CMS generally establishes prices for both old and new drugs under the Outpatient Prospective Payment System; (2) how and why CMS deviated from its standard procedure in establishing the price of Aranesp; and (3) the potential benefits and risks of the functional equivalence decision.
Exubera and NICE

Historically, the biggest obstacle that healthcare innovators, such as pharmaceutical and medical device manufacturers, needed to overcome on their way to market was securing approval by the U.S. Food & Drug Administration (FDA) or other international regulatory authorities. However, in the last decade, a new (sometimes even more challenging) hurdle had to be cleared: insurance coverage and reimbursement. Payers—either public payers, such as Medicare in the U.S. and the National Health Services (NHS) in the U.K., or private commercial payers, such as Blue Cross/Blue Shield and UnitedHealth Group—could deny coverage for a technology that had received regulatory approval if they determined that the supporting evidence did not adequately demonstrate that the technology was superior to existing treatment alternatives that were already being reimbursed. This had the potential to create a potentially adversarial relationship between payers and innovators in cases where they had conflicting interpretations of the evidence regarding the cost, benefits, and risks of new technologies. The challenges to innovators in managing this conflict are illustrated in this case study by an example: the 2006 decision by the U.K.'s NHS to deny coverage for Pfizer’s drug Exubera, a new form of inhaled insulin.

Learning objective: The learning objectives of this case are to help readers (1) evaluate the pros and cons associated with the role payers are increasingly playing in the adoption of new technologies; and (2) consider the arguments for and against the requirement faced by companies to collect cost effectiveness data in their clinical trials.

Plavix: Drugs in the Age of Personalized Medicine

Plavix, one of the world's best selling drugs in 2010, appears to have a limited future. Its patent was due to expire soon and recently new data had been discovered which indicated that a small subset of the population would be at risk for stroke, heart attack or even death if they took Plavix. As a result the FDA had added a black box warning--the agency's most severe--to Plavix's label in 2010. In addition, it had been discovered that the common combination of Plavix and Prilosec, an over-the-counter drug, could adversely affect patients. Finally, Plavix faced new competition from two new drugs with different mechanisms of action. This case reviews the recent history of Plavix in greater detail to encourage a discussion of the following questions: How might the current manufacturers of Plavix handle these emerging threats to their leading blockbuster? How might Plavix's potential competitors utilize Plavix's mixed history to their advantage? How should genotyping be integrated into the clinical care of patients in the light of emerging knowledge?

Learning objective: To help students understand how advances in the field of personalized medicine impact drug management and strategy.
Managing Drugs on the Forefront of Personalized Medicine: The Erbitux and Vectibix Story

In May 2007, Amgen Inc. (Amgen) received disappointing news from the European Medicines Agency (EMEA) that its drug Vectibix, developed to fight metastatic colorectal cancer, had been rejected. This was especially surprising news given that a similar rival drug had received approval several years prior. Moreover, Vectibix had also received Food and Drug Administration approval in 2006. During additional trials, Amgen has learned that the Vectibix is only effective with the 60% of the population that has a specific gene marker. Given this development, what should Amgen's strategy around Vectibix be both in Europe and the United States?

Learning objective: To help students understand how advances in the field of personalized medicine impact drug management and strategy

CVS Health: Promoting Drug Adherence

The case describes a program that CVS Health recently implemented to improve medication adherence, an important problem from societal, public policy, and firm perspectives. A test of the program, costing hundreds of thousands of dollars to implement, increased the proportion of adherent customers by 1.4 percentage points. Students are asked to quantify the system-wide economic benefit of this improvement and draw upon insights from behavioral science to examine approaches for boosting medication adherence.

Learning objective: The case fosters debate on the complexities of capturing value when the alignment of several stakeholders is required to make a product or service (in this case, the Pharmacy Advisor Program) effective. Students realize that successful value capture often requires coordination across stakeholders because, although each party derives value from the product, none is sufficiently incented to overcome the inertia and costs of getting the program started. The case also offers insights into behavior change. Specifically, the case discussion considers how marketing efforts designed to modify deeply ingrained behaviors can be made dramatically more effective by using principles from behavioral economics and psychology.

Performance Pay for Massachusetts General Orthopedic Associates Physicians

Examines the transition of an orthopedic surgical group at a premier teaching and research hospital from a system in which the surgeons are compensated with flat salaries to a system where they are compensated based on profitability. Allows for an examination of several critical issues in incentive strategy, including pay-to-performance in a not-for-profit environment, whether a compensation system is truly aligned with value creation (issues of quality of care and research time), and the difficulty in designing a compensation system in a competitive labor market when the objectives of the institution extend beyond pure profit maximization.
New treatments for genotype 1 hepatitis C infections

On December 18, 2014, the California Technology Assessment Forum (CTAF) held a meeting to review the newest treatments for genotype 1 hepatitis C infections. The CTAF Panel voted that there was sufficient evidence to demonstrate that multiple-direct-acting antiviral therapy is clinically superior to single-DAA therapy or pegylated interferon and ribavirin alone. ICER’s cost-effectiveness analysis found that, at a 12-week cost of $94,500, LDV/SOF regimens for treatment-naïve and treatment-experienced patients met commonly accepted thresholds of $50,000-$100,000 per additional quality-adjusted life year gained. A strategy of treating patients at all fibrosis stages rather than waiting to treat patients until they reached fibrosis levels F3 or F4 also met commonly accepted cost-effectiveness thresholds.

Estimating potential total costs for Medi-Cal and the California Department of Corrections, ICER’s budget impact analysis showed: 1) an initial cost of $3 billion to treat all patients known to be infected with hepatitis C genotypes 1, 2, and 3 with the most effective therapies; and 2) that even after 20 years, less than half of this initial cost would be offset by savings from reduced liver complications. This analysis also found that a price range of $34,000-$42,000 for new regimens would be required to allow treatment of all individuals with known infections while keeping per-member-per-month (PMPM) cost increases to 0.5%-1%, the maximum increase many insurers considered manageable without special measures.

PCSK9 Inhibitor Therapies for High Cholesterol: Effectiveness, Value, and Value-Based Price Benchmarks

The report includes a comprehensive review of currently available evidence on the newly approved PCSK9 inhibitors alirocumab (Praluent®, Regeneron/Sanofi) and evolocumab (Repatha™, Amgen), and also provides analyses of cost-effectiveness and potential budget impact under different utilization assumptions. Based on these findings the report presents the draft incremental cost-effectiveness ratio (ICER) value-based price benchmark for these drugs; prices that reflect the magnitude of estimated improvements in long-term patient outcomes and a threshold for new drug costs that does not exceed growth in the overall national economy.

It has been estimated that as many as 3.5-15 million Americans with elevated cholesterol may be eligible and considered for treatment with PCSK9 inhibitors. But there is remaining uncertainty about interpretation of the existing evidence on the clinical effectiveness of these drugs for different types of patients. In addition, with a list price over $14,000 per year there are serious questions regarding the price at which these drugs would represent a sensible value to patients and to the health care system.

The results of ICER’s analyses indicate that the price that best represents the overall benefits these drugs may bring to patients would be between $3,615 and $4,811, representing a 67% discount off the list price. But, as Pearson noted, this price range excludes a critical consideration: potential budget impact.
“Even if these drugs were used in just over 25% of eligible patients, then employers, insurers, and patients would need to spend on average more than $20 billion a year for these drugs, a cost that would continue on into the future.”

The report concludes that it would take a further price reduction to an annual drug cost of $2,177 for the total costs of these new drugs to come down to a level at which doctors and insurers would not have to try to limit patient use in some way to keep overall health care cost growth within bounds.