This exam includes four questions. You must answer each of the four questions. Please use one blue book for each question, and mark the blue book with your name, the question number and the name of the faculty member. You have six hours to complete this exam. At the end of the exam, please place the bluebooks into the envelope, seal it, and deliver it to Pam Peterson at 3078 Mechanical Engineering.

Question 1 (Patti Brennan)

The health care industry system is rapidly embracing a patient centered care philosophy. The table below summarizes some key difference between traditional care and patient-centered care (from Starfield, 2011)

<table>
<thead>
<tr>
<th>Traditional care</th>
<th>Patient–centered care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit focused</td>
<td>Relationships over time</td>
</tr>
<tr>
<td>Episode oriented</td>
<td>Episodes reflect life course</td>
</tr>
<tr>
<td>Focus on management of diseases</td>
<td>Focus on health concerns &amp; diseases as interrelated phenomena</td>
</tr>
<tr>
<td>Comorbidity &amp; the number of chronic diseases</td>
<td>Multimorbidity</td>
</tr>
<tr>
<td>Coding systems reflect professional defined condition</td>
<td>Coding systems allow for specifications of people’s health concerns</td>
</tr>
</tbody>
</table>

Patient centered care philosophies present unique challenges for health systems engineers who are responsible for establishing quality improvement programs and performance measurement strategies. Pick one quality improvement or performance measurement strategy you are familiar with (e.g. kanban, dashboard, microsystem, PDCA), describe how it would be implemented under a traditional health care model and what modifications would be necessary to insure it remains reliable and valid under a patient-centered care model.

Question 2: (David Zimmerman)

The following terms are important concepts in evaluation research. For each concept, define and briefly discuss the concept. Then provide an example of how the concept would apply to a real life evaluation design situation. You may use any examples from long term care or health care. For example, you might
assume that the evaluation is to assess an intervention to reduce antipsychotic drug use in a nursing home. Or, you could assume that the evaluation is to assess an intervention to improve patient satisfaction in an orthopedic unit of a hospital. The example is completely up to you, and you can use the same example to discuss each concept or different examples for different concepts.

The concepts are as follows:

- Reliability of an outcome measure
- Sensitivity and specificity of an outcome measure
- Intervention integrity (sometimes called intervention loyalty)
- Sampling frame
- Threat to internal validity of an evaluation (select two possible threats)
- External validity (select one possible threat)

Question 3 (David Vanness)

Suppose five mutually-exclusive treatment options are available for a condition: treatments A, B, C, D and E:

- Treatment A (standard care) costs $10,000 and yields 10 QALYs.
- Treatment B costs $20,000 and yields 11 QALYs.
- Treatment C costs $5,000 and yields 9 QALYs.
- Treatment D costs $50,000 and yields 12 QALYs.
- Treatment E costs $100,000 and yields 13 QALYs.

A. Construct a table with columns: Costs, QALYs, Incremental Costs, Incremental QALYs and Incremental Cost-Effectiveness Ratios. If the calculated ICER is not relevant, enter “NR.” Be sure to choose the correct comparator for each treatment.

B. Are any treatments dominated or extended dominated?

C. If the health care system is able to produce health through other interventions at a cost of $35,000 per QALY, which of the 5 treatments is economically efficient?

D. Now suppose Treatment E still costs $100,000 but actually yields 15 QALYs. Construct a second table with columns: Costs, QALYs, Incremental Costs, Incremental QALYs and
Incremental Cost-Effectiveness Ratios. If the calculated ICER is not relevant, enter “NR.” Be sure to choose the correct comparator for each treatment.

E. Are any treatments dominated or extended dominated?

F. Given the changed information in D, and still assuming that the health care system is able to produce health through other interventions at a cost of $35,000 per QALY, which of the 5 treatments is economically efficient?

G. Should the treatment identified in F as economically efficient be adopted? Why or why not? Please describe any assumptions you would need to make to answer the question and discuss limitations to the use of cost-effectiveness in the context of real world health care policy.

4. Information Systems (Eneida Mendonça)

The attached article was published in the New York Times on September 21, 2012. The articles make reference to increases in Medicare cost due to inadequate or illegal coding based on the implementation of electronic health records. Please read the article and answer the following questions. Evaluation criteria include completeness, creativity, and accuracy.

1. What is the main assumption made in the article? Do you agree with the author? Please give your reasons for a positive or negative response?

2. In what ways do you think the implementation of electronic health records can improve efficiency, patient safety, while reducing health care costs?

3. What is the role of coding in the electronic health record? Please list 2 common terminologies used in health care and compare their characteristics.
Medicare reimbursement levels substantially. According to the lawsuit, Dr. Gravett was eventually let doctors pull exam findings “from thin air” and include them in patients’ records.

In a whistle-blower lawsuit filed in 2007, Dr. Gravett contended that these techniques drove up Medicare reimbursement levels substantially. According to the lawsuit, Dr. Gravett was eventually
fired for ordering too many tests. He says he was retaliated against for complaining about the new system. The Justice Department is weighing whether to join an amended suit in Federal District Court in Central Illinois. An independent analysis by The Times showed that Methodist’s Medicare billings for the highest level of emergency care jumped from 50 percent of its emergency room Medicare claims in 2006 to more than 80 percent in 2010, making the 353-bed hospital one of the country’s most frequent

Methodist declined to comment on Dr. Gravett’s allegations. But in an e-mailed statement, a spokesman said that not all of the hospital’s billing was done electronically, that it followed professional coding guidelines and that its patients required more care than patients at other hospitals. Many hospitals and doctors say that the new systems allow them to better document the care they provide, justifying the higher payments they are receiving. Many doctors and hospitals were actually underbilling before they began keeping electronic records, said Dr. David J. Brailer, an early federal proponent of digitizing records and an official in the George W. Bush administration. But Dr. Brailer, who invests in health care companies, acknowledged that the use of electronic records “makes it faster and easier to be fraudulent.”

Both the Bush and Obama administrations have encouraged electronic records, arguing that they help doctors track patient care. When used properly, the records can help avoid duplicate tests and remind doctors about a possible diagnosis or treatment they had not considered. As part of the economic stimulus program in 2009, the Obama administration put into effect a Bush-era incentive program that provides tens of billions of dollars for physicians and hospitals that make the switch. But some critics say an unintended consequence is the ease with which doctors and hospitals can upcode — industry parlance for seeking a higher rate of reimbursement than is justified. They say there is too little federal oversight of electronic records. A spokesman for the Health and Human Services Department, however, said electronic health records “can improve the quality of care, save lives and save money.” Medicare, he added in an emailed statement, “has strong protections in place to prevent fraud and abuse of this technology that we’re improving all the time.” He also said Medicare had reduced improper payments in the last two years. In emergency rooms, which use special billing codes to indicate how much care a patient needs, hospitals have increased their claims for the two highest-paying categories to 54 percent of Medicare claims in 2010, from 40 percent in 2006, according to The Times’s analysis of Medicare data. The Center for Public Integrity, a nonprofit investigative journalism group, recently released a similar analysis.

Some contractors handling Medicare claims have already alerted doctors to their concerns about billing practices. One contractor, National Government Services, recently warned doctors that it would refuse to pay them if they submitted “cloned documentation,” while another, TrailBlazer Health Enterprises, found that 45 out of 100 claims from Texas and Oklahoma emergency department doctors were paid in error. “Patterns of overcoding E.D. services were found with template-generated records,” it said. The Office of Inspector General is studying the link between electronic records and billing.

One sophisticated patient witnessed the overbilling firsthand. In early 2010, Robert Burleigh, a health care consultant, came to the emergency room of a Virginia hospital with a kidney stone. When he received the bill from the emergency room doctor, his medical record, produced electronically, reflected a complete physical exam that never happened, allowing the visit to be billed at the highest level, Mr. Burleigh said. The doctor indicated that he had examined Mr. Burleigh’s lower extremities, but Mr. Burleigh said that he was wrapped in a blanket and that the doctor never even saw his legs.
“No one would admit it,” Mr. Burleigh said, “but the most logical explanation was he went to a menu and clicked standard exam,” and the software filled in an examination of all of his systems. After he complained, the doctor’s group reduced his bill. As software vendors race to sell their systems to physician groups and hospitals, many are straightforward in extolling the benefits of those systems in helping doctors increase their revenue. In an online demonstration, one vendor, Praxis EMR, promises that it "plays the level-of-service game on your behalf and beats them at their own game using their own rules."

The system helps doctors remember what they did when they successfully billed for similar patients, and ensures that they do not forget to ask important questions or to perform necessary tests, said Dr. Richard Low, chief executive of Infor-Med Corporation, which developed Praxis. "The doctor can use a chart the way the pilot uses a checklist," he said. But others place much of the blame on the federal government for not providing more guidance. Dr. Simborg, for one, said he helped draft regulations in 2007 that would have prevented much of the abuse that now appears to be occurring. But because the government was eager to encourage doctors and hospitals to enter the electronic era, he said, those proposals have largely been ignored.